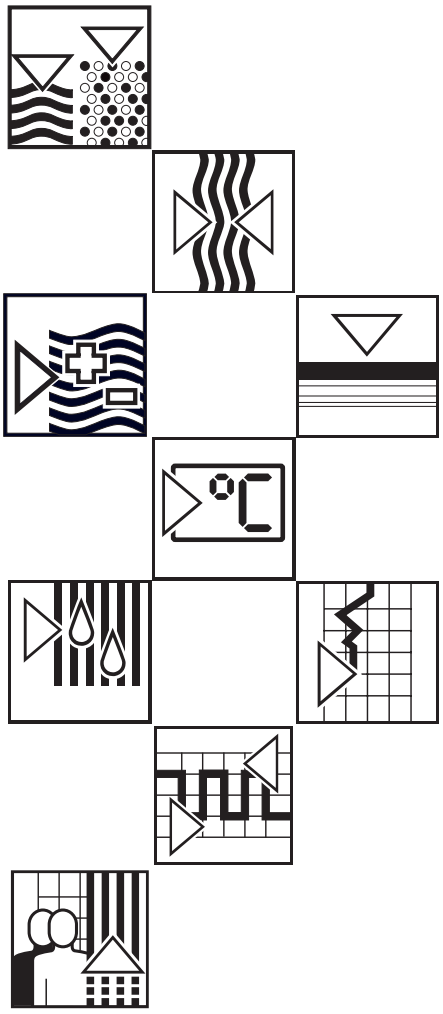
BA 019T/02/en/11.02

# *smartgrad TMD833*

# Field transmitter
# Hart protocol

Installation and Operation Manual




Quality made by
Endress+Hauser

ISO 9001

Endress+Hauser

**Nothing beats know-how**

# Contents Page

## Safety hints

**Correct use**

- The field transmitter displays scaled signals from thermometers and thermocouples to a loop powered output. The optional display indicates the measurement regarding the real temperature in the process.
- The manufacturer cannot be held responsible for damage caused by incorrect use of the instrument. Changes must not be made to the unit.
- The unit has been designed for use in industrial areas and must only be used in an installed condition.
- The process display is manufactured using state of the art technology and complies to the directives. On the version for use in explosion hazardous areas the norms EN 50014, EN 50020 are also complied with.

The unit could become dangerous if it is incorrectly installed or used.
Therefore please take note of all the safety hints and pictograms shown in these installation and operating instructions. The meanings of the pictograms are:


"Note" means activities or sequences that, if not done correctly could have an indirect influence on the units operation or could release an unforeseen unit reaction.


"Caution" means activities or sequences that, if not done correctly could lead to personal injury or faulty unit operation.


"Warning" means activities or sequences that, if not done correctly could lead to serious personal injury, to a safety risk or total damage to the unit.

## Installation, initial setting up and operating personnel

- Mechanical and electrical installation, setting up and maintenance of the unit must only be carried out by skilled and qualified personnel who have been authorised to do so by the plant operator. The skilled personnel must have read and understood these installation and operating instructions. They must follow them carefully.
- The unit must only be operated by trained personnel who have been authorised by the plant operator. They must follow all instructions contained in this manual.
- Always make sure that the unit is correctly connected following the electrical connection diagrams. When removing the unit cover the electrical contact protection is lost (danger of electrical shock). The housing must only be opened by qualified skilled personnel.
- The unit must only be used in an installed condition.

**Repairs**

Repairs must only be carried out by trained customer service personnel. If the unit is to be returned to Endress+Hauser for repair, please include a description of the fault.

**Technical advancement**

The manufacturer reserves the right to improve and update the technical details.

# 1. System description

The smartgrad TMD833 is a microprocessor based 2 wire smart field transmitter for temperature measurement. The transmitter and the optional LC Display are encapsulated into IP 65 housing.
The instrument converts a resistance bulb change or a thermocouple generated mV signal into process information (typical 4-20mA).
Otherwise generated Ohm or mV signals are also accepted as input signals.
The smartgrad TMD833 Field - Transmitter accepts one of the following inputs with a single set of electronics:

- 3 different RTD types
- 10 different Thermocouple types
- Ohm, two different ranges
- mV

The smartgrad TMD833 is available as General Purpose, Intrinsically Safe or Explosion proof design (Pending). Generally the input is galvanically isolated from the output; another guarantee for high operational reliability.

# 2. Mechanical installation

**Installation hints:**

Caution!

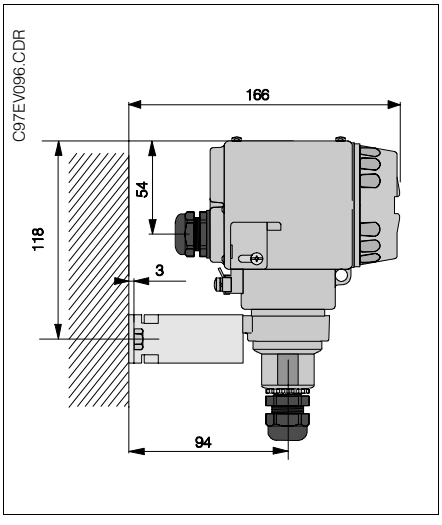
- The unit must be operated in an installed condition.
- The permissible operating ambient temperature is -40...+85°C (for the EEx ia version please respect the temperature class in the certification).
- Protect the unit from heat sources.

Normally the installation requirements for both Ex and non-Ex units are the same.
The operator has to follow the rules regarding the specific Ex area class.

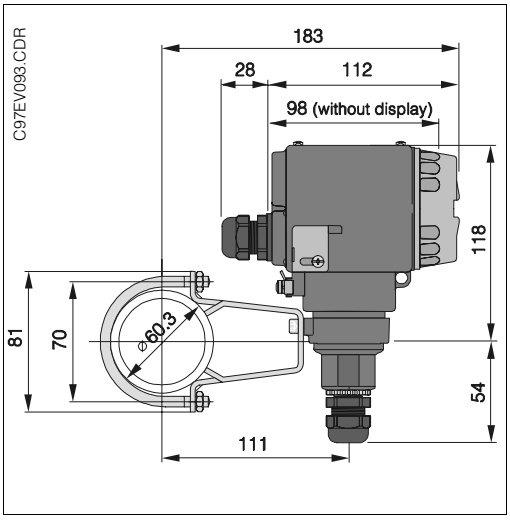
## 2.1 Mounting

TMD833 can be 2" pipe or wall mounted.

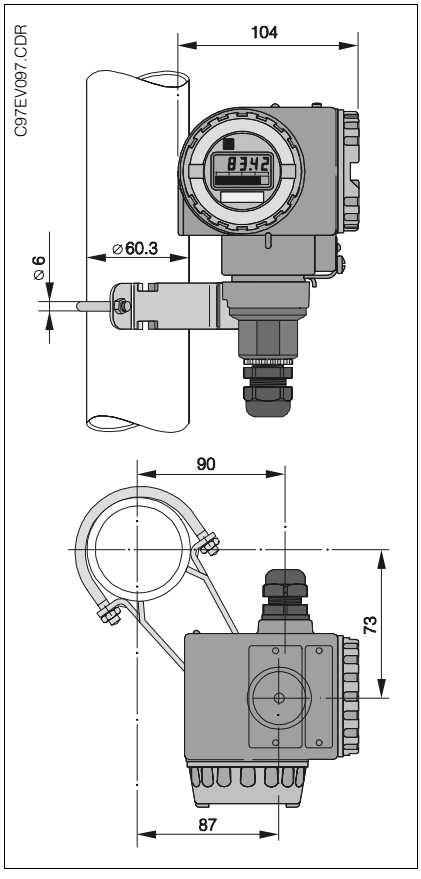
Please find the brackets for 2" pipe or wall mounting inside the carton box.




Wall mounting




Horizontal pipe mounting

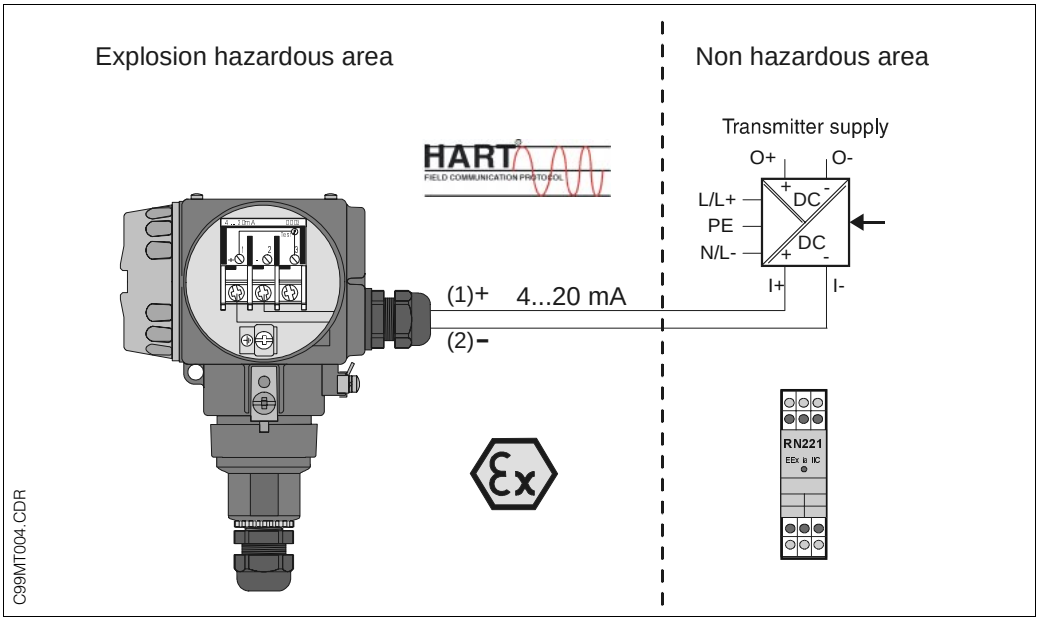



Vertical pipe mounting

# 3. Electrical connection

## 3.1 Terminal layout and power supply

The smartgrad TMD833 field transmitter utilises the standard 4...20 mA signal for temperature, ohm or mV linear output.
The analogue output signal is available both for direct 4...20 mA or reverse 20...4 mA.
HART® Protocol is superimposed onto the two wire loop powered output signal.
If self-diagnostics detect a sensor burnout or transmitter failure, the analogue signal will be driven either below 3.8 mA or above 21 mA to alert the user. High or low failure mode signal is user-selectable by software (Commuwin II or DXR275).




| | Terminal layout |
|---|---|
| 1 | Measured signal (+) 4 ... 20 mA |
| 2 | Measured signal (–) 4 ... 20 mA |
| 3 | Together with (1), Test signal mA |
| ⏚ | Grounding |

• TMD833 EEx ia Version - CESI EX-99.E.003**X**

**Special conditions for safe use (X)**

The temperature transmitter TMD833 (EEx ia version) shall be supplied by associated apparatus with galvanic insulation certified according to EN 50.014 / 50.020 standards, type of protection EEx ia, with the electrical characteristics indicated in the certification.

Warning!

In flammable atmosphere the electrical characteristics on the power / loop side and also on the sensor side must correspond to the certification.

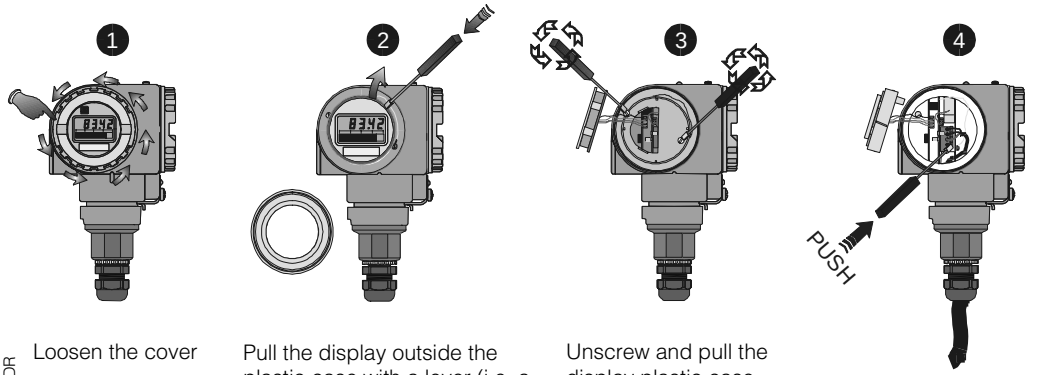
## 3.2 Grounding of the loop circuit

Both the terminal layout and the connection values of the field transmitter relate to the Ex version. The unit is only meant for use in a 4 ... 20 mA current loop circuit.
Potential equilibrium must be garanteed on the current loop (inside and outside the Ex hazardous area). In order to achieve this use the earthing (ground) lug on the housing.

## 3.3 Sensor connection

Warning!

For installing the sensor connection wires, open the cover on the opposite side of the cable entry (display cover), see figure 1.
If the instrument has a display, pull the display outside the plastic case, see figure 2.
Remove the plastic case, see figure 3, and find the fix board for the wires.
Push the sensor cable in, through the cable entry on the bottom of the instrument to the connection room, see figure 4.



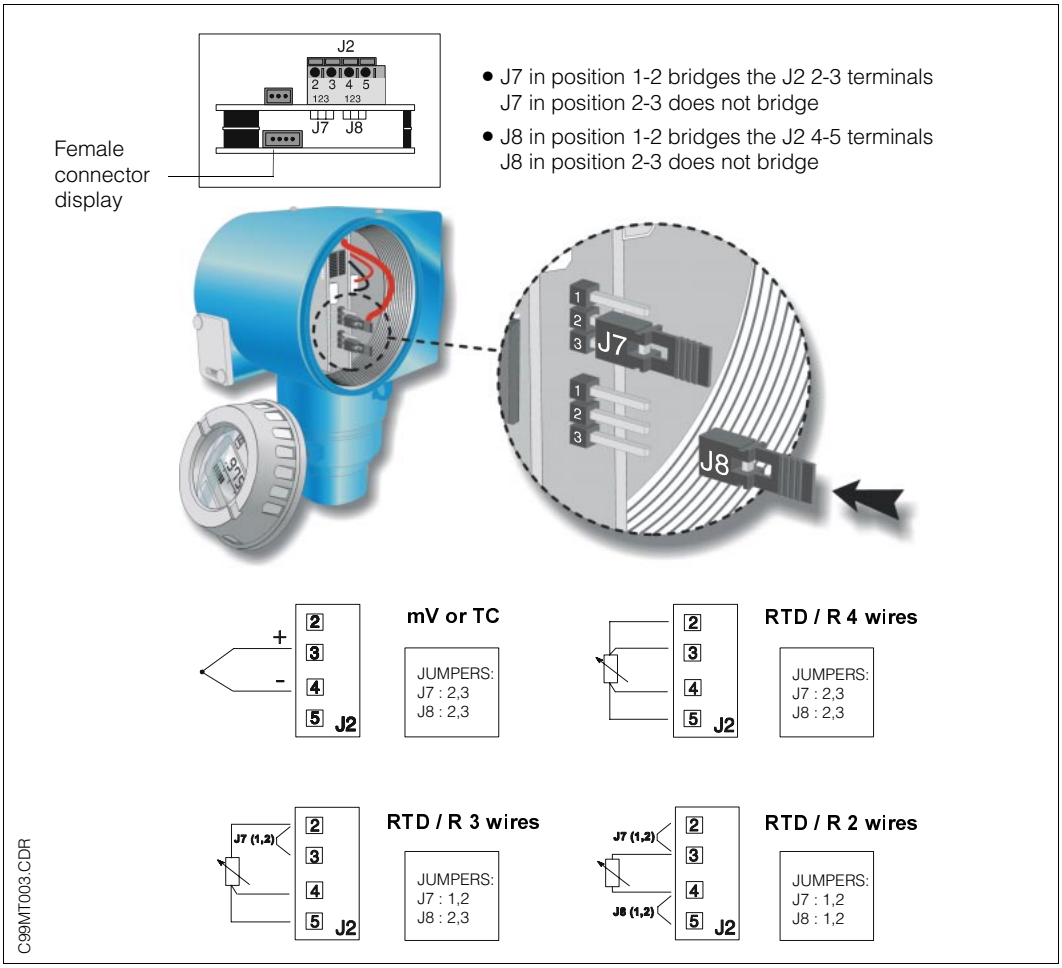

C99MT005.CDR

1. Loosen the cover
2. Pull the display outside the plastic case with a lever (i.e. a screwdriver) between the case and the display edge
3. Unscrew and pull the display plastic case
4. Push the sensor cable in and connect the sensor signal (see below)

Note!

### Sensor signal connection

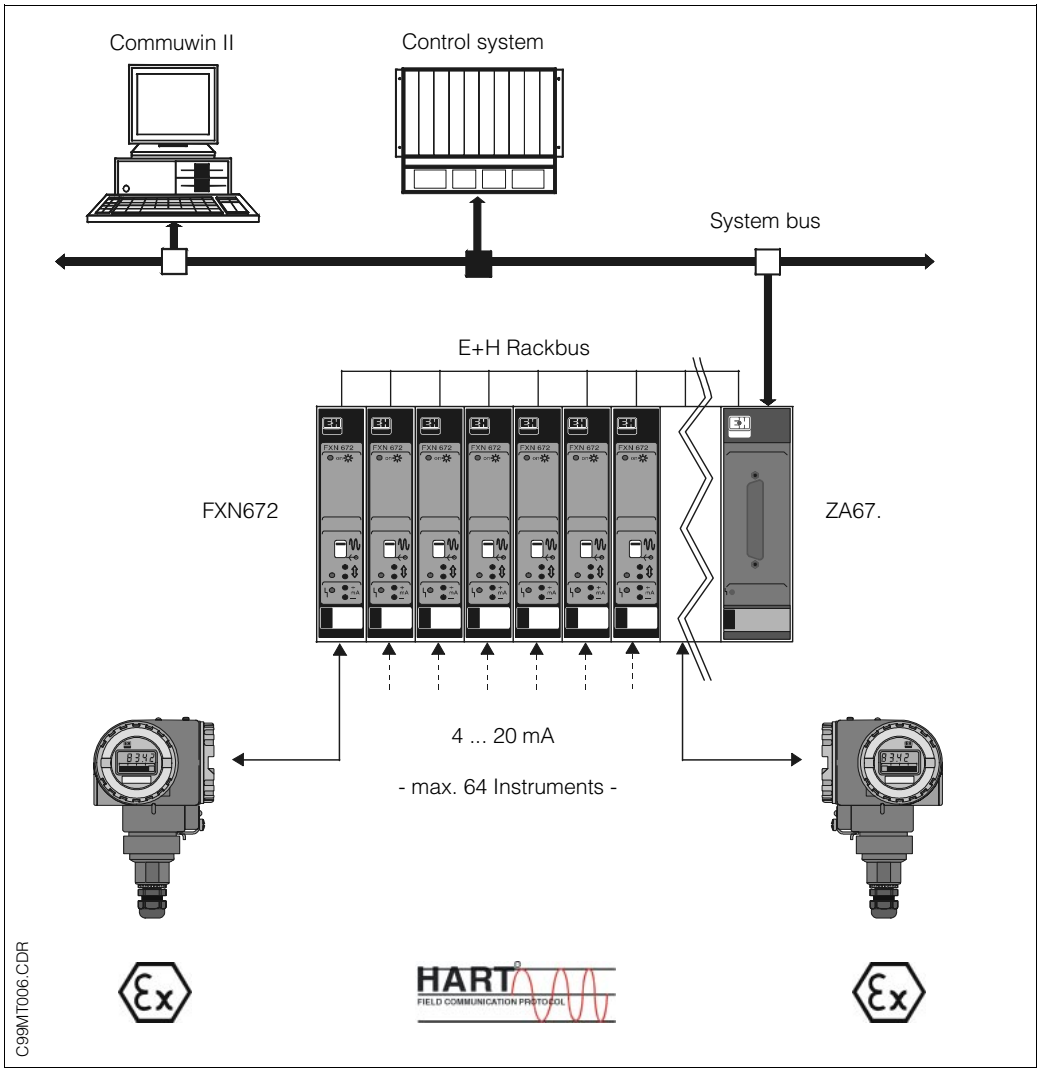
Attention! : Regarding the type of sensor, the bridges must be installed in J7/J8 on the right pins.




C99MT003.CDR

## 3.4 System integration

The smartgrad TMD833 field transmitter with HART® Protocol can be integrated into a 19" rack with the 19" Power supply FXN672.




Integration with HART® Multiplexer in generic Fieldbus system. Direct reading of the process variable with Digital accuracy.

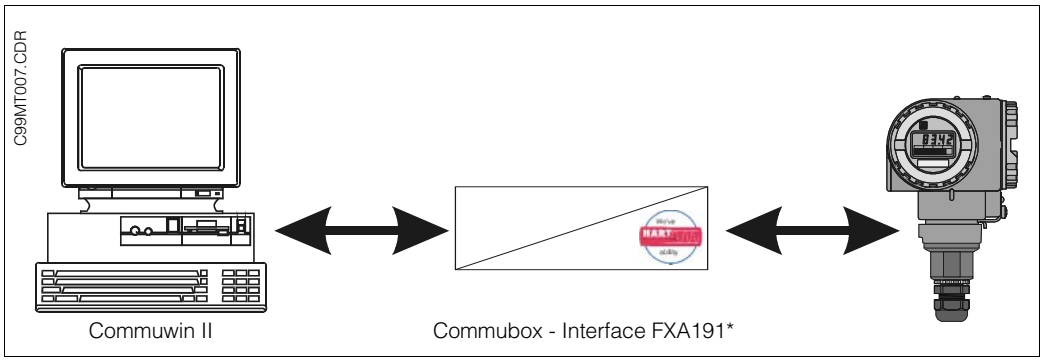
# 4. Operating overview

Operation as well as the parameter settings and their function are exactly the same as General Purpose - EEx ia or EEx d - Version of smartgrad TMD833 field transmitter. Please note the following paragraphs for operation and the notes for setting up.

## 4.1 Configuration

The complete configuration of smartgrad TMD833 field transmitter can be made remotely with HART® protocol. The digital communication is superimposed on the 4 ... 20 mA output signal and transmits condition information during the operation without disturbing the measurement value.

## 4.2 Set up using a personal computer with Commuwin II




* The description of the wiring FXA191 is indicated in chapter 4.3 Set up using hand held module.

**Note:**
HART® Communication requires a minimum loop resistance of 250 Ohms. Do not communicate with the instrument when power is below 13 V DC at the transmitter terminals.

The TMD833 set up is via a PC and the software Commuwin II (FXS113). Connection to the PC is via the Commubox (FXA191). Parameter matrix menu in Commuwin II is as follows:

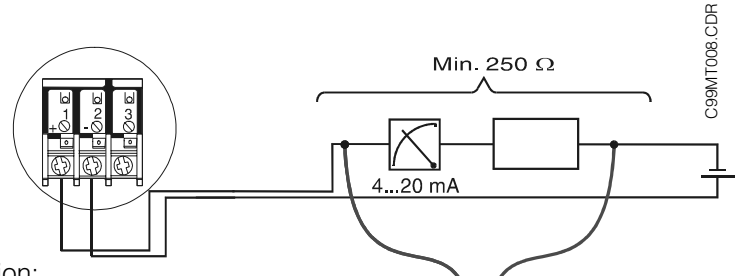
| | H0 | H1 | H2 | H3 | H4 | H5 | H6 | H7 | H8 | H9 |
|---|---|---|---|---|---|---|---|---|---|---|
| V0 WORKING PARAMETERS | MEASURED TEMP. | TEMP. COMPENSATION | INPUT FILTER | RJ MODE | RJ EXTERNAL VALUE | BIAS INPUT 1 | | | | |
| V1 | | | | | | | | | | |
| V2 CALIBRATION CHAN. 1 | INPUT 1 CONFIG. | | MEASURING UNIT 1 | DIR. / REV. ACTION | VALUE FOR 4 mA | VALUE FOR 20 mA | OPERATION MODE 1 | 2 WIRE COMP. | SAFETY ALARM | INSTRUM. ADDR. |
| V3 | | | | | | | | | | |
| V4 | | | | | | | | | | |
| V5 | | | | | | | | | | |
| V6 | | | | | | | | | | |
| V7 | | | | | | | | | | |
| V8 | | | | | | | | | | |
| V9 SERVICE | ERROR CODE | LAST DIAGNOSTIC | | | | SIMULATION | SIM. VALUE | | | DEFAULT VALUES |
| VA USER INFORMATION | TAG NUMBER | | SOFTWARE VERSION | MODIFICATION NO. | SERIAL NUMBER | | | | | |

## 4.3 Set up using the hand held module

Below are several examples to set up the smartgrad TMD833 field transmitter with DXR275 according the most important parameters.

**Description of configuration for the following parameters:**

- Sensor Input
- RTD connection
- Measuring Unit
- Measurement Range
- Cold Junction
- Input Filter
- Offsets
- Default Values




Connection:

With the same connection it is also possible to use the E+H interface Commubox FXA191 instead of the hand held module !

**Configuration of Sensor Type**

Online → Matrix Parameters → Working Parameters → (3) Sensor Input → Configure the desired type of sensor with key ↑ ↓ ;
ENTER F4 ; SEND F2

**Configuration of RTD connection (2- / 3- / 4-wire connection)**

Online → Matrix Parameters → Calibration Chan. 1 → RTD connection → Configure the desired wires with key ↑ ↓ ;
ENTER F4 ; SEND F2

**Configuration of the Measuring Unit °C / °F**

Online → Matrix Parameters → Working Parameters → (2) Measuring Unit → Configure the desired measuring unit with key ↑ ↓ ;
ENTER F4 ; SEND F2

**Configuration of Measurement Range**

Online → Matrix Parameters → Output Calibration → Value for 4mA ; → Configure of temperature (at 4 mA) ; ENTER F4 ; SEND F2
→ Value for 20mA → Configure of temperature (at 20 mA)
ENTER F4 ; SEND F2

**Configuration of Cold Junction (Thermocouples)**

Online → Matrix Parameters → Working Parameters → (6) RJ Mode → Select: INTERN or EXTERN Cold Junction with key ↑ ↓
ENTER F4 ; SEND F2

If EXTERN cold junction is selected, the external temperature is required

EXTERN Cold Junction : → (7) RJ External Value → Save the External Temperature ; ENTER F4 ; SEND F2

**Input Filter T [s]**

Online → Matrix Parameters → Working Parameters → (4) Input Filter → Configure the desired time ; ENTER F4 ; SEND F2

**Offsets**

Online → Matrix Parameter → Working Parameters → (2) Calibration Chan.1 → Bias Input 1 → Configure the desired temperature ; ENTER F4 ; SEND F2

**Default Values**

Online → Matrix Parameters → (4) Service → (5) Default Values ; → Input Number 833 ; ENTER F4 ; SEND F2

**Parameters DXR 275 / TMD833**

| Matrix parameters | Working parameters | PV Value |
|---|---|---|
| | | Measuring unit |
| | | Sensor input |
| | | Input filter |
| | | Temp. compensation |
| | | RJ mode |
| | | RJ external value |
| | Calibration Chan. 1 | Bias Input 1 |
| | | R/RTD connection |
| | | R/RTD 2 - wire comp. |
| | Output calibration | Output value (mA) |
| | | Dir./rev. Action |
| | | Value for 4 mA |
| | | Value for 20 mA |
| | | Sensor Error |
| | Service | Error code |
| | | Last diagnostic |
| | | Simulation mode |
| | | Simulation value |
| | | Default values |
| Device information | Descriptor | |
| | Message | |
| | Date | |
| | Serial number | |
| | Software version | |
| | Modification n. | |
| | Universal Rev. | |
| | Fld dev Rev. | |
| | Software Rev. | |
| HART output | Poll addr. | |
| | Num req preams | |
| | Burst mode | |
| | Burst option | |
| PV (Measurement) | | |
| AO (mA) | | |

# 5. Operating parameter description

| Commuwin II | Matrix Feld | Parameter | Significance |
|---|---|---|---|
| | | | |
| V0 WORKING PARAMETERS | V0H0 | Process Variable (PV)<br>Measured Temperature | PV regarding the selected unit [°C or °F] V2H2, corrected by bias value entered in field V0H5, in case of error the PV will be 9999 or -9999 |
| | V0H1 | Cold junction (RJ)<br>Temperature | Temperature of cold junction (terminal temperature) according to the selected unit [C or F] V2H2 when "internal" RJ Mode V0H3 is defined. |
| | V0H2 | Input Filter<br>Selection range: 0 .. 32s | Damping of the input signal in seconds, according to the reaction time to filter the input. |
| | V0H3 | Cold junction (RJ) Mode<br>Select: Internal or External | The smartgrad TMD833 field transmitter has an "internal" cold junction compensation for thermocouples. If "external" is selected, the reference temperature must be indicated in V0H4. |
| | V0H4 | (RJ) External Value, Selection range:<br>-50°C .. +94°C or -58°F .. +201,19°F | Before setting up the External Value of Cold junction, the Measuring Unit [°C or °F] in V2H2 must be defined. |
| | V0H5 | Bias Input<br>Selection range: -10 .. 10 Units | Parallel shifting of the Linearisation to correct Sensor drifts or Thermometer installation inaccuracy. |
| | | | |
| V2 CALIBRATION CHAN. 1 | V2H0 | Input Sensor, Selection | RTD Thermometer: Pt100, Ni100, Pt1000<br>Thermocouples: Type B, E, J, K, L, R, S, T, N or U<br>Voltage: mV Full scale<br>Resistance: 400 Ohms Full scale or 4000 Ohms Full scale<br>Not used: Pt100/TT-CAL, Pt100/TT-CAL and Ni/TT-CAL |
| | V2H2 | Measuring unit<br>Select: °C or °F | Selection of Process Variable unit, the unit is applied to the fields<br>V0H0 - V0H1 - V0H4 - V2H4 - V2H5 |
| | V2H3 | Output Action<br>Select: DIR. or REV. | DIR. = Direct: 4 .. 20 mA / REV. = Reverse: 20 .. 4 mA |
| | V2H4 | (PV) Value for 4 mA<br>Selection regarding Sensor Type | Zero value of PV in the selected unit. Before setting up this value, the Measuring Unit [°C or °F] in V2H2 must be defined. The value must be internal the input range of the thermometer. |
| | V2H5 | (PV) Value for 20 mA<br>Selection regarding Sensor Type | Upscale value of PV in the selected unit. Before setting up this value, the Measuring Unit [°C or °F] in V2H2 must be defined. The value must be within the input range of the thermometer. |
| | V2H6 | Operation Mode<br>Resistance wire connection<br>Select: 2 WIRE, 3 WIRE or 4 WIRE | Connection to the Sensor, applicable to RTD Thermometers and Resistance input. |
| | V2H7 | 2 WIRE Compensation<br>Selection range: 0 .. 30 Ohms | If the 2 WIRE connection in V2H6 is selected, the value to be inserted is the resistance of the connection wires with 0.01 Ohms resolution. |
| | V2H8 | Safety Alarm<br>Select: MAX. or MIN. | MAX.: Alarm output = 21 mA / MIN.: Alarm output = 3.8 mA.<br>If self-diagnostics detect a sensor burnout or transmitter failure, the analogue signal will be driven to the selected value. |
| | V2H9 | Instrument address<br>Selection range: 0 .. 15 | Instrument address in the BUS structure. For point to point communication, the address must be 0 !<br>For multi-drop connection the address can be set from 1 to 15 |
| | | | |
| V9 SERVICE | V9H0 | Error Code | This field shows the transmitter status, see chapter 6. for details. |
| | V9H1 | Last Diagnostic | This field shows the previous status of the instrument. |
| | V9H5 | Simulation<br>Select: OFF or ON | Set up of output simulation. If ON is selected, the analogue signal will be driven to the value indicated in V9H6 ! |
| | V9H6 | SIM. Value<br>Selection range: 3.8 mA .. 21 mA | The output simulation value for a "Test" period can be entered here, if simulation is selected in field V9H5 ! |
| | V9H9 | Default Values | Putting 833 in this field sets all the parameters to the default values, see chapter 5.1 !<br>Note: The indicated BUS address will not be changed. |
| | | | |
| VA USER INFORMATION | VAH0 | TAG Number | An 8 character alpha-numeric string is available to enter measuring point designation. With Commuwin II configuration the first digit must be a letter or _ ! |
| | VAH2 | Software Version | Contains information relating to the instrument software version. |
| | VAH3 | Modification | Contains information relating to the smartgrad TMD833 field transmitter. |
| | VAH4 | Serial Number | Contains information relating to the circuit board production. |

## 5.1 Standard configuration

| | |
|---|---|
| Unless otherwise requested the smartgrad TMD833 field transmitter is delivered with default values according to the following standard setting: | Pt100 Sensor, Measuring unit [°C]<br>Measuring range: -200°C .. +850°C<br>Output: 4 .. 20 mA<br>Safety Alarm: MIN.: Alarm output = 3.8 mA<br>Other Values to zero. |
| These default values will also be implemented, if the code 833 is placed in the field V9H9 ! | |

# 6. Fault finding and repair

During production all units go through a number of quality control stages. In order to assist you in fault finding a number of possible faults, causes and cures are listed below:

**Note:**
Fault messages; the current error is transmitted with the measured value and displayed in field V9H0 of the matrix. The last error code is displayed in V9H1 !

| Fault Code | Type | Cause | Cure |
|---|---|---|---|
| 0 | | Normal operation ! | |
| 011 | Alarm | Hardware error or Sensor fail | Appears if the Sensor is broken. Check the cable connection between Thermometer and Transmitter. If there is no fault from the Sensor to the smartgrad TMD833 field transmitter, call the Endress+Hauser Service in your Country. |
| 012 | Alarm | Over - scale | The measurement is above the range limit for example Pt100 >850°C or >390,48Ω. Check in the matrix in position V2H0 if the right sensor is selected. Appears if the Sensor isn't working correctly. |
| 013 | Alarm | Under - scale | The measurement is below the range limit for example Thermocouple Type J <-200°C or <-7.89mV. Check in the matrix in position V2H0 if the right sensor is selected. Appears if the Sensor isn't working correctly. |
| 201 | Warning | Over - range | The measurement is above the selected range for example Thermocouple Type J: Range 0..500°C ⇒ >500°C or >27,393mV. Check in the matrix in position V2H5 the value for 20mA. Appears if the Sensor isn't working correctly. |
| 202 | Warning | Under - range | The measurement is below the selected range for example Pt100: Range 0..200°C ⇒ <0°C or <100Ω. Check in the matrix in position V2H4 the value for 4mA. Appears if the Sensor isn't working correctly. |
| 203 | Warning | Up - Download of data activated | Appears during download from computer, measurements cannot be made during this period. This warning disappears by itself. |
| 204 | Warning | Reset activated | Appears shortly during start-up. This warning disappears by itself. |
| 20 | Warning | Display error | Option without Display, the display is not available, the plug of the display is not in or the display is defect. |

The self - monitoring system of the smartgrad TMD833 field transmitter differentiates between alarms and warnings.

**Alarm:**

- The smartgrad TMD833 field transmitter is not measuring.
- An error code is displayed in matrix field V9H0 to help locate the fault.

**Warning:**

- The smartgrad TMD833 field transmitter continues to measure.
- An error code is displayed in matrix field V9H0 to help locate the fault.

# 7. Technical data

**General information**

| | |
|---|---|
| Manufacturer | Endress+Hauser |
| Description | *smartgrad TMD833* |
| Unit function | Temperature transmitter for the installation in the field with HART® Protocol and galvanic insulation. |

**Application areas**

| | |
|---|---|
| Transmitter | Transforming resistance or voltage signals into 4 ... 20 mA current signals, scalable measured signal and output signals. LC Display optional. |

**Operation and system construction**

| | |
|---|---|
| Measuring principle | Measured value recording using analogue/digital conversion, the recorded values are then analysed and retransmitted as a 4 ... 20 mA measurement signal loop via a digital/analogue converter.<br>Additionally digital information is superimposed on this 4 ... 20 mA signal. This is used for communication with a relative communications unit or system. |
| Measurement system | Microprocessor controlled analogue/digital and digital/analogue conversion with integrated fault monitor. |

**Input**

| RTD input | |
|---|---|
| Types | Pt100 and Pt1000, according to IEC751;<br>Ni100 according to DIN 43 760 |
| Measurement range | Pt100, Pt1000: -200...+850 °C; Ni100: -60...+180 °C |
| Minimum span (1) | 10 °C |
| Connection | 2-, 3-, 4-wire |
| Sensor current | < 0.2 mA |

| Resistance input | |
|---|---|
| Measurement range | 0 (2)...400 Ω or 0 (2)...4000 Ω |
| Minimum span (1) | Range 0-400 Ω : 5 Ω / Range 0-4000 Ω : 50 Ω |
| Connection | 2-, 3-, 4-wire |
| Sensor current | < 0.2 mA |

| Thermocouple input (TC) | | | |
|---|---|---|---|
| Measurement type | B, E, J, K, N, R, S, T (IEC 584); L, U (DIN 43 710) | | |
| Measuring ranges/ minimum span | Type | Measuring range | Minimum span (1) |
| | B | *+400 to +1820 °C | 100 °C |
| | E | -200 to +1000 °C | 20 °C |
| | J | -200 to +1000 °C | 20 °C |
| | K | -200 to +1370 °C | 20 °C |
| | L | -200 to +900 °C | 20 °C |
| | N | -180 to +1300 °C | 20 °C |
| | R | -50 to +1760 °C | 25 °C |
| | S | -50 to +1760 °C | 20 °C |
| | T | -200 to +400 °C | 20 °C |
| | U | -200 to +600 °C | 20 °C |
| | * Non linearised range from 0 ... +400°C is admissible | | |
| Input impedance | >10 MΩ | | |

**Input (continued)**

| Input resolution | Type | Input resolution |
|---|---|---|
| | B | 0.8 °C for T> 1000 °C; 1 °C for T< 1000 °C |
| | E | 0.15 °C for T> -100 °C; 0.3 °C for T< -100 °C |
| | J | 0.15 °C for T> 0 °C; 0.2 °C for T< 0 °C; 0.4 °C for T< -150 °C |
| | K | 0.2 °C for T> 0 °C; 0.3 °C for T< 0 °C; 0.4 °C for T< -150 °C |
| | L | 0.15 °C for T> -50 °C; 0.3 °C for T< -50 °C |
| | N | 0.2 °C for T> 300 °C; 0.3 °C for T< 300 °C; 0.5 °C for T< 0 °C |
| | R | 0.3 °C for T> 500 °C; 0.4 °C for T< 500 °C; 1 °C for T< 200 °C |
| | S | 0.4 °C for T> 200 °C; 0.8 °C for T< 200 °C |
| | T | 0.15 °C for T> 100 °C; 0.2 °C for T< 100 °C; 0.4 °C for T< 0 °C |
| | U | 0.15 °C for T> 200 °C; 0.25 °C for T< 200 °C; 0.4 °C for T< -100 °C |
| Cold junction drift | 0.06 °C/°C in the range -40 ... +85 °C (Ref.: 20°C) | |
| Cold junction compensation | selectable internal or fixed by software | |

| Voltage input (mV) | |
|---|---|
| Measurement range | -10.0 ... +80.0 mV |
| Minimum span *(1)* | 3 mV |
| Input impedance | >10 MΩ |
| Input resolution | 3 µV |

| Note | |
|---|---|
| | *(1)* Spans can be set to each value below the minimum because the D/A convertor accuracy is dependent on the resolution; the analogue resolution can be calculated as follows: $\text{Resolution [\%]} = \frac{100 \times \text{Input resolution}}{\text{Span set}}$ |
| | *(2)* When a value below 1 Ω is applied to the input, a sensor error is detected (sensor short circuit). |

**Output**

| | |
|---|---|
| Output signal | 4 ... 20 mA or 20 ... 4 mA |
| Failure signal | ≅ 3.8 mA or ≅ 21.0 mA presettable |
| Damping | 0 ... 32 s presettable |
| Load | Power supply - 13.0 V / 0.022 A |
| Power supply effect | 0.003% / V |
| D/A resolution | 0.5 µA |
| D/A converter accuracy | ±0.025% of the calibrated span |
| Analogue accuracy | Analogue accuracy, referenced to the output, can be calculated as follows:<br>D/A converter accuracy + Digital accuracy<br>Example: Pt100 input, 0...100°C calibrated span, ± 0.025% of calibrated span + ± 0.15 K Digital accuracy = ± 0.175 K Total accuracy |
| Long term stability (12 months) | ±0.1% of the span or ±0.1°C |

**Measurement accuracy**

| RTD input | |
|---|---|
| Digital accuracy | ± 0.15 °C, contains calibration and linearisation errors |
| Input resolution | 0.1 °C |
| Linearity | 0.15 °C |
| Linearisation | Using software module |
| Influence of connection cable | 2-wire: Compensation per software<br>3-wire: no influence, when R < 100 Ω<br>4-wire: no influence |

| Resistance input | |
|---|---|
| Digital accuracy | Range 0-400 Ω : ± 0.04 Ω / Range 0-4000 Ω : ± 0.8 Ω<br>contains calibration errors |
| Input resolution | Range 0-400 Ω : ± 0.008 Ω / Range 0-4000 Ω : ± 0.16 Ω |
| Linearity | Range 0-400 Ω : ± 0.04 Ω / Range 0-4000 Ω : ± 0.8 Ω |
| Influence of connection cable | 2-wire: Compensation per software<br>3-wire: no influence, when R < 100 Ω<br>4-wire: no influence |

| Thermocouple input (TC) | | |
|---|---|---|
| Digital accuracy | Type | Digital accuracy |
| | B | 1.5 °C for T> 1000 °C; 2.5 °C for T< 1000 °C |
| | E | 0.3 °C for T> -100 °C; 0.6 °C for T< -100 °C |
| | J | 0.3 °C for T> 0 °C; 0.4 °C for T< 0 °C;<br>0.8 °C for T< -150 °C |
| | K | 0.4 °C for T> 0 °C; 0.6 °C for T< 0 °C;<br>0.8 °C for T< -150 °C |
| | L | 0.3 °C for T> 0 °C; 0.6 °C for T< 0 °C |
| | N | 0.4 °C for T> 300 °C; 0.6 °C for T< 300 °C;<br>1 °C for T< 0 °C |
| | R | 0.6 °C for T> 500 °C; 0.8 °C for T< 500 °C;<br>2 °C for T< 200 °C |
| | S | 0.8 °C for T> 200 °C; 1.5 °C for T< 200 °C |
| | T | 0.3 °C for T> 100 °C; 0.4 °C for T< 100 °C;<br>0.8 °C for T< 0 °C |
| | U | 0.3 °C for T> 200 °C; 0.5 °C for T< 200 °C;<br>0.8 °C for T< -100 °C |
| | The digital accuracy contains calibration and linearisation errors. Cold junction error: 0.5°C at 25°C. | |

| Voltage input (mV) | |
|---|---|
| Digital accuracy | 12 µV, contains calibration errors |
| Input resolution | 3 µV |
| Linearity | 12 µV |

| | |
|---|---|
| Temperature drift | 30 ppm/°C for digital reading<br>50 ppm/°C for analogue output |
| Warm-up time | ≈ 60 s |
| Reaction time | ≈ 400 ms (update time) |

**Application conditions**

| Installation conditions | |
|---|---|
| Installation angle | No limitation |

| Ambient conditions | |
|---|---|
| Ambient temperature | -40 ... +85 °C for standard version (IEC 68-2-14)<br>(for Intrinsically safe version, see table next page) |
| Storage temperature | -45 ... +90 °C (IEC 68-2-14) |
| Climatic class | Humidity 10 ... 95% (IEC 68-2-14) without condensation |
| Ingress protection | Housing IP65 |
| Shock | according to IEC 68-2-31 |
| Vibration | according to IEC 68-2-6 |

| EM immunity | |
|---|---|
| Field strength | to EN 50011 : 1991, Group 1, Class B,<br>ENV 50140 (1993) / ENV 50204 (1995) |
| ESD | to EN 61000-4-2, Level 3:<br>6 kV contact discharge, Criteria A |
| Burst | to EN 61000-4-4, Level 3:<br>I/O Lines: 1 kV, Criteria A ; 2 kV, Criteria B |
| Surge | to EN 61000-4-5,<br>I/O Lines: 1 kV Line to earth, Criteria A |
| Conducted HF | to EN 61000-4-6,<br>0,15 ... 80 MHz, 10 V, Criteria A |
| Judgement | Requirements according to technical specification,<br>EN 61326-1 (industrial locations) and NAMUR NE21<br>are fulfilled. |

**Mechanical construction**

| Model | Housing T4 | |
|---|---|---|
| Weight | approx. 1200 g | |
| Materials | Housing | Cast alluminium housing with protective polyester-based powder coating RAL 5012 (blue), cover RAL 7035 (grey), seawater resistant , saltwater spray test DIN 50021 (504 h) passed |
| | Nameplate | 1.4301 (SS 304) |
| | O-ring | NBR (for cover seal) |
| Electrical connections | PG 13.5 with Skintop cable gland or<br>Conduit entry M20 x 1.5, 1/2" NPT, G 1/2" | |
| Output terminals | Screw terminals, 2.5 $mm^2$ (13 AWG), max. wires | |
| Sensor connections | PG 13.5 with Skintop cable gland or<br>M20 x 1.5, 1/2" NPT, G 1/2" | |
| Sensor terminals | Spring terminals, 0.2 (24 AWG) to 1.5 $mm^2$ (16 AWG),<br>max. wires | |

**Display and operating level**

| Display | |
|---|---|
| Type | 4 digit LCD |
| Range | -9999 to +9999 |
| Temperature resolution | 0.1 (up to 999.9)<br>1 (> 1000) |
| Resistance/mV resolution | 0.01 (up to 99.99)<br>0.1 (up to 999.9) |
| Bargraph | 28 segments |
| Operating surface | HART hand operating module DXR 275 or Commuwin II software package, operational under Windows 3.11/95/NT, for setting up, transmission and visualisation of measured data. |

**Power supply**

| | |
|---|---|
| Power supply (3) | 13 to 36 V DC for general purpose version<br>13.0 to 30 V DC for EEx-d and EEx-i versions |
| Voltage drop | 13 V |
| Allowable ripple | 5% of power supply, within the admitted voltage range |
| Galvanic separation | Isolation input / output : 500 V AC for 1 minute |
| | Isolation input / ground : ≤ 250 V AC |
| Note | (3) Hart communication protocol requires a min. loop resistance of 250 Ω. The power supply must consider the voltage drop across the resistor, to guarantee the minimum 13 V across transmitter terminals:<br>$V_{min.\ supply}$ = 13 V + (0.022 x $R_{loop}$) |

**Serial connection**

| | |
|---|---|
| Protocol | HART ® |
| Transmission speed | 1200 Baud |
| Number of addresses | 16 (0 to 15) |
| Max connection length 4 ... 20mA | 3000 m (see also Hart Smart Communication Protocol, Physical Layer, Specification Rev. 7.1) |

**Certificates and Approvals**

| Instrinsicallv safe version | | |
|---|---|---|
| Certificate number | CESI no. EX-99.E.003X [Special conditions, see Note (4)] | |
| | ATEX II 1 G EEx ia IIC T6, T5, T4 - CESI 99 ATEX 077 | |
| According to II 1 G EEx ia IIC T6, T5, T4 | 4 ... 20 mA : Ci ≅ 10 µF<br>: Li ≅ 20 mH | Sensor : $C_O$ ≤ 3.0 µF<br>: $L_O$ ≤ 3.0 mH |
| Max. voltage | Ui = 30 V | |
| Max. current | Ii =100 mA | |
| Max. power | Pi = 0.75 W | |
| Max. ambient temperature | T4 = 85°C ; T5 = 70°C ;T6 = 55°C | |
| Note | (4) The temperature transmitter TMD833 (EEx ia Version) shall be supplied by associated apparatus with galvanic insulation certified according to EN 50.014 / 50.020 standards, with the electrical characteristics above indicated. | |

| Thermoprobe connection Sensor input [EEx ia] | |
|---|---|
| Max. voltage | Uo = 6.78 V |
| Max. current | Io = 10.3 mA |
| Max. power | Po = 17.3 mW |

| Explosion proof version | |
|---|---|
| Certificate number | CESI 00 ATEX 045 |
| According to II 2 G EEx d IIC T6, T5, T4 | Ui ≤ 36 VDC |

**CE-mark**

| | |
|---|---|
| Recommendation | 89/336/EW |

Technical alterations reserved.

## Europe

**Austria**
❑ Endress+Hauser Ges.m.b.H.
Wien
Tel. 01/ 88056-0, Fax 01/ 88056-35

**Belarus**
Belorgsintez
Minsk
Tel. (0172) 263166, Fax (0172) 263111

**Belgium / Luxembourg**
❑ Endress+Hauser S.A./N.V.
Brussels
Tel. (02) 2480600, Fax (02) 2480553

**Bulgaria**
INTERTECH-AUTOMATION
Sofia
Tel. (02) 624834, Fax (02) 688186

**Croatia**
❑ Endress+Hauser GmbH+Co.
Zagreb
Tel. (01) 4158 12, Fax (01) 44 78 59

**Cyprus**
I+G Electrical Services Co. Ltd.
Nicosia
Tel. (02) 484788, Fax (02) 484690

**Czech Republic**
❑ Endress+Hauser GmbH+Co.
Ostrava
Tel. (069) 6611948, Fax (069) 6612869

**Denmark**
❑ Endress+Hauser A/S
Søborg
Tel. (31) 673122, Fax (31) 673045

**Estonia**
Elvi-Aqua-Teh
Tartu
Tel. (7) 422726, Fax (7) 422726

**Finland**
❑ Endress+Hauser Oy
Espoo
Tel. (90) 859615 5, Fax (90) 8596055

**France**
❑ Endress+Hauser
Huningue
Tel. 89696768, Fax 89694802

**Germany**
❑ Endress+Hauser Meftec hnik GmbH+Co.
Weil am Rhein
Tel. (07621) 975-01, Fax (07621) 975-555

**Great Britain**
❑ Endress+Hauser Ltd.
Manchester
Tel. (0161) 2865000, Fax (0161) 9981841

**Greece**
I & G Building Services Automation S.A.
Athens
Tel. (01) 9241500, Fax (01) 9221714

**Hungary**
Mile Ipari-Elektro
Budapest
Tel. (01) 2615535, Fax (01) 2615535

**Iceland**
Vatnshreinsun HF
Reykjavik
Tel. (05) 889616, Fax (05) 332022

**Ireland**
Flomeaco Company Ltd.
Kildare
Tel. (045) 868615, Fax (045) 868182

**Italy**
❑ Endress+Hauser Italia S.p.A.
Cernusco s/N Milano
Tel. (02) 92106421, Fax (02) 92107153

**Latvia**
Rino
Riga
Tel. (01) 7312897 , Fax (01) 7312894

**Lithuania**
Agava Ltd.
Kaunas
Tel. (07) 202410, Fax (07) 207414

**Netherlands**
❑ Endress+Hauser B.V.
Naarden
Tel. (035) 6958611, Fax (035) 6958825

**Norway**
❑ Endress+Hauser A/S
Tranby
Tel. (032) 851085, Fax (032) 851112

**Poland**
❑ Endress+Hauser Polska Sp. z o.o.
Warsaw
Tel. (022) 651 01 74, Fax (022) 651 01 78

**Portugal**
Tecnisis - Tecnica de Sistemas Industriais
Linda-a-Velha
Tel. (01) 4172637, Fax (01) 4185278

**Romania**
Romconseng SRL
Bucharest
Tel. (01) 4101634, Fax (01) 4101634

**Russia**
Avtomatika-Sever Ltd.
St. Petersburg
Tel. (0812) 555 07 00, Fax (0812) 556 1321

**Slovak Republic**
Transcom Technik s.r.o.
Bratislava
Tel. (07) 44888664, Fax (07) 44887112

**Slovenia**
❑ Endress+Hauser D.O.O.
Ljubljana
Tel. (061) 1592217, Fax (061) 1592298

**Spain**
❑ Endress+Hauser S.A.
Barcelona
Tel. (93) 4734644, Fax (93) 4733839

**Sweden**
❑ Endress+Hauser AB
Sollentuna
Tel. (08) 6261600, Fax (08) 6269477

**Switzerland**
❑ Endress+Hauser AG
Reinach/BL 1
Tel. (061) 7157575 Fax (061) 7111650

**Turkey**
Intek Endüstriyel Ölcü ve Kontrol Sistemleri
Istanbul
Tel. (0212) 275 13 55, Fax (0212) 266 27 75

**Ukraine**
Photonika GmbH
Kiev
Tel. (044) 2688102, Fax (044) 2690805

## Africa

**Egypt**
IAB Office
Et Cairo
Tel. (02) 361 61 17, Fax (02) 360 96 76

**Morocco**
Oussama S.A.
Casablanca
Tel. (02) 241338, Fax (02) 405602

**Nigeria**
J F Technical Invest. Nig. Ltd.
Lagos
Tel. (1) 62234546, Fax (1) 62234548

**South Africa**
❑ Endress+Hauser Pty. Ltd.
Sandton
Tel. (011) 4441386, Fax (011) 4441977

**Tunisia**
Controle, Maintenance et Regulation
Tunis
Tel. (01) 793077, Fax (01) 788595

## America

**Argentina**
Servotron SACIFI
Buenos Aires
Tel. (011) 45227970, Fax (011) 45227909

**Bolivia**
Tritec S.R.L.
Cochabamba
Tel. (042) 509 81, Fax (042) 509 81

**Brazil**
Servotek
Sao Paulo
Tel. (011) 536 34 55, Fax (011) 536 34 57

**Canada**
❑ Endress+Hauser Ltd.
Burlington, Ontario
Tel. (905) 681 92 92, Fax (905) 681 94 44

**Chile**
DIN Instrumentos Ltda.
Santiago
Tel. (02) 205 01 00, Fax (02) 225 81 39

**Colombia**
Colsein Ltd.
Santafe de Bogota D.C.
Tel. (01) 236 76 59, Fax (01) 610 78 68

**Costa Rica**
EURO-TEC S.A.
San Jose
Tel. 296 15 42, Fax 296 15 42

**Ecuador**
Insetec Cia. Ltda.
Quito
Tel. (02) 461833, Fax (02) 461833

**El Salvador**
ACISA
San Salvador, C.A.
Tel. (02) 840748

**Guatemala**
ACISA Automatiziacion Y Control
Ciudad de Guatemala, C.A.
Tel. (02) 327432, Fax (02) 327431

**Mexico**
Maquinaria y Accesorios S.A. de C.V.
Mexico D.F.
Tel. (5) 563 81 88, Fax (5) 393 29 37

**Paraguay**
Incoel S.R.L.
Asuncion
Tel. (021) 203465, Fax (021) 26583

**Peru**
Esim S.A.
Lima
Tel. (01) 471 46 61, Fax (01) 471 09 93

**Uruguay**
Circular S.A.
Montevideo
Tel. (02) 925785, Fax (02) 929151

**USA**
❑ Endress+Hauser Inc.
Greenwood, Indiana
Tel. (317) 535-7138, Fax (317) 535-1489

**Venezuela**
Controval C.A.
Caracas
Tel. (02) 9440966, Fax (02) 9444554

## Asia

**China**
❑ Endress+Hauser Beijing
Beijing
Tel. (010) 407 21 20, Fax (010) 403 45 36

**Hong Kong**
❑ Endress+Hauser (H.K.) Ltd.
Hong Kong
Tel. 2528 31 20, Fax 2865 41 71

**India**
❑ Endress+Hauser India Branch Office
Mumbai
Tel. (022) 8521458, Fax (022) 8521927

**Indonesia**
PT Grama Bazita
Jakarta
Tel. (21) 7975083, Fax (21) 7975089

**Japan**
❑ Sakura Endress Co., Ltd.
Tokyo
Tel. (0422) 540611, Fax (0422) 550275

**Malaysia**
❑ Endress+Hauser (M) Sdn. Bhd.
Petaling Jaya, Selangor Darul Ehsan
Tel. (03) 7334848, Fax (03) 7338800

**Philippines**
Brenton Industries Inc.
Makati Metro Manila
Tel. (2) 8430661, Fax (2) 8175739

**Singapore**
❑ Endress+Hauser (S.E.A.) Pte., Ltd.
Singapore
Tel. 4688222, Fax 4666848

**South Korea**
Hitrol Co. Ltd.
Kyung Gi-Do
Tel. (032) 672 31 31, Fax (32) 672 00 90

**Taiwan**
Kingjarl Corporation
Taipei R.O.C.
Tel. (02) 718 39 38, Fax (02) 713 41 90

**Thailand**
❑ Endress+Hauser Ltd.
Bangkok
Tel. (2) 272 36 74, Fax (2) 272 36 73

**Vietnam**
Tan Viet Bao Co. Ltd.
Ho Chi Minh City
Tel. (08) 833 52 25, Fax (08) 833 52 27

**Iran**
Telephone Technical Services Co. Ltd.
Tehran
Tel. (021) 882 74 26, Fax(021) 882 73 36

**Israel**
Instrumetrics Industrial Control Ltd.
Tel-Aviv
Tel. (03) 648 02 05, Fax (03) 647 19 92

**Jordan**
A.P. Parpas Engineering S.A.
Amman
Tel. (06) 839283, Fax (06) 839205

**Kingdom of Saudi Arabia**
Intrah
Dammam
Tel. (03) 834 78 79, Fax (03) 834 48 32

**Kuwait**
Kuwait Maritime & Mercantile Co. K.S.C.
Safat
Tel. 243 47 52, Fax 244 14 86

**Lebanon**
Network Engineering Co.
Jbeil
Tel. (3) 254052, Fax (9) 944080

**Sultanate of Oman**
Mustafa & Jawad Sience & Industry Co.
L.L.C.
Ruwi
Tel. 602009, Fax 607066

**United Arab Emirates**
Descon Trading EST.
Dubai
Tel. (04) 653651, Fax (04) 653264

**Yemen**
Yemen Company for Ghee and Soap Industry
Taiz
Tel. (04) 230665, Fax (04) 212338

## Australia + New Zealand

**Australia**
ALSTOM Australia Ltd.
Villawood N.S.W.
Tel. (02) 97224777, Fax (02) 97224883

**New Zealand**
EMC Industrial Instrumentation
Auckland
Tel. (09) 444 92 29, Fax (09) 444 11 45

## All other countries

❑ Endress+Hauser GmbH+Co.
Instruments International
Weil am Rhein
Tel. (07621) 975-02, Fax (07621) 975345

Endress+Hauser

❑ Members of the Endress+Hauser group http://www.endress.com

BA 019T/02/en/11.02
EHT/ CV4.2