HART® Compatible Intelligent 2-wire In-head Transmitters

MESO-H is a Smart and universal 2-wire In-head transmitter for temperature and other measurement applications.

MESO-HX is the Intrinsic Safe version for use in Ex-applications.

MESO-H and MESO-HX are fully HART-compatible, with communication through the HART protocol, directly on the 4-20 mA output loop, by using either a general hand-held HART Communicator or the Inor PC software, MEPRO 2.

MEPRO 2 is a Windows based and user friendly software, which facilitates the access to and use of functions like transmitter configuration, documentation, monitoring and calibration.

Performance and design:

Excellent stability
- Long-term stability 0.1 %/year.

Enhanced total system accuracy
- Sensor error correction (compensates for known sensor errors).

Input-Output isolation 1500 VAC
- Eliminates measuring errors due to ground loops.

High load capacity
- Only 10 V voltage drop over the transmitter (MESO-H) allows for high loads.

Designed for harsh conditions
- Operation temperature:
  - up to 85 °C / 185 °F (105 °C / 221 °F on request)
- Excellent EMC performance.
- Durable, shockproof design.

Simple mounting and connection
- For DIN B head or larger.
- Large center hole (dia. 7 mm / 0.28 inch).

5 year limited warranty

Functions:

Fully HART® Compatible
- True on-line communication with hand-held HART Communicator or Windows software MEPRO 2.

Input for RTDs, T/Cs, mV and resistance
- Reduced inventory costs.
- Simplified plant engineering.

Efficient customized 50-point linearization
- Any sensor characteristics can be matched.

Sensor diagnostics
- SmartSense detects low sensor isolation (essential for correct measurements).
- Selectable sensor break action.

Simplified loop check-up
- The transmitter works as an accurate current generator.

On-screen indications of input and output
- Valuable tools for temporary measurements.

Improved QA with data storage
- Vital information, such as TAG-No., maintenance record etc. can be stored in the nonvolatile memory.
**Main features of MESO-H and MESO-HX**

**Accuracy and stability**
MESO-H/MESO-HX are designed for applications with high demands on accuracy, also under severe operating conditions. To reach these demands, the following factors are essential:

- **Linearity and calibration errors** - The combination of an efficient linearization function and the use of quality components and precision calibration equipment reduce these errors to ±0.1% of span.
- **Ambient temperature influence** - The transmitters in the MESO family are compensated to reduce the ambient temperature influence to low levels.
- **High long-term stability** - Internal “self calibration”, by means of continuous adjustment of important parameters after comparison with accurate built-in references, contributes to a stability of ±0.1%/year.

**Measurements with RTDs and other resistances**
MESO-H/MESO-HX accept inputs from standardized Platinum and Nickel RTDs like Pt10…Pt1000 acc. to IEC 751 (a=0.00385), Pt100 acc. to JIS 1604 (a=0.003916) and Ni100 / Ni1000 acc. to DIN 43760, as well as inputs from plain resistance sensors such as potentiometers.

A 3- or 4-wire connection can be chosen.

**Measurements with thermocouples and plain voltage**
MESO-H/MESO-HX accept inputs from 11 types of standardized thermocouples as well as plain mV input.

For T/C input, the CJC (Cold Junction Compensation) is fully automatic, by means of an accurate measurement of the terminal temperature. Alternatively, the CJC can be disabled.

**Sensor error connection**
MESO-H/MESO-HX offer a way of improving the measurement with temperature sensors:

- Known sensor errors compared to the standard curve, e.g. for a calibrated sensor, are entered, and the transmitter automatically corrects for the sensor errors.

**Customized linearization and Engineering units**
The accurate and versatile 50-point Customized linearization can be used to create almost any type of linearization curve for RTD, T/C, resistance and mV inputs. By combining Customized linearization with the use of Engineering units, the transmitters can be programmed to give a linear output corresponding to a specific measuring range expressed in the primary process value.

The sensor characteristics are described by either up to 50 data pairs or a third order polynomial. **Fig. 2a and 2b.**

- **SmartSense - Sensor isolation monitoring**
SmartSense continuously monitors the isolation resistance of thermocouples and 3-wire connected RTDs as well as the cabling between sensor and transmitter. The transmitter will react by forcing the output to a user defined level if the isolation level is too low. SmartSense requires an extra lead inside the thermocouple or RTD. **Fig. 7.**

  For detailed information, see section Theory and Facts.

**Sensor break monitoring**
MESO-H/MESO-HX monitor sensor break and force the output signal to a user defined level, when any sensor lead is broken or disconnected. The sensor break monitoring can be switched off. The monitoring is furnished with a pulsed excitation current. This eliminates the voltage drop in the lead wires (giving a measuring error), caused by a standard DC excitation current.

**Controlled output for instrument calibration**
With MEPRO 2, MESO-H/MESO-HX can be set to automatically provide the recurring output values of 4, 12, 20, 12, 4 mA in a periodical scheme. Each level will last 15 seconds. The total time for controlled output is adjustable up to 30 minutes. With the hand-held Hart Communicator model 275, a constant transmitter output can be set at any level between 4 and 20 mA.
Adjustable dampening
The dampening function can be used to dampen undesired instabilities on the input signal. The dampening time can be set to values between 0 and 10 seconds in intervals of 1 second. The dampening time is the time required, in addition to the update time, for the output to reach 90% of its final value after a step change has been applied to the input.

Power supply
MESO-H/MESO-HX are loop-powered and will work on voltages down to 10 VDC (12 VDC for MESO-HX). Reversed polarity will not damage the transmitter.
Since the HART communication requires a loop resistance of at least 250 Ω, the minimum power supply is 15.75 VDC for MESO-H and 17.75 VDC for MESO-HX.
The relation between supply voltage and permissible load in the output loop is shown in fig. 8.

Mounting
MESO-H/MESO-HX are designed to fit inside connection heads type DIN B or larger.

The large center hole, dia. 7 mm / 0.28 inch, facilitates the pulling through of the sensor leads or an insert tube, greatly simplifying the mounting procedure. Fig. 3.

Output cabling
MESO-H/MESO-HX allow for long output cables. The length is determined by the combination of the cable capacitance, the cable resistance, and the load resistance. Fig. 4.

Warranty
MESO-H/MESO-HX are covered by a 5 year limited warranty.
Communicating with PC and MEPRO 2 software
MEPRO 2, which is used with all MESO-transmitters, is the best tool to utilize all the versatile functions of the MESO-H/MESO-HX such as:

- Measurement configuration: sensor type, range, sensor error correction, linearization, engineering units, output settings, filter activation, etc.
- Monitoring of the sensor status: Sensor break and sensor isolation (SmartSense).
- Transmitter diagnostics.
- On-screen real time presentation of measured values and output signal.
- Transmitter basic calibration.
- Documentation: Configuration files can be saved for future use and configuration protocols can easily be printed.

MEPRO 2 is compatible with Windows 3.1, Windows 3.11 and Windows 95. The program is menu-driven and easy to use. On-line help is an effective tool for the user.

Communicating with HART Communicator
In a system with different HART compatible units, the HART Communicator, model 275, offers a great advantage. When connected to the current loop, the device automatically recognizes the slave’s make and model and is directly ready to communicate. The HART Communicator can reach all functions within the MESO-H/MESO-HX (except for the Customized Linearization with data pairs and transmitter calibration).

The software of the HART Communicator must include the DD (Device Description) for MESO. New devices delivered as of July, 1997, normally include the DD for MESO, and older communicators can easily be upgraded by the supplier of the device.

HART® is a master-slave concept where compatible instruments like MESO-H/MESO-HX are the slave devices. The master can be either a PC with the INOR MEPRO 2 software and a HART modem, or the hand-held HART Communicator, model 275.

The HART protocol uses the very robust FSK (Frequency Shift Keying) communication method. The frequency signal is superimposed on the 4-20 mA signal as a near sinus-shaped waveform. The average value of the superimposed signal is 0, and therefore, it will not interfere with the 4-20 mA signal.

For a more detailed explanation of the HART concept, the reader is referred to “A Technical Overview”, published by the HART Communication Foundation.

**Standard mode**
In the standard mode, the 4-20 mA output is active, and the master is connected anywhere across the output leads. Please note, that there must be a resistance of at least 250 Ω between the connection point and the power supply for safe HART communication. The total loop resistance (load + cable) should not exceed 1100 Ω. Fig. 6.

**Multidrop mode**
In multidrop mode, the 4-20 mA output is not used (locked to 4 mA). A maximum of 15 units in the same loop can communicate digitally with the master. Each unit will only reply to messages directed to its personal address. The message rate is 2-3 complete messages per second. Fig. 5.

**Fig. 4**

**Fig. 5**

Up to ~1500 m 4-20 mA HART

R ≥ 250 Ω

DCS, PLC etc.

Field instruments

HART Communicator with DD for MESO

PC with MEPRO 2

Alternatives

Typical “Standard Mode” installation. Special requirements for Hazardous Locations (see Conformity Certificates).

HART is registered trademark of HART Communication Foundation.
MESO-H/ MESO-HX Configuration scheme

### Input
- **RTD**
  - Pt100 (IEC751, $\alpha = 0.00385$)
  - Pt1000 (IEC751, $\alpha = 0.00385$)
  - PtX ($10 \times X \leq 1000$ (IEC751, $\alpha = 0.00385$))
  - Ni100 (DIN 43760)
  - Ni1000 (DIN 43760)
  - D100 (Pt 100 acc. to JIS1604, $\alpha = 0.003916$)

- **Thermocouple**
  - Type A: W5%Rh-W26%Rh
  - Type B: Pt30%Rh - Pt6%Rh
  - Type E: NiCr-CuNi
  - Type J: Fe-CuNi
  - Type K: NiCr-Ni

- **Resistance**
  - Span: 10 $\Omega$ to 2000 $\Omega$

- **Voltage**
  - Span: 2 mV to 500 mV

### Linearity
- Temperature linear
- Resistance linear
- Voltage linear
- Customized linearization

### Connections and Additional Functions
- 3-wire connection
- 4-wire connection
- 3-wire connection + SmartSense (Pt100)
- Diff temperature (Pt100)
- Sensor break protection
- Sensor error correction

- Cold junction compensation (CJC)
- No CJC
- CJC + SmartSense
- Sensor break protection
- Sensor error correction

### Dampening
- Dampening time 0-10 s

### Output
- Current
  - 4 - 20 mA
  - 20 - 4 mA
  - Special

- Engineering unit
- Min/max correction
## Specifications

### Input

#### RTD’s and Resistance

<table>
<thead>
<tr>
<th>Material</th>
<th>Type</th>
<th>Connection</th>
<th>Temperature Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt100 (IEC751, $\alpha = 0.00385$)</td>
<td>3-, 4-wire connection</td>
<td>-200 to +1000 °C / -328 to +1832 °F</td>
<td></td>
</tr>
<tr>
<td>Pt1000 (IEC751, $\alpha = 0.00385$)</td>
<td>3-, 4-wire connection</td>
<td>-200 to +200 °C / -328 to +392 °F</td>
<td></td>
</tr>
<tr>
<td>$\alpha X$ ≤ 1000 (IEC751, $\alpha = 0.00385$)</td>
<td>3-, 4-wire connection</td>
<td>Upper range depending on $X$ value</td>
<td></td>
</tr>
<tr>
<td>Ni100 (DIN 43760)</td>
<td>3-, 4-wire connection</td>
<td>-60 to +250 °C / -76 to +482 °F</td>
<td></td>
</tr>
<tr>
<td>Ni1000 (DIN 43760)</td>
<td>3-, 4-wire connection</td>
<td>-60 to +150 °C / -76 to +302 °F</td>
<td></td>
</tr>
<tr>
<td>D100 (Pt 100 acc. to JIS1604, $\alpha = 0.003916$)</td>
<td>3-, 4-wire connection</td>
<td>-200 to +1000 °C / -328 to +1832 °F</td>
<td></td>
</tr>
</tbody>
</table>

#### Potentiometer/resistance

- 3-, 4-wire connection
- 25 Ω / wire

### Thermocouples and Voltage

<table>
<thead>
<tr>
<th>Type</th>
<th>Voltage input</th>
<th>Input impedance</th>
<th>Maximum sensor wire resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>T/C</td>
<td>-10 to +500 mV</td>
<td>&gt;10 MΩ</td>
<td>500 Ω (total loop)</td>
</tr>
</tbody>
</table>

### Monitoring

- Sensor break monitoring: User definable output (3.6 to 22.8 mA)
- SmartSense, sensor isolation monitoring: User definable output (3.6 to 22.8 mA)

### Adjustments

- Zero adjustment: All inputs, any value within range limits
- Minimum spans:
  - Pt100, Pt1000, Ni100, Ni1000: 10 °C / 18 °F
- Pt100, Pt1000: 10 °C / 18 °F

### Output

- Straight, reversed or any intermediate value: 4-20/20-4 mA
- Resolution: 5 μA
- Minimum output signal: ~ 3.6 mA
- Maximum output signal: ~ 23 mA
- Permissible load, see fig. 8:
  - MESO-H: 610 Ω @ 24 VDC, 23 mA
  - MESO-HX: 520 Ω @ 24 VDC, 23 mA

### Temperature

- Ambient, storage: -40 to +85 °C / -40 to +185 °F
- Ambient, operation:
  - MESO-H: -40 to +85 °C / -40 to +185 °F
  - MESO-HX: See Intrinsic Safety Specifications

### General data

- Adjustable dampening time: 0 to 10 s
- Update time: ~ 0.8 s
- Isolation In-Out: 1500 VAC, 1 min
- Humidity (non-condensing): 0 to 95 %RH
- Intrinsic safety:
  - MESO-HX: Cenelec EEx ia IIC T4, T5, T6
  - FM: Approval pending

### Power supply, polarity protected

<table>
<thead>
<tr>
<th>Material</th>
<th>Supply voltage</th>
<th>Permissible ripple</th>
</tr>
</thead>
<tbody>
<tr>
<td>MESO-H</td>
<td>10 to 42 VDC 2-wire</td>
<td>2 V p-p @ 50/60Hz</td>
</tr>
<tr>
<td>MESO-HX</td>
<td>12 to 30 VDC 2-wire</td>
<td></td>
</tr>
</tbody>
</table>

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1. Higher load permitted with higher supply voltage (see fig. 8).
2. Minimum 250 Ω required for HART communication.
3. With 250 Ω in the output loop, a minimum of 15.75 VDC (MESO-H) or 17.75 VDC (MESO-HX) is required.
4. For detailed information about permissible noise, we refer to the HART specification HCFSPEC-54.
5. ~1.5 s with Sensor Break Monitoring activated.
**Intrinsic Safety specifications**

<table>
<thead>
<tr>
<th>Specifications</th>
<th>MESO-HX</th>
<th>MESO-HX</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Approval</strong></td>
<td>Demko / Cenelec</td>
<td>Factory Mutual (FM)</td>
</tr>
<tr>
<td><strong>Classification</strong></td>
<td>EEx ia IIC T4, T5, T6</td>
<td>IS for use in Class I, Div. 1, T4/ +85 °C, T5/ +65 °C, T6/ +50 °C Group A-D, T4 / +80 °C</td>
</tr>
<tr>
<td><strong>Certificate No.</strong></td>
<td>96D.121277, Appendix II</td>
<td>Approval pending</td>
</tr>
<tr>
<td><strong>Output/ Supply</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max voltage to transmitter</td>
<td>Ui = 30 Vdc</td>
<td></td>
</tr>
<tr>
<td>Max current to transmitter</td>
<td>Ii = 100 mA</td>
<td></td>
</tr>
<tr>
<td>Max power to transmitter</td>
<td>Pi = 900 mW</td>
<td></td>
</tr>
<tr>
<td>Internal inductance</td>
<td>Li = 1 mH</td>
<td></td>
</tr>
<tr>
<td>Internal capacitance</td>
<td>Ci = 1 nF</td>
<td></td>
</tr>
<tr>
<td><strong>Input (Sensor)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max voltage from transmitter</td>
<td>Ui = 30 Vdc</td>
<td></td>
</tr>
<tr>
<td>Max current from transmitter</td>
<td>Ii = 100 mA</td>
<td></td>
</tr>
<tr>
<td>Max power from transmitter</td>
<td>Not specified</td>
<td></td>
</tr>
<tr>
<td>Max inductance (input loop)</td>
<td>Li = 1.4 mH</td>
<td></td>
</tr>
<tr>
<td>Max capacitance (input loop)</td>
<td>Ci = 65 nF</td>
<td></td>
</tr>
</tbody>
</table>

The User Instructions must be read prior to adjustment and/or installation.

---

### Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accuracy</strong></td>
<td></td>
</tr>
<tr>
<td>Linearity</td>
<td>±0.1 % 1)</td>
</tr>
<tr>
<td>Calibration</td>
<td></td>
</tr>
<tr>
<td>RTD</td>
<td>Max. of ±0.2 °C / ±0.4 °F or ±0.1 % 1)</td>
</tr>
<tr>
<td>Potentiometer</td>
<td>Max. of ±0.1 Ω or ±0.1 % 1)</td>
</tr>
<tr>
<td>mV, T/ C</td>
<td>Max. of ±20 µV or ±0.1 % 1)</td>
</tr>
<tr>
<td><strong>Cold Junction Compensation (CJC)</strong></td>
<td>±0.5 °C / ±0.9 °F</td>
</tr>
<tr>
<td><strong>Temperature influence</strong> 4)</td>
<td></td>
</tr>
<tr>
<td>All inputs</td>
<td>Max. of ±0.25 °C / 25 °C or ±0.25 % / 25 °C 1) 3)</td>
</tr>
<tr>
<td></td>
<td>Max. of ±0.5 °F / 50 °F or ±0.28 % / 50 °F 1) 3)</td>
</tr>
<tr>
<td><strong>Temperature influence CJC 4)</strong></td>
<td>±0.5 °C / 25 °C / ±1.0 °F / 50 °F</td>
</tr>
<tr>
<td><strong>Instrument calibration output</strong></td>
<td>±4.2 mA</td>
</tr>
<tr>
<td><strong>Sensor wire resistance influence</strong></td>
<td>±8 µA</td>
</tr>
<tr>
<td>RTD, Potentiometer, 3-wire</td>
<td>Negligible 2)</td>
</tr>
<tr>
<td>RTD, Potentiometer, 4-wire</td>
<td>Negligible</td>
</tr>
<tr>
<td>mV, T/ C</td>
<td>Negligible</td>
</tr>
<tr>
<td><strong>Load influence</strong></td>
<td>Negligible</td>
</tr>
<tr>
<td><strong>Power supply influence</strong></td>
<td>Negligible</td>
</tr>
<tr>
<td>RFI influence, 0.15-1000 MHz, 10 V or V/ m</td>
<td>±0.2 % 1) (typical)</td>
</tr>
<tr>
<td><strong>Long-term stability</strong></td>
<td>±0.1 % 1) / year</td>
</tr>
</tbody>
</table>

---

1) Of input span
2) With equal wire resistance
3) If zero-deflection > 100% of input span; add 0.125% of input span / 25 °C or 0.14% of input span / 50 °F per 100% zero-deflection
4) Reference temperature 23 °C / 73 °F
**INPUTS**

<table>
<thead>
<tr>
<th>RTD</th>
<th>Pt100, Pt1000, Ni100, Ni1000, PtX, D100</th>
<th>Pt100</th>
<th>Pt100</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-wire connection</td>
<td></td>
<td>3-wire connection</td>
<td>Diff temperature $T_1 &gt; T_2$</td>
</tr>
</tbody>
</table>

- **4-wire connection**
- **3-wire connection**
- **Diff temperature $T_1 > T_2$**

**Potentiometer**

- 4-wire connection
- 3-wire connection

**Voltage**

- Millivolt

**Thermocouple**

- Or customer specific

**SmartSense lead**

**OUTPUT**

**4-20 mA Output**

**Connections**

**Dimensions**

**Fig. 8**

**Ordering table**

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitter</td>
<td>70MEH00001</td>
</tr>
<tr>
<td>MESO-H</td>
<td>70MEH00001</td>
</tr>
<tr>
<td>MESO-HX (Cenelec)</td>
<td>70MEH00001</td>
</tr>
<tr>
<td>MESO-HX (FM)</td>
<td>70MEH00001</td>
</tr>
<tr>
<td>Options</td>
<td>70CAL00001</td>
</tr>
<tr>
<td>Configuration</td>
<td>70CAL00001</td>
</tr>
<tr>
<td>Configuration with 5-point</td>
<td>70CAL00001</td>
</tr>
<tr>
<td>calibration certificate</td>
<td>70CAL00001</td>
</tr>
<tr>
<td>Software, Modem</td>
<td>70MEP00001</td>
</tr>
<tr>
<td>Software MEPRO</td>
<td>70MEP00001</td>
</tr>
<tr>
<td>HART Modem R5 232</td>
<td>70MEM00001</td>
</tr>
<tr>
<td>Accessories</td>
<td>70ADA00008</td>
</tr>
<tr>
<td>Surface mounting box</td>
<td>70ADA00009</td>
</tr>
<tr>
<td>Rail mounting box</td>
<td>70ADA00012</td>
</tr>
<tr>
<td>Head mounting kit</td>
<td>70ADA00013</td>
</tr>
<tr>
<td>Rail mounting kit</td>
<td>70ADA00013</td>
</tr>
</tbody>
</table>
1. CERTIFICATE OF CONFORMITY

2. DEMKO No. 960.121277

3. This certificate is issued for 2 wire Transmitter

4a. Type: MESO-H

4b. Man. and sub-contracted: INOR HX AB, Box 9235, S-200 39 Malmö, Sweden

5. This electrical apparatus and any acceptable variations thereof is specified in the Appendix to this certificate and the documents therein referred to.

6. DEMKO using an Approval Certification Body in accordance with Article 34 of the Council Directive of the European Communities of 16 December 1995, document N1/15/95/EC, confirms that the apparatus has been found to comply with the harmonized European Standards:

   EN 30014 incl. amd. 1 - 5
   EN 50020 incl. amd. 1 - 5

7. The apparatus marking shall include the code:

   Exia to BS 7671/IEC

8. The supplier of the electrical apparatus referred to in this certificate has the responsibility to ensure that the apparatus conforms to the specifications laid down in the Appendix to this certificate and has satisfied the relevant notifications and non-specific criteria.

9. The apparatus may be marked with the European Community Mark specified in Annex II to the Council Directive of 16 January 1994, document 48/139/EEC. A facsimile of this mark is printed at the top of this certificate. The marking of the equipment shall be visible, legible and durable.

For and on behalf of DEMKO

Signature: [Signature]

Höganäs, 1997-04-15

Deviations

Underwriters Laboratories Inc.

APPENDIX II

Page 2/3

in Certificate of Conformity No. 960.121277

GROUP IIA specifications

INPUT: Current loop - Signal output inputtable:

P = 1000W
I = 100mA
L = 100mA
C = 100µF
G = 1mΩ

OUTPUT: Source terminals:

U = 30Vdc
I = 100mA
C = 1-stat
G = 100µF

SPECIAL CONDITIONS FOR BASIC USE

The transmitter shall be intended for housing having protection IP30 or better. The transmitter is approved to be mounted in hazardous area and must be electrically connected via a suitable isolating device with power supply and or power supply, which is located outside the hazardous area.

A 200 mm extension or greater, must be placed in a non-hazardous area in series with the current loop, either external or nested in power supply or power bus.

DRAWSN TO

Number Date Description

A.1510 08.01.97 Labels for Ex

This APPENDIX II is to be used together with the previously issued APPENDIX dated 1997-04-15 and Certificate of Conformity 1997-04-15.