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2-WIRE TRANSMITTER WITH HART® PROTOCOL Operation Manual



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WINTERS INSTRUMENTS
MANUFACTURER OF INDUSTRIAL INSTRUMENTATION

2-WIRE TRANSMITTER WITH HART® PROTOCOL

CONTENTS

EC declaration of conformity.....	
Application.....	1
Technical characteristics.....	1
Mounting / installation.....	1
Applications.....	2
Order: TTHA.....	3
Electrical specifications.....	3
Connections.....	7
Block diagram.....	8
Programming.....	10
Connection of transmitters in multidrop mode.....	11
Mechanical specifications.....	11
Mounting of sensor wires.....	11
Appendix.....	12
ATEX Installation Drawing - TTHA:A.....	13
IECEx Installation Drawing - TTHA:A.....	14
ATEX Installation Drawing - TTHA:D.....	15
IECEx Installation Drawing - TTHA:D.....	16
FM Installation Drawing - TTHA:D.....	17
CSA Installation Drawing - TTHA:D.....	19

EC declaration of conformity

As manufacturer

**Electronics A/S
Lerbakken 10
DK-8410 Rønde**

hererby declares that the following product:

**Type: TTHA
Name: 2-Wire transmitter with HART**

is in conformity with the following directives and standards:

The EMC Directive 2004/108/EC and later amendments
EN 61326-1: 2006

For specification of the acceptable EMC performance level, refer to the
electrical specifications for the module.

The ATEX Directive 94/9/EC and later amendments
**EN 60079-0: 2009, EN 60079-11: 2007
EN 60079-15: 2010, EN 60079-26: 2007
and EN 61241-11: 2006
ATEX certificate: KEMA 03ATEX1508 X (TTHA: A)
ATEX certificate: KEMA 03ATEX1537 (TTHA: D)**

No changes are required to enable compliance with the replacement standard:
EN 60079-11: 2012

Notified body

**DEKRA Certification B.V. (0344)
Utrechtseweg 310, 6812 AR Arnhem
P.O. Box 5185, 6802 ED Arnhem
The Netherlands**

Rønde, 9 August 2012


Kim Rasmussen

2-WIRE TRANSMITTER WITH HART® PROTOCOL

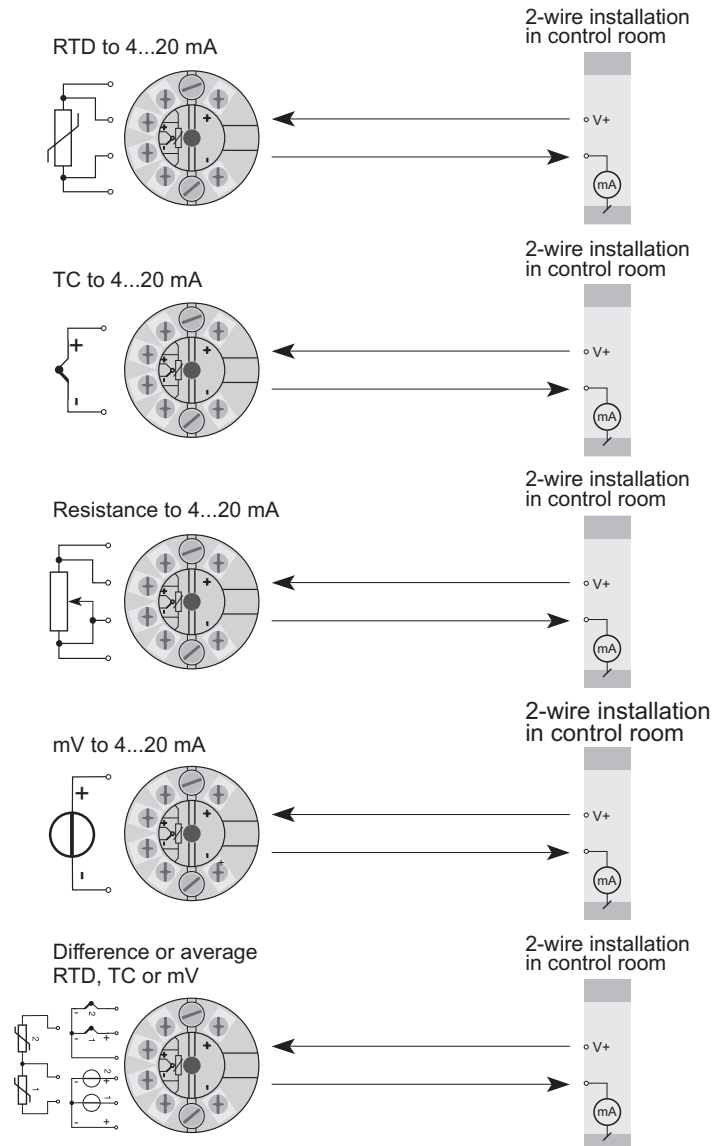
- RTD, TC, Ohm, or mV input
- Extremely high measurement accuracy
- HART® communication
- Galvanic isolation
- For DIN form B sensor head mounting

Application

- Linearised temperature measurement with Pt100...Pt1000, Ni100...Ni1000, or TC sensor.
- Difference or average temperature measurement of 2 resistance or TC sensors.
- Conversion of linear resistance variation to a standard analogue current signal, for instance from valves or Ohmic level sensors.
- Amplification of a bipolar mV signal to a standard 4...20 mA current signal.
- Connection of up to 15 transmitters to a digital 2-wire signal with HART

Technical characteristics

- Within a few seconds the user can program TTHA to measure temperatures within all ranges defined by the norms.
- The RTD and resistance inputs have cable compensation for 2-, 3- and 4-wire connection.
- The TTHA has been designed according to strict safety requirements and is thus suitable for application in SIL 2 installations.
- Continuous check of vital stored data for safety reasons.
- Sensor error detection according to the guidelines in NAMUR NE 89. Mounting / installation
- For DIN form B sensor head mounting. In non-hazardous areas the TTHA can be mounted on a DIN rail with the WINTERS fitting type TTHA.
- NB: As Ex barrier for TTHA we recommend TTHA.



Type	Version
TTHA	Standard : A
	CSA, FM, ATEX, IECEx & INMETRO : D

Accessories

Loop Link USB interface and eset Software
DIN rail clip

Electrical specifications

Specifications range:

-40°C to +85°C

Common specifications:

Supply voltage, DC

Standard..... 8.0...35 V

CSA, FM, ATEX, IECEx & INMETRO..... 8.0...30 V

Isolation voltage, test / operation..... 1.5 kVAC / 50 VAC

Warm-up time..... 30 s

Communications interface..... HART

Signal / noise ratio..... min. 60 dB

Response time (programmable)..... 1...60 s

EEPROM error check..... < 10 s

Signal dynamics, input..... 22 bit

Signal dynamics, output..... 16 bit

Calibration temperature..... 20...28°C

Accuracy, the greater of general and basic values:

General values		
Input type	Absolute accuracy	Temperature coefficient
All	≤ ±0.05% of span	≤ ±0.005% of span / °C

Basic values		
Input type	Basic accuracy	Temperature coefficient
Pt100 and Pt1000	≤ ±0.1°C	≤ ±0.005°C/°C
Ni100	≤ ±0.2°C	≤ ±0.005°C/°C
Lin. R	≤ ±0.1 Ω	≤ ±5 mΩ / °C
Volt	≤ ±10 μV	≤ ±0.5 μV / °C
TC type: E, J, K, L, N, T, U	≤ ±0.5°C	≤ ±0.025°C / °C
TC type: B, R, S, W3, W5	≤ ±1°C	≤ ±0.1°C / °C

EMC immunity influence < ±0.1% of span

Extended EMC immunity:

NAMUR NE 21, A criterion, burst < ±1% of span

Effect of supply voltage variation < 0.005% of span / VDC

Vibration IEC 60068-2-6 Test FC

Lloyd's specification no. 1 4 g / 2...100 Hz

Max. wire size..... 1 x 1.5 mm² stranded wire

Screw terminal torque 0.4 Nm

Relative humidity < 95% RH (non-cond.)

Dimensions..... Ø 44 x 20.2 mm

Protection degree (enclosure / terminals) ... IP68 / IP00

Weight 50 g

Electrical specifications, input:

Max. offset..... 50% of selec. numerical max. value

RTD and linear resistance input:

RTD type	Min. value	Max. value	Min. span	Standard
Pt100	-200°C	+850°C	10°C	IEC 60751
Ni100	-60°C	+250°C	10°C	DIN 43760
Lin. R	0 Ω	7000 Ω	25 Ω	-----

Cable resistance per wire (max.)..... 5 Ω

(up to 50 Ω per wire is possible with reduced measurement accuracy)

Sensor current Nom. 0.2 mA

Effect of sensor cable resistance (3- / 4-wire) < 0.002 Ω/Ω

Sensor error detection Yes

Short circuit detection If 0% > 30 Ω

TC input:

Type	Min. temperature	Max. temperature	Min. span	Standard
B	+400°C	+1820°C	100°C	IEC584
E	-100°C	+1000°C	50°C	IEC584
J	-100°C	+1200°C	50°C	IEC584
K	-180°C	+1372°C	50°C	IEC584
L	-100°C	+900°C	50°C	DIN 43710
N	-180°C	+1300°C	50°C	IEC584
R	-50°C	+1760°C	100°C	IEC584
S	-50°C	+1760°C	100°C	IEC584
T	-200°C	+400°C	50°C	IEC584
U	-200°C	+600°C	50°C	DIN 43710
W3	0°C	+2300°C	100°C	ASTM E988-90
W5	0°C	+2300°C	100°C	ASTM E988-90

Cold junction compensation < ±1.0°C
 External CJC with Ni100 or Pt100..... -40 ≤ T_{amb.} ≤ 135°C
 Sensor error detection Yes
 Sensor error current:
 When detecting..... Nom. 33 µA
 Else 0 µA
 Short circuit detection If 0% > 5 mV

Voltage input:

Measurement range -800...+800 mV
 Min. span..... 2.5 mV
 Input resistance 10 MΩ

Current output:

Signal range 4...20 mA
 Min. signal range 16 mA
 Updating time 440 ms
 (660 ms for diff.)
 Fixed output signal Between 4 and 20 mA
 Output signal at EEPROM error ≤ 3.5 mA
 Load resistance ≤ (V_{supply} - 8) / 0.023 [Ω]
 Load stability < ±0.01% of span / 100 Ω

Sensor error detection:

Programmable..... 3.5...23 mA
 NAMUR NE43 Upscale..... 23 mA
 NAMUR NE43 Downscale 3.5 mA

Of span = Of the presently selected range

Approvals:

EMC 2004/108/EC..... EN 61326-1

GOST R

Marine approval:

Det Norske Veritas, Ships & Offshore..... Stand. for Certific. No. 2.4

Ex / I.S.:

TTHA:

ATEX 94/9/EC..... KEMA 03ATEX1508 X

IECEx..... KEM 10.0083 X

TTHA:

ATEX 94/9/EC..... KEMA 03ATEX1537

IECEx..... KEM 10.0083 X

FM certificate..... 2D5A7

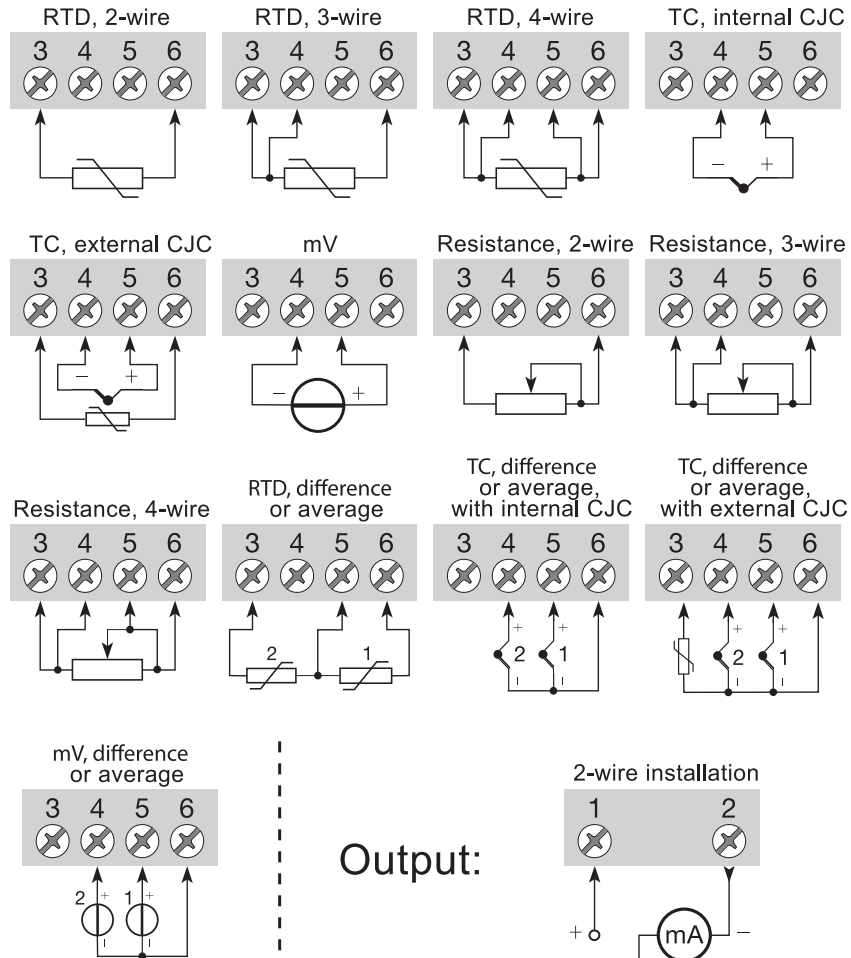
CSA certificate..... 1125003

INMETRO certificate..... NCC 12.0844 X

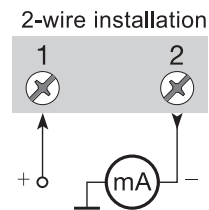
GOST Ex

CONNECTIONS

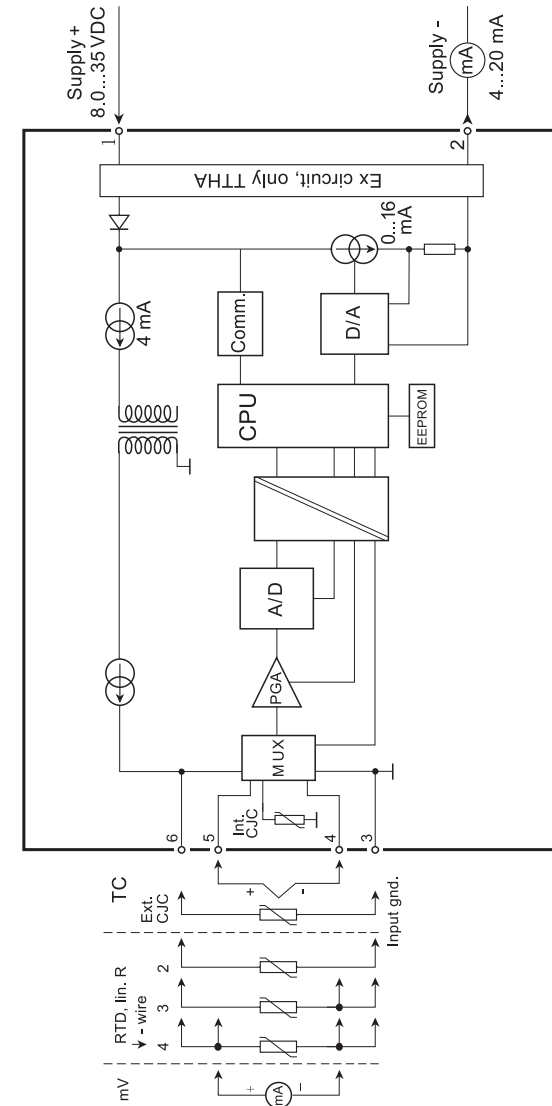
Input:



Output:



BLOCK DIAGRAM



PROGRAMMING

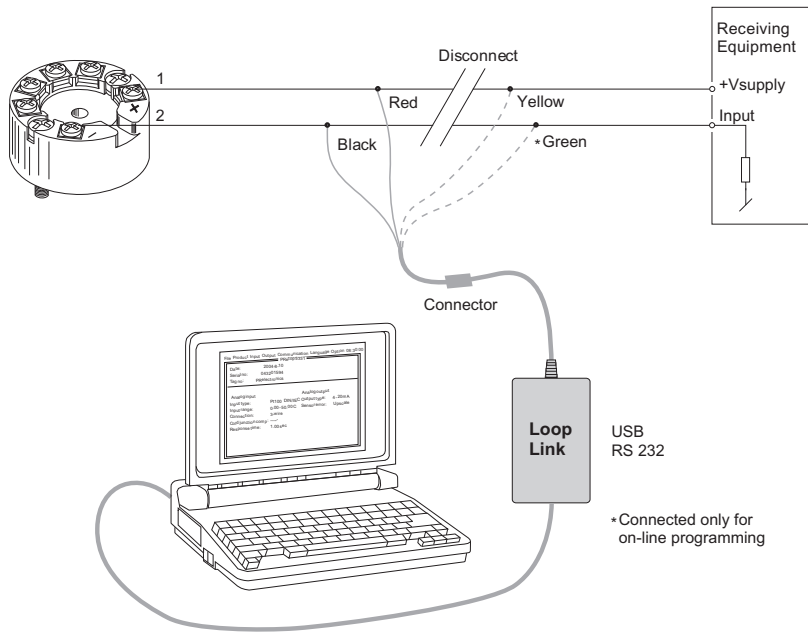
TTHA can be configured in the following 3 ways:

1. With electronics A/S' communications interface Loop Link and set PC, configuration software.
2. With a HART®
3. With a HART® DDL driver.

1: Loop Link

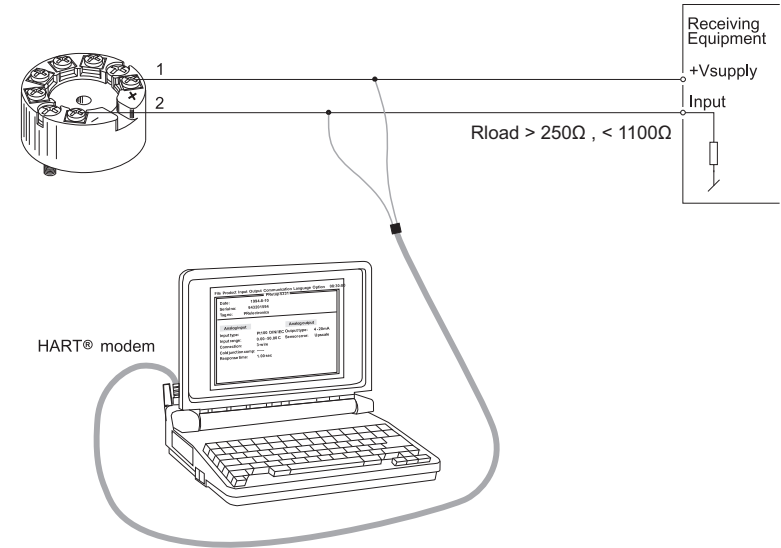
For programming please refer to the drawing below and the help functions in WINTERS.

Loop Link is not approved for communication with modules installed in hazardous (Ex) areas.



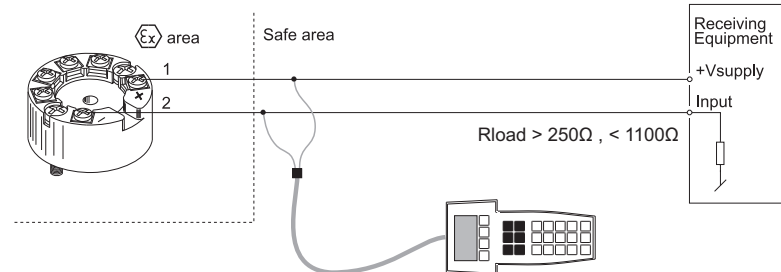
2: HART® modem

For programming please refer to the drawing below and the help functions in set.



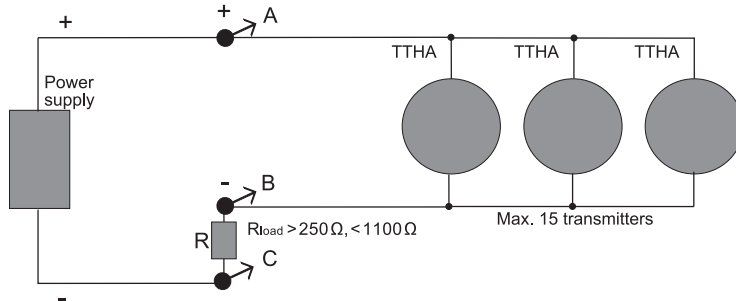
3: HART® communicator

For programming please refer to the drawing below. To gain access to product-specific commands, the HART® communicator must be loaded with the electronics A/S DDL driver. This can be ordered either at the HART® Foundation or at electronics A/S.



CONNECTION OF TRANSMITTERS IN MULTIDROP MODE

The HART® communicator or a PC modem can be connected across AB or BC.

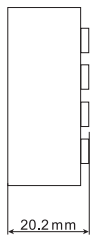
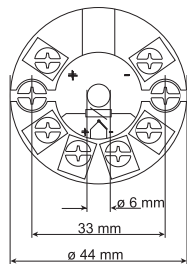


The outputs of max. 15 transmitters can be connected in parallel for a digital HART® communication on 2-wires.

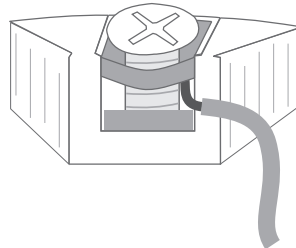
Before it is connected, each transmitter must be configured with a unique number from 1 to 15. If 2 transmitters are configured with the same number, both will be excluded. The transmitters must be programmed for multidrop mode (with a fixed output signal of 4 mA). Maximum current in the loop is therefore 60 mA. The communication is either by means of a HART® communicator or a HART® modem.

The set PC configuration software can configure the individual transmitter for multidrop mode and provide it with a unique polling address.

Mechanical specifications



Mounting of sensor wires



Wires must be mounted between the metal plates.

Appendix

ATEX Installation Drawing - TTHA:A

IECEx installation drawing - TTHA:A

ATEX Installation Drawing - TTHA:D

IECEx installation drawing - TTHA:D

FM Installation Drawing No. TTHAQ120

CSA Installation Drawing No. TTHAQ121

ATEX Installation drawing

For safe installation of TTHA: A, the following must be observed. The module shall only be installed by qualified personnel who are familiar with the national and international laws, directives and standards that apply to this area.
Year of manufacture can be taken from the first two digits in the serial number.

ATEX Certificate KEMA 03ATEX 1508X

Marking



II 3 G Ex nA [ic] IIC T6..T4 Gc
II 3 G Ex ic IIC T6..T4 Gc
II 3 D Ex ic IIIC Dc

Standards EN60079-0:2009, EN60079-11:2007, EN60079-15:2010 EN61241-11:2006

T4: -40 ≤ Ta ≤ 85°C T6: -40 ≤ Ta ≤ 60°C	Terminal: 3,4,5,6 Ex nA [ic] Uo: 9.6 V Io: 28 mA Po: 67 mW Lo: 45 mH Co: 28 µF	Terminal: 1,2 Ex nA U ≤ 35 VDC I = 4 - 20 mA	Terminal: 1,2 Ex ic Ui = 35 VDC Li = 10 µH Ci = 1.0 nF
--	---	--	---

Installation note:

For use in an explosive dust atmosphere, the transmitter shall be mounted in an enclosure providing a degree of protection of at least IP6X in accordance with EN60529, eg. a form B enclosure according to DIN 43729. The surface of the enclosure is equal to the ambient temperature + 20K, for a dust layer with a maximum thickness of 5 mm.

Special conditions for safe use:

For use in an explosive gas atmosphere, the transmitter shall be mounted in an enclosure providing a degree of protection of at least IP54 in accordance with EN60529.

For an ambient temperature ≥ 60 °C, heat resistant cables shall be used with a rating of at least 20K above the ambient temperature.

IECEx Installation drawing



For safe installation of TTHA:A the following must be observed. The module shall only be installed by qualified personnel who are familiar with the national and international laws, directives and standards that apply to this area.
Year of manufacture can be taken from the first two digits in the serial number.

IECEx Certificate IECEx KEM 10.0083X

Marking

Ex nA [ic] IIC T6..T4 Gc
Ex ic IIC T6..T4 Gc
Ex ic IIIC Dc

Standards IEC 60079-0 : 2007, IEC 60079-11 : 2006, EN 60079-15 : 2010

T4: -40 ≤ Ta ≤ 85°C T6: -40 ≤ Ta ≤ 60°C	Terminal: 3,4,5,6 Ex nA [ic] Uo: 9.6 V Io: 28 mA Po: 67 mW Lo: 45 mH Co: 28 µF	Terminal: 1,2 Ex nA U ≤ 35 VDC I = 4 - 20 mA	Terminal: 1,2 Ex ic Ui = 35 VDC Li = 10 µH Ci = 1.0 nF
--	---	--	---

Installation note:

For installation in a potentially explosive gas atmosphere, the following instructions apply:

The transmitter shall be installed in an enclosure providing a degree of protection of at least IP54 according to IEC60529 or in an enclosure with type of protection Ex n or Ex e. Cable entry devices and blanking elements shall fulfill the same requirements

For an ambient temperature ≥ 60°C least 20 K above the ambient temperature.

For installation in a potentially explosive dust atmosphere, the following instructions apply:

If the transmitter is supplied with an intrinsically safe signal "ic" and interfaces an intrinsically safe signal "ic" (e.g. a passive device), the transmitter shall be mounted in a metal enclosure form B according to DIN 43729 that provides a degree of protection of at least IP6X according to IEC60529, and that is suitable for the application. Cable entry devices and blanking elements shall fulfill the same requirements.

If the transmitter is supplied with a non-sparking signal "nA", or interfaces a non sparking signal, the transmitter shall be mounted in a metal enclosure form B according to DIN 43729 providing a degree of protection of at least IP6X according to IEC60529, and in conformance with type of protection Ex tD and suitable for the application. Cable entry devices and blanking elements shall fulfill the same requirements.

ATEX Installation drawing



For safe installation of TTHA:D the following must be observed. The module shall only be installed by qualified personnel who are familiar with the national and international laws, directives and standards that apply to this area.

Year of manufacture can be taken from the first two digits in the serial number.

ATEX Certificate KEMA 03ATEX 1537

Marking

II 1 G Ex ia IIC T6..T4 Ga
II 1 D Ex ia IIC Da
I M1 Ex ia I Ma

Standards EN 60079-0 : 2009, EN 60079-11 : 2007,
EN 60079-26 : 2007, EN 61241-11: 2006

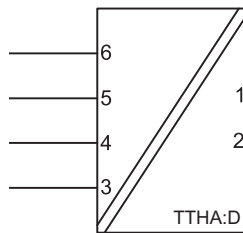
Hazardous area

Zone 0, 1, 2, 20, 21, 22, and Coal mining

T4: $-40 \leq T_a \leq 85^\circ\text{C}$
T6: $-40 \leq T_a \leq 60^\circ\text{C}$

Terminal: 3,4,5,6

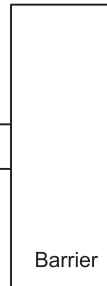
Uo: 9.6 VDC
Io: 28 mA
Po: 67 mW
Lo: 35 mH
Co: 3.5μF



Terminal: 1,2

Ui: 30 VDC
Ii: 120 mA
Pi: 0.84 W
Li: 10μH
Ci: 1.0nF

Non Hazardous Area



IECEx Installation drawing



For safe installation of TTHA:D the following must be observed. The module shall only be installed by qualified personnel who are familiar with the national and international laws, directives and standards that apply to this area.

Year of manufacture can be taken from the first two digits in the serial number.

IECEx Certificate IECEx KEM.10.0083X

Marking

Ex ia IIC T6..T4 Ga
Ex ia IIC Da
Ex ia I Ma

Standards IEC60079-11:2006, IEC60079-0: 2007
IEC60079-26:2006, IEC61241-11:2005

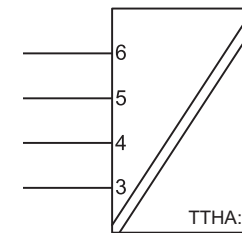
Hazardous area

Zone 0, 1, 2, 20, 21, 22, and Coal mining

T4: $-40 \leq T_a \leq 85^\circ\text{C}$
T6: $-40 \leq T_a \leq 60^\circ\text{C}$

Terminal: 3,4,5,6

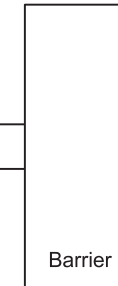
Uo: 9.6 VDC
Io: 28 mA
Po: 67 mW
Lo: 35 mH
Co: 3.5μF



Terminal: 1,2

Ui: 30 VDC
Ii: 120 mA
Pi: 0.84 W
Li: 10μH
Ci: 1.0nF

Non Hazardous Area



FM Installation Drawing TTHAQ120 Rev AG

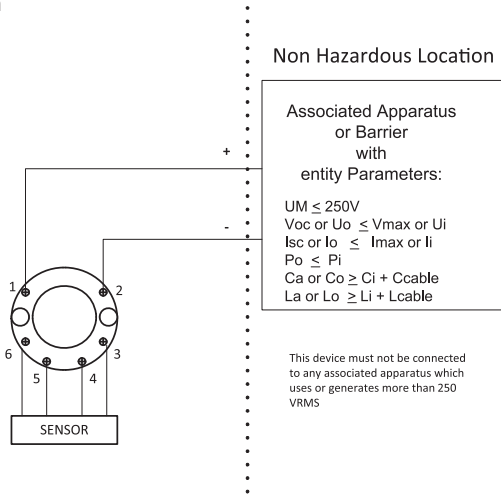
MODEL: TTHA:D

Hazardous (Classified) Location
Class I, Division 1, Groups A, B, C, D
Class I, Zone 0, IIC

Ambient temperature limits
T4: -40 to + 85 deg. Celcius
T6: -40 to + 60 deg. Celcius

Terminal 1, 2
V_{max} or U_i: 30 V
I_{max} or I_i: 120 mA
P_{max} or P_i: 0.84 W
C_i: 1 nF
L_i: 10 uH

Terminal 3, 4, 5, 6
V_t or U_o: 9.6 V
I_t or I_o: 28 mA
P_t or P_o: 67.2 mW
C_a or C_o: 3.5 uF
L_a or L_o: 35 mH



OPERATION MANUAL

The entity concept.

The Transmitter must be installed according to National Electrical Code (ANSI-NFPA 70) and shall be installed with the enclosure, mounting, and spacing segregation requirement of the ultimate application.

Equipment that is FM-approved for intrinsic safety may be connected to barriers based on the ENTITY CONCEPT. This concept permits interconnection of approved transmitters, meters and other devices in combinations which have not been specifically examined by FM, provided that the agency's criteria are met. The combination is then intrinsically safe, if the entity concept is acceptable to the authority having jurisdiction over the installation.

The entity concept criteria are as follows:

The intrinsically safe devices, other than barriers, must not be a source of power. The maximum voltage U_i(V_{MAX}) and current I_i(I_{MAX}), and maximum power P_i(P_{max}), which the device can receive and remain intrinsically safe, must be equal to or greater than the voltage (U_o or V_{oc} or V_t) and current (I_o or I_{sc} or I_t) and the power P_o which can be delivered by the barrier.

The sum of the maximum unprotected capacitance (C_i) for each intrinsically device and the interconnecting wiring must be less than the capacitance (C_a) which can be safely connected to the barrier.

The sum of the maximum unprotected inductance (L_i) for each intrinsically device and the interconnecting wiring must be less than the inductance (L_a) which can be safely connected to the barrier.

The entity parameters U_o, V_{oc} or V_t and I_o, I_{sc} or I_t, and C_a and L_a for barriers are provided by the barrier manufacturer.

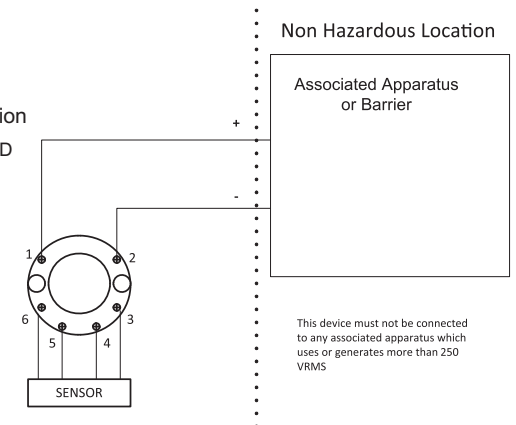
NI Field Circuit Parameters

MODEL: TTHA:D

Hazardous (Classified) Location
Class I, Division 1, Groups A, B, C, D
Class I, Zone 2, IIC

Ambient temperature limits
T4: -40 to + 85 deg. Celcius
T6: -40 to + 60 deg. Celcius

Terminal 1, 2
V_{max}: 35 VDC
C_i: 0 uF
L_i: 10 uH

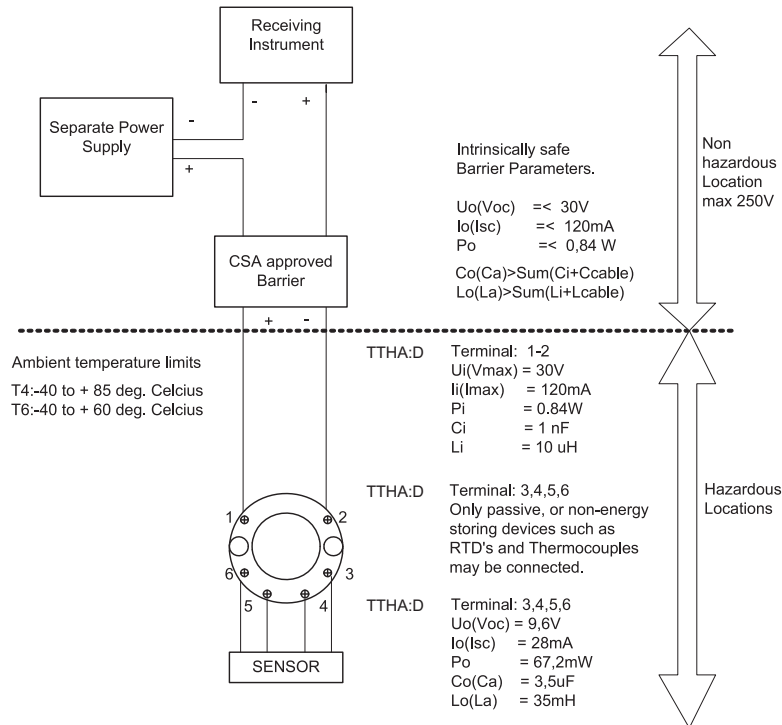


CSA Installation Drawing TTHAQ121

TTHA:D transmitters are intrinsically safe in Zone 0 Group IIC or Class I, Division 1, Group A, B, C, D when installed according to Installation Drawing.

1. Connections with separate power supply and receiver.

Output: Standard 4 - 20mA loop

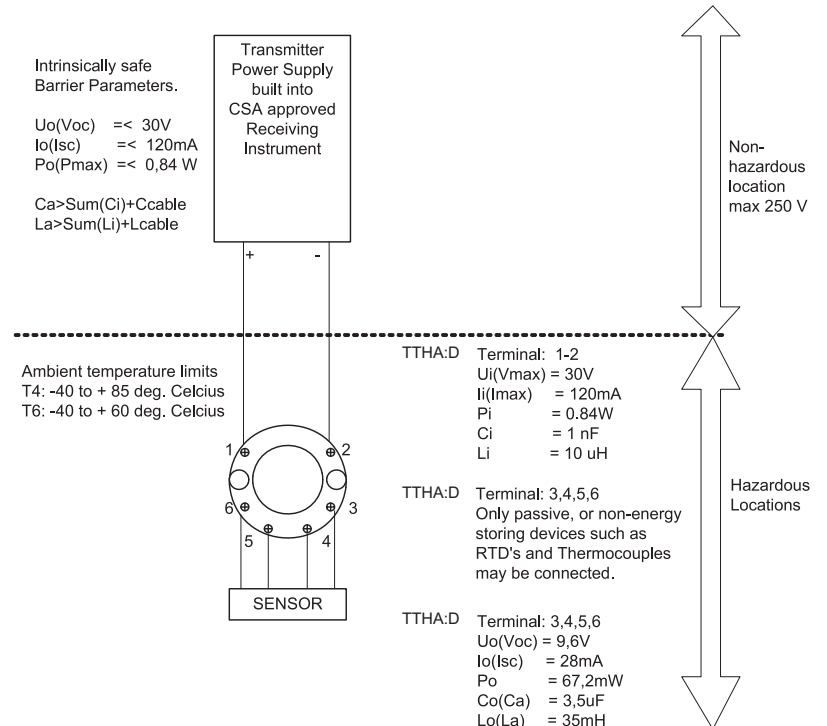


Warning:

Substitution of components may impair intrinsic safety.
The transmitters must be installed in a suitable enclosure to meet installation codes stipulated in the Canadian Electrical Code (CEC).

2. Connections with separate power supply and receiver.

Output: Standard 4 - 20mA loop



Warning:

Substitution of components may impair intrinsic safety.
The transmitters must be installed in a suitable enclosure to meet installation codes stipulated in the Canadian Electrical Code (CEC).