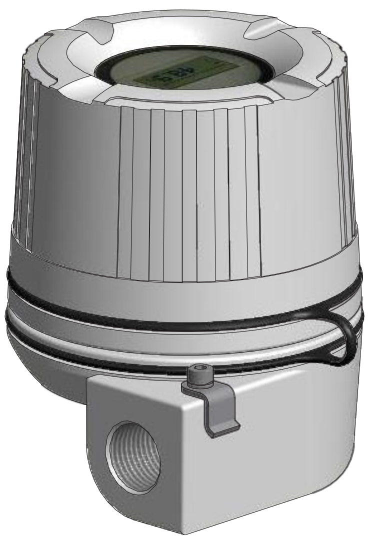
Configuration Code TM01
T82 Programmable HART® Temperature Transmitter

The T82 programmable HART® field temperature transmitter is a 2-wire unit with analog output. It includes input for RTDs: resistance inputs in 2-wire, 3-wire, and 4-wire connections; thermocouples and voltage signals. The transmitter can be supplied with or without a digital display, in a general-purpose aluminum screw-cover housing. The T82 can be programmed using a HART® protocol handheld terminal. When supplied with a digital display, the LCD display shows the current measured value.

PROGRAMMABLE DUAL INPUT TEMPERATURE TRANSMITTER

Programmable temperature transmitter for resistance thermometers (RTDs), thermocouples, resistance inputs and voltage inputs: adjustable via HART® protocol.



HART COMMUNICATION PROTOCOL

Application Areas

- Temperature transmitter with 2 input channels and HART® protocol for converting various input signals to an analog, scalable (4 to 20) mA output signal
- Input:
  Resistance thermometer (RTD)
  Thermocouples (TC)
  Resistance input (Ohm)
  Voltage input (mV)
- HART® protocol for operating the device on site using a handheld communicator

Features and Benefits

- Universally programmable with HART® protocol for various input signals
- 2-wire, single, analog output (4 to 20) mA
- Undervoltage detection
- Highly accurate in entire operating temperature range
- Approvals: FM and CSA (IS, NI)
- Galvanic isolation
- Output simulation
- Customized measuring range setup or expanded SETUP; see manual

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FM APPROVED

CE marked

pyromation inc.

ORDER CODES

Example Order Number:

1-0		1-1		1-2		1-3		1-4		1-5		1-6	1-7
36T82-D10	-	**33**	-	**85**	-	**85**	-	**E**	-	**U**	-	**S(0-200)**	**C**

1-0 Transmitter Type

CODE	DESCRIPTION
T82-00	No display (transmitter only)
T82-D10	Transmitter with digital display
36T82-D10	Transmitter with digital display and general purpose screw-cover housing

1-1 Configuration Input

CODE	DESCRIPTION
00	Unconfigured
2I	Ch1: RTD 2-wire, Ch2: inactive
22	Ch1: RTD 2-wire, Ch2: RTD 2-wire
23	Ch1: RTD 2-wire, Ch2: RTD 3-wire
2T	Ch1: RTD 2-wire, Ch2: Thermocouple
3I	Ch1: RTD 3-wire, Ch2: inactive
32	Ch1: RTD 3-wire, Ch2: RTD 2-wire
33	Ch1: RTD 3-wire, Ch2: RTD 3-wire
3T	Ch1: RTD 3-wire, Ch2: Thermocouple
4I	Ch1: RTD 4-wire, Ch2: inactive
4T	Ch1: RTD 4-wire, Ch2: Thermocouple
TI	Ch1: Thermocouple, Ch2: inactive
TT	Ch1: Thermocouple, Ch2: Thermocouple

1-2 Sensor Input Channel 1

CODE	DESCRIPTION
J	Type J thermocouple
K	Type K thermocouple
T	Type T thermocouple
N	Type N thermocouple
E	Type E thermocouple
R	Type R thermocouple
S	Type S thermocouple
B	Type B thermocouple
85	100 ohm platinum (α = 0.003 85 ºC^{-1})
55	500 ohm platinum (α = 0.003 85 ºC^{-1})
95	1000 ohm platinum (α = 0.003 85 ºC^{-1})

1-7 Unit of Measure

CODE	DESCRIPTION
C	Celsius
F	Fahrenheit

1-6 Range

CODE	DESCRIPTION
S	(lower limit – upper limit)

1-5 Failure Mode

CODE	DESCRIPTION
U	Upscale Burnout ≥ 23 mA
D	Downscale Burnout ≤ 3 mA

1-4 Input Set-ups

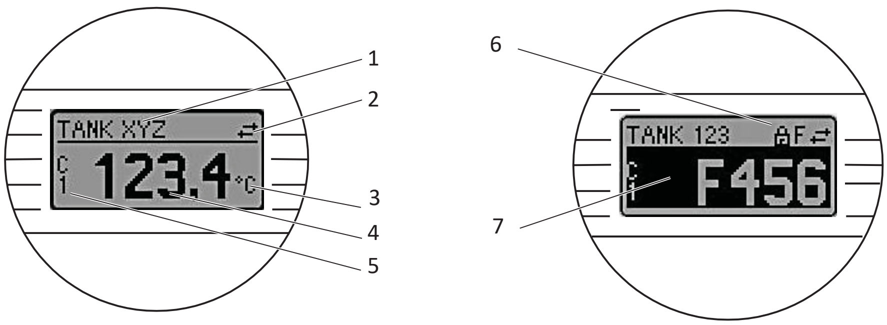
CODE	DESCRIPTION
A	Process variable = Ch1; Ch2 = inactive
B	Process variable = Ch1; Secondary value = Ch2
C	Process variable = the difference between Ch1 and Ch2
D	Process variable = average of Ch1 and Ch2
E	Sensor backup; Process variable = Ch1 and Ch2

1-3 Sensor Input Channel 2

CODE	DESCRIPTION
00	No second channel
J	Type J thermocouple
K	Type K thermocouple
T	Type T thermocouple
N	Type N thermocouple
E	Type E thermocouple
R	Type R thermocouple
S	Type S thermocouple
B	Type B thermocouple
85	100 ohm platinum (α = 0.003 85 ºC^{-1})
55	500 ohm platinum (α = 0.003 85 ºC^{-1})
95	1000 ohm platinum (α = 0.003 85 ºC^{-1})

INTERFACE

Display Elements



Item 1: Displays the TAG
Item 2: 'Communication' symbol
Item 3: Unit display
Item 4: Measured value display
Item 5: Value/channel display S1, S2, DT, PV, I, %
Item 6: 'Configuration locked' symbol
Item 7: Status signals

Remote Operation

Interface	HART® (Version 6) communication via transmitter power supply
Configurable device parameters	Sensor type and connection type, engineering units (°C/°F), measurement ranges, internal/external cold junction compensation of wire resistance with 2-wire connection, failure mode, output signal (4 to 20) mA (20 to 4) mA, digital filter (damping), offset, TAG+descriptor (8+16 characters), output simulation, analog output: option: customized linearization

APPROVALS

Approvals

CE marked	Unit complies with the legal requirements set forth by the EU regulations.
FM APPROVED, CSA	Intrinsically safe and non-incendive Class I, Division 1 and 2, Groups A, B, C and D

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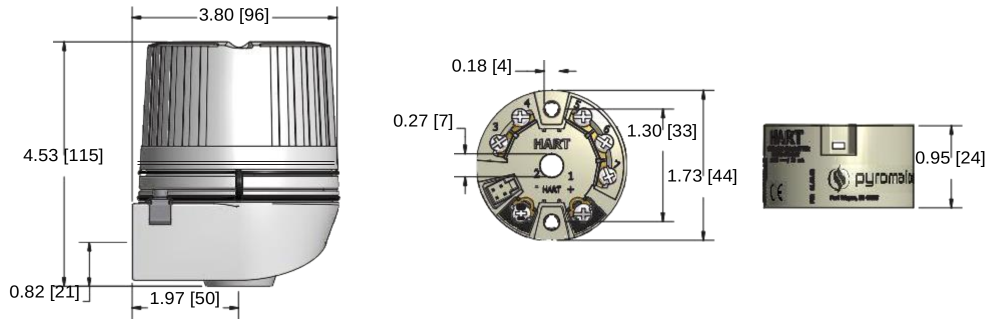
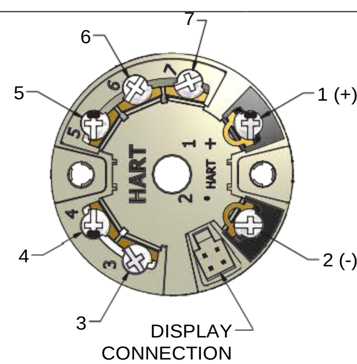
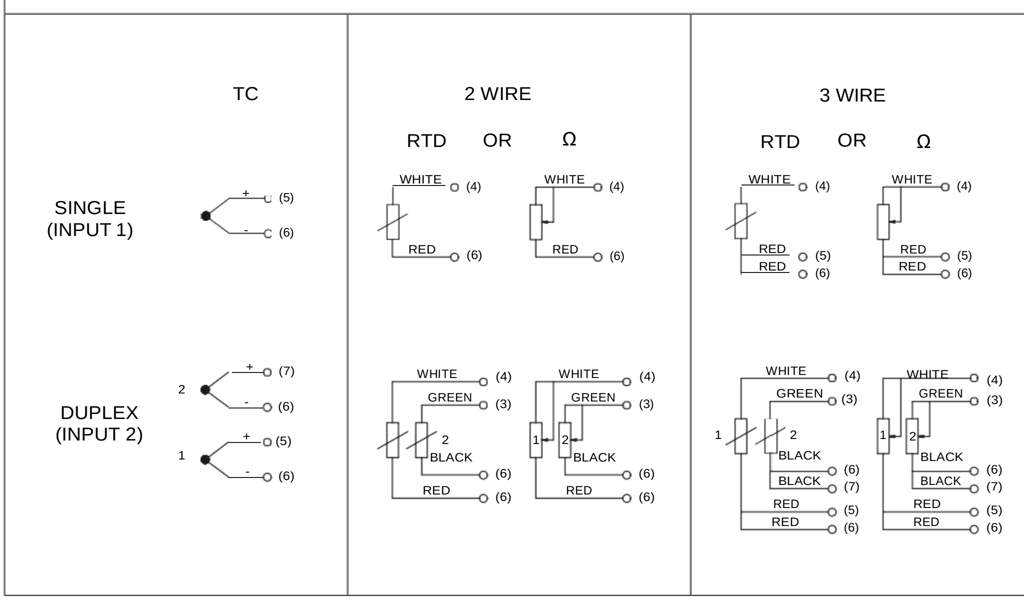
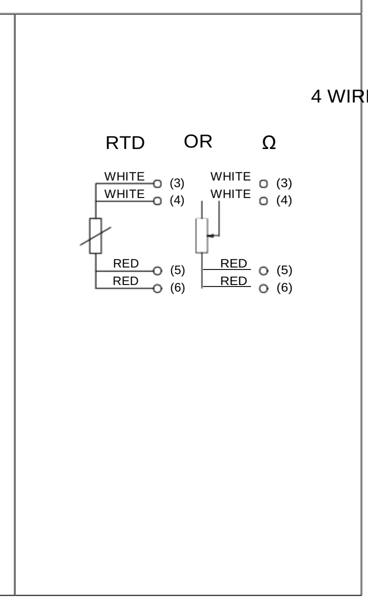
MECHANICAL CONSTRUCTION

Dimensions	
Weight	Housing, transmitter, and display: approximately 970 g (2 1/4 lbs)
	Transmitter only: approximately 50 g (1/4 lb)
Materials	Housing: die-cast aluminum with powder coating
Terminals	15 AWG Maximum

Terminal Connections







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OUTPUT

Output (Analog)

Output signal	Analog (4 to 20) mA or (20 to 4) mA	
Transmission as	Temperature linear, resistance linear, voltage linear	
Maximum load	($U_{b\ max}$ - 11V) / 0.023 A (current output)	
Digital filter 1st degree	(0 to 120) s	
Minimum current required	3.5 mA, multidrop mode 4 mA	
Current limit	≤ 23 mA	
Switch on delay	10 s (during switch-on operation $I_a \leq 3.8$ mA)	
Response time	Resistance thermometer (RTD)	0.9 to 1.2 s (depends on the connection method 2/3/4-wire)
	Thermocouples (TC)	0.7 s
	Reference temperature	0.5 s

Failure Mode

Underranging	Linear drop from 4.0 mA to 3.8 mA
Overranging	Linear increase from 20.0 mA to 20.5 mA
Failure, e.g. sensor breakage; sensor short circuit	≤ 3.6 mA or ≥ 21 mA (configurable 21.5 mA to 23 mA)

Electrical Connection

Supply Voltage	11V ≤ Vcc ≤ 42 V non-hazardous area, reverse polarity protected, see XP documentation for hazardous locations
Entry	3/4 inch NPT conduit connection x 1/2 inch NPT process connection
Residual	$U_{ss} \leq 3$ V at $U_b \geq 13.5$ V, $f_{max} = 1$ kHz

ACCURACY

Reference conditions	Calibration temperature (25 ± 5) °C [77 ± 9] °F Supply voltage: 24 V dc 4-wire circuit for resistance adjustment

Resistance Thermometer (RTD)

TYPE	MEASUREMENT ACCURACY - DIGITAL[1]	MEASUREMENT ACCURACY - D/A[2]
Pt100, Ni100, Ni120	0.1 °C [0.18 °F]	0.03%
Pt500	0.3 °C [0.54 °F]	0.03%
Cu50, Pt50, Pt1000	0.2 °C [0.36 °F]	0.03%
Pt200	1.0 °C [1.8 °F]	0.03%

Thermocouple (TC)

TYPE	MEASUREMENT ACCURACY - DIGITAL[1]	MEASUREMENT ACCURACY - D/A[2]
K, J, T, E, L, U	0.25 °C [0.45 °F]	0.03%
N, C, D	0.5 °C [0.9 °F]	0.03%
S, B, R	1.0 °C [1.8 °F]	0.03%

Resistance (Ω)

TYPE	MEASUREMENT ACCURACY - DIGITAL[1]	MEASUREMENT ACCURACY - D/A[2]	MEASUREMENT RANGE
Resistance	± 0.04 Ω	0.03%	(10 to 400) Ω
	± 0.8 Ω	0.03%	(10 to 2000) Ω

Voltage (mV)

TYPE	MEASUREMENT ACCURACY - DIGITAL[1]	MEASUREMENT ACCURACY - D/A[2]	MEASUREMENT RANGE
Voltage	± 10 µV	0.03%	(-20 to 100) mV

[1] Using HART® transmitted measured value
[2] % refers to the set span. Accuracy of current output = digital + D/A accuracy

ACCURACY (continued)

Physical input range of the sensors

(10 to 400) Ω	Cu50, Cu100, polynomial RTD, Pt50, Pt100, Ni100, Ni120
(10 to 2000) Ω	Pt200, Pt500, Pt1000
(-20 to 100) mV	Thermocouple type: B, C, D, E, J, K, L, N, R, S, T, U

General

Load influence	≤ ± 0.0025%/V with reference to the span
Long term stability	≤ 0.1 °C [0.18 °F] / year or ≤ 0.05%/year Date under reference conditions. % relates to the set span. The larger value is valid.

Influence of ambient temperaure (temperature drift)

Total temperature drift = input temperature drift + output temperature drift	Impact on the accuracy when ambient temperature changes by 1 °C [1.8 °F]	
	Input (10 to 400) Ω	typ. 0.001% of measured value, min. 1 mΩ
	Input (10 to 2000) Ω	typ. 0.001% of measured value, min. 10 mΩ
	Input (-20 to 100) mV	typ. 0.001% of measured value, min. 0.2 µV
	Output (4 to 20) mA	typ. 0.0015% of the span

INSTALLATION CONDITIONS

Ambient Conditions

Ambient temperature	Without display: (-40 to 85) °C [-40 to 185] °F non-hazardous location (for hazardous locations, see XP documentation)			
Storage temperature	Without display: (-50 to 100) °C [-58 to 212] °F			
Altitude	Up to 4000 m (4374.5 yeards) above mean sea level per IEC 61010-1, CAN/CSA C22.2 No. 61010-1			
Climatic class	As per EN 60 654-1, Class C			
Humidity	Condensation permitted per IEC 60 068-2-33/Max. rel. humidity: 95% per IEC 60068-2-30			
Shock and vibration protection	(25 to 100) Hz for 4g			
Electromagnetic compatibility (EMC)	Electromagnetic compatibility in accordance with all the relevant requirements of the EN 61326 series and NAMUR Recommendation EMC (NE21),			
	ESD (electrostatic discharge)	EN/IEC 61000-4-2		6 kV cont., 8 kV air
	Electromagnetic fields	EN/IEC 61000-4-3	0.08 to 2.7 GHz	10 V/m
	Burst (fast transients)	EN/IEC 61000-4-4		2 kV
	Surge (surge voltage)	EN/IEC 61000-4-5		0.5 kV sym./1 kV assym.
	Conducted RF	EN/IEC 61000-4-6	0.01 to 80 MHz	10 V
Protection	IP 20 with screw terminals in the installed state. NEMA 4X, IP 66/67 when installed in field housing option 36.			

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INPUT

Resistance Thermometer (RTD)

TYPE	STANDARD	MEASUREMENT RANGE		MINIMUM RANGE
Pt100 (α = 0.003 85 °C^{-1}) Pt200 Pt500 Pt1000	ASTM E1137 IEC 60 751	(-200 to 850) °C (-200 to 850) °C (-200 to 500) °C (-200 to 250) °C	[-328 to 1562] °F [-328 to 1562] °F [-328 to 932] °F [-328 to 482] °F	10 °C [18 °F] 10 °C [18 °F] 10 °C [18 °F] 10 °C [18 °F]
Pt100 (α = 0.003 916)	JIS C1604:1984	(-200 to 510) °C	[-328 to 950] °F	10 °C [18 °F]
Ni100 (α = 0.006 18) Ni120 (α = 0.006 18)	DIN 43 760 IPTS-68	(-60 to 250) °C (-60 to 250) °C	[-76 to 482] °F [-76 to 482] °F	10 °C [18 °F] 10 °C [18 °F]
Pt50 (α = 0.003 91) Pt100 (α = 0.003 91) Cu50 (α = 0.004 28)	GOST 6651-94	(-185 to 1100) °C (-200 to 850) °C (-175 to 200) °C	[-301 to 2012] °F [-328 to 1562] °F [-283 to 392] °F	10 °C [18 °F] 10 °C [18 °F] 10 °C [18 °F]
Pt100 (Callendar van Dusen) Nickel polynomial Copper polynomial		The measuring range limits are specified by entering the limit values that depend on the coefficients A to C and R_O.		10 °C [18 °F]
Type of connection: 2-wire, 3-wire or 4-wire connection, sensor current: ≤ 0.3 mA With 2-wire circuit, compensation of wire resistance possible (0 to 30 Ω) With 3-wire and 4-wire connection, sensor wire resistance up to max. 50 Ω per wire				

Resistance (Ω)

TYPE	MEASUREMENT RANGE	MINIMUM RANGE
Resistance (Ω)	(10 to 400) Ω (10 to 2000) Ω	10 Ω 100 Ω

Thermocouples (TC)

TYPE	STANDARD	MEASUREMENT RANGE		RECOMMENDED TEMPERATURE RANGE		MINIMUM RANGE
B (PtRh30-PtRh6) E (NiCr-CuNi) J (Fe-CuNi) K (NiCr-Ni) N (NiCrSi-NiSi) R (PtRh13-Pt) S (PtRh10-Pt) T (Cu-CuNi)	IEC 584 part 1 ASTM E230	(40 to 1820) °C (-270 to 1000) °C (-210 to 1200) °C (-270 to 1372) °C (-270 to 1300) °C (-50 to 1768) °C (-50 to 1768) °C (-260 to 400) °C	[104 to 3308] °F [-454 to 1832] °F [-346 to 2192] °F [-454 to 2501] °F [-454 to 2372] °F [-58 to 3214] °F [-58 to 3214] °F [-436 to 752] °F	(100 to 1500) °C (0 to 750) °C (20 to 700) °C (0 to 1100) °C (0 to 1100) °C (0 to 1400) °C (0 to 1400) °C (-185 to 350) °C	[212 to 2732] °F [32 to 1382] °F [68 to 1292] °F [32 to 2012] °F [32 to 2012] °F [32 to 2552] °F [32 to 2552] °F [-301 to 662] °F	50 °C [90 °F] 50 °C [90 °F] 50 °C [90 °F] 50 °C [90 °F] 50 °C [90 °F] 50 °C [90 °F] 50 °C [90 °F] 50 °C [90 °F]
C (W5Re-W26Re)	ASTM E230	(0 to 2315) °C	[32 to 4199] °F	(0 to 2000) °C	[32 to 3632] °F	50 °C [90 °F]
D (W3Re-W25Re)	ASTM E1751	(0 to 2315) °C	[32 to 4199] °F	(0 to 2000) °C	[32 to 3632] °F	50 °C [90 °F]
L (Fe-CuNi) U (Cu-CuNi)	DIN 43 710	(-200 to 900) °C (-200 to 600) °C	[-328 to 1652] °F [-328 to 1112] °F	(0 to 750) °C (-185 to 400) °C	[32 to 1382] °F [-301 to 752] °F	50 °C [90 °F] 50 °C [90 °F]
Cold junction		internal (Pt100) or external (-40 to 85) °C [-40 to 185] °F				
Max. sensor resistance		10 kΩ				

Voltage (mV)

TYPE	MEASUREMENT RANGE	MINIMUM RANGE
Millivolt (mV)	(-20 to 100) mV	5 mV

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