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AUTROL®

Smart Temperature Transmitter

MODEL

ATT 2100

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Description of Product

The ATT2100 Smart Temperature Transmitter is a microprocessor-based high performance transmitter, which has flexible sensor input and output, automatic compensation of ambient temperature and process parameters, configuration of various parameters, communication with HART protocol. All Data of Sensor (Tag No., type, range etc.) is to be input, modified and stored in EEPROM.

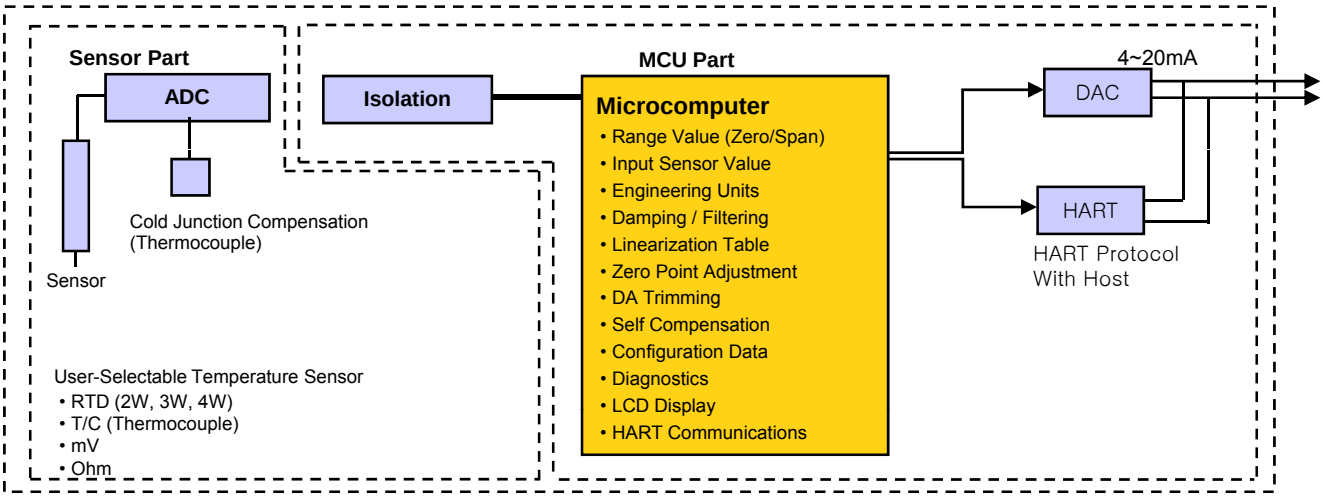
Function

- Flexible Sensor input : RTD, T/C, mV, Ohm
- Various output: 4 ~20mA(Analog), Digital Signals
- Automatic Compensation by Linearization table in which user can modify the various necessary values
- Automatic Compensation of Ambient Temperature
- Setting Various Parameters : Zero/Span, Unit, Fail-mode, Trim, etc.
- Self Diagnostic Function : Sensor, A/D Converter, Memory, Power, etc.
- Digital Communication with HART protocol
- Flameproof Approval and Intrinsic Safety Approval: KOSHA, KTL, CSA, ATEX

Features

- Superior Performance
  - Excellent Accuracy
  - Long-Term Stability
- Flexibility
  - Selection of various T/C, RTD, mV, Ohm
  - Data Configuration with HART configurator
- Reliability
  - Automatic Compensation : Linearization of sensor input, Ambient temperature compensation
  - Continuous Self Diagnostic
  - Fail-mode Process function
  - EEPROM Write Protection
  - I/O Isolation : Grounded Thermocouple
  - CE EMC Conformity Standards (EN50081-2,EN50082-2)

Functional Block Diagram



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Transmitter Description

Electronics Module

The Electronics module consists of a circuit board sealed in an enclosure.
There are a MCU module, a power module, an analog module, a LCD module and a terminal module in a transmitter.
The analog module digitize signal From the sensor.
The MCU module acquires the digital value from the analog module and apply correction coefficients selected from EEPROM.
The output section of the power module converts the digital signal to a 4~20 mA output.
The MCU module communicates with the HART-based Configurator or Control Systems such as DCS.
The Power module have a DC-to-DC Power conversion circuit and an Input/output isolation circuit.
An optional LCD module plugs into the MCU module and displays the digital output in user-configured unit.

Configuration Data Storage

The transmitters store configuration data in nonvolatile EEPROM in their electronics modules.
This data is retained in the transmitter when power is interrupted, so the transmitters are functional immediately upon power-up.

Sensor Inputs

The model ATT2100 is compatible with a variety of temperature sensors, including 2W, 3W and 4Wire RTDs, thermocouples, and other resistance and millivolt inputs (see table 1).
The sensor part module converts the temperature sensor into the digital value. The MCU module calculates the process temperature value based on the digital value.
The sensor type and configuration
are software-selectable using the Hand-Held terminal and PC configurator.

The sensor modules include the following features

- The software of the transmitter compensates for the thermal effects, improving performance.
- Precise input compensation during operation is achieved with temperature and voltage or resistance correction coefficients that are characterized over the range of temperature sensor and stored in the EEPROM memory.
- Input sensor type
  - -. RTD (Pt-100 ohm) : 2W, 3W, 4Wire
  - -. Thermocouple : B, E, J, K, N, R, S, T type
  - -. mV : -10 ~ 75mV
  - -. Ohm : 0 ~ 430 Ω
  - -. Dual sensor input (option)

Basic Setup

ATT2100 Transmitter can be easily configured from any host that support the HART protocol. Configuration consists of setting the following transmitter operational parameters.

- Sensor Type
- Number of sensor input wires
- 4 and 20mA Points (Zero/Span)
- Engineering Units
- Damping Time
- Tag : 8 alphanumeric characters
- Descriptor : 16 characters
- Message : 32 characters
- Date : day / month / year

Calibration and Trimming

- Lower/Upper Range (zero/span)
- Sensor Linearization
- Zero Point Adjustment
- DAC Output Trimming
- Self-Compensation

Self-Diagnosis and Others

- CPU & Analog Module Fault Detection
- Communication Error
- Fail-mode Handling
- LCD Indication

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Performance Specifications

Reference Accuracy
(Refer to Table 1)

Stability
RTDs.
±0.12% of Reading or 0.15℃, whichever is greater, for 24 months

Thermocouples
±0.12% of Reading or 0.15℃, whichever is greater, for 12 months

Repeatability
±0.05% of span

Ambient Temperature Effect
(per 1℃ change in ambient temperature.)

Sensor Type	Digital Accuracy	D/A effect
2W, 3W, 4Wire RTD		
Pt 100(a=0.00385)	0.003℃	0.002% of Span
Pt 100(a=0.003916)		
Thermocouple		
NIST Type B	0.046℃	0.002% of Span
NIST Type E, J, K, N	0.005℃+0.00054% of reading	
NIST Type R, S, T	0.015℃ If reading ≥ 200℃ 0.021℃ - 0.0032% of reading if not	

Power Supply Effect
Less than ±0.005% of Span per Volt

Update Time and Turn-On Time
Update Time : 0.5 seconds
Turn-On Time : 5 seconds

Failure Mode
The value to which the transmitter drives its output in failure is as follows
Fail High: Current ≥ 21.75 mA
Fail Low: Current ≤ 3.75 mA

Function Specifications

Range and Sensor Limits
(Refer to Table 1)

Zero and Span Adjustment Limits
- Zero and span values can be set anywhere within the range limits stated in Table 1.
- Span must be greater than or equal to the minimum span stated in Table 1

Output (Analog Current and Digital Data)
Two wire 4~20mA , Digital process value superimposed on 4~20mA signal, available to any host that conforms to the HART protocol

Power Supply & Load Requirement
External power supply required.
Transmitters operate on 11.9 to 45 V dc.
With 250 ohm load, 17.4 Vdc power supply is required
With 24 Vdc Supply, up to a 550 ohm load can be used
Max. Loop Resistance = (E-11.9) / 0.022
(E = Power Supply Voltage)

Supply Voltage
11.9 to 45 Vdc for operation
17.4 to 45 Vdc for HART Communications
11.9 to 42 Vdc for CSA Approval

Loop Load
0 to 1500 Ω for Operation
250 to 550 Ω for HART Communications

Ambient Humidity Limits
5% ~ 100%RH (Relative Humidity)

Ambient Temperature Limits
- -40℃ ~ 85℃ (without condensing)
- -30℃ ~ 80℃ (with LCD module)

Storage Temperature
- -40℃ ~ 85℃ (without condensing)

Isolation
Input / output isolated to 500Vrms (707 Vdc)

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Physical Specifications

Electrical connections
1/2-14 NPT conduit with M3.5 Screw Terminals

Materials of Construction
Electronics Housing : Low-copper aluminum
Flameproof and waterproof (IP67)
Paint : Epoxy-Polyester or Polyurethane
Cover O-ring : Buna-N
Mounting Bracket : 2-inch Pipe, 304 SST,
Painted Carbon Steel with 304 SST U-bolt
Nameplate : 304 SST

Weight :
1.2 kg below (excluding options)

Hazardous Location Certifications (option)

KOSHA Approvals
(KOSHA: Korea Occupational Safety & Health Agency)

K1 Code :
Flameproof for Class Ⅰ, Zone 1 : Ex d ⅡC T6, IP67
Ambient Temperature : -20 to 60 °C
Power Supply : Max. 45 Vdc
Output : 4 to 20 mA + HART, Max. 22 mA

KTL Certification (KTL: Korea Testing Laboratory)

K2 Code :
Intrinsic Safety: Ex ia IIC T5
Ambient Temperature : -20 to 60 °C
Entity Parameter : Umax = 40Vdc, Imax = 165mA,
Pmax = 0.9W

CSA (Canadian Standards Association) Approvals

C1 Code : (On Processing)

"SEAL NOT REQUIRED"
Explosion proof for Class I, Division 1,
Groups A, B, C & D
Dust-ignition proof for Class II, Division 1,
Groups E, F & G ; Class III
Flameproof for Class I, Zone 1 : Ex d IIC
Class I, Division 2, Groups A, B, C, D ;
Class II, Division 2, Groups E, F, G ;
Class III T4
Nonsparking Equipment for Class I, Zone 2 :
Ex nA IIC T4
Enclosure : Type 4x, IP66
Power Supply : 11.9 to 42 Vdc Max.
Output Signal : 4 to 20 mA + HART
Ambient Temp. : -20 to 60 °C

EMC Conformity Standards

a) EMI (Emission) – EN50081-2:1993

	Test Item	Frequency Range	Basic Standard
1	Applicable Electromagnetic Radiation Disturbance	30 ~1000MHz	EN55011:1988 (Class A Group 1)

b) For EMS (Immunity) – EN50082-2:1995

	Test Item	Test Specification	Basic Standard	Performance Criteria
1	Electrostatic Discharge	± 4 KV (contact) ± 8 KV (air)	EN61000-4-2 :1995 A +A1 :1998	A
2	Radio Frequency Electromagnetic Field Amplitude modulated	80 MHz ~ 1GHz 1 KV, 80% AM	EN61000-4-3 : 1996 A ENV 50204 : 1995	A
3	Radio Frequency Electromagnetic Field Pulse Modulated	900 MHz ±5MHz, A 10V/m , 200Hz, 50% Duty Cycle PM		A
4	Electrical Fast Transients / Burst Immunity	±2KV (power line) 5KHz / 15mS / I minute	EN61000-4-4:1995 A	A
5	Immunity to Conducted Disturbance Induced by Radio Frequency Fields	150KHz ~ 80MHz 10V/m, 80% AM (1KHz)	EN61000-4-6:1995 A	A

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General Specifications

1. Temperature Sensor Range & Accuracy

<Table1>

Sensor Type	Sensor Reference	Input Range	Minimum Span	Digital Accuracy	D/A Accuracy Of Span
2W, 3W, 4Wire RTD					
Pt-100	KSC 1603-1991 (a=0.00385) DIN	-200 ~ 650 ℃	15 ℃	±0.17 ℃	±0.03%
Pt-100	JISC 1604-1981 (a=0.00391)	-200 ~ 500 ℃		±0.16 ℃	
Thermocouple					
NIST Type B	KSC1602-1982	100 ~ 1,820 ℃	25 ℃	±0.77℃	±0.03%
NIST Type E		-200 ~ 1,000 ℃		±0.20℃	
NIST Type J		-200 ~ 1,200 ℃		±0.25℃	
NIST Type K		-200 ~ 1,350 ℃		±0.35℃	
NIST Type N		-200 ~ 1,300 ℃		±0.40℃	
NIST Type R		0 ~ 1,760 ℃		±0.60℃	
NIST Type S		0 ~ 1,740 ℃		±0.50℃	
NIST Type T		-200 ~ 400 ℃		±0.25℃	
Millivolt Input		-10 ~ 75 mV	2 mV	± 0.012 mV	
Ohm Input		0 ~ 430 Ω	20 Ω	± 0.35 Ω	

< Note > 1) RTD input : a=0.00385 : KS, JIS, DIN, IEC, a=0.00391 : US.
2) Thermocouple input : KSC 1602-1982, JISC 1602-1981, ANSI MC96.1-1982

Ambient Temperature Effects (per 1℃ change in Ambient temperature)

Sensor Type		Digital Accuracy	D/A effect per
RTD 2w, 3w, 4-Wire	Pt 100 (a=0.00385)	0.003℃	0.002% of Span
	Pt 100 (a=0.003916)		
Thermocouple	NIST Type B	0.046℃	
	NIST Type E, J, K, N	0.005℃+0.00054% of reading	
	NIST Type R, S, T	0.015℃ If reading	
		0.021℃ - 0.0032% of reading if not	

2. Electrical Specifications

Power Supply	11.9 ~ 45 Vdc	Output Signal	4~20 mA/HART
HART loop resistance	250 ~ 550 Ohm (24 Vdc)	Isolation	500 Vrms (707 DC)

3. Performance Specifications

Accuracy	Refer to item No.1	Operating Temp.	-40 ~ +85℃
Stability for 2 year	±0.1% of Reading or 0.1℃ whichever is greater	LCD Meter Operating Temp.	-30 ~ +80℃
Ambient Temp. Effect	±0.05% of Span/10℃	Humidity Limits	5% ~ 98% RH
Repeatability	±0.05% of Span	Power Supply Effect	±0.005% of Span/V

4. Physical Specifications

Electrical Connections	1/2-14NPT(w/M3.5)	Weight (excluding Option Items)	1.5Kg below
Electronics Housing	Aluminum	2” Pipe Stanchion Type bracket	Angle or Flat Type
O-rings	Buna-N	Housing Class	Waterproof (IP67)

5. Hazardous Location Certifications- Option

Korea Standards Approval	Overseas Standards Approval
Flameproof Approval : Ex d IIC T6 (KOSHA) Intrinsic Safety Approval : Ex ia IIC T5 (KTL)	CSA Explosion proof Approval ATEX Flame proof Approval

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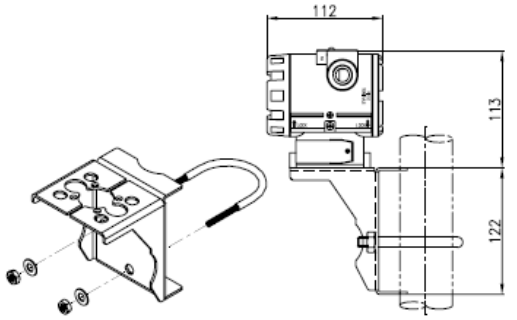
Ordering Information

MODEL NO.	Code	Description		
ATT2100	-S	Single Element		
	-D	Dual Elements		
Housing Materials and Electrical Connection Size	1	1/2 - 14 NPT Epoxy Coated-Aluminum		
	2	G1/2 Epoxy Coated-Aluminum		
	X	Special		
Hazardous Locations Certifications	K0	Maker Standard (Waterproof : IP67)		
	K1	KOSHA Flameproof Approval : Ex d IIC T6.		
	K2	KTL Intrinsic Safety Approval : Ex ia IIC T5		
	*E1	CENELEC(KEMA) Flameproof		
	*E2	CENELEC(KEMA) Intrinsic Safety		
	*C1	CSA Explosion proof		
	*C2	CSA Intrinsic Safety		
	F1	FM Explosion proof		
	*F2	FM Intrinsic Safety		
Local Indicator (Meter) Temperature Sensor, Thermowell	M1	LCD Indicator	LP	Lighting Protector
	C7	Custom Calibration	ET	External Terminal Block
	BA	Stainless Steel Bracket (Angle type) with SST Bolts		
	BF	Stainless Steel Bracket (Flat type) with SST Bolts		
	CA	Painted Steel Mounting Bracket (Angle Type) with SST Bolts		
	CF	Painted Steel Mounting Bracket (Flat Type) with SST Bolts		
	X1	Assembly Option (Element/Well)		

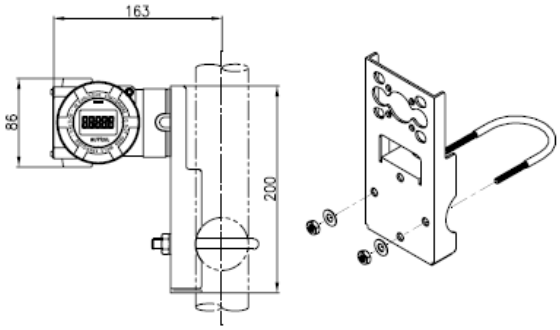
Example : ATT2100-S1-K1-M1
Note 1 : Request to manufacturer for Items marked " * " before order.

Default Configuration
Sensor Type : RTD, Pt100 (a = 0.00385, 3Wire), 4mA (at 0℃) / 20mA (at 100℃)
Output : Linear , Fail Mode : Low , EEPROM Write : Enable

Optional Transmitter Mounting Brackets



2" Pipe Mounting Bracket
Model : Angle Type



2" Pipe Mounting Bracket
Model : Flat Type

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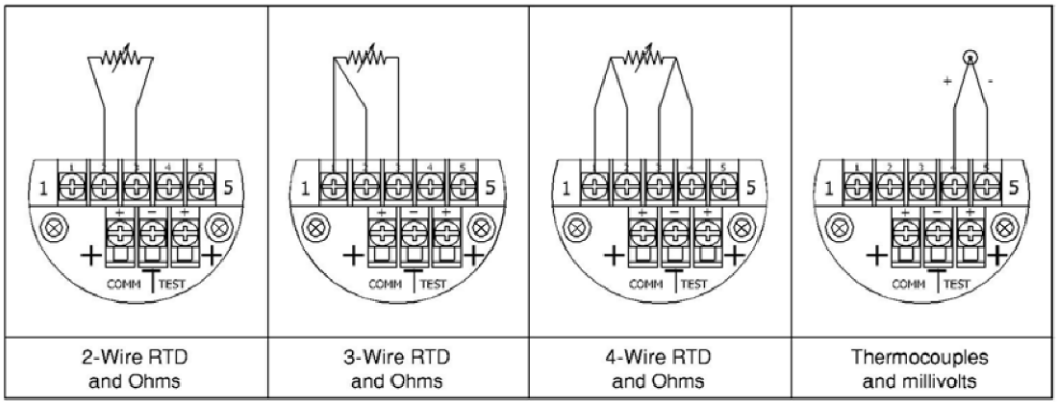
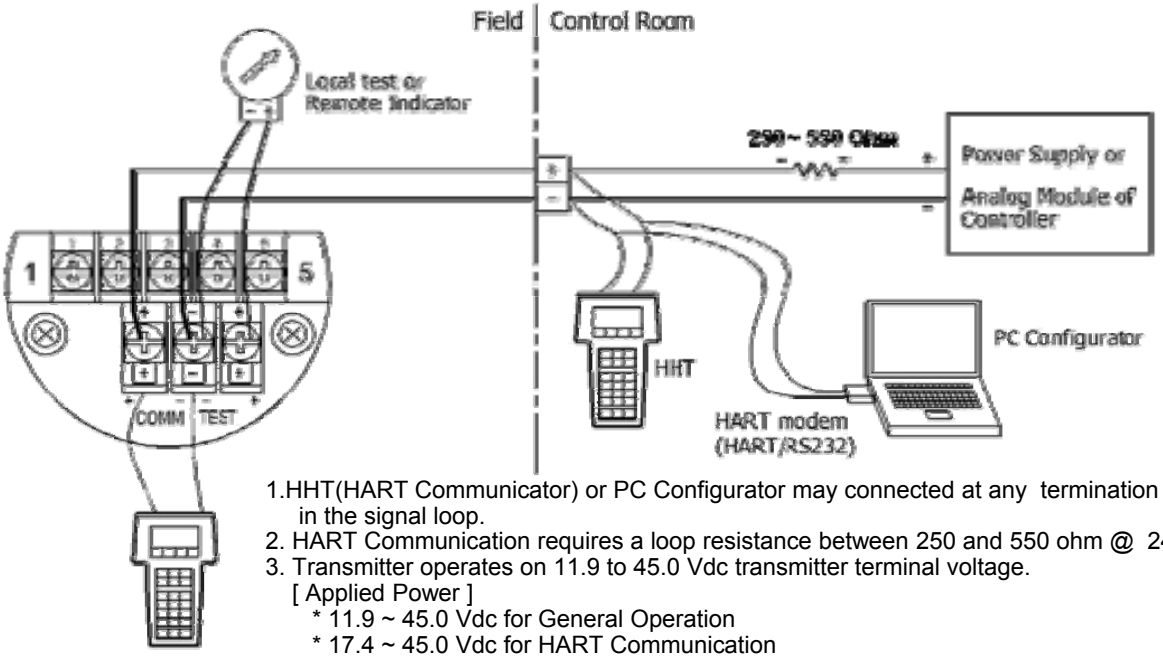
ATT2100 Transmitter Field Wiring and Sensor Wiring Diagrams



2-Wire RTD and Ohms	3-Wire RTD and Ohms	4-Wire RTD and Ohms	Thermocouples and millivolts

Connection Diagram of Signal, Power, HHT for Transmitter



1.HHT(HART Communicator) or PC Configurator may connected at any termination point in the signal loop.
2. HART Communication requires a loop resistance between 250 and 550 ohm @ 24 Vdc
3. Transmitter operates on 11.9 to 45.0 Vdc transmitter terminal voltage.
[Applied Power]
* 11.9 ~ 45.0 Vdc for General Operation
* 17.4 ~ 45.0 Vdc for HART Communication
* 17.4 ~ 42.0 Vdc for CSA Approval (Power supply must not exceed 42.0 Vdc)

Dimensions of Transmitter (mm)