

**Barton®**

# Model 3940

## Temperature Transmitter with Hart Communications



The Barton 3940 Temperature Transmitter is a Smart, HART compatible, isolated, two-wire, transmitter that accommodates any one of eleven types of thermocouples, six types of RTD's, millivolt or ohm inputs. Once input type is selected the 3940 is precision linearized over the entire usable range of the selected sensor. This transmitter is simple to configure and operates like a high performance analog transmitter.

Numerous advanced features are achieved through the use of digital signal processing and micro-controller technologies. Typical of these features are the precision linearization, the independent zero and full-scale settings as well as digital filtering. Other advanced features, such as automatic self-diagnostics and exceptional stability, are continuously active and transparent to the user.

The 3940 transmitter can also accept one of two optional plug-in displays. One, an inexpensive, single line display provides low-cost, local indication of the measured temperature. The other is a two-line display that provides a local indication of the process value and alarms. Both displays facilitate local configuration and ranging of the transmitter.

The standard configuration includes a 3-wire 100 ohm platinum RTD. This element is installed in a 6.3 mm (0.25") OD, 316 SS sheath and connected to the thermowell with a 12.7 mm (1/2") NPT. The Barton 3940 Temperature Transmitter can communicate with any HART Communicator for various setup, configuration and calibration procedures.

- **Stable**
- **Continuous self-diagnostics**  
**< 0.1% per year**
- **Accurate**
- **< 0.1%**
- **Rapid response**
- **Versatile mounting options**
- **DIN Rail**
- **Explosion proof**
- **Easy to use**
- **Calibrate without handheld**
- **HART Communications**
- **Set up, configuration & calibration**

## Ordering Information – RTD Temperature Transmitter

**MODEL 3940** 0 °C to 100 °C (32 °F to 212 °F)

Model 3940 is a Smart, Hart Compatible Temperature Transmitter. Standard features include: 4-20 analog output, 3-wire RTD input, output linear with temperature.

### 1. Temperature Range

Specify range, minimum to maximum and °C or °F

### 2. Housing

- None, Electronic Module Only, Aluminum (No probe supplied) GP
- None, Electronic Module Only, Indicating 1 line display w/o probe GP
- None, Electronic Module Only, Indicating 2 line display w/o probe GP
- Integral, Hazardous Location, Blind
- Integral, Hazardous Location, Indicating, 1 line display
- Integral, Hazardous Location, Indicating, 2 line display
- Remote, Hazardous Location, Wall Mount, Blind
- Remote, Hazardous Location, Wall Mount, Indicating, 1 line display
- Remote, Hazardous Location, Wall Mount, Indicating, 2 line display
- Remote, Hazardous Location, 2" Pipe Mount, Blind
- Remote, Hazardous Location, 2" Pipe Mount, Indicating, 1 line display
- Remote, Hazardous Location, 2" Pipe Mount, Indicating, 2 line display

### 3. Sensors

- 100 Ohm Fixed RTD
- 100 Ohm 3 Spring Loaded RTD
- Thermocouple - Fixed or Spring Loaded
- No Probe Supplied (For Integral Configurations)
- No Probe Supplied (For Remote Configurations)

### 4. Special Requirements

- CSA Group B Explosion-proof housing (applicable to remote housings only).
- Union Nipple 3" (IBL, II1, or II2 only)
- Union Nipple 6" (IBL, II1, or II2 only)
- High Accuracy RTD (IBL, II1, or II2 only)
- Long Length RTD (over 12 inches) (IBL, II1, or II2 only)
- Temperature Bath Calibration (4 points between -25 to 260° C (31 to 500° F)
- Ceramic Terminal Block (required temperatures in excess of 290° F - applicable to remote housing)
- Other, Submit drawings and / or Specifications

X-X° C/F			
	MBL		
	MI1		
	MI2		
	IBL		
	II1		
	II2		
	WBL		
	WI1		
	WI2		
	PBL		
	PI1		
	PI2		
		FX	
		SL	
		TC	
		NP	
		NP	
			N3
			N6
			HA
			LL
			TB
			SR

1. Non-indicating transmitter require HART HC275 Hand Held Communicator or equivalent for setup and configuration purposes.  
 2. Hazardous Location housings are CSA Explosion Proof, Class I, Div I, Groups B, C, D; Class II, Groups E, F, G; Class III; CSA Enclosure 4.  
 3. Remote Transmitters required for temps in excess of 120° C (250° F).  
 4. Spring loaded probes require thermowell for CSA approval.  
 5. Probe length or Thermowell dimension must be specified.  
 6. Consult Factory when ordering transmitters with thermocouple input.

SENSOR INPUT	RANGE, °F		ACCURACY	RANGE, °C		ACCURACY
Thermocouple Type B	+109 to	+3,308° F	±0.99° F	+43 to	+1,820° C	±0.55° C
Thermocouple Type C	+32 to	+4,208° F	±0.72° F	0 to	+2,320° C	±0.40° C
Thermocouple Type E	-454 to	+1,832° F	±0.18° F	-270 to	+1,000° C	±0.10° C
Thermocouple Type J	-346 to	+2,129° F	±0.27° F	-210 to	+1,200° C	±0.15° C
Thermocouple Type K	-454 to	+2,502° F	±0.27° F	-270 to	+1,372° C	±0.15° C
Thermocouple Type L	-328 to	+1,652° F	±0.27° F	-200 to	+900° C	±0.15° C
Thermocouple Type N	-454 to	+2,372° F	±0.36° F	-270 to	+1,300° C	±0.20° C
Thermocouple Type R	-58 to	+3,214° F	±0.81° F	-50 to	+1,768° C	±0.45° C
Thermocouple Type S	-58 to	+3,214° F	±0.90° F	-50 to	+1,768° C	±0.50° C
Thermocouple Type T	-454 to	+752° F	±0.18° F	-270 to	+400° C	±0.10° C
Thermocouple Type U	-328 to	+1,112° F	±0.18° F	-200 to	+600° C	±0.10° C
100Ω Platinum RTD DIN Curve ( $\alpha = 0.00385$ )	-328 to	+1,000° F	±0.09° F	-200 to	+540° C	±0.05° C
100Ω Platinum RTD SAMA Curve ( $\alpha = 0.003923$ )	-328 to	+1,000° F	±0.09° F	-200 to	+540° C	±0.05° C
Call Factory for 100Ω Ni, 120Ω Ni, and 10Ω Cu						
Millivolt	-15 to	115mV	±0.006 mV			
Ohm	0 to	500 Ω	±0.002 Ω			

# General Specifications – Standard Series RTD Temperature Transmitter

## TRANSMITTER ACCURACY:

± 0.01% of the millivolt or ohm equivalent input reading, or the value from the Accuracy Table, whichever is greater; plus ±0.04% of the span. For thermocouples, add ±0.5° C (0.9° F) for cold junction effect.

Accuracy includes transmitter repeatability, hysteresis and linearity as well as A/D conversion error, analog output error, line voltage effects, humidity effect under non-condensing conditions, vibration effect to 2g's & 500Hz.

## STANDARD RTD ACCURACY:

±0.32° C @ 0° C  
±2.3° C @ 500° C  
0.00385 Ω/Ω/° C

## TRANSMITTER AMBIENT TEMPERATURE EFFECT:

One-half the transmitter accuracy per 28° C (50° F).

## TRANSMITTER REPEATABILITY:

One-half the transmitter accuracy.

## COLD-JUNCTION COMPENSATION:

Digital self-correcting over the ambient temperature range to ±0.5° C.

## LINEARIZATION:

Thermocouple and RTD linearization to ±0.05°C.  
Custom linearization with 22 point curve via HART® Communications.

## OUTPUT:

Analog: Two wire 4 to 20mA.  
Digital: HART® simultaneous communication

## OUTPUT RANGING ADJUSTMENTS:

Analog Zero: 100% of Sensor range – Noninteracting  
Analog Full-scale: Normal or Reverse Acting

## LONG TERM STABILITY:

Stability deviation per year is less than: (0.04% of output span + 0.05% of the millivolt or ohm equivalent reading.)

## OPERATING TEMPERATURE RANGE:

-40°C to 85°C Electronics  
(-40° F to 185° F)  
-20°C to 70°C Display (full visibility)  
(-4° F to 158° F)  
-40°C to 85°C Display (with reduced visibility)  
(-40° F to 185° F)

## INSTRUMENT CONNECTION:

1/2" NPT

## STORAGE TEMPERATURE RANGE:

-50° C to 85° C; -58° F to 185° F

## DAMPING:

Factory selectable time constant (63%) from 0 to 32 sec.

## FAILSAFE:

User settable to 3.6 mA or 23 mA or user specified value.

## MOUNTING POSITION:

No effect on measurement value.

## WEIGHT:

Module only: 0.2 kg (0.4 lbs.)  
Explosion proof: 1.6 kg (3.5 lbs.)

## ISOLATION:

Input to Output 500 VAC

## INPUT IMPEDANCE:

Greater than 1 MΩ

## POWER SUPPLY:

The transmitter operates on 12 to 42 VDC (30 VDC for I/S installations) with no load. Transmitter is protected against reverse polarity connection.

## LOAD LIMITATIONS:

Loop resistance including optional indicator:  
 $R(K\Omega) = (\text{Supply Voltage} - 12 \text{ VDC}) / (23 \text{ mA})$   
For communication with HART Handheld Communicator, a minimum of 250 Ω is required.

## INTERCHANGEABILITY:

Fully interchangeable without field calibration.

## ELECTROMAGNETIC COMPATIBILITY (CE COMPLIANCE):

Transmitter operates within specification in fields from 20 to 1,000 MHz with field strengths to 30 V/m. Meets EN 50082-1 Generic Immunity Standard and EN 55011 Compatibility Emissions Standard.

## DYNAMIC RESPONSE,

### EXCLUDING TEMPERATURE SENSOR:

UPDATE RATE:  
150 milliseconds (7 times per second), typical.

RESPONSE TO STEP CHANGE:  
250 milliseconds, minimum; 1 second, typical.

START-UP TIME: 7 sec.  
Operation to specification less than 30 sec.

AMBIENT TEMPERATURE CHANGE:  
Self-correcting for ambient temperature changes up to 20° C/hr.

## HAZARDOUS LOCATION CERTIFICATIONS:

### Explosion Proof:

Explosion Proof Housings available with and without windows; CSA listed for Class I, Div I Group, C, & D; Class II, Div I & II, Groups E, F & G, Class III and enclosure 4, Group B optional.

### Nonincendive:

Transmitter is CSA rated nonincendive in Class I, Div II, Groups A, B, C & D; Class II, Div II, Groups F & G, Class III, Div II.

### Intrinsic Safety:

The Intrinsically Safe Model 3940 is CSA and FM listed for Class I, Div I, Groups A, B, C & D & Class II, Div I, Groups E, F, & G, & Class III, Div I, when installed per AIC Drawing 6022588, Rev B.

### Barrier Entity Parameters:

30 VDC Max  
240Ω Min.

## OPTIONS:

### THERMOWELLS:

Order as required. See Series 20 Product Bulletin

### MOUNTING:

2" Pipe Yoke for XP housing  
DIN Rail Mounting Adapter

### RTD:

Extra high accuracy  
Spring loaded probe, supplied with thermowell  
Armoured flexible leads.  
Not available as explosion proof

### PROBE:

Nipple union 76 mm (3") or 152 mm (6")

### HOUSING:

Module only  
Din rail mount  
Explosion proof  
Remote mount (Series 20 Sensor)  
Explosion proof - Group B

### DISPLAYS

Includes LCD  
Two-button keypad configures & calibrates  
One-Line: Local Display and Keyboard  
4 digits and minus sign, decimal point  
6 mm (0.25") numerals  
Responds with codes during programming and calibration  
Two-Line: Smart Local Display and Keyboard  
Line one displays 4 digits, minus sign, decimal point and engineering units  
Mid line displays analog bar graph of output current  
14 segment, 2 mm x 40 mm (0.08" x 1.5")

## STANDARD CONFIGURATION:

Sensor Input	RTD
LRV (4mA)	0° F Lower Range Value
URV (20mA)	200° F Upper Range Value
Damping	0 seconds
Output	Linear with Temperature
Failsafe	Upscale (23 mA)

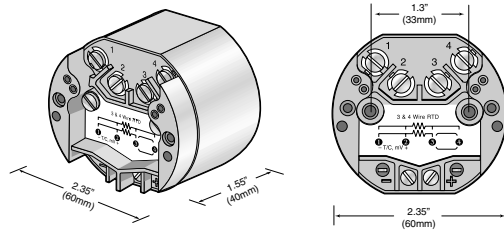
## ORDERING INFORMATION:

Specify calibration.

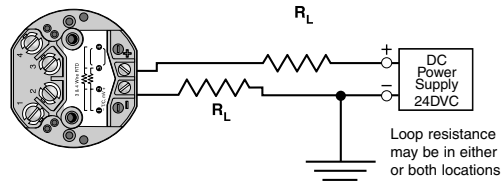
## NOTE:

Specifications are determined with the factory default software settings or with the various software parameters set to optimize the performance for a given specification.

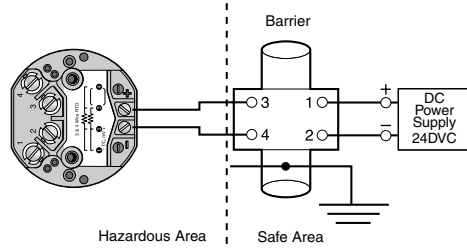
### Dimensions



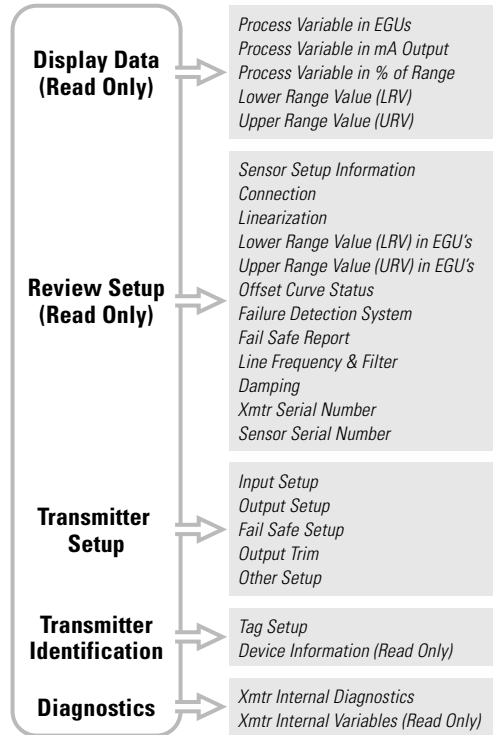
### Connections



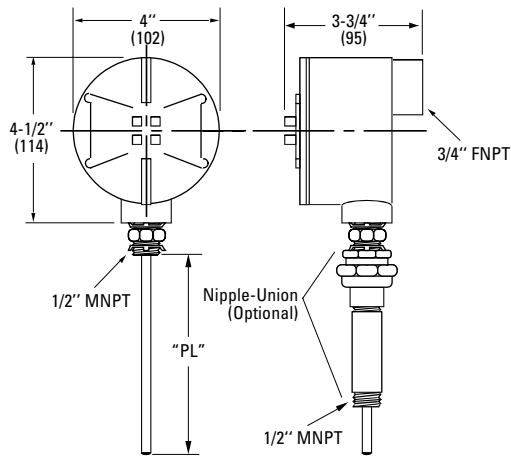
#### INTRINSICALLY SAFE INSTALLATION



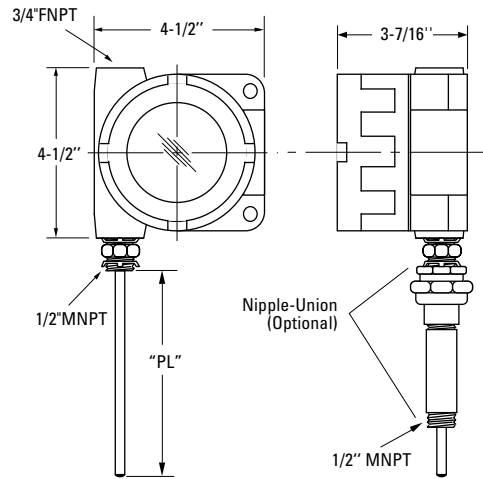
### Device Description Function Map



### Housing Dimensions



(IB) BLIND HOUSING



(II) INDICATING / BLIND HOUSING WITH GROUP B OPTION

## NuFlo Measurement Systems

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