

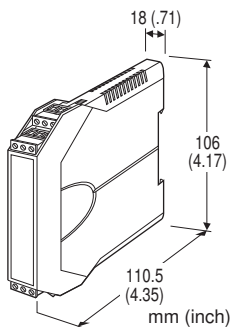
## Space-saving Two-wire Signal Conditioners B3-UNIT

### 2-WIRE UNIVERSAL TEMPERATURE TRANSMITTER

(HART communication, intrinsically safe)

#### Functions & Features

- Universal input: mV, V, T/C, RTD, resistance and potentiometer
- High accuracy
- HART communication
- Intrinsically safe approval
- Programming via hand-held communicator or via PC
- A wide variety of T/C and RTD types
- User's temperature table can be used
- Self diagnostics
- Input-output isolated
- CE marking (conforms to ATEX and EMC)



### MODEL: B3HU-[1]

#### ORDERING INFORMATION

- Code number: B3HU-[1]
- Specify a code from below for [1]  
(e.g. B3HU-0).
- Use Ordering Information Sheet (No. ESU-7502). Factory standard setting will be used if not otherwise specified.
  - Specify the country in which the product is to be used with the Safety Approval code 2.

#### [1] SAFETY APPROVAL

- 0: None
- 1: FM intrinsically safe
- 2: CENELEC intrinsic safety (ATEX)

#### RELATED PRODUCTS

- RS-232-C interface Bell202 modem (model: COP-H)  
Usable in 'non-hazardous' area only.
- USB interface Bell202 modem (model: COP-HU)  
Usable in 'non-hazardous' area only.

- Hand-held communicator  
(Consult HART Communication Foundation (HCF) web site: [www.hartcomm.org](http://www.hartcomm.org).)
- AMS (version 6.0 or higher)
- Simatic PDM (version 6.0 or higher)

#### PACKAGE INCLUDES...

- PC configurator software CD (model: B3HUCON)  
(OS: Windows 98SE, NT4.0, 2000 and XP Pro)

#### GENERAL SPECIFICATIONS

**Construction:** Small-sized front terminal structure

**Connection:** Euro type connector terminal

**Housing material:** Flame-resistant resin (gray)

**Isolation:** Input to output

**Burnout (T/C & RTD):** Upscale, downscale or no burnout selectable (standard: upscale);

Also detects wire breakdown and overrange input exceeding the electrical design limit for DC input.

**Cold Junction Compensation (thermocouple input):** CJC sensor incorporated

**User-configurable items:**

- Input sensor type
- Number of wires (RTD & resistance)
- Input range
- Inverted output
- Burnout
- Damping time (via HART only, standard: 0)
- Sensor calibration (via HART only)
- Output calibration
- Special linearization data (via HART only)
- HART communication mode

#### HART COMMUNICATION

**Protocol:** HART communication protocol

**HART address range:** 0 - 15 (factory set to 0)

**Transmission speed:** 1200 bps

**Digital current:** Approx. 1 mA<sub>p-p</sub> when communicating

**Character format:** 1 Start Bit, 8 Data Bits, 1 Odd Parity Bit, 1 Stop Bit

**Distance:** 1.5 km (0.9 miles)

**HART communication mode:** Master-Slave Mode and Burst Mode (factory set to Master-Slave)

**HART network mode:** Point-to-Point Mode and Multi-drop Mode; automatically set to Multi-drop Mode when the address is set to other than 0.

#### INPUT SPECIFICATIONS

The input is factory set for use with K thermocouple, 0 to 100°C.

See Table 1 for the available input type, the minimum span and the maximum range.

## ■ DC mV & V

Input resistance:  $\geq 1 \text{ M}\Omega$

## ■ THERMOCOUPLE

Input resistance:  $\geq 1 \text{ M}\Omega$

Burnout sensing: 130 nA  $\pm 10 \%$

## ■ RTD (2-wire, 3-wire or 4-wire)

Input resistance:  $\geq 1 \text{ M}\Omega$

Excitation: 0.2 mA  $\pm 10 \%$

Allowable leadwire resistance: Max. 20  $\Omega$  per wire

## ■ RESISTANCE (2-wire, 3-wire or 4-wire)

Excitation: 0.2 mA  $\pm 10 \%$

Allowable leadwire resistance: Max. 20  $\Omega$  per wire

## ■ POTENTIOMETER

Excitation: 0.2 mA  $\pm 10 \%$

Allowable leadwire resistance: Max. 20  $\Omega$  per wire

## OUTPUT SPECIFICATIONS

Output range: 4 - 20 mA DC

Operational range: 3.8 - 21.6 mA

Load resistance vs. supply voltage:

Load Resistance ( $\Omega$ ) = (Supply Voltage (V) - 12 (V))  
 $\div 0.024 \text{ (A)}$  (including leadwire resistance)

## INSTALLATION

Supply voltage:

- 12 - 42 V DC (non-approved)
- 12 - 28 V DC (approved)

Operating temperature: -40 to +85°C (-40 to +185°F)

(See Safety Parameters for use in a hazardous location.)

Operating humidity: 0 to 95 %RH (non-condensing)

Mounting: DIN rail

Weight: 80 g (2.8 oz)

## PERFORMANCE

Accuracy: See Table 1 and 'Explanation of Terms.'

Cold junction compensation error:  $\pm 0.5^\circ\text{C}$

Temp. coefficient:  $\pm 0.015 \%/^\circ\text{C}$  ( $\pm 0.008 \%/^\circ\text{F}$ ) of max. span at -5 to +55°C [23 to 131°F]

Start-up time: Approx. 8 sec.

Response time:  $\leq 2 \text{ sec.}$  (0 - 90 %) with damping time set to 0 and when not communicating via HART.

Supply voltage effect:  $\pm 0.003 \%$   $\times$  [Output Span] / 1 V

Insulation resistance:  $\geq 100 \text{ M}\Omega$  with 500 V DC

Dielectric strength: 1500 V AC @1 minute (input to output)

## EXPLANATIONS OF TERMS

### ■ ACCURACY

This transmitter's accuracy is theoretically defined as the addition of A/D and D/A conversion errors:

$$\text{Accuracy} = \text{A/D Conversion Error} + \text{D/A Conversion Error}$$

The A/D conversion error means that measured as HART signal which is A/D converted from the analog input signal. The D/A conversion error of this transmitter is relatively very small so that it does not really affect the unit's overall performance.

The "Accuracies" given in Table 1 therefore equals the A/D conversion error.

The temperature drift (coefficient) or the cold junction compensation error is not included in the "Accuracy."

### ■ CALCULATION EXAMPLES OF OVERALL ACCURACY IN %

#### • DC Voltage

1) 0 - 200 mV

Absolute value accuracy (Table 1): 40  $\mu\text{V}$

$$40 \mu\text{V} / 200000 \mu\text{V} \times 100 = 0.02 \% < 0.1 \%$$

➡ Overall accuracy =  $\pm 0.1\%$  of span

2) 0 - 4 mV

Absolute value accuracy (Table 1): 10  $\mu\text{V}$

$$10 \mu\text{V} / 4000 \mu\text{V} \times 100 = 0.25 \% > 0.1 \%$$

➡ Overall accuracy =  $\pm 0.25 \%$  of span

#### • Thermocouple

1) K thermocouple, 0 - 1000°C

Absolute value accuracy (Table 1): 0.25°C

$$0.1\% \times 1000^\circ\text{C} = 1^\circ\text{C} > 0.25^\circ\text{C}$$

CJC error (0.5°C) added: 1 + 0.5 = 1.5°C

$$1.5^\circ\text{C} / 1000^\circ\text{C} \times 100 = 0.15 \%$$

➡ Overall accuracy including CJC error =  $\pm 0.15 \%$  of span

2) K thermocouple, 50 - 150°C

Absolute value accuracy (Table 1): 0.25°C

$$0.1\% \times (150 - 50)^\circ\text{C} = 0.1^\circ\text{C} < 0.25^\circ\text{C}$$

CJC error (0.5°C) added: 0.25 + 0.5 = 0.75°C

$$0.75^\circ\text{C} / (150 - 50)^\circ\text{C} \times 100 = 0.75 \%$$

➡ Overall accuracy including CJC error =  $\pm 0.75 \%$  of span

#### • RTD

1) Pt 100, -200 - 800°C

Absolute value accuracy (Table 1): 0.15°C

$$0.15^\circ\text{C} / (800 - -200)^\circ\text{C} \times 100 = 0.015 \% < 0.1 \%$$

➡ Overall accuracy =  $\pm 0.1 \%$  of span

2) Pt 100, 0 - 100°C

Absolute value accuracy (Table 1): 0.15°C

$$0.15^\circ\text{C} / 100^\circ\text{C} \times 100 = 0.15 \% > 0.1 \%$$

➡ Overall accuracy =  $\pm 0.15 \%$  of span

## STANDARDS & APPROVALS

### CE conformity:

ATEX Directive (94/9/EC)  
Ex ia EN 50020: 2002  
EMC Directive (2004/108/EC)  
EMI EN 61000-6-4: 2007  
EMS EN 61000-6-2: 2005

### Safety approval:

FM: Intrinsically safe  
Class I, Div. 1, Groups A, B, C and D  
Class I, Zone 0, AEx ia IIC  
T4 and T5  
(Class 3610: 2007)  
CENELEC: Intrinsically safe (ATEX)  
⊕ II 1G, Ex ia IIC; T4 and T5  
(EN50020: 2002)

## SAFETY PARAMETERS

### Operating temperature

#### For CENELEC (ATEX) / FM:

T4: -40 to +80°C  
T5: -40 to +55°C

### Ex-data:

- Output circuit  
Ui (Vmax): 30 V DC  
Ii (Imax): 96 mA DC  
Pi (Pmax): 0.72 W  
Ci: 1 nF  
Li: 0 mH
- Sensor circuit  
Uo (Voc): 6.4 V DC  
Io (Isc): 30 mA DC  
Po: 48 mW  
Co (Ca): 20 µF  
Lo (La): 10 mH

**INPUT TYPE, RANGE & ACCURACY**

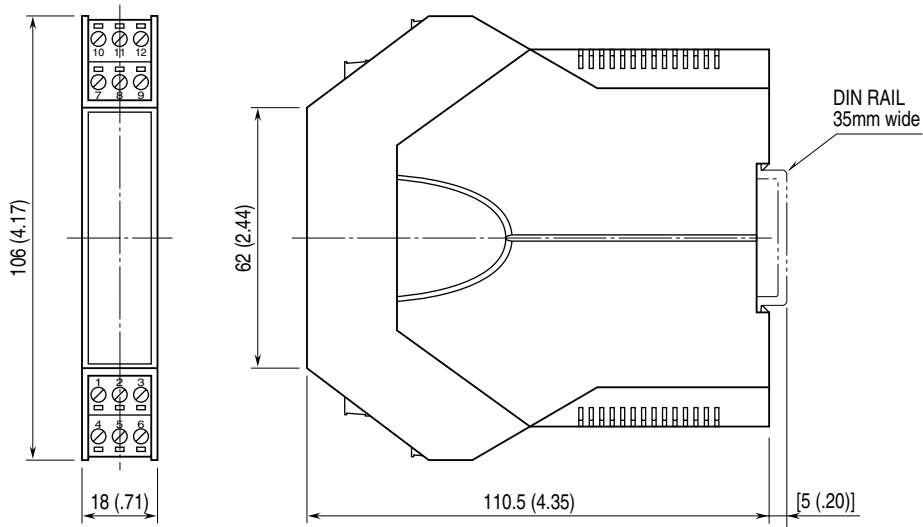
INPUT TYPE	MIN. SPAN	MAXIMUM RANGE	ACCURACY					
DC mV & mV	4 mV	-50 to 1000 mV	0.1 % or 10 V, whichever is greater (F.S. input 50 mV) 0.1 % or 40 V, whichever is greater (F.S. input 200 mV) 0.1 % or 60 V, whichever is greater (F.S. input 500 mV) 0.1 % or 80 V, whichever is greater (F.S. input >500 mV)					
Potentiometer	80	0 to 4000	0.1 %					
Resistance	10	0 to 4000	0.1 % or 0.1 , whichever is greater. *2					
THERMOCOUPLE	C				F			
	MIN. SPAN	MAXIMUM RANGE	CONFORMANCE RANGE	ACCURACY *1	MIN. SPAN	MAXIMUM RANGE	CONFORMANCE RANGE	ACCURACY *1
(PR)	20	0 to 1760	0 to 1760	1.00	36	32 to 3200	32 to 3200	1.80
K (CA)	20	-270 to +1370	-150 to +1370	0.25	36	-454 to +2498	-238 to +2498	0.45
E (CRC)	20	-270 to +1000	-170 to +1000	0.20	36	-454 to +1832	-274 to +1832	0.36
J (IC)	20	-210 to +1200	-180 to +1200	0.25	36	-346 to +2192	-292 to +2192	0.45
T (CC)	20	-270 to +400	-170 to +400	0.25	36	-454 to +752	-274 to +752	0.45
B (RH)	20	100 to 1820	400 to 1760	0.75	36	212 to 3308	752 to 3200	1.35
R	20	-50 to +1760	200 to 1760	0.50	36	-58 to +3200	392 to 3200	0.90
S	20	-50 to +1760	0 to 1760	0.50	36	-58 to +3200	32 to 3200	0.90
C (WRe 5-26)	20	0 to 2315	0 to 2315	0.25	36	32 to 4199	32 to 4199	0.45
N	20	-270 to +1300	-130 to +1300	0.30	36	-454 to +2372	-202 to +2372	0.54
U	20	-200 to +600	-200 to +600	0.20	36	-328 to +1112	-328 to +1112	0.36
L	20	-200 to +900	-200 to +900	0.25	36	-328 to +1652	-328 to +1652	0.45
P (Platinel II)	20	0 to 1395	0 to 1395	0.25	36	32 to 2543	32 to 2543	0.45
RTD	C			F				
	MIN. SPAN	MAXIMUM RANGE	ACCURACY *2	MIN. SPAN	MAXIMUM RANGE	ACCURACY *2		
Pt 100 (JIS '97, IEC)	20	-200 to +850	0.15	36	-328 to +1562	0.27		
Pt 200	20	-200 to +850	0.15	36	-328 to +1562	0.27		
Pt 300	20	-200 to +850	0.15	36	-328 to +1562	0.27		
Pt 400	20	-200 to +850	0.15	36	-328 to +1562	0.27		
Pt 500	20	-200 to +850	0.15	36	-328 to +1562	0.27		
Pt 1000	20	-200 to +850	0.15	36	-328 to +1562	0.27		
Pt 50 (JIS '81)	20	-200 to +649	0.15	36	-328 to +1200	0.27		
JPt 100 (JIS '89)	20	-200 to +510	0.15	36	-328 to +950	0.27		
Ni 100	20	-80 to +260	0.15	36	-112 to +500	0.27		
Ni 120	20	-80 to +260	0.15	36	-112 to +500	0.27		
Ni 508.4	20	-50 to +200	0.15	36	-58 to +392	0.27		
Ni-Fe 604	20	-200 to +200	0.15	36	-328 to +392	0.27		
Cu 10 @25C	20	-50 to +250	0.50	36	-58 to +482	0.90		

\*1. [Accuracy or 0.1 % of span, whichever is greater] + Cold Junction Compensation Error

\*2. Or 0.1% of span, whichever is greater.

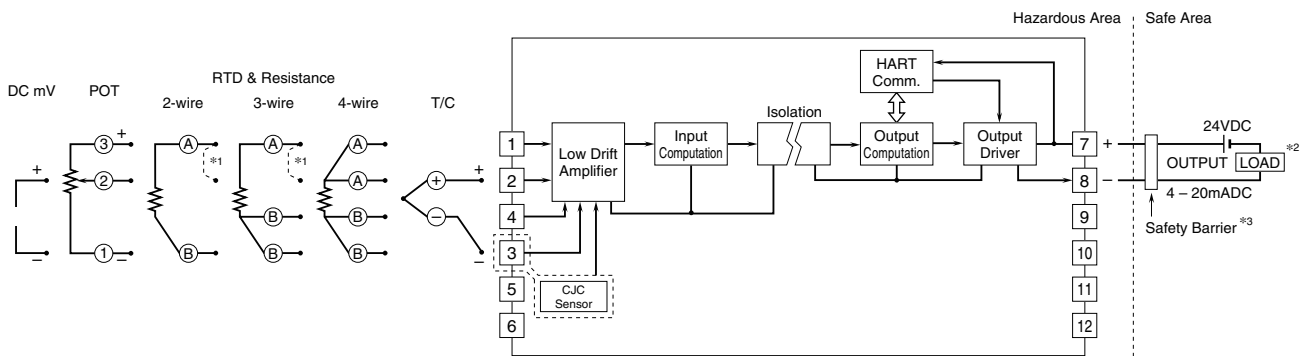
(For 2- or 3-wire resistor or RTD, the value is valid by the sensor calibration after the wiring is done.)

## EXTERNAL DIMENSIONS & TERMINAL ASSIGNMENTS unit: mm (inch)



• When mounting, no extra space is needed between units.

## SCHEMATIC CIRCUITRY & CONNECTION DIAGRAM



\*1. Close across the terminals 1 & 2 for a resistance or RTD input.

\*2. Limited to 250 – 1100Ω for HART communication.

\*3. A safety barrier must be installed for the intrinsic safety.

The safety barrier must meet the Ex-data of this unit and must be approved for the hazardous location.



Specifications are subject to change without notice.