

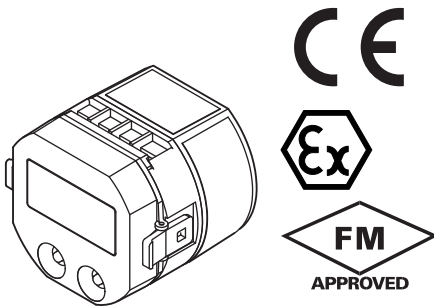
## Field-mounted Two-wire Signal Conditioners B6-UNIT

### 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: B6U-[1][2]**

### ORDERING INFORMATION

Specify code number: B6U-[1][2]

Specify a code from below for each [1], [2].

(e.g. B6U-21).

Use Ordering Information Sheet (No. ESU-7451). 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)

5: FM nonincendive

7: TIIS intrinsic safety (Pending. CE not available)

### [2] LCD DISPLAY

0: Without

1: With

### RELATED PRODUCTS

- Outdoor enclosure (model: 6BX-E)
- 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
- AMS software (version 6.0 or higher)

### PACKAGE INCLUDES...

- PC configurator software CD (model: B6UCON)  
(OS: Windows 98SE, NT4.0, 2000 and XP Pro)

### GENERAL SPECIFICATIONS

**Electrical connection:** M3.5 screw terminals (torque 0.8 N·m)

#### Materials

**Transmitter housing:** Flame-resistant resin (black)

**Screw terminals:** Nickel-plated brass

**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.

## LCD DISPLAY (option)

### Features:

- Indicates and sets input signal, engineering unit and transmitter status.

- Removable while the module is powered.

**Display size:** 36 × 20 mm (1.41" × 0.79")

### Characters

**Color:** Black

**Format:** 2 rows of 5 alphanumeric characters;

Top: 7.4 mm high

Bottom: 6.5 mm high

6 status characters, 1.9 mm high

**Display range:** -99999 to 99999

**Decimal point:** Top row only; positioned between two characters

**Read rate:** 150 msec.

**Back light:** None

## 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:** ≥ 1 MΩ

### ■ THERMOCOUPLE

**Input resistance:** ≥ 1 MΩ

**Burnout sensing:** 130 nA ±10 %

### ■ RTD (2-wire, 3-wire or 4-wire)

**Input resistance:** ≥ 1 MΩ

**Excitation:** 0.2 mA ±10 %

**Allowable leadwire resistance:** Max. 20 Ω per wire

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

**Excitation:** 0.2 mA ±10 %

**Allowable leadwire resistance:** Max. 20 Ω per wire

### ■ POTENTIOMETER

**Excitation:** 0.2 mA ±10%

**Allowable leadwire resistance:** Max. 20 Ω per wire

## OUTPUT SPECIFICATIONS

**Output range:** 4 - 20 mA DC

**Operational range:** 3.8 - 21.6 mA

### Load resistance vs. supply voltage:

Load Resistance (Ω) = (Supply Voltage (V) - 12 (V))

÷ 0.024 (A) (including leadwire resistance)

## INSTALLATION

### Supply voltage:

- 12 - 42 V DC (non-approved)

- 12 - 28 V DC (approved)

**Operating temperature:** -40 to +85°C Electronics

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

-30 to +80°C Display (full visibility)

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

**Weight:** 150 g (0.33 lbs) including the LCD

## PERFORMANCE

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

**Cold junction compensation error:** ±0.5°C

**Temp. coefficient:** ±0.015 %/°C (±0.008 %/°F) of max. span at -5 to +55°C [23 to 131°F]

**Start-up time:** Approx. 8 sec.

**Response time:** ≤ 2 sec. (0 - 90 %) with damping time set to 0 and when not communicating via HART.

**Supply voltage effect:** ±0.003 % × [Output Span] / 1 V

**Insulation resistance:** ≥ 100 MΩ 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 μV

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

⇒ Overall accuracy = ±0.1% of span

2) 0 - 4 mV

Absolute value accuracy (Table 1): 10 μV

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

⇒ Overall accuracy = ±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:  $1 + 0.5 = 1.5^\circ\text{C}$   
 $1.5^\circ\text{C} / 1000^\circ\text{C} \times 100 = 0.15\%$   
 ➤ 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:  $0.25 + 0.5 = 0.75^\circ\text{C}$   
 $0.75^\circ\text{C} / (150 - 50)^\circ\text{C} \times 100 = 0.75\%$   
 ➤ 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

## For TIIS:

T5: -20 to +60°C

## Ex-data:

- Output circuit  
 Ui (Vmax): 30 V DC  
 Ii (Imax): 96 mA DC  
 Pi (Pmax): 720 mW  
 Ci: 0 µF (TIIS Intrinsic Safety: 'Negligible value')  
 Li: 0 mH (TIIS Intrinsic Safety: 'Negligible value')
- Sensor circuit  
 Uo (Voc): 6.4 V DC  
 Io (Isc): 30 mA DC  
 Po: 48 mW  
 Co (Ca): 20 µF  
 Lo (La): 10 mH

## 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, Division 1, Groups A, B, C and D  
 Class I, Zone 0, AEx ia IIC  
 T4, T5 and T6  
 (Class 3610)  
 FM: Nonincendive  
 Class I, Division 2, Groups A, B, C, and D  
 Class I, Zone 2, Group IIC  
 T4, T5 and T6  
 (Class 3611)  
 TIIS: Intrinsic safety  
 Ex ia IIC T5  
 CENELEC: Intrinsic safety (ATEX)  
 Ⓔ II 1G, Ex ia IIC; T4, T5 and T6  
 (EN 50020: 2002)

## SAFETY PARAMETERS

### Operating temperature

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

T4: -40 to +80°C  
 T5: -40 to +65°C  
 T6: -40 to +50°C

## INPUT TYPE, RANGE & ACCURACY

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Table 1

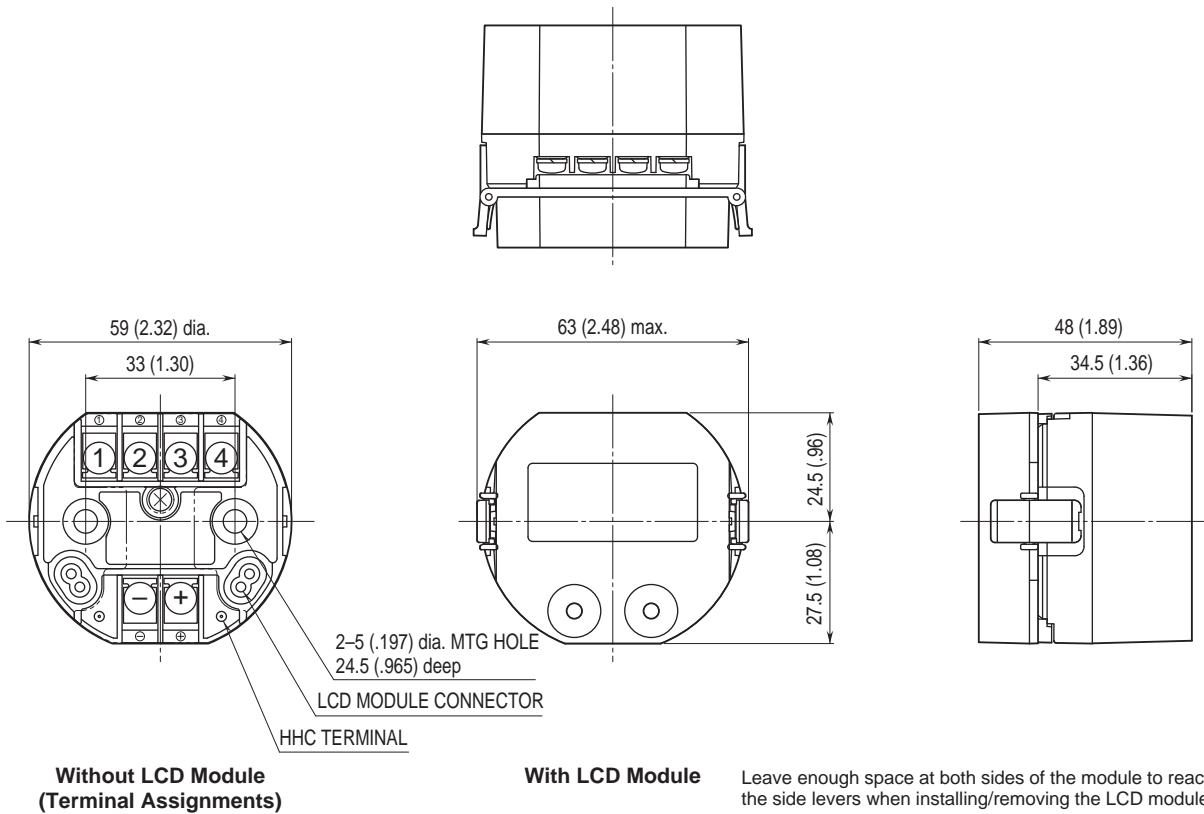
INPUT TYPE	MIN. SPAN	MAXIMUM RANGE	ACCURACY					
DC mV & mV	4 mV	-50 to 1000 mV	±0.1 % or ±10 μV, whichever is greater (F.S. input ≤50 mV) ±0.1 % or ±40 μV, whichever is greater (F.S. input ≤200 mV) ±0.1 % or ±60 μV, whichever is greater (F.S. input ≤500 mV) ±0.1 % or ±80 μV, whichever is greater (F.S. input >500 mV)					
Potentiometer	80 Ω	0 to 4000 Ω	±0.1 %					
Resistance	10 Ω	0 to 4000 Ω	±0.1 % or ±0.1 Ω, 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 Ω (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 Ω	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 @25°C	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

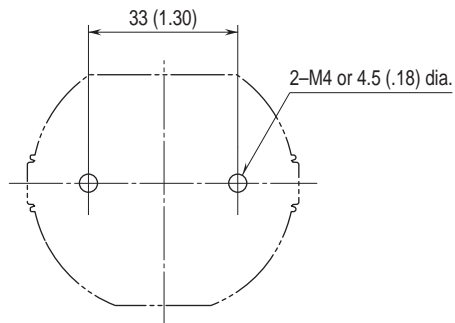
\*2. Or ±0.1% of span, whichever is greater.

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

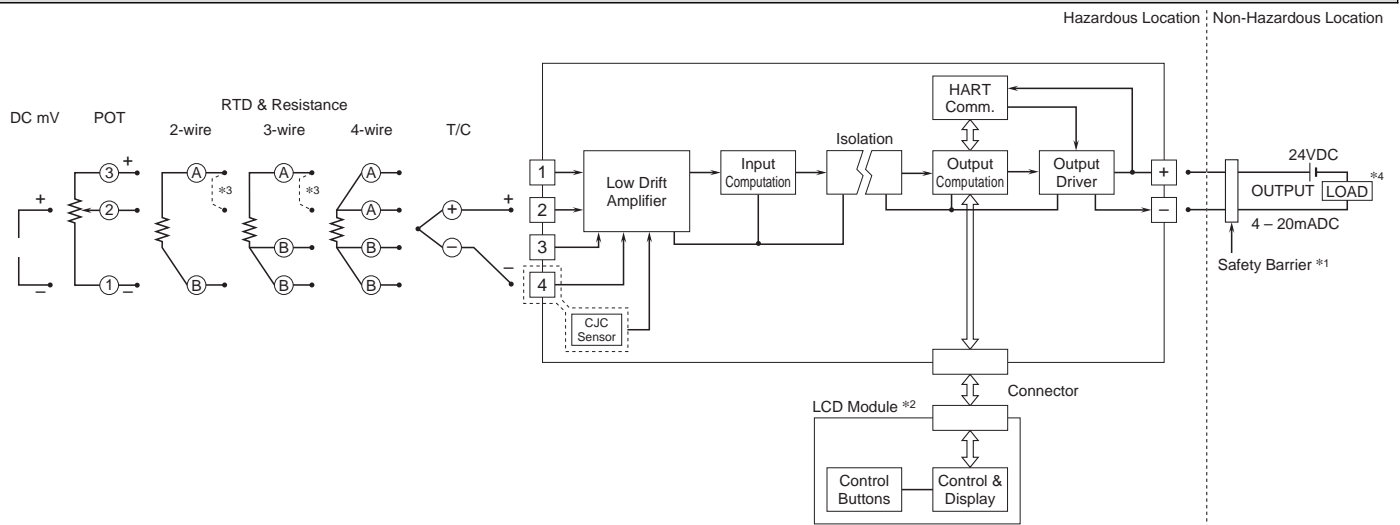
## DIMENSIONS unit: mm (inch)



## MOUNTING REQUIREMENTS unit: mm (inch)



## SCHEMATIC CIRCUITRY & CONNECTION DIAGRAM



- \*1. 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.
- \*2. Optional
- \*3. Close across the terminals 1 & 2 for a resistance or RTD input.
- \*4. Limited to 250 – 1100Ω for HART communication.



Specifications are subject to change without notice.