

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

**2-WIRE UNIVERSAL TEMPERATURE TRANSMITTER**  
(HART communication, intrinsically safe)

MODEL

**B6U**

**MODEL & SUFFIX CODE SELECTION**

B6U-□□

MODEL \_\_\_\_\_

SAFETY APPROVAL \_\_\_\_\_

0 : None

1 : FM intrinsically safe

2 : CENELEC intrinsically safe (ATEX)

5 : FM nonincendive

7 : TIIS intrinsically safe \*1

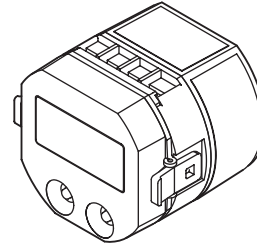
LCD DISPLAY \_\_\_\_\_

0 : Without

1 : With

\*1 : CE not available

**ISOLATION**



**Functions & Features**

- Universal input: mV, V, T/C, RTD, resistance and potentiometer
- High accuracy
- HART communication
- Intrinsically safe approval
- CE marking (conforms to ATEX and EMC)
- 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

**ORDERING INFORMATION**

Specify code number and suffix codes. 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.

- **Code number** (e.g. B6U-21)

**PACKAGE INCLUDES....**

- PC configurator software CD (model: B6UCON)  
(OS: Windows 95, 98, NT4.0, and 2000)

**RELATED PRODUCTS**

- Outdoor enclosure (model: 6BX-E)
- HART modem\*  
MACTek VIATOR RS232 HART IF recommended
- Hand-held communicator\*
- AMS software (version 6.0 or higher)

\*Consult HART Communication Foundation (HCF) web site: [www.hartcomm.org](http://www.hartcomm.org).

**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

**User-configurable items:**

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

**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 (T/C):** CJC sensor incorporated

**Dampening time:** 0 to 30 sec. (standard: 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

**HART COMMUNICATION**

**Protocol:** HART communication protocols

**HART address range:** 0 – 15 (standard: 0)

**Transmission speed:** 1200 bps

**Digital current:** Approx. 1mA p-p when communicating

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

**Distance:** 1.5 kilometers (0.9 mile)

**HART communication mode:** Master-Slave Mode and Burst Mode (standard: 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**

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:** 1MΩ minimum

**■THERMOCOUPLE**

**Input resistance:** 1MΩ minimum

**Burnout sensing:** 130nA ±10%

**■RTD (2-wire, 3-wire or 4-wire)**

**Input resistance:** 1MΩ minimum

**Excitation:** See Table 1.

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

**■POTENTIOMETER**

**Excitation:** 0.2mA ±10%

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

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

**Excitation:** 0.2mA ±10%

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

Specifications subject to change without notice.

**OUTPUT**

**Output range:** 4 – 20mA DC

**Operational range:** 3.8 – 21.6mA

**Load resistance vs. supply voltage:**

$$\text{Load Resistance } (\Omega) = \frac{\text{Supply Voltage (V)} - 12 \text{ (V)}}{0.024 \text{ (A)}}$$

(including leadwire resistance)

**INSTALLATION**

**Supply voltage:** 12 – 42V DC (non-approved)  
12 – 28V 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)

**Dimensions:** See External Dimensions.

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

**PERFORMANCE**

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

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

**Temp. coefficient** (of max. range at -5 to +55°C):  
±0.015%/°C (±0.008%/°F)

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

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

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

**Insulation resistance:** ≥100MΩ with 500V DC  
(input to output)

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

## STANDARDS & APPROVAL

**CE conformity:** ATEX Directive (94/9/EC)

EEx ia EN50020

EMC Directive (89/336/EEC)

EMI EN61000-6-4

EMS EN61000-6-2

### Safety approval

FM: Intrinsically safe

Class I, Div. 1, Groups A, B, C and D

Class I, Zone 0, AEx ia IIC

T4, T5 and T6

(Class 3610)

FM: Nonincendive

Class I, Div. 2, Groups A, B, C, and D

Class I, Zone 2, Group IIC

T4, T5 and T6

(Class 3611)

CENELEC: Intrinsically safe (ATEX)

⊕ II 1G, EEx ia IIC; T4, T5 and T6

(EN50020 - 1994)

TIIS: Intrinsically safe

Ex ia IIC T5

## SAFETY PARAMETERS

### Operating temperature for CENELEC (ATEX) / FM:

T4 -40 to +80°C

T5 -40 to +65°C

T6 -40 to +50°C

### Operating temperature for TIIS:

T5 -20 to +60°C

<b>Ex-data:</b>	U <sub>i</sub> (V <sub>max</sub> ) 30V DC	U <sub>o</sub> (V <sub>oc</sub> ) 6.4V DC
	I <sub>i</sub> (I <sub>max</sub> ) 96mA DC	I <sub>o</sub> (I <sub>sc</sub> ) 30mA DC
	P <sub>i</sub> (P <sub>max</sub> ) 0.72W	P <sub>o</sub> 48mW
	C <sub>i</sub> 0 μF***	C <sub>o</sub> (C <sub>a</sub> ) 20 μF
	L <sub>i</sub> 0 mH***	L <sub>o</sub> (L <sub>a</sub> ) 10 mH

\*\*\* TIIS Intrinsically Safe: 'Negligible value'

## EXPLANATION OF TERMS

### ■ ACCURACY

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

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 – 200mV

Absolute value accuracy (Table 1): 40μV

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

➡ Overall accuracy = ±0.1% of span

2) 0 – 4mV

Absolute value accuracy (Table 1): 10μV

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

➡ Overall accuracy = ±0.25% of span

#### • Thermocouple

1) K thermocouple, 0 – 1000°C

Absolute value accuracy (Table 1): 0.25°C

CJC error (0.5°C) added: 0.75°C

$$0.75^\circ\text{C} / 1000^\circ\text{C} \times 100 = 0.075 \% < 0.1\%$$

➡ Overall accuracy including CJC error

= ±0.1% of span

2) K thermocouple, 50 – 150°C

Absolute value accuracy (Table 1): 0.25°C

CJC error (0.5°C) added: 0.75°C

$$0.75^\circ\text{C} / (150 - 50)^\circ\text{C} \times 100 = 0.75 \% > 0.1\%$$

➡ Overall accuracy including CJC error

= ±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 = ±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 = ±0.15% of span

INPUT TYPE, RANGE &amp; ACCURACY

TABLE 1

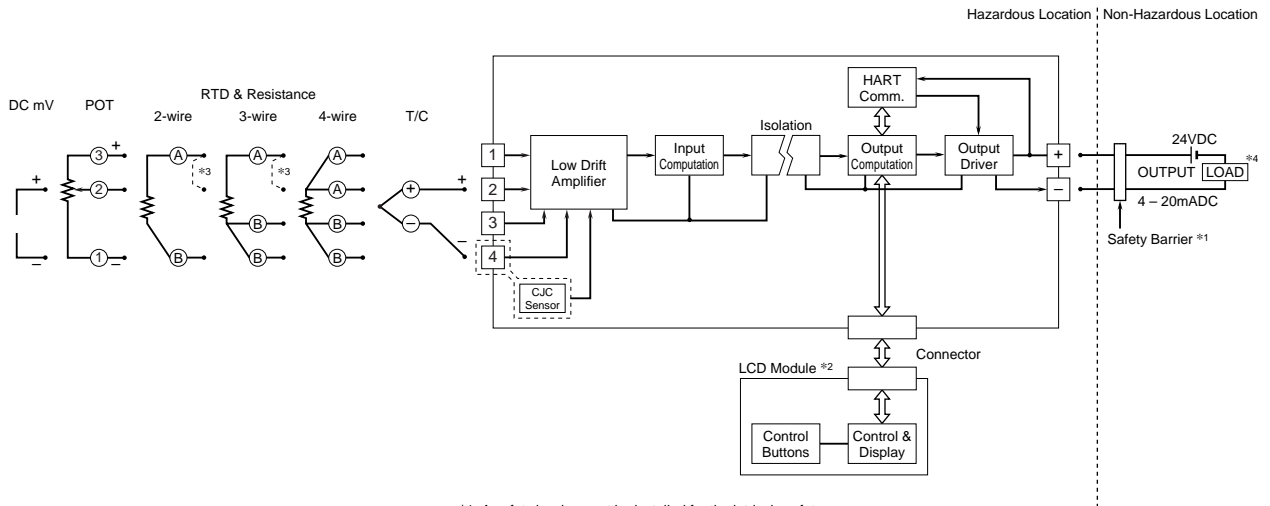
INPUT TYPE	MIN. SPAN	MAXIMUM RANGE	ACCURACY					
DC mV & V	4mV	-50 to +1000mV	±0.1% or ±10μV, whichever is greater (F.S. input ≤50mV) ±0.1% or ±40μV, whichever is greater (F.S. input ≤200mV) ±0.1% or ±60μV, whichever is greater (F.S. input ≤500mV) ±0.1% or ±80μV, whichever is greater (F.S. input >500mV)					
Potentiometer	80Ω	0 to 4000Ω	±0.1%					
Resistance	10Ω	0 to 4000Ω	±0.1% or ±0.1Ω, 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	EXCITATION	°C			°F			
		MIN. SPAN	MAXIMUM RANGE	ACCURACY *2	MIN. SPAN	MAXIMUM RANGE	ACCURACY *2	
Pt 100 (JIS '97/DIN/IEC)	0.2mA	20	-200 to +850	±0.15	36	-328 to +1562	±0.27	
Pt 200	0.2mA	20	-200 to +850	±0.15	36	-328 to +1562	±0.27	
Pt 300	0.2mA	20	-200 to +850	±0.15	36	-328 to +1562	±0.27	
Pt 400	0.2mA	20	-200 to +850	±0.15	36	-328 to +1562	±0.27	
Pt 500	0.2mA	20	-200 to +850	±0.15	36	-328 to +1562	±0.27	
Pt 1000	0.2mA	20	-200 to +850	±0.15	36	-328 to +1562	±0.27	
Pt 50 (JIS '81)	0.2mA	20	-200 to +649	±0.15	36	-328 to +1200	±0.27	
JPt 100 (JIS '89)	0.2mA	20	-200 to +510	±0.15	36	-328 to +950	±0.27	
Ni 100	0.2mA	20	-80 to +260	±0.15	36	-112 to +500	±0.27	
Ni 120	0.2mA	20	-80 to +260	±0.15	36	-112 to +500	±0.27	
Ni 508.4	0.2mA	20	-50 to +200	±0.15	36	-58 to +392	±0.27	
Ni-Fe 604	0.2mA	20	-200 to +200	±0.15	36	-328 to +392	±0.27	
Cu 10 (25°C)	0.2mA	20	-50 to +250	±0.50	36	-58 to +482	±0.90	

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

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

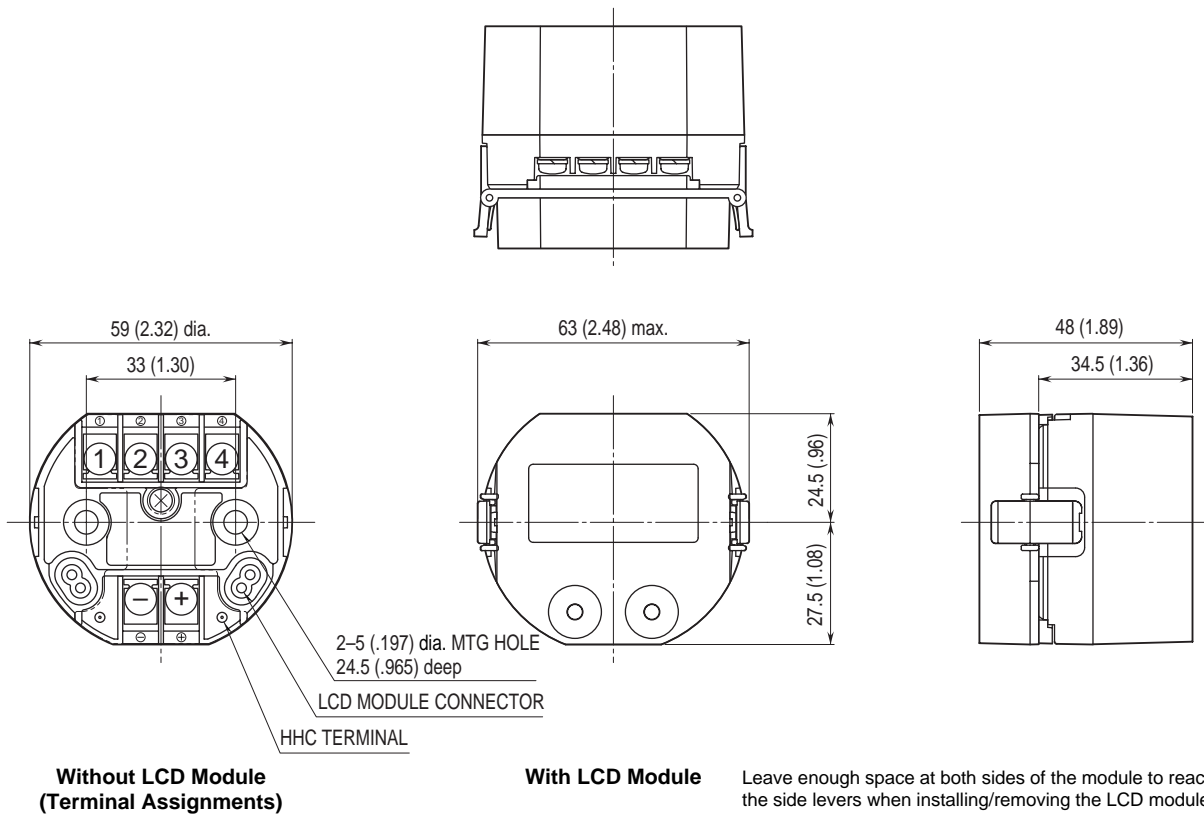
(For 2- or 3-wire RTD, the value is valid by the sensor calibration after the wiring is done.)

# 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.

# EXTERNAL DIMENSIONS mm (inch)



# MOUNTING REQUIREMENTS mm (inch)

