

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

2-WIRE UNIVERSAL TEMPERATURE TRANSMITTER
(HART communication, intrinsically safe/explosion-proof)

MODEL **B6U-B**

MODEL & SUFFIX CODE SELECTION

B6U-B-□□□□

MODEL _____

SAFETY APPROVAL*1 _____

- 0 : None
- 1 : FM intrinsically safe
- 2 : CENELEC intrinsically safe (ATEX)
- 3 : FM explosion-proof
- 4 : CENELEC flameproof (ATEX)
- 5 : FM nonincendive
- 7 : TIIS intrinsically safe *2
- 8 : TIIS flameproof *2

LCD DISPLAY _____

- 0 : Without
- 1 : With

WIRING CONDUIT *1 _____

- 0 : G 1/2
- 1 : 1/2 NPT
- 2 : M20 × 1.5
- 3 : PG 13.5

MOUNTING BRACKET _____

- 0 : Without
- 1 : With

OPTIONS _____

/S : Stainless steel enclosure *3

*1 : Confirm selectable combinations of approval and wiring conduit types in the table below.

*2 : CE not available

*3 : TIIS approval not selectable

SELECTABLE WIRING CONDUITS SPECIFIC TO EACH APPROVAL

'N' marked combinations are not selectable.

WIRING CONDUIT \ APPROVAL	APPROVAL							
	0	1	2	3	4	5	7	8
0	Y	N	Y	N	N	N	Y	Y
1	Y	Y	Y	Y	Y	Y	Y	N
2	Y	Y	Y	N	Y	Y	Y	N
3	Y	N	Y	N	N	N	Y	N

ORDERING INFORMATION

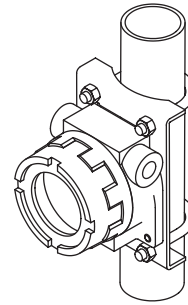
Specify code number and suffix codes. Use Ordering Information Sheet (No. ESU-7451). Factory standard setting will be used if not otherwise specified.

Specify the country in which the product is to be used with the Safety Approval code 2 or 4.

• **Code number** (e.g. B6U-B-4121)

PACKAGE INCLUDES....

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



Functions & Features

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

RELATED PRODUCTS

- 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.

GENERAL SPECIFICATIONS

Environmental protection: NEMA 4X, IP65

Wiring conduit: See 'Model & Suffix Code.'

Cable gland: Two provided for TIIS flameproof type

Model No.: BX-E-SXY

Cable entries: Elastomeric sealing rings

Wiring conduit size: G 1/2

Material: Chrome-plated brass (entry)
CR (sealing ring)

Applicable wire size: 8 – 12 dia.

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

Materials

- **Transmitter housing:** Flame-resistant resin (black)
- **Screw terminals:** Nickel-plated brass
- **Enclosure:** Diecast aluminium standard; stainless steel casting optional (equivalent to type 316); silver color, epoxy resin coated
- **Mounting bracket assembly:** Stainless steel 304

Applicable pipe: 1 1/2" min.; 2" max.

Isolation: Input to output to outdoor enclosure

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

Damping 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

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)

Dimensions: See External Dimensions.

Weight: Approx. 1.3 kg (2.9 lbs), aluminum

Approx. 4.0 kg (8.8 lbs), stainless steel

Approx. 2.0 kg (4.4 lbs), TIIS flameproof

PERFORMANCE

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

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

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

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: $\pm 0.003\% \times [\text{Output Span}] / 1\text{V}$

Insulation resistance: $\geq 100\text{M}\Omega$ with 500V DC
(input to output)

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

STANDARDS & APPROVAL

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

EEx ia EN50020

EEx d EN50018

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 II, Div. 1, Groups E, F and G

Class III, Div. 1

Class I, Zone 0, AEx ia IIC

T4, T5 and T6

(Class 3610)

FM: Explosion-proof and

Dust-ignition proof

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

Class II, Div. 1, Groups E, F and G

Class III, Div. 1

T6

(Class 3615)

FM: Nonincendive

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

Class II, Div. 2, Groups F and G

Class III, Div. 1

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)

CENELEC: Flameproof (ATEX)

⊕ II 2G, EEx d IIC; T4, T5 and T6

(EN50018 - 2000)

TIIS: Intrinsically safe

Ex ia IIC T5

TIIS: Flameproof

Ex d IIC T5

SAFETY PARAMETERS

Operating temperature for CENELEC (ATEX) / FM:

T4 -40 to $+80^{\circ}\text{C}$

T5 -40 to $+65^{\circ}\text{C}$

T6 -40 to $+50^{\circ}\text{C}$

(-40 to $+80^{\circ}\text{C}$ for FM explosion-proof)

Operating temperature for TIIS:

T5 -20 to $+60^{\circ}\text{C}$

Ex-data: U_i (Vmax) 30V DC U_o (Voc) 6.4V DC

I_i (Imax) 96mA DC I_o (Isc) 30mA DC

P_i (Pmax) 0.72W P_o 48mW

C_i 0 μF^{***} C_o (Ca) 20 μF

L_i 0 mH *** L_o (La) 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

= A/D Conversion Error + 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): 40 μV

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

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

2) 0 – 4mV

Absolute value accuracy (Table 1): 10 μV

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

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

•**Thermocouple**

- 1) K thermocouple, 0 – 1000°C
 Absolute value accuracy (Table 1): 0.25°C
 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 & ACCURACY **TABLE 1**

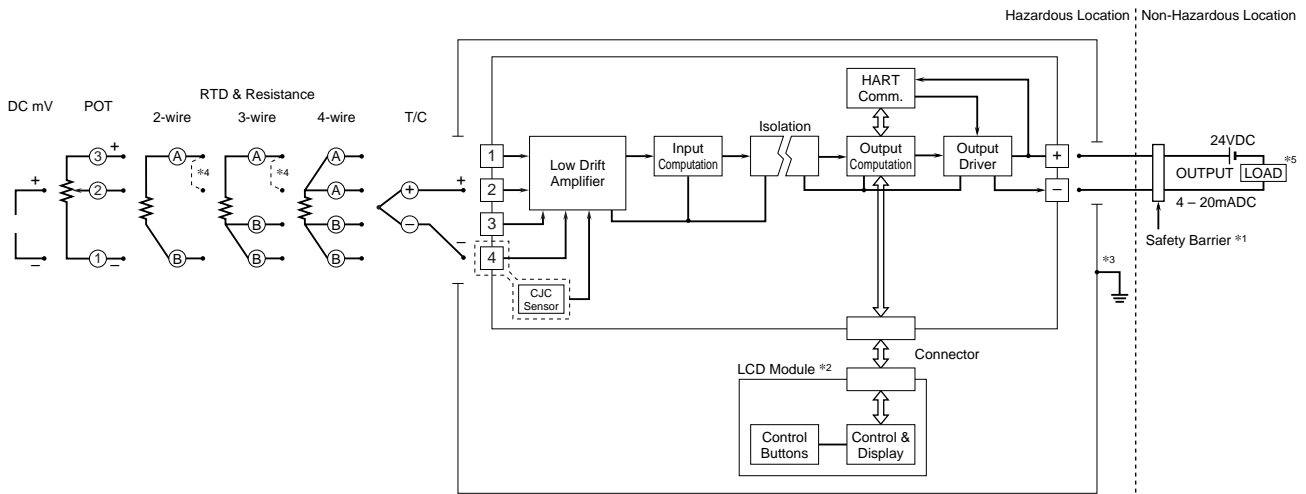
INPUT TYPE	MIN. SPAN	MAXIMUM RANGE	ACCURACY					
DC mV & V	4mV	-50 to +1000mV	±0.1% or ±10μV, whichever is greater (F.S. input ≤50mV) ±0.1% or ±40μV, whichever is greater (F.S. input ≤200mV) ±0.1% or ±60μV, whichever is greater (F.S. input ≤500mV) ±0.1% or ±80μV, whichever is greater (F.S. input >500mV)					
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.

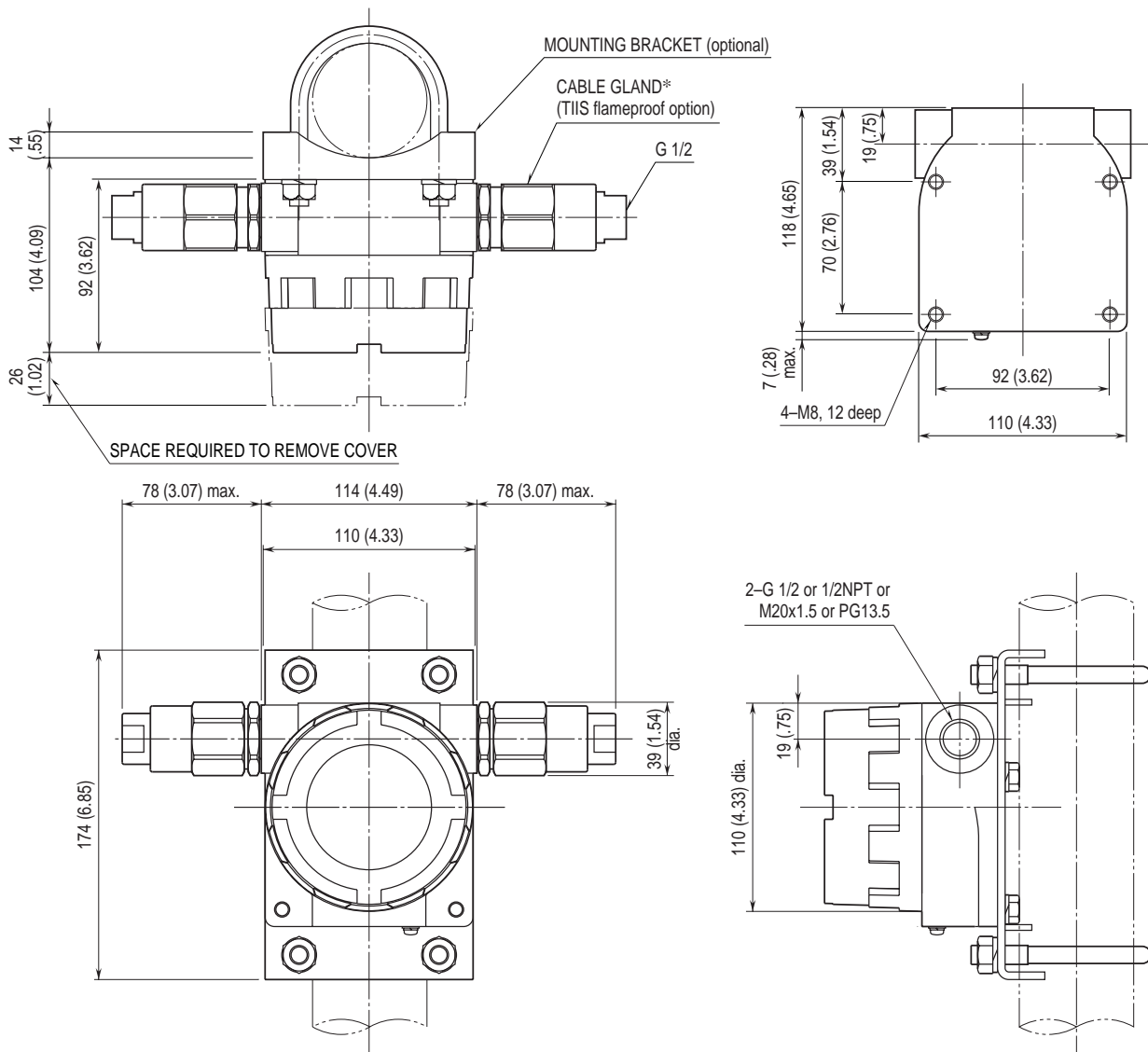
(For 2- or 3-wire RTD, the value is valid by the sensor calibration after the wiring is done.)

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. Be sure to earth the unit's enclosure to meet the intrinsic safe or explosion-proof (flameproof) requirements.
- *4. Close across the terminals 1 & 2 for a resistance or RTD input.
- *5. Limited to 250 – 1100Ω for HART communication.

EXTERNAL DIMENSIONS & MOUNTING REQUIREMENTS mm (inch)



*Two sets of cable gland are attached with TIIS flameproof option.