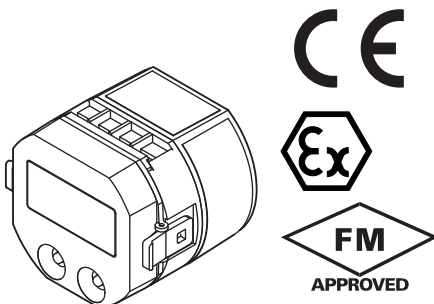


Field-mounted Two-wire Signal Conditioners B6-UNIT SERIES

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



MODEL: B6U-[1][2]

ORDERING INFORMATION

- Code number: B6U-[1][2]

Specify a code from below for each of [1] and [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: IECEx/ATEX intrinsic safety
- 5: FM nonincendive
- 7: TIIS intrinsic safety (CE not available)

[2] LCD DISPLAY

- 0: Without
- 1: With

RELATED PRODUCTS

- Outdoor enclosure (model: 6BX-E)
 - USB interface Bell202 modem (model: COP-HU)
- Usable in 'non-hazardous' area only.
- Hand-held communicator
 - AMS (version 6.0 or higher)
 - PC configurator software (model: B6UCFG)
- Downloadable at M-System's web site.
- LCD display (model: B6U-LCD) (non safety approval)

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, Potentiometer & Resistance): 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_{p-p} 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:

- Setting and display of input signals, engineering units and the transmitter operating status, etc.
- Removable while the module is powered.

Display size: 36 × 20 mm (1.42" × 0.79")

Characters

Color: Black

Format:

- 2 rows of 5 alphanumeric characters:

Top row: 7.4 mm high;

Bottom row: 6.5 mm high,

- Status indicators and engineering units

For detail of the LCD panel indication, refer to the instruction manual.

Display range: -99999 to 99999

Decimal point: In top row

Read rate: 150 msec.

Back light: None

INPUT SPECIFICATIONS

The input type is factory-set to K thermocouple, and the input range to 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

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:

- Non-safety-approved unit: -40 to +85°C (-40 to +185°F)
- Safety-approved unit: See Safety Parameters for use in a hazardous location.

· LCD display (full visibility): -30 to +80°C (-22 to +176°F)

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

Weight: 150 g (0.33 lb) including the LCD

PERFORMANCE

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

Cold junction compensation error: ±0.5°C (±0.9°F)

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)

Safety integrity level: Suitable for use in a safety instrumented system up to SIL1 or SIL2 if appropriate safety instructions are observed. Consult M-System.

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

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

⇒ Overall accuracy = ±0.1% of span

2) 0 - 4 mV

Absolute value accuracy (Table 1): 10 μV

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

⇒ 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: $1 + 0.5 = 1.5^\circ\text{C}$
 $1.5^\circ\text{C} \div 1000^\circ\text{C} \times 100 = 0.15\%$
 ➤ 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: $0.25 + 0.5 = 0.75^\circ\text{C}$
 $0.75^\circ\text{C} \div (150 - 50)^\circ\text{C} \times 100 = 0.75\%$
 ➤ 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
 $0.15^\circ\text{C} \div (800 - -200)^\circ\text{C} \times 100 = 0.015\% < 0.1\%$
 ➤ Overall accuracy = $\pm 0.1\%$ of span
- 2) Pt 100, 0 - 100°C
 Absolute value accuracy (Table 1): 0.15°C
 $0.15^\circ\text{C} \div 100^\circ\text{C} \times 100 = 0.15\% > 0.1\%$
 ➤ Overall accuracy = $\pm 0.15\%$ of span

- ATEX Intrinsic safety
 Ⓢ II 1G, Ex ia IIC, T4, T5 and T6 Ga
 (EN 60079-0)
 (EN 60079-11)
- Functional safety
 (IEC 61508-1)
 (IEC 61508-2)
 (IEC 61511-1)

SAFETY PARAMETERS

Operating temperature

For IECEx, ATEX and FM:

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

For TIIS:

- T5: -20 to +60°C

Ex-data:

- Output circuit
 - Ui (Vmax): 30 V
 - Ii (Imax): 96 mA
 - 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 (TIIS Intrinsic Safety: 6.0 V)
 - Io (Isc): 30 mA
 - Po: 48 mW
 - Co (Ca): 20 µF
 - Lo (La): 10 mH

STANDARDS & APPROVALS

Refer to the manuals to comply with the standards.

EU conformity:

- ATEX Directive
 - Ex ia EN 60079-11
- EMC Directive
 - EMI EN 61000-6-4
 - EMS EN 61000-6-2
- RoHS Directive

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 3600)
 - (Class 3610)
 - (ANSI/ISA 60079-0)
 - (ANSI/ISA 60079-11)
- FM: Nonincendive
 - Class I, Division 2, Groups A, B, C, and D
 - Class I, Zone 2, Group IIC
 - T4, T5 and T6
 - (Class 3600)
 - (Class 3611)
- IECEx intrinsic safety
 - Ex ia IIC T4, T5 and T6 Ga
 - (IEC 60079-0)
 - (IEC 60079-11)
- TIIS: Intrinsic safety
 - Ex ia IIC T5 X

INPUT TYPE, RANGE & ACCURACY

INPUT TYPE, RANGE & ACCURACY

Table 1

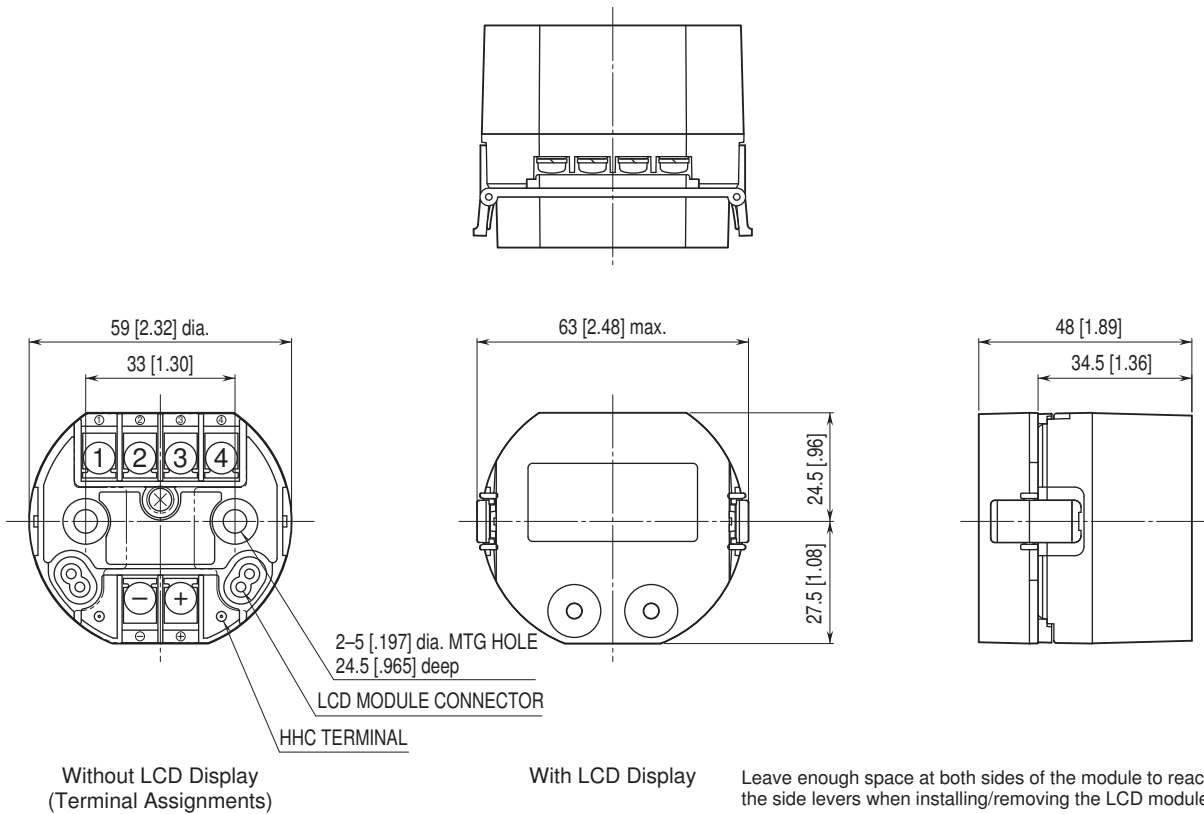
INPUT TYPE	MIN. SPAN	MAXIMUM RANGE		ACCURACY				
DC mV & V	4 mV	-50 to +1000 mV		±0.1 % or ±10μV, whichever is greater (F.S. input 50 mV) ±0.1 % or ±40μV, whichever is greater (F.S. input 200 mV) ±0.1 % or ±60μV, whichever is greater (F.S. input 500 mV) ±0.1 % or ±80μV, whichever is greater (F.S. input >500 mV)				
Potentiometer	2%	Total resistance 80 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	°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

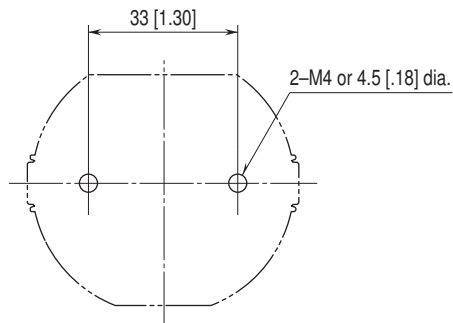
*2. Or ±0.1% of span, whichever is greater.

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

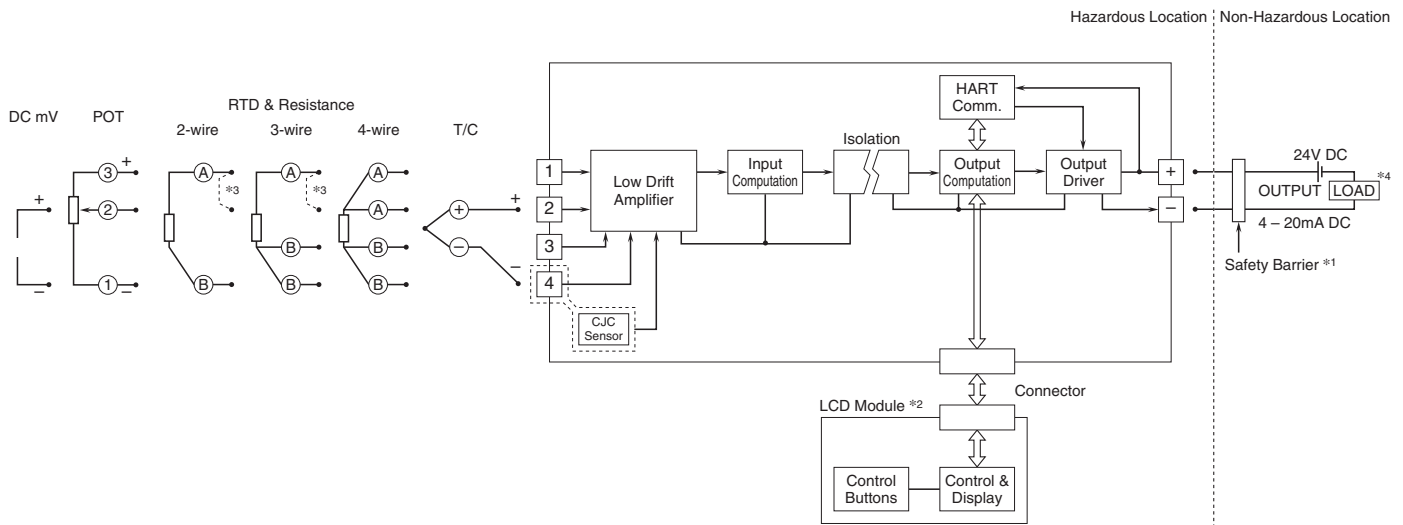
EXTERNAL DIMENSIONS & TERMINAL ASSIGNMENTS unit: mm [inch]



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.