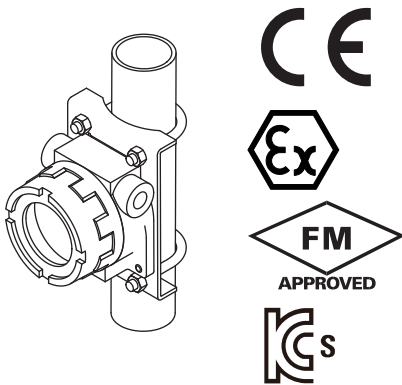


Field-mounted Two-wire Signal Conditioners B6-UNIT

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

Functions & Features

- Universal input: mV, V, T/C, RTD, resistance and potentiometer
- High accuracy
- HART communication
- Intrinsically safe and explosion-proof approval
- 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



MODEL: B6U-B-[1][2][3][4][5]

ORDERING INFORMATION

Specify code number: B6U-B-[1][2][3][4][5]

Specify a code from below for each [1] through [5].
(e.g. B6U-B-4121).

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.

[1] SAFETY APPROVAL

- 0: None
- 1: FM intrinsically safe
- 2: IECEx/ATEX intrinsic safety
- 3: FM explosion-proof
- 4: IECEx/ATEX flameproof
- 5: FM nonincendive
- 7: TIIS intrinsic safety (CE not available)

8: TIIS flameproof (CE not available)

Confirm selectable combinations of approval and wiring conduit types in the table.

[2] LCD DISPLAY

0: Without

1: With

[3] WIRING CONDUIT

0: G 1/2

1: 1/2 NPT

2: M20 × 1.5

3: PG 13.5

Confirm selectable combinations of approval and wiring conduit types in the table.

[4] MOUNTING BRACKET

0: Without

1: With

[5] OPTIONS

Enclosure Materials

Blank: Diecast aluminium enclosure

/S: Stainless steel enclosure

(TIIS flameproof 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

RELATED PRODUCTS

- 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.
- Cable gland (model: BX-E-SXY)

PACKAGE INCLUDES...

- **Cable gland:** Two provided for TIS 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.
- **Mounting bracket assembly (option):**
Stainless steel 304
Applicable pipe: 1 1/2" min.; 2" max.
Mounting screws (4)

GENERAL SPECIFICATIONS

- Degree of protection:** NEMA 4X, IP66/IP67
Wiring conduit: See 'Ordering information.'
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
- Isolation:** Input to output to outdoor enclosure
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:

- 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: In top row

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 (-40 to 185°F)

Electronics

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

-30 to +80°C (-22 to 185°F) Display (full visibility)

Weight:

- Unit
 - Approx. 1.3 kg (2.9 lb), aluminium
 - Approx. 4.0 kg (8.8 lb), stainless steel
 - Approx. 2.0 kg (4.4 lb), TIIS flameproof
- Mounting bracket assembly (option)
 - Approx. 0.78 kg (1.72 lb)

PERFORMANCE

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

Cold junction compensation error: ±0.5°C or ±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 to outdoor enclosure)

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°C

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

⇒ Overall accuracy including CJC error = ±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

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

⇒ Overall accuracy including CJC error = ±0.75 % of span

• RTD

1) Pt 100, -200 - 800°C

Absolute value accuracy (Table 1): 0.15°C

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

⇒ Overall accuracy = ±0.1 % of span

2) Pt 100, 0 - 100°C

Absolute value accuracy (Table 1): 0.15°C

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

⇒ Overall accuracy = ±0.15 % of span

STANDARDS & APPROVALS

EU conformity:

ATEX Directive

Ex ia EN 60079-11 (for ATEX intrinsic safety)

Ex d EN 60079-1 (for ATEX flameproof)

EMC Directive

EMI EN 61000-6-4

EMS EN 61000-6-2

RoHS Directive

EN 50581

Safety approval:

FM: Intrinsically safe

Class I, Division 1, Groups A, B, C and D

Class II, Division 1, Groups E, F and G

Class III, Division 1

Class I, Zone 0, AEx ia IIC

T4, T5 and T6

(Class 3600)

(Class 3610)

(ANSI/ISA 60079-0)

(ANSI/ISA 60079-11)

FM: Explosion-proof and Dust-ignition proof

Class I, Division 1, Groups B, C and D
Class II, Division 1, Groups E, F and G
Class III, Division 1
T6
(Class 3600)
(Class 3615)

FM: Nonincendive

Class I, Division 2, Groups A, B, C, and D
Class II, Division 2, Groups F and G
Class III, Division 1
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)

IECEX flameproof

EX d IIC; T4, T5 and T6 Gb
(IEC 60079-0)
(IEC 60079-1)

KOSHA: flameproof (Occupational Safety and Health Act)

Ex d IIC T6
(Only available for Model: B6U-B-41****)

TIIS: Intrinsic safety

Ex ia IIC T5 X

TIIS: Flameproof

Ex d IIC T5

CENELEC: Intrinsic safety (ATEX)

⊕ II 1G, Ex ia IIC; T4, T5, Ga
(EN 60079-0)
(EN 60079-11)

CENELEC: Flameproof (ATEX)

⊕ II 2G, Ex d IIC, T4, T5 and T6, Gb
(EN 60079-0)
(EN 60079-1)

Functional safety

(IEC 61508-1)
(IEC 61508-2)
(IEC 61511-1)

• 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

SAFETY PARAMETERS

Operating temperature**For IECEx, ATEX and FM:**

T4: -40 to +80°C
T5: -40 to +65°C
T6: -40 to +50°C (-40 to +80°C for FM explosion-proof)

For TIIS:

T5: -20 to +60°C

Ex-data:

INPUT TYPE, RANGE & ACCURACY

■ INPUT TYPE, RANGE & ACCURACY

Table 1

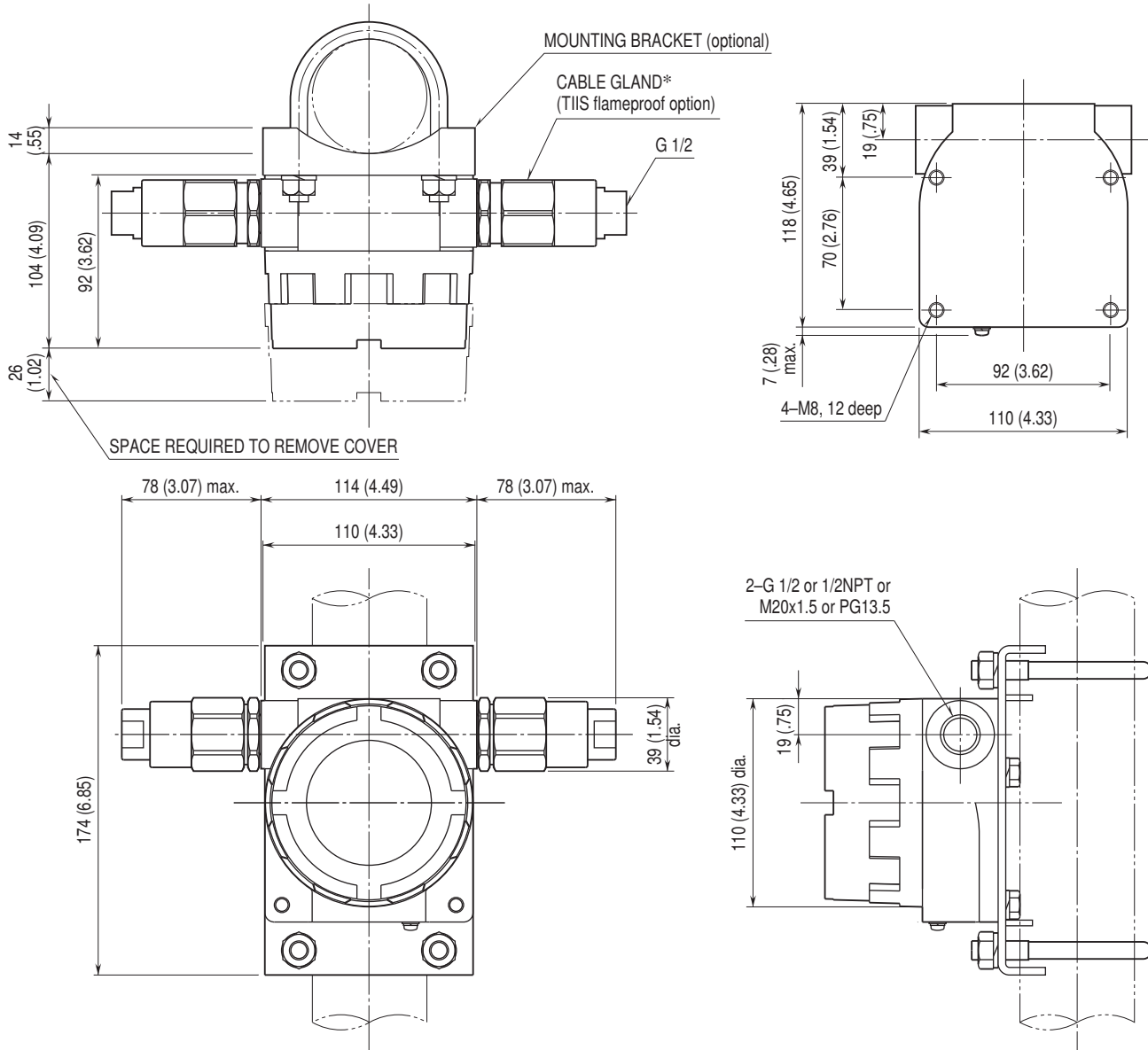
INPUT TYPE	MIN. SPAN	MAXIMUM RANGE		ACCURACY				
DC mV & V	4 mV	-50 to +1000 mV		±0.1 % or ±10μV, whichever is greater (F.S. input 50 mV) ±0.1 % or ±40μV, whichever is greater (F.S. input 200 mV) ±0.1 % or ±60μV, whichever is greater (F.S. input 500 mV) ±0.1 % or ±80μV, whichever is greater (F.S. input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

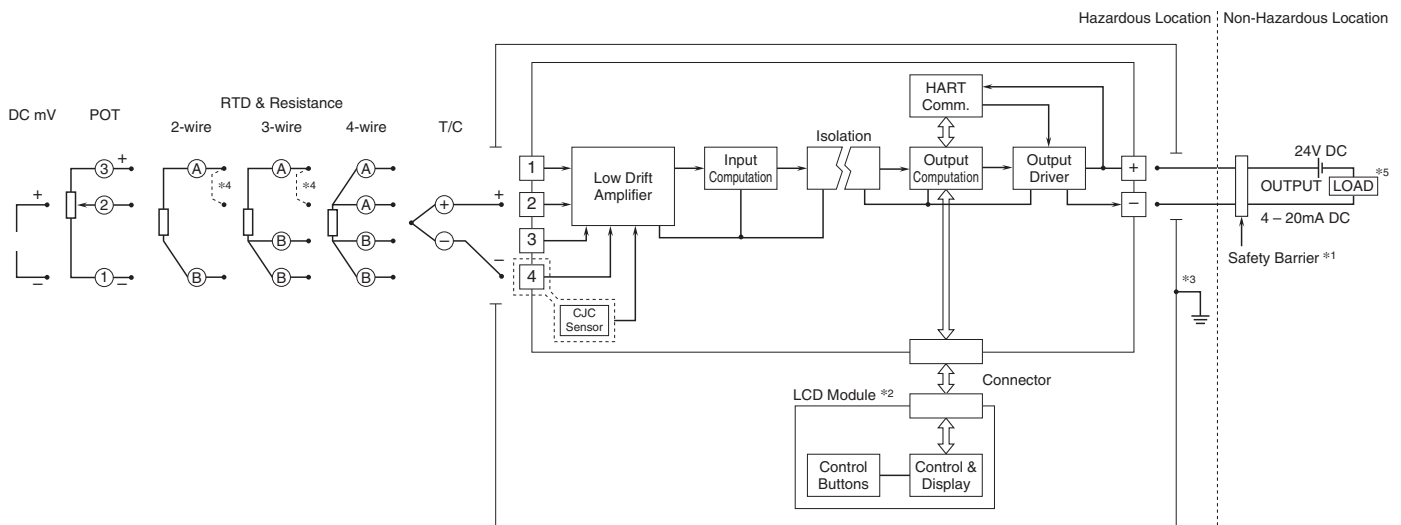
(For 2- or 3-wire resistance or RTD, the value is valid by the sensor calibration after the wiring is done.)

EXTERNAL DIMENSIONS unit: mm (inch)



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

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 intrinsically 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.



Specifications are subject to change without notice.