THERMOCOUPLE TRANSMITTER
(field-configurable, non-linearization)

MODEL **6BTS1**

BEFORE USE ....

Thank you for choosing us. Before use, please check contents of the package you received as outlined below.
If you have any problems or questions with the product, please contact our sales office or representatives.

■ PACKAGE INCLUDES:

Transmitter module (body + CJC sensor)..........................(1)
Outdoor enclosure ....(1)
Mounting screws
  Bolt (M8 × 15)..(4)
  Spring washer for M8 ....(4)
Mounting bracket assembly (optional)
  Mounting bracket...(1)
  M10 U-bolt...(2)
  Nut for M10 ....(4)
  Spring washer for M10 ....(4)

■ MODEL NO.

Confirm Model No. marking on the product to be exactly what you ordered.

■ INSTRUCTION MANUAL

This manual describes necessary points of caution when you use this product, including installation, connection and basic maintenance procedures.

POINTS OF CAUTION

■ GENERAL PRECAUTIONS

• Before you remove the unit or mount it, turn off the power supply and input signal for safety.

■ ENVIRONMENT

• Do not install the unit where it is subjected to continuous vibration. Do not subject the unit to physical impact.
• Environmental temperature must be within -5 to +70°C (23 to 158°F) with relative humidity within 30 to 90% RH in order to ensure adequate life span and operation.

■ WIRING

• Do not install cables close to noise sources (relay drive cable, high frequency line, etc.).
• Do not bind these cables together with those in which noises are present. Do not install them in the same duct.

■ AND ....

• The unit is designed to function as soon as power is supplied, however, a warm up for 10 minutes is required for satisfying complete performance described in the data sheet.

COMPONENT IDENTIFICATION

• Case Details

Cable Entry Conduit

Internal Earthing Screw

External Earthing Screw

Specifications

Case

Gasket

Transmitter Module

Cover

Spring Clip(s)

Knurled Knob(s)
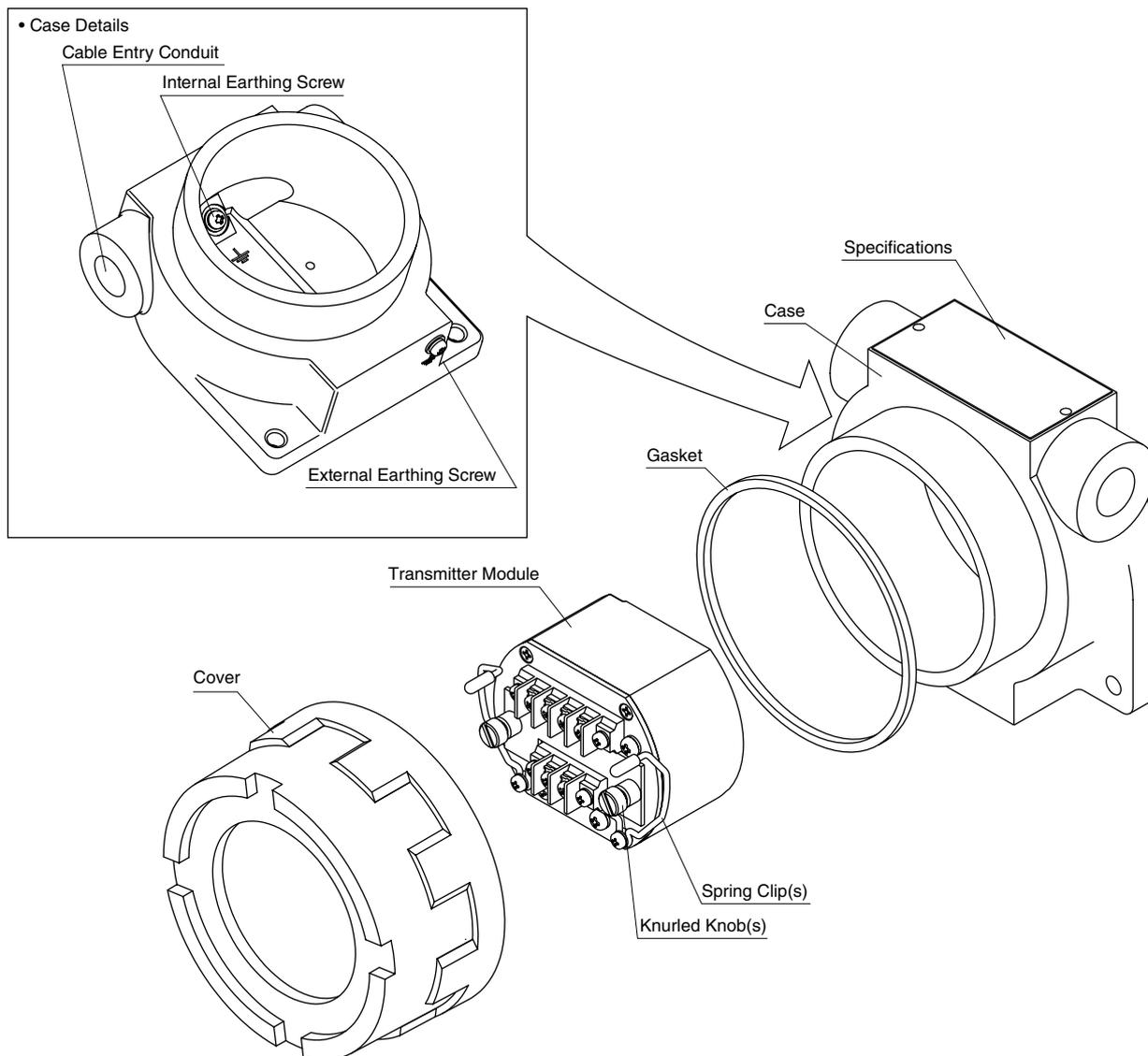
EXTERNAL DIMENSIONS unit: mm (inch)

MOUNTING BRACKET
(optional)

14 (.55)

92 (3.62)

104 (4.09)

26 (1.02)

SPACE REQUIRED TO REMOVE COVER

118 (4.65)

39 (1.54)

19 (.75)

70 (2.76)

7 (.28) max.

4–M8, 12 deep

92 (3.62)

110 (4.33)

114 (4.49)

110 (4.33)

174 (6.85)

2–G 1/2, 1/2NPT, M20x1.5 or PG13.5

19 (.75)

110 (4.33) dia.
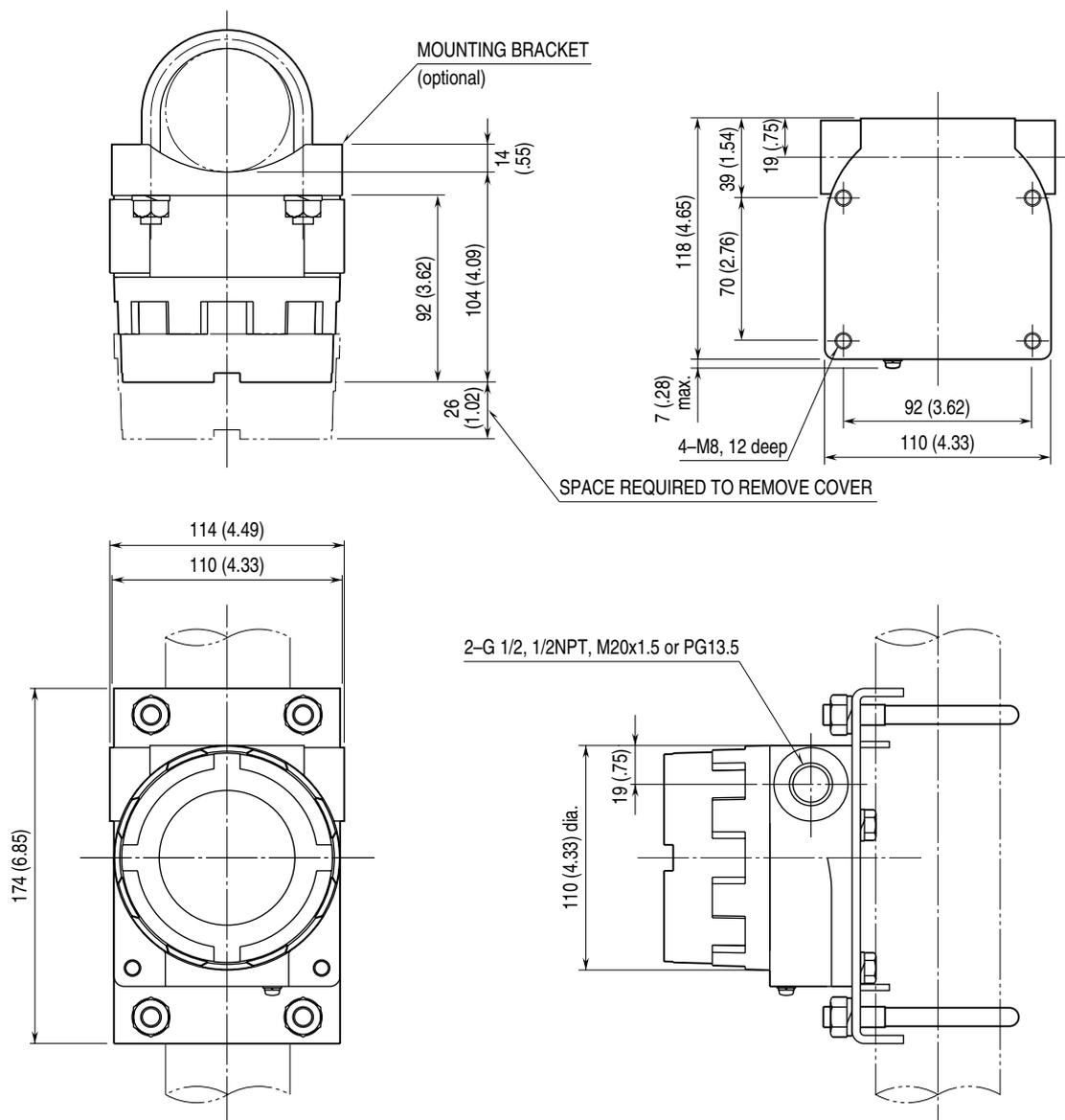
INSTALLATION

■ **MOUNTING THE ENCLOSURE ON A PIPE**
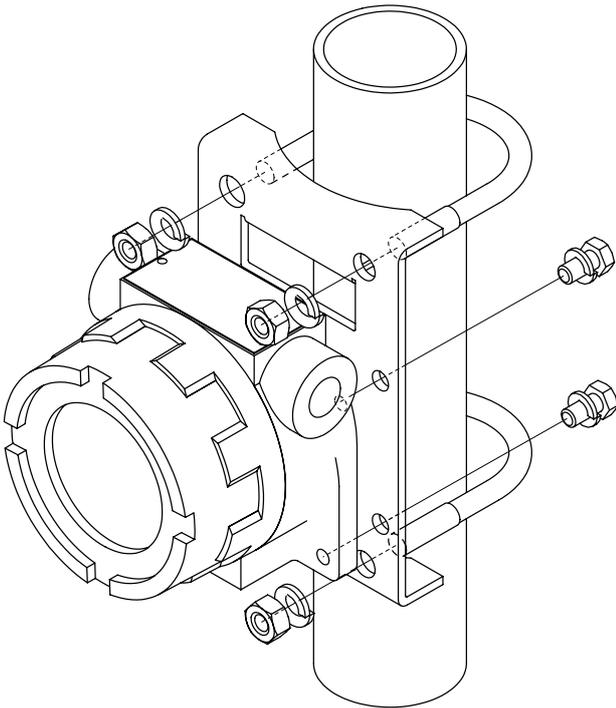
■ **MOUNTING THE ENCLOSURE ON A WALL**
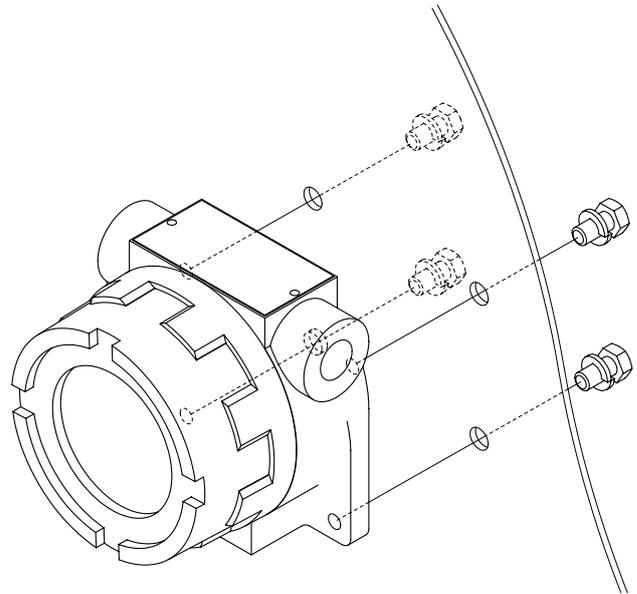
TERMINAL CONNECTIONS

Connect the unit as in the diagram below.

Attach the CJC sensor together with input wiring to the input terminals. The CJC sensor is not interchangeable. Check that its serial number is identical to that of the unit.
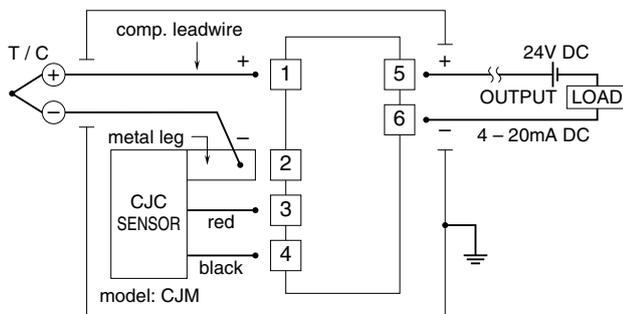
WIRING INSTRUCTIONS

■ **SCREW TERMINAL**

Torque: 0.6 N·m

CHECKING

Open the unit's outdoor enclosure cover when you conduct checking of the transmitter. Be sure to close the cover after the checking is complete.

1) Terminal wiring: Check that all cables are correctly connected according to the connection diagram.

2) Input: Check that the input voltage is within 0 – 100% of full-scale.

   If the thermocouple or its extension wires are broken, the output goes over 100% (below 0% with downscale) due to burnout function. Check leadwires in such a case.

3) Output: Check that the load is within the permissible limit including wiring resistance.

$$\text{Load Resistance } (\Omega) = \frac{\text{Supply Voltage (V)} - 13 \text{ (V)}}{0.02 \text{ (A)}}$$

(including leadwire resistance)

ADJUSTMENT PROCEDURE

This unit is calibrated at the factory to meet the ordered specifications, therefore you usually do not need any calibration.

For matching the signal to a receiving instrument or in case of regular calibration, adjust the output as explained in the following.

■ PREPARATION

1) Open the outdoor enclosure cover.

2) Release knurled knobs (A) at the front of the transmitter and open the top cover.

3) Remove three screws (B), four screws (C), two spring clips and take out the circuit boards from the housing.

4) After the calibration is complete, refit the spring clips, screws and close the covers by performing the above procedure in the reverse order.
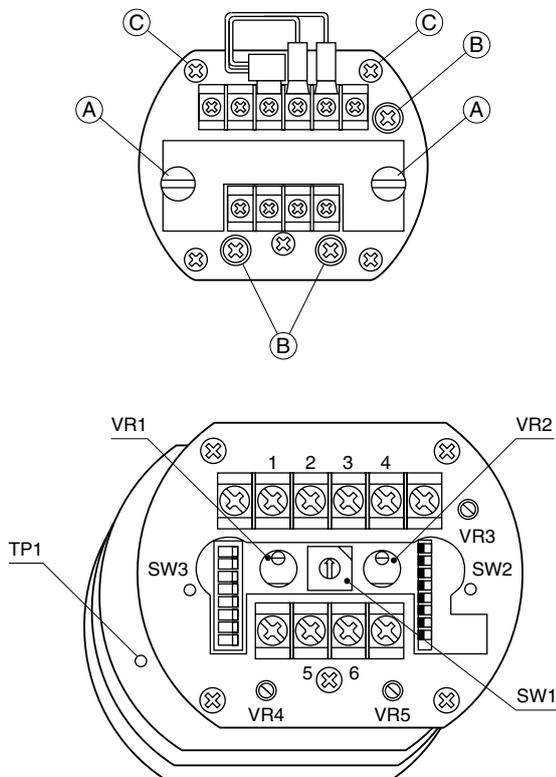
SW1 : CJC Selector
SW2 : Zero Bias Selector
SW3 : Span Gain Selector
VR1 : 0% Adjustment (fine)
VR2 : 100% Adjustment (fine)
VR5 : 0% Adjustment (coarse)
VR4 : 100% Adjustment (coarse)
VR3 : CJC Sensor Adjustment

■ THERMOCOUPLE TYPE SELECTION

1) Adjust SW1 (rotary code switch) to an appropriate position for customer's thermocouple type. Positions are shown in the illustration below.
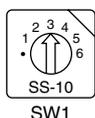
1 : PR, R, S thermocouples
2 : K (CA) thermocouple
3 : E (CRC) thermocouple
4 : J (IC) thermocouple
5 : T (CC) thermocouple
6 : B thermocouple

■ INPUT BIAS ADJUSTMENT (0% temperature)

Check first electromotive force (mV) for 0% (and 100%) temperature in Thermocouple Reference Table.

1) Close across the front terminal 2 – 3 and remove temperature sensor connected to voltage generator as in the above illustration. (Canceling cold junction compensation)

2) Connect a digital voltmeter across the front terminal 2 (–) and TP1 (+).

3) With minimum (0%) input, adjust SW2 to appropriate positions – nearest to desired value – according to Table 1 [INPUT BIAS SELECTION TABLE], and adjust output reading to 0 ±0.002V with VR5 (zero-coarse adjustment).

4) With minimum (0%) input, adjust output to 0 ±0.05% with VR1 (zero-fine adjustment).

■ INPUT RANGE ADJUSTMENT (100% temperature)

5) With maximum (100%) input, adjust SW3 to appropriate positions according to Table 2 [INPUT RANGE SELECTION TABLE], and adjust output to 100 ±0.05% with VR4 (span-coarse adjustment) and VR2 (span-fine adjustment).

6) With minimum (0%) input, check that input is 0 ±0.05%. When the ZERO point is changed, repeat the procedure 2) to 5).

■ COLD JUNCTION COMPENSATION ADJUSTMENT

7) Connect temperature sensor to the voltage generator again and remove shortcircuit across the terminal 2 – 3.

8) With minimum (0%) input, adjust output reading to 0% with VR3.

■ OUTPUT ZERO & SPAN ADJUSTMENT

1) ZERO: Apply 0% input and adjust output to 0% with the VR1.

2) SPAN: Apply 100% input and adjust output to 100% with the VR2.

3) Check ZERO adjustment again with 0% input.

4) When ZERO value is changed, repeat the above procedure 1) – 3).

MAINTENANCE

Regular calibration procedure is explained below:

■ CALIBRATION

Warm up the unit for at least 10 minutes. Apply 0%, 25%, 50%, 75% and 100% input signal. Check that the output signal for the respective input signal remains within accuracy described in the data sheet. When the output is out of tolerance, recalibrate the unit according to the "ADJUSTMENT PROCEDURE" explained earlier.

LIGHTNING SURGE PROTECTION

We offer a series of lightning surge protector for protection against induced lightning surges. Please contact us to choose appropriate models.

TABLES

■ INPUT BIAS SELECTION TABLE
[TABLE 1]

SW2								WEIGHT OF BIT
1	2	3	4	5	6	7	8	
1	1	0	0	0	0	0	0	+76 mV
1	0	1	0	0	0	0	0	+38 mV
1	0	0	1	0	0	0	0	+19 mV
1	0	0	0	1	0	0	0	+10 mV
1	0	0	0	0	1	0	0	+ 5 mV
1	0	0	0	0	0	1	0	+ 2.5mV
1	0	0	0	0	0	0	1	+ 1.2mV
1	0	0	0	0	0	0	0	+ 0 mV
0	1	1	1	1	1	1	1	− 1.5mV
0	1	1	1	1	1	1	0	− 2.5mV
0	1	1	1	1	1	0	1	− 3.5mV
0	1	1	1	1	0	1	1	− 6 mV
0	1	1	1	0	1	1	1	−11 mV
0	1	1	0	1	1	1	1	−20 mV
0	1	0	1	1	1	1	1	−39 mV
0	0	1	1	1	1	1	1	−76 mV

Note 1: The SW2-1 is turned ON (1) with suppressed zero range, while it is turned OFF (0) with elevated zero range.

Note 2: With suppressed zero range, weight of bit (mV) is added by turning ON (1) each one of the SW2-8 to SW2-2, while with elevated zero range, it is added by turning OFF (0) the same.
For example, 20mV bias (zero suppression) is nearly obtained by turning on SW2-1 (positive), SW2-4 and SW2-8 (19mV + 1.2mV = 20.2mV).

Note 3: When the test pin reads a positive voltage, turning one bit ON (1) decreases the bias.
When the test pin reads a negative voltage, turning one bit OFF (0) increases the bias.

■ INPUT RANGE SELECTION TABLE
[TABLE 2]

SW3								GAIN	SPAN [mV] 100%IN – 0%IN
1	2	3	4	5	6	7	8		
1	1	1	1	1	1	1	1	1 – 2	50 – 100
1	1	1	1	1	1	1	0	2 – 3	33 – 50
1	1	1	1	1	1	0	1	3 – 4	25 – 33
1	1	1	1	1	1	0	0	4 – 5	20 – 25
1	1	1	1	1	0	1	1	5 – 6	16.7 – 20.0
1	1	1	1	1	0	1	0	6 – 7	14.3 – 16.7
1	1	1	1	1	0	0	1	7 – 8	12.5 – 14.3
1	1	1	1	1	0	0	0	8 – 9	11.1 – 12.5
1	1	1	1	0	1	1	1	9 – 10	10.0 – 11.1
1	1	1	1	0	1	1	0	10 – 11	9.0 – 10.0
1	1	1	0	1	1	1	1	11 – 12	8.3 – 9.0
1	1	1	0	1	1	1	0	12 – 13	7.7 – 8.3
1	1	1	0	1	1	0	1	13 – 14	7.3 – 7.7
1	1	1	0	1	1	0	0	14 – 15	6.7 – 7.3
1	1	1	0	1	0	1	1	15 – 16	6.3 – 6.7
1	1	1	0	1	0	1	0	16 – 17	5.9 – 6.3
1	1	1	0	1	0	0	1	17 – 18	5.6 – 5.9
1	1	1	0	1	0	0	0	18 – 19	5.3 – 5.6
1	1	1	0	0	1	1	1	19 – 20	5.0 – 5.3
1	1	1	0	0	1	1	0	20 – 21	4.8 – 5.0
1	1	0	1	1	1	1	1	21 – 22	4.5 – 4.8
1	1	0	1	1	1	1	0	22 – 23	4.3 – 4.5
1	1	0	1	1	1	0	1	23 – 24	4.2 – 4.3
1	1	0	1	1	1	0	0	24 – 25	4.0 – 4.2
1	1	0	1	1	0	1	1	25 – 26	3.8 – 4.0
1	1	0	1	1	0	1	0	26 – 27	3.7 – 3.8
1	1	0	1	1	0	0	1	27 – 28	3.5 – 3.7
1	1	0	1	1	0	0	0	28 – 29	3.4 – 3.5
1	1	0	1	0	1	1	1	29 – 30	3.3 – 3.4
1	1	0	1	0	1	1	0	30 – 31	3.2 – 3.3
1	1	0	0	1	1	1	1	31 – 32	3.1 – 3.2
1	1	0	0	1	1	1	0	32 – 33	3.0 – 3.1

Note 1: Gain indicates the multiplying factor adjustable with SW3.

Note 2: Gain is calculated by using the following equation:

$$\text{Gain} = \frac{2000 \ (mV)}{20 \ (V100\% - V0\%)}$$

Where   V100% = input span
V0% = input zero

Add an weight of bits according to the gain value.
For example, with 0 – 4.2mV input, the calculated gain, 23.8, is rounded to either 23 or 24.
Then turn off (0) SW3-3 and SW3-7.
Alternately, turn off (0) SW3-3, SW3-7 and SW3-8.