BS-15CT Strain Transducer INSTRUCTION MANUAL

Thank you for purchasing the KYOWA product. Before using it, please read this instruction manual carefully. Also, keep the manual within easy reach so that you can refer to it whenever necessary.

1. Accessories

1.1 Calibration sheet
1.2 Instruction manual
1.3 M6 Hexagonal lever

2. Mounting

There are different methods to mount the transducer. Let us explain here three typical ones. They are, namely:

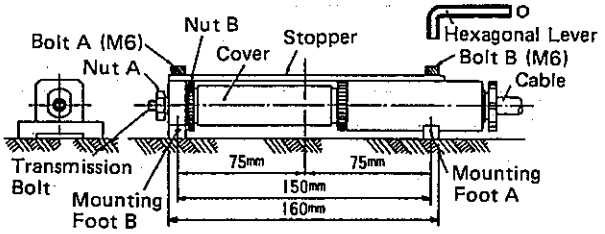
(1) Direct welding
(2) Indirect welding
(3) Bolting

2.1 Direct welding

Directly welded onto a steel pipe or sheet pile in the axial direction, the transducer performs stable measurement even after being given an impact caused by striking the pipe or pile into the ground.

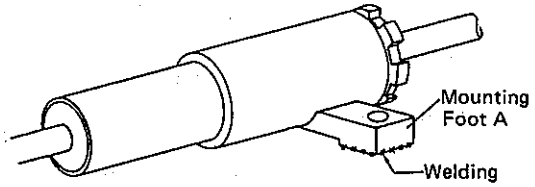
2.1.1 Mounting procedure

(1) First, scribe guide lines whose interval is 150mm so that the distance from the center of Mounting Foot A to that of Mounting Foot B will be 150mm.



If it is difficult to observe the center-to-center distance, you may observe the distance between the outer sides of the respective mounts. In this case, the interval of guidelines should be 160mm.

(2) Place the Mounting Foot A at the guide line and weld it to a structure. The transducer is so designed that the mainframe is hardly affected by welding heat. But, welding should be made as quickly as possible to avoid unwanted thermal effect.



(3) Next, using the hexagonal lever, loosen Bolts A and B which fix the stopper, and remove the stopper. At this time, take care to leave Bolt A at Mounting Foot B and not to take it away. While taking care that the transmission bolt does not turn, loosen Nuts A and B, and set Mounting Foot B in place meeting the guideline.

Loosen Nuts A and B thoroughly so that the transducer main frame will be free from the effect of deformation inducible to welding. After this, weld Mounting Foot B in place meeting the guide line.

(4) After the welding heat cools down, perform initial balancing. (For how to, see Item 3.)

2.1.2 Precautions

(1) Welding should be done as quickly as possible to prevent high heating effect.
(2) If the mounting surface of a structure is curved, file Mounting Feet in advance to match the surface, in order to ensure firm mounting.
(3) The transducer is so designed that it well accepts an impact applied in the axial direction. But, it is weakest against an impact applied in right angles to the axial direction. Take care to avoid such impacts as above.

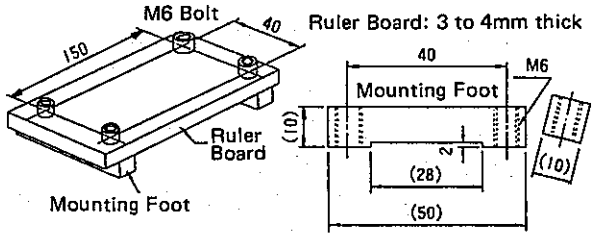
2.2 Indirect welding

This method is used where the transducer cannot be directly welded onto a structure (for example, a structure whose all parts need to be preheated for welding). With this method, mounting feet alone are welded in advance, and the transducer is mounted later after finish of welding. This method is advantageous in that the transducer can be free from direct heat of welding.

The mounting method using bolts, the third method we will introduce, is suitable for such structures as unable to accept drilling. This method should however be avoided where the transducer may be subjected to impacts.

2.2.1 Mounting procedure

(1) Prepare a ruler board and mounting feet as illustrated in the sketch below.



(2) Weld Mounting Feet, which are bolted to the ruler board, to a structure.
(3) After welding, remove the bolts and ruler board.
(4) Using screws, fasten the transducer's Mounting Foot A and B to the welded mounting feet. At this time, be sure remove the transducer's stopper in advance.
(5) Perform initial balancing using Nut A and B. (For how to, see Item 3.)

2.2.2 Precautions

If bolts are tightened while the screw threads of the welded mounting feet do not meet with those of the transducer's Mounting Feet, the transducer will be subjected to bending force to cause hysteresis. Take care to avoid harm.

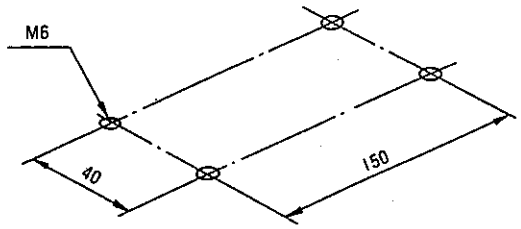
2.3 Bolting procedure

With this method, screw holes are made directly on a structure, and the transducer is fixed there using bolts. The method features simple mounting, but it should not be used on a structure which may be subjected to impacts.

2.3.1 How to mount

(1) Make screw holes as illustrated in the sketch below.

(2) Mount the transducer, using the screw holes.



How to mount is same as the preceding item. Be sure to use M6 hexagon socket head cap screws (steel). (For initial balancing, see Item 3.)

2.3.2 Precautions

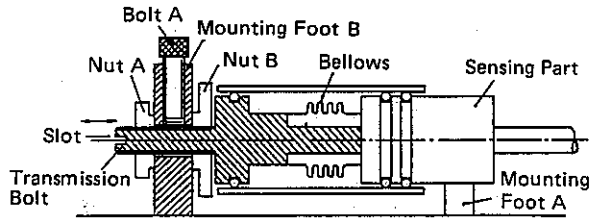
If bolts are tightened with unmatched screw positions, the transducer may be subjected to a bending force to cause hysteresis. Take care to avoid harm.

3. Initial balancing

3.1 Initial balancing

(1) Connect the transducer's leadwires to the indicator in the correct manner. (See Items 6 and 9.)

Using Nuts A and B, obtain the initial unbalance value approximating to the description in the calibration sheet. Error should be within $\pm 50 \times 10^{-6}$ strain against the description. Tightening Bolt A pulls the transmission bolt, thus causing tension to the sensor, and tightening Bolt B pushes the transmission bolt, thus causing compression to the sensor.



(2) After this balancing, tighten Bolt A firmly. The screw threads of the transmission bolt is then destroyed, and the bolt will then be temporarily fixed to Mount Foot B.

(3) Complete initial balancing by fixing both Nuts A and B securely. Use the adjustable wrench to tighten Nut A and pliers to tighten Nut B. 8N•m (reference value: about 4kg with a 20cm wrench) tightening torque will be enough. Though the transmission bolt is temporarily fixed with Bolt A already. But if it turns together with Nut A or B, the bellows and sensor inside will be damaged. To avoid harm, apply the screwdriver to the slot on top of the transmission bolt to keep it from turning.

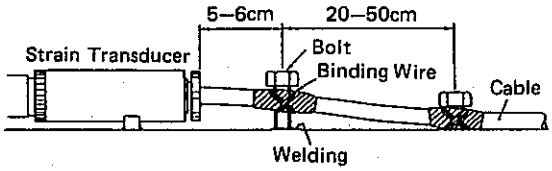
(4) The transducer is theus fixed at three points by Nuts A, B an Bolt A. For more sturdy fixing, use of a bonding agent such as screw lock will be efficient. But, do not apply spot-welding to fix the nuts to mounting foot. If otherwise, welding strain may adversely affect the setup value.

3.2 Precautions to be exercised in weld-mounting

If the strain transducer is mounted by direct welding, take care to avoid initial balancing till the welding heat cools down. To see whether or not initial balancing is allowed, measure the initial value at intervals (for instance, 30 minuets or so). If the first reading is same as the second one, you may well start initial balancing. But if they are found otherwise, wait till you get stabilized readings through later interval measurements. (Variation of Initial unbalance value should be 20×10^{-6} strain or thereabouts.)

4. Laying cable

4.1 Where an impact may occur to the transducer, securely fix the cable to the structure (such as steel pipe pile) at a point 5 to 6cm from the cable outlet of the transducer so that the outlet will be free from causal impact force (cable weight x impact acceleration).



For an example, weld a hexagonal bolt onto the structure as illustrated in the sketch above. Wind tape (vinyl tape or the like) around the cable for protection and sesurely fix the cable to the bolt using a wire (#20 or so).

4.2 Starting from a point 5 to 6cm from the cable outlet, fix the cable at 20 to 50cm intervals.

4.3 Lay the cable closely on the steel pipe or the like if it has no sharp curvature. With a sheet pile or the like which has sharp curvature on the contrary, take care to give enough allowance to the cable length while fixing.

5. Handling precautions

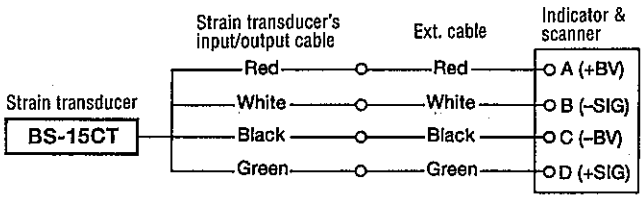
5.1 The transducer is so designed that it safely accepts impacts in the axial direction. But it is weakest against impacts given in right angles to the axial direction. When mounting, therefore, take care to avoid impacts in the said direction.

5.2 During existence of impact, strain measurement is impossible due to the transducer's response frequency and other factors.

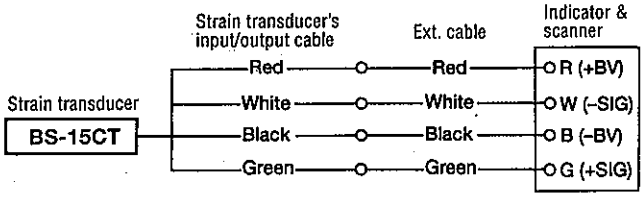
6. Connection

6.1 Illustrated in the sketch below is the connections which should be made between the transducer's input/output cable, the indicator and the scanner, respectively. The indicator and scanner have terminals of two kinds: one is marked with A, B, C and D; and another, marked with R, W, B and G.

① Markings: A, B, C and D



② Markings: R, W, B and G



6.2 Choose an indicator from the following.

(1) SMD-20A
(2) UCAM-70A-20 to be used in combination with USB-70A-30
(3) UCAM-20PC to be used in combination with USB-23A USS-23A
(4) UCAM-5DM-99
(5) RMH-201A, 210A
(6) RDT-110A, 170A

7. Conversion

7.1 For conversion, use the calibration factor stated in the calibration sheet.

7.2 When a strain amplifier is used, its outputs read in $\varepsilon \times 10^{-6}$ equivalent strain. Strain corresponding to 1×10^{-6} equivalent strain is stated in the calibration sheet. Strain can then be obtained through multiplication.

$$\text{Strain} = (\text{Strain amplifier's output: } \varepsilon \times 10^{-6}) \times (\text{Calibration factor} \times 10^{-6}/1 \times 10^{-6})$$

7.3 When an amplifier of other type or a recorder is used, it is necessary to accurately measure the bridge voltage applied. The calibration sheet states strain corresponding to 1μV output voltage against 1V bridge voltage. Strain can then be found through multiplication.

$$\text{Strain} = \frac{\text{Bridge output voltage: } \mu V}{\text{Bridge voltage: V}} \times (\text{Calibration factor} \times 10^{-6}/1\mu V/V)$$

7.4 Conversion of temperature when using the temperature measuring function

Conversion formula when temp. meas. function is used

Temperature $t = (S - S_0) \times \beta$

S: Amplifier's temperature reading (x 0.01Ω)

So: Reading against 0 degree (x 0.01Ω)

B: Temperature factor (°C/0.01Ω)

8. Special applications (Changing meas. range)

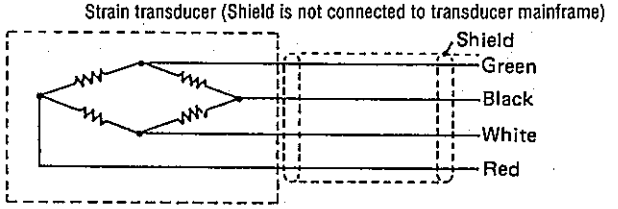
The transducer has a rated capacity of $\pm 2000 \times 10^{-6}$ strain and its standard application lines in strain measurement in a range of $\pm 2000 \times 10^{-6}$. We give here a brief description of special applications available by changing the measuring range.

(1) If it is only tensile (positive) strain to be measured , measurement is possible in a range from 0×10^{-6} to $+4000 \times 10^{-6}$ strain.

(2) If is only compressive (negative) strain to be measured, measurement is possible in a range of 0 to -4000×10^{-6} strain.

For such applications as above, add the strain quantity, which corresponds to the rated output sensitivity described on the calibration sheet, to the initial unbalance described on the calibration sheet. Regard the sum as the initial value for adjustment. For tensile strain as in case (1), regard the strain quantity corresponding to the rated output sensitivity as a negative value, and for compressive strain as in case (2), as a positive value.

9. Circuit Diagram



Input resistance: 350Ω±2% between red (+) and black (–)
Output resistance: 350Ω±2% between green (+) and white (–)

10. Other

For any question should arise, contact KYOWA representative for information..

11. Specifications

11.1 Strain measurement

(1) Gage length: 150mm
(2) Rated capacity: $\pm 2000 \times 10^{-6}$ strain
(3) Rated output: ±1.25mV/V to 2mV/V (±2500 to 4000 x 10^{-6} strain)
(4) Safe overload rating: 150%
(5) Non-linearity: ±2%RO or better
(6) Hysteresis: ±2%RO or better
(7) Input resistance: 350Ω±7Ω
(8) Output resistance: 450Ω±7Ω
(9) Recommended bridge voltage: 2 to 10V, AC or DC
(10) Compensated temp. range: –20 to +70°C
(11) Safe temperature range: –30 to +80°C
(12) Coefficient of linear expansion: $11 \pm 1 \times 10^{-6}$/°C
(13) Thermal effect on output: ±0.05%/°C or better

11.2 Temperature measurement

(1) Rated capacity –30 to +70°C
(2) Temp. meas. error: ±0.5°C (–30 to +70°C) (Using UCAM-5D M99, UCAM-70A-20, UCAM-20PC, RMH-201A, RMH-210A or SMD-20A)

Weight: Approx. 600g

Cable: 0.5mm², 4-conductor chloroprehen 1m,, ø9.6mm, terminated exposed wires

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