

Linear Variable Differential Transformer
Displacement measuring device

Displacement Sensor : KA series
Signal Conditioner : SA-DM

INSTRUCTION MANUAL

新 光 電 機 株 式 会 社

SHINKO ELECTRIC CO., LTD.

1-55, 3-chome, Takatsukadai, Nishi-ku, Kobe,
651-2271, Japan

Tel : 078-991-2632 Fax : 078-992-3049

Introduction

Please read this instruction manual before use and use our displacement measuring device correctly.

Precautions for handling the displacement sensor

1. Do not install in a location that is extremely close to ferromagnets such as iron.
2. Install so that the movement of the object to be measured is parallel to the axis.
(Be careful not to apply a lateral load to the shaft)
3. Keep the movement amount of the shaft within the movable range.
4. The core is heat-treated, so be careful not to give it an impact or bend.
5. The operating temperature range is -10 to +80 degrees Celsius. Please use within this range.

Precautions for handling signal conditioner

1. Use the power supply voltage within the specified voltage range.
2. The power terminal is located at the bottom left of the terminal block. The terminal block numbers are colored to distinguish them, but be careful when connecting the power supply.
3. Be sure to ground the FG (frame ground) terminal.
4. The operating ambient temperature is 0 to 50 degrees Celsius. Please use within this range. Please note that the failure rate may increase if the temperature is relatively high within the specified temperature range.
The maximum value of ambient humidity is 80%.
5. As with general electronic measurement, avoid using it in the following adverse environments.
 - ◇ Humid place
 - ◇ Places exposed to direct sunlight
 - ◇ Places with strong vibration and/or impact
 - ◇ Places filled with dust, salt, moisture, oil, corrosive gas, etc.

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1. General

This device converts the mechanical displacement that was given to displacement sensor, into an electrical signal and is the device, which is output as electrical output corresponding to quantity of a displacement.

2. Signal Conditioner : in combination with Displacement Sensor

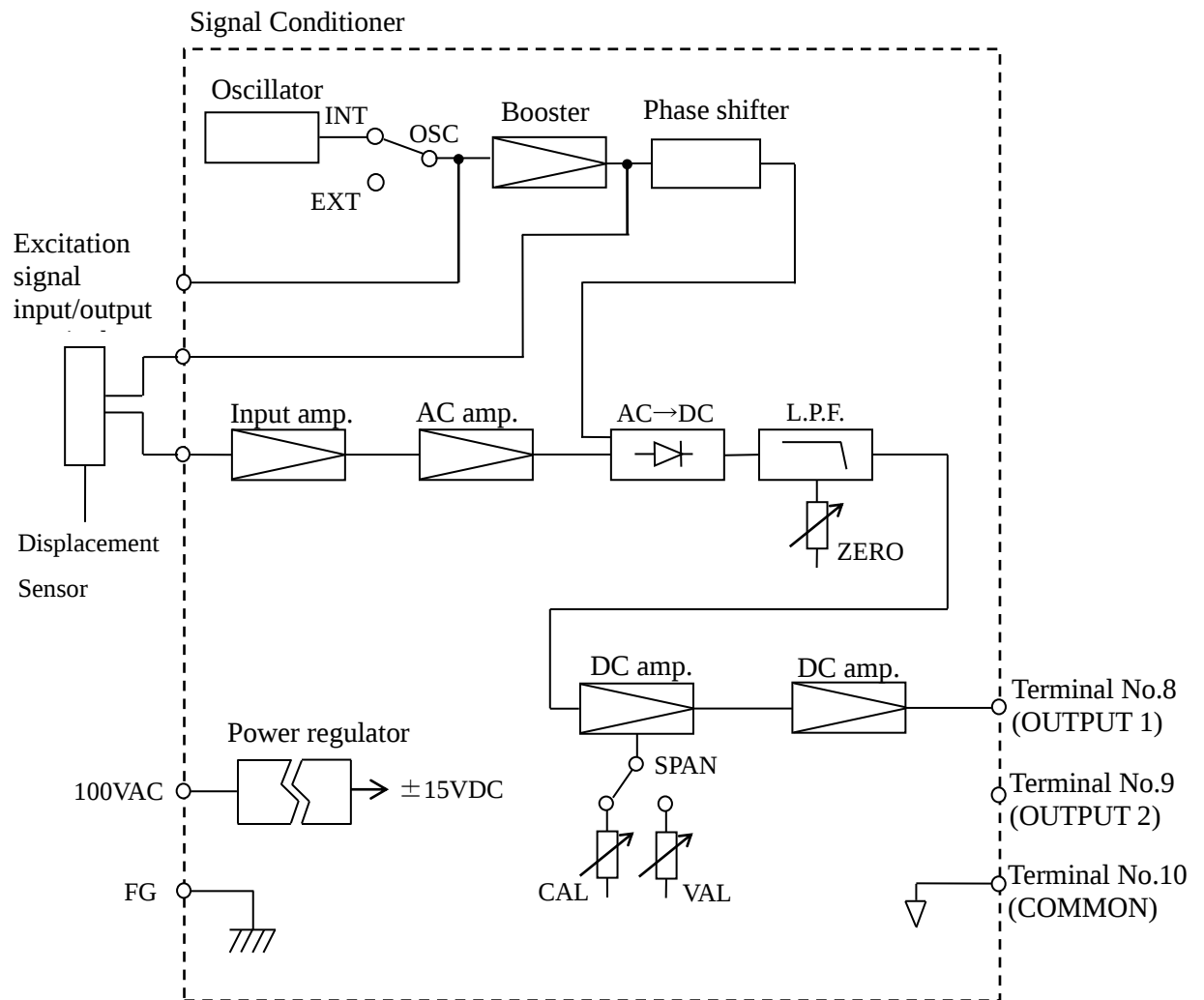
measuring stroke	Displacement Sensor type	Signal Conditioner type	Output Spec.	Displacement Sensor temperature coefficient
±5mm	KA-005	SA-DM-K005	±10V / ±5mm	±100ppm/°C
±10mm	KA-010	SA-DM-K010	±10V / ±10mm	±100ppm/°C
±20mm	KA-020	SA-DM-K020	±10V / ±20mm	±100ppm/°C
±30mm	KA-030	SA-DM-K030	±10V / ±30mm	±50ppm/°C
±50mm	KA-050	SA-DM-K050	±10V / ±50mm	±50ppm/°C
±100mm	KA-100	SA-DM-K100	±10V / ±100mm	±50ppm/°C
±150mm	KA-150	SA-DM-K150	±10V / ±150mm	±50ppm/°C
±200mm	KA-200	SA-DM-K200	±10V / ±200mm	±50ppm/°C

3. Constitution

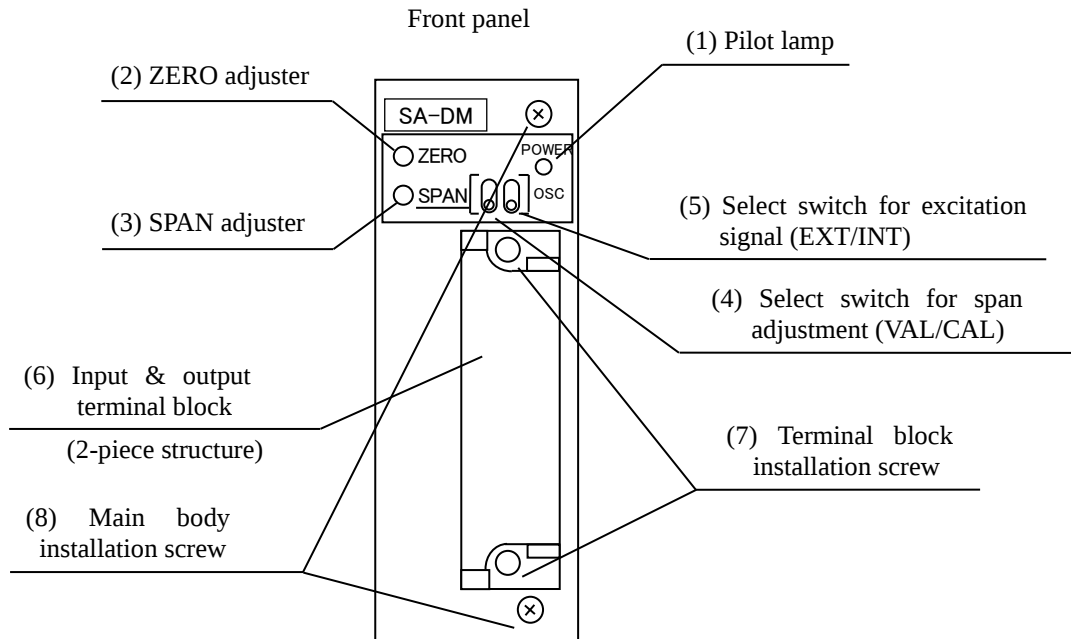
The basic constitution (amount per one set) of this device is as follow.

Item	Type	Basic number of configurations
Displacement Sensor	KA series	1 unit
Mounting Block for Sensor	LH-16A	1 pc./unit or 2 pcs./unit
Signal Conditioner	SA-DM	1 unit (Power supply cable, sold separately)
Mounting Holder for conditioner	H-02	2 pcs. (2 pcs./unit)

4. Block diagram



5. Part explanation for Signal Conditioner



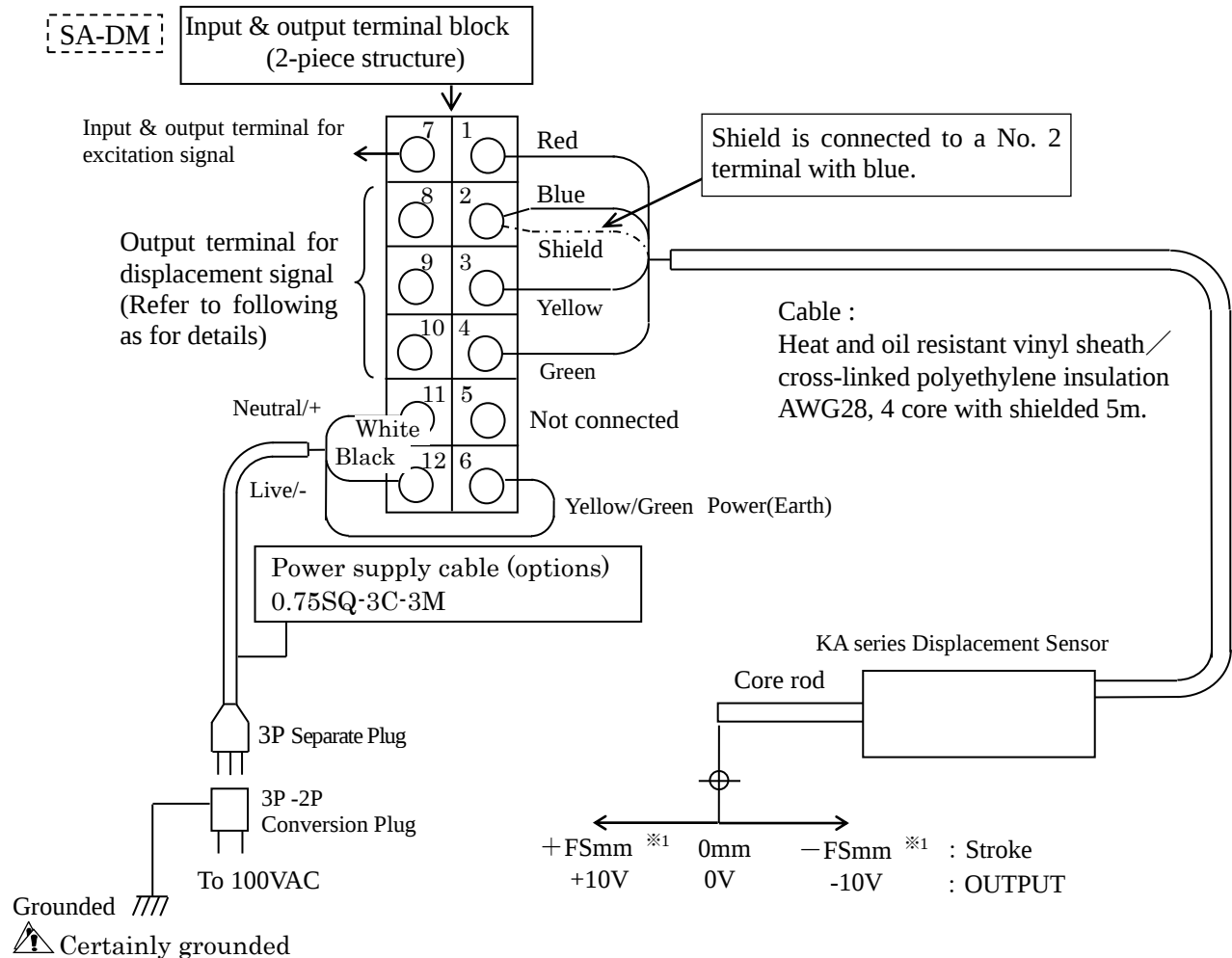
- (1) Pilot lamp It will light when power is supplied.
- (2) ZERO adjuster It will be used when the Displacement Sensor is installed and start up.
It is not used for anything else.
- (3) SPAN adjuster It will be used when you conduct sensitivity adjustment (SPAN adjustment).
Basically, not used.
- (4) Select switch for SPAN adjustment (VAL/CAL)
If the switch is in “CAL” side, user can get the value adjusted when it was shipped from the factory. Basically, use as it “CAL” side.
When the switch should be changed to “VAL” side, user can conduct sensitivity adjustment (SPAN adjustment).
- (5) Select switch for excitation signal (EXT/INT)
User can select whether to use excitation signal from inside (INT) or from outside (EXT) by this switch. For single use, it should be in “INT” side.
- (6) Input & output terminal block
All connection shall be connected here by M3.5 solder less terminal.
For further information about connection, please refer to chapter 6, “External connection diagram.”
- (7) Terminal block installation screw
Screws for terminal block.
- (8) Main body installation screw
This device contains fuse. To exchange the fuse, please unscrew these screws and remove the main body.

6. External connection diagram

6.1 One unit configuration

CAUTION: (1) Certainly grounded terminal No.6(Power(Earth))
 (2) Be careful in handling of a power supply.
 (3) At the time of use, a cover is surely attached.

NOTE:
 Please use M3.5 solderless terminal in connection to a signal conditioner.



○ Connection for output

Terminal No.8 ○ → $\pm 10\text{VDC} / \pm \text{FSmm}^{\text{※1}}$

Terminal No.9 ○ Open

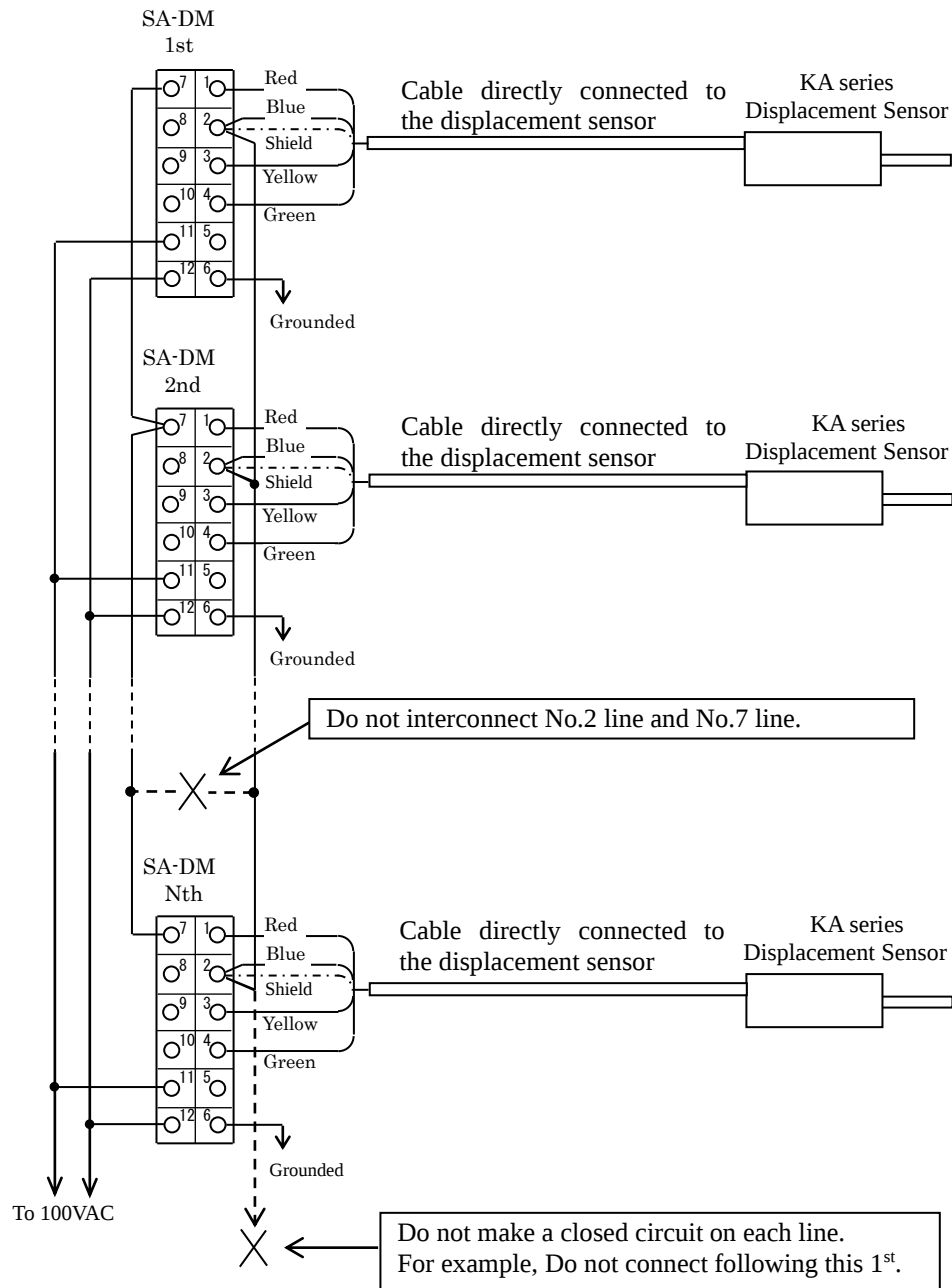
Terminal No.10 ○ → Common

^{※1} FS : Half stroke (E.G. KA-100 : 100mm)

6.2 External synchronization and multiple units configuration

(Reference P.7 7.5 “Select switch for excitation signal”)

- (1) If the excitation signal interferes when two or more units are installed close to each other, use the external synchronization function of the displacement meter to avoid this.
- (2) Only 10 units can be driven by one external synchronization. If you want to connect more than 10 units, please contact us.



※ About one unit configuration, refer to the previous page “7.1”.

7. Operation

7.1 Preparation

- (1) Refer to “6. External connection diagram”, please connect correctly.
- (2) Power supply voltage for Signal conditioner is 100VAC (90~138VAC).
Power cable connections for Signal conditioner are number 11 (white), number 12 (black), and number 6 (yellow / green).
(Nos. 11 and 12 are distinguished by coloring the terminal block number in yellow.)
Pilot lamp (POWER) will light and the instrument will be ready to operate.
However, 5 to 10 minutes is required to reach stable operating condition.

7.2 Zero adjustment

- (1) Set the “ZERO” adjuster to about roughly center position. It is center position at the time of shipment.
- (2) The body of Displacement Sensor is installed in a fixed position and a core rod is connected with an object of measurement.
- (3) While output is monitored, an installation condition of a Displacement Sensor's body or a core rod (refer to P.4) is adjusted, and output makes it a zero (0VDC) approached as possible.
- (4) After Displacement Sensor and core rod was fixed perfectly, operate the “ZERO” adjuster and turn output into zero position output (0.00VDC).

7.3 Span adjustment

Notice : Basically, not used.

Span adjuster is only use in the case of changing relation between displacement and output, basically. Except the special case, Signal Conditioner and Displacement Sensor are adjusted in combination at factory.

Adjustment method is as follows

- (1) Span adjustment switch change to “VAL” side.
- (2) Following “7.2”, it is zero adjusted accurately.
- (3) Provide the displacement of due full-scale by calibrator (for example micro meter) to the Displacement Sensor. (E.G. KA-100 : 100mm)
- (4) Monitor output, and adjust “SPAN” adjuster in order that output becomes full-scale output (+10.00VDC) accurately.

Then, measuring accuracy is cannot guarantee for “SPAN” adjustment by user.

7.4 Select switch for SPAN adjustment (VAL/CAL)

- (1) When they are “CAL” sides, it becomes adjusted value at time of factory shipment.

Basically, not used. Any setting is possible.

“SPAN adjuster” is acting, not related to a position of a switch.

Do not operate “SPAN adjuster” when “CAL” sides is selected.

- (2) When a user performs change of SPAN adjustment, a SPAN adjuster is operated as “VAL” side at this switch. Refer to “7.3 SPAN adjustment” of a front page as for a practical used way.

7.5 Select switch for excitation signal (OSC : EXT/INT)

※ Refer to "P.5 6.2" for the connection diagram and "P.10 9.3" for notes.

- (1) It is chosen whether a synchronizing signal from outside is used in an excitation signal (EXT) or used in an inside signal (INT).

When it is singly used, this switch is usually “INT” side.

- (2) When it is used in more than 2 units and so on, a beat depending on a difference of the excitation frequency is caused, 1 unit is turned into “INT” side and the synchronized between channels is taken as “EXT” side in the other.

In that case, each No.7 terminal (for excitation signal) of plural Signal Conditioner is mutually connected. And each No.2 terminal (common) also connects similarly.

Do not connected No.7 and No.2.

7.6 Connection to terminal board

All is connected in this terminal. M3.5 solder less terminal is used in connection.

Since the terminal block is separable, it can be removed while it is connected.

Please refer to “6. External connection diagram”, as for detail of connection.

7.7 Fuse exchange

- (1) This device has a fuse within. And, when a fuse is exchanged, “Main body installation screw” is removed and the main body is pull out.

Please do not pull out the substance for the purpose of the exception, which exchanges a fuse.

- (2) Please warn that a foreign substance does not mix when a fuse is exchanged.

And rapidly return the main body after it was exchanged.

8. Specification

8.1 Displacement Sensor : Common Specifications

- (1) System : LVDT(Linear Variable Differential Transformer)
- (2) Structure : Drip-proof structure, with cable connected.
- (3) Excitation : 5kHz, 5VAC
- (4) Operating temperature : $-10^{\circ}\text{C} \sim +80^{\circ}\text{C}$ (However, do not condense or freeze.)
- (5) External form & Dimension : Refer to each type drawings

KA-005, KA-010 : No. K4-22573E

KA-020, KA-030, KA-050, KA-100, KA-150, KA-200 : No. K4-22574E

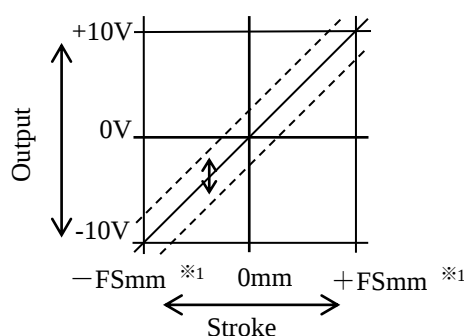
- (6) Dielectric strength test : Coil & Coil, Coil & Case 500VAC 60Hz 1 minute
- (7) Insulation test : Coil & Coil, Coil & Case 500VDC 100M Ω or more
- (8) Standard Mounting Block : Type LH-16A
Refer to DWG. No. K4-22417E-A

8.2 Signal Conditioner : Common Specifications

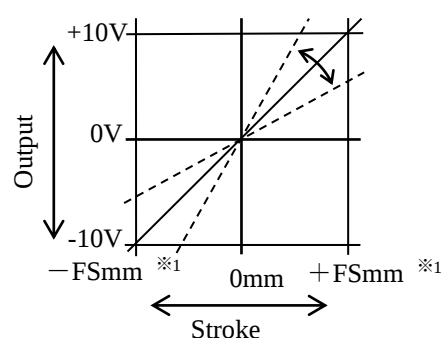
- (1) Excitation signal : 5kHz , 5VAC
- (2) Excitation signal switch : By using "OSC" switch, user is able to select whether to use excitation signal from inside or outside
"EXT" Outside signal is used
"INT" : Inside Signal is used
- (3) Linearity : $\pm 0.5\%$ or less / The entire measurement stroke of each model
(E.G.) KA-100/SA-DM-K100 : $\pm 0.5\%$ or less / $0 \sim 200\text{mm}$
- (4) Response : $0 \sim 200\text{Hz}$ ($\pm 3\text{dB}$)
- (5) Zero adjustable range : $\pm 10\%$ / each type half measuring stroke
(E.G.) KA-100/SA-DM-K100 : $\pm 10\text{mm}$ ($\pm 10\%$ / $0 \sim 100\text{mm}$)
- (6) Span adjustable range : $\pm 20\%$ / each type half measuring stroke
(E.G.) KA-100/SA-DM-K100 : $\pm 20\%$ / 100mm
- (7) Span adjustment switch : By using "SPAN" switch, user is able to select whether to use the condition when it was shipped or the condition which user has adjusted.
"VAL" : User is able to adjust the condition by "SPAN." (Initial condition is adjusted as same as "CAL.")

"CAL" : It is fixed with the condition when it was shipped from the factory

ZERO adjusted image



SPAN adjusted image

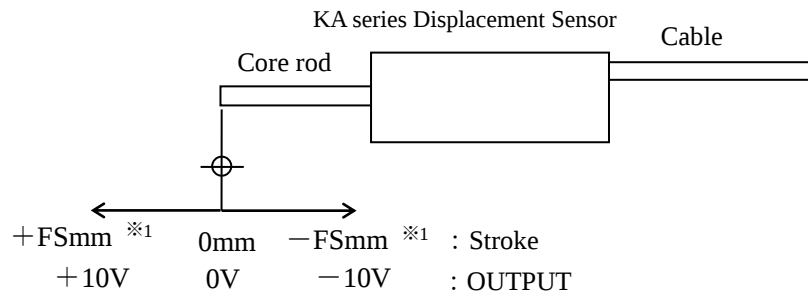


(8) Cable between Displacement sensor and Signal conditioner :

: Only the 5m cable directly connected to the sensor is used between the displacement sensor and the signal conditioner for adjustment and verification.

(9) Stroke polarity

: When the core rod moves in the direction opposite to cable, output will increase.



^{※1} FS : Half stroke (E.G. KA-100 : 100mm)

(10) Power supply : 100VAC (90VAC~138VAC) 50/60Hz

(11) Dielectric strength test : Power supply terminal vs. chassis 500VAC 60Hz 1 minute

(12) Insulation test : Power supply terminal vs. chassis 500VDC 25MΩ or more

(13) Operating temperature range : 0 to 50°C

(14) Mounting holder : Type H-02 (2 pcs./unit)

(15) Weight : Around 1.3kg

(16) Painting : Munsell 5GY 7/1.5

(17) External form & Dimension : Refer to DWG. No. K3-10913E

9. Suggestions on handling

9.1 Displacement Sensor

- (1) Please be careful not to install Displacement Sensor near highly magnetic material, such as irons.
- (2) Please install it in order that the movement of measuring object will be parallel with the rod.
(Please be aware that the core rod will not be affected by any force from cross direction.).
- (3) Please be aware that core rod must be kept in the mechanical movable range.
- (4) Please be aware that since the core of Displacement Sensor has been performed with heat treatment, it must be protected from shock and/or distortion.

9.2 Measuring cable

- (1) Displacement Sensor and Signal Conditioner are adjusted using the test cable.
Refer to page 9. 「8.2 (8) Measuring cable」
- (2) Measuring cable is exclusive, so don't cut or extend the cable.

9.3 About external synchronizing of excitation

- (1) If you install more than 2 units close to each other and the excitation signal interferes, you can use external synchronization function of Signal Conditioner to avoid the interference.
- (2) Outline of external synchronizing connection is mentioned below.
Each No. 7 terminal (for excitation signal) of plural Signal Conditioner should be mutually connected. And each No. 2 terminal (common) also should be connected mutually.
After connection is done, please switch excitation signal to "INT" for 1 unit and other units to "EXT."

9.4 Signal Conditioner

- (1) Please treat this Signal Conditioner as same as other general electrical measuring device.
Especially, please avoid using this meter under the environment mentioned in below.
 - Usage at the temperature out of standard.
 - Usage under the sun.
 - Usage under the condition with vibration and/or shock
 - Usage under the atmosphere with dust, salt, moisture, oil and/or corrosive gas.