

## SV Series

SV01A103AEA01R00

SV03A103AEA01R00



## Rotary Position Sensor

### Features

- High Durability: 300k cycles
- Pb Free Soldering: 260°C
- Operating Temperature: -40°C to +125°C
- Terminal Shape: SMD Type and Lead Type
- Rotational Rotor: Through Hole Type
- Thin Type: 2.1mm
- RoHS Compliant

### Applications

- Switch for white goods
- Digital still camera
- Multi-function printer
- Robot
- Motor drive unit

### Overview

Value analysis type for Consumer and Automotive market.

#### 1. SV01A103AEA01R00

Small 12mm-size position sensors can be operated at temperatures from -40 to +85 deg, and has endurance of up to 1M cycles

#### 2. SV03A103AEA01R00

Small 12mm-size position sensors can be operated at temperatures from -40 to +125 deg, and has endurance of up to 300,000 cycles

---

#### Attention:

This datasheet is downloaded from the website of Murata Manufacturing Co., Ltd.  
Therefore, it's specifications are subject to change or our products in it may be discontinued without advance notice.  
Please check with our sales representatives or product engineers before ordering.

## TABLE OF CONTENT

<b>1. Introduction</b> .....	<b>1</b>
<b>2. Board Design</b> .....	<b>3</b>
2.1 Land Pattern	
2.2 Locating Holes	
<b>3. Circuit Design</b> .....	<b>5</b>
3.1 Recommended Circuit	
3.2 Avoid inserting a fixed resistor in series with the sensor	
3.3 Avoid using the product at a voltage that exceeds the rated voltage	
<b>4. Mechanical Design</b> .....	<b>6</b>
4.1 Cross-section dimension of the shaft inserted into the rotor	
4.2 Load on the bearing	
<b>5. System Design</b> .....	<b>7</b>
5.1 Precautions for Loading Data	
<b>6. Mounting and Soldering</b> .....	<b>7</b>
6.1 Reflow soldering	
6.2 Hand soldering	
<b>7. Connecting with Mechanical parts</b> .....	<b>10</b>
<b>8. Storage</b> .....	<b>10</b>
<b>9. Problem and Countermeasures</b> .....	<b>11</b>

---

### Attention:

This datasheet is downloaded from the website of Murata Manufacturing Co., Ltd.  
Therefore, it's specifications are subject to change or our products in it may be discontinued without advance notice.  
Please check with our sales representatives or product engineers before ordering.

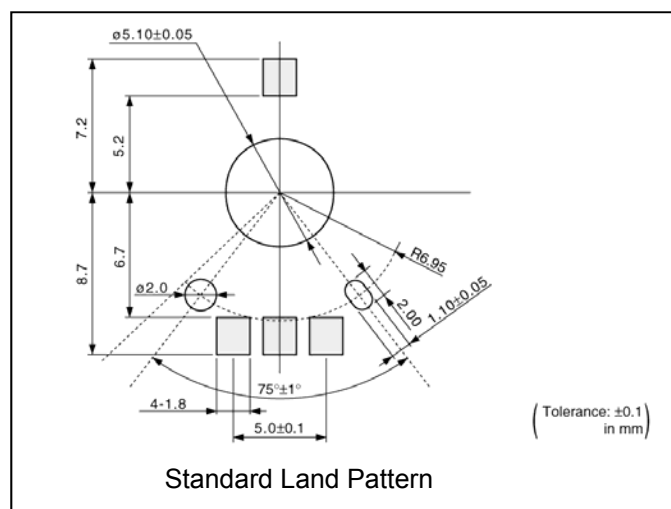
## 2. Board Design

## 2.1 Land Pattern (use recommend land pattern only)

When a land pattern area that is greater than necessary is used, a positional error or rotation of the product may occur due to the effect of the surface tension of the solder, which may result in problems when the product is connected to a mechanical part.

Also, if the land pattern area is too small, the force bonding the product to the printed circuit board will be low, which may result in the product separating from the board.

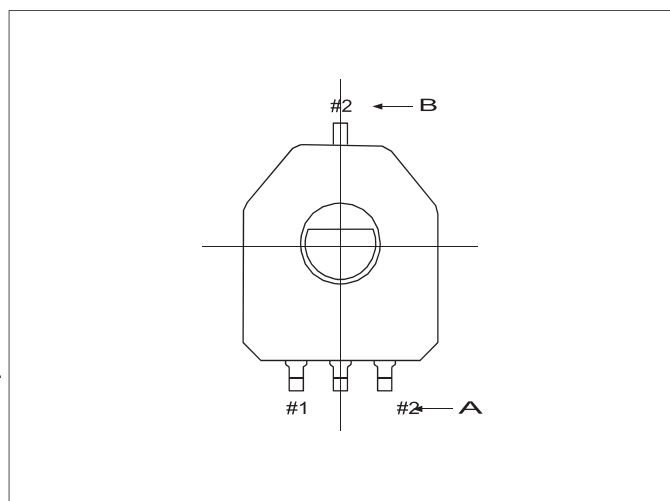
In order to prevent the above problems,  
please use our standard land pattern.



This product has two #2 terminals, at positions A and B to ensure flexibility of mounting on the board to cope with various wiring layouts.

This permits “in-line use” in which the #1 and #3 terminals are connected with the #2 terminal on the same side (A), or “zigzag alignment use” in which the #2 terminal on the B side is connected to the circuit.

In the case of “in-line use” as well, be sure to provide a land for the #2 terminal on the B side in order to ensure that the product is fixed to the board with adequate force.



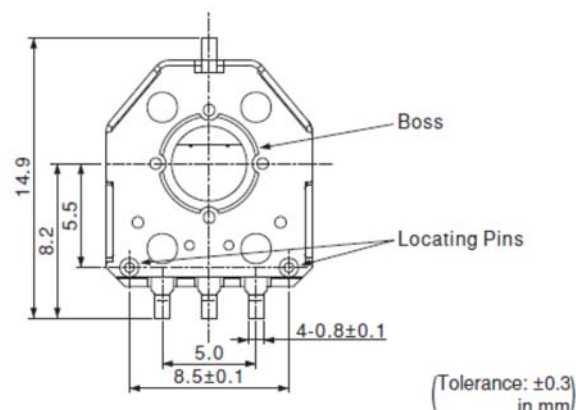
**Attention:**

This datasheet is downloaded from the website of Murata Manufacturing Co., Ltd.  
Therefore, it's specifications are subject to change or our products in it may be discontinued without advance notice.  
Please check with our sales representatives or product engineers before ordering.

## 2.2 Locating Holes

The mounting position of the product is determined by the holes in the following three places.

- (a) Center position (X-and Y-directions) is determined by Hole (one location) for boss at rear of product.
- (b) Rotation angle (° angle) is determined by hole(s) for locating pins at rear of product. (° angle can be fixed by one hole or two holes.)

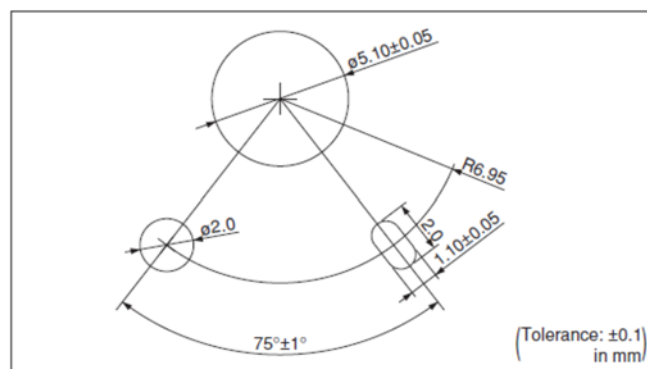


Determine the dimension of the locating holes as follows, depending upon the method of mounting the product (when mounting the product using a mouter or mounting it by hand).

- (a) In case of hand soldering; Please refer to right drawing.
- (b) In case of using chip mouter;

Expand the size of each hole to account for the accuracy of the mounts.

Note, however, that the accuracy of the mounting position of the product is determined by the "accuracy of the mouter."



### Attention:

This datasheet is downloaded from the website of Murata Manufacturing Co., Ltd. Therefore, it's specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.

### 3. Circuit Design

#### 3.1 Recommended Circuit

This product is designed on the assumption that it is to be used with the output terminals directly connected to the A/D port of a microprocessor as shown in Fig1. In other words, the contact resistance inside the product is slightly high based on the assumption that the connection impedance value is of the order meg-ohms.

Consequently, when using the product in the circuit of Fig2, take steps to ensure that the connection impedance does not fall below 1Mohm.

(Refer to sub-section 3 of 9. Examples of Actual Problems and Preventive Measures.)

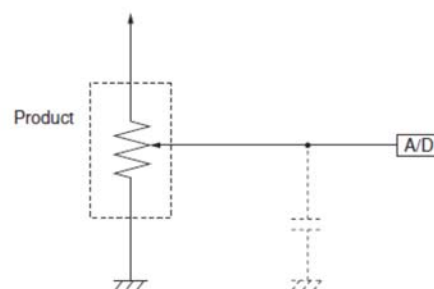


Fig.1

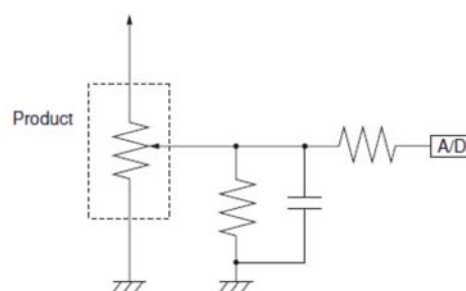
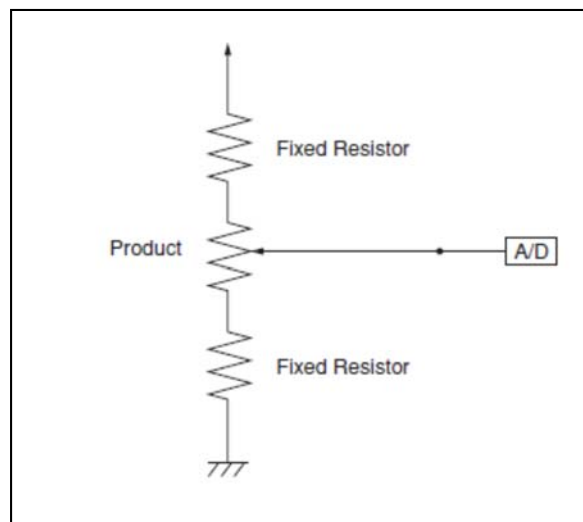


Fig.2

#### 3.2 Avoid inserting a fixed resistor in series with the sensor

Because the resistive element used in this product is a “carbon resistive element,” its temperature characteristics cause its total resistance value to change with the ambient temperature. The total resistance also changes due to changes in the external environment along with the passage of time. However, the resistance of each part of the resistive element changes uniformly, so the “output voltage characteristics” that are determined by the voltage division ratio due to the contact point will not be greatly affected.

Note, however, that if fixed resistors are connected in series with the product as shown in the figure at right, the “output voltage characteristics” may be adversely affected by the difference in the rate of change of the resistance of the fixed resistors and that of the resistive element of the product. For this reason, avoid connecting fixed resistor in series with the sensor.



#### Attention:

This datasheet is downloaded from the website of Murata Manufacturing Co., Ltd. Therefore, its specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.

### 3.3 Avoid using the product at a voltage that exceeds the rated voltage

If the product is used at a voltage that exceeds the rated voltage, the resulting abnormal heat generation may impair the function of the product.

## 4. Mechanical Design

### 4.1 Cross-section dimension of the shaft inserted into the rotor

The cross-section dimension of the shaft inserted into the rotor of the product greatly affects the characteristics of the product. If the dimension is too small, backlash between the product rotor and the inserted shaft will occur, which may cause a delay in the change in the output voltage accompanying the rotation of the shaft.

If the dimension is too large, the rotor will break, resulting in an increase in the rotational torque and also abnormal wear of the product bearing. In addition, wear dust from the bearing in which wear occurs may adversely affect the characteristics of the output voltage, and so on.

The cross-section dimension of the shaft inserted into the rotor of the product greatly affects the characteristics of the product. If the dimension is too small, backlash between the product rotor and the inserted shaft will occur, which may cause a delay in the change in the output voltage accompanying the rotation of the shaft.

If the dimension is too large, the rotor will break, resulting in an increase in the rotational torque and also abnormal wear of the product bearing. In addition, wear dust from the bearing in which wear occurs may adversely affect the characteristics of the output voltage, and so on..

### 4.2 Load on the product bearing

If a thrust, radial, or twist load, for example, is applied to the rotor bearing, the electrical characteristics may change, the rotational may increase, or mechanical damage may occur. When designing a system, pay attention to the following points.

1. Mount the product only by soldering the terminal.

Avoid screwing it to an auxiliary board, for example, because this may cause deformation of the product.

2. The shaft that is inserted into the rotor is supported by a bearing, so do not apply a load to this bearing.

(Refer to sub-section 1 of 9. Examples of Actual Problem and Preventive Measures.)

---

#### Attention:

This datasheet is downloaded from the website of Murata Manufacturing Co., Ltd.  
Therefore, it's specifications are subject to change or our products in it may be discontinued without advance notice.  
Please check with our sales representatives or product engineers before ordering.

## 5. System Design

### 5.1 Precautions for Loading Data

Implement the following software measures in order to minimize data loading failure that occur occasionally, and also the effect of sliding noise and external noise.

1. Perform several data loading operations and obtain the mean value.
2. Disable data that is considered to be the cause of data loading failures.
3. If any doubt arises, take appropriate action such as carrying out a data acquisition operation once again.

## 6. Mounting and Soldering

### 6.1 Reflow soldering (When mounting the product with a mounter, and reflow soldering it.)

#### 6.1.1 Quantity of solder paste

The standard coating thickness of solder paste used on SMD product is 150μm.

If the quantity of solder is insufficient, the solder adhesion strength may be inadequate.

Conversely, if there is too much solder, “solder bridging” or “ingress of flux into the product” may occur impairing the contact condition of the electrical contact. This in turn will result in an abnormal output voltage.

The standard solder paste is Sn-3Ag-0.5Cu.

---















#### Attention:

This datasheet is downloaded from the website of Murata Manufacturing Co., Ltd.  
Therefore, its specifications are subject to change on our products in it may be discontinued without advance notice.  
Please check with our sales representatives or product engineers before ordering.

### 6.1.2 Applicable mounter

A rotary position sensor is an “atypical component,” so it is necessary to use a “placement machine suitable for this part.” (Refer to the table below. For details, please contact the various mounter manufacturers.)

The judgment concerning whether or not a particular mounter is suitable depends upon the required mounting speed and mounting position accuracy. Be sure to carry out an advance mounting check on the

Name of Manufacturer	Model Name	Nozzle Part No./Series Name/Drawing No.	Nozzle Shape	Suction Position
Panasonic Factory Solutions Co., Ltd.	CM40□ CM602	1461 nozzle		
	BM Series	10807GK823		
	MSF Series	10807GK823		
Yamaha Motor Co., Ltd.	YV100X YV100Xg	SKV8-M77MJ-000		
	YV88X YV88Xg YG100R YG88R YS100 YS88	A customized nozzle of the same shape as that of the SKV8-M77MJ-000 must be newly fabricated.		
JUKI Corporation	KE-2060	No.648 nozzle		
	KE-2050	No.648 nozzle		
Hitachi High-Technologies Corporation	GXH Series	High-speed head: VT14 or VG02		
		Multi-function head: WT14 or WG02		
	TIM-5000 Series	High-speed head: VT14 or VG02		
		Multi-function head: WT14 or WG02		
	TIM-X100	High-speed head: VT14 or VG02		
		Multi-function head: WT14 or WG02		
I-PULSE Co., Ltd.	M2	SLYYM1183-000		
	M6	SLYYM1283-000		
	M6e	SLYYM1083-000		
	M2	SLYYM112T-000		
	M6	SLYYM122T-000		
	M6e	SLYYM102T-000		
Fuji Machine Mfg. Co., Ltd.	NXT, NXTII	It is necessary to newly fabricate a customized nozzle.		
	XP			

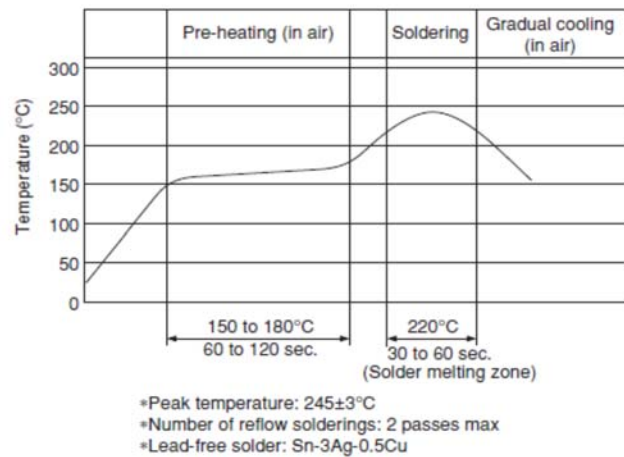
#### Attention:

This datasheet is downloaded from the website of Murata Manufacturing Co., Ltd. Therefore, its specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.



### 6.1.3 Reflow Temperature Profile

The Standard conditions are shown to the right.



## 6.2 Hand soldering (When mounting the product by hand and soldering it with a soldering iron.)

### 6.2.1 Quantity of solder

For both SMD and leaded products, supply a quantity of wire solder that is within the range where solder bridging between the terminals does not occur. The standard wire solder is Sn-3Ag-0.5Cu.

### 6.2.2 Soldering Iron

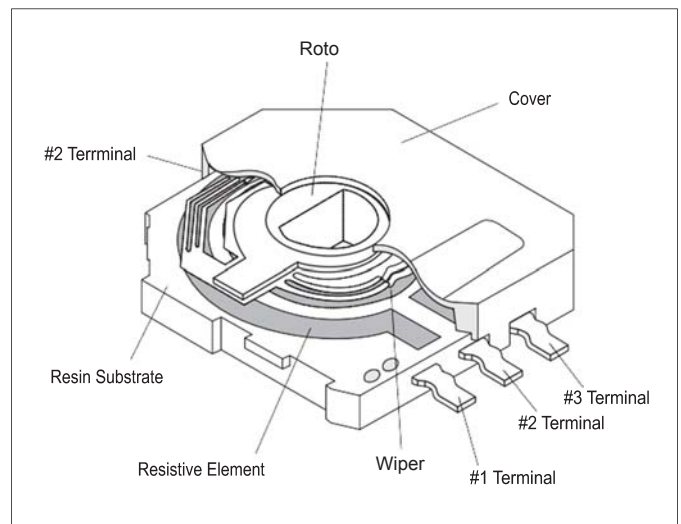
The standard conditions are as shown at right.

Temperature of soldering iron tip:  $350 \pm 10^{\circ}\text{deg}$   
 Soldering time : Within 3 sec. per terminal  
 Diameter of the soldering iron tip:  $\phi 3\text{mm}$  max.  
 Wattage of iron : 30W max

When soldering, take care that the tip of the soldering iron does not come into direct contact with the product (cover, rotor, plastic substrate, etc.).

If such contact does occur, the product may be damaged.

Heat both the terminal and the land at the same time so that the wire solder melts quickly. This will reduce deformation of the resin substrate of the product due to heat transmitted from terminals.



## 6.3 Washing

This product is not of a sealed construction so you cannot wash it.

### Attention:

This datasheet is downloaded from the website of Murata Manufacturing Co., Ltd. Therefore, it's specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.

## 7. Connecting with Mechanical Parts

In case of using grease or lubricant on connecting shaft or gear, please prevent grease lubricant coming into the product. If grease or lubricant gets inside the product, the product may deviate from the specified characteristics. (Refer to sub-section 2 of 9. Examples of Actual Problems and Preventive Measures.)

When combining the product with a mechanical part, please ensure that the center of the product's rotor hole coincides with the center of the shaft that is to be inserted into the rotor.

(Refer to sub-section 5 of 9. Examples of Actual Problems and Preventive Measures. )

## 8. Storage

The electrodes of each SV series rotary position sensor (hereafter called "product" ) are placed to ensure solderability.

However, if a product is exposed to high temperature and humidity, sulfur gas, or other contaminated environment, the surface of the electrodes may oxidize or sulfurize, resulting in defective soldering.

The following are the precautions to be observed conserving storage management, so please refer to them.

### (1) Storage Environment

Ensure that the atmosphere is within a temperature range of between -10 and +40deg, and a humidity range of between 30 and 85%RH, and does not contain chlorine, sulfur, or other corrosive gas. Also, avoid storing the products in a location that is exposed to direct sunlight.

### (2) Storage Method

Store products in a condition such the minimum packing in boxes are not subject to a load. Do not stack the boxes to the extent that the bottom box becomes deformed under the weight of the boxes stacked on top of it.

### (3) Storage Period

Use products within 6 months after they are shipped from us. If you use products within 6 months have elapsed, carry out a solderability test to make sure that there is no problem prior to use.

### Qualified Standards

The products listed here have been produced by the ISO9001 and ISO/TS16949 certified factory.

MURATA FACTORY	Qualified Date	Standard	Qualified Number
Wuxi Murata Electronics Co.,Ltd.	May 12, 1999	UNDERWRITERS LABORATORIES INC.	A7924

\* No ODCs (Ozone Depleting Chemicals) are used on any of Murata's Rotary Position Sensors.

### Attention:

This datasheet is downloaded from the website of Murata Manufacturing Co., Ltd. Therefore, it's specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.

## 9. Problems and Countermeasures

1. Do not apply a load other than rotational motion to the bearing. Because this product has been designed with emphasis on miniaturization and low weight, the bearing is not intended to support a load. For this reason, please provide a separate bearing function to ensure that an excessively high load is not applied to the bearing of the product. If a load is applied to the bearing in the radial or thrust direction, the bearing may wear, resulting in the following problems.

- (a) Deterioration of output voltage linearity due to backlash in the rotor.
- (b) Deterioration of the contact condition of the contacts due to wear dust

Also, be sure to carry out an evaluation using an actual machine.

2. Do not allow grease or other lubricant to get into the product.

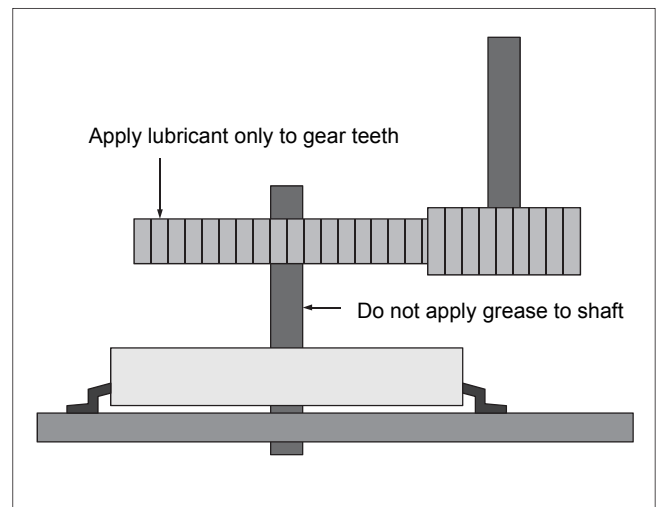
The rotational life of this product has been increased by appropriate selection of materials, processing method, and

so on, without relying on lubricants. Consequently, if grease or other lubricant gets into the product, problems are likely to occur.

This product is not of a sealed construction, so lubricant may flow into it from the bearing or gaps in the case, for example. When it is unavoidably necessary to coat a gear, or other part, that you use with grease, or another lubricant, take the following precautions to prevent grease from getting into the product.

- (a) Use a high viscosity lubricant
- (b) Do not allow lubricant to get onto the shaft that is to be connected to the product.

(In the case of a shaft that is integral with the gear, apply lubricant only to the gear teeth.)



### Attention:

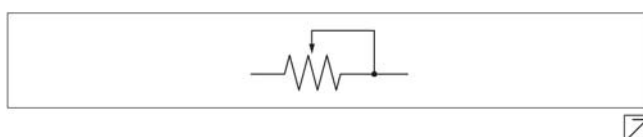
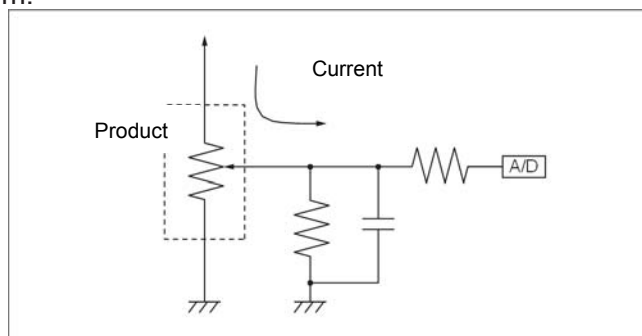
This datasheet is downloaded from the website of Murata Manufacturing Co., Ltd. Therefore, its specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.

3. Ensure that the connection impedance is at least 1M ohm.

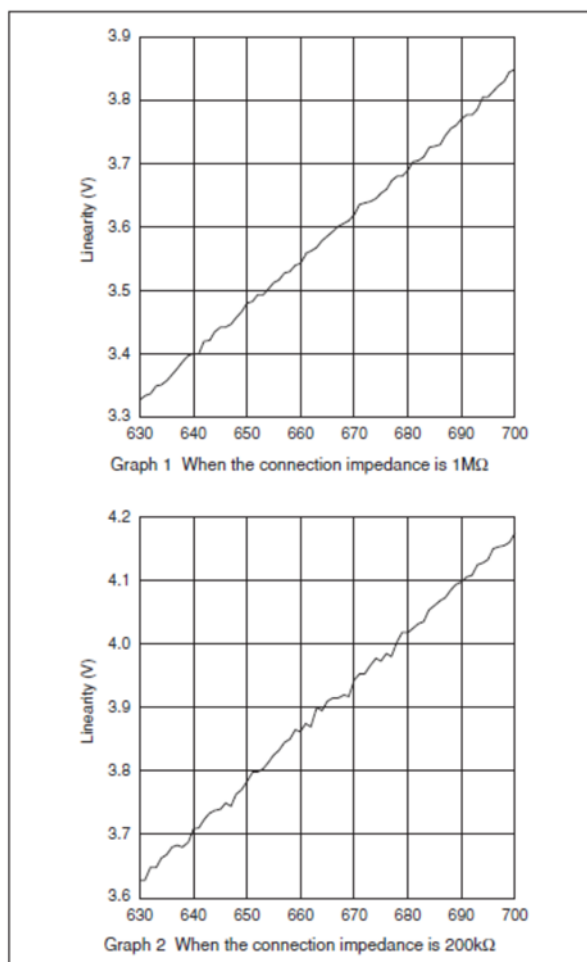
This product has increased contact resistance (sliding noise) in order to maximize its rotational life. Consequently, in order to reduce the effect of sliding noise, it is necessary to reduce the current flowing through the contacts (current  $i$  indicated in the figure at right) as far as possible. Accordingly, take steps to ensure that the internal impedance of the circuit connected to the output terminal (#2 terminal) is at least 1M ohm.

Be particularly careful in the case of the filter circuit shown in the figure at right.

Do not connect rheostat type as shown in the figure at right because the contact resistance is slightly high.



The graph at right shows the results of measuring the output voltage linearity of the same sample when the impedance to which it is connected is changed between 1M and 200k ohm. It can be seen that the effect of sliding noise is reduced when the connection impedance is increased.



**Attention:**

This datasheet is downloaded from the website of Murata Manufacturing Co., Ltd. Therefore, it's specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.

4. When using the product in atmosphere containing a corrosive gas (chlorine, sulfur, etc.), install it in sealed structure.

This product is not of a sealed construction, so the contacts and resistive element inside it are exposed directly to the ambient air. For this reason, if the product is used in an atmosphere containing a corrosive gas, the contacts and resistive element may corrode. When it is unavoidably necessary to use the product in an atmosphere containing a corrosive gas, install the product in a sealed structure.

5. Ensure that the positions of the mechanical part (shaft) that you wish to connect to the product and the product rotor hole do not become misaligned.

When combining a mechanical part with the product, ensure that the center of the product rotor hole coincides with the center of the shaft to be inserted into the rotor. If you use these parts in a misaligned condition, the bearing may wear, resulting in the following problems.

- (a) Deterioration of output voltage linearity due to play in the rotor
- (b) Deterioration of the contact condition of the contacts due to wear dust

---

**Attention:**

This datasheet is downloaded from the website of Murata Manufacturing Co., Ltd.  
Therefore, it's specifications are subject to change or our products in it may be discontinued without advance notice.  
Please check with our sales representatives or product engineers before ordering.