

Non-contact Potentiometers



LP Series

The semiconductive reluctance elemental device (single crystal InSb) of high sensitivity was designed for the non-contact potentiometers.

Excellent characteristics by matching with the magnetic circuitry are exhibited.

■ Features

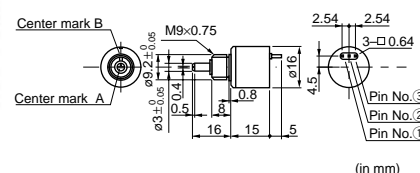
1. There is the following advantage because it is the contact-less structure that a magnet was combined with the reluctance elemental device unlike slide wire potentiometer.
 - Long life time because a resistor isn't worn away.
 - No sliding noise.
 - No hysteresis of the output signal.
 - Low torque because a shaft is held by the ball bearing.
 - Mechanical response is excellent and electric response exceeds the mechanical response fully.
2. The angle detection of $\pm 50^\circ$ is possible.
3. LP05M series is suitable for the high reliability use because a temperature compensation circuit is built in.

■ Applications

- Paper thickness measurement for ATM and OCR.
- String tension or Tape tension controller
- Angle measurement of valve
- Level detection of fluid
- Rotation angle measurement of servomotor



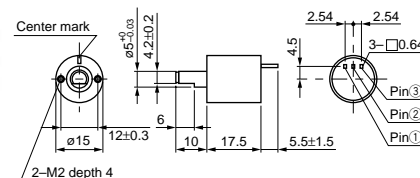
LP05M2F1AA
LP06M2F1HA



(in mm)



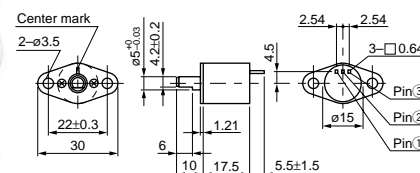
LP05M3R1AA
LP06M3R1HA



in mm



LP05M4R1AA
LP06M4R1HA



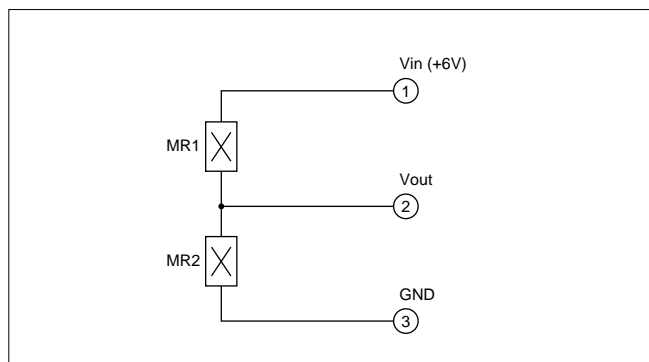
in mm

■ Ratings

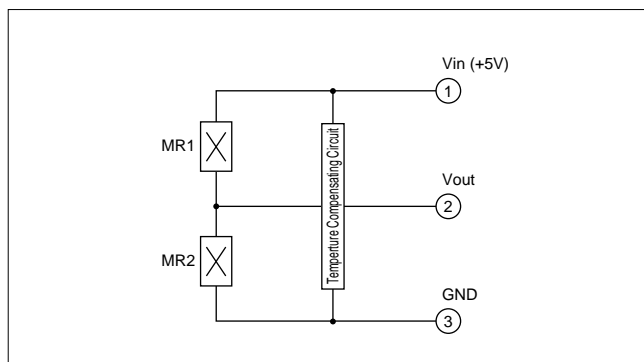
Items		Condition		LP06M2F1HA	LP06M3R1HA	LP06M4R1HA	LP05M2F1AA	LP05M3R1AA	LP05M4R1AA
Fixing method		-		Bushing	Screw	Flange	Bushing	Screw	Flange
Ball bearing		-		oil type	grease type		oil type	grease type	
Magnetic shield		-		○	-		○	-	
Temperature Compensating Circuit		-		-			○		
Total Resistance (k ohm)		Between pin ① and ③		3.5 to 10			2 to 10		
Supply Voltage (Vdc)		25°C		6 max.			5 max.		
Maximam applied Voltage (Vdc)		less than 1 minute at 25°C		15			8		
Effective Linearity Range (deg.)		Centerd at 1/2 Vcc		±50			±50		
Output Sensitivity (mV/deg.)		25°C Effective Linearity Range	Vin=6V	22±4			-		
			Vin=5V	-			9 min.		
Individual Linearity (%)		Within effective linearity range		±1.5			±1.5		
Resolution		-		Infinitesimal (Analog output)			Infinitesimal (Analog output)		
Temperature Coefficient	(%/°C)	25°C Effective Linearity Range	-10 to +60°C	-0.40 to -0.15 (Reference)			-		
	(%)		-10, +60°C	-			±7		
Output Load Resistance (M ohm)		25°C		10 min.			10 min.		
Insulation Resistance (M ohm)		DC500V, 25°C, 60%RH		500 min.			500 min.		
Insulation Voltage		AC250V, 25°C, 60%RH		No significant damage for 1 minute.			No significant damage for 1 minute.		
Shaft Angle (deg.)		-		360 (endless)			360 (endless)		
Max. Rotation Torque (N•m)		25°C		1x10 ⁻⁴	5x10 ⁻⁴		1x10 ⁻⁴	5x10 ⁻⁴	
Max. Shaft Load (kg)		Thrust, Radial		0.5	1		0.5	1	
Operating temperature (°C)		-		-10 to +80°C			-10 to +60°C		

■ Schematic

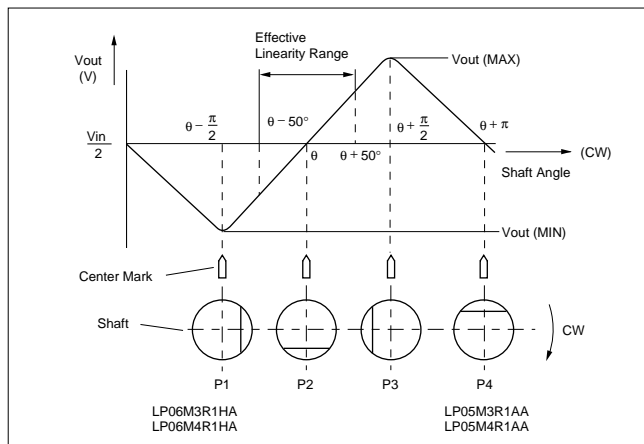
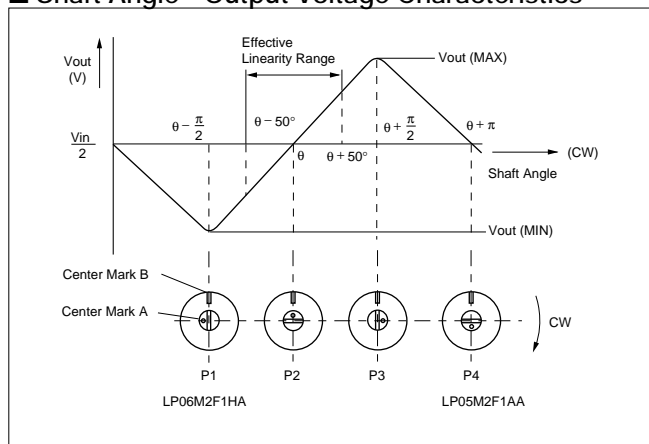
LP06M Series



LP05M Series



■ Shaft Angle - Output Voltage Characteristics



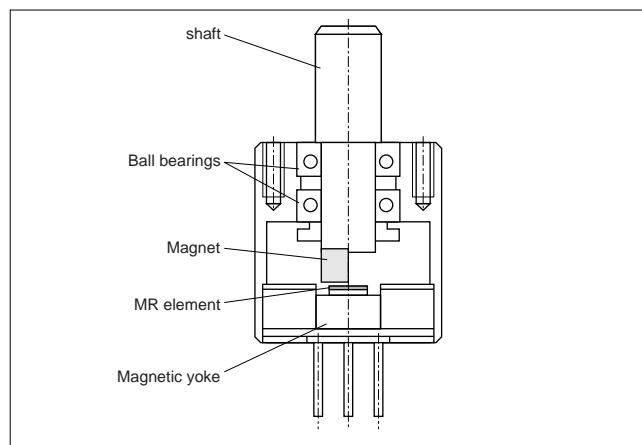
Reference Data

■ Construction

The figure shows the construction of the non-contact potentiometer. A magnet is mounted on the end of a rotation shaft. When the shaft rotates, the magnetic field applied to the magnetoresistive (MR) elements varies and a quasi-sine wave signal can be obtained.

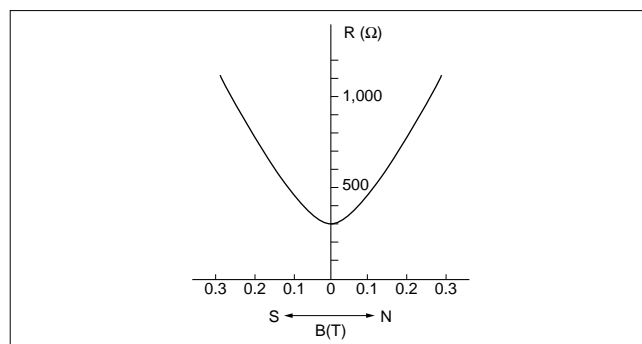
In the range near the center of the amplitude of the signal, the output changes linearly. The rotational angle is therefore converted into the output voltage linearly.

The magnetic yoke is placed opposite to the magnet in order to generate a parallel magnetic field and the MR elements are positioned at the center of the magnetic yoke.



■ Magnetoresistive

A change in the resistance of a ferromagnetic or semiconductive material when it is subjected to magnetic flux. Used in Murata's non-contact potentiometer is InSb which exhibits very high magnetoresistive effect.

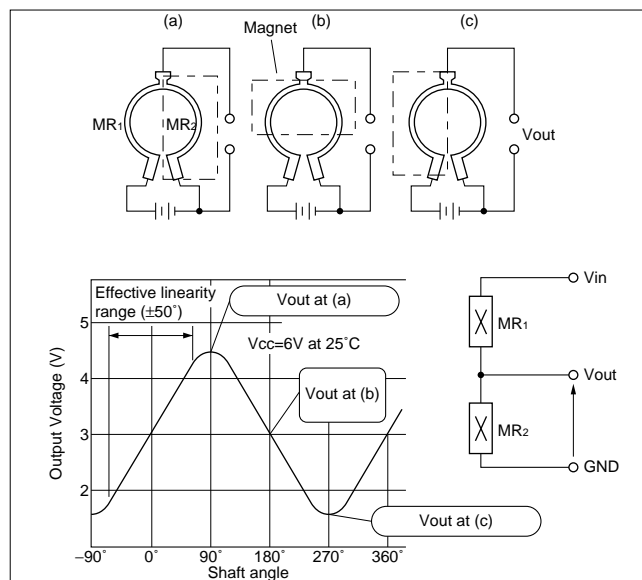


■ Principle

A suitable space gap is maintained between the magnet and the MR elements. The magnet is made of rare earth metals having high energy product.

The rotation shaft is supported with two miniature bearings so that it can rotate smoothly. The life of this sensor depends on these bearings, and long life performance is guaranteed by a high precision assembly.

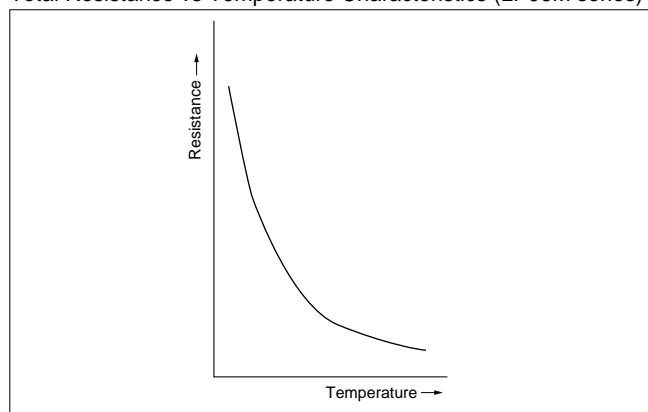
The figure shows the relationship between the magnet and the MR elements positions, the non-contact potentiometer equivalent circuit, and the relationship between the angle of rotation and the output voltage.



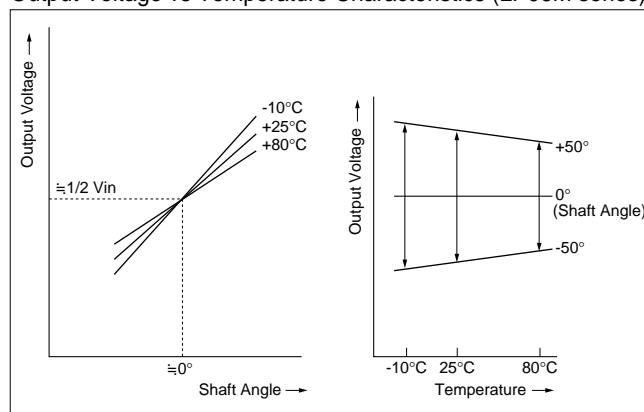
Reference Data

■ Temperature Characteristics

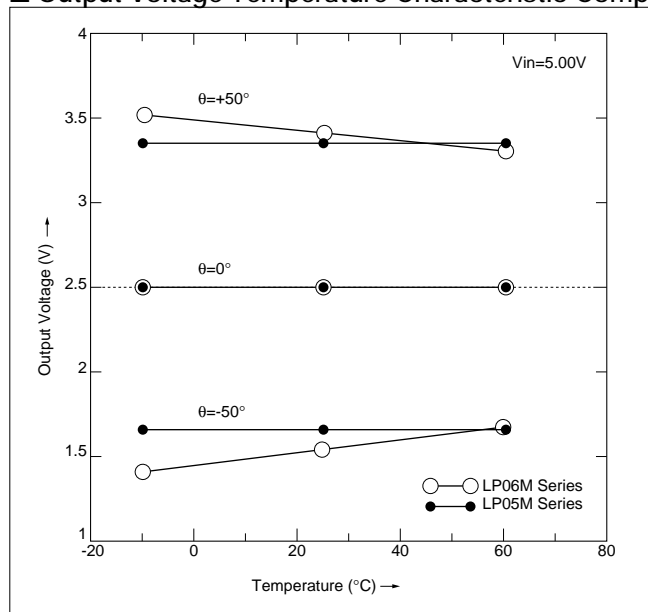
Total Resistance vs Temperature Characteristics (LP06M series)



Output Voltage vs Temperature Characteristics (LP06M series)



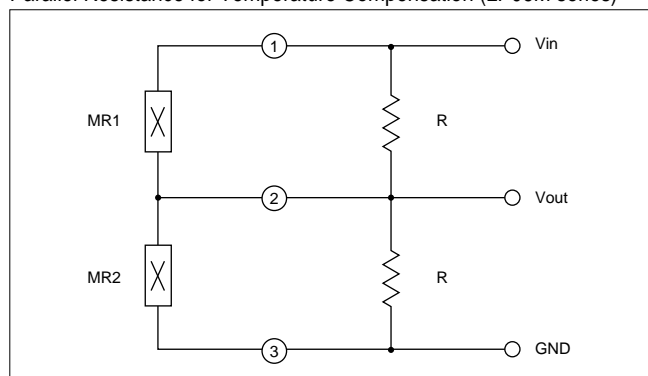
■ Output Voltage Temperature Characteristic Comparison Graph



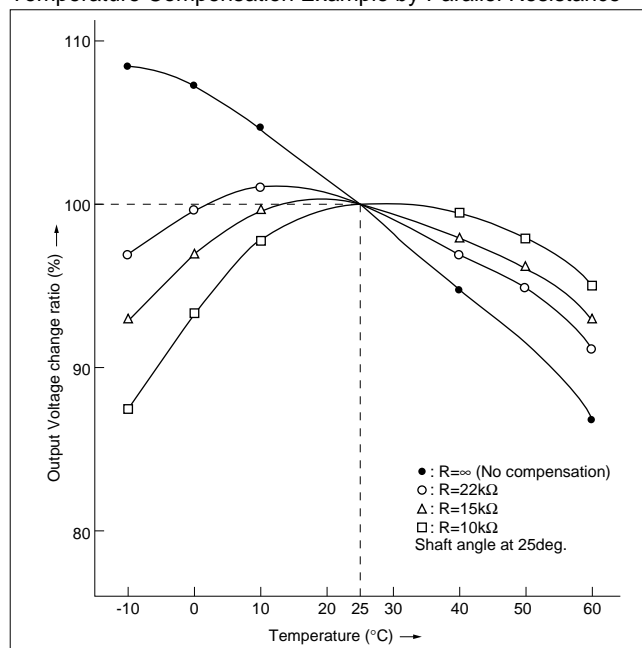
Reference Data

Temperature Compensating Method

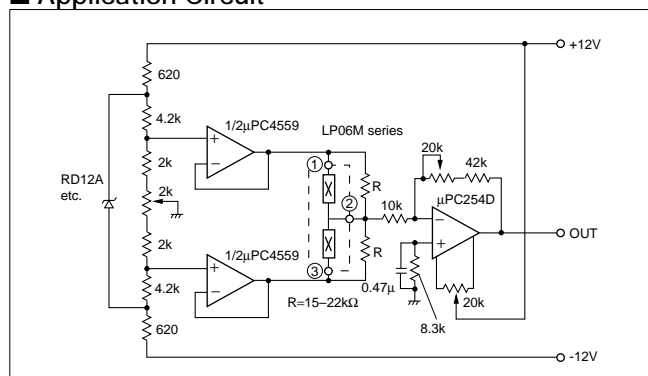
Parallel Resistance for Temperature Compensation (LP06M series)



Temperature Compensation Example by Parallel Resistance



Application Circuit



Technical Terms

■ Supply Voltage (Vcc)

Maximum voltage which can be applied to the sensor at the rated operating temperature.

■ Total Resistance

The resistance between Vcc and GND pin when the output voltage is a half of supply voltage (Vcc) by adjusting the shaft rotation angle position.

■ Effective Linearity Range

Angle range guaranteed linearity.

■ Sensitivity

Output voltage change per degree in the effective linearity range.

■ Individual Linearity

Individual linearity is obtained by following manner.

1. Get output voltages at predetermined shaft angles.
2. Calculate standard line which makes the deviations minimum.
3. Percentage of the maximum deviations from the individual standard line is the linearity.

The figure shows the meaning visually.

$$\text{Linearity} = C \div (V_{\text{max.}} - V_{\text{min.}}) \times 100(\%)$$

C:Max. deviation from the theoretical line.

Vmax.:Max. output voltage on the theoretical line.

Vmin.:Min. output voltage on the theoretical line.

■ Temp. Coefficient

The ratio of output drift to standard output of +25°C

■ Max. Rotation angle

Max. shaft rotation angle.

360deg. endless usually.

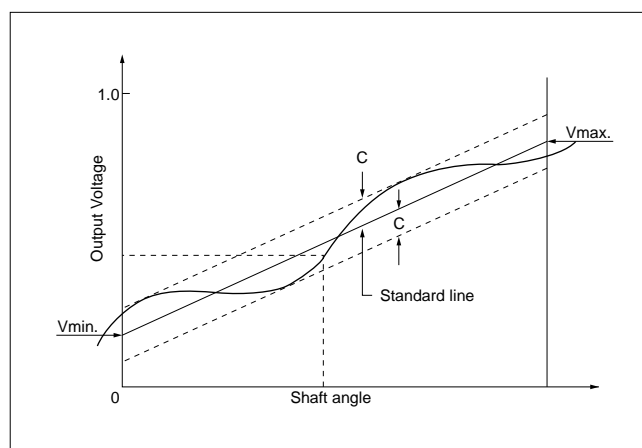
■ Max. Rotation Torque

Torque which is required to make the shaft start rotation.

Rotation torque increases when ambient temperature decreases.

■ Max. Shaft Load

Max. allowable load to the shaft.



Notice/⚠Caution/Part Numbering

■ Notice (Storage and Operating Condition)

1. Please do not apply mechanical shock or pressure on the product, especially to the shaft. Because it leads to change in the output level or destruction of magnetoresistive element.
2. Please do not use or keep the sensor in the corrosive gas(Cl₂, NO_x, SO₂, and so on). Metal case might be corroded due to it.

3. Keep the product away from water, chemical solvent and oil.
4. The terminal should be avoided excessive force, rotation or bent.
5. Avoid storing and using the product in the locations where the ambient temperature changes suddenly.

■ Notice (Soldering and Mounting)

1. Wiring should be avoided while supply voltage is applied.
2. Do not place the product near high voltage lines or high current lines.
3. Please avoid placing magnetic material or magnetic field generator other than the detected object near to the sensor. It could cause change in the output level, resulting in malfunction of the finished goods
4. Hand soldering should be applied. Soldering should

be done in following condition;

Temperature of soldering iron: 350+/-10 degree C

Period of time: Within 3 seconds per point

Distance from case: Over 1.5mm

5. Flux should be rosin flux and its chlorine content should be no more than 0.2wt%.
6. Flux cleaning should be done by hand brushing.
7. Prevent the flux cleaning solvent from splashing on the product.

■ ⚠Caution (Handling)

1. Because this sensor contains a permanent magnet, it could damage magnetic signal in the writable magnetic card such as train ticket and pre-paid card. Please consult with us before applying it in such circumstance.
2. Be sure to provide an appropriate fail-safe function on your product to prevent a second damage that may be caused by an abnormality or failure related to our product.

● Part Numbering (The structure of the "Global Part Numbers" that have been adopted since June 2001 and the meaning of each code are described herein.) (If you have any questions about details, inquire at your usual Murata sales office or distributor.)

Non-contact Potentiometers

(Global Part Number)

LP	05M	4R1AA	
----	-----	-------	--

① ② ③ ④

① Product ID

② Type

③ Characteristics

④ Individual Specification Code

* Global Part Number shows only an example which might be different from actual part number.

* Any other definitions than "① Product ID" might have different digit number from actual Global Part Number.

⚠Note:

1. Export Control

〈For customers outside Japan〉

Murata products should not be used or sold for use in the development, production, stockpiling or utilization of any conventional weapons or mass-destructive weapons (nuclear weapons, chemical or biological weapons, or missiles), or any other weapons.

〈For customers in Japan〉

For products which are controlled items subject to the "Foreign Exchange and Foreign Trade Law" of Japan, the export license specified by the law is required for export.

2. Please contact our sales representatives or product engineers before using our products listed in this catalog for the applications listed below which require especially high reliability for the prevention of defects which might directly cause damage to the third party's life, body or property, or when intending to use one of our products for other applications than specified in this catalog.

- | | |
|-----------------------------|---|
| ① Aircraft equipment | ② Aerospace equipment |
| ③ Undersea equipment | ④ Power plant equipment |
| ⑤ Medical equipment | ⑥ Transportation equipment (vehicles, trains, ships, etc.) |
| ⑦ Traffic signal equipment | ⑧ Disaster prevention / crime prevention equipment |
| ⑨ Data-processing equipment | ⑩ Application of similar complexity and/or reliability requirements to the applications listed in the above |

3. Product specifications in this catalog are as of March 2002. They 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. If there are any questions, please contact our sales representatives or product engineers.

4. Please read rating and ⚠CAUTION (for storage and operating, rating, soldering and mounting, handling) in this catalog to prevent smoking and/or burning, etc.

5. This catalog has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specification or transact the approval sheet for product specification before ordering.

6. Please read CAUTION and Notice in this catalog for safety. This catalog has only typical specifications. Therefore you are requested to approve our product specification or to transact the approval sheet for product specification, before ordering.

7. Please note that unless otherwise specified, we shall assume no responsibility whatsoever for any conflict or dispute that may occur in connection with the effect of our and/or third party's intellectual property rights and other related rights in consideration of your using our products and/or information described or contained in our catalogs. In this connection, no representation shall be made to the effect that any third parties are authorized to use the rights mentioned above under licenses without our consent.

8. No ozone depleting substances (ODS) under the Montreal Protocol are used in our manufacturing process.



<http://www.murata.com/>

Head Office
2-26-10, Tenjin Nagaokakyo-shi, Kyoto 617-8555, Japan Phone: 81-75-951-9111

International Division
3-29-12, Shibuya, Shibuya-ku, Tokyo 150-0002, Japan
Phone: 81-3-5469-6123 Fax: 81-3-5469-6155 E-mail: intl@murata.co.jp