

FAQ

●About Potentiometers

◆ General

Q1 How much voltage can we input to the potentiometer?

A1 Maximum input voltage (V) defined by rated dissipation can be calculated by using the following formula.

However this value is only calculation value, please design with 80% approx. of it.

$$V = \sqrt{W \times R}$$

V: Maximum Input Voltage

R: Total Resistance - Total Resistance Tolerance

W: Rated Dissipation

Note: Built-in Amplifier sensors that are MR-Element type (Blue Pot) and Hall-IC type (Orange Pot) are shown
Input voltage on catalog or drawing.

Q2 How to choose total resistance value?

A2 Potentiometer's total resistance value is 1/100 max. (MR-Element type (Blue Pot) is 1/500 max.) of "Load resistance", and also choose total resistance value which is not exceeded its of Rated dissipation from input voltage.

$$\frac{RL}{100} > \text{Resist. Value (R)} > \frac{V^2}{P \times 0.5}$$

R: Total Resistance of Potentiometer (ohm)

RL: Load Resistance (ohm)

V: Input Voltage (V)

P: Rated Dissipation (W)

Note: Resistance value of MR-Element type (Blue Pot) is fixed by capacitance so that you cannot choose it.

Q3 We would like to use with narrower/shorter angle/stroke than effective electrical travel. Any problems?

A3 If you use the potentiometer with narrower/shorter angle/stroke than effective electrical travel, it will be no problem. However output range will be narrower/shorter in ratio to angle/stroke. If you would like to use with very narrow/short angle/stroke, please contact us for technical advice.

Q4 Life time?

A4 Life time end is defined by coming up to:

- Total resistance value will be changed to +10% from initial value.
- Linearity, Rotational torque & Output smoothness : 1.5 times of specifications.

At the actual usage, output noise by environmental condition such as vibration and dither may be appeared before the abovementioned life time end. For minimizing noise influence, load impedance of your circuit should be close to infinite large.

Q5 What does "Independent Linearity" mean?

A5 Please refer Category "Independent Linearity" in Technical Term.

Q6 How much is actual error when Independent Linearity is calculated to angle?

A6 If using angle/stroke is defined to full scale (FS), it is multiplied value of Independent Linearity (%).

$$\rightarrow X(\%FS) / 100 \times FS(^{\circ}) \quad X = \text{Independent Linearity}$$

Q7 What is "Total Resistance Tolerance"? Is it same as Accuracy?

A7 It is not relation with Accuracy. It is the tolerance of total resistance value.

Q8 How to connect the potentiometer?

A8 Terminal type is connected cables by soldering. Input voltage between terminal 1 and terminal 3 and output voltage between terminal 1 and terminal 2. There are some other types, leadwire and connector types. For these types, please refer each catalog.

Q9 How to mount the potentiometer?

A9 Angle Potentiometer has 3 mounting types, Screw mount (Fixed screws directly to the panel), Servo mount (Fixed by using mounting cleats to the panel) and Bushing mount (Fixed by a nut to the panel).

A10 Where we can buy your products?

A10 Our dealer list is on our website. (See "Global Support") If you cannot find any of your area, please contact us.

Q11 How many years is life time of the potentiometer?

A11 Our definition of life time of the potentiometer is not years. It is defined (Q4 / A4).

Life time will be affected by operating environment or your circuit structure. If it is even within life time, it may be occurred noise on output.

High wiper current will be caused of noise. Recommend to use the circuit which do not apply current to terminal 2 (wiper).

For minimizing noise influence, load impedance of your circuit should be close to infinite large. Recommendation is using Buffer amplifier which is used op-amp. However noises are existed many types, it is difficult to specify the best circuit.

Q12 Storage term of the potentiometer?

A12 Our guarantee is 1 year from shipping. If you do not use it, inside parts would be deteriorated.

Q13 What does "Step Response Time" of Tilt Angle Sensors mean?

A13 "Step Response Time" is the time required for returning 63% (time constant) output of static state (horizontal position) when it drastically move back from maximum tilt angle to horizontal position.

Thus it means how long it takes time for become stable. It does not mean that followability of tilt angle motion.

For more details, please refer Technical Term, "Step Response Time (Time Constant)".

Q14 Size of Hexagonal Wrench for DM-15?

A14 1.25mm (width across flat).

Q15 We have used contactless potentiometers with inverse position of index point. They are out of linearity sometime. Are they failure units?

A15 Some products output inverse position however output of inverse position is out of guarantee. Compensation range is fixed angle range so out of range may be out of linearity. For more detail, please contact us.

Q16 Are there any methods to change inverse output?

A16 Contact type potentiometers can be used by changing inverse connection of power supply line or output

between +V and OUT. However Built-in amplifier and Hall-IC type cannot connect inversely. It would be cause of failure. If you need inverse output product, it will be needed programming at our side. Please contact us.

Q17 Can you repair potentiometers?

A17 Potentiometers are small electronic device. Basically they are not repairable. Please buy new one.

Q18 Could you assemble the potentiometer with lead wires as custom model?

A18 Please contact us at first. For large quantity or serial orders, we may be able to assemble as custom.

Q19 Is the potentiometer different from the volume?

A19 The volume is one of the variable resistor. More precious accuracy variable resistor is called the potentiometer. Recently, the variable resistor is used as the position sensor than the volume.

Meanwhile, MIDORI's contactless potentiometers cannot be used as the variable resistor like the volume.

◆ Conductive Plastic Potentiometer (Green Pot)

Q1 I bought resistance value 1kohm potentiometer however actual unit was 1120ohm.

A1 Total resistance value has tolerance. This tolerance is mentioned on each catalogue.

Resistive element of Wire wound Potentiometer is produced with physically calculated so that tolerance is only about $\pm 5\%$, Tolerance of Conductive Plastic Potentiometer is $\pm 15\sim 20\%$ owing to variation in molecular of carbon.

Q2 When the unit was checked resistance value by the analog tester at the acceptance inspection, resistance value was within specification. However it was failed then.

A2 The analog tester current is quite high because they need to move the hand. Owing to Conductive Plastic Element is made by Plastic, the element would be burn-out by current heat if over-current was applied on the unit. Acceptable current of Potentiometer's output line is only 1mA max. We recommend you to use the digital tester for checking resistance value.

Q3 Which specification should I check for accuracy?

A3 Linearity is one of specification which is expressed the Potentiometer's accuracy. Linearity is the value how much output is linear-line. Compared logic linear –lines are classified according to the definitions of Independent Linearity, Absolute Linearity, Terminal Based Linearity & Zero Based Linearity.

Resolution of Conductive Plastic Potentiometer is infinitesimal as the reading accuracy.

Q4 Even though the potentiometer works little (or occasionally), the output become abnormal in a short period.

A4 If there is a micro sliding motion like dither or influence of vibration, it may cause wear of the resistive element and output noise may occur.

Q5 The potentiometer will be used where the temperature change is large. How much will temperature characteristic be affected by?

A5 Although the resistance value fluctuates by ± 400 ppm / K, the potentiometer outputs voltage ratio of the input voltage corresponding to the rotational position. For example, if the power supply is 10 V, the 5 V position will

be 50% of the effective electrical travel with either a 2 k Ω potentiometer or a 5 k Ω potentiometer. Therefore, there is little influence on actual use.

Q6 Is it possible to use the potentiometers in places with much dust?

A6 Dust on the resistive element inside the potentiometer may affect the contact between the resistive element and the wiper. Please select a dust-proof type potentiometer or cover it for preventing dust entering from the bearing part and the joint part of the potentiometer.

Q7 The resistance value of the potentiometer is higher than its specification, and shaft is not rotated smoothly.

A7 There is a possibility that the resistive element of the potentiometer is burned-out (see Q2 · A2). Please reconfirm input / output connection to terminals, input voltage, load impedance, etc.

Q8 Hear faint noise when the shaft of potentiometer is rotated.

A8 Contact noise of the resistive element and the wiper may occur.

Q9 The output (resistance value) characteristic was confirmed with the tester, however the maximum resistance value between terminal 1 and terminal 2 was not same as the total resistance value of the specification.

A9 The contact type potentiometer (W - w pot, Green Pot) has contact resistance at the contact surface between the wiper and the resistive element. Therefore, in the resistance value measurement between terminal 1 and terminal 2, the contact resistance may be added to the original resistance value and it may become larger than the total resistance value.

Q10 Is it possible to add a resistor in series with a contact potentiometer?

A10 For example, if a fixed resistance of 10% of the total resistance value is attached to the terminal 3 side (+ V), the output changes from 0% to 90%. Connecting to terminal 1 and terminal 2 has no effect on the output, however the difference in temperature coefficient of resistance between the potentiometer and the fixed resistor may affect the temperature characteristics and the output sensitivity may change.

Q11 What is the difference between the center tap (= C. T) and the intermediate tap?

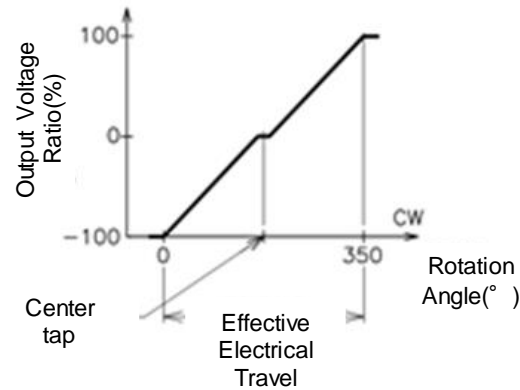
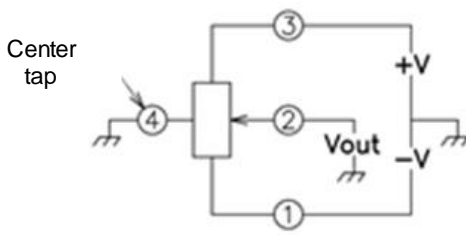
A11 The intermediate tap is the terminal between the terminals on both ends of the resistive element. The center tap (C.T) is at the center of the resistive element.

Q12 What is the difference between C.T (A) and C.T (B)?

Q12 The A tap has a short circuit width at the terminal part. On the other hand, the B tap has no short circuit width. The C. T of the A tap does not influence the linearity depending on its position. The B-tap has a short-circuit width of 2 to 3 °, and the linearity is worse because the output does not change in that part. Therefore, it is mainly used when using \pm power supply and using it by sorting based on center position etc.

【Example: CT-B circuit and output 】

Connection Diagram



◆ Magneto-Resistive Potentiometer (Blue Pot)

Q1 Does “Contactless” mean that it can be used with no connection mechanically like the optical sensor?

A1 “Contactless” means that the detection method is non-contact in order to change the output by a combination of a magnet closed to a magneto-resistive element /a Hall element. It is necessary to input a mechanical moment in order to obtain the output.

However, Tilt Angle type has a moment mechanism such as a pendulum inside so that it can output only by installing and energizing.

Q2 Is it possible to select resistance value?

A2 Detection part of The magneto-resistive element is a semiconductor. It cannot be accepted specific resistance value requirement like contact type potentiometers. With the contactless potentiometer, the allowable voltage (power supply voltage) that can be applied is specified. Please note that overvoltage will cause burn-out of the resistive element.

Q3 The output seems to be changing in Summer and Winter, morning and afternoon, why?

A3 Magneto-Resistive elements are semiconductors and are affected by temperature. Therefore, the potentiometer output is affected when the ambient temperature changes.

Q4 Our operating temperature is at + 50 ° C stable. Is temperature compensation necessary?

A4 If the temperature is constant, the influence of temperature drift is small. However, since the temperature difference between the operating and mounting the potentiometer causes drift of the output. If you want to reduce the drift of output, please select a potentiometer with temperature compensation.

Q5 Is it possible to correct temperature drift on the controller side?

A5 In case of temperature compensation by series / parallel resistance, we measure the temperature characteristics and supply each resistance value with minimum drift. The same effect can be obtained by connecting the resistance on the potentiometer's output line.

Q6 What is temperature compensation?

A6 The magneto-resistive element itself has temperature dependency (temperature characteristic). In addition, its

magnetic force also changes depending on temperature although the output of a magneto-resistive element changes due to changes in magnetic force. In order to suppress the output change due to these temperature changes, it is needed to added fixed resistors for balancing or a circuit with thermistor.

(Orange Pot has built-in temperature compensation circuit in Hall IC)

Q7 Can the response time of the tilt angle sensor be made faster?

A7 Damper (vibration suppression) is done with silicone oil. Response time improves if oil viscosity is lowered. However, since oil viscosity and output stability are in a trade-off relationship, it is necessary to evaluate sufficiently to determine the oil viscosity.

Q8 The output width is small. Is it output failure?

A8 The resistance value varies depending on the strength of the magnetic field which applied to the magneto-resistive element, and the difference between the part with and without the magnetic field is output. Therefore, the Blue Pot has a characteristic that output width is quite small.

◆Hall IC products (Orange Pot)

Q1 The tester (resistance value) is used for checking the characteristic and positioning of the sensor, but the resistance value does not change.

A1 Orange Pot and part of Blue Pot are built-in operational amplifier types, so resistance value of potentiometer cannot be measured, but it is not a malfunction. It is necessary to apply a specified voltage to them for measurement.

Q2 Input power is connected inversely, but inverse characteristics cannot be output.

A2 Since Orange Pot uses (partially excluded) Hall IC which is combination with a Hall element and an amplifier, it does not work with inverse connection. Blue Pot with built-in amplifier type is also the same. Please contact us if inverse output is required.

Q3 What kind of static electricity countermeasure is necessary?

A3 Hall IC is a semiconductor. If you touch to the terminal, the end of lead wire, the connector pin, etc. directly, the static electricity charged on the body may jump and then the Hall-IC may be damaged. It is recommended to work on the earth wristband or conductive mat to prevent static charging. Please note that the tip of the lead wire may touch the worker's body without knowing it. Also, be careful of the static electricity generated when using the potentiometer. Please take care that static electricity will not be charged on the potentiometer and its surroundings.

Q4 What is the electromagnetic immunity?

A4 It is tolerance to external radio noise (such as those generated from wireless and electronic devices). A unit such as 100 V / m is the electric field intensity. In general, the handy radio is about 1 to 10 V / m, and the transmitting antenna of the broadcasting station is close to 100 V / m.

For reference, please also refer to the term "[Electromagnetic immunity \(EMS\)](#)".

Q5 What is the influence of the external magnetic field?

A5 According to the experimental results, output fluctuation of about 1% can be seen with a magnetic field of about 10mT although it depends on the product.

For reference, please also refer to the term "[Effect of external magnetic field](#)".

Q6 What is 12 bit resolution means?

A6 The resolution of the Hall IC is 12 bits (= 4096 counts) with respect to the power supply.

However, the resolution with respect to the output voltage decreases with the output range. For example, when the output range is 10 - 90% (FS = 80%), the resolution is 80% (= 3276) of 4096 counts.

Q7 How is the response time of Orange Pot determined?

A7 The Hall IC performs A/D conversion internally, and the calculation speed in that logic is inevitably determined. Specification is different from each model. For details, please contact us.

Q8 What happens when the power supply voltage exceeds the prescribed DC 5 V or when the power supply drops?

A8 It depends on the Hall IC which is used for the product, so please contact us.

Q9 Can we get 0V output?

A9 Although it outputs in the voltage division ratio, 0 V (0%) does not come out depending on the performance of the built-in amplifier. Also, max power (100%) is not output for 5 V power supply.

Q10 What happened does Effective electrical travel 360 ° potentiometer output at 360°. (=0°.)?

A10 Actually, the effective electrical angle is 359 ° based on the temperature characteristics and hysteresis. Between 359 ° and 360 ° (= 0 °), the output changes abruptly from the maximum to the minimum, but it will not be interrupted.

Q11 What is the output mode when the potentiometer is disconnected?

A11 It depends on the Hall IC which is used for the product, so please contact us.

●About encoders

◆About general product

Q1 What is the difference between the potentiometer and the encoder?

A1 Both are a kind of position sensor. There are various definitions of terms, but MIDORI distinguishes between analog output products as potentiometers and digital output products as encoders.

Q2 What is the difference between the incremental and the absolute encoder?

A2 Incremental counts pulses generated corresponding to the rotation angle from the measurement starting point. In general, the rotary encoder outputs a two-phase pulse train having a phase difference of 1/4 period with respect to the angular displacement of the input shaft. The phase relation of this 2-phase pulse train is designed to reverse according to the rotation direction. This makes it possible to determine the direction of rotation. The number of pulses output per rotation (360 °) is determined by the resolution of the encoder. Absolute measures the absolute angular position of one revolution or multiple revolutions with respect to the

origin. Reset operation etc. are unnecessary after turning on the power supply.

Q3 What is resolution? Is difference from accuracy?

A3 The resolution of the absolute encoder represents the minimum detectable angle unit for one rotation (360 °).
The resolution unit is [bit]. Accuracy is a measure of its output's veracity.

For reference, the count number and angle of resolution 10 to 22 bits are shown below.

[bit]	[Counts]	[°]	[sec]
10	1,024	0.3515625	1265.63
11	2,048	0.1757813	632.81
12	4,096	0.0878906	316.41
13	8,192	0.0439453	158.20
14	16,384	0.0219727	79.10
15	32,768	0.0109863	39.55
16	65,536	0.0054932	19.78
17	131,072	0.0027466	9.89
18	262,144	0.0013733	4.94
19	524,288	0.0006867	2.47
20	1,048,576	0.0003433	1.24
21	2,097,152	0.0001717	0.62
22	4,194,304	0.0000858	0.31

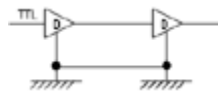
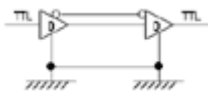
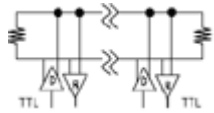
Q4 What does "position data update period" mean?

A4 The encoder computes the position internally and outputs it. This is the time interval from the determination of the current position data to the determination of the next position data.

Q5 What is RS-422 interface?

A5 It is one of serial interface standards. The transfer rate is faster than RS-232C used in common personal computers, etc., and its speed is up to 10 Mbps. It is also possible to transfer data over long distances, and the cable length on the communication standard is 1.2 km at the longest.

For reference, a table comparing RS - 232C, RS - 422, RS - 485 is shown below.

Parameter	RS-232C	RS-422A	RS-485
Transmission mode	Simplex	Multipoint Simplex	Multipoint Multiplex
Max. number of connected units	1 Driver 1 Receiver	1 Driver 10 receiver	32 Drivers 32 receiver
Max. transmission rate	20Kbps	10Mbps	10Mbps
Max. cable length	15m	1200m	1200m
Operating mode	Single ended	Differential	Differential
Connection			
Characteristic	Short distance Full duplex 1: 1 connection	Long distance Full duplex / half duplex 1: N connection	Long distance Full duplex / half duplex Connection of N: N

Q6 What are the output formats ASI, SSI, and SPI?

A6 Please see the comparison table below.

Communication Interfaces		Clock Input	Overview
ASI	Asynchronous serial interface	No	Output is constant interval from the encoder. It is necessary to match Baud Rate.
SSI	Synchronous serial interface	Yes	The serial data is output according to a clock from the outside. It is widely used in the industry as a standard for serial interfaces between a master (eg, controller) and a slave (eg, sensor).
SPI	Serial Peripheral Interface	Yes	The serial data is output according to a clock from the outside. Proposed by Motorola. Normally, it consists of three or four connection lines, and communication of several Mbps is possible.

◆Magnetic Encoder

Q1 What is the advantage of magnetic type?

A1 Generally, magnetic type is less susceptible to environmental influences (dust, vibration, temperature, etc.) than optical type. In addition, it is relatively easy to change the resolution (including high resolution) by changing the resolution of the magnetic scale.

Q2 Will the encoder performance be affected near the motor etc?

A2 Inside the magnetic encoder, a magnet and a magnetoelectric conversion element (an element that converts a magnetic field generated by a magnet into an electric signal) are used. MIDORI designs that it is hard to be affected by the design of the magnetic circuit as much as possible, however there is a possibility that the precision etc. may be affected if the case where a strong magnet is arranged close to the encoder. Please contact us in advance.

Q3 What should be kept in mind for installing encoder?

A3 In order to fully demonstrate the precision of the encoder, the installation error between the rotating shaft of the user's equipment and the rotating shaft of the encoder should be less than the specified value and use coupling.