

# Technical Data

## Magnetic Encoder

### ■Overview

A magnetic encoder is a generic term for an encoder that has a magnet and a magnetoelectric conversion element. As a major classification, MIDORI distinguishes between a potentiometer and an encoder by difference of output (analog / digital output).

Since the magnetic encoder is non-contact type and excellent in environment resistance, highly accurate and highly reliable position detection is possible.

### ■Features

In general, the magnetic encoders have the following features.

- Because there are few physical restrictions and increase of components, high resolution can be achieved at a small size and low cost.
- It can operate correctly even in a dusty environment.
- Compared to the optical type, it is easy to reduce current consumption because there are few electronic components.

### ■Operating principle

#### 1. Detecting element

Figure 1 shows an example of a magnetoelectric transducer.

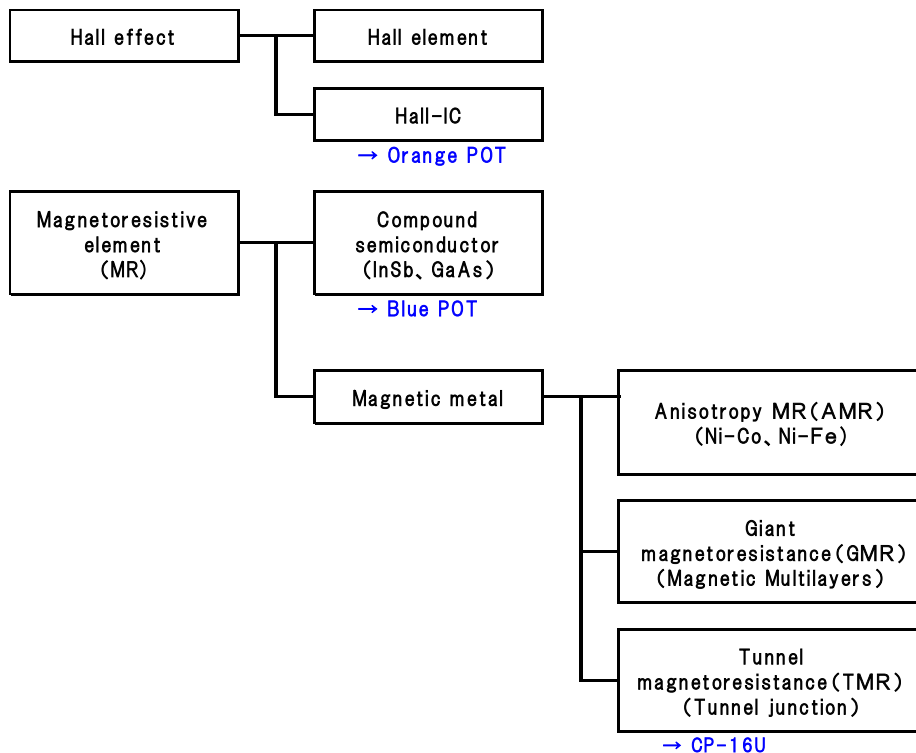


Fig.1: Magnetoelectric conversion element

#### 2. Detection method

Generally, the magnetic encoder consists of a combination of a magnetoelectric conversion element and a magnet (permanent magnet). When the shaft of the product rotates, the magnet attached to the shaft rotates, and the magnetic flux density applied to the magnetoelectric conversion element changes. The magnetoelectric transducer outputs position information of the shaft by converting the change in magnetic flux density into an electric signal.

Although the output of many magnetoelectric conversion elements is analog signals, signal amplification and digital conversion are performed by the signal processing circuit inside the encoder, and finally output as serial signals. (Fig. 2)

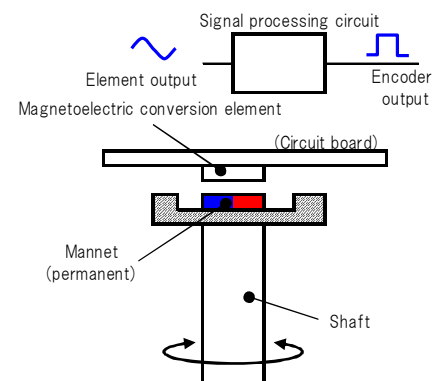


Fig.2: Principle of operation (rotation type)

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Generally, it is said that the magnetic type is less susceptible to the use environment (dust, vibration, temperature, etc.) compared to optical type. In addition, it is said that it is easy to realize a relatively small and high-resolution absolute encoder.

Since the operation principle itself of the magnetic detection part is the same as the non-contact type potentiometer, please refer to the following technical document on our HP.

- About magnetoresistance element potentiometer (Blue Pot)
- About Hall element potentiometer (Orange Pot)

### 3. Other detection method

In addition to the magnetic type, the detection method of the encoder is as follows.

#### Optical (photoelectric) type

It consists of a slit plate (Fig. 3) on which scales and cords are formed, a light source (such as LED) and a light receiving element (such as a phototransistor).

The on / off signal of the light passing through the slit is output as the information of the rotational position.

Unlike the magnetic type, it is not adversely affected by the surrounding magnetic field, so it can be used for applications that generate a strong magnetic field.

On the other hand, there are demerits such as weak against foreign objects such as dust and oil mist that may block light.

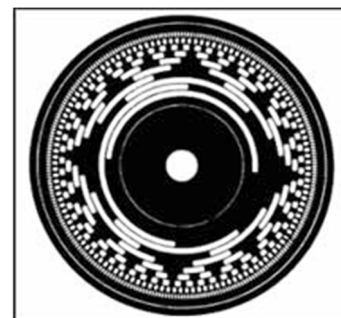


Fig.3: Example of optical slit plate

#### Resolver

When an excitation signal is supplied to a rotor type winding via a rotary transformer, signals that are parallel-modulated by a sine and a cosine wave are output from two pairs of detection coils installed on the stator side.

Sine and cosine wave signals corresponding to the rotation angle are extracted by synchronous detection. Although the structure is simple and excellent in environmental resistance, there are demerits such as difficulty in achieving high accuracy.

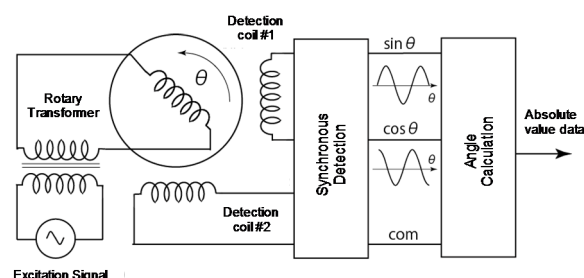


Fig.4: Detection method of resolver

#### Electromagnetic induction type

Please refer to our HP's "IncOder Series" for detailed technical information.

### ■ Resolution

Basically, high resolution is required for highly accurate measurements.

In order to increase the resolution of magnetic encoders, the technique of electrical interpolation is used. Electrical interpolation methods include resistance division, balanced modulation, and AD converter (ADC) methods.

In our magnetic encoder "CE 36 M series", the resolution (11 to 13 bits) has been decided by this electrical interpolation technique.



### Handling Instruction

#### 1. For safety

##### 1) Installation environment

- (1) Do not use in flammable or explosive gas environments. It may cause damage or burnout.
- (2) Please use seal type in dust, oil, water etc. environment. Also, please contact us in the case of a gas or organic gas environment containing significant salinity. Please note that products without IP notation in the catalog are not waterproof. It may cause breakage or burnout due to disconnection or short circuit of the internal circuit.
- (3) Since it may be affected by an external magnetic field, please confirm it well in the installation environment. It may cause measurement error.

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## 2) Power supply, wiring

- (1) Do not apply voltage exceeding the rated voltage or AC power. It may cause breakage or burnout.
- (2) Do not connect or disconnect while power is on. It may cause damage or electric shock.
- (3) To prevent miswiring, be sure to check the wiring before installation. It may cause breakage, burnout and burns.
- (4) Handle the product in an environment with static electricity countermeasures. It may cause damage or breakage.

## 3) Others

- (1) Please do not add processing and disassembling of the encoder purchased absolutely. It may cause destruction or damage, which may cause electric shock or burns.
- (2) For storage, please avoid places such as temperature, dust, salt and organic gas.
- (3) In case of long-term storage, after dehumidification, please seal with moisture-proof agent-containing polyethylene bags.
- (4) Falling etc. will cause destruction, so please handle with care.

## 2. Static electricity

Encoders are precision products and many semiconductor parts are used.

Static electricity may be charged unexpectedly due to various factors, such as when the surrounding air is dry or wearing chemical fiber. Depending on such handling and use environment, the element may be destroyed by static electricity which was unknowingly charged. Therefore, in addition to the electrostatic withstand voltage standard between the terminals of the product, please also pay attention to the following circumstances after mounting on the equipment.



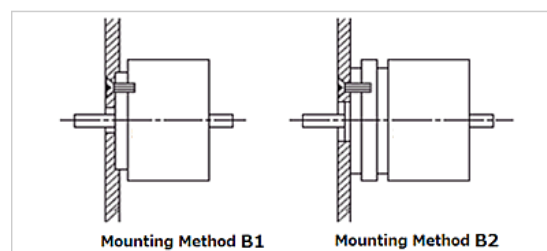
**Caution:ESD**

- 1) Be sure to touch the ground and remove the charging during work such as installation.
- 2) When touching the sensor directly, please do it in the state that it is not charged.
- 3) In particular, when there is an electric wire, please be careful not to touch the charged body with the tip of the electric wire (conductor part).
- 4) Before attaching the sensor to the equipment, please make the equipment and the sensor case the same potential.
- 5) After installation, it is recommended to design the sensor mounting part and the power supply housing to have the same potential.

## 3. Mounting method

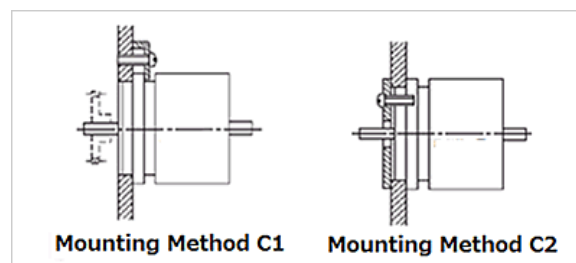
### 1) Screw mount (B1, B2)

- Secure with screws to the tapped hole on the mounting surface.
- Make sure the mounting screws are not too long.
- Make sure to use mounting screws only at specified positions.
- In the case of B1, please make the shaft hole diameter sufficiently large. Rotation failure may occur due to the shaft rubbing.



### 2) Servo mount (C1, C2)

- Use the attached mounting bracket to hold the flange and secure it to the panel. This method is suitable for easily adjusting the origin position. After rough adjustment, fine adjustment is possible while rotating the main body.
- Please make sure that there is no looseness in the hole diameter for fitting the flange.
- When turning the main body, please loosen the screw for attachment sufficiently.
- The outer shape such as gears and couplings is smaller than the hole diameter for fitting, which is convenient when assembling.
- In the case of C1, please use the mounting claws at equally spaced locations.



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## 3) Shaft (rotating shaft)

Alignment errors between the encoder shaft and the instrument shaft cause a decrease in bearing life. Flexible coupling is absolutely necessary for connecting shafts. It is recommended to use the coupling described in each product.

Alignment error (argument, eccentricity) may cause damage to the sensor or measurement error. Please use flexible coupling within the allowable range.

- (1) Be careful not to apply shock to the shaft when attaching the coupling to the shaft. It may be damaged.
- (2) If the shaft of the encoder and equipment is attached to the rigid, an excessive load may be applied to the shaft of the encoder, and the bearing may be damaged.
- (3) Please install so as not to exceed allowable shaft load (both thrust and radial). It may cause damage.

## ■Unit

This catalog is expressed in international unit system (SI).

·torque	1kgf·m=9.80655N·m	1gf·m=9.80655mN·m	1N·m=0.10197kgf·m=101.97gf·m
·force	1kgf=9.80655N	100gf=980.655mN	1N=0.10197kgf=101.97gf    5N≒500gf
·acceleration	1G=9.80655m/s <sup>2</sup>	150m/s <sup>2</sup> ≒15G	500m/s <sup>2</sup> ≒51G
·Magnetic flux density	1G=1×10 <sup>-4</sup> T		

## ■Guaranty

1. If our products are intended to be used for any applications that required high reliability such as nuclear power, satellite, and medical devices, please contact us before purchasing.
2. Environmental specifications that are indicated on this web catalog are guaranteed based on the test conditions established by our company. It is not guaranteed the performance in actual use. When making a decision to adopt our products, please be sure to examine the products by mounting and testing them beforehand at your own risk.
3. Although specifications and handling instructions of each product were offered in this web catalog, the function may be limited depending on the handling conditions. When making a decision to adopt our products, please obtain detailed documentations of the products from us.
4. As a principle, we cannot provide compensation for any damages to the customer's equipment or device caused by the breakdown or malfunction of our products.
5. Our products are electronics components. Repair or replacement is not supported except some of the products.
6. We do not accept any returns or exchanges for the product. Please carefully check the specifications of the product before placing an order.
7. The content of this website is subject to change without notice for the sake of improvement.
8. Please contact the sales department if you have any questions or concerns.

## ■Notes on using this HP catalog

·About product specification change

Please note that the items described on this website may be changed without prior notice.



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