Magnescale technology essential for high-performance machine tools

Magnescale, which was developed based on Magnescale’s advanced magnetic technology, adapts magnetism to the measurement principle, thus far less affected by the condensation or oil problems commonly found in machine tools and always making stable and precise position measurement possible. Magnescale with high precision and high environmental resistance supports the front line of your manufacturing.

The product name “Magnescale” is trademark of Magnescale Corporation.
What is Magnescale?

Mounting allowance
Magnescale is constructed so that the sensor for signal detection slides along the guide in the scale with bearings to detect the position. Therefore, it can perform stable, high-precision detection even in the presence of a positional deviation of the scale or head caused by installation or disagreement in parallelism with the machine guides.

Vibration and impact resistance
Magnescale primarily uses ferrous members as the housing material to protect the detector section, thereby realizing the high vibration resistance and impact resistance characteristics. In the SR80 series, furthermore, it employs multi-point fixation construction in addition to the housing with high rigidity, achieving the industry’s top class vibration resistance and impact resistance.

Thermal characteristics
Magnescale have the same linear expansion coefficient as that of cast iron used for the structure of general machine tools. Therefore, it exhibits the same behavior as the equipment in which it is installed even in environments where temperature changes, making very stable control possible. In particular, the SR80 series scales can be installed in close contact with the equipment; heat exchange with the equipment is effectively achieved, enabling them to attain consistent accuracy even in an environment in which temperature changes occur.

Resistant to condensation and oil
Magnescale employs the magnetic detection principle, thus far less affected by the condensation or oil problems inherent in machine tools and making stable and high precision operation possible in severe environments.

Scale construction
The magnetic signal detection sensor is supported by a bearing, maintaining a non-contact status with respect to the scale material. This bearing runs on the guide incorporated in the scale and detects the equipment’s traveling distance. Therefore, the sensor has very small sliding resistance, enabling the scale to be used even for equipment with small driving force. Moreover, the use of a specially constructed sealing structure helps to prevent dust and dirt from entering inside the scale. In addition, air purging the scale provides further protection.

The advantage of scales

A scale is mainly used for machine tools and detects the position of a component such as the stage to which it is installed. Feeding back position information from the scale eliminates errors caused by the following and enables more precise machining to be accomplished.

- Thermal expansion of a ball screw
- Pitch error of a ball screw
- Backlash

In order to maximize the performance of the scale mounted on a machine tool, it is vitally important to keep a scale signal constant. Magnescale, possesses environmental resistance against contamination by condensation or oil, which makes the signal unstable causing signal errors. Thus, Magnescale is suitable for high-precision position detection.
# Selection Guide

<table>
<thead>
<tr>
<th>Measurement length (ML: mm)</th>
<th>Accuracy</th>
<th>Resolution</th>
<th>Output signal</th>
<th>Type</th>
<th>Cross section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear scale 70mm-2,040mm</td>
<td>3+3ML/1,000μm-p</td>
<td>0.01μm, 0.05μm, 0.1μm, 0.5μm, 1μm</td>
<td>Absolute serial bidirectional signal</td>
<td>SR77</td>
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<td></td>
<td>5+5ML/1,000μm-p</td>
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<td></td>
<td>A quad B signal Ref. point. Line driver signal</td>
<td>SR74</td>
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<td>34</td>
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<td>140mm-3,040mm</td>
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<td>Absolute serial bidirectional signal</td>
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<td>A quad B signal Ref. point. Line driver signal</td>
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<tr>
<td>Rotary 360°</td>
<td>±2.5second</td>
<td>Maximum output pulse counts 2^m-33,554,432p.p.r</td>
<td>Absolute serial bidirectional signal</td>
<td>RU77</td>
<td><img src="image" alt="Image" /></td>
<td>38</td>
</tr>
</tbody>
</table>
Measurement Principle

Scale material
The magnetic recording media, or the raw material for scales, was developed as the scale material that realizes high-density recording at high precision, based on Magnescale's magnetic technology that has been cultivated for magnetic tapes and magnetic discs. The scales adopt magnetic metal powder that is used for data storage systems because of its high density and reliability. Its magnetic characteristics are that Br: 0.2 to 0.25T and Hc: approximately 120 kA/m. The magnetic media form a strong coated surface resistant to cutting fluids and strong alkaline solutions through a hardening process after coating.

Magnetic powder
Magnetic metal powder used for data storage systems because of its high density and reliability Br: 0.2 to 0.25T, Hc: Approx. 120 kA/m

Coating
Resistant to cutting fluids and strong alkaline solutions

Coating
Magnetic material is coated from the tip of the die head onto a scale.

Signal detection sensor (MR sensor)
The MR sensor is a thin-film sensor patterned on a PWB. It obtains the signal output through the change in the resistance value according to the size of magnetic field leakage from the scale when it moves keeping a certain distance from the magnetic media (scale) to which magnetic signals have been recorded as shown in Figure 1. In this case, however, the signal obtained from the resistance change characteristics of the sensor and the status of magnetic field leakage from the scale also contains distortion components (such as harmonic components) in addition to the sine wave components of the signal pitch. Therefore, the sensor is positioned by shifting it in the operating direction by the distance of 1/6 of another signal pitch λ (Figure 2). In this case, when third-order harmonic components are observed, the following Equation “A” is established for three-fold periodic signal components because 1/6 of the signal pitch λ is π/3 in the periodic phase, and the phase is shifted by 180° with respect to the three-fold periodic signal components of the first sensor, resulting in a reverse signal. The addition of this signal enables the third-order harmonic components to be cancelled out. That is, the combination of these sensors enables harmonic components of the 3n-th orders to be cancelled out. In the same way, the combination of multiple units of the sensors also enables the harmonic components of other orders such as 5th and 7th orders to be cancelled out simultaneously.

In detection sensors, the circuit is generally formed in a bridge structure for stability of the temperature characteristics, etc. as well. In that case, distortion of odd numbered orders are cancelled out by the arrangement of sensors configuring a bridge. Therefore, the use of the bridge structure and the arrangement of the sensor configuration that cancels out harmonic components of the extent of the 3rd, 5th, and 7th orders enable a signal close to sine waves to be obtained. In this way, the scale achieves high precision and high resolution by digitization of electrical interpolation based on a distortion-less signal, coinciding with various electrical signal compensation.
Incremental signal

An incremental signal is taken as the source of scale performance and does not have absolute positional information of length longer than the wavelength. In magnetic scales, the S and N poles are regularly arranged at wavelength intervals.

**Automatic consecutive compensation**
Because signals are detected at a maximum resolution of 0.01 μm, consistent signal detection is achieved at high precision even in case of unmatched parallelism or in an environment in which the temperature varies.

**Output signal**
- Wavelength: 40, 80 μm, etc.
- Phase angle accuracy: Approx. 0.1 to 0.2 μm

A sinusoidal signal of approx. 1/400 (62 dB) is required.

**Factors that deteriorate the phase angle**
- DC, gain, or phase variations
- Noise
- Harmonics

**Improved signal by the arrangement of MR-element patterns**
Improved signal stability, etc. by harmonics and DC cancellation or averaging effects

**Compensation**
Automatic consecutive compensation

![Example of the measurement of Lissajous figure](image)

\[ \begin{align*}
\sin(\theta) + \sin(\phi) &= 0 \\
\cos(\theta) + \cos(\phi) &= 0
\end{align*} \]

Absolute signal

An M code is a code string consisting of two values (0 and 1) known as M sequence and is a cyclic code whose period is \( N = 2^n - 1 \). Where \( \text{“n”} \) is the order of a primitive polynomial that generates an M code. In the scales, it is the number of digits of M-code bits (value written as \( \text{“18 bits”} \) above). There is a primitive polynomial for each order, and a code string is serially created from any initial value. As the creation and features of codes, the following shows an example of the order “8” in the condition that the number of digits of a bit = the order of a primitive polynomial. Assuming that a creating polynomial is \( F(x) = x^8 + x^2 + x^3 + x^4 \) and the 8-bit initial value is 00000001, \( x^0 + x^2 + x^3 + x^4 = 0 + 0 + 0 + 1 \) is exclusive OR and the order and bit are in reverse, so that a higher-level order corresponds to a lower-order bit, the following performs the same logical calculation for data 00000011 in which the initial value is moved by one, to obtain code 000000110001110101… In this case, when the code string created by the order “8” is observed as 8-bit data (a set of 8 pieces) one by one, the code strings of 8-bit data can be obtained as follows: 00000001, 00000011, 00000110, 00001100, 00011001, …

In this case, for M code = cyclic code, when the sequence is cyclically replaced in a period \( \text{(N = 2^n)} \), the code word of that sequence always becomes different. That is, the same value of 8-bit data is never presented. Moreover, the code string is composed of apparently random code strings, which are not arranged in an ascending or descending order or in other rules as seen from the example above.

**Configuration of absolute encoder detection**
M codes are non-repetitive codes in which n-bit M codes are created by a generating polynomial of n bits and that there is no identical code among 2n-1 data. Because codes of 2n are required for a rotary encoder, it adopts the 2-track M-code system that adds 0 (all 0). - Lambda: 40, 80 microns - Number of M-code bits: Up to 18 bits

Figure 1 below: Example of 4-bit codes

![Figure 1](image)

**Incremental/absolute signal record reproduction to signal composition**
- Phase angle in \( \lambda \) is calculated from an incremental signal and taken as positional information in \( \lambda \).
- An address in \( \lambda \) is calculated from each absolute signal and an M code is recognized by M-code sensors (multiple).
- The M code is decoded into an address in \( \lambda \).
- Both data are added.
- Data format conversion to communication protocol
- Communication (Figure 2 below)

![Figure 2](image)
The He-Ne stabilized laser, the standard for accuracy measurement, is frequency calibrated in-house using the "633-nm iodine molecular absorption line wavelength stabilization Helium neon laser device for length," which is the specified secondary standard of Magnescale. This specified secondary standard is calibrated by the specified standard of the National Institute of Advanced Industrial Science and Technology (AIST), a national standard. In this way, Magnescale has been qualified as the calibration approval operator of "length" and magnetic scales manufactured by Magnescale are provided with traceability to the national standard.

Accuracy

The grating of an incremental signal and the bit information of an absolute signal of the scale are written to a magnetic track using the recording head. For the recording head position during this write, the writing position of each signal is determined based on the position information of a light-wave interferometer using the He-Ne stabilized laser. Therefore, the position of each signal on the recording head (= accuracy) can be determined very accurately. The accuracy of the completed magnetic scale into which a detecting head is incorporated is also measured by comparing it with the positional information of the light-wave interferometer using the He-Ne stabilized laser, which becomes accuracy data.

Traceability Flow Chart (Length)

National Primary Standards
- National Institute of Advanced Industrial Science and Technology (AIST)
- Iodine saturation absorption stabilized He-Ne laser at 633nm
- Speed of light (laser) c=299792458 m/s

National Secondary Standards
- Magnescale Corporation
- Calibration product (Customer’s equipment) + Equipment of SMS

Practical Standards
- Iodine saturation absorption stabilized He-Ne laser at 633nm
- Stabilized He-Ne Laser (633nm)

International Committee for Weights and Measures (CIPM)
International Bureau of Weights and Measures (BIPM)
Installation method

Linear Scale SR87

Scale and slider installation notes
- Do not turn on the power before installing the scale.
- Install the scale with the opening on the scale unit facing downward. If the opening cannot be turned downward, it should face horizontally. Never install it facing upward. (Fig. 1)
- Remove off the coating around the tap hole to ground the scale unit using the installation surface contact with the scale.
- Be aware that the scale will be damaged if slider moved outside the measuring length (ML).
- In environments where coolant can splash directly on the scale, be sure to mount a cover on the scale to protect the scale from splashing. (Fig. 2)

Example 1 (recommended): Installation when a stop surface of the scale and slider is made with the bracket
Scale installation accuracy is improved when a stop surface is made. This also simplifies reinstallation of the scale.
1. Check and adjust the scale bracket's parallelism with respect to the machine guide, and then secure in place. Even when using divided brackets, adjust the parallelism over the entire bracket length as shown in the figure.

Example 2: Installation when a stop surface of the scale and slider is not made with the bracket

2. Check and adjust the height and parallelism of the slider bracket, and then secure in place.

Installation example

1. Adjust the parallelism of the scale bracket and slider bracket with respect to the machine guide, and then secure in place. Adjust the height and parallelism of the slider bracket with respect to the scale bracket, and then secure in place.

2. Adjust the parallelism with respect to the machine guide of the scale rear while measuring the scale rear with a dial gauge. Tighten the set screws.

3. Insert the supplied spacer (t = 1.0 mm) in the space between the scale and slider, and then adjust the slider position while bringing the slider into contact with the scale.

Air injection and oil lubrication
In the standard configuration, the end cap section is provided with an M5 tap hole for air injection and oil lubrication. For more detailed information, please refer to the Instruction Manual (sold separately).
**Linear Scale SR77**

**Scale and slider installation notes**
- Do not turn on the power before installing the scale.
- Install the scale with the opening on the scale unit facing downward. If the opening cannot be turned downward, it should face horizontally. Never install it facing upward. (Fig. 1)
- Remove the coating around the tap hole to ground the scale unit using the installation surface contact with the scale.
- Be aware that the scale will be damaged if slider moved outside the measuring length (ML).
- In environments where coolant can splash directly on the scale, be sure to mount a cover on the scale to protect the scale from splashing. (Fig. 2)

**Installation example**

**Example 1 (recommended): Installation when a stop surface of the scale and slider is made with the bracket**

Scale installation accuracy is improved when a stop surface is made. This also simplifies reinstallation of the scale.

1. Check and adjust the scale bracket’s parallelism with respect to the machine guide, and then secure in place. As shown in the figure, adjust the parallelism over the entire bracket length even when making a difference in levels on the scale installation surface. (Fig. 6)

2. Check and adjust the height and parallelism of the slider bracket, and then secure in place. (Fig. 7)

3. Bring the scale into contact with the stop surfaces and install. (Fig. 8)

**Example 2: Installation when a stop surface of the scale and slider is not made with the bracket**

1. Adjust the parallelism of the scale bracket and slider bracket with respect to the machine guide, and then secure in place. Adjust the height and parallelism of the slider bracket with respect to the scale bracket, and then secure in place. (Fig. 9)

2. Adjust the parallelism with respect to the machine guide of the scale rear while measuring the scale rear with a dial gauge. Tighten the set screws. (Fig. 10)

3. Insert the supplied spacer (t = 1.0 mm) in the space between the scale and slider, and then adjust the slider position while bringing the slider into contact with the scale. (Fig. 11)

**Scale and slider installation notes**

- The slider holders are used to secure the slider in place during transport. They are not guides for installation.
- Do not take off the slider holders, if possible, until immediately before securing the slider.
- Even if the slider holders are removed, the plastic hook provided on the slider allows the slider to maintain an approximate positional relationship with the scale unit.
- The plastic hook can come off if the slider is forcibly twisted or other excessive force is applied. If the plastic hook comes off, return the plastic hook back to its original position before performing the installation. (See Fig. 4.)
- After removing the slider holder, be sure to take off the clamp nuts remaining on the scale. (Fig. 4)

- Before installing the scale, check that the alignment of the installation surface (or installation brackets) is within the standards.
- Use a scale installation bracket, where applicable, having a length covering the entire scale length. The parallelism of the scale may be harmed if only using a bracket divided for the installation section.
- The foot plates on both ends and intermediate foot plate installed on the scale unit are used as the installation guides.
- Loosely turn the mounting screws first. Determine the alignment and then tighten the screws to fasten the scale. (See Fig. 5.)

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- The foot plates on both ends and intermediate foot plate installed on the scale unit are used as the installation guides.
- Loosely turn the mounting screws first. Determine the alignment and then tighten the screws to fasten the scale. (See Fig. 5.)
Rotary Magnescale Installation

Installation Dimensions and Tolerance
Make preparations so that the rotary magnescale installation surface dimensions and tolerance have the values shown in the figure below.

![Diagram of installation dimensions and tolerance]

Installation Precaution
- If the surface of the rotary side or stationary side where the rotary magnescale will be installed has paint or other coating, remove the paint or coating in order to obtain conductivity between the rotary magnescale and the machine.
- Before installing the rotary magnescale, be sure to check that the dimensional tolerance of the installation surface and machine shaft are within the standards. If the installation dimensional tolerance is not within the standards, the required accuracy will not be obtained, and the rotary magnescale can even be damaged.
- In environments where coolant can splash directly on the rotary magnescale, be sure to mount a cover on the rotary magnescale to protect the rotary magnescale from splashing.
- The installation nut and other installation tools must be obtained by the customer.
- The absolute position becomes 0 at the reference point mark ±2 degrees. Be sure to check its location when securing the scale shaft. (See section 6, “Outside Dimensions.”)
- In its standard configuration, the rotary magnescale has an M5 tap hole for air injection.

Installation Preparation
Transport plate is used to secure the scale unit and scale shaft so that excess vibrations are not applied to the scale shaft during transportation. Before installing the rotary magnescale, be sure to remove the transport plate.

Note: The transport plate does not set the installation standard for the rotary magnescale. Perform the installation by following section 5-1, “Installation Dimensions and Tolerance.”
Installation Procedure

1. Check that there is no dust or scratches on the rotary magnescale installation surface. Check that there are no indentations, rust, or scratches on the machine shaft where the rotary magnescale will be installed. Completely wipe off any dust and dirt on the machine shaft.

2. Insert the rotary magnescale gently into the machine shaft. The machine shaft and scale shaft are designed for a precise fit, and so do not try to force insertion of the rotary magnescale into the machine shaft.

3. Secure the rotary magnescale. Use M4 screws to install from the rotary magnescale top, and use M6 screws to install from the rotary magnescale bottom. (M4 tightening torque: 2.5 N.m)

4. Use the installation nut to secure the scale shaft to the machine shaft. (M20 x 1 tightening torque: 20 N.m) The securing operation can be performed more smoothly by using a tightening wrench and fastening wrench as shown in the “7. Appendix.”

Air purging

If Magnescale is used in a dusty or misty environment, it is recommended that air is introduced into the scale to alleviate any unwanted effects. Attach air nipples to M5 holes for air introduction that are provided at both ends of the scale to supply air into the scale. When introducing air into the scale, supply air via an air filter (nominal filtration rating: 5 µm), mist separator (nominal filtration rating: 0.3 µm), and a regulator to remove dust, dirt, and mist. As a guide, the amount of air supplied to the scale is 30 NL/min.
This robust type magnetic absolute scale system that outputs position signals for machine tools and other equipment that require high-precision positioning.

### Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Measuring Length (ML)</th>
<th>Accuracy</th>
<th>Maximum Resolution</th>
<th>Maximum Response Speed</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>140-3,040mm</td>
<td>±0.4µm</td>
<td>0.01µm</td>
<td>200m/min</td>
<td>FANUC, Mitsubishi, Panasonic, YASKAWA</td>
</tr>
</tbody>
</table>

- **Optimal Signal**: Absolute serial bidirectional signal, compliant with EIA-485

- **Resolution**: Selectable from 0.01, 0.05, 0.1, 0.5 and 1.0 µm (set at factory shipping)

- **Accuracy**: ±0.4µm at 20°C

- **Maximum Resolution**: 0.01µm

- **Maximum Response Speed**: 200m/min (User-selected resolution setting)

- **Vibration Resistance**: 200m/s² (300Hz ~ 2kHz)

- **Impact Resistance**: 250m/s² (50Hz ~ 2kHz)

- **Protective Design Grade**: IP54 (Air purge not included), IP65 (Air purge included)

**Safety Standards**

- FSC-Part5 Subpart B Class A, IESS-485 Class A Digital Device
- EN60011 Sp Class A, EN61000-6-2, Safety standards not applicable (60 V DC or less)

**Operating Temperature Range (°C)**

- 0 ~ +50°C

**Storage Temperature Range (°C)**

- -20 ~ +55°C

**Mass**

- Approx. 1.24kg + 4kg/m

**Sliding Resistance**

- ≤1N

**Power Supply Protection**

- In the case of errors such as a reverse-connected power supply or over-voltage, the internal fuse is cut to protect the power being supplied and wiring.

**Power Supply Voltage**

- DC4.75 - 5.25V (At cable connection end)

**Consumption Current**

- 2A max (When the power supply rise time is 10 ms)

**Impulse Current**

- 2A max (When the power supply rise time is 10 ms)

**Specifications**

- **Measuring Length (ML)**: 140-3,040mm
- **Accuracy**: ±0.4µm
- **Maximum Resolution**: 0.01µm
- **Maximum Response Speed**: 200m/min.
- **Protocol**: FANUC, Mitsubishi, Panasonic, YASKAWA

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**Model Designation**

- **Operating Temperature Range (°C)**: 0 ~ +50°C
- **Storage Temperature Range (°C)**: -20 ~ +55°C
- **Mass**: Approx. 1.24 kg + 4 kg/m
- **Soldering Resistance**: ≤1N
- **Power Supply Protection**: In the case of errors such as a reverse-connected power supply or over-voltage, the internal fuse is cut to protect the power being supplied and wiring.

**Communication Protocol**

- Absolute serial bidirectional signal, compliant with EIA-485

**Resolution & Direction**

- A: 5+5ML/1000 µm
- B: 3+3ML/1000 µm

**Accuracy**

- ±0.4µm at 20°C

**Cable Out Direction**

- R= Right, L= Left
This robust medium type magnetic scale system that outputs position signals for machine tools and other equipment that require high-precision positioning.

- Measuring Length (ML): 140-3,040mm
- Accuracy: 3+3ML/1,000 μm p-p, 5+5ML/1,000 μm p-p
- Maximum resolution: 0.01 μm
- Maximum response speed: 200m/min.
- Protocol (SR85): Mitsubishi

### Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>SR84</th>
<th>SR85</th>
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<tr>
<td>Measuring length (ML)</td>
<td>140~3,040mm</td>
<td>140~3,040mm</td>
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<table>
<thead>
<tr>
<th>Specifications</th>
<th>SR84</th>
<th>SR85</th>
</tr>
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<tbody>
<tr>
<td>Measuring length (ML)</td>
<td>140~3,040mm</td>
<td>140~3,040mm</td>
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<tr>
<td>Thermal expansion coefficient (°C)</td>
<td>12 ± 1 x 10⁻⁶°C</td>
<td>12 ± 1 x 10⁻⁶°C</td>
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<td>Output signal</td>
<td>A/B: Reference point line (digital signal  compliant with EIA-422)</td>
<td>A/B: Reference point line (digital signal  compliant with EIA-422)</td>
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<tr>
<td>Incremental serial bidirectional signal, compliant with EIA-485</td>
<td>Incremental serial bidirectional signal, compliant with EIA-485</td>
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<tr>
<td>Accuracy (at 20°C) ML/mm</td>
<td>3+3ML/1,000 μm p-p or 5+5ML/1,000 μm p-p</td>
<td>3+3ML/1,000 μm p-p or 5+5ML/1,000 μm p-p</td>
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<td>Selectable from 0.05, 0.1, 0.5 and 1 μm (Set at factory shipping)</td>
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<td>None, Center point, Multi-point (40 mm pitch), Reference mark (standard pitch: 30 mm), User-selected point (1 mm pitch)</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>DC4.75 - 5.25V (At cable connection end)</td>
<td>DC4.75 - 5.25V (At cable connection end)</td>
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<tr>
<td>Consumption current</td>
<td>200mA (at 120Ω to terminal max)</td>
<td>200mA (at 120Ω to terminal max)</td>
</tr>
<tr>
<td>Direct current</td>
<td>2A max. (When the power supply rise time is 10 ms)</td>
<td>2A max. (When the power supply rise time is 10 ms)</td>
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<td>Maximum response speed</td>
<td>50m/sec/Resolution: 0.1 μm</td>
<td>200m/sec/Resolution: 0.1 μm</td>
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<td>Vibration resistance</td>
<td>250m/s² (50Hz~2kHz)</td>
<td>250m/s² (50Hz~2kHz)</td>
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<tr>
<td>Impact resistance</td>
<td>450m/s² (11ms)</td>
<td>450m/s² (11ms)</td>
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<td>Protective design grade</td>
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<td>IP54 (Air purge not included), IP65 (Air purge included)</td>
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<td>Other protections</td>
<td>Oil lubricant can also be used under severe environmental conditions.</td>
<td>Oil lubricant can also be used under severe environmental conditions.</td>
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<td>Safety standards</td>
<td>FCC Part 15 Subpart B Class A. ICES-003 Class A Digital Device. EN55011 Gp1 Class A, EN61000-6-2. Safety standards not applicable (60 V DC or less).</td>
<td>FCC Part 15 Subpart B Class A. ICES-003 Class A Digital Device. EN55011 Gp1 Class A, EN61000-6-2. Safety standards not applicable (60 V DC or less).</td>
</tr>
</tbody>
</table>

#### Details of model designation

SD 50 | 100 | 150 | 200 | 250 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 | 1250 | 1500 | 1800 | 2000 | 2500 | 3000
A | D | B | E | C | F | G | J | K | L | M | N | O | P | Q | R | S | T | U | V

When the slider is moved in the direction of the arrow, if the X signal is ahead when the direction is “positive,” and B signal is ahead when the direction is “negative.”
This slim type magnetic scale system that outputs position signals for machine tools and other equipment that require high-precision positioning.

- Measuring Length (ML): 70-2,040mm
- Accuracy: 3+3ML/1,000 μm p-p, 5+5ML/1,000 μm p-p
- Maximum resolution: 0.01 μm
- Maximum response speed: 200m/min.
- Protocol: FANUC, Mitsubishi, Panasonic, YASKAWA

**Specifications**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring length (ML)</td>
<td>70-2,040mm</td>
</tr>
<tr>
<td>Thermal expansion coefficient (°C)</td>
<td>12 ± 1 x 10^-5°C</td>
</tr>
<tr>
<td>Absolute serial bidirectional signal, compliant with EIA-485</td>
<td>Absolute serial bidirectional signal, compliant with EIA-485</td>
</tr>
<tr>
<td>Resolution (at 20°C)</td>
<td>3+3ML/1,000 μm p-p or 5+5ML/1,000 μm p-p</td>
</tr>
<tr>
<td>Zero count position</td>
<td>Center mark</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>DC4.75 - 5.25V (At cable connection end)</td>
</tr>
<tr>
<td>Consumption current</td>
<td>2A max. (Mass: 0.05 to 70.00 kg)</td>
</tr>
<tr>
<td>Maximum response speed</td>
<td>200m/min (User-selected resolution setting)</td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>350m/s^2 (50Hz~3kHz)</td>
</tr>
<tr>
<td>Protective design grade</td>
<td>IP54 (Air purge not included), IP65 (Air purge included)</td>
</tr>
<tr>
<td>Other protections</td>
<td>Oil lubricant can also be used under severe environmental conditions.</td>
</tr>
<tr>
<td>Safety standards</td>
<td>FDD Part15, Subject B, Class A, IEC60529 Class A Digital Device</td>
</tr>
<tr>
<td>Operating temperature range (°C)</td>
<td>0 ~ +50°C</td>
</tr>
<tr>
<td>Storage temperature range (°C)</td>
<td>-20 ~ +55°C</td>
</tr>
<tr>
<td>Mass</td>
<td>Approx. 0.375 kg + 1.36 kg/m</td>
</tr>
<tr>
<td>Sliding resistance</td>
<td>7N or less</td>
</tr>
</tbody>
</table>

**Details of model designation**

- Absolute zero point shown by iron bar on left end of ML, e.g. 850mm = A850, in case of center then 8, For 1050mm or longer, 1 left digit shown by digit signal followed by signal
- Maximum zero point shown by iron bar on left end of ML, e.g. 850mm = A850, in case of center then 8, For 1050mm or longer, 1 left digit shown by digit signal followed by signal

*When the slider is moved in the direction of the arrow, the signal is addition when the direction is "positive", and it is subtraction when the direction is "negative." The direction is selected when ordering.*

**Note:** Mitsubishi controller is only A
SR74/75

This slim type magnetic scale system that outputs position signals for machine tools and other equipment that require high-precision positioning.

- Measuring Length (ML): 70-2,040mm
- Accuracy: 3+3ML/1,000 μm p-p, 5+5ML/1,000 μm p-p
- Maximum resolution: 0.01 μm
- Maximum response speed: 200m/min.
- Protocol (SR75): Mitsubishi

Specifications

<table>
<thead>
<tr>
<th>Measurement</th>
<th>SR74</th>
<th>SR75</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring length (ML)</td>
<td>70-2,040mm</td>
<td>70-2,040mm</td>
</tr>
<tr>
<td>Thermal expansion coefficient (°C)</td>
<td>12 x 1 x 10^-6</td>
<td>12 x 1 x 10^-6</td>
</tr>
<tr>
<td>Output signal</td>
<td>A/B: Reference point driver signal (compliant with EIA-422)</td>
<td>Incremental serial directional signal, compliant with EIA-485</td>
</tr>
<tr>
<td>Accuracy (at 20°C, ML)</td>
<td>3+3ML/1,000 μm p-p or 5+5ML/1,000 μm p-p</td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>Selectable from 0.05, 0.1, 0.2, 0.5 and 1 μm</td>
<td>Selectable from 0.01, 0.05, 0.1, 0.2, 0.5 and 1 μm</td>
</tr>
<tr>
<td>Reference point</td>
<td>None, Center point, Multi-point (100 mm pitch), Reference mark (standard pitch 20 mm), User-selected point (1 mm pitch)</td>
<td>None, Center point, User-selected point (1 mm pitch)</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>DC4.75 - 5.25V (at cable connection end)</td>
<td></td>
</tr>
<tr>
<td>Operating current</td>
<td>200 mA (at 120 Ω terminal) max.</td>
<td></td>
</tr>
<tr>
<td>Impact resistance</td>
<td>150m/s² (50Hz~3kHz)</td>
<td>350m/s² (11ms)</td>
</tr>
<tr>
<td>Protective design grade</td>
<td>IP54 (Air purge not included), IP65 (Air purge included)</td>
<td>Oil lubricant can also be used under severe environmental conditions.</td>
</tr>
<tr>
<td>Safety standards</td>
<td>FCC Part15 Subpart B Class A, ICES-003 Class A Digital Device.</td>
<td>EN55011 Gp1 Class A, EN61000-6.2. Safety standards not applicable (60 V DC or less).</td>
</tr>
<tr>
<td>Operating temperature range (°C)</td>
<td>0 ~ +50°C</td>
<td>0 ~ +55°C</td>
</tr>
<tr>
<td>Storage temperature range (°C)</td>
<td>-20 ~ +55°C</td>
<td></td>
</tr>
<tr>
<td>Mass / Slider sliding resistance</td>
<td>Approx.0.27kg + 1.36kg/m</td>
<td>1N or less</td>
</tr>
<tr>
<td>Protective design grade</td>
<td>IP54 (Air purge not included), IP65 (Air purge included)</td>
<td>Oil lubricant can also be used under severe environmental conditions.</td>
</tr>
<tr>
<td>Power supply protection</td>
<td>In the case of errors such as a reverse-connected power supply or over-voltage, the internal fuse is cut to protect the power being supplied and wiring.</td>
<td></td>
</tr>
<tr>
<td>Safety standards</td>
<td>FCC Part15 Subpart B Class A, ICES-003 Class A Digital Device.</td>
<td>EN55011 Gp1 Class A, EN61000-6.2. Safety standards not applicable (60 V DC or less).</td>
</tr>
<tr>
<td>Operating temperature range (°C)</td>
<td>-20 ~ +55°C</td>
<td></td>
</tr>
<tr>
<td>Storage temperature range (°C)</td>
<td>0 ~ +55°C</td>
<td></td>
</tr>
<tr>
<td>Mass / Slider sliding resistance</td>
<td>Approx.0.27kg + 1.36kg/m</td>
<td>1N or less</td>
</tr>
</tbody>
</table>

Details of model designation

- Single reference mark, shown by arrow mark on left end of ML, e.g. 600mm-640, in case of center then X is added. E.g. 1,000-1,099mm A, 1,100-1,199mm B, 1,200-1,299mm C, 1,300-1,399mm D, 1,400-1,499mm E, 1,500-1,599mm F, 1,600-1,699mm G, 1,700-1,799mm H, 1,800-1,899mm I, 1,900-1,999mm J, 2,000-2,040mm K. Specific model: X-center, DR is only single reference mark.
- When the slider is moved in the direction of the arrow, for A signal is ahead when the direction is "positive," and B signal is ahead when the direction is "negative."
Magnetic principle
- Excellent resistance to workshop conditions (PL60).
- Resistant to oil, dirt, vibration, and shock.
- Read head resistant to external magnetic field.

Example for connection
- Cable length of more than 15 m, please consult our sales.

Compatible interpolator
- Compatible scale

Resistant to oil, dirt, vibrations, and shocks. Read head resistant to external magnetic field.

Example for connection
- Cable length of more than 15 m, please consult our sales.

Compatible read head
- Compatible scale

High response speed: 250 m/min with a resolution of 5 μm

Resolution: SL331 with PL60 - 5 μm, 10 μm

Accuracy: (15 + 5L/1000) μm

Overall length
- Effective length L mm (inch) 200/300/400/500/600/700/800/1000/1200/1500/1600/1700/1800/2000/2500/3000/4000/5000/6000/7000/8000

Model
- SL110
- SL130

Example for connection
- Cable length of more than 15 m, please consult our sales.

Compatible head
- Compatible scale

Response speed of PL60
- 1) x 10-6/˚C

Response speed (m/min)
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1

Model name
- SL110-200
- SL130-800

SL110-200
- N x 300/11.81 P1
Integrated reader head and Interpolator unit for position control

• Compact design
• Interpolator unit for automated position control
• High response speed: 300 m/min
• Resolution: 10 μm, 20 μm, 25 μm, 50 μm, 100 μm

Output signal: All quadrature signal, compliant with EIA-422
Resolution: 10 μm
Max. response speed: 300 m/min (varies with the read head and settings)
Excellent resistance to workshop conditions (IP65)
Resistant to oil, dirt, vibration, and shock.

Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>PL20C</th>
<th>PL25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read head cable length</td>
<td>3 m</td>
<td>5 m</td>
</tr>
<tr>
<td>Max. response speed</td>
<td>700 m/min</td>
<td>1400 m/min</td>
</tr>
<tr>
<td>Resolution</td>
<td>10 μm</td>
<td>20 μm</td>
</tr>
<tr>
<td>Alarm display</td>
<td>1-500 MA</td>
<td>1-500 MA</td>
</tr>
<tr>
<td>Power supply</td>
<td>DC 10 ~ 30 V</td>
<td>DC 5 V ±5 %</td>
</tr>
</tbody>
</table>

Dimensions

<table>
<thead>
<tr>
<th>PL20C</th>
<th>PL25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable length</td>
<td>2-M5 Tap (Mounting holes)</td>
</tr>
<tr>
<td>3 m</td>
<td>2-M3 Tap (Mounting holes)</td>
</tr>
<tr>
<td>5 m</td>
<td>2-M3 Tap (Mounting holes)</td>
</tr>
<tr>
<td>10 m</td>
<td>2-M3 Tap (Mounting holes)</td>
</tr>
<tr>
<td>15 m</td>
<td>2-M3 Tap (Mounting holes)</td>
</tr>
<tr>
<td>20 m</td>
<td>2-M3 Tap (Mounting holes)</td>
</tr>
<tr>
<td>30 m</td>
<td>2-M3 Tap (Mounting holes)</td>
</tr>
</tbody>
</table>

For cable lengths greater than 15 meters, please contact our sales office.

Example for connection

- PL20C: PL81/82 SL110/130
- PL25: PL81/82 SL20C/25

Example for connection

- PL81/82: PL81/82 SL110/130
- Interpolator: CE08 CK-T12/13/14/15/16

Head cable unit

*Made in Japan*
**SL700 Series**

- Compact ribbon type scale for easy mounting in cramped spaces
- Non-contact detection
- Magnetic detection system with excellent resistance to dust, oil, vibrations and shocks.
- Effective length from 50 mm to 100,000 mm
- Detects linear displacement and produces analog or AB quadrature signal output when connected to PL101 head and MJ500/600/620 Series interpolator (both sold separately).

Three types are available with different reference point specifications.

**Dimensions**

![Dimensions diagram](image)

**Reference mark**

- When connected to MJ500/600 Series interpolator
- Produces AB quadrature signal

---

**PL101 Series**

- Non-contact detection
- Magnetic detection system for excellent resistance to dust, oil, vibrations and shocks.
- Detects linear position and displacement and produces analog signal output when connected to the SL700 Series. Produces AB quadrature signal when connected to MJ500/600 Series interpolator
- A wide range of models is available so you can select the best model for your specific application.

**Dimensions**

![Dimensions diagram](image)

---

**Specifications**

<table>
<thead>
<tr>
<th>Model</th>
<th>SL700</th>
<th>SL710</th>
<th>SL720</th>
<th>SL730</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>1 μm</td>
<td>1 μm</td>
<td>1 μm</td>
<td>1 μm</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.2˚</td>
<td>±0.2˚</td>
<td>±0.2˚</td>
<td>±0.2˚</td>
</tr>
<tr>
<td>Pitch accuracy</td>
<td>±0.1˚</td>
<td>±0.1˚</td>
<td>±0.1˚</td>
<td>±0.1˚</td>
</tr>
<tr>
<td>Max. response speed</td>
<td>1000 mm/s</td>
<td>1000 mm/s</td>
<td>1000 mm/s</td>
<td>1000 mm/s</td>
</tr>
<tr>
<td>Power consumption</td>
<td>0.03 W</td>
<td>0.03 W</td>
<td>0.03 W</td>
<td>0.03 W</td>
</tr>
</tbody>
</table>

---

**Magnescale® Digiruler®**
Digital Scales
RU77

High precision absolute rotary type with excellent resistance to environments.

- System accuracy: ± 2.5°/sec
- Output wave number: 2,000 waves/rotation
- Output pulse number: 33,554,432 p.p.r.
- Low-profile shape: 42mm
- Protocol: FANUC, Mitsubishi, YASKAWA

Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output signal</td>
<td>Absolute serial (2/4 duplex; Compliant with EIA-422)</td>
</tr>
<tr>
<td>Detection system</td>
<td>Magnetic system (MR sensor)</td>
</tr>
<tr>
<td>System accuracy (at 20°C)</td>
<td>±2.5°/sec</td>
</tr>
<tr>
<td>Resolution</td>
<td>Approx. 0.01°/1,000 - Approx. 1°/10,000 (131,072 pulses/revolution - 33,554,432 pulses/revolution)</td>
</tr>
<tr>
<td>Output wavelength</td>
<td>40 mm (D)</td>
</tr>
<tr>
<td>Output wave number</td>
<td>4,096 waves/revolution</td>
</tr>
<tr>
<td>Number of divisions</td>
<td>4,096</td>
</tr>
<tr>
<td>Electrical allowable revolution</td>
<td>2,000mmh2/1 (imp)</td>
</tr>
<tr>
<td>Mechanical allowable revolution</td>
<td>3,000mmh2/1 (imp)</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>-10°C ~ +60°C</td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>15mm/sV(390Hz ~ 2,000Hz)</td>
</tr>
<tr>
<td>Shock resistance</td>
<td>1,000mm/s(11ms)</td>
</tr>
<tr>
<td>Protection design grade</td>
<td>IP65</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>DC 4.75 - 5.25 V (4-pin cable connection end)</td>
</tr>
<tr>
<td>Current consumption</td>
<td>100mA at 10°C (rated or less)</td>
</tr>
<tr>
<td>Inrush current</td>
<td>2 A max. (When the power supply razing time is 10 ms)</td>
</tr>
<tr>
<td>Power supply protection</td>
<td>In the case of errors such as a reverse-connected power supply or over-voltage, the internal fuse is cut to protect the power being supplied and wiring.</td>
</tr>
<tr>
<td>Safety standards</td>
<td>FCC Part15 Subpart B Class A</td>
</tr>
<tr>
<td>Dimensions</td>
<td>ø110 x 42mm</td>
</tr>
<tr>
<td>Cable length</td>
<td>Standard 1 m (maximum length of 15m with extension cable)</td>
</tr>
<tr>
<td>Output connector</td>
<td>Male, round waterproof connector NJB1DB 10PL2 by Japan Aviation Electronics Industry</td>
</tr>
<tr>
<td>Compliant connector</td>
<td>Female, round waterproof connector NJB1HB 10SL2 by Japan Aviation Electronics Industry</td>
</tr>
<tr>
<td>Moment of inertia</td>
<td>9.6 x 10^-5 km²/°</td>
</tr>
<tr>
<td>Starting torque (at 20°C)</td>
<td>0.1 N.m or less</td>
</tr>
<tr>
<td>Mass</td>
<td>Approx. 3.8kg</td>
</tr>
</tbody>
</table>

Dimensions RU77

- ø18 x ø100
- 4 x M3, depth: 5
- ø35 (when installing from top)
- 4 x mounting hole for M4
- ø5.6
- ø92 Air injection hole (M5)
- 4 x installation hole from bottom
- 4 x installation hole for M4 (when installing from top)
- Cable length 1000+100

Details of model designation

- RU77-4096A
- Protocol: FANUC, Mitsubishi, YASKAWA
- Resolution and Polarity
- Note: YASKAWA controller is only D
- Polarities in CEE
RS310
Rotary scale for feedback applications

- Magnetic principle
- Excellent resistance to workshop conditions.
- Resistant to oil, dirt and vibrations.
- Thin design
- Directly mountable onto a machine’s rotary shaft. Large-diameter scale drum that can be used for large-sized machines such as turning centers.
- Easy installation
- Noncontact. Clearance: 0.1 mm/0.004”

Example for connection

<table>
<thead>
<tr>
<th>Scale</th>
<th>Cable</th>
<th>Interpolator</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS310</td>
<td>AQC-C</td>
<td>ME038</td>
</tr>
</tbody>
</table>

Dimensions

- Interpolators
- Rotary scale for feedback applications

Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>RS310-1800A</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of reader heads</td>
<td>1</td>
</tr>
<tr>
<td>No. of recorded waves</td>
<td>7</td>
</tr>
<tr>
<td>Recorded wave length</td>
<td>0.32 mm</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.001˚</td>
</tr>
<tr>
<td>Maximum mechanical revolutions</td>
<td>100 to 110</td>
</tr>
<tr>
<td>Recommended</td>
<td>7.2”</td>
</tr>
<tr>
<td>Recommended</td>
<td>3.6”</td>
</tr>
<tr>
<td>Accuracy</td>
<td>0.12 kg</td>
</tr>
<tr>
<td>Mass</td>
<td>300 mm</td>
</tr>
<tr>
<td>Cable length</td>
<td>ø144</td>
</tr>
<tr>
<td>Diameter excl. cable guide</td>
<td>ø183.2</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>0 ˚C to 40 ˚C/ 32 ˚F to 104 ˚F</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-10 ˚C to 50 ˚C/ 14 ˚F to 122 ˚F</td>
</tr>
<tr>
<td>Interpolation accuracy</td>
<td>±0.25 mT</td>
</tr>
<tr>
<td>Maximum head mounting face flatness</td>
<td>7000 min-1</td>
</tr>
<tr>
<td>Allowable scale drum runout</td>
<td>ø 132 mm/ 5.20”</td>
</tr>
<tr>
<td>Allowable residual machine magnetism</td>
<td>Approx. 1.6 kg/ 3.53 lbs</td>
</tr>
<tr>
<td>Mass</td>
<td>1.12 x 10^-2 kg m^2</td>
</tr>
<tr>
<td>Moment of inertia</td>
<td>Max. approx. ø 235 mm/ 9.26”</td>
</tr>
<tr>
<td>Diameter excl. cable guide</td>
<td>±0.004”</td>
</tr>
<tr>
<td>Allowable residual machine magnetism</td>
<td>±0.004”</td>
</tr>
<tr>
<td>Mass</td>
<td>±0.004”</td>
</tr>
<tr>
<td>Moment of inertia</td>
<td>±0.004”</td>
</tr>
<tr>
<td>Allowable residual machine magnetism</td>
<td>±0.004”</td>
</tr>
<tr>
<td>Mass</td>
<td>±0.004”</td>
</tr>
<tr>
<td>Moment of inertia</td>
<td>±0.004”</td>
</tr>
</tbody>
</table>

Rotation-drive mechanism

- NC controller
- MAGNESWITCH external zero point (optional)
- Detecting head
- ME038 Interpolator (optional)

RS310

- Detecting head
- ME038 Interpolator (optional)

Mounted face

- Magnet coated surface
- Guide plate
- (Renove after mounting head assy)
- 4-M4 HSB
- 4-M3 HSB
- 6-M5 Holes EQ SP
- 6-6 Holes (by 6mm drill) EQ SP

Interpolators

MJ100/110
MJ620
MJ820/821
MJ830/831
**MJ100/110**
High response speed interpolator unit for position control

- Capable of 40 to 1000 divisions
- Produces AB quadrature signals with a resolution of 2 μm to 125 μm, when used in combination with the optionally available Digiruler® PL25 head unit and the SL110/130 scale unit (scale signal wavelength: 5 mm, or with the PL60 and the SL331 scale unit (scale signal wavelength: 2 mm).
- MJ100: Supply voltage 5 V input, Line driver (BA-422) compliance output.
- MJ110: Supply voltage 12 to 30 V input, Open collector (IOL=50 mA) output.
- MJ100 also generates U'/V'W' phase output with a period of reproduced Digiruler® signal (5 mm with PL25, 2 mm with PL60).

**Example for connection:**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Head</th>
<th>Cable</th>
<th>Interpolator</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL331</td>
<td>PL25</td>
<td>MJ620</td>
<td>MJ100/110</td>
</tr>
</tbody>
</table>

**System Configuration**

- Scale unit
- Head cable unit
- Interpolator

- PL25 or PL60

**Dimensions**

- MJ100: Supply voltage 12 to 30 V input, Open collector (IOL=50 mA) output
- PL25 or PL60

**Outputs**

- AB quadrature, Z phase, alarms

**Power consumption**

- 200 divisions: 7.4 KHz (2220 m/min when connected to PL25; 888 m/min when connected to PL60)
- 1000 divisions: 6 KHz (1800 m/min when connected to PL25; 720 m/min when connected to PL60)

**Power supply**

- 12 V to 30 V (11 V to 31 V)

**Model**

- MJ100/110

**Example for connection**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Head</th>
<th>Cable</th>
<th>Interpolator</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL700</td>
<td>PL101</td>
<td>MJ620</td>
<td>MJ100/110</td>
</tr>
</tbody>
</table>

**MJ620**
Compact one-axis module with analog input port

- Divides analog input signal into 32 to 800 divisions.
- Produces AB quadrature signal output from the differential line driver when combined with SL700 series scale and PL101 series head cable (both sold separately).

**Example for connection**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Head</th>
<th>Cable</th>
<th>Interpolator</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL700</td>
<td>PL101</td>
<td>MJ620</td>
<td>MJ500/510</td>
</tr>
</tbody>
</table>

**Dimensions**

- MJ620

**Specifications**

- MJ500/510

- MJ620

**Outputs**

- U', V', W', Z phase

**Power consumption**

- MJ500/510: 2.2 W (with PL101)
- MJ620: 5 V (4.5 to 6 V)

**Model**

- MJ620

**Example for connection**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Head</th>
<th>Cable</th>
<th>Interpolator</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL700</td>
<td>PL101</td>
<td>MJ620</td>
<td>MJ500/510</td>
</tr>
</tbody>
</table>
Generalized interpolator with serial-interface output for FANUC CNC series and its successor models

- Connectable to any general analog-output encoder.
- Input impedance: DC 1 Vp-p voltage differential input
- Max. response frequency: 140 kHz for any number of divisions selected
- Switch-selectable number of divisions: 40,80,100,120,160,200,240,400, 480,500,800,1000,1600,2000,3200,4000
- Compensation: DC offset, gain and phase
- Power supply: DC 5 V (4.5 to 5.5 V) for MJ820, DC 12 V to 24 V (11 V to 32 V) for MJ821
- Compatible with Sony’s Digital scales SL700 series with PL101

Example for connection:
- MJ820/821 to FANUC control unit

- MJ830/831

Interpolator for Mitsubishi MR-J2 Super Series amplifier

- Connectable to any general analog-output encoder.
- Input impedance: DC 1 Vp-p voltage differential input
- Max. response frequency: 140 kHz for any number of divisions selected
- Switch-selectable number of divisions: 40,80,100,120,160,200,240,400, 480,500,800,1000,1600,2000,3200,4000
- Compensation: DC offset, gain and phase
- Power supply: DC 5 V (4.5 to 5.5 V) for MJ830, DC 12 V to 24 V (11 V to 32 V) for MJ831
- Compatible with Sony’s Digital scales SL700 series with PL101

Example for connection:
- MJ830/831 to Mitsubishi control unit

---

**System configuration**

- MJ820/821
- PL101
- Serial interface

- MJ830/831
- PL101
- Serial interface

---

**Specifications**

**MJ820/821**

- **Input Impedance**: DC 1 Vp-p voltage differential input
- **Max. Response Frequency**: 140 kHz
- **Switch-Selectable Number of Divisions**: 40, 80, 100, 120, 160, 200, 240, 400, 480, 500, 800, 1000, 1600, 2000, 3200, 4000
- **Compensation**: DC offset, gain and phase
- **Power Supply**: DC 5 V (4.5 to 5.5 V) for MJ820, DC 12 V to 24 V (11 V to 32 V) for MJ821

**MJ830/831**

- **Input Impedance**: DC 1 Vp-p voltage differential input
- **Max. Response Frequency**: 140 kHz
- **Switch-Selectable Number of Divisions**: 40, 80, 100, 120, 160, 200, 240, 400, 480, 500, 800, 1000, 1600, 2000, 3200, 4000
- **Compensation**: DC offset, gain and phase
- **Power Supply**: DC 5 V (4.5 to 5.5 V) for MJ830, DC 12 V to 24 V (11 V to 32 V) for MJ831

---

**Dimensions**

- **MJ820**
- **MJ821**

---

**Accessories**

- **Power Supply Plug**: 1
- **Connector cap**: 1
- **Supplement**: 1
- **Binding band**: 1 (for MJ821 only)

---

**Power Consumption**

- **MJ820**: 3 W
- **MJ830**: 3 W

---

**Communications**

- **Serial communication**: Compliant with EIA-422 (SN75C1167 or equivalent)

---

**Mounting Hole**

- **MJ820/821**: ø4.5/ø0.18
- **MJ830/831**: ø4.5/ø0.18

---

**Interpolators**

- **Head Scale**: 4000, 3200, 2000, 1600, 1000, 800, 500, 480, 400, 240, 200, 160, 120, 100, 80, 40, 20

---

**Power Supply Voltage**

- **MJ820/821**: DC 5 V (4.5 to 5.5 V) for MJ820; DC 12 V to 24 V (11 V to 32 V) for MJ821
- **MJ830/831**: DC 5 V (4.5 to 5.5 V) for MJ830; DC 12 V to 24 V (11 V to 32 V) for MJ831

---

**Storage Temperature and Humidity Range**

- **MJ820/821**: -20 to +65˚C (20 to 90%RH)
- **MJ830/831**: -20 to +65˚C (20 to 90%RH)

---

**Notes**

- 1: When input voltage is lower than 9 Vp-p, a phase deviation occurs
- 2: Offset alarm is triggered when noise or overrange occurs or at the time of erroneous counting due to noise. Level warning is triggered when the sine and cosine signal input level is lower than 0.6 to 0.5 Vp-p
- 3: All LEDs light at the next power-on in case, at the time of compensated data backup error
- 4: “1” is sent to a designated flag at time of speed alarm and level warning
- 5: MJ820/821 LED and power on in case of full time of data compensation, the compensated data was not correctly backed up
List of Adopter Cables (SR80,SR70,RU77 Series)

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Output</th>
<th>Connector type on controller side</th>
<th>Position of grounding wire</th>
<th>Contour</th>
<th>Connection connector on scale side</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>Spread-out end</td>
<td>Spread-out end</td>
<td>Not provided</td>
<td>Provided</td>
<td>-</td>
<td>Standard</td>
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<td>For relaying (JN2DS10SL2-R)</td>
</tr>
</tbody>
</table>

*If the scale-side connection connector for relaying uses a relaying connector, please use this cable.
*The standard cable is not A quad B signal.
Please consult our local sale office for detail.
The total quality control system that operates throughout the entire design and production process ensures products with enhanced safety, high quality, and high reliability that match our customers’ requirements. The company is certified for length calibration in compliance with the traceability system required by the “Weights and Measures Act,” and has been granted ISO 9001 certification, which is the international standard for quality assurance.

Safety  No compromise for high-accuracy products

The total quality control system that operates throughout the entire design and production process ensures products with enhanced safety, high quality, and high reliability that match our customers’ requirements. The company is certified for length calibration in compliance with the traceability system required by the “Weights and Measures Act,” and has been granted ISO 9001 certification, which is the international standard for quality assurance.

Our products comply with CE Marking requirements, have acquired UL certifications and meet other regulations, ensuring safe use the world over. We have met:

- EMC Directives (CE)
  EMI: EN 55011 Group 1 Class A / 91
  EMS: EN 61000-6-2

- FCC regulation
  FCC Part 15 Subpart B Class A

  for Products with built-in AC power supply:
  - UL 61010-1

- FCC Part 15 Subpart B Class A

  for Products with Laser:
  - DHHS Class 1 (21 CFR 1040.10)

  When using our devices with machines to which the European Machinery Directive applies, please make sure that the devices when installed on the machines fulfill the applicable requirements of the Directive.

  Standards or regulations to be complied with may vary by product.