

# Magnescape®

Scale Unit

# SR33 / SR34, CH33, CN33

Read all the instructions in the manual carefully before use and strictly follow them.  
Keep the manual for future references.

Instruction Manual



# Safety Precautions

Magnescale Co., Ltd. products are designed in full consideration of safety. However, improper handling during operation or installation is dangerous and may lead to fire, electric shock or other accidents resulting in serious injury or death. In addition, these actions may also worsen machine performance.

Therefore, be sure to observe the following safety precautions in order to prevent these types of accidents, and to read these "Safety Precautions" before operating, installing, maintaining, inspecting, repairing or otherwise working on this unit.

## Warning indication meanings

The following indications are used throughout this manual, and their contents should be understood before reading the text.

### **Warning**

Failure to observe these precautions may lead to fire, electric shock or other accidents resulting in serious injury or death.

### **Caution**

Failure to observe these precautions may lead to electric shock or other accidents resulting in injury or damage to surrounding objects.

## **Warning**



- Do not use this unit with voltages other than the specified supply voltages as this may result in fire or electric shock.
- Do not perform installation work with wet hands as this may result in electric shock.



- Do not disassemble or modify the unit as this may result in injury or damage the internal circuits.

## **Caution**



- Be sure to check the machine and device conditions to ensure work safety before working on the machine.



- Be sure to cut off the power supply and other sources of drive power before working on the machine. Failure to do so may result in fire or accidents.



- When turning on the power supply or other sources of drive power to operate the machine, take care not to catch your fingers in peripheral machines and devices.

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## **General Precautions**

When using Magnescale Co., Ltd. products, observe the following general precautions along with those given specifically in this manual to ensure proper use of the products.

- Before and during operations, be sure to check that our products function properly.
- Provide adequate safety measures to prevent damages in case our products should develop malfunctions.
- Use outside indicated specifications or purposes and modification of our products will void any warranty of the functions and performance as specified of our products.
- When using our products in combination with other equipment, the functions and performance as noted in this manual may not be attained, depending upon operating environmental conditions. Make full study of the compatibility in advance.

**[For U.S.A. and Canada]**

THIS CLASS A DIGITAL DEVICE COMPLIES WITH PART15 OF THE FCC RULES AND THE CANADIAN ICES-003. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS.

- (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND
- (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDERSIGNED OPERATION.

CET APPAREIL NUMERIQUE DE LA CLASSE A EST CONFORME A LA NORME NMB-003 DU CANADA.

**[ For EU and EFTA countries ]**

**CE Notice**

Marking by the symbol CE indicates compliance with the EMC directive of the European Community. This marking shows conformity to the following technical standards.

**EN 55011 Group 1 Class A / 98 :**

"Limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment"

**EN 61000-6-2 / 99 :**

"Electromagnetic compatibility (EMC) - Part 6-2 : Generic standards - Immunity for industrial environments"

**警告**

本装置を機械指令 (EN 60204-1) の適合を受ける機器にご使用の場合は、その規格に適合するように方策を講じてから、ご使用ください。

**Warning**

When using this device with equipment governed by Machine Directives EN 60204-1, measures should be taken to ensure conformance with those directives.

**Warnung**

Wenn dieses Gerät mit Ausrüstungsteilen verwendet wird, die von den Maschinenrichtlinien EN 60204-1 geregelt werden, müssen Maßnahmen ergriffen werden, um eine Übereinstimmung mit diesen Normen zu gewährleisten.



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# 1. Overview

This product is a scale system that outputs position signals for machine tools and other equipment that require high-precision positioning.

## 1-1. System Configuration

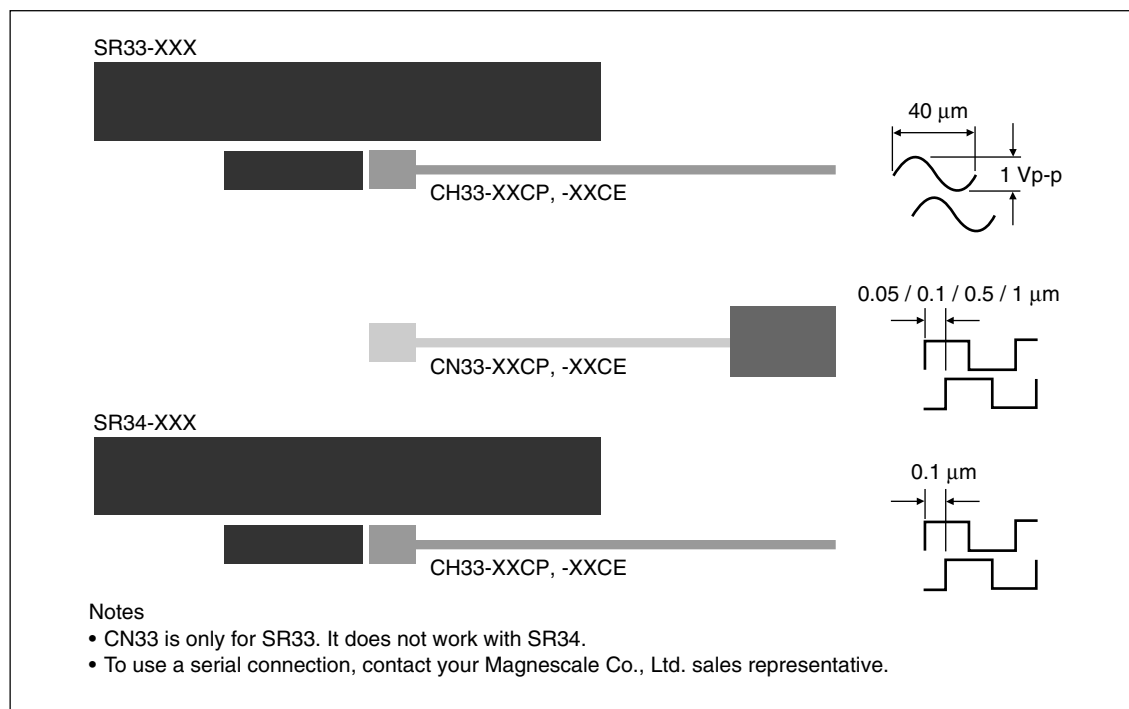


Fig. 1-1

Model name	Product name	Discription	Remarks
SR33-XXX	MAGNESCALE	Sine wave output	XXX: Measuring length (cm)
SR34-XXX	MAGNESCALE	A/B quadrature signal output	
CH33-XXCP	Cable with unterminated end	Cable sheath: PVC With cable armor	XX: Cable length (m)
CH33-XXCE	Cable with unterminated end	Cable sheath: Polyurethane With cable armor	
CN33-XXCP	Cable with interpolator	A/B quadrature signal output Cable sheath: PVC With cable armor	
CN33-XXCE	Cable with interpolator	A/B quadrature signal output Cable sheath: Polyurethane With cable armor	

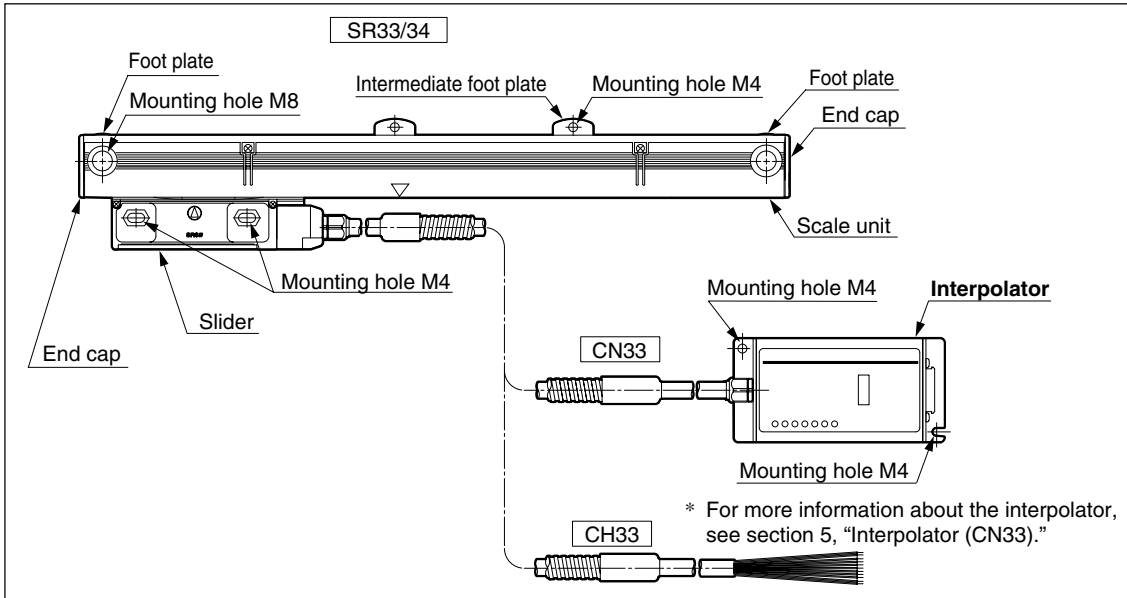
## 1-2. Features

- The scale unit has a compact cross-section and uses iron channels in the case for superior rigidity.
- The scale and connecting cables are separated by the connector on the scale slider unit for easy installation.
- All cables include protective casing (cable armor).
- The scale system (SR34 or SR33 with CN33) includes a built-in function for correcting the variations in scale signal levels in order to enable high-precision positioning. The CN33, in particular, uses a high-precision correction function developed exclusively by Magnescale Co., Ltd. to achieve high precision and high resolution.

## 2. Installation

For the installation dimensions, refer to section 7, “Dimensional Diagram.”

### 2-1. Names of Parts



### 2-2. Installing the Scale and Slider

#### Notes

- 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.

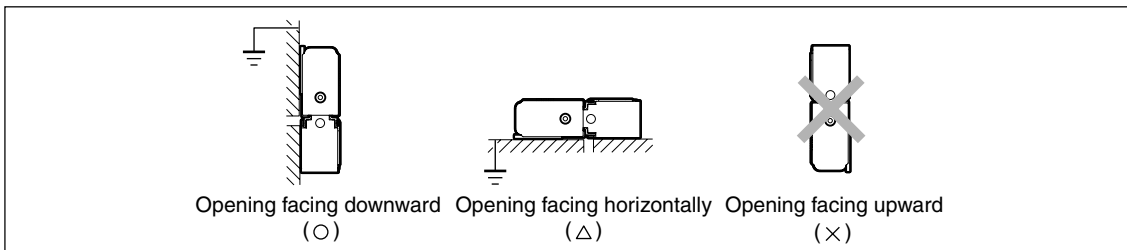


Fig. 2-1

- 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. 2-2)

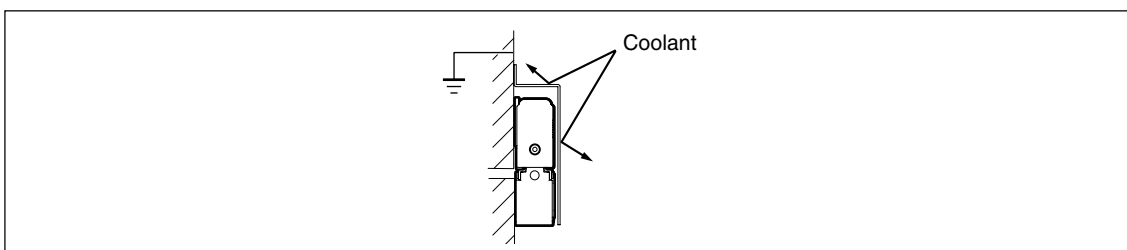


Fig. 2-2

- 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.
- After removing the slider holder, be sure to take off the clamp nuts remaining on the scale.

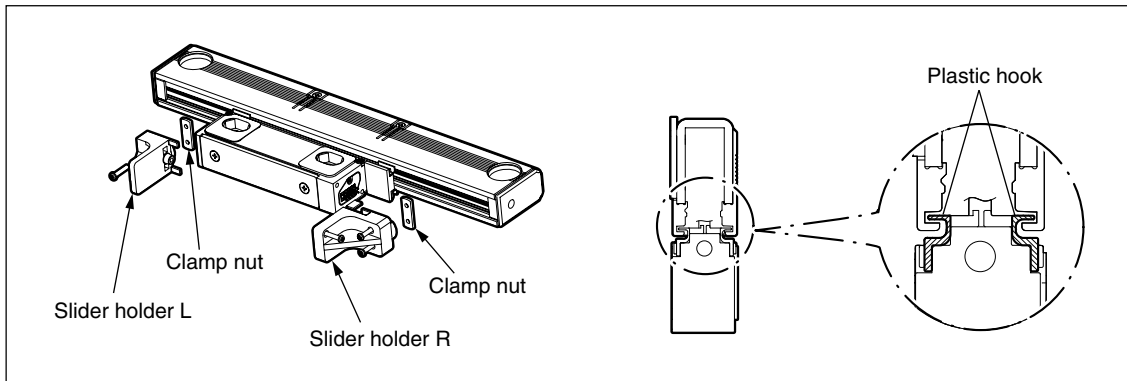


Fig. 2-3

- 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. 2-4)

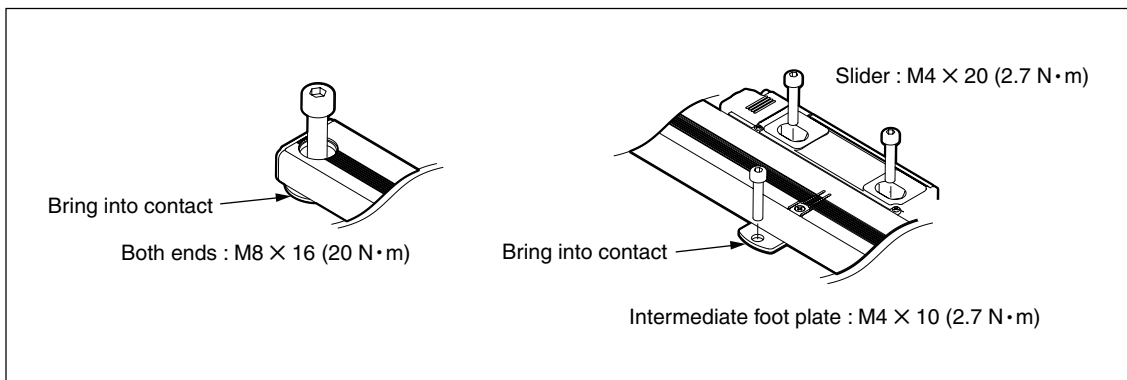


Fig. 2-4

## 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.

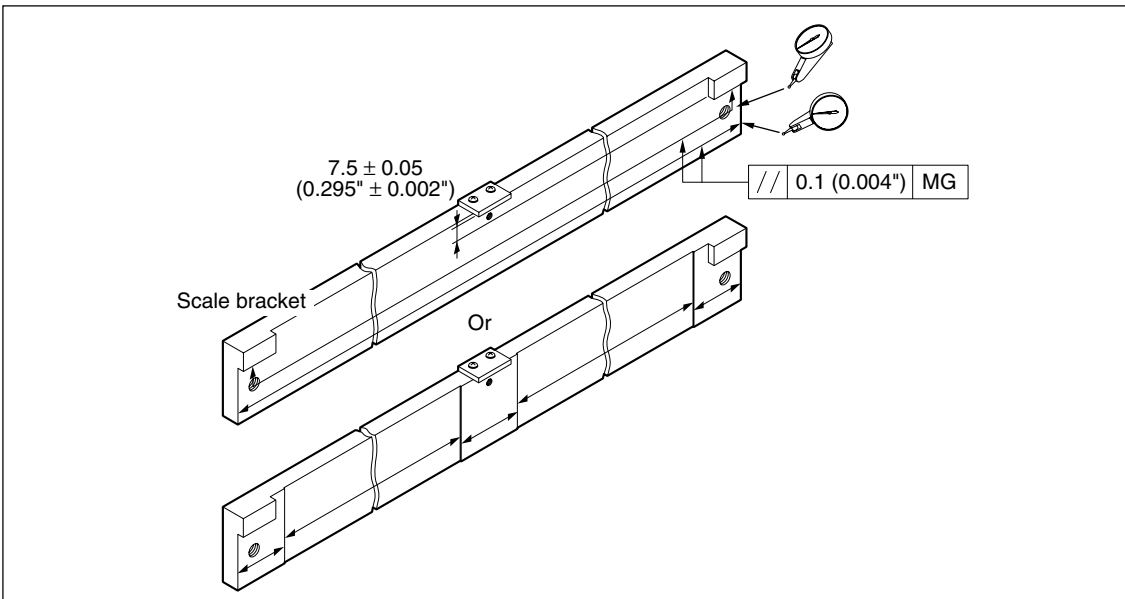


Fig 2-5

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

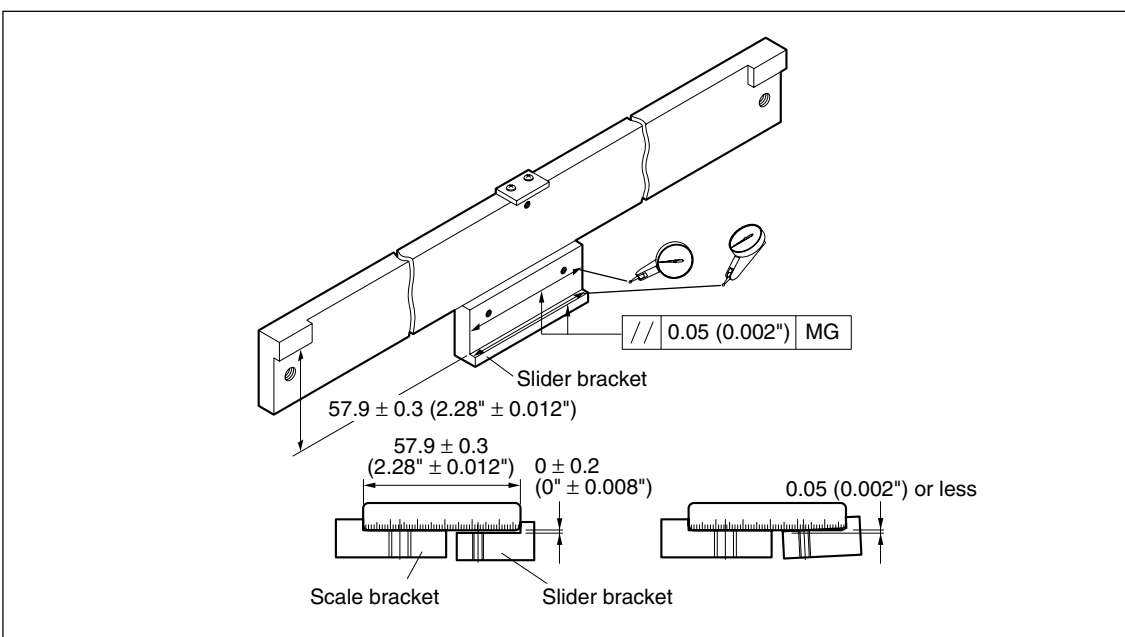


Fig 2-6

3. Bring the scale into contact with the stop surfaces and install.

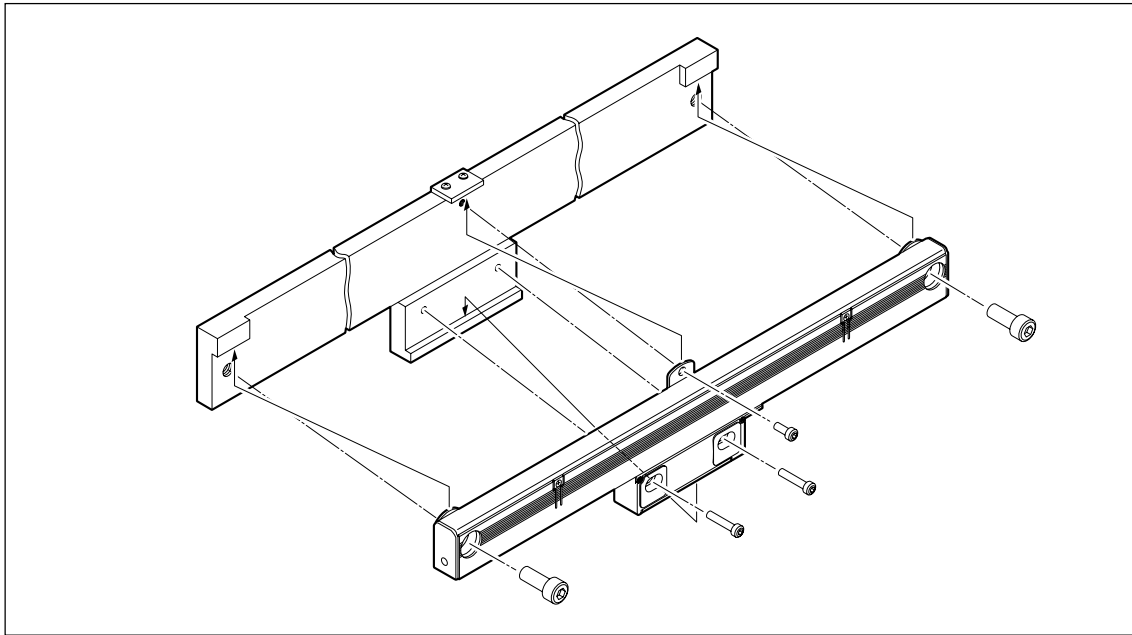


Fig 2-7

**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.

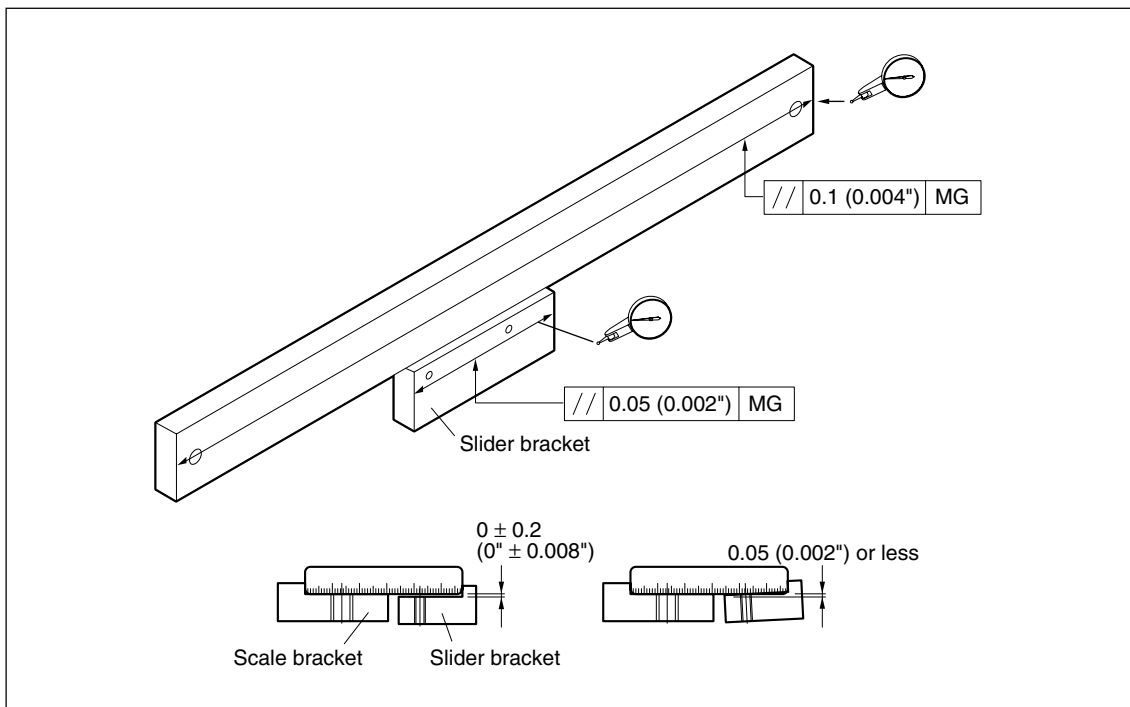
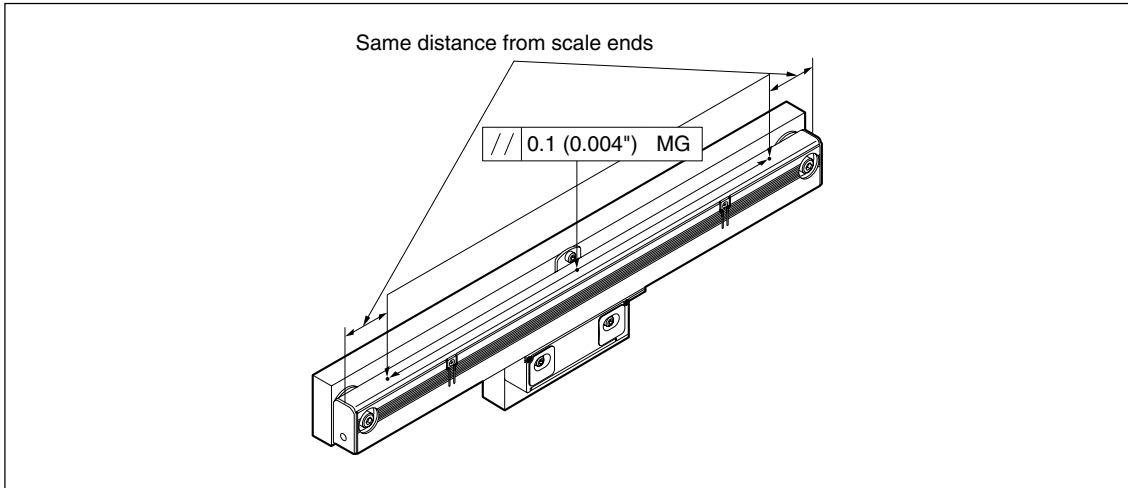


Fig 2-8

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.

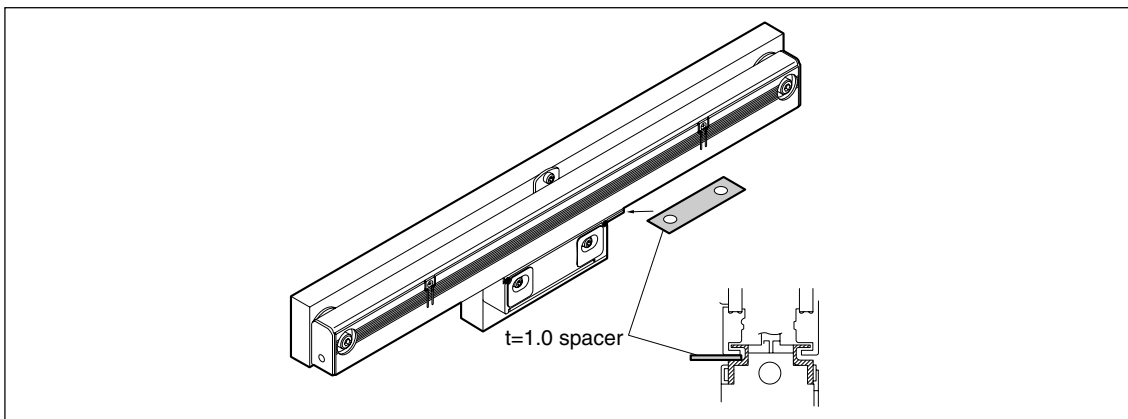
**\*<Measurement method>**

Measure at two points where the measurement distance is as wide as possible and at the same distance from the right and left scale ends. If using a scale with intermediate foot plate, be sure to also measure the intermediate foot plate.



**Fig 2-9**

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



**Fig 2-10**

## 2-3. Installing the Interpolator

### Note

Take careful note of the following points to prevent noise from other equipment.

- Implement noise prevention measures for relays, solenoids, motors, and other devices connected and used with the interpolator.
- Implement further noise prevention measures if there is a possibility of noise from other equipment mixing into the power supply line.
- Be sure to ground the interpolator together with the machine unit by securing with a grounding wire or screw holder.
- Connect the shielded braided wire of the output cable to the supplied case of output connector. Also, connect so that the interpolator and frame ground (shaded area) have the same electric potential.

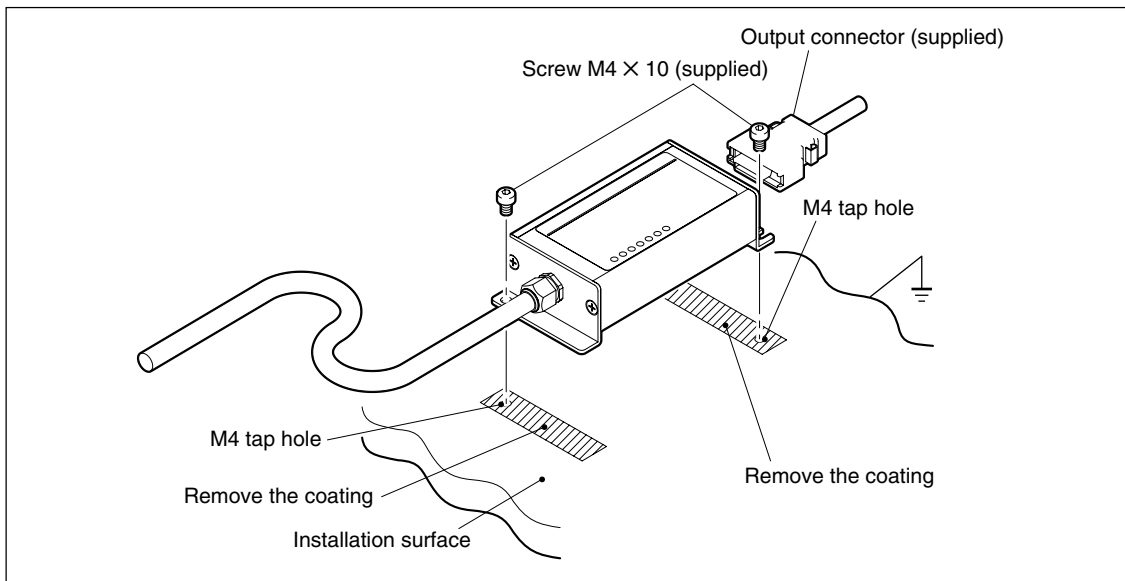


Fig. 2-11

### Installation location

### Note

Install the interpolator in a well-ventilated location with an ambient temperature of 0 °C to 50 °C and not exposed to direct sunlight or heat sources. If the interpolator is installed in a location where it is exposed to water drops, be sure to always attach a cover or other waterproof protection.

### Installation

1. Drill M4 tap holes at the mounting hole positions.
2. Remove the coating around the tap hole to obtain a full electrical conductor by surface contact with the interpolator case.
3. Insert the supplied screws (M4 × 10, tightening torque of 2 N·m) into the two installation holes, and secure them in place.
4. Firmly insert the output connector.

### Note

- After installation, be careful that you do not apply unnecessary force to the cable or connector. This could damage these parts.
- Arrange the scale cable and output cable so that they are at least 100 mm from the power cable. If these cables must be arranged closer, place the cables so that they are perpendicular, not parallel, to the power cable.

# 3. Scale (SR33/SR34)

## 3-1. Output Signal

### 3-1-1. SR33

The COS signal is ahead when the slider is moved in the direction of the arrow in Fig. 3-1.

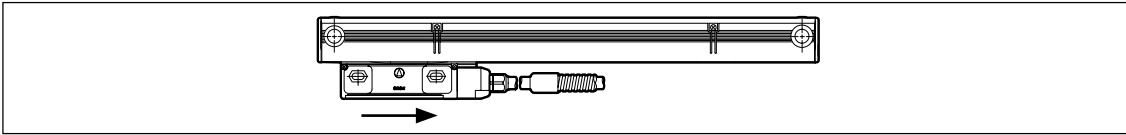


Fig. 3-1

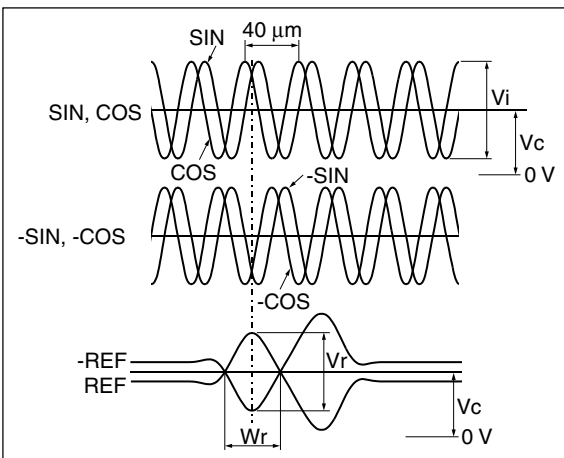


Fig. 3-2

	Min.	Typ.	Max.
$V_i$ (Vp-p)	0.3	0.5	0.6
$V_r$ (V)	0.3	0.7	1.0
$W_r$ ( $\mu\text{m}$ )	10	40	70
$V_c$ (V)	2.3	2.5	2.8

Use of the differential type receiving circuit shown in Fig. 3-3 results in an analog 1 Vp-p (typ.) signal.

### Recommended Receiving Circuit

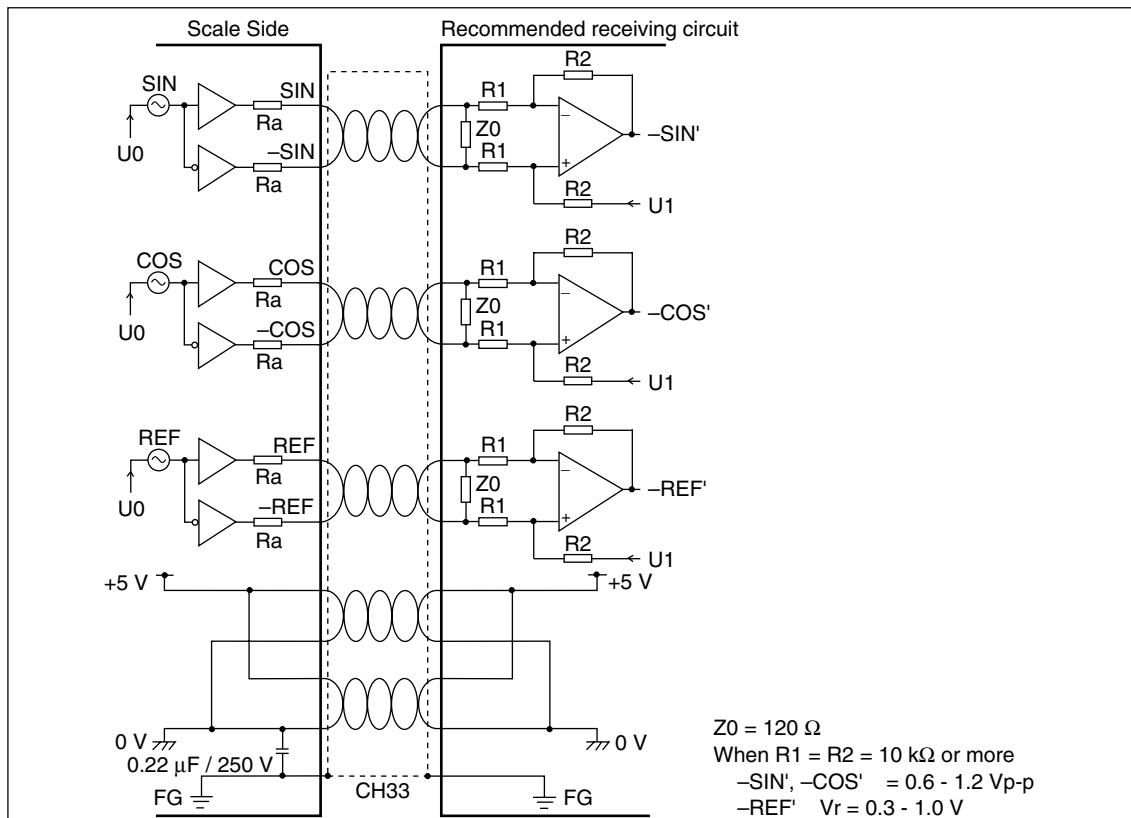


Fig. 3-3



### 3-1-2. SR34

The A signal is ahead when the slider is moved in the direction of the arrow in Fig. 3-4.

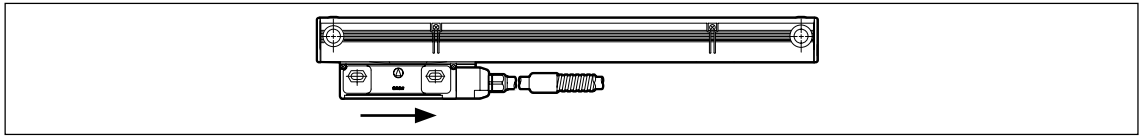


Fig. 3-4

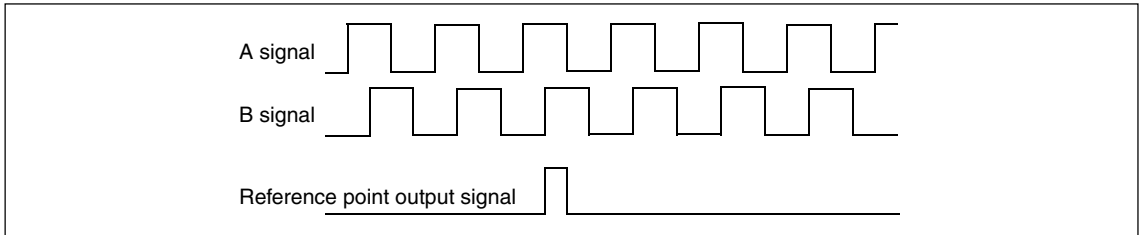


Fig. 3-5

The scale movement is detected every 100 ns, and this output as the phase difference time proportionate to the displacement. The phase difference time changes in integer multiples of 100 ns.

The A/B quadrature signal assumes high impedance state in the following cases.

- When the phase difference time of the A/B quadrature signal is less than 100 ns.
- When the scale signal level is less than 0.7 Vp-p.
- When noise or other malfunction occurs.

### Recommended Receiving Circuit

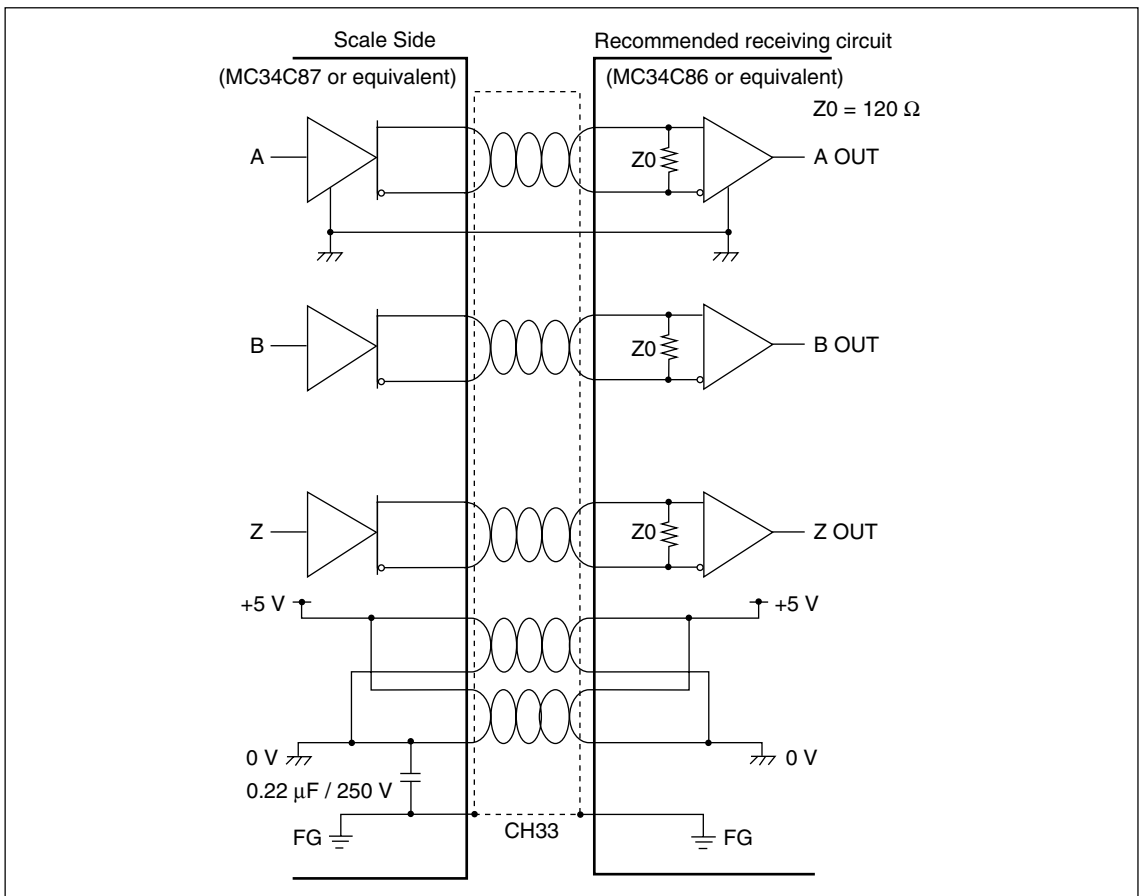


Fig. 3-6

## 3-2. Power Supply

Use a power supply that satisfies the specifications below.

Use of a power supply with a short-circuit protection device is recommended.

	SR33	SR34
Supply voltage	4.75 to 5.25 V DC	4.75 to 5.25 V DC
Consumption current	150 mA or less	400 mA or less
Inrush current	2 A or less *	2 A or less *
Ripple voltage	50 m Vp-p or less	50 m Vp-p or less

\*: When the power supply rise time is 10 ms.

### Note

When the SR33/SR34 is turned on, no signals are output for approximately 0.2 seconds.

Also, a signal may be output momentarily when the power is turned on or off, and this signal can cause the entire system to malfunction. To prevent this, be sure to follow the proper power-on and power-off procedures.

### Power-on procedure

1. Turn on the power for the SR33/SR34.
2. Turn on the power for the receiving device.

### Power-off procedure

1. Turn off the receiving device.
2. Turn off the SR33/SR34.

### 3-3. Measures for Operating Environments

#### 3-3-1. Air Injection to Scale

In the standard configuration, the end cap section of the scale is provided with an M5 tap hole for air injection.

Air can be injected into the scale unit to reduce the effects of the environments shown below.

The actual effects, however, will vary depending on the usage conditions. Therefore, be sure to fully check the effects before using air injection.

- Locations where dust is prevalent
- Locations where coolant is sprayed

#### Air Tube Route and Device Configuration

Prepare the devices as shown in the figure below, and air is injected into the scale by connecting the air tubes.

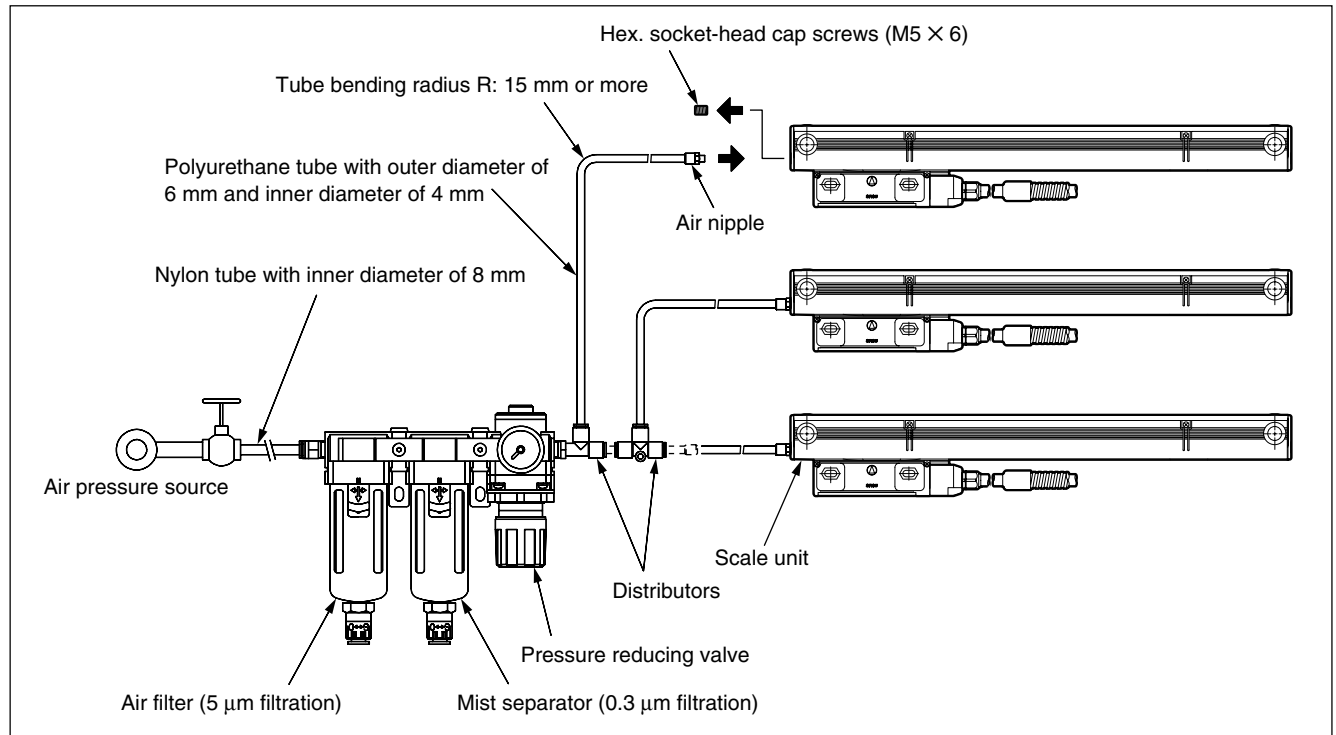


Fig. 3-7

The customer must obtain the air supply unit and input/output polyurethane tube. The recommended air supply unit specifications and main components are shown in the table below.

#### Specifications

Guaranteed pressure resistance	1.5 MPa
Maximum operating pressure	1020 kPa
Minimum operating pressure	20 kPa
Pressure setting range	20 to 200 kPa
Operating temperature and operating fluid temperature	-5 to 60 °C (no freezing allowed)
Filtration	Air filter: 5 μm Mist separator: 0.3 μm
Pressure gauge connection port	Rc (PT) 1/8
Tube connection port	Input side: Tube outer diameter of 8 mm (1 location), Output side: Tube outer diameter of 6 mm (3 locations)
Auto drain differential pressure	150 to 1020 kPa

## Main components

Manufacturer	Model	Name	Quantity
SMC Corporation	AF3000-02C	Air filter	1
SMC Corporation	AFM3000-02C	Mist separator	1
SMC Corporation	AR3000-02G-1	Regulator with 200 kPa pressure gauge	1
SMC Corporation	Y30L	Spacer accessory with L-type bracket	2
SMC Corporation	KQ2S06-M5	Air nipple	1

### Note

The air filter and mist separator should incorporate a float-type auto drain (NC) mechanism. Use a drain tube with a diameter of at least 4 mm and length of 5 m or less. Set the tubes so that there is no rising.

## Tube Layout Notes

### Tube arrangement

Use tubes with a bending radius of at least 15 mm and arrange them so that there are no sharp bends. Also, if the tubes are laid parallel within the ducts for the air tubes or hydraulic tubes, be careful that the tubes are not crushed by the action of the ducts.

### Tube length

To inject air simultaneously into multiple scales, make the tubes the same length from the distributor of the air supply unit to each scale so that the injection air pressure is uniform for each scale.

### Pressure setting and tube length for pressure reducing valve

If the air injection pressure for each scale is around  $20 \pm 10$  kPa, the air in the scale can be maintained at a low humidity. However, only setting the air injection pressure with the pressure reducing valve will not result in an air injection pressure of  $20 \pm 10$  kPa due to pressure losses stemming from the tube length. Refer to graph below to determine the pressure setting of the pressure reducing valve.

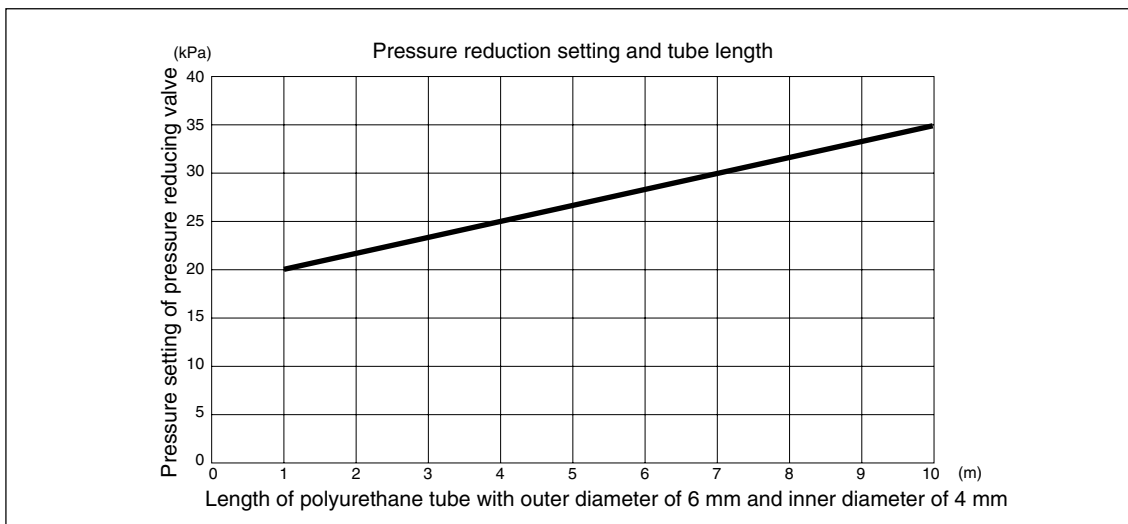


Fig. 3-8

This graph illustrates the relationship between the regulator pressure setting and tube length when the air injection pressure is 20 kPa. The tube length here is considered to be the length from the distributor of the air supply unit to the scale. When the air injection pressure is 20 kPa, the air consumption amount per scale unit is approximately 30 Nl/min.

### Tube flushing

Perform flushing of the tube from the air pressure source to the air supply unit connectors and each scale connector.

This cleans the tubes, prevents the embedding of foreign objects in the equipment, and also provides a check of the tubes.

### Air pressure source

If a compressor is selected for use, take into consideration the air consumption amount (approx. 30 Nl/min per scale). The graph below shows the discharged air amount and rated output as a rough guideline for selecting a compressor. Although the specific graph may vary depending on the compressor model, please use it as a reference.

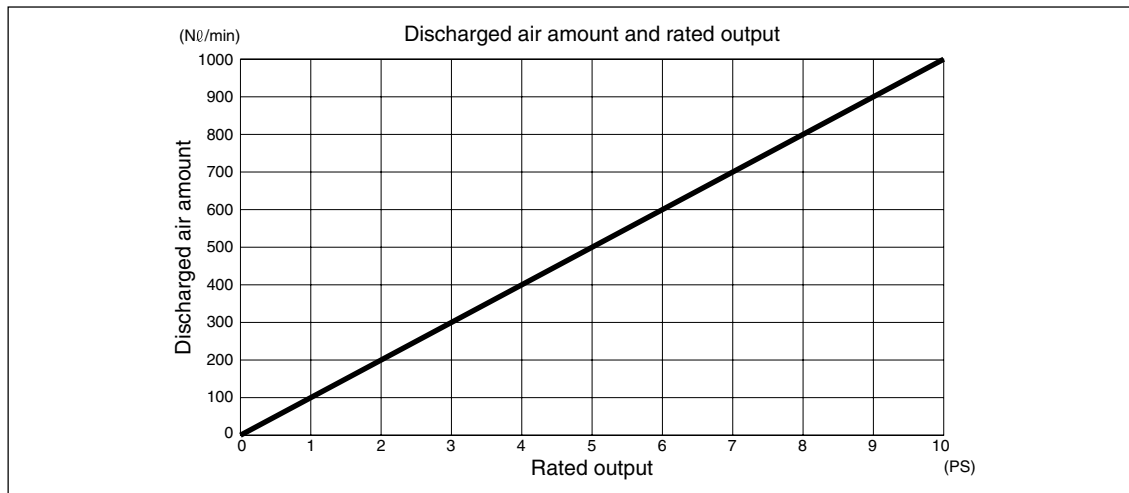


Fig. 3-9

## 4. Connecting Cables (CH33/CN33)

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### Note

Be sure to use either CH33 or CN33 to satisfy safety standards.

For more information about the CN33, see section 5, “Interpolator (CN33).”

### 4-1. CH33 (cable with unterminated end) Signal Specifications

Cable color	SR33	SR34
Brown	0 V	0 V
Black	0 V	0 V
Green	+5 V	+5 V
Violet	+5 V	+5 V
Blue	SIN	A
Yellow	-SIN	-A
Orange	COS	B
Gray	-COS	-B
Red	REF	Z
White	-REF	-Z

There are always two cables each for +5 V and 0 V, and so be sure to connect these cables in pairs. If only one cable is connected, the scale may not operate due to the voltage drop in the cable.

# 5. Interpolator (CN33)

This section describes the CN33 interpolator.

## 5-1. Names of Parts

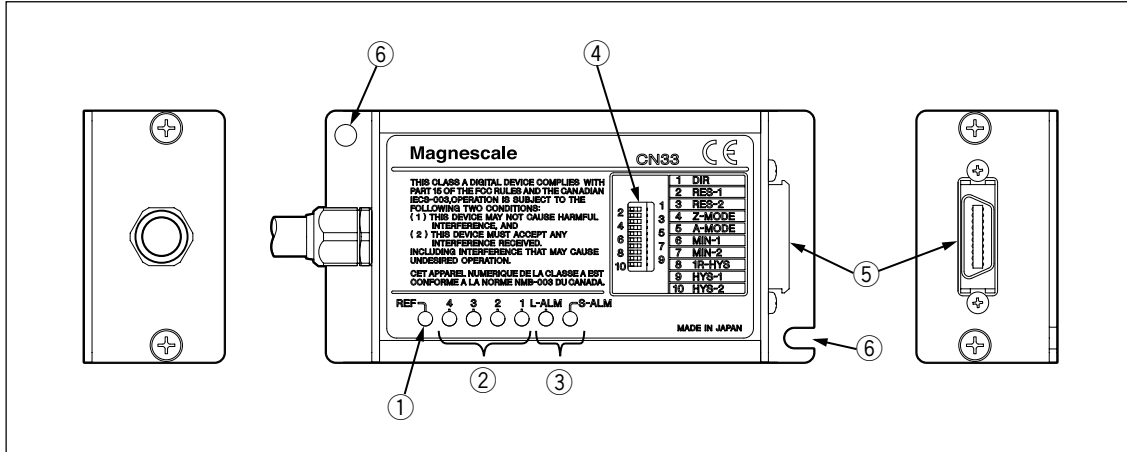
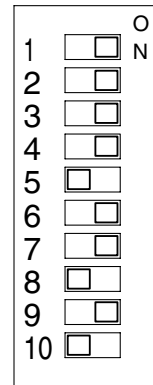


Fig. 5-1

- ① **REF LED** Turns on when the reference point signal is detected.
- ② **POS LEDs** Turn on successively according to the scale movement direction.
- ③ **Alarm LEDs** Turn on when an alarm occurs.  
L-ALM: Level alarm for input signal  
S-ALM: Speed alarm for input signal
- ④ **MODE switch** Used to set the direction, resolution, reference point signal width, alarms, minimum output phase difference time, and resolution hysteresis.
- ⑤ **Output connector** Provided for power supply input and signal output.
- ⑥ **Mounting holes** These holes (screw: M4) are used to install the interpolator (2 locations: top and bottom).

## 5-2. MODE Switches

No	Switch Name	Default Setting
1	DIR (Direction)	ON
2	RES-1 (Resolution 1)	ON
3	RES-2 (Resolution 2)	ON
4	Z-MODE (Reference point signal width)	ON
5	A-MODE (Alarm mode)	OFF
6	MIN-1 (Minimum phase difference time 1)	ON
7	MIN-2 (Minimum phase difference time 2)	ON
8	IR-HYS (Resolution hysteresis)	OFF
9	HYS-1 (Hysteresis 1)	ON
10	HYS-2 (Hysteresis 2)	OFF



Default Setting

### MODE switch 1 (Direction)

This switch is used to select the way in which the A/B quadrature signal output phase is correlated with the scale movement direction.

For more information, see section 5-2-1, “Direction.”

### MODE switch 2 (Resolution 1)

### MODE switch 3 (Resolution 2)

This switch is used to set the resolution.

For more information, see section 5-2-2, “Setting the Resolution.”

### MODE switch 4 (Reference point signal width)

This switch is used to change the output signal width of the reference point.

For more information, see section 5-2-3, “Setting the Reference Point Signal Width.”

### MODE switch 5 (Alarm mode)

This switch is used to select the alarm mode.

For more information, see section 5-2-4, “Selecting the Alarm Mode.”

### MODE switch 6 (Minimum phase difference time 1)

### MODE switch 7 (Minimum phase difference 2)

This switch is used to set the minimum phase time difference between A and B signal.

For more information, see section 5-2-5, “Setting the Minimum Phase Difference Time of the Output Signal.”

### MODE switch 8 (Resolution Hysteresis)

This switch is used to set the resolution hysteresis.

For more information, see section 5-2-6, “Setting the Hysteresis.”

### MODE switch 9 (Hysteresis 1)

### MODE switch 10 (Hysteresis 2)

This switch is used to set the amount of hysteresis.

For more information, see section 5-2-6, “Setting the Hysteresis.”



### 5-2-1. Direction

In the default setting, the A signal is ahead when the slider moves to the right. MODE switch 1 can be used to switch the output phase difference relationship of the A/B quadrature signal with respect to the scale movement direction.

Direction	MODE switch 1
<b>A signal is ahead</b>	<b>ON</b>
B signal is ahead	OFF

The default setting is indicated in bold.

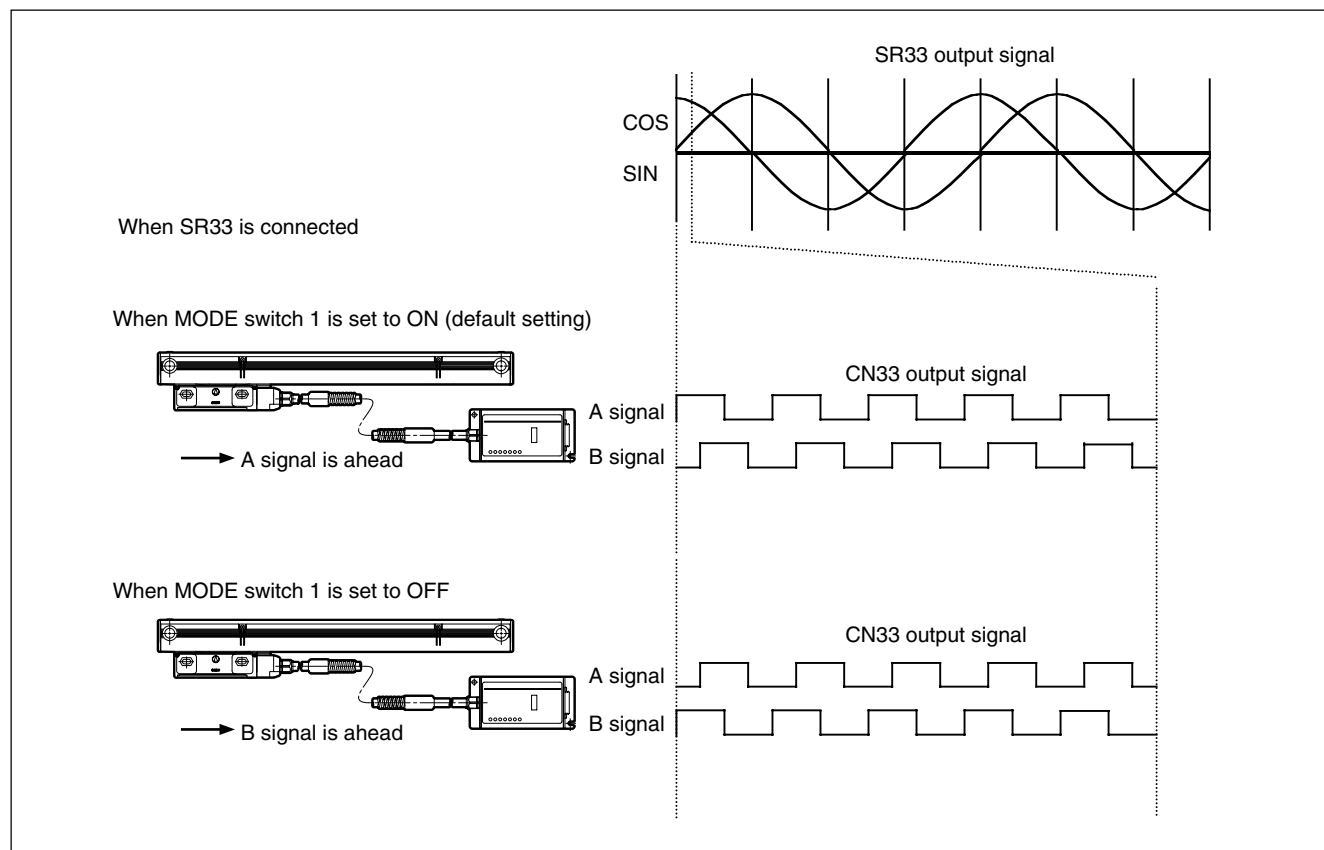


Fig. 5-2

### 5-2-2. Setting the Resolution

One wavelength of the input signal is 40  $\mu\text{m}$ .

MODE switches 2 and 3 can be used to change the resolution.

Resolution ( $\mu\text{m}$ )	MODE switch 2	MODE switch 3	Number of divisions
<b>0.05</b>	<b>ON</b>	<b>ON</b>	<b>800</b>
0.1	OFF	ON	400
0.5	ON	OFF	80
1.0	OFF	OFF	40

The default settings are indicated in bold.

### 5-2-3. Setting the Reference Point Signal Width

MODE switch 4 can be used to change the reference point signal width.

Reference point signal width	MODE switch 4
<b>1/4 Z Mode</b> A synchronized reference point is output when both the A signal and B signal are at the high level.	<b>ON</b>
Z Mode A synchronized reference point is output during the A signal cycle.	OFF

The default settings are indicated in bold.

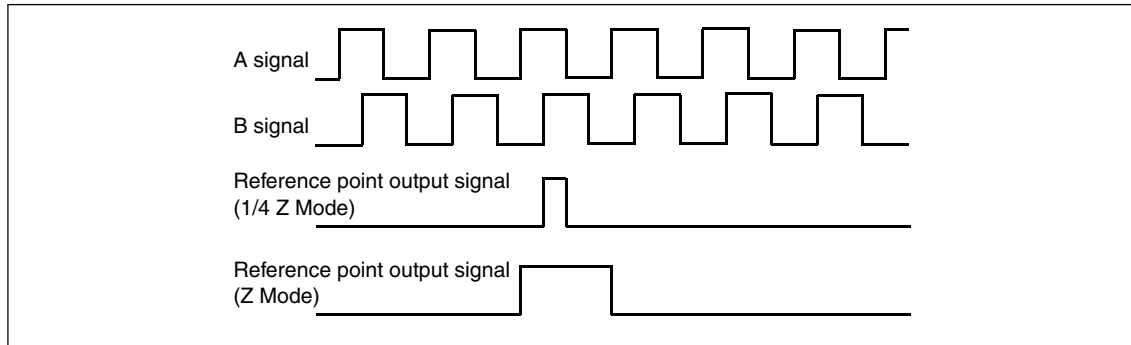


Fig. 5-3

## 5-2-4. Selecting the Alarm Mode

When an alarm occurs, the ALARM output is High and \*ALARM output is Low. At this time, the PCA, \*PCA, PCB, and \*PCB outputs assume high impedance state.

(The asterisk indicates an inverse signal of the respective signal. See section 5-5, “Output Connectors.”)

MODE switch 5 can be used to change to the following two modes.

Alarm mode	MODE switch 5
Automatic reset mode	ON
<b>Hold mode</b>	<b>OFF</b>

The default settings are indicated in bold.

### Automatic Reset Mode

An alarm signal is output for approximately 250 ms.

If the cause of the alarm is removed during this time, the alarm is automatically reset after approximately 250 ms.

If the cause of the alarm is not removed within approximately 250 ms, the alarm is reset once the cause of the alarm is removed.

### Hold Mode

If an alarm signal is output, the output continues even after the cause of the alarm is removed.

The alarm is reset by turning the power off and then on again if the cause of the alarm is removed.

### Alarm Signals

The alarm LEDs turn on when an alarm occurs.

The alarm LEDs turn on in the following cases.

L-ALM	This alarm occurs when the input signal level from the scale is less than 0.6 Vp-p.
S-ALM	This alarm occurs when the phase difference time of the A/B quadrature signal is less than the minimum phase difference time setting or when noise or other malfunction occurs.

## 5-2-5. Setting the Minimum Phase Difference Time of the Output Signal

The CN33 output phase difference time continuously changes by width of  $N \times 62.5$  ns (where N is an integer) from the minimum phase difference time depending on the scale movement speed.

### Note

When using this scale system, set to the minimum phase difference time based on the capability of the receiving device. If the setting for the minimum phase difference time does not match the capability of the receiving device, it may be unable to receive signals.

Once the phase difference time of the A/B quadrature signal falls below the setting value, the S-ALM turns on, and an alarm signal is output.

Minimum phase difference time setting value	MODE switch 6	MODE switch 7
<b>62.5 ns</b>	<b>ON</b>	<b>ON</b>
125 ns	OFF	ON
187.5 ns	ON	OFF
250 ns	OFF	OFF

The default settings are indicated in bold.

## 5-2-6. Setting the Hysteresis

The hysteresis can be set electrically using MODE switches 8 to 10. Increasing the hysteresis can improve performance when the resolution is high with respect to the input signal accuracy or when the A/B quadrature signal flickers under noise or other adverse conditions.

### Note

A higher hysteresis results in a higher return error.

### Hysteresis

Hysteresis ( $\mu\text{m}$ )	MODE switch 8	MODE switch 9	MODE switch 10
User-selected resolution *	ON	Disabled	Disabled
0.005	OFF	ON	ON
0.01	OFF	OFF	ON
<b>0.02</b>	<b>OFF</b>	<b>ON</b>	<b>OFF</b>
0.04	OFF	OFF	OFF

\*: See section 5-2-2, "Setting the Resolution."

The default settings are indicated in bold.

## 5-3. Maximum response speed

If the phase difference time of the A/B quadrature signal output falls below the minimum phase difference time setting, S-ALM turns on, and an alarm signal is output. The speed immediately before the alarm signal is output is considered to be the maximum response speed.

The maximum response speed is determined by the resolution and minimum phase difference time, and a higher resolution results in a lower speed.

For more information about setting the resolution, see section 5-2-2, "Setting the Resolution."

Resolution ( $\mu\text{m}$ )	Output pulse width (Minimum phase difference time setting value) (ns)			
	<b>62.5</b>	<b>125.0</b>	<b>187.5</b>	<b>250.0</b>
0.05	<b>20</b>	10	5	3
0.1	48	24	16	12
0.5	100	100	100	75
1	150	150	150	150

The default settings are indicated in bold.

(Unit: m/min)

## 5-4. Power Supply

### WARNING

Do not mistake the pin numbers for the wires (pins 9, 12, 14, 16, 18, and 20) used for input of the output connector power supply. Inadvertently connecting to these pins can cause a short circuit, resulting in fire or smoke from the power supply cable or activation of a protective device for the power supply. Be extremely careful when connecting the wires.

Once the connections are made, be ready to immediately turn off the power supply after turning on, and if the scale system does not operate, turn off the power and inspect.

Use a power supply that satisfies the specifications below.

Use of a power supply with a short-circuit protection device is recommended.

CN33	
Supply voltage	4.75 to 5.25 V DC
Consumption current	400 mA or less
Inrush current	5 A or less *
Ripple voltage	50 m Vp-p or less

\*: When the power supply rise time is 10 ms.

### Note

When the CN33 is turned on, no signals are output for approximately 0.2 seconds. Also, a signal may be output momentarily when the power is turned on or off, and this signal can cause the entire system to malfunction. To prevent this, be sure to follow the proper power-on and power-off procedures.

### Power-on procedure

1. Turn on the power for the CN33.
2. Turn on the power for the receiving device.

### Power-off procedure

1. Turn off the receiving device.
2. Turn off the CN33.

### Note

All LEDs turn on for approximately 0.8 seconds for the CN33's self-check process when the power is turned on.

## 5-5. Output connectors

### Connector :

Receptacle : PCR-E20LMDT (manufactured by HONDA TSUSHIN KOGYO CO., LTD.)

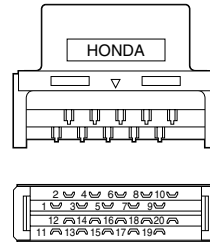
### Matching socket :

Plug : PCR-E20FS (manufactured by HONDA TSUSHIN KOGYO CO., LTD.)

Plug case : PCR-E20LC (manufactured by HONDA TSUSHIN KOGYO CO., LTD.)

### • Pin arrangement

Pin no.	Signal	Pin no.	Signal
1	PCA	11	ALARM
2	*PCA	12	0 V
3	PCB	13	*ALARM
4	*PCB	14	0 V
5	PCZ	15	NC
6	*PCZ	16	0 V
7	NC	17	NC
8	NC	18	+Vcc
9	+Vcc	19	NC
10	NC	20	+Vcc



(Inverted signals are indicated by an asterisk (\*) by the signal name.)

Three pins each are provided for +Vcc and 0 V, and so be sure to connect each of the three pins. If only one or two pins are connected, a voltage drop will occur in the cable, and the scale system may not operate.

### Output Cable Specifications

Use the shielded cables shown in the figure below (Fig. 5-4). Connect the shielded wires of the cable to the case of each connector. Make the cable length as short as possible to prevent noise from entering. (The maximum allowable length is 10 m.)

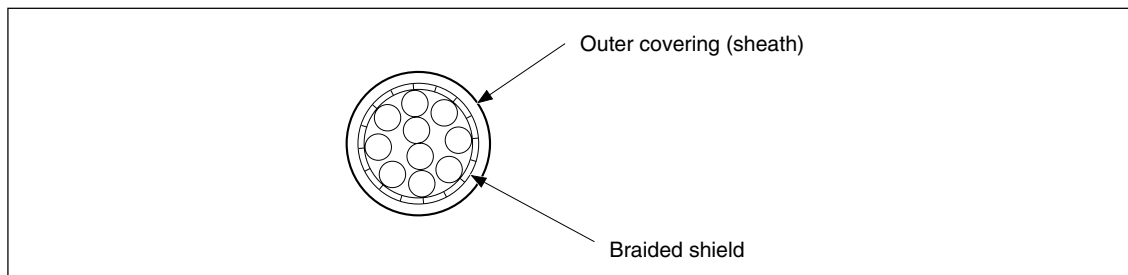


Fig. 5-4

#### Note

Take note of the following points when working with the cabling.

- Use twisted-pair cables with a thickness of AWG26 or greater to connect to the voltage differential line driver output section (pins 9, 12, 14, 16, 18, and 20).
- Connect the shielded braided cable directly to the casing (FG) without passing through the connector interior.
- AWG26 cables have a DC resistance of about 146  $\Omega$ /km. Therefore, use them so the supply voltage satisfies the rated values in the scale unit input section.

## Recommended Receiving Circuit

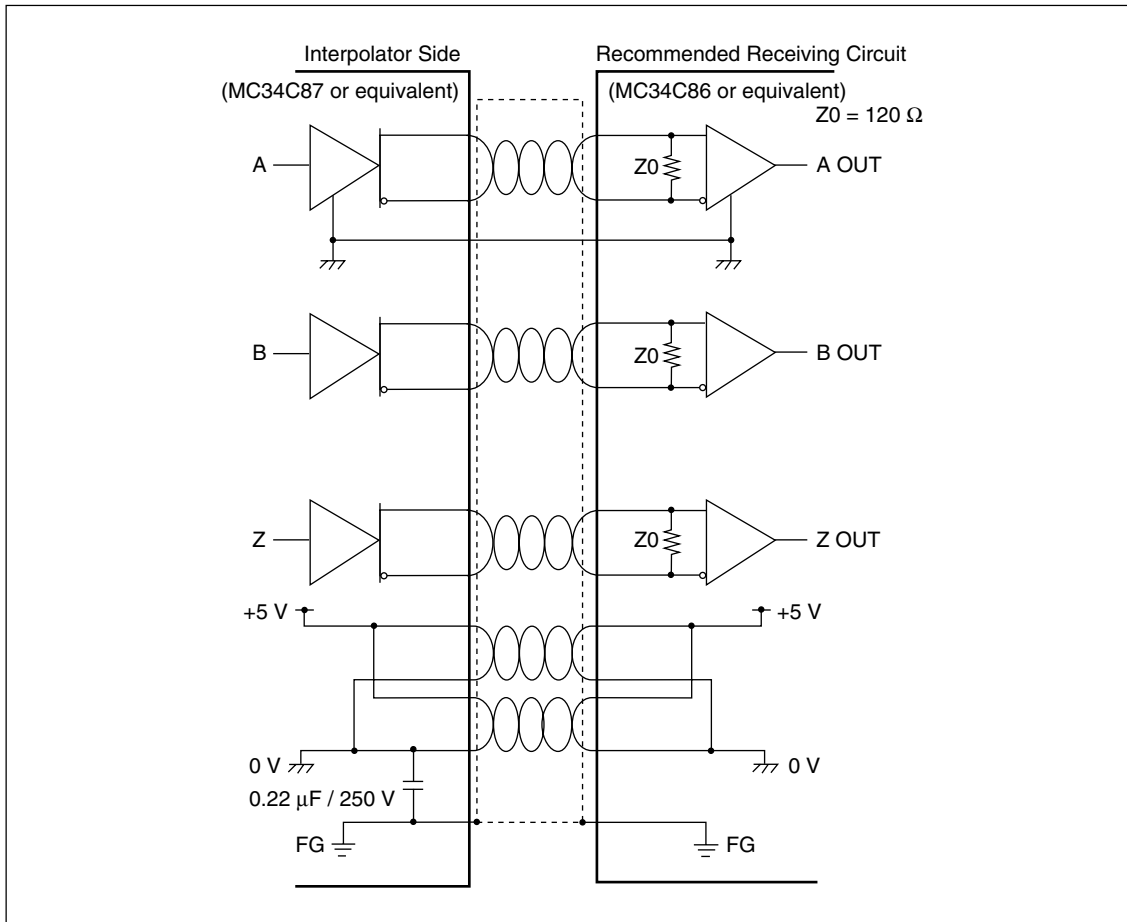


Fig. 5-5

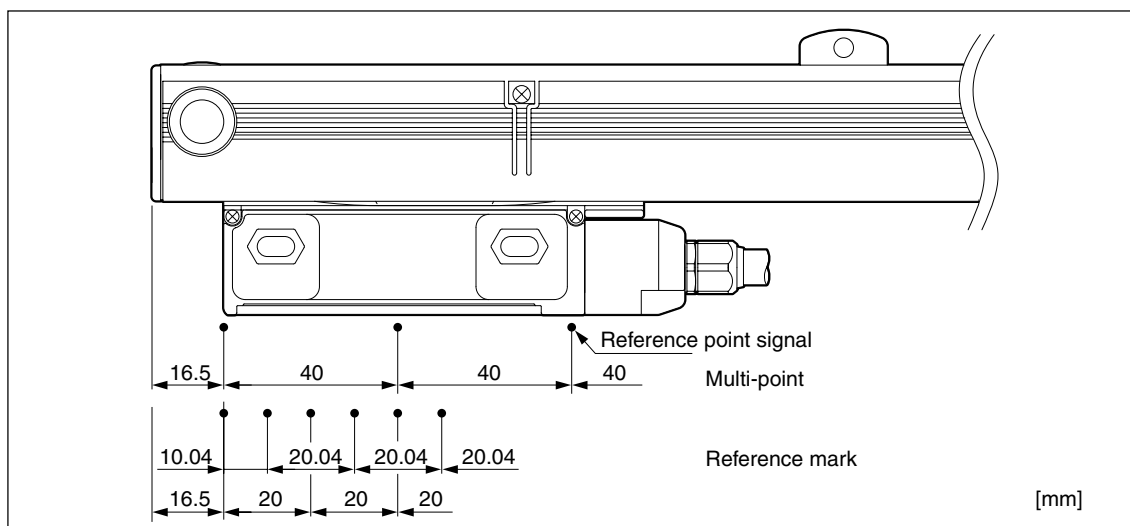
# 6. Specifications

## 6-1. Scale

Item	Model name SR33-XXX	SR34-XXX
Measuring length (ML)	70 to 2040 mm (26 types) 70, 120, 170, 220, 270, 320, 370, 420, 470, 520, 570, 620, 720, 770, 820, 920, 1020, 1140, 1240, 1340, 1440, 1540, 1640, 1740, 1840, 2040	
Thermal expansion coefficient	12 ±1 × 10 <sup>-6</sup> /°C	
Output signal	λ = 40 μm 1 Vp-p Sine wave, reference point, and differential output (See section 3-1-1.)	A/B/Z <sup>(Note 1)</sup> Line driver (compliant with EIA-422) (See section 3-1-2.)
Minimum phase difference time of output signal	—	100 ns
Accuracy (at 20 °C) ML: Measuring length (mm)	3 + 3ML/1000 μmp-p or 5 + 5ML/1000 μmp-p	5 + 5ML/1000 μmp-p
Resolution	0.05/0.1/0.5/1 μm (When used in combination with CN33)	0.1 μm
Reference point	One of the following: • Any designated position (at 1-mm pitch) • Multi-point (40 mm pitch) <sup>(Note 2)</sup> • Reference mark (standard pitch: 20 mm) <sup>(Note 2)</sup>	
Power supply voltage	5V DC ±5 %	
Power consumption	150 mA (with 120 Ω load)	400 mA (with 120 Ω load)
Inrush current	2 A max. (When the power supply rise time is 10 ms)	
Operating temperature range	0 to +50 °C	
Storage temperature range	-20 to +55 °C	
Maximum response speed	150 m/min	47 m/min
Vibration resistance	150 m/s <sup>2</sup> (50 Hz to 3 kHz)	
Impact resistance	350 m/s <sup>2</sup> (11 ms)	
Protective design grade	IP54 (no air injection), IP65 (with air injection)	
Power supply protection	Power supply reverse connection, excess voltage (fuse blows during fault)	
Safety standards	FCC Part15 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)	
Mass	Approx. 0.27 kg + 1.36 kg/m	
Dimensions	See section 7, "Dimensional Diagram."	

Note 1: The Z signal indicates the reference point output signal.

Note 2: See Fig. 6-1.



Multi-point reference signal and Reference mark reference signal positions  
24 (E)

Fig. 6-1



## 6-2. Connecting Cables

Item	Model name	CH33-XXCP	CH33-XXCE	CN33-XXCP	CN33-XXCE
Type	Cable with unterminated end			Cable with interpolator	
Cable sheath	PVC	Polyurethane		PVC	Polyurethane
Connecting scale	SR33, SR34			SR33	
Cable length	3, 5, 10, 15 m (with cable armor) Up to 150 m when combined with SR33-XXX Up to 30 m when combined with SR34-XXX			3, 5, 10, 15 m (with cable armor) Up to 30 m when combined with SR33-XXX <sup>(Note 1)</sup>	
Output signal	—			A/B/Z <sup>(Note 2)</sup> , alarm Line driver (Compliant with EIA-422)	
Minimum phase difference time	—			62.5/125/187.5/250 ns Switch selectable	
Resolution	—			0.05/0.1/0.5/1 μm Switch selectable	
Direction selection	—			Selectable by switch	
Maximum response speed	—			See section 5-3.	
Power supply voltage	—			5 V DC ±5 %	
Power consumption	—			400 mA (with 120 Ω load)	
Inrush current	—			5 A max. (When the power supply rise time is 10 ms.)	
Power supply protection	—			Power supply reverse connection, excess voltage (fuse blows during fault)	
Safety standards	—			FCC Part15 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)	
Protective design grade	IP65 (scale-side connector)			IP65 (scale-side connector) None (interpolator unit)	
Mass	Approx. 20 g + 157 g/m			Approx. 180 g + 157 g/m	
Minimum bending radius	With repeated bending	50 mm			
	Without repeated bending	Armored part: 25 mm Unarmored part: 20 mm			
Operating temperature range	0 to +50 °C				
Storage temperature range	-20 to +55 °C				
Dimensions	See section 7, "Dimensional Diagram."				

Note 1: To use nonstandard cable, contact your Magnescale Co., Ltd. sales representative.

Note 2: The Z signal indicates the reference point output signal.

## 6-3. Accessories

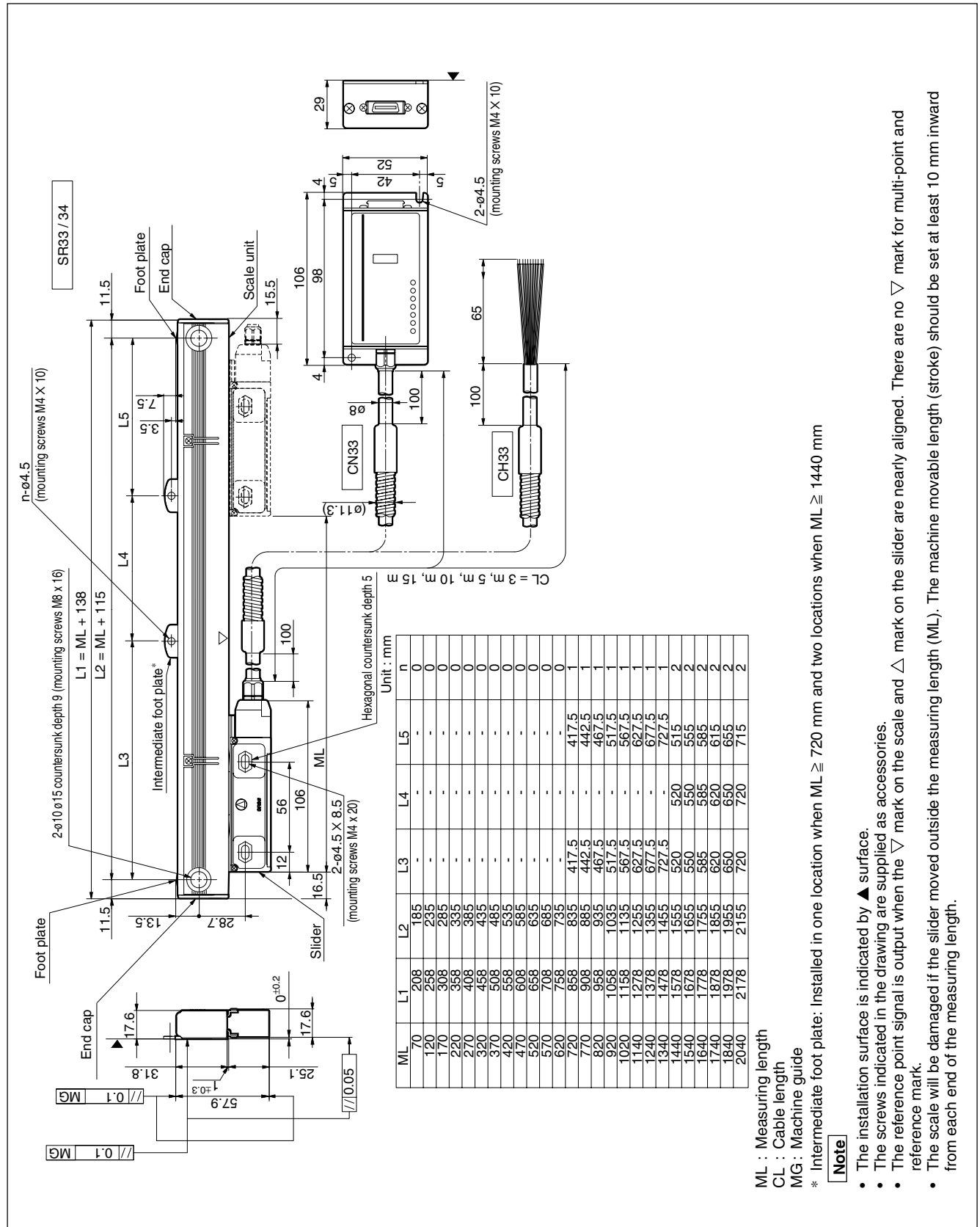
### SR-33/SR-34

M4 × 10	Hex. socket-head cap screws	2	(For intermediate foot plate installation)
M4 × 20	Hex. socket-head cap screws	2	(For slider installation)
M8 × 16	Hex. socket-head cap screws	2	(For scale installation)
M4	Hex. nuts	2	(For slider installation)
Spacer: t = 0.1		3	(For slider installation)
Spacer: t = 1.0		1	(For slider positioning)
Accuracy table		1	
Installation Manual		1	

### CN33

M4 × 10	Hex. socket-head cap screws	2	(For interpolator installation)
PCR-E20FS (HONDA TSUSHIN KOGYO Co., LTD)	Plug	1	(Output connector for connecting interpolator)
PCR-E20LC (HONDA TSUSHIN KOGYO Co., LTD)	Plug case	1	

# 7. Dimensional Diagrams



ML : Measuring length  
 CL : Cable length  
 MG : Machine guide  
 \* Intermediate foot plate: Installed in one location when ML ≥ 720 mm and two locations when ML ≥ 1440 mm

**Note**

- The installation surface is indicated by ▲ surface.
- The screws indicated in the drawing are supplied as accessories.
- The reference point signal is output when the ▽ mark on the scale and △ mark on the slider are nearly aligned. There are no ▽ mark for multi-point and reference mark.
- The scale will be damaged if the slider moved outside the measuring length (ML). The machine movable length (stroke) should be set at least 10 mm inward from each end of the measuring length.



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