Magnescale®

Rotaly Scale

RS310-1800A/1800B

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

Instruction Manual

NOTES TO USERS

Read all Instructions carefully before starting Use.
Save this MANUAL for future reference.

WARNING-This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Important-To insure that the complete system (including this peripheral) is capable of complying with the FCC requirements, it is recommended that the user make sure that the individual equipment of the complete system has a label with one of the following statements.

"This equipment has been tested with a Class A Computing Device and has been found to comply with Part 15 of FCC Rules."
-or-
"This equipment complies with the requirements in Part 15 of FCC Rules for a Class A Computing Device."
-or equivalent.

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 malfunction.
- 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.

CONTENTS

1. INTRODUCTION

RS310 Rotary Scale is a successor to RS1 Rotary Scale. As with RS1 Rotary Scale, it is used for NC feedbacks.

This Instruction Manual explains the procedures for mounting the RS310 Rotary Scale on a machine tool. Before the RS310 Rotary Scale can be mounted, it is necessary to prepare the dimensions, shape, etc., of the machine tool to allow the mounting. For details on selecting the appropriate rotary scale for the machine tool, and the necessary preparations on the machine tool, refer to Product Specifications (SD-G-2115C) provided in the package.

[Contents of Product Specifications (provided in the package)]

* Model variations
* Names of parts
* Specifications
* Dimensions and tolerances for preparations of mounting area
* Accuracy of rotary shaft
* Allowable residual magnetism inside machine tool
* Material of RS310 mounting area
* Shape of RS310 mounting area
* Waterproofing and oil-proofing
* Precautions on components generating leakage magnetic field
* Absolute zero point
* Precision of RS310 Rotary Scale
* System connection diagrams
* Maximum response revolution
* Outside dimensions
* Dimensions, etc., for replacing RS1 with RS310
* Options

2. ACCESSORIES

TABLE 1

Item	Number of Units		Remarks
	RS310-1800A	RS310-1800B	
Hexagon socket head cap screws, HSB M5 x 16	6 pcs.		For fastening the scale drum
Hexagon socket head cap screws, HSB M4 x 10	2 pcs.	4 pcs.	For fastening the head assembly
Pan head screws, +P3 x 16	2 pcs.	4 pcs.	For connecting the connector case
Flat washers, W5	6 pcs.		For fastening the scale drum
Spring washers, SW5	6 pcs.		For fastening the scale drum
Bellville spring, ø/8	2 pcs.	4 pcs.	For fastening the head assembly
Polyester film, 100μm thick	Adequate amount		For checking the clearance
Instruction Manual	1 pc.		
Product Specifications	1 pc.		

3. TOOLS NECESSARY FOR MOUNTING ADJUSTMENT

* Electrical comparator (or Lever Type Dial Test Indicator of 1μ reading)
* Magnet stand
* Oscilloscope
* Allen wrench for M5 (4 mm wide)
* Allen wrench for M4 (3 mm wide)
* Philips head screwdrivers (No. 1 and 2)
* Slotted screwdriver (2 to 3mm wide tip)
* Plastic hammer
* Polyester film for checking the clearance (provided)

4. MOUNTING ADJUSTMENT (Excluding the mounting adjustment of absolute zero point sensor)

4-1. Precautions on Mounting Adjustment

- **Do not loosen the head assembly guide plate!**
  The guide plate fastened on the head assembly is moved after the head assembly is positioned and fastened based on the circumference of the scale drum. Do not loosen the guide plate before the head assembly is fastened.

- **Keep magnets away!**
  Keep magnets on the magnet stand, etc., away from the magnetic recording surface, on the scale drum, head assembly, etc.,

- **Do not use organic solvents!**
  Do not use organic solvents on the magnetic recording surface.

- **Do not scratch the magnetic recording surface!**
  Do not scratch the magnetic recording surface with a tool (with screwdriver tip, allen wrench, etc.). The luster of the magnetic recording surface may be affected when the polyester film rubs against the magnetic recording surface when checking the clearance upon mounting, but this extent of change will have no effect on performance.

- **Store the guide plate!**
  Although the guide plate is normally repositioned and fastened after the head assembly is mounted, it is removed when using the optional cover. As the guide plate is necessary for removing the scale, be sure to store it in a safe place.

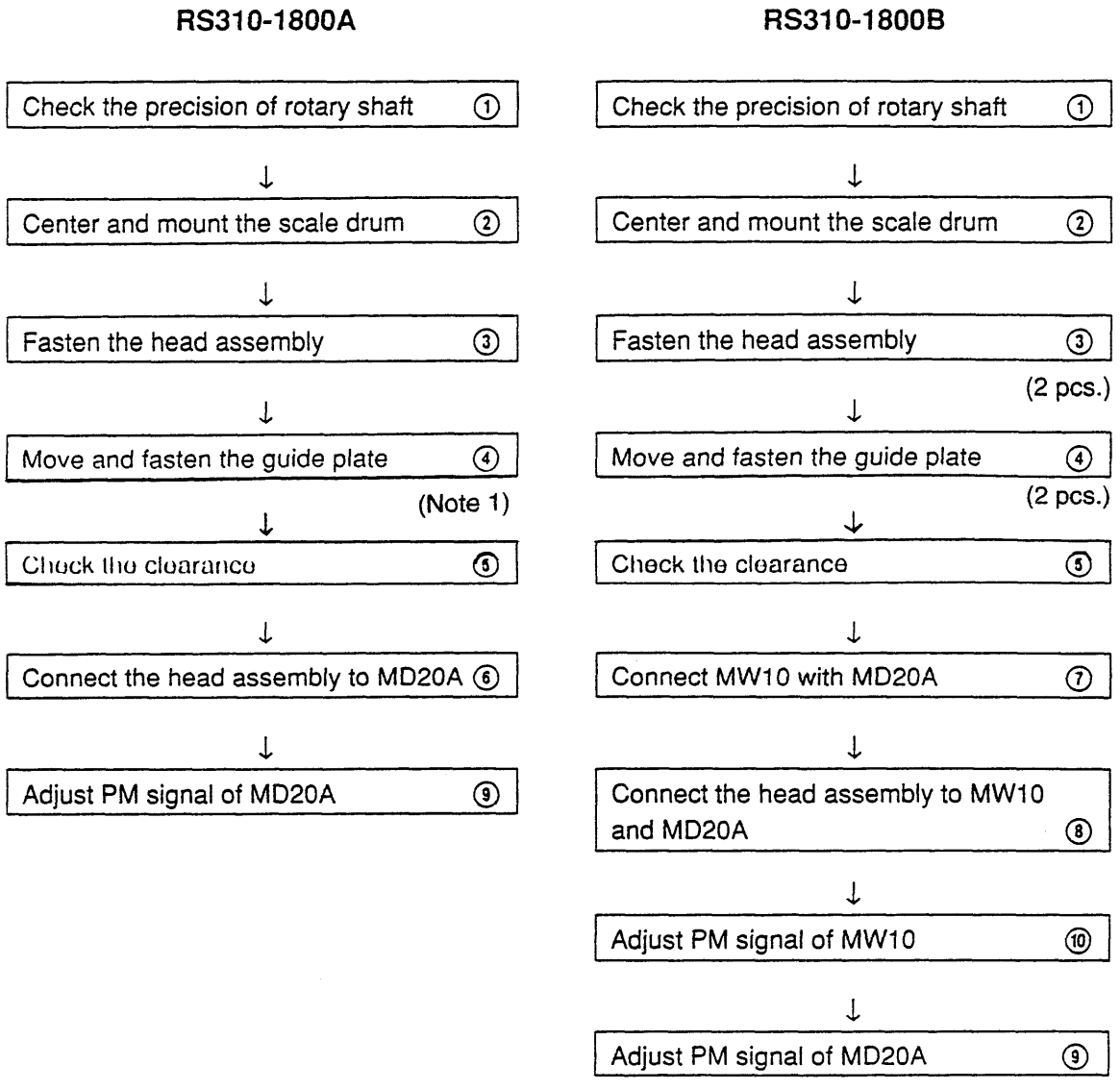
- **Keep the magnetic recording surface clean!**
  Be careful that chips and dirt do not attach to the magnetic recording surface. If a chip is caught between the scale drum and head assembly, it may scratch the magnetic recording surface and cause a failure.

- **Do not use metallic thickness gauge!**
  Be sure to use the polyester film provided in the package to check the clearance between the scale drum and head assembly. Using a metallic thickness gauge, etc., will scratch the magnetic recording surface and cause an error or breakdown.

- **Do not spill water soluble coolant!**
  If water soluble coolant remains in contact with the magnetic recording surface for 24 hours or longer, the magnetic recording surface will suffer a damage, causing an error or breakdown. If water soluble coolant spills on the magnetic recording surface during mounting, promptly wipe it off with a clean dry cloth, etc. For details, refer to section 9, "WATERPROOFING AND OIL-PROOFING" in the Product Specifications provided in the package.

4-2. Mounting Adjustment Procedure

The numbers in circles correspond to the description numbers on the following page. Refer to the following page for details on mounting adjustment.



(Note 1) Remove and store the guide plate when using an optional accessory.

4-3. Specifics of Mounting Adjustment

The numbers of descriptions below correspond to the numbers on the preceding page. For the overall flow of the mounting adjustment process, refer to section 4-2, "Mounting Adjustment Procedure" on the preceding page.

① Check the precision of rotary shaft (eccentric shaft and runout of mounting surface)

Use an electrical comparator or a Lever Type Dial Indicator of 1 micron reading to confirm that the runout of the shaft and the runout of the drum mounting surface, to both of which the scale drum is mounted, are within the tolerance shown in TABLE 2. For details, refer to section 5, "ACCURACY OF ROTARY SHAFT " in Product Specifications provided in the package.

TABLE 2

Model	RS310-1800A	RS310-1800B
Allowable runout of rotary shaft	As small as possible	30μm (0.00118") or less
Allowable runout of scale drum mounting surface	20μm (0.00079") or less	20μm (0.00079") or less

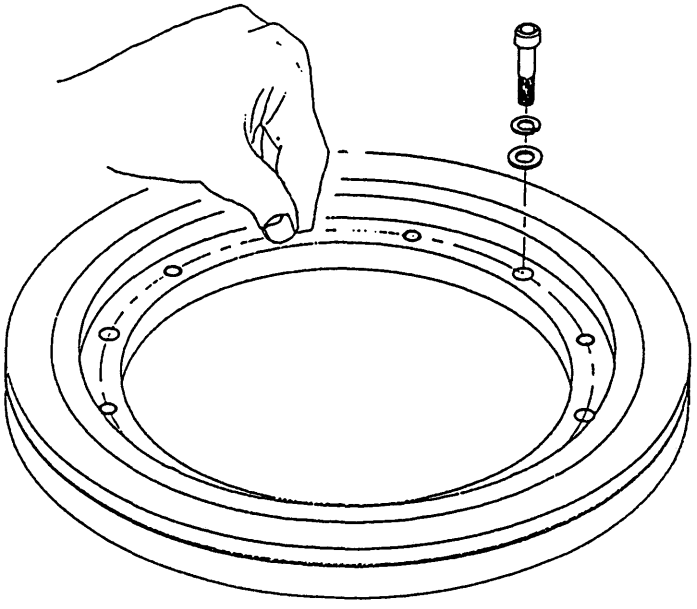
② Center and mount the scale drum

②-1 Place the scale drum on the rotary shaft, and visually confirm that the six bolt through holes of the scale drum are in line with the M5 mounting holes tapped into the rotary shaft.

②-2 Tentatively fix the scale drum to the rotary shaft with the M5 x 16 hexagon socket cap screws and SW5 spring washers, and W5 flat washer. When doing so, fit the hexagon socket cap screws with your fingers to ensure that hexagon socket cap screws fit smoothly into the bolt through hole with your fingers. (Fig. 1)

If the fit isn't smooth, the scale drum will deform when the hexagon socket cap screws are tightened with a wrench, causing a cumulative pitch error.

FIGURE 1



②-3 Place an electrical comparator or a Lever Type Dial Test Indicator of 1 micron reading against the circumference of the scale drum as shown in Fig. 2.

②-4 Prepare a suitable aluminum or brass piece beforehand, place the piece into the groove of the scale drum as shown in Fig. 2, and lightly tap the piece with a plastic hammer to center the scale drum. The allowable radial runout of the scale drum during centering is as shown in Table 3.

TABLE 3

Model	Allowable Radial Runout of Scale Drum
RS310-1800A	As small as possible
RS310-1800B	30μm (0.00118") or less including rotary shaft play

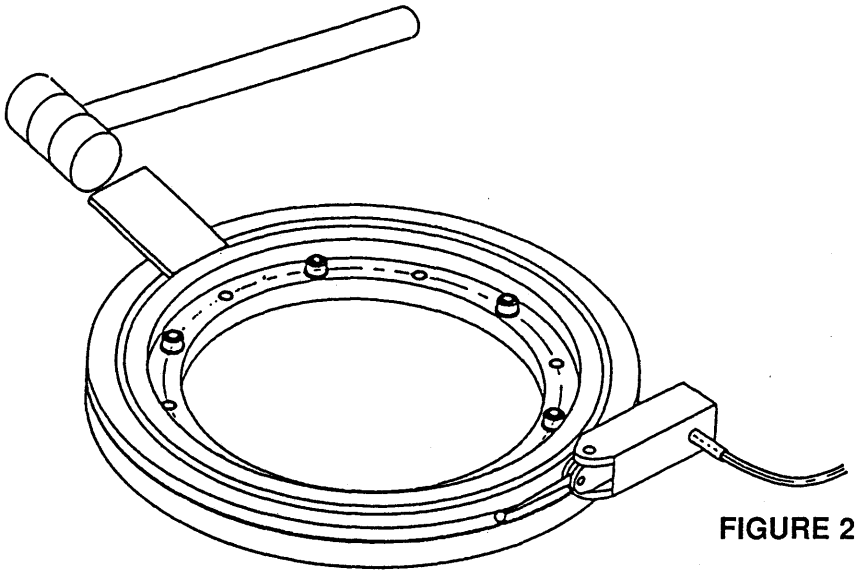


FIGURE 2

②-5 Securely tighten the hexagon socket cap screws that were tentatively tightened. Do not tighten all the screws at once, but turn one screw, then move onto the next one, to gradually and evenly tighten the six screws.

②-6 Recheck the radial runout of the scale drum.

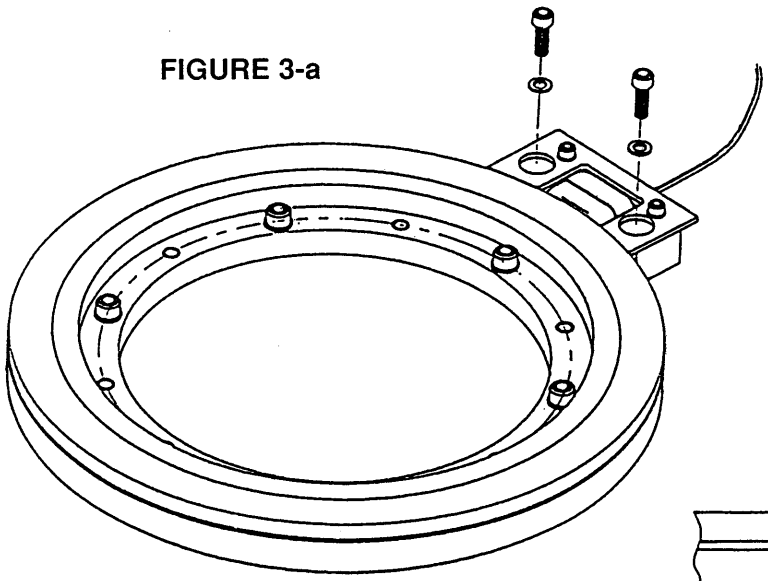
③ Fasten the head assembly

③-1 Make sure that the scale drum is not rotating. Steps ③, ④, and ⑤ are performed when the scale drum is still.

③-2 As shown in Fig. 3-a, gently place the guide plate of the head assembly against the reference track of the scale drum. Here, as shown in Fig. 3-b, slide the mounting reference surface of the head assembly over the mounting surface of the machine to place the head assembly against the reference track of the scale drum.

Fasten the head assembly to the machine with the M4 x 10 hexagon socket cap screws and the spring washers that are provided in the package.

FIGURE 3-a



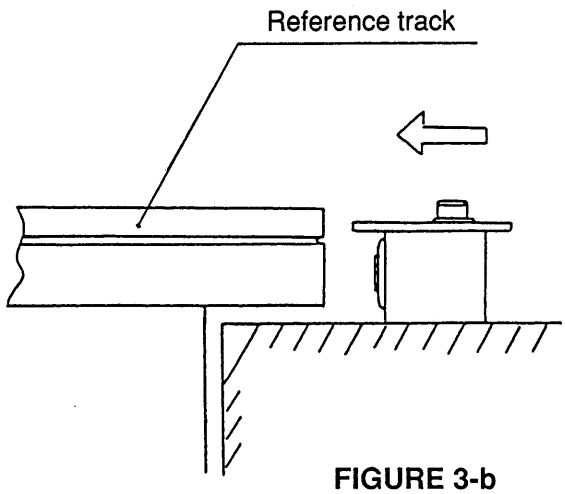


FIGURE 3-b

③-3 Checking the clearance (with the polyester film provided in the package)
Cut the polyester film (100 micron in thickness) provided in the package into a suitable size with a razor blade, and confirm that the piece of film can be inserted into the clearance between the scale drum and head assembly (refer to Figs. 4-a and 4-b). If the polyester film can not be inserted, remove the head assembly from the machine, refasten it, then check the clearance again.

(Note 2) Cut the polyester film with a sharp blade. If it is cut with a dull blade, burrs may be created on the cut section, which may then get caught when the piece of film is inserted into the clearance between the scale drum and head assembly, thus making accurate confirmation of clearance impossible.

FIGURE 4-a

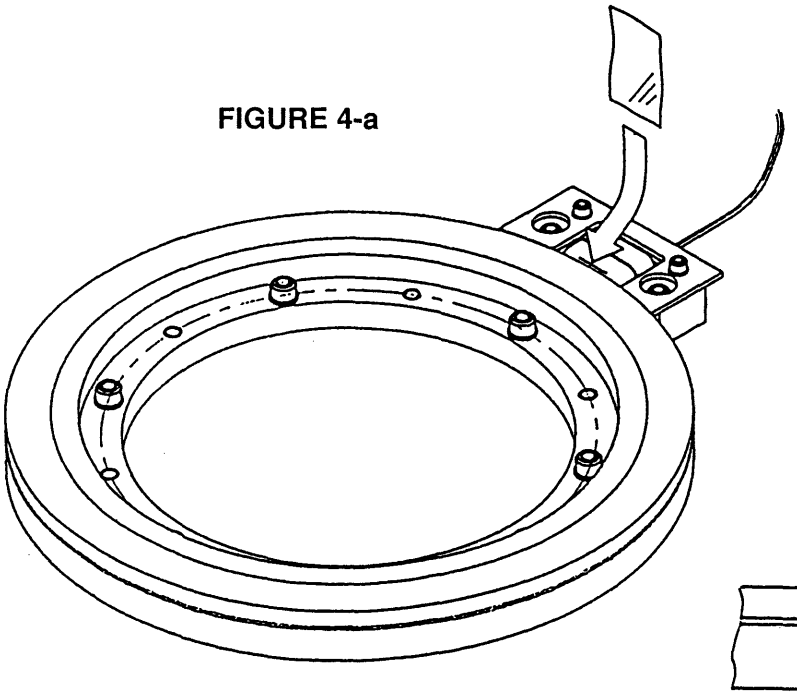
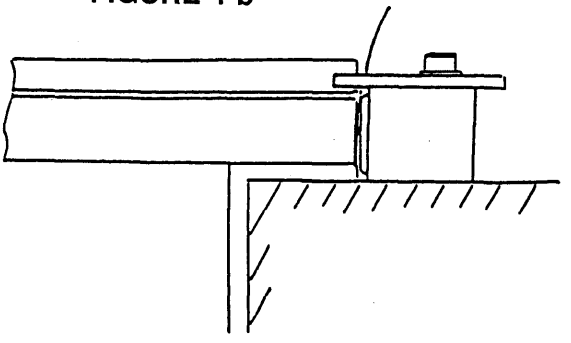
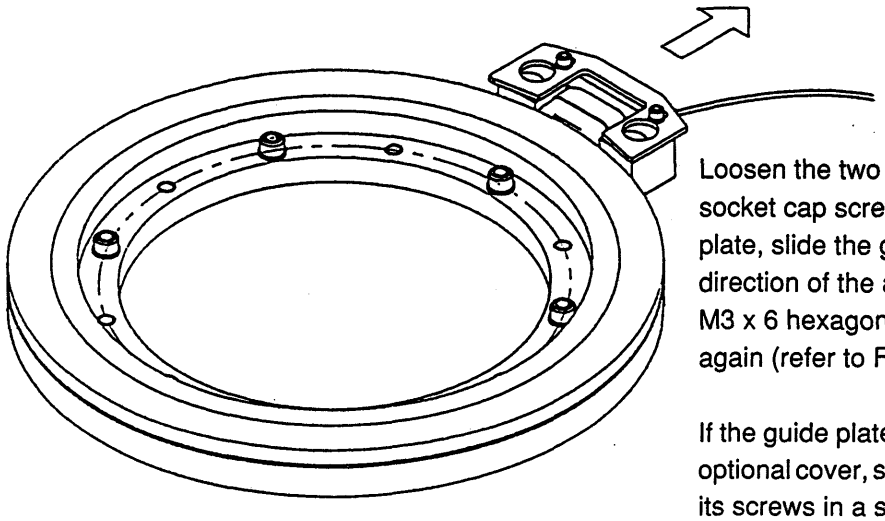


FIGURE 4-b



④ Move and fasten the guide plate



Loosen the two M3 x 6 hexagon socket cap screws fastening the guide plate, slide the guide plate toward the direction of the arrow, then tighten the M3 x 6 hexagon socket cap screws again (refer to Fig. 5).

If the guide plate is removed to use the optional cover, store the guide plate and its screws in a safe place.

FIGURE 5

⑤ Check the clearance (with the polyester film provided in the package)

Reconfirm that the polyester film (100 micron thickness) provided in the package can be inserted into the clearance between the scale drum and head assembly. This procedure is the same as ③-3.

⑥ Connect the head assembly to MD20A

Using the AK2 cable purchased separately, connect the head assembly to MD20A. Use the +P3 x 16 pan head screws provided in the package to connect the head assembly's connector with the AK2 cable's connector. For details, refer to the Instruction Manual on MD20A.

⑦ Connect MW10 with MD20A

Using the flat cable provided with MW10, connect MW10 with MD20A. For details, refer to the Instruction Manual on MW10.

⑧ Connect the head assembly to MW10 and MD20A

Using the AK2 cable purchased separately, connect the head assembly to MD20A and MW10. Use the +PM3 x 16 pan head screws provided in the package to connect the head assembly's connector with the AK2 cable's connector. For details, refer to the instruction manuals on MD20A and MW10.

⑨ Adjust PM signal of MD20A

While rotating the scale drum, use an oscilloscope to adjust PM signal. For details, refer to the Instruction Manual on MD20A.

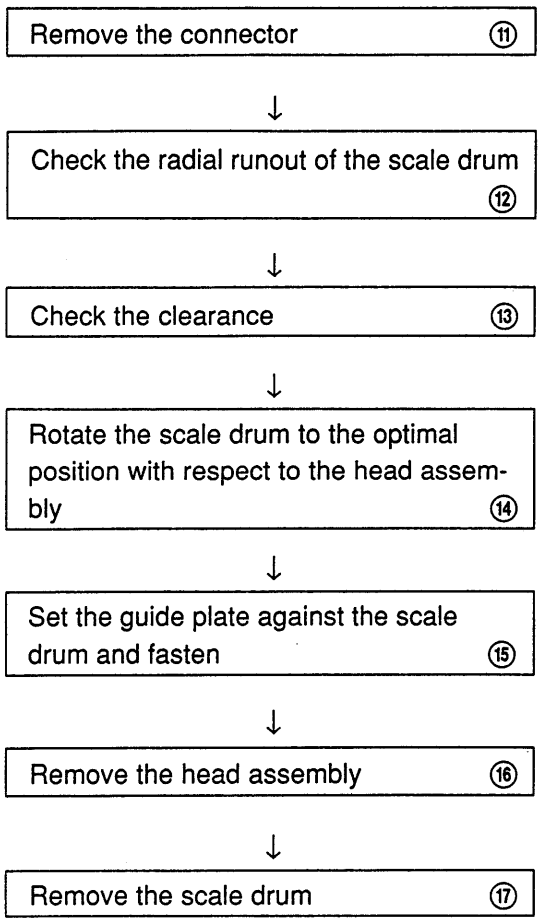
⑩ Adjust PM signal of MW10

When using RS310-1800B (2-head assembly), first adjust the PM signal of MW10. After the PM signal of MW10 has been adjusted, adjust the PM signal of MD20A. If the PM signal of MD20A is adjusted without adjusting the PM signal of MW10 beforehand, the adjustment will not be correct.

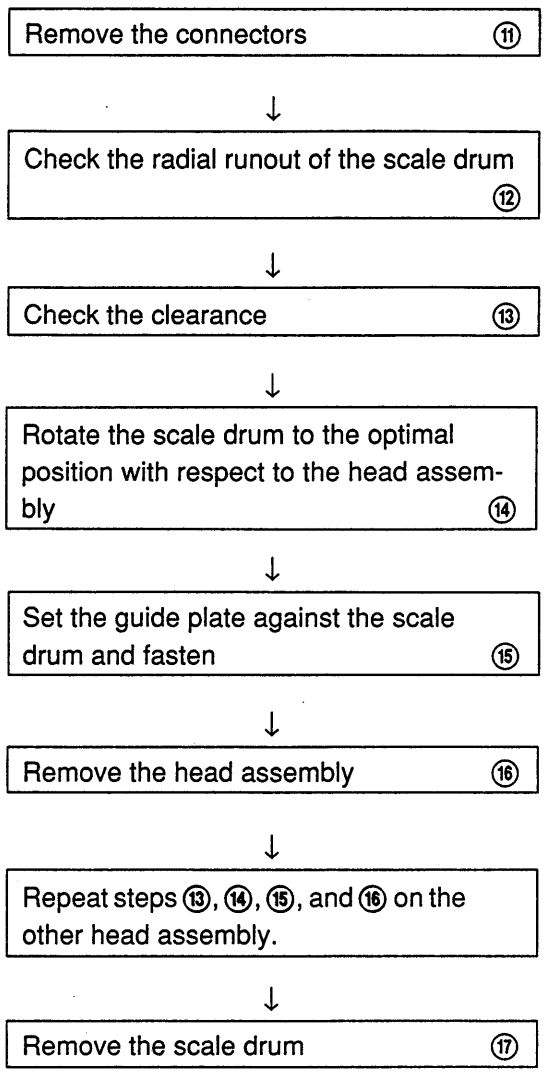
4-4. Removal Procedure

The numbers in circles correspond to the description numbers on the following page. Refer to the following page for details on the removal process.

RS310-1800A



RS310-1800B



4-5. Specifics of Removal

The numbers of descriptions below correspond to the numbers on the preceding page. For the overall flow of the removal process, refer to section 4.4, "Removal Procedure" on the preceding page.

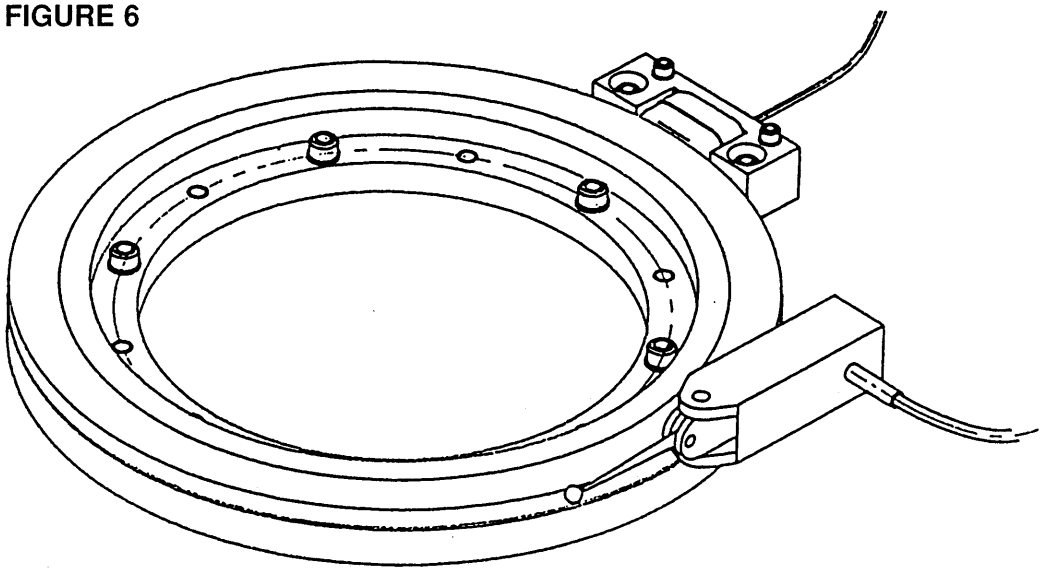
⑪ Remove the connector

Loosen the M3 x 16 pan head screws to remove the connector on the head assembly from the AK2 cable.

⑫ Check the radial runout of the scale drum

Place an electrical comparator or a lever type dial test indicator of 1 micron reading against the circumference of the scale drum as shown in Fig. 6 to measure the radial runout of the scale drum.

FIGURE 6



⑬ Check the clearance

Cut the polyester film (100 micron thickness) provided in the package into a suitable size with a razor blade, and confirm that the piece of film can be inserted into the clearance between the scale drum and head assembly (refer to Figs. 7-a and 7-b). Even if the polyester film can not be inserted, proceed to the following step.

(Note 3) Cut the polyester film with a sharp blade. If it is cut with a dull flade, burrs may be created on the cut section, which may then get caught when the piece of film is inserted into the clearance between the scale drum and head assembly, thus making accurate confirmation of clearance impossible.

FIGURE 7-a

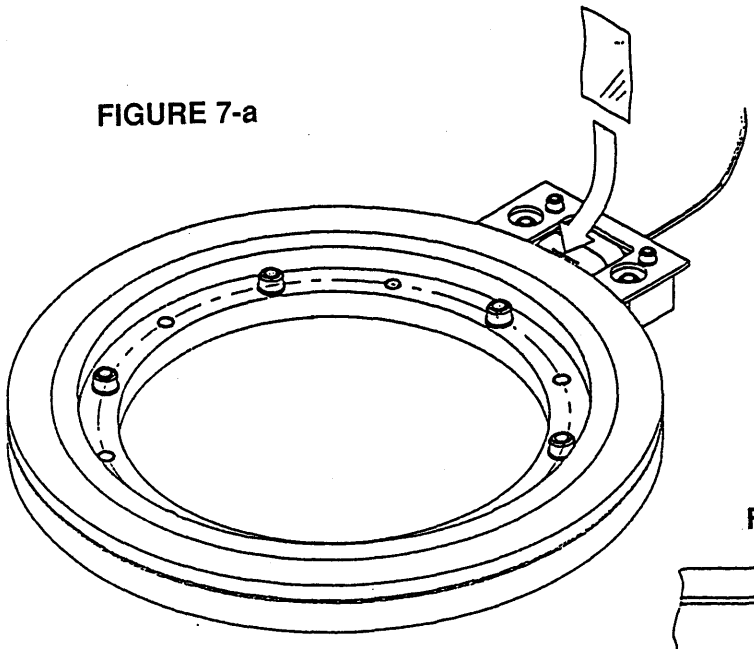
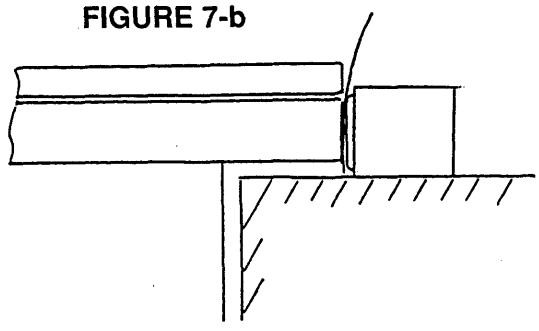


FIGURE 7-b



⑭ Rotate the scale drum to the optional position with respect to the head assembly

While referring to the radial runout of the scale drum checked in step ⑫, slowly rotate the scale drum to the position where the polyester film can be inserted, then stop the scale drum there.

⑮ Set the guide plate against the scale drum and fasten

Loosen the M3 × 6 hexagon socket cap screws fastening the guide plate, and lightly press the guide plate against the reference track of the scale drum as shown in Fig. 8. Using the M3 × 6 screws, fasten the guide plate to the head assembly.

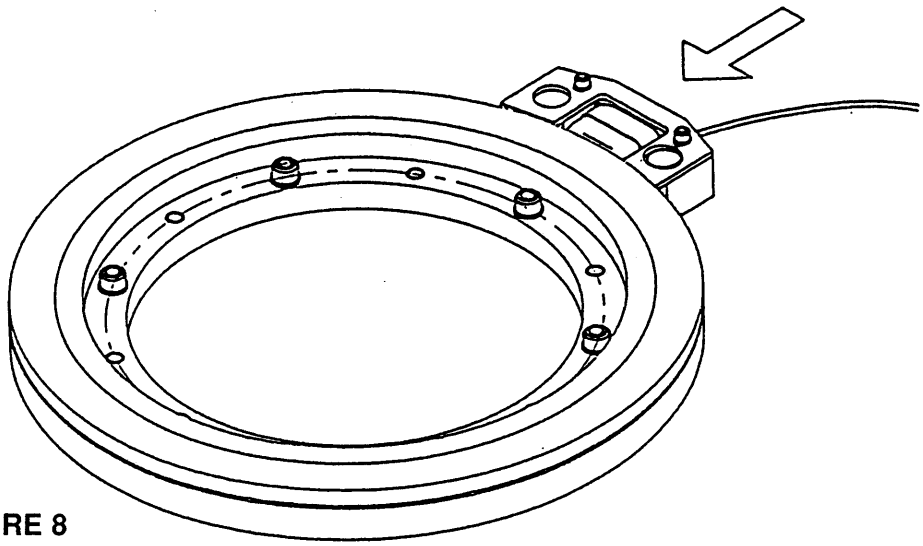


FIGURE 8

⑯ Remove the head assembly

Loosen the two M4 × 10 hexagon socket cap screws fastening the head assembly, and remove the head assembly from the machine.

⑰ Remove the scale drum

Loosen the six M5 × 16 hexagon socket cap screws fastening the scale drum, and remove the scale drum from the rotary shaft.

5. TROUBLESHOOTING FOR MOUNTING ADJUSTMENT AND REMOVAL

[Symptom]

When the scale drum was fastened on the rotary shaft, the radial runout of the scale drum increased.

Causes:

1. The bolt through holes of the scale drum and the M5 mounting hole tapped into the rotary shaft are out of alignment, and when the M5 hexagon socket cap screws were tightened, the roundness of the scale drum deteriorates.

2. The surface coarseness of the scale drum mounting surface of the rotary shaft is inferior, causing the scale drum to be deformed when it is fastened.

Countermeasures:

1. Remove the scale drum, and bore out the bolt through holes with a file. Be sure to remove all the filing chips from the scale drum with air. Also be careful not to scratch the magnetic coating surface.

2. Determine whether the surface roughness of the scale drum mounting surface of the rotary shaft satisfies the surface roughness described in section 5, "ACCURACY OF ROTARY SHAFT" in the Product Specifications. In particular, check for blisters and swelling caused by machining distortion around the tapped holes.

[Symptom]

When the head assembly was fastened to the machine tool, the clearance was reduced and the polyester film cannot be inserted.

Cause:

1. It is likely that the surface roughness of the mounting surface on the machine tool to which the head assembly is fastened is bad, so the head assembly leans to one side when the screws are tightened.

Countermeasure:

1. Check whether the head assembly mounting surface is machined as specified in section 4, "DIMENSIONS AND TOLERANCES FOR PREPARATIONS OF MOUNTING AREA" in the Product Specifications provided in the package, and correct inappropriate areas.

[Symptom]

On the RS310-1800B system, although the PM signals of MD20A and MW10 are adjusted according to the Instruction Manual, no output signals can be obtained from MD20A.

Cause:

1. For some faulty wiring in cluding the cable, the signal outputs from the two head assemblies are acting to cancel each other as the scale drum rotates.

Countermeasure:

1. Switch the adder-subtracter switch (S103) inside the MW10.

[The following symptoms do not indicate a failure]

1. When the electric comparator probe was placed in contact with the magnetic coating surface and the scale drum was rotated, glossy line appeared on the magnetic coating surface.

2. When the scale drum was rotated while the polyester film was inserted in the clearance between the head assembly and scale drum, glossy line appeared on the magnetic coating surface.

Such a slight change in the luster of the magnetic coating surface does not affect the performance.

Magnescale Co., Ltd.
Shinagawa Intercity Tower A-18F, 2-15-1, Konan, Minato-ku, Tokyo 108-6018, Japan

RS310-1800A / 1800B
2-995-614-04

2010.4
Printed in Japan