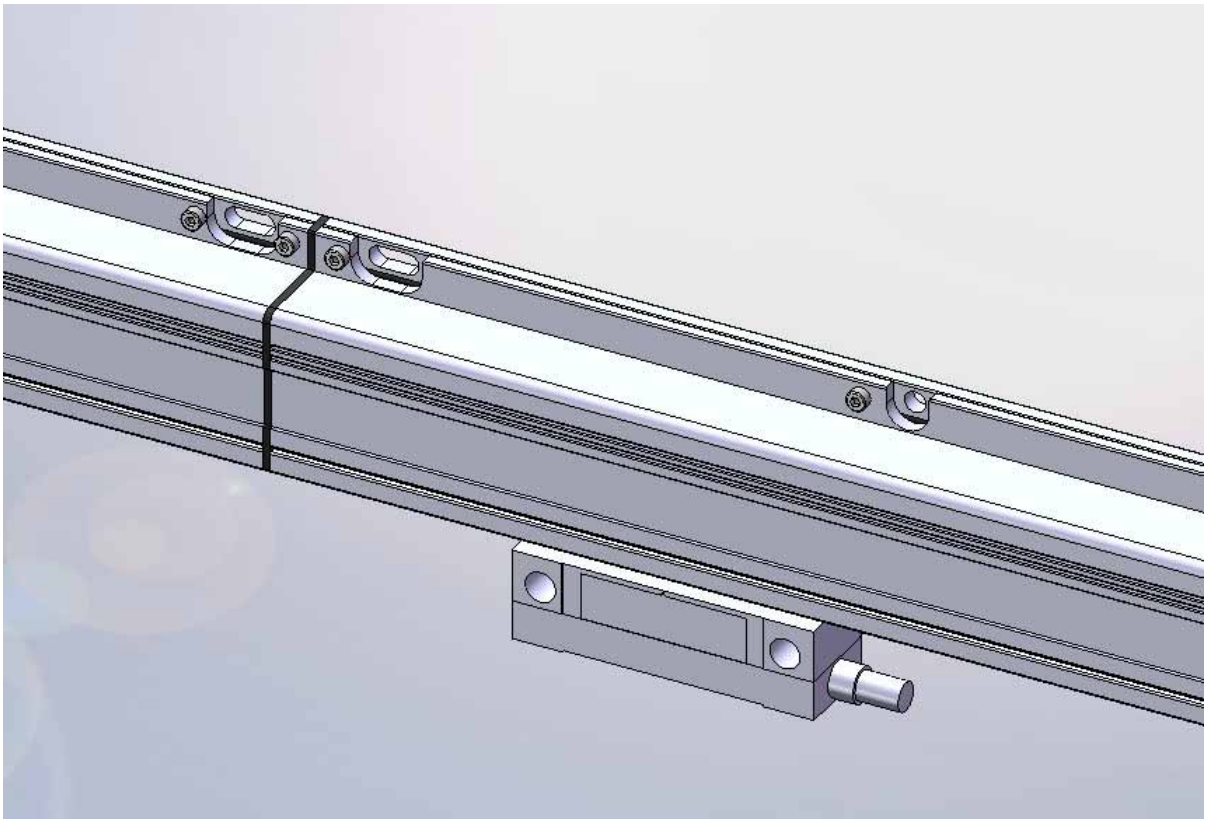
Lokshun 诺信® 数控

SINO®

# KA800M Magnetic Scale

# Operation Instructions



GUANGZHOU SINO DRO CO., LTD

# Contents

# 1 Safety Precautions

This manual is designed for technicians concerning installation and commissioning.

Please read this manual carefully before use.

Unauthorized modification and operation will invalidate the warranty.

## 1.1 Applications

KA800M Magnetic Scale is a linear displacement sensor designed with a theoretical measuring length of up to 100m. With an extremely high precision, the magnetic is mainly applied to heavy lathes, as a position measuring device of a lathe. Showing the positions of lathe moving parts through digital display, it facilitates the machining and improves the precision of machining.

## 1.2 Precautions

Always follow safety rules and regulations when using the displacement sensor. Do take measures to ensure that the sensor will not bring any danger to operator or devices like limit switch and emergency stop switch.

## 1.3 Validity

The manual is only designed for KA800M magnetic scale.

For instructions of other sensors of KA series, refer to their corresponding manual.

CE The displacement sensor complies with 73/23/EEC directive for low-voltage electric apparatus and 89/336/EEC directive for EMC.

We are certified with ISO 9001: 2000 by World-a British international certification company.

## 2 Features and Specifications

KA800M magnetic scale is a non-contact displacement measurement system, using detection of magnetic signals, which features:

- High precision of up to ± 10μm / 300mm or ± 20μm / 1000mm,
- Measurement length of up to 3–100m,
- Low sensitivity to impact, vibration and contamination (e.g. dirt and petroleum),
- ease of maintenance due to high resistance to wear, and
- Robustness.

Specifications:

- Resolution: 1μm
- Output signal: RS422
- Operating voltage: 5V±5%
- Max. moving speed: 30m/min
- Operating temperature: -20–70℃

## 3 Principle of Operation

The read head is fixed on a part of the lathe, and does not move. When the KA800M body is connected to the moving part of the lathe, the tape on the body records an alternating magnetic field with north and south poles, while the two increment sensors of magnetic head on the read head measures the alternating magnetic field.

Since the tape is not in contact with the magnetic head, the two increment sensors on the entire magnetic head must be always located above the tape, which pick up the period of the alternating magnetic field so that the controller can determine the distance. In order to determine the direction of movement, an offset exists between these two increment sensors, and the sine output signals of the sensors have a phase shift of 90°, which can be considered as a sine and cosine signals. Both the signals are converted into A/B pulses by the magnetic head, which is then sent to the controller (RS422) to generate differential signals. A phase shift exists between the A and the B digital signals shifting periodically, so as to determine the direction of sensor.

# 4 Structure

KA800M magnetic scale mainly consists of the body and the reading head. The body consists of the head section, the standard section and the end section (Fig. 4.1). Only one head and end sections are provided, and the quantity of standard sections may vary as the measuring length changes.

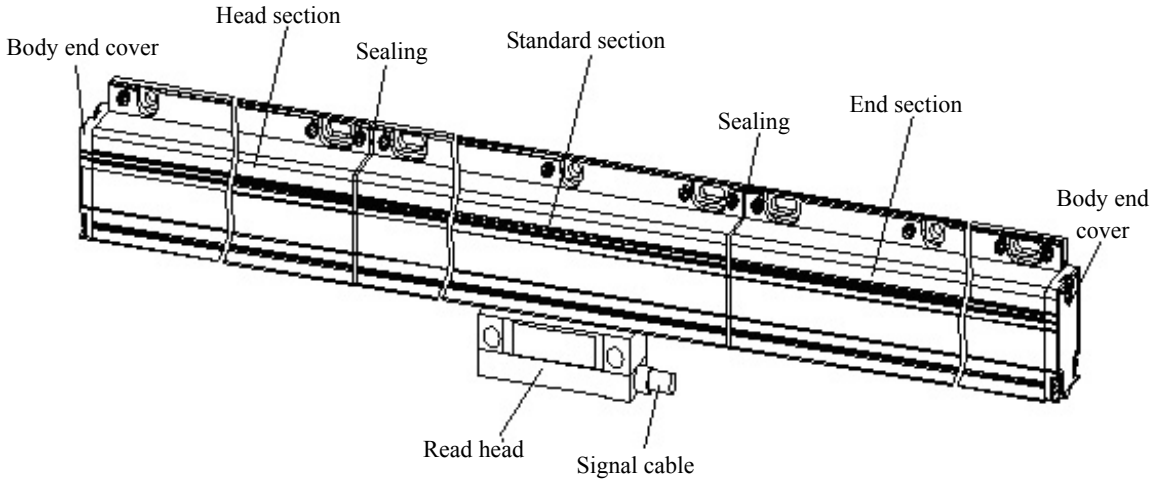



Fig. 4.1 Structure of product

The sections consist of casings of sections and body cover secured by M3×8 hex socket cap screws (Fig. 4.2).

Dimensions of the structure are as shown in Fig. 4.3.

Note: $L_0$ is the effective measuring length.

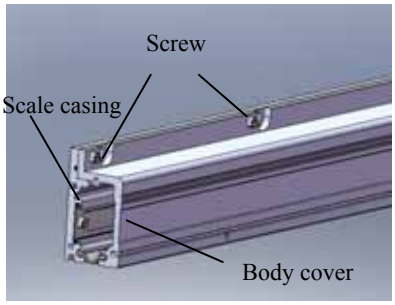



Fig. 4.2 Structure of body

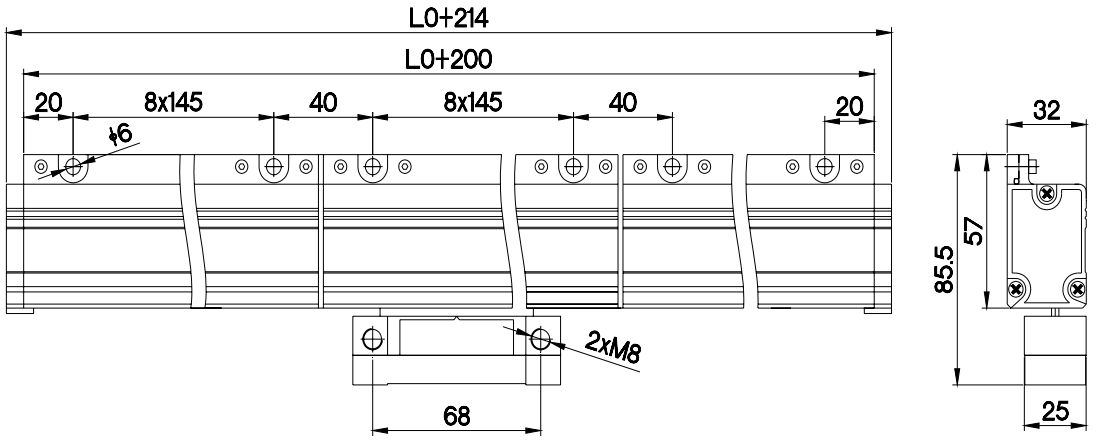



Fig. 4.3 Dimensions of structure

# 5 Installation

## 5.1 Priority of installation:

(1) To install the magnetic scale, the scale shall be kept parallel with the lathe guide rail.

(2) The center of the measuring range of magnetic scale shall be located at the center of the lathe travel. In addition, ensure that the actual measuring range of the magnetic scale is at least 50mm greater than the maximum travel of the lathe.

(3) The magnetic scale shall be located as near as possible to the transmission screw rod of lathe. Mostly, the magnetic scale will move together with the workbench after installation, and the read head is fixed on the lathe, namely it is better that the wire does not move.

(4) The magnetic scale shall be so installed that the operation of lathe is not blocked and the instinctive functions of the lathe are not degraded.

(5) The magnetic scale shall be installed so that it will not be hit during machining, not block the operation of any lathe handle, braking device or other projections, and not be touched easily during workpiece loading or unloading.

(6) The magnetic scale shall be installed correctly as shown in Fig. 5.1 (with the read head upwards and body downwards). Do not expose the sealing side on the body right to the coolant injection of the lathe.

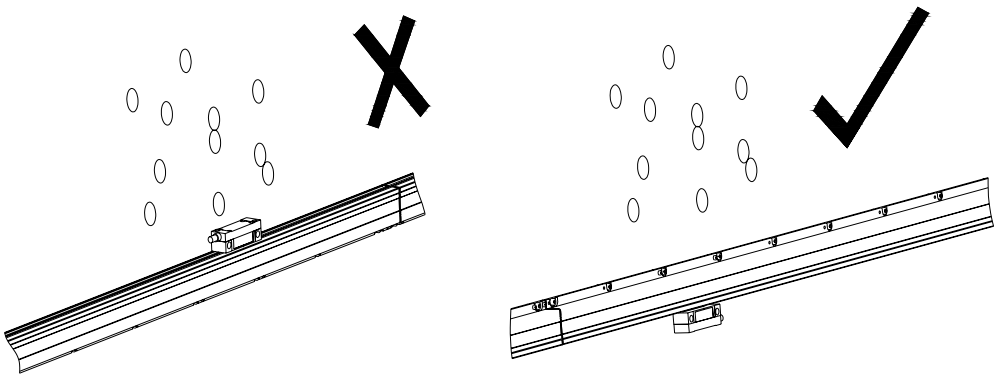


Fig. 5.1 Do not reverse!

Fine or coarse reference installation is optional according to the site conditions. Fine reference installation means that the installation reference face on the lathe is installed by machining, and coarse reference installation means that he installation reference face on the lathe is not installed by machining.

# 5 Installation

## 5.2 Fine reference installation

Steps of installation:

**(1) Machining reference face:** Select a suitable place for installation and installation reference face. The installation reference face shall be machined to a roughness of Ra6.3. Drill M6 screw holes on the installation reference face with intervals and dimensions as shown in Fig. 4.3.

**(2) Installation of scale casing:** Install the casings of head, standard and end sections accordingly to the reference face. Connect all casings with cylindrical pins, and apply sealing rubber to the connections without any gap as shown in Fig. 5.2, so as to ensure good sealing. After installation, correct the surface to a range within 0.1mm horizontally and vertically as shown in Fig. 5.3.

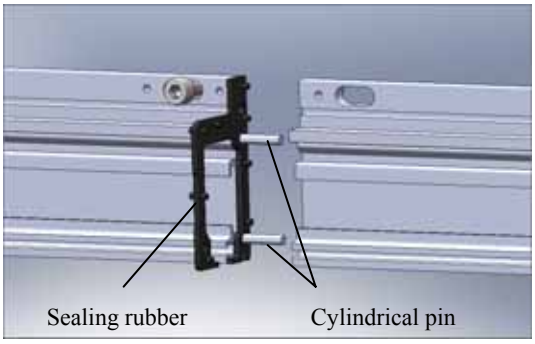



Fig. 5.2 Casing connection

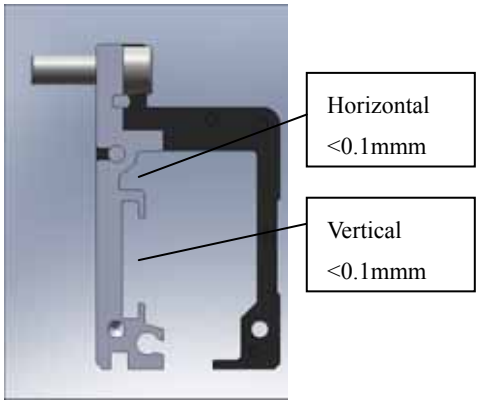



Fig. 5.3 Correction of surface

**(3) Installation of steel strip:** Push the entire steel strip into the open slot as shown in Fig. 5.4. Push two Φ 2.5 sealing strip orderly into the open slot, and press down the steel strip to make it flat as shown in Fig. 5.5. After pressing down the steel strip securely, clean the strip with acetone, alcohol or gasoline, so as to attach the tape securely.

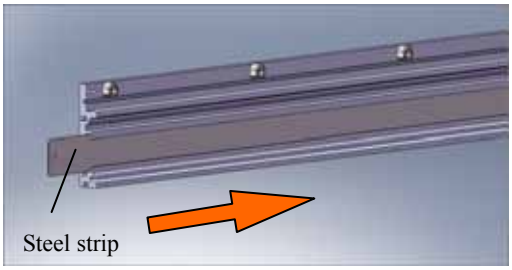



Fig. 5.4 Installation of steel strip

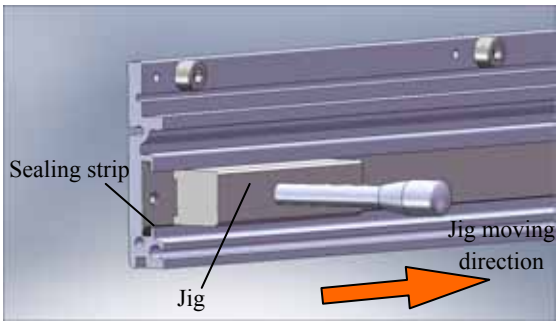



Fig. 5.5 Pressing down steel strip

# 5 Installation

**(4) Attachment of tape:** Remove the backing as shown in Fig. 5.6, and attach the tape straight on the specified position on the steel strip by clamping the tape with a jig. (Figs. 5.6 and 5.7)

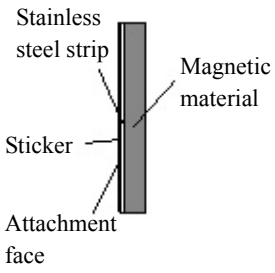



Fig. 5.5 Structure of tape

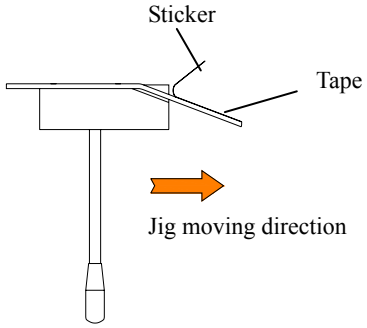



Fig. 5.6 Use of jig

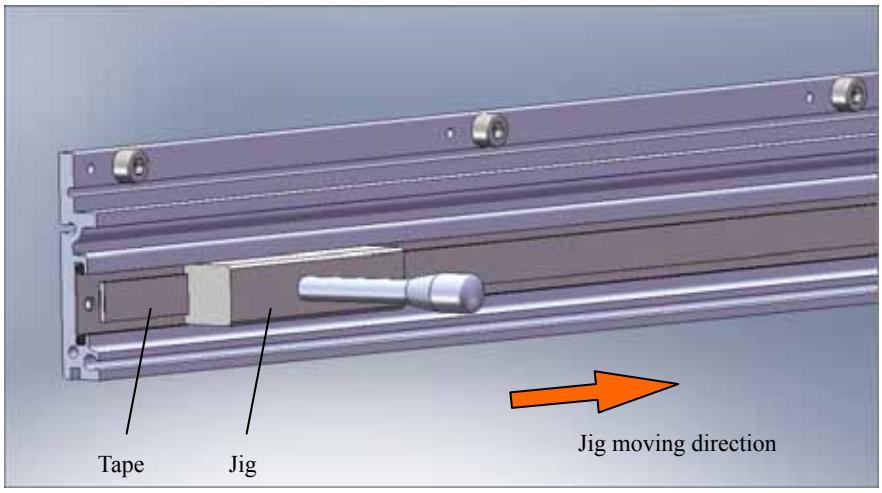



Fig. 5.7 Attachment of tape

## Note:

① Since the tape is one of the critical parts of magnetic scale, special attention shall be paid during attachment, and the tape shall be kept straight to attach by fixing by a jig.

② The tape shall not be exposed to any impact from external magnetic field, and shall not be in contact with a solenoid valve or other permanent magnetisms.

③ Before attachment of tape protection strip, the tape shall be kept clean. If it is stained, clean it with acetone, turpentine oil or soft plastic tool instead of gasoline.

**(5) Attachment of tape protection strip:** Attach a stainless steel protection strip over the tape surface in the same way for attachment of tape, and secure the steel strip to the casing of the head section with an M3×4 screw, with one end unfixed.

# 5 Installation

**(6) Installation of read head:** Put the sealing strip through the Φ4 hole, with the toothed edge upwards (Fig. 5.8). Install the connection base symmetrically on both sides of the read head, with the base closely placed to the both contact face as shown in Fig. 5.9. Fix the read head to the scale casing with a jig as shown in Figs. 5.10 and 5.11.

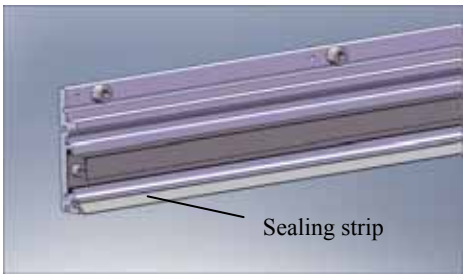



Fig. 5.8 Installation of sealing strip

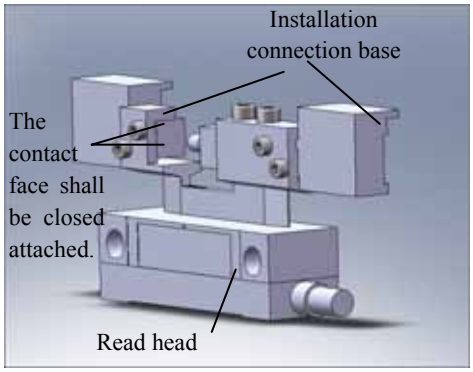



Fig. 5.9 Read head installed to the connection base

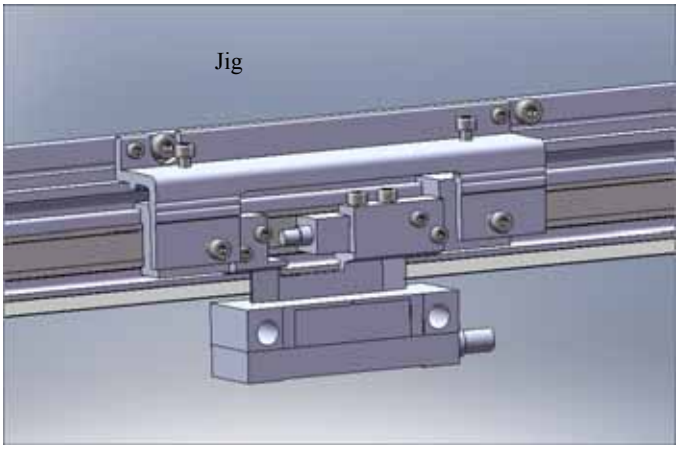



Fig. 5.10 Positioning of jig

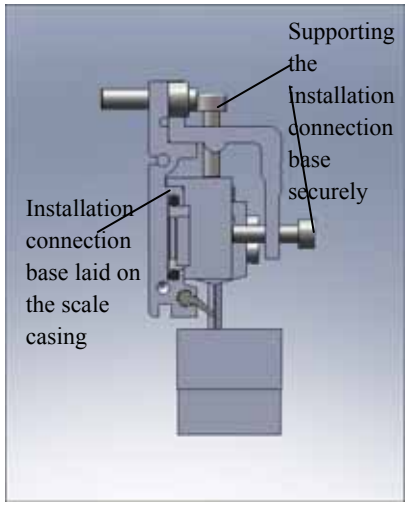



Fig. 5.11 Side view

The ends of signal cable can be reversed. Since the read head cover is a symmetrical type, the cover can be removed and installed reversely, so as to adjust the cable outgoing direction (Fig. 5.12).

# 5 Installation

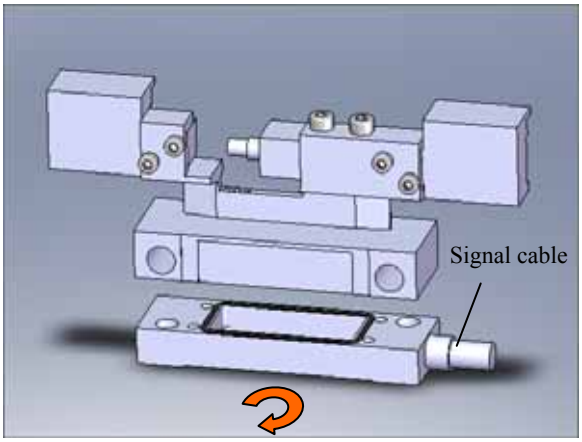



Fig. 5.12 Cable direction reversion

Connect and fix the read head to the moving part of the lathe. General accessories provided include: T-support A, B, C, D, and E, which are optional and used as a transition part for connection between the read head and moving part of the lathe.

Remove the jig and the connection base of read head, and distribute the signal cabling.

**(7) Test of magnetic scale**

Connect the cable to the digital display, and switch on the power supply for the digital display after they are securely connected, so as to check that the measurement of magnetic scale is normal. Compare the read-out with a length reference, and perform further installation. In case of failure, switch off the power supply, refer to the “Troubleshooting” section (on page 12) for maintenance, and perform the further installation.

**(8) Installation of Φ2 sealing strip:** To install the strip, put the sealing strip through the round rubber hole as shown in Fig. 5.13.

**(9) Installation of scale body cover:** Align the body cover with both ends of the scale casing, and secure it with M3×8 screws in the same way as shown in Fig. 5.14.

**(10) Installation of sealing strip:** Close the sealing strip with toothed edge for dust proofing as shown in Fig. 5.15.

**(11) Installation of covers of both ends:** Apply some sealant before fixing the end covers. Apply sealant on the exposed position of the Φ2 sealing strip, so as to ensure a good sealing effect as shown in Fig. 5.16.

# 5 Installation

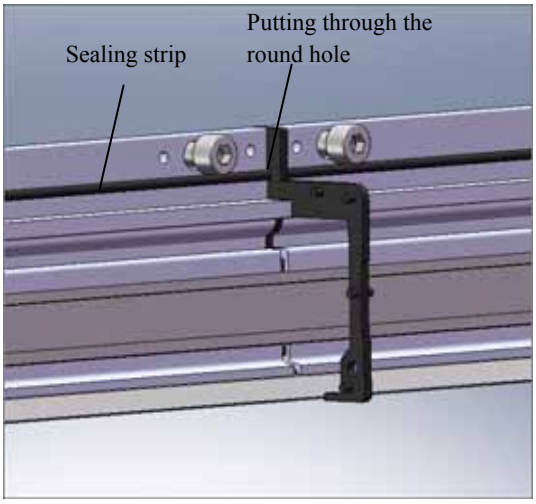



Fig. 5.13 Installation of sealing strip

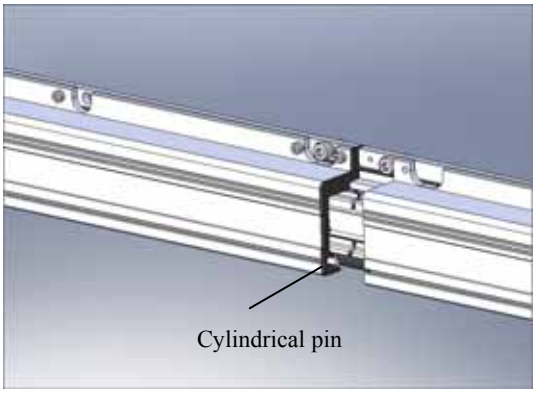



Fig. 5.14 Installation of body cover

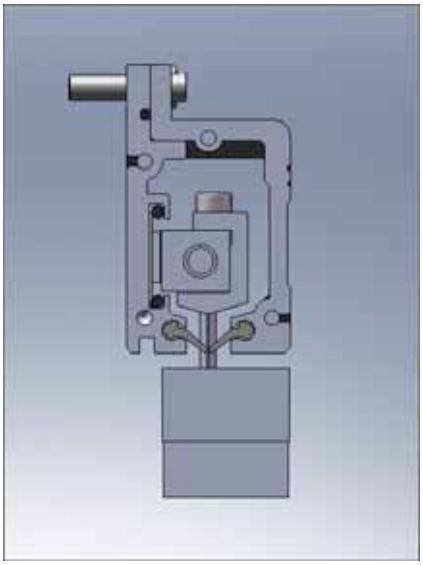


Fig. 5.15 Installation of strip

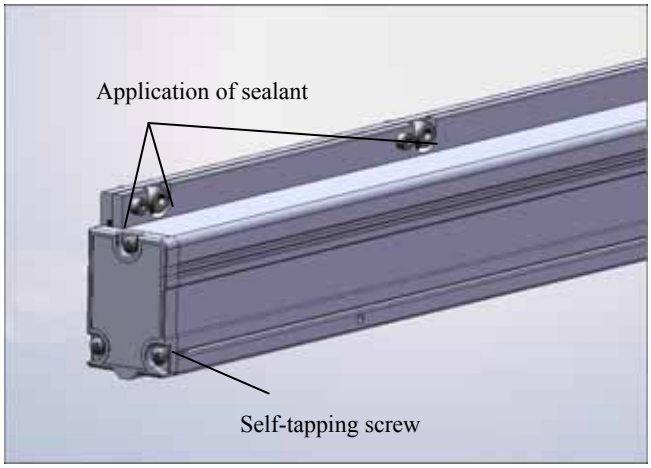



Fig. 5.16 Application of sealant

## 5.3 Coarse reference installation

Brackets are options specially designed for coarse reference installation.

Installation method: Install and adjust securely the brackets to the designated position on the lathe bed, with each bracket corresponding to connection position of the magnetic scale. Adjust to the brackets within 0.1mm horizontally and vertically on the installation reference face by adjusting the screws. The method for bracket installation is as shown in Figs. 5.17 and 5.18.

# 5 Installation

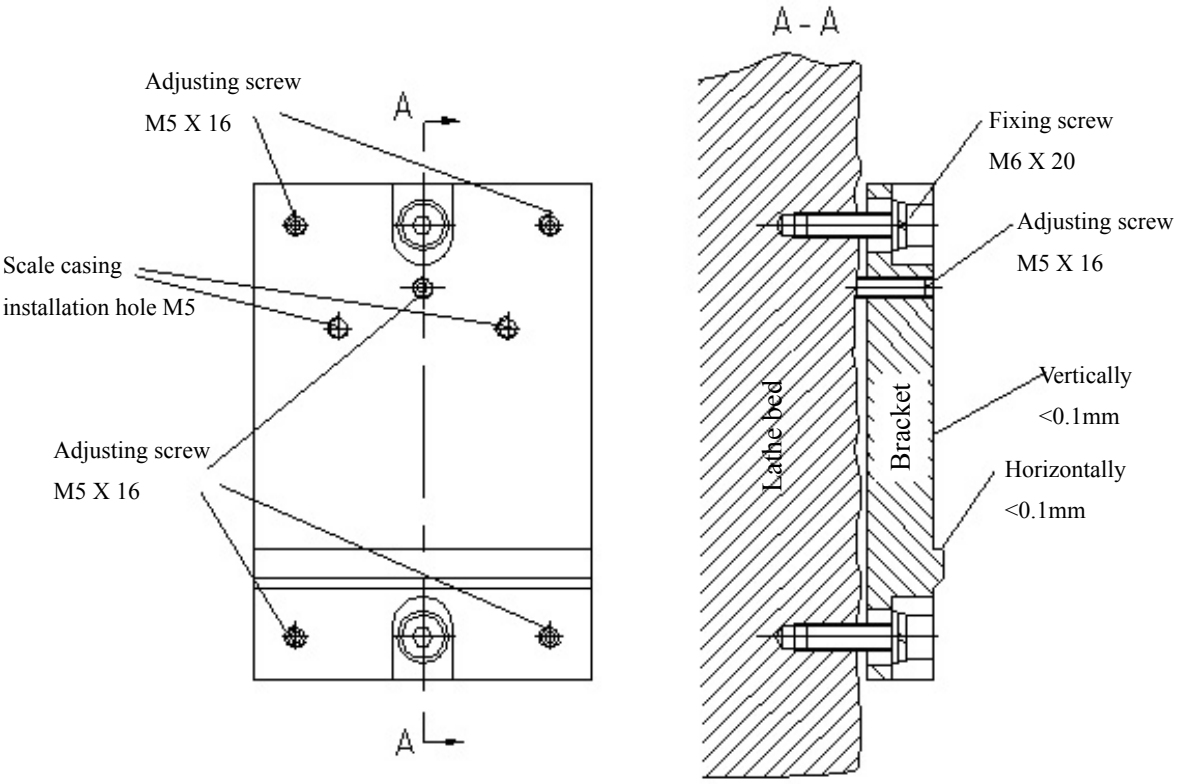



Fig. 5.17 Installation method for bracket adjustment

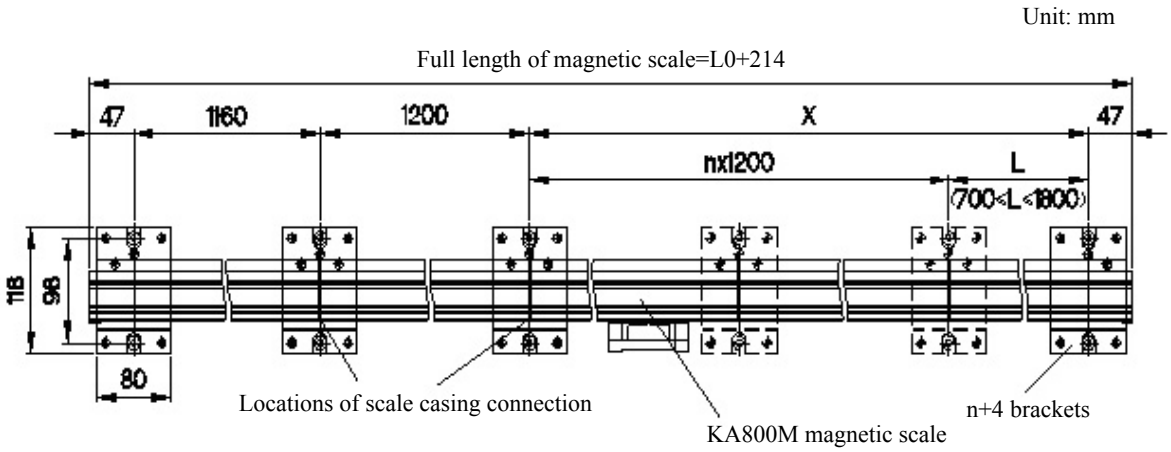



Fig. 5.18 Installation dimensions and quantity of brackets

As shown in Fig. 5.18: $X=L_0+214-(47+1160+1200+47)=L_0-2240$

$L_0$ is the effective measuring length.

If $X \geq 1900$, $L=X-n\times1200$ ($700 \leq L \leq 1800$).

# 5 Installation

If 700≤X≤1800, X=L and n=0.

e.g. if the effective measuring length $L_0$ of the magnetic scale is 9000mm

X=L0-2240=9000-2240=6760

X=6760≥1900, L= X-n×1200, 700≤L≤1800

∵L=6760-n×1200, 700≤L≤1800

∴n=5, L=760mm

The quantity of brackets is n+4=9.

Steps of coarse reference installation:

(1) Installation of bracket: Drill M6 screw holes to install a bracket. For installation method and dimensions, see Figs. 5.17 and 5.18.

(2) Installation of scale casing: Fix the scale casing on the bracket as shown in Fig. 5.19.

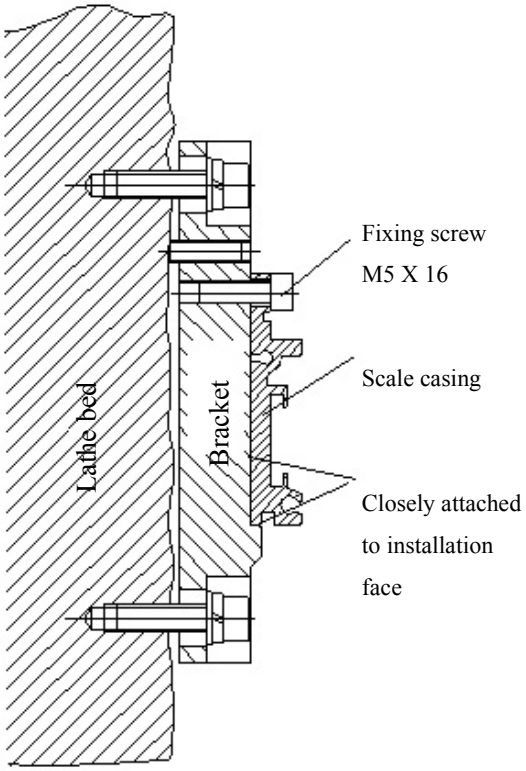



Fig. 5.19 Installation of scale casing

Steps (3)–(11) are the same as those of fine reference installation.

# 6 Signal Cables

**(1) Pinout: See Table 6.1.**

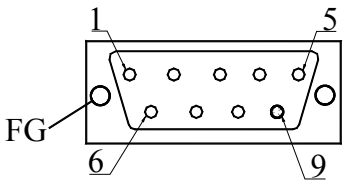



Table 6.1 Pinout

| Pin No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| Signal | $\overline{A}$ | *OV* | $\overline{B}$ | Idle | $\overline{Z}$ | *A* | +5V | *B* | *Z* |
| Color | Green /Black | Black | Orange / Black | FG | White / Black | Green | Red | Orange | White |

**(2) Length of cable**

The length of standard cable is 5m.

# 7 Troubleshooting

| Failure | Cause | Solution |
|---|---|---|
| The digital display receives no distance information (sometimes) or the LED flashes. | Insufficient voltage | Turn on the digital display and check the LED for short circuit, or check that the digital display switch is turned on or the power supply is connected. |
| | Excessive voltage drop | An operation voltage of 5V±5% shall be supplied to the system. Check the voltage of cables. |
| | Any magnetic scale cable unconnected | Connect cables as specified by the circuit diagram. |
| No signal is produced at certain measuring distance. | The clearance between the magnetic and tape of this distance is not as specified. | Adjust the height of the magnetic head, and manually move it to the whole travel until the information is shown. |
| | The magnetic pole of tape of the distance is damaged by strong magnetic field. | Replace the tape. |
| The linear error exceeds the allowable range. | The clearance between the magnetic head and the tape is excessive. | Correct the position of magnetic head. |

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