No. 99MBE033B6 / Absolute Linear Scale Unit AT715 User's Manual

en

Foreword

- Mitutoyo Corporation assumes no responsibilities for any damage to the product, caused by its use not conforming to the procedure described in this document.
- Contents of this document are subject to change without notice.

Conventions Used in This Document

NOTICE	Indicates a situation which, if not avoided, **may result in property damage**.
⊘	Indicates concrete information about prohibited actions.
❗	Indicates concrete information about mandatory actions.
IMPORTANT	Indicates information that must be known when using the product.
Tips	Indicates further information and details relevant for the operating methods and procedures that are explained in that section.
📖	Indicates reference location if there is information that should be referred to in this document or an extraneous User's Manual. Example: See 📖 "7 External View and Dimensional Drawings of the Scale Main Unit".

Safety Precautions

Observe the following descriptions to make full use of the performance of this product:

NOTICE

⊘	• To prevent defective contacts, do not touch the connecting terminals of the connectors with bare hands.
❗	• Read this document thoroughly before operating the product. • Before connecting this product to the machine main unit, make sure that the power for the control unit is turned off. • To maintain the shielding effect, firmly tighten the screws on the connectors of each connecting cable.

Electromagnetic Compatibility (EMC)

This product complies with the EMC Directive and the UK Electromagnetic Compatibility Regulations; however, if this receives electromagnetic interference that exceeds these requirements, it will be out of warranty and require appropriate measures.
This product is an industrial product, and is not intended to be used in residential environment. If this product is used in residential environment, this product may cause electromagnetic interference with other instruments. In such a case, it is required to take appropriate measures for preventing such electromagnetic interference.

Export Control Compliance

This product falls into the Catch-All-Controlled Goods and/or Catch-All-Controlled Technologies (including Programs) under Category 16 of Appended Table 1 of Export Trade Control Order or under Category 16 of Appended Table of Foreign Exchange Control Order, based on Foreign Exchange and Foreign Trade Act of Japan.
If you intend re-export of the product from a country other than Japan, re-sale of the product in a country other than Japan, or re-providing of the technology (including Programs), you shall observe the regulations of your country.
Also, if an option is added or modified to add a function to this product, this product may fall under the category of List-Control Goods, List-Control Technology (including Programs) under Category 1 - 15 of Appended Table 1 of Export Trade Control Order or under Category 1 - 15 of Appended Table of Foreign Exchange Control Order, based on Foreign Exchange and Foreign Trade Act of Japan. In that case, if you intend re-export of the product from a country other than Japan, re-sale of the product in a country other than Japan, or re-providing of the technology (including Programs), you shall observe the regulations of your country. Please contact Mitutoyo in advance.

Notes on Export to European Countries

When you intend exporting of this product to any of the European countries, it may be required to provide User's Manual(s) in English and Declaration of Conformity in English (in some cases, the official language of the country to be exported).
For detailed information, please contact Mitutoyo in advance.

Disposal of Products outside the European Countries

- Please follow the official instruction in each community and country.

Disposal of Old Electrical & Electronic Equipment (Applicable in the European Countries with Separate Collection Systems)

This symbol on the product or on its packaging is based on WEEE Directive (Directive on Waste Electrical and Electronic Equipment), and this symbol indicates that this product shall not be treated as household waste.
To reduce the environmental impact and minimize the volume of landfills, please cooperate in reuse and recycle.
For how to dispose of the product, please contact the agent where you purchased the product or a Mitutoyo sales office.

China RoHS Compliance Information

This product meets China RoHS requirements. See the table below.

产品中有害物质的名称及含量

部件名称	有害物质									
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)	邻苯二甲酸二正丁酯 (DBP)	邻苯二甲酸二异丁酯 (DIBP)	邻苯二甲酸丁基苄酯 (BBP)	邻苯二甲酸二(2-乙基己)酯 (DEHP)
本体	○	○	○	○	○	○	○	○	○	○
电气设备部分	×	○	○	○	○	○	○	○	○	○
配件	○	○	○	○	○	○	○	○	○	○

本表格依据 SJ/T 11364 的规定编制。
○：表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。
×：表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。

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环保使用期限标识是根据《电器电子产品有害物质限制使用管理办法》以及《电器电子产品有害物质限制使用标识要求(SJ/T11364—2024)》制定的，适用于中国境内销售的电子电气产品的标识。

电器电子产品只要按照安全及使用说明内容在正常使用情况下，从生产日期算起，在此期限内产品中含有的有毒有害物质不致发生外泄或突变，不致对环境造成严重污染或对其人身、财产造成严重损害。

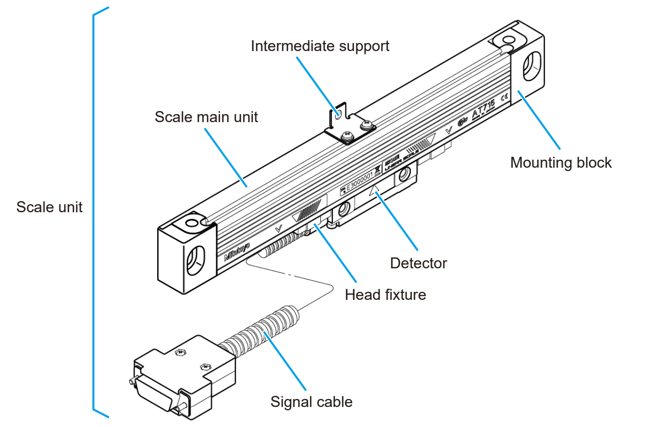
产品使用后，要废弃在环保使用年限内或者刚到年限的产品，请根据国家标准采取适当的方法进行处置。

另外，此期限不同于质量/功能的保证期限。

Warranty

This product has been manufactured under strict quality management, but should it develop problems within one year of the date of purchase in normal use, repair shall be performed free of charge. Please contact the agent where you purchased the product or Mitutoyo sales office. This warranty is effective only where the product is properly installed and operated in conformance with the instructions in this document within the original country of the installation.

1. Checking the Scale and the Supplied Accessories



Scale unit	1
Intermediate support set	1 (supplied with a scale with an effective length of 500 mm or more)
Extension cable (2 m)	1 (supplied with a scale with an effective length of 2400 mm or more)
User's Manual	1
Warranty card	1
Inspection certificate	1

● Accessories

Hex socket head cap screw (M6 x 25)	2
Plain washer (nominal 6)	2
Hex socket head cap screw (M4 x 25)	2
Plain washer (nominal 4)	2
Cable stopper	6
Hex socket head cap screw (M4 x 8)	6
Spacer set	1 each for 0.3, 0.4, 0.5, and 0.6

● Intermediate support set

Effective length	500 mm–1000 mm	1100 mm–1500 mm	1600 mm–2000 mm	2200 mm–2600 mm	2800 mm–3000 mm
Intermediate support	1	2	3	4	5
Intermediate support (V)	1	2	3	4	5
Hex socket head cap screw (M4 x 8)	1	2	3	4	5
Plain washer (nominal 4)	1	2	3	4	5
Spring washer (nominal 4)	1	2	3	4	5
Hex socket head cap screw (M3 x 6 with plain washer and spring washer)	2	4	6	8	10
Hexagonal nut (nominal 3)	2	4	6	8	10
Countersunk screw (nominal 3)	2	4	6	8	10
Block spacer	2	2	2	2	2

2. Designing the Installation of the Scale Unit and Setting Up for Installation

■ Checking the scale size

Make sure that the scale unit's maximum travel length L1 is greater than the travel distance of the machine. The accuracy is guaranteed only within the effective length L0.

> ❗ If the maximum travel length or the effective length of the scale unit is insufficient, one of the following actions is required:
> - Reduce the travel distance of the machine (by installing a mechanical stopper or limit switch).
> - Change the scale unit size.

■ Checking the counter to be connected

The scale unit can be connected only to the KA-200 counter.

■ Checking the installation location and installation method of the scale main unit

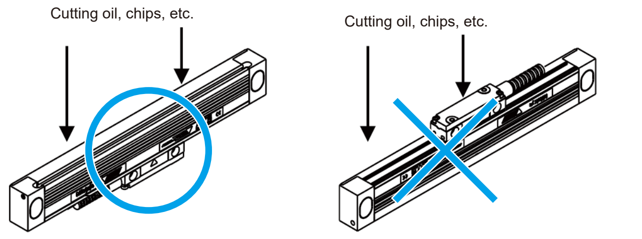
Note the following when deciding the installation location of the scale unit:

● Easy installation

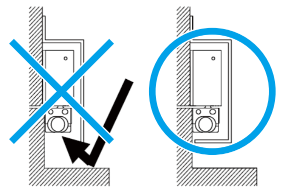
Choose the installation location and the installation method so that the scale main unit, detector and cables do not interfere with the machine handle and other parts. To make installation easy, mount the scale unit and brackets on the machined surface if possible.

● Protection from cutting oil, chips, etc.

The scale unit is designed so that cutting oil and chips do not easily enter the main unit. To prevent the scale main unit from being exposed to cutting oil, chips, etc., however, decide the mounting direction while giving consideration to their splattering directions.

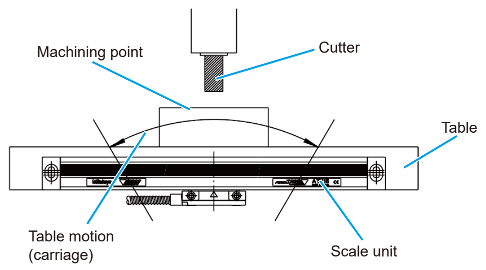


To further ensure protection against the exposure, prepare a cover that protects the entire scale unit as well. This requires an assumption that the cutting oil and chips splatter on the opening side of the cover.



● Accuracy

The entire system accuracy of the machine with the scale unit mounted is affected by the accuracy of the scale unit and the motion accuracy of the machine. A machine containing a slide table, particularly, requires special consideration on installation to reduce geometrical errors caused by the motion straightness of the movable part as much as possible. If the slide table makes not a straight but a curved motion, it generates an error in proportion to the distance between the scale unit and the machining point (cutter position). The scale unit must be mounted as close to the machining point of the machine as possible.



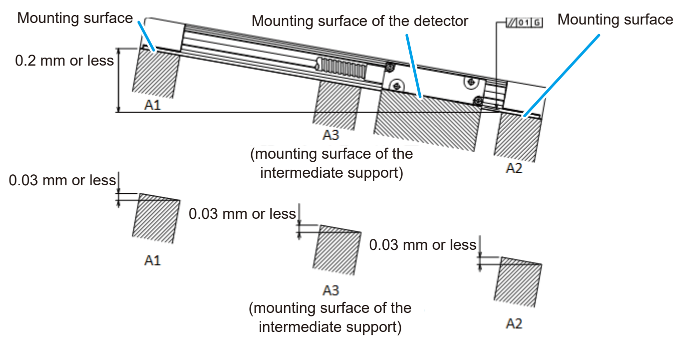
● Others

- Pay extra attention to routing the signal cable because moving the detector also moves the slide table and even the signal cable.
- Mount the scale unit in a location not exposed to air blow. When removing chips with an air duster, make sure that they do not scatter over the scale unit.
- Choose the installation location based on maintainability because maintenance may be required if an abnormality occurs.

■ Designing a bracket for mounting the scale unit

Design and make a mounting bracket according to 📖 "7 External View and Dimensional Drawings of the Scale Main Unit". Be sure to note the following on designing and making:

- The bracket must achieve the mounting relation shown in 📖 "7 External View and Dimensional Drawings of the Scale Main Unit".
- Provide some margins for screw holes or use the spacers to adjust the parallelism of the mounting surfaces against the machine guide (G) as shown below.
  - Entire parallelism of the mounting surfaces A1, A2, and A3 of the scale main unit: 0.2 mm or less
  - Parallelism of each mounting surface (A1, A2, and A3) of the scale main unit: 0.03 mm or less
  - Parallelism of the mounting surface of the detector: 0.1 mm or less


Mounting surface
Mounting surface of the detector
// 0.1 G
Mounting surface
0.2 mm or less
A1
A3
(mounting surface of the intermediate support)
A2
0.03 mm or less
0.03 mm or less
0.03 mm or less
A1
A3
(mounting surface of the intermediate support)
A2

- The bracket must have high rigidity because if the rigidity is insufficient, the scale unit may malfunction due to machine vibrations.
- Even when you mount the bracket directly on the machine, use the above parallelism for the mounting surfaces of the scale main unit and the detector.

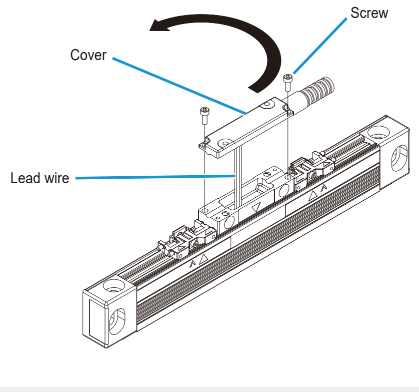
■ Checking the routing direction of the signal cable

Check the routing direction of the signal cable. In this product, the routing direction of the signal cable can be changed.

1. Remove the screws (x2) that fix the detector cover.

> ❗ Do not pull the lead wire forcibly.

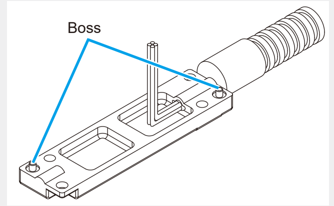
2. Rotate the detector cover 180 degrees counterclockwise and secure it with the screws (x2).



> ❗ Make sure that the lead wire does not get caught between the detector and the detector cover when mounting the cover.

Tips

Mount the detector cover by aligning with the bosses.

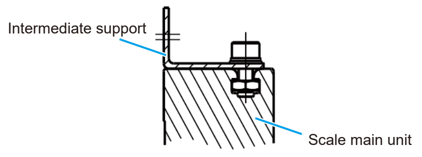


■ Installing the intermediate support

Install the intermediate support and the intermediate support (V) for a scale unit that has an effective length of 500 mm or more.

The installation method using the intermediate support described in the mounting method 1 shown in 📖 "7 Exterior and Mounting Dimension of the Scale Main Unit" will be specified below.

1. Insert the hexagonal nuts into the T-slots on the scale main unit.
2. Fix the intermediate support with the hex socket head cap screws (M3 x 6 with plain washer and spring washer).



Tips

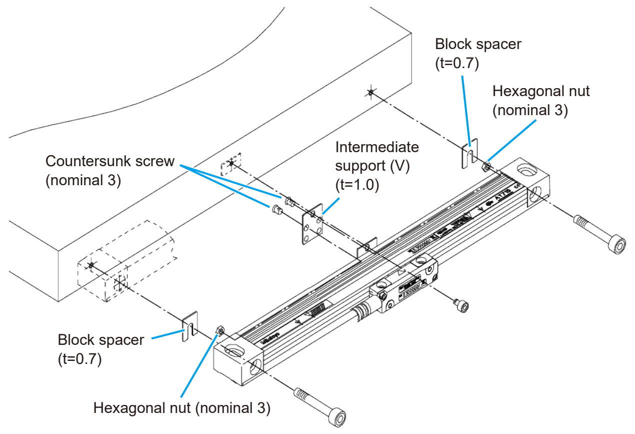
For the recommended fixing position of the intermediate support, see 📖 "7 External View and Dimensional Drawings of the Scale Main Unit". The intermediate support can be moved to any position.

The installation method using the intermediate support described in the mounting method 2 and 3 shown in 📖 "7 Exterior and Mounting Dimension of the Scale Main Unit" will be specified below.

1. Insert a hex nut into the T-slot of the scale main unit
2. Secure the intermediate support (V) with hex bolts (M3x6, plain and spring washers).

Tips

To mount the scale main unit and the intermediate support using the installation method 2 or 3 shown in 📖 "7 External View and Dimensional Drawings of the Scale Main Unit", use the intermediate support (V) and the block spacers according to the figure below because they are mounted on the same surface.


Block spacer (t=0.7)
Hexagonal nut (nominal 3)
Countersunk screw (nominal 3)
Intermediate support (V) (t=1.0)
Block spacer (t=0.7)
Hexagonal nut (nominal 3)

3. Mounting the Scale Main Unit and Adjusting the Position

> ❗ The head fixture that fix the detector are used to maintain the positional relationship between the scale main unit and the detector Do not remove the head fixture until the scale main unit and the detector are mounted on the machine.

■ Temporarily fixing the scale main unit and intermediate support

IMPORTANT

- The tap depth of screw holes for mounting the scale main unit must be 16 mm or more.
- For a scale main unit that has an effective length of 500 mm or more, drill screw holes on the mounting surface by aligning with the screw holes on the intermediate support.
- The tap depth of screw holes for mounting the intermediate support must be 12 mm or more.

1. Temporarily fix the scale main unit with the hex socket head cap screws (M6 x 25) and the plain washers (nominal 6).

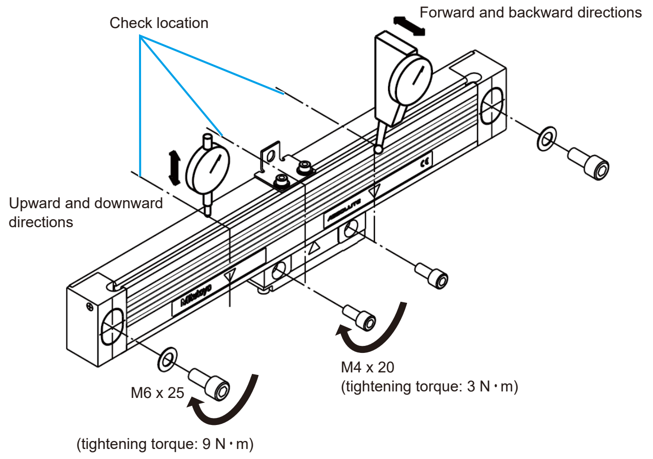
Tips

For a scale main unit that has an effective length of 500 mm or more, use the hex socket head cap screws (M4 x 8), plain washers (nominal 4), and spring washers (nominal 4) to temporarily fix the intermediate support.

■ Checking and adjusting the parallelism

1. Use a dial indicator or the like to check the parallelism.

Parallelism allowance	See 📖 "7 External View and Dimensional Drawings of the Scale Main Unit".
Check direction	Forward, backward, upward, and downward directions of the mounting surface
Check location	Near the effective length mark of the scale main unit. For a scale main unit that has an effective length of 500 mm or more, check near the mounting location of the intermediate support.


Check location
Forward and backward directions
Upward and downward directions
M6 x 25
M4 x 20
(tightening torque: 3 N・m)
(tightening torque: 9 N・m)

■ Fully fixing the scale main unit and intermediate support

1. Fully fix the scale main unit and the intermediate support.

IMPORTANT

The tightening torques for scale main unit and intermediate support fixing screws are as follows:

Screws for fixing the scale at both ends	9 N・m
Intermediate support	3 N・m

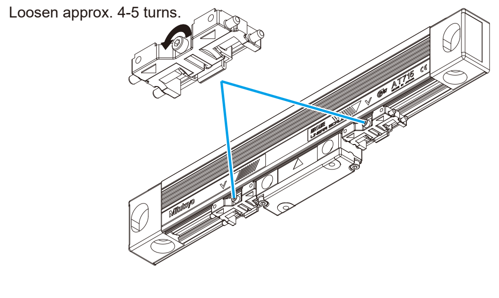
4. Mounting the Detector and Adjusting the Position

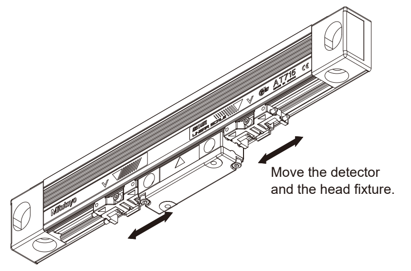
1. Check the parallelism of the mounting surface of the detector.

IMPORTANT

The parallelism of the mounting surface of the detector against the machine guide must be 0.1 mm or less.

2. Loosen the bolt of the both head fixture by about 4-5 turns, and slide the detector and the head fixture to the position where they are attached to the bracket.





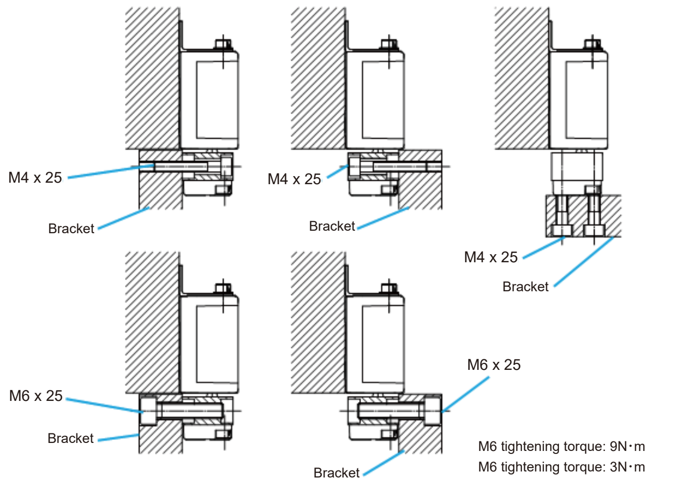
Tips

Do not remove the head fixture while working. The detector may fail.
The head fixture determine the positional relationship between the scale main unit and the detector.
This is to maintain this positional relationship when attaching the scale unit to the machine main unit.

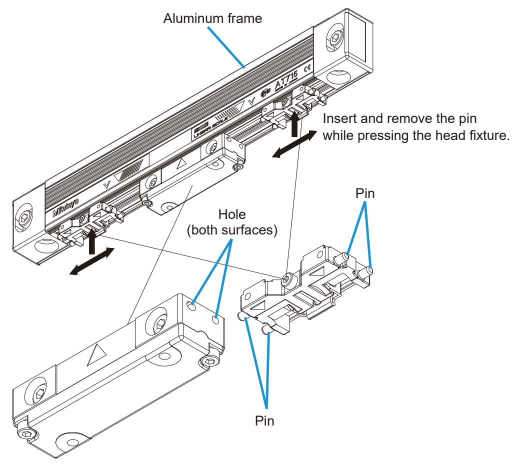
3. Temporarily fix the detector.

Tips

- If there is a gap between the detector and the bracket, insert the provided spacer.
- The detector can be fixed to the bracket from the following directions.



4. Tighten the bolt of the head fixture. (Tightening Torque 0.36 N・m)
5. Fully fix the detector.
6. Loosen the bolt of the head fixture by about 4-5 turns.
7. While pressing the head fixture against the aluminum frame, confirm that the pin of the head fixture can be inserted into and removed from the hole of the detector smoothly.



> ❗ If a gap is generated when the head fixture are inserted or the blocks cannot be smoothly inserted, reinsert them and adjust the positional relationship between the detector and the bracket.

Tips

Make sure that you do not lose the head fixture because they will be used to mount the scale unit again.

5. Handling the Signal Cable

1. Route the signal cable while noting the following:

- The signal cable must have an extra length between the scale unit and the counter.
- The bend radius of the signal cable must be as follows:

When the detector is fixed (signal cable is fixed)	Radius = 50 mm or more
When the detector moves (signal cable is repeatedly bent)	Radius = 100 mm or more

- When the detector moves, the signal cable moves accordingly. Therefore, make sure that excessive force is not applied to the signal cable and no friction occurs when the detector moves.
- Do not bundle the signal cable with other cables that may cause electrical noise or place it near a relay that handles a large current. Otherwise, a malfunction may occur.

Tips

If there is a long distance to the counter connected to the scale unit, the following extension cables can be used:

Code No.	Cable length
09AAB674A	2 m
09AAB674B	5 m
09AAB674C	7 m

IMPORTANT

The total cable length of the signal cable and the extension cable must not exceed 15 m.

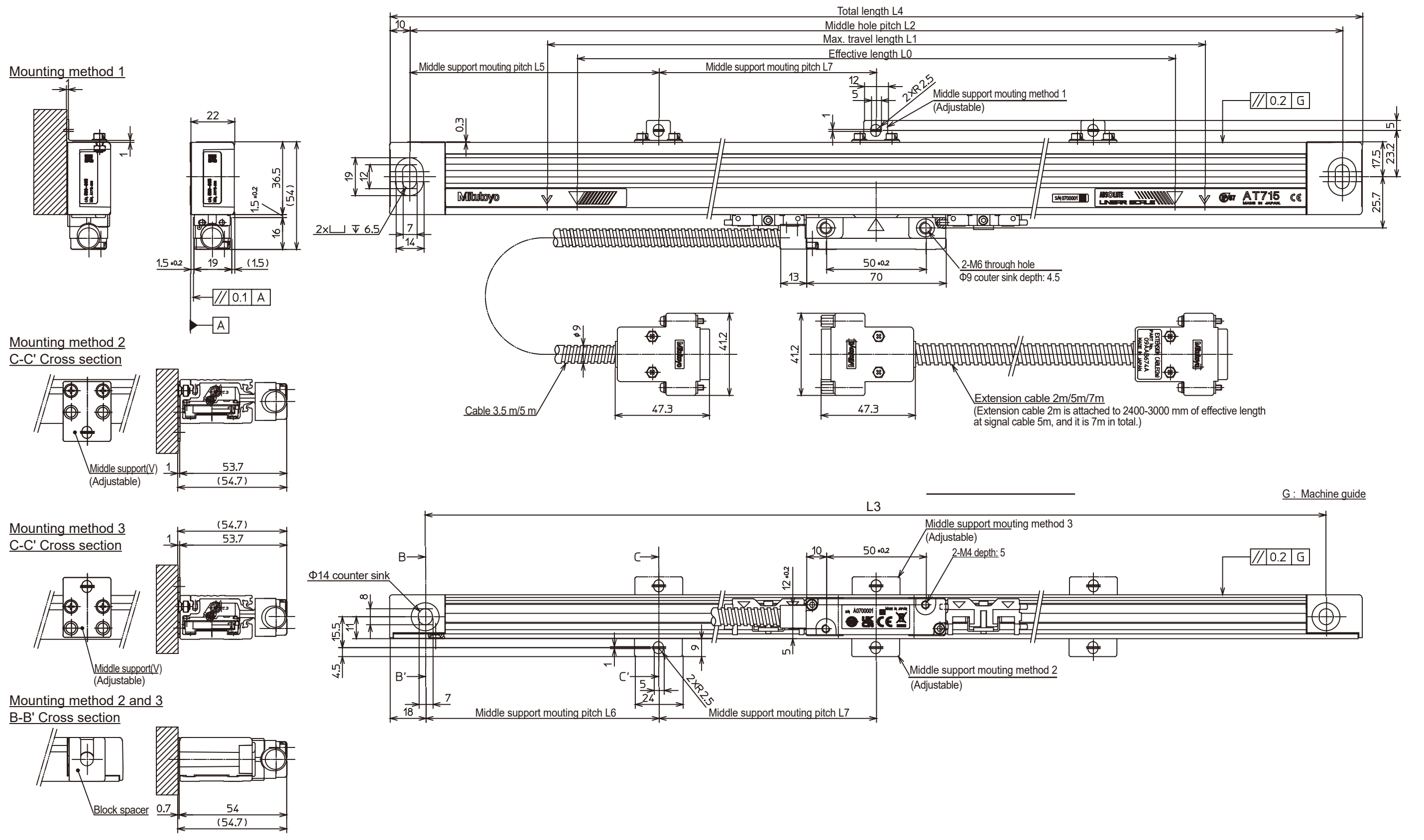
2. Fix the signal cable with the supplied cable stopper.
3. Make sure that excessive force is not applied to the signal cable or there is no interference with other objects throughout the entire stroke.
4. Attach the cover.

> ❗ Make sure that the cover does not touch the scale unit and the signal cable throughout the entire stroke. .

6. Specifications

Minimum resolution	0.005 mm, 0.001 mm, 0.0005 inch, 0.0001 inch (changeable in the KA counter parameter)
Indication accuracy (20 °C)	±5 µm (effective length of 100 mm–500 mm) ±7 µm (effective length of 600 mm–1800 mm) ±10 µm (effective length of 2000 mm–3000 mm)
Maximum response speed	50 m/min
Current consumption	Maximum 50 mA
Dustproof and waterproof	IP67
Sliding force	5 N (approx. 500 gf) or less
Used temperature and humidity range	0 °C–45 °C, 20 %RH–80 %RH (non condensation)
Storage temperature and humidity range	-20 °C–70 °C, 20 %RH–80 %RH (non condensation)
CE marking/ UKCA marking	EMC Directive/Electromagnetic Compatibility Regulations: EN61326-1 Immunity test requirement: Clause 6.2 Table 2 Emission limit: Class B RoHS Directive/The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations: EN IEC 63000

7. External View and Dimensional Drawings of the Scale Main Unit



Code No.	Model number	Effective length L0 (mm)	Maximum travel length L1 (mm)	Mounting hole pitch L2 (mm)	Mounting hole pitch L3 (mm)	Full length L4 (mm)	Intermediate support L5 (mm)	Intermediate support L6 (mm)	Intermediate support L7 (mm)	Number of intermediate supports	Signal cable length (m)
539-801N	AT715-100	100	120	258	242	278	-	-	-	-	3.5
539-802N	AT715-150	150	170	308	292	328					
539-803N	AT715-200	200	220	358	342	378					
539-804N	AT715-250	250	270	408	392	428					
539-805N	AT715-300	300	330	468	452	488					
539-806N	AT715-350	350	380	518	502	538					
539-807N	AT715-400	400	430	568	552	588					
539-808N	AT715-450	450	480	618	602	638					
539-809N	AT715-500	500	540	678	662	698	339	331		1	
539-811N	AT715-600	600	640	778	762	798	389	381			
539-813N	AT715-700	700	740	878	862	898	439	431			
539-814N	AT715-750	750	780	918	902	938	459	451			
539-815N	AT715-800	800	840	978	962	998	489	481			
539-816N	AT715-900	900	940	1078	1062	1098	539	531			
539-817N	AT715-1000	1000	1040	1178	1162	1198	589	581			5

Code No.	Model number	Effective length L0 (mm)	Maximum travel length L1 (mm)	Mounting hole pitch L2 (mm)	Mounting hole pitch L3 (mm)	Full length L4 (mm)	Intermediate support L5 (mm)	Intermediate support L6 (mm)	Intermediate support L7 (mm)	Number of intermediate supports	Signal cable length (m)
539-818N	AT715-1100	1100	1140	1278	1262	1298	424	416	430	2	5
539-819N	AT715-1200	1200	1240	1378	1362	1398	459	451	460		
539-820N	AT715-1300	1300	1340	1478	1462	1498	494	486	490		
539-821N	AT715-1400	1400	1440	1578	1562	1598	524	516	530		
539-822N	AT715-1500	1500	1540	1678	1662	1698	559	551	560		
539-823N	AT715-1600	1600	1640	1778	1762	1798	459	451	430	3	
539-824N	AT715-1700	1700	1740	1878	1862	1898	479	471	460		
539-825N	AT715-1800	1800	1840	1978	1962	1998	459	451	530		
539-860N	AT715-2000	2000	2040	2178	2162	2198	539	531	550		
539-861N	AT715-2200	2200	2240	2378	2362	2398	469	461	480	4	
539-862N	AT715-2400	2400	2440	2578	2562	2598	509	501	520		7 (5+2) (※1)
539-863N	AT715-2500	2500	2540	2678	2662	2698	529	521	540		
539-864N	AT715-2600	2600	2640	2778	2762	2798	549	541	560		
539-865N	AT715-2800	2800	2840	2978	2962	2998	489	481	500	5	
539-866N	AT715-3000	3000	3040	3178	3162	3198	529	521	530		

※1 Extended cable 2m is attached to 2400-3000mm of effective length at signal cable 5m, and it is 7m in total.

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