Mitutoyo

Separate Type Linear Scale

ST46-EZA Tape Scale

User's Manual

- Instructions for use -

Read this document thoroughly before operating the product. After reading, retain it close at hand for future reference.
This English language version of the document contains the original instructions.

No. 99MBE082B3
Date of publication: July 1, 2021 (1)

■ Correspondence of product names and model numbers

Product name	Model number
Separate Type Linear Scale	ST46-EZA

■ Notice regarding this document

- Mitutoyo Corporation assumes no responsibilities for any damage to the product, caused by its use not conforming to the procedure described in this document.
- Upon loan or transfer of this product, be sure to attach this document to the product.
- In the event of loss or damage to this document, immediately contact the agent where you purchased the product or a Mitutoyo sales office.
- Before operation of the product, thoroughly read this document to comprehend its contents.
- Particularly, for full understanding of information, carefully read "Safety Precautions" and "Precautions for Use" at the outset of this document before using the product.
- The contents in this document are based on the information current as of July 2021.
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- The corporation, organization and product names that appear in this document are their trademarks or registered trademarks.

CONVENTIONS USED IN MANUALS

Conventions used in Mitutoyo's User's Manual are roughly divided into three types (safety reminders, prohibited and mandatory actions, and referential information and locations). Moreover, these conventions include general warnings and specific warnings. Specific warning symbols are provided with concrete pictograms inside of them.

■ Safety reminder conventions and wording warning against potential hazards

DANGER	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates a potentially hazardous situation which, if not avoided, may result in property damage.
	Alerts the user to a specific hazardous situation that means "Caution, risk of electric shock".

■ Conventions and wording indicating prohibited and mandatory actions

	Indicates concrete information about prohibited actions.
	Indicates concrete information about mandatory actions.
	Indicates that grounding needs to be implemented.

■ Conventions and wording indicating referential information or referential locations

Tips Indicates further information and details relevant for the operating methods and procedures that are explained in that section.

Indicates referential locations if there is information that should be referred to in this document or an extraneous User's Manual.

Example: For details about XX, see "System Configuration and Name of Each Part" on page 1

Safety Precautions

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

NOTICE

- Read this User's Manual thoroughly before operating this 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.
- To prevent defective contacts, do not touch the connecting terminals of the connectors with bare hands.

Precautions for Use

■ Product applications and handling

● This product is a measuring instrument.

Do not use it for any purposes other than measuring.

● This is an industrial product.

Do not use this product for any purposes other than industrial applications.

● This product is precision equipment.

Handle this product with care. Do not apply excessive shock or force to any of the parts during operation.

■ Required environment for installation

● Vibration

To install this product onto the machine main unit, select a location where there is as little vibration as possible.

If the scale unit is used for an extended period of time on a machine where there is a substantial amount of vibration, the built-in precision parts may be damaged, thereby adversely influencing the performance of the unit.

● Shock, dust, water protection

To protect the scale main unit from being directly exposed to machining oil and chips, or from being bumped by a workpiece, etc., prepare a cover that protects the entire scale main unit.

● Ambient temperature and humidity

This product should be operated in an environment where the temperature is 0 °C–40 °C and where the relative humidity is 20 %RH–80 %RH. Do not use this product in a place where sudden changes in temperature or humidity are observed.

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 exproted). 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)
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。

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《电子电气产品有害物质限制使用标识要求(SJ/T11364–2014)》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 a Mitutoyo sales office. This warranty, however, shall not affect any provisions of the Mitutoyo Software End User License Agreement.

If this product fails or is damaged for any of the following reasons, it will be subject to a repair charge, even if it is still under warranty.

- Failure or damage owing to fair wear and tear
- Failure or damage owing to inappropriate handling, maintenance or repair, or to unauthorized modification
- Failure or damage owing to transport, dropping, or relocation of the product after purchase
- Failure or damage owing to fire, salt, gas, abnormal voltage, lightning surge, or natural disaster
- Failure or damage owing to use in combination with hardware or software other than those designated or permitted by Mitutoyo
- Failure or damage owing to use in ultra-hazardous activities

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.

EXCEPT AS SPECIFIED IN THIS WARRANTY, ALL EXPRESS OR IMPLIED CONDITIONS, REPRESENTATIONS, AND WARRANTIES OF ANY NATURE WHATSOEVER INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NONINFRINGEMENT OR WARRANTY ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE, ARE HEREBY EXCLUDED TO THE MAXIMUM EXTENT ALLOWED BY APPLICABLE LAW.

You assume all responsibility for all results arising out of its selection of this product to achieve its intended results.

Disclaimer

IN NO EVENT WILL MITUTOYO, ITS AFFILIATED AND RELATED COMPANIES AND SUPPLIERS BE LIABLE FOR ANY LOST REVENUE, PROFIT, OR DATA, OR FOR SPECIAL, DIRECT, INDIRECT, CONSEQUENTIAL, INCIDENTAL, OR PUNITIVE DAMAGES HOWEVER CAUSED AND REGARDLESS OF THE THEORY OF LIABILITY ARISING OUT OF THE USE OF OR INABILITY TO USE THIS PRODUCT EVEN IF MITUTOYO OR ITS AFFILIATED AND RELATED COMPANIES AND/OR SUPPLIERS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

If, notwithstanding the foregoing, Mitutoyo is found to be liable to you for any damage or loss which arises out of or is in any way connected with use of this product by you, in no event shall Mitutoyo's and/or its affiliated and related companies' and suppliers' liability to you, whether in contract, tort (including negligence), or otherwise, exceed the price paid by you for the product only.

The foregoing limitations shall apply even if the above-stated warranty fails of its essential purpose.

BECAUSE SOME COUNTRIES, STATES OR JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR THE LIMITATION OF LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES, IN SUCH COUNTRIES, STATES OR JURISDICTIONS, MITUTOYO'S LIABILITY SHALL BE LIMITED TO THE EXTENT PERMITTED BY LAW.

About This Document

■ Positioning of this document in document map

● For linear scale

ST46-EZA Tape Scale
Separate Type Linear Scale
User's Manual (this document)

● For software

ST46-EZA
Separate Type Linear Scale
Application Program
User's Manual

■ Intended readers and purpose of this document

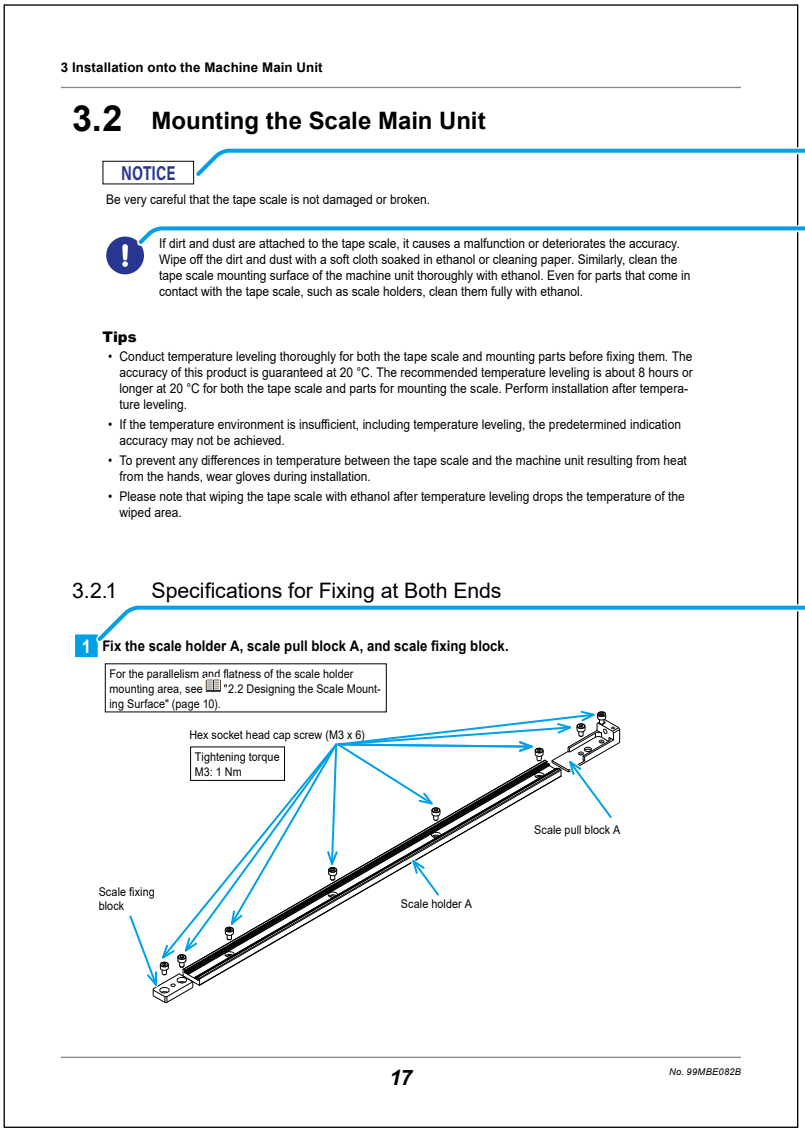
● Intended readers

This document is intended for first-time users of the ST46-EZA Tape Scale Separate Type Linear Scale.
Readers are assumed to be able to understand instructions by reading technical drawings.

● Purpose

The purpose of this document is to help you understand the basic knowledge of the ST46-EZA Tape Scale Separate Type Linear Scale.

■ How to read this document



Indicates safety information.

Indicates supplementary information.

Indicates an operating procedure to be performed or its outline.

■ Representation of brackets or marks

The meanings of brackets or marks to be used in this document are as follows.

( ): Round brackets	Represent a paraphrase of an immediately preceding phrase or a supplementary explanation.
" ": Double quotation marks	Represent a highlighted phrase. They also indicate an index where information to be referenced is described.
[ ]: Square brackets	Represent the menu names on screen, the name of screens, buttons, display items, tab names, and keyboard keys. They also indicate an item to be purposely entered or selected by the customer.

Contents

1 Overview

This chapter describes the features of this product, the names and functions of the parts, and the flow of the main tasks to use this product.

1.1 Features

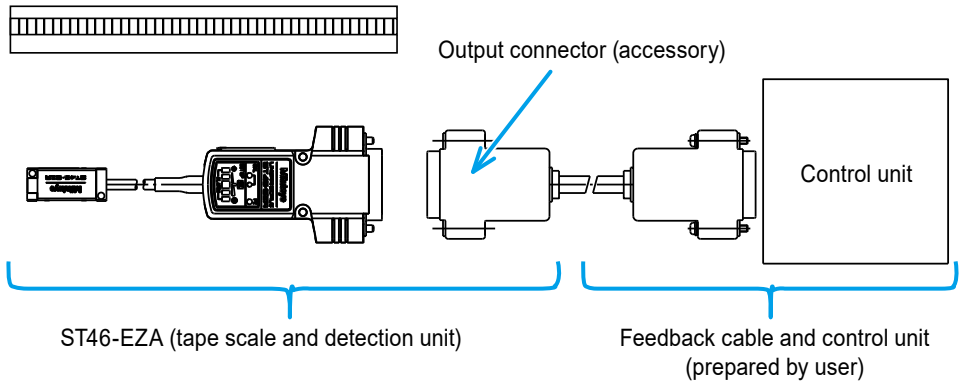
The optical separate type linear scale detects changes in the amount of light using light emitting elements and light receiving elements based on the tape scale grids and outputs the amount of changes.

This can precisely measure moving amounts of various instruments including an aligner, wire bonding, and stage for semiconductor manufacturing.

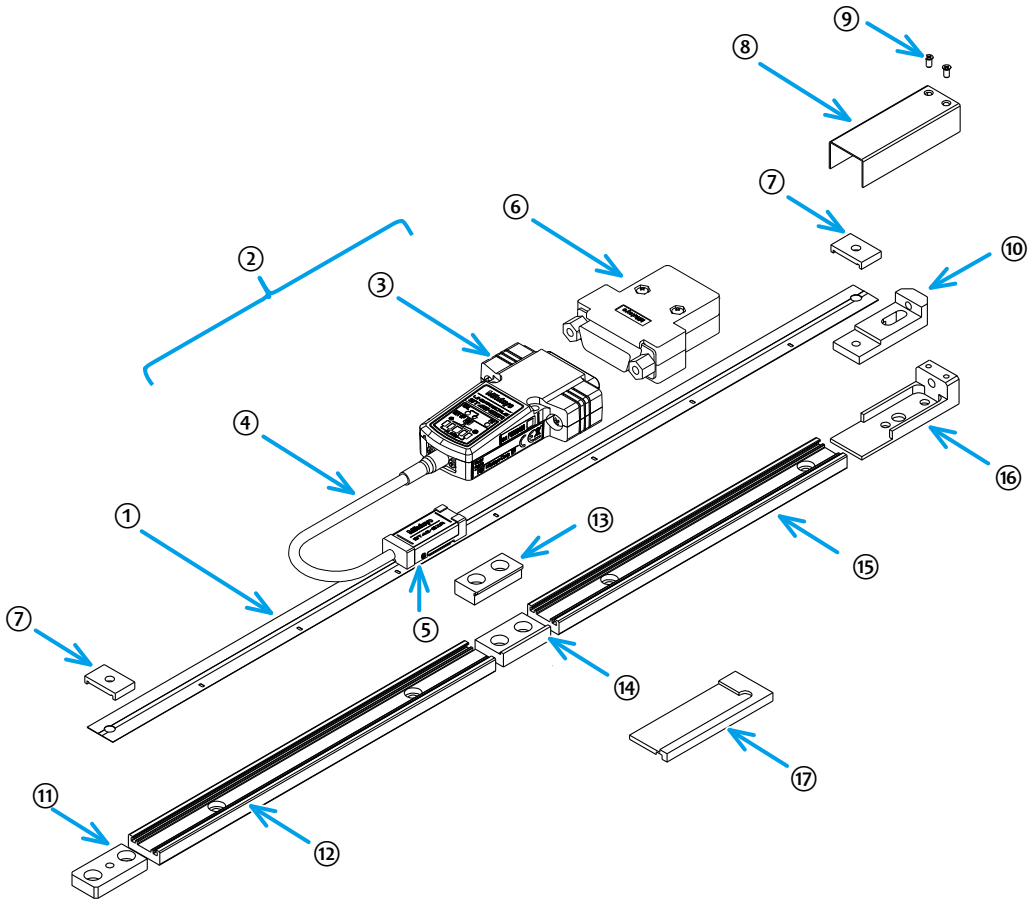
This product is equipped with the Automatic Signal Adjustment function (EZA function), which is triggered by pushing the button. During the installation of the Detector, you can check the signal strength by the setup indicator mounted on the connector shell, which eliminates adjustment using an oscilloscope. By connecting this product to the PC, you can check the signal strength and set the parameters on the dedicated application program. The I/F circuit built inside the connector shell also allows a space-saving design.

1.2 System Configuration and Name of Each Part

The system configuration and the name of each part are shown below.

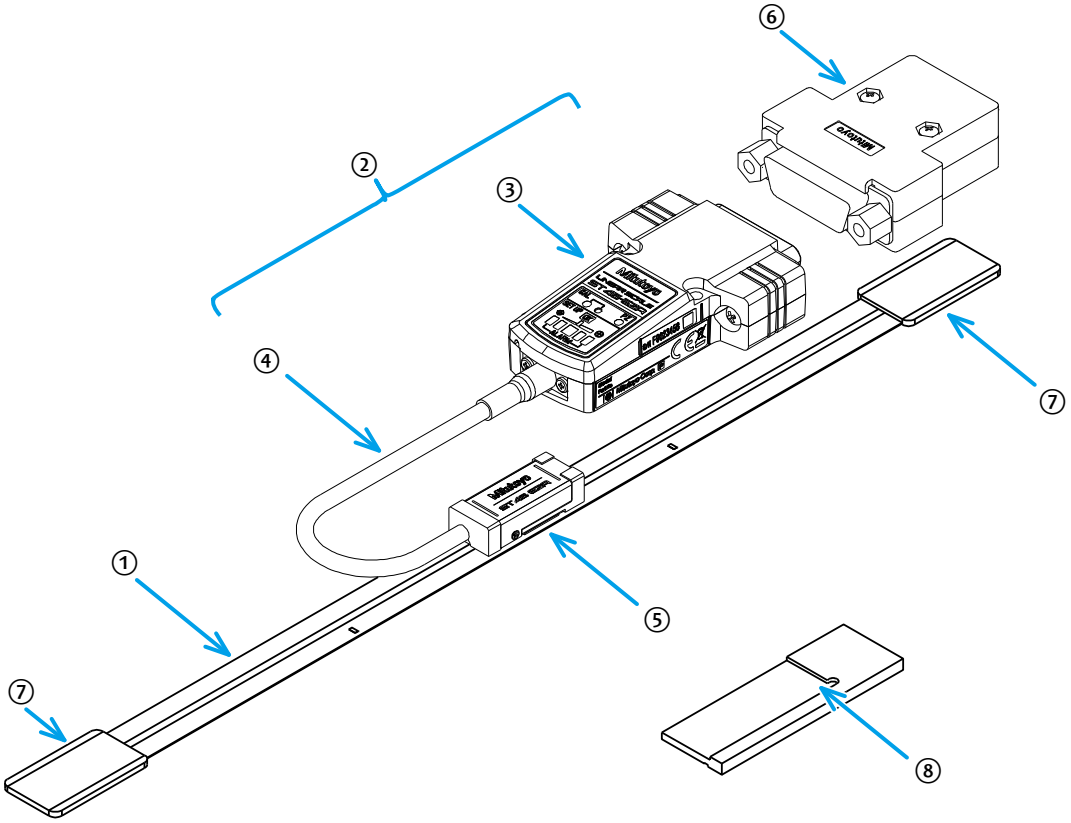


1.2.1 Specifications for Fixing at Both Ends



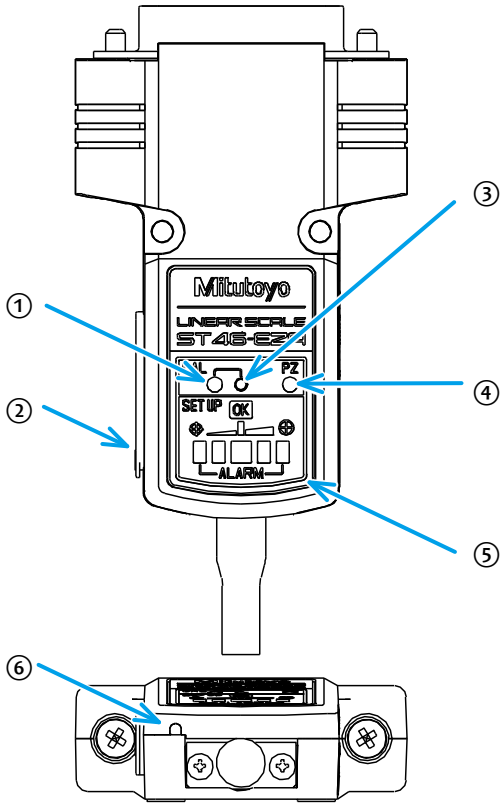
No.	Name
①	Tape scale
②	Detection unit
③	Connector shell
④	Detector cable
⑤	Detector
⑥	Output connector
⑦	Scale retaining block
⑧	Cover
⑨	Countersunk screw
⑩	Scale pull block B
⑪	Scale fixing block
⑫	Scale holder B
⑬	Scale intermediate fixing block
⑭	Scale intermediate fixing base
⑮	Scale holder A
⑯	Scale pull block A
⑰	Detector mounting auxiliary tool

1.2.2 Specifications for Fixing with Double-Sided Tape



No.	Name
①	Tape scale
②	Detection unit
③	Connector shell
④	Detector cable
⑤	Detector
⑥	Output connector
⑦	End cap
⑧	Detector mounting auxiliary tool

1.2.3 Name of Each Part of Connector Shell



No.	Name
①	CAL light
②	Direction switch/USB connector (PC connection)
③	Setup button A (switch through hole: ø 1.5)
④	PZ light
⑤	Setup indicator
⑥	Setup button B (switch through hole: ø 1.5)

Tips

- You can check the following states by the CAL light.

State	Light color	Solid/flashing
Normal operation or power-off	Not available	Off
Mounting position adjustment mode/error occurrence	Red	Flashing (2-second intervals)
Auto-tuning mode	Red	Flashing (0.5-second intervals)
Auto-tuning in progress	Red	On

- The PZ light turns on in green when the origin is detected.

1.3 The Flow of Main Tasks

The following chart shows the flow of preliminary preparation and installation onto the machine main unit as tasks to use this product.

■ Preliminary preparation

- Checking the Equipment Model — "2.1 Checking the Equipment Model" (page 7)
- Designing the Scale Mounting Surface — "2.2 Designing the Scale Mounting Surface" (page 10)
- Designing the Detector Bracket — "2.3 Designing the Detector Bracket" (page 12)

■ Installation onto the machine main unit

- Checking the Package Contents — "3.1 Checking the Package Contents" (page 15)
- Mounting the Scale — "3.2 Mounting the Scale Main Unit" (page 17)
- Mounting the Detector Bracket and Detector — "3.3 Mounting the Detector Bracket and Detector" (page 31)
- Connecting the Feedback Cable — "3.4 Connecting the Feedback Cable" (page 34)
- Adjusting the Detector Signals — "3.5 Adjusting the Detector Signals" (page 35)
- Handling the Cables and Checking the Mounting State — "3.6 Handling the Cables and Checking the Mounting State" (page 38)

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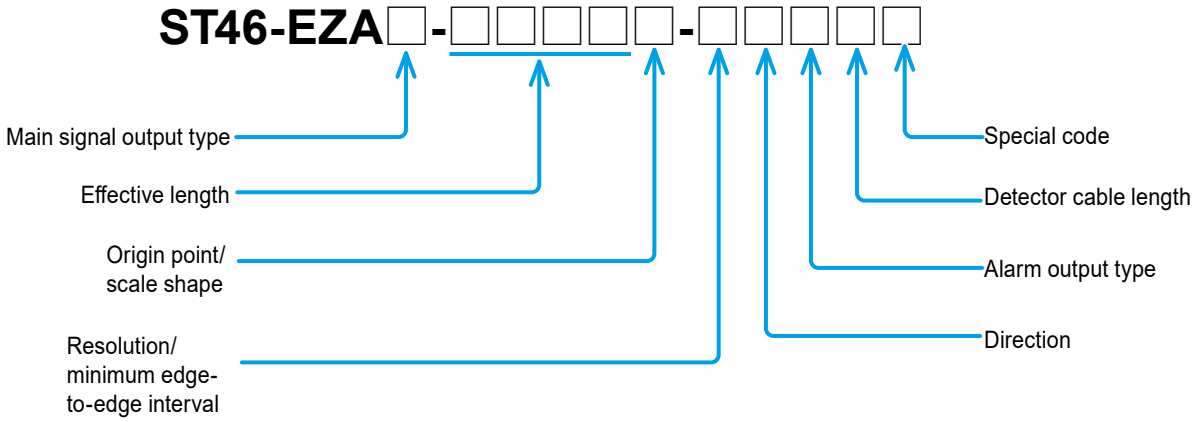
2 Setup for Installation

This chapter describes the preliminary preparation for installing this product onto the machine main unit.

2.1 Checking the Equipment Model

The ST46-EZA model number is determined based on the main signal output type, effective length, origin point/scale shape, resolution/minimum edge interval, direction, alarm output type, Detector cable length, and special code.

Make sure that your scale unit model satisfies desired specifications.



■ Main signal output type

Symbol	Description
B	Two-phase square wave + external reset input
C	Two-phase square wave + two-phase sine wave

■ Effective length

Symbol	Effective length (mm)	Symbol	Effective length (mm)
0010	10	0500	500
0025	25	0600	600
0050	50	0700	700
0075	75	0800	800
0080	80	0900	900
0100	100	1000	1000
0150	150	1100	1100
0200	200	1200	1200
0250	250	1300	1300
0300	300	1400	1400
0350	350	1500	1500
0400	400	1600	1600
0450	450	1700	1700
1800	1800	2500	2500

Symbol	Effective length (mm)	Symbol	Effective length (mm)
2000	2000	2600	2600
2200	2200	2800	2800
2400	2400	3000	3000

■ Origin point/scale shape

Symbol	Scale shape (effective length)	Origin point (effective length)
D	Metal tape scale (with specifications for fixing at both ends): Thickness 0.2 mm x width 13 mm (500 mm–3000 mm)	50-mm pitch
E	Metal tape scale (with specifications for fixing with double-sided tape): Thickness 0.2 mm x width 13 mm (10 mm–3000 mm)	Center point (10 mm–80 mm), 50-mm pitch (100 mm–3000 mm)
Z	Special shape	Special point specification

■ Resolution/minimum edge interval

Symbol	Resolution	Minimum edge-to-edge interval	Maximum response speed
A	0.05 µm	100 ns	450 mm/s
B		200 ns	225 mm/s
C		400 ns	112 mm/s
D		800 ns	56 mm/s
E	0.1 µm	100 ns	900 mm/s
F		200 ns	450 mm/s
G		400 ns	225 mm/s
H		800 ns	112 mm/s
J	0.5 µm	100 ns	2600 mm/s
K		200 ns	2250 mm/s
L		400 ns	1125 mm/s
M		800 ns	562 mm/s
N	1 µm	100 ns	2600 mm/s
P		200 ns	2600 mm/s
Q		400 ns	2250 mm/s
R		800 ns	1125 mm/s
S	5 µm	100 ns	2600 mm/s
T		200 ns	2600 mm/s
U		400 ns	2600 mm/s
V		800 ns	2600 mm/s

■ Direction

Symbol	Description
1	Forward: PA phase advance
2	Reverse: PB phase advance

■ Alarm output type

Symbol	Description
S	Alarm signal
H	High impedance

■ Detector cable length

Symbol	Length
A	1 m (standard)
B	0.5 m
C	2 m
Z	Special length specification (maximum length: 2.5 m)

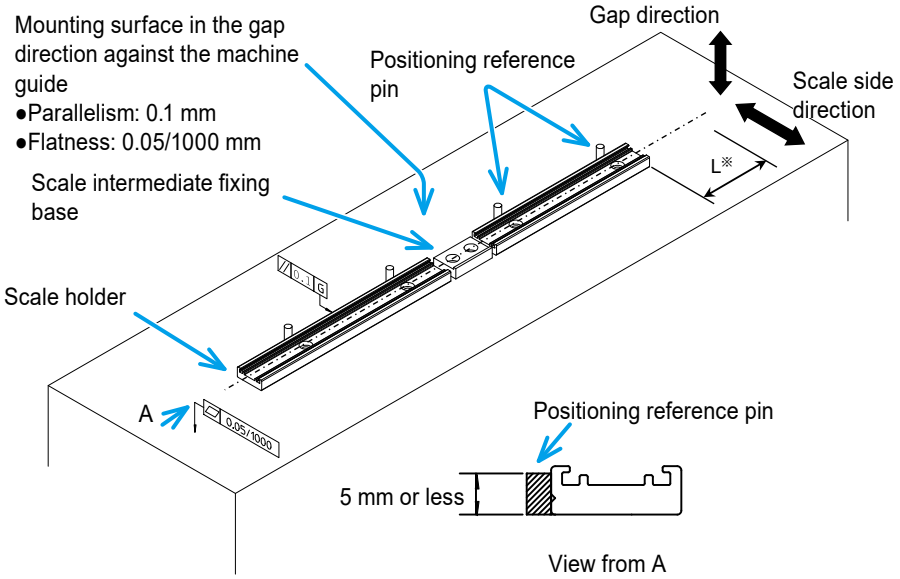
■ Special code

Symbol	Description
Not available	Standard selection specification
Z	Special specification

2.2 Designing the Scale Mounting Surface

2.2.1 Mounting the Scale with the Specifications for Fixing at Both Ends

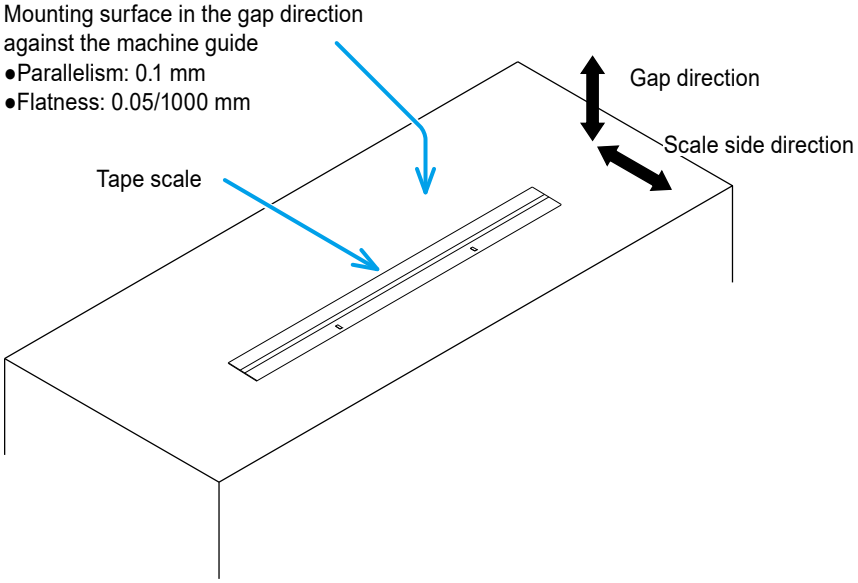
Design the scale mounting area as shown in the figure below according to "4.8.1 Specifications for Fixing at Both Ends (Effective Length of 500 mm–1000 mm)" (page 51) and "4.8.2 Specifications for Fixing at Both Ends (Effective Length of 1100 mm–3000 mm)" (page 53).



- L must be about 300 mm in size to secure a working space for fixing scale pull blocks and tightening scale pull screws.
- Design it so that the scale can be mounted with the parallelism in the scale holder side direction against the machine guide set to 0.1 mm. The scale holder surface with a groove on its side is the mounting reference surface in the scale side direction.
- For the scale with the effective length of 1100 mm–3000 mm, which comes with the scale intermediate fixing base, set the pin hole position in a location where the positioning reference pin does not come in contact with the scale intermediate fixing base.
- Set the positioning reference pin according to the pitch of the scale holder fixing screw.
- The abutting of the scale holder can be also set with stepped machining. Even in this case, secure the above specified value for the parallelism against the machine guide.

2.2.2 Mounting the Scale with the Specifications with Double-Sided Tape

Design the scale mounting area as shown in the figure below according to "4.8.3 Specifications for Fixing with Double-Sided Tape (Effective Length of 10 mm–3000 mm)" (page 55).



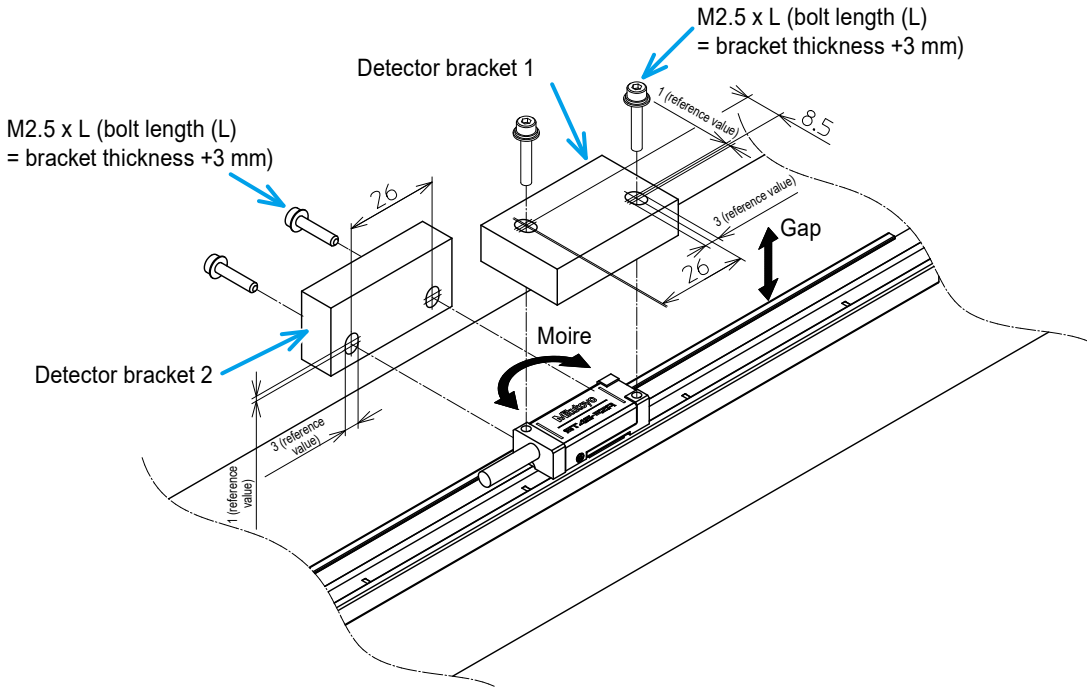
Design it so that the scale can be mounted with the parallelism in the scale side direction against the machine guide set to 0.1 mm.

Tips

Using the optional scale attaching auxiliary tool (P/N: 06AEJ690) makes it easier to mount the tape scale. For details, see "■ Effective length of 200 mm–3000 mm" (page 25).

2.3 Designing the Detector Bracket

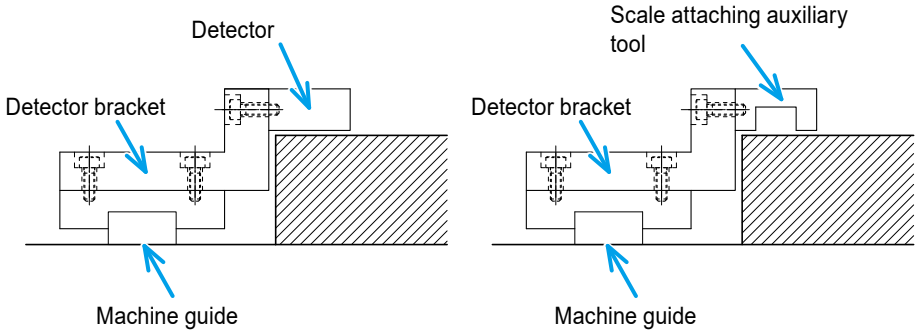
Design the Detector bracket according to the figure below. Its shape must allow adjustment of the Detector position (moire/gap). It is recommended that the Detector fixing screw holes should be long holes to make it easier to adjust the Detector position.



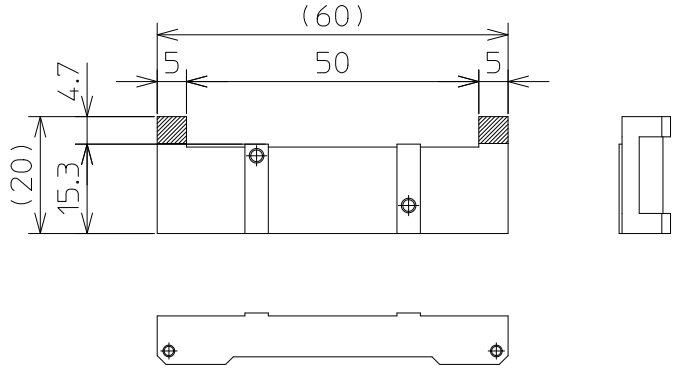
Design it so that the parallelism of the Detector mounting surface against the scale mounting surface is within 0.05 mm.

Tips

- To attach the tape scale with the specifications for fixing with double-sided tape with the effective length of 200 mm–3000 mm, it is recommended that the optional scale attaching auxiliary tool (P/N: 06AEJ690) should be used. The mounting position relationship of the scale attaching auxiliary tool is the same as that of the Detector.



- If the scale mounting auxiliary tool is used, design it so that it does not interfere with the Detector bracket according to the figure below.



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3 Installation onto the Machine Main Unit

This chapter describes the procedures, methods, and precautions required when mounting this product onto the machine main unit.

3.1 Checking the Package Contents

Before installation, make sure that the product package contains the following items.

If your scale does not satisfy the specified specifications or you have any questions or concerns about the product, please contact the agent where you purchased the product or a Mitutoyo sales office/service center.

3.1.1 Specifications for Fixing at Both Ends

Name	Quantity	Note
Tape scale	1	Check the effective length.
Detection unit	1	
Scale holder A	1	
Scale holder B		This accessory comes with the scale with the effective length of 1100 mm or more. For details on the quantity, see "4.8.2 Specifications for Fixing at Both Ends (Effective Length of 1100 mm–3000 mm)" (page 53).
Scale pull block A	1	
Scale pull block B	1	
Scale fixing block	1	
Scale retaining block	2	
Scale intermediate fixing base		This accessory comes with the scale with the effective length of 1100 mm or more. For details on the quantity, see "4.8.2 Specifications for Fixing at Both Ends (Effective Length of 1100 mm–3000 mm)" (page 53).
Scale intermediate fixing block		This accessory comes with the scale with the effective length of 1100 mm or more. For details on the quantity, see "4.8.2 Specifications for Fixing at Both Ends (Effective Length of 1100 mm–3000 mm)" (page 53).
Cover	1	
Countersunk screw (M2 x 4)	2	
Detector mounting auxiliary tool	1	
Output connector	1	
User's Manual	1	This document
Warranty card	1	
Inspection certificate	1	

To mount the scale unit, prepare the following parts.

Part name	Quantity	Note
Hex socket head cap screw (M4 x 12)	1	For fixing the scale pull block B
Hex socket head cap screw (M3 x 6)	10–43	For fixing the scale holder, scale fixing base, and scale intermediate fixing base. For details on the required quantity, see "4.8.1 Specifications for Fixing at Both Ends (Effective Length of 500 mm–1000 mm)" (page 51) and "4.8.2 Specifications for Fixing at Both Ends (Effective Length of 1100 mm–3000 mm)" (page 53).
Hex socket head cap screw (M3 x 5)	2	For fixing the scale retaining block
Hex socket head cap screw (M3 x 14)	1	Screw for pulling the tape scale
Plain washer (nominal diameter 4)	1	For fixing the scale pull block B
Hex socket head cap screw (M2.5 x L)	2	For mounting the Detector. The screw length L must be within the thickness of the prepared Detector bracket + 3 mm.

3.1.2 Specifications for Fixing with Double-Sided Tape

Name	Quantity	Note
Tape scale	1	Check the effective length.
Detection unit	1	
End cap	2	
Detector mounting auxiliary tool	1	
Output connector	1	
User's Manual	1	This document
Warranty card	1	
Inspection certificate	1	

- To mount the scale unit, prepare the following parts.

Part name	Quantity	Note
Hex socket head cap screw (M2.5 x L)	2	For mounting the Detector. The screw length L must be within the thickness of the prepared Detector bracket + 3 mm.
Roller	1	Option (P/N: 06AEJ505)

- To mount the tape scale with the effective length of 200 mm–3000 mm, prepare the following parts.

Part name	Quantity	Note
Scale attaching auxiliary tool	1	Option (P/N: 06AEJ690)

3.2 Mounting the Scale Main Unit

NOTICE

Be very careful that the tape scale is not damaged or broken.

If dirt and dust are attached to the tape scale, it causes a malfunction or deteriorates the accuracy. Wipe off the dirt and dust with a soft cloth soaked in ethanol or cleaning paper. Similarly, clean the tape scale mounting surface of the machine unit thoroughly with ethanol. Even for parts that come in contact with the tape scale, such as scale holders, clean them fully with ethanol.

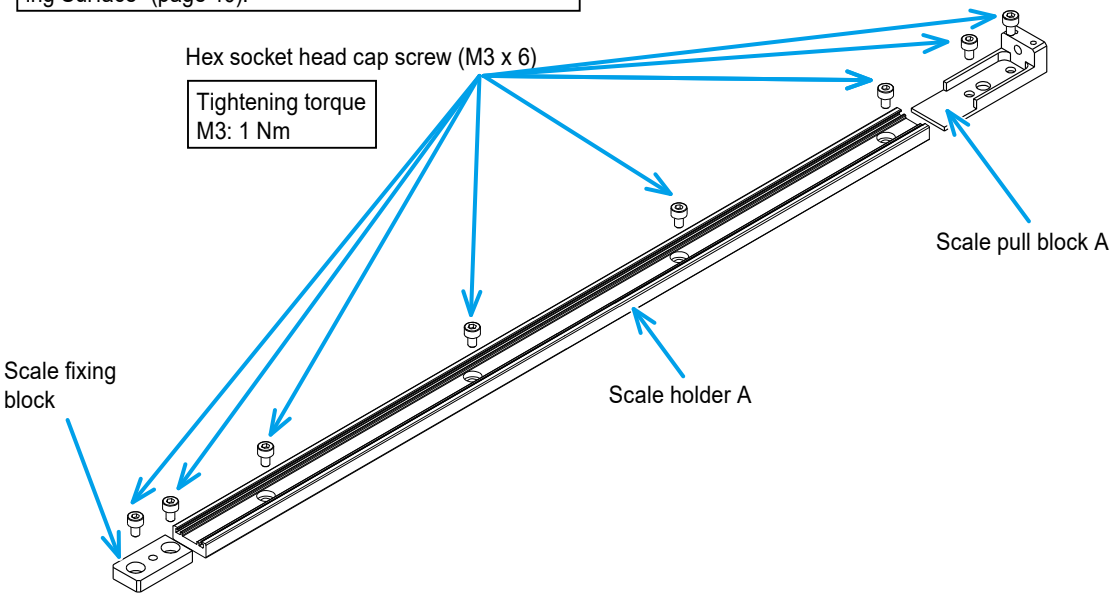
Tips

- Conduct temperature leveling thoroughly for both the tape scale and mounting parts before fixing them. The accuracy of this product is guaranteed at 20 °C. The recommended temperature leveling is about 8 hours or longer at 20 °C for both the tape scale and parts for mounting the scale. Perform installation after temperature leveling.
- If the temperature environment is insufficient, including temperature leveling, the predetermined indication accuracy may not be achieved.
- To prevent any differences in temperature between the tape scale and the machine unit resulting from heat from the hands, wear gloves during installation.
- Please note that wiping the tape scale with ethanol after temperature leveling drops the temperature of the wiped area.

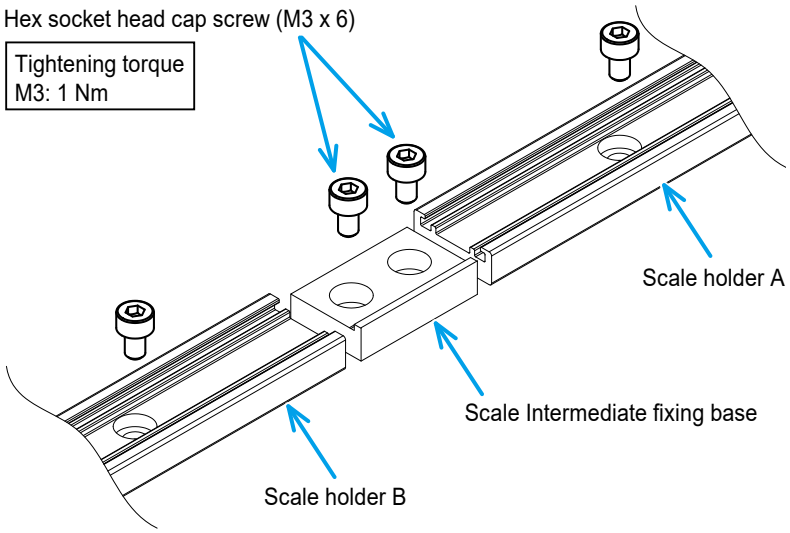
3.2.1 Specifications for Fixing at Both Ends

1 Fix the scale holder A, scale pull block A, and scale fixing block.

For the parallelism and flatness of the scale holder mounting area, see "2.2 Designing the Scale Mounting Surface" (page 10).



For the scale with the effective length of 1100 mm or more, fix as many scale holder B units and scale intermediate fixing base units as supplied.

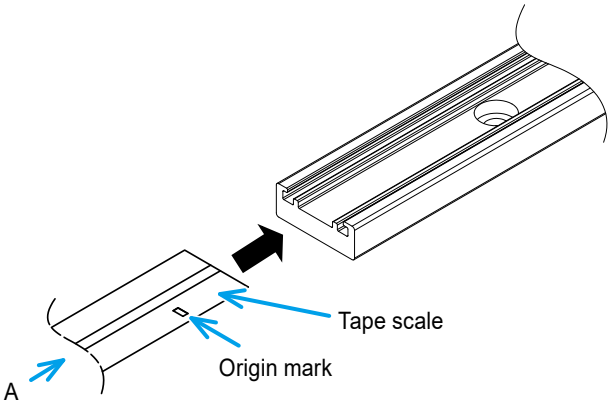


2 Peel the scale protection tape.

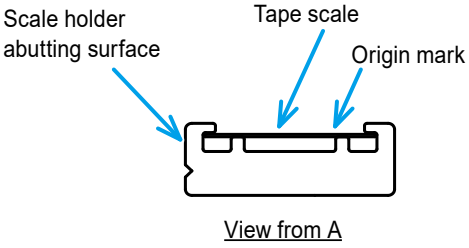
Tips

Wipe the tape scale thoroughly with a soft cloth soaked in ethanol or cleaning paper.

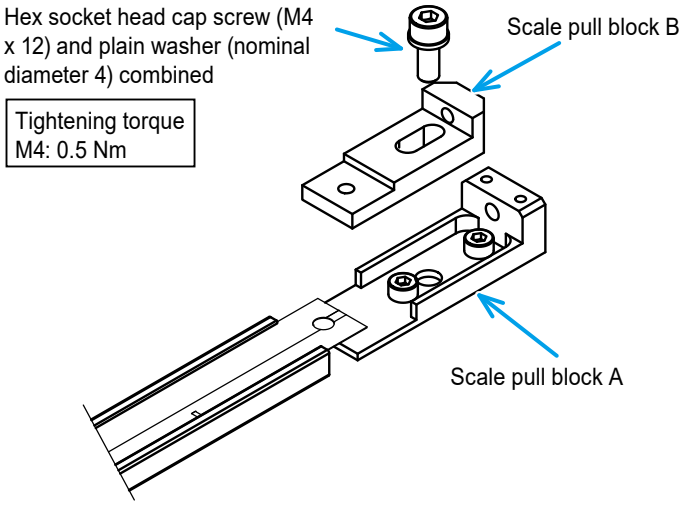
3 Insert the tape scale into the scale holder.



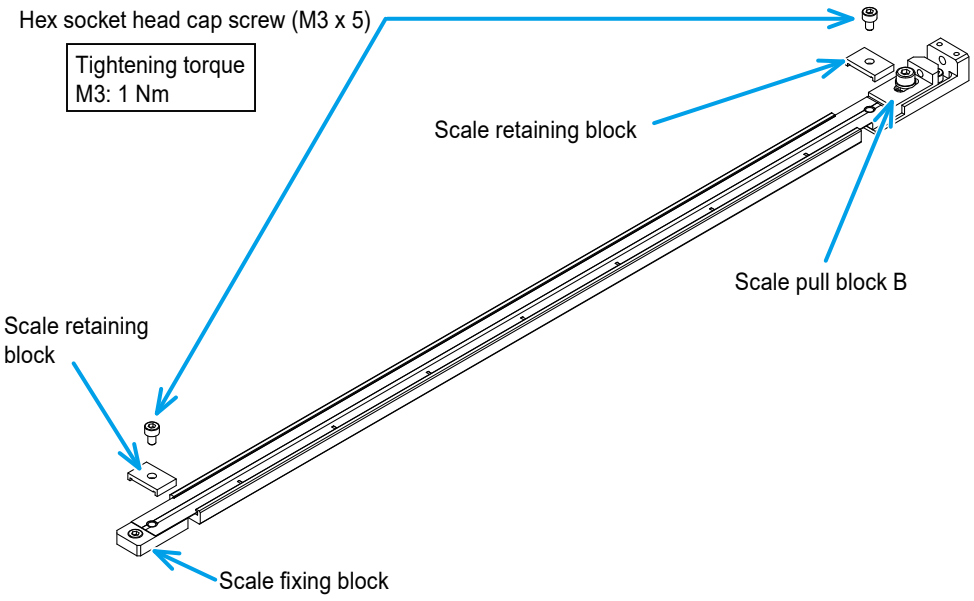
Insert the tape scale so that the origin mark of the tape scale is on the opposite side of the scale holder abutting surface (side with a groove).



4 Put the scale pull block B on the scale pull block A and temporarily fix it.



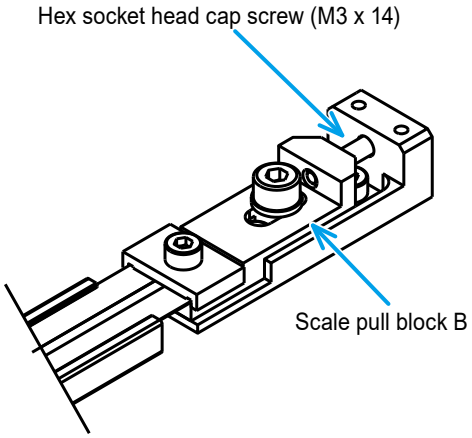
5 Put the scale retaining block each on the scale retaining block and scale pull block B and temporarily fix it.



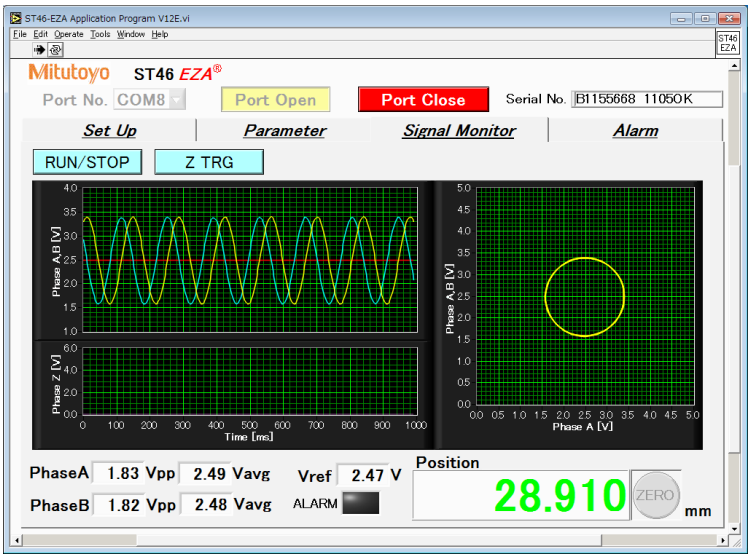
6 Pull the tape scale up to the specified amount with the scale pull block B.

1. Mount the Detector by referring to "3.3 Mounting the Detector Bracket and Detector" (page 31).
2. Be prepared to check the Detector signals according to the instructions in the separate document "ST46-EZA Application Program User's Manual".

3 Install the hex socket head cap screw (M3 x 14) on the scale pull block B.

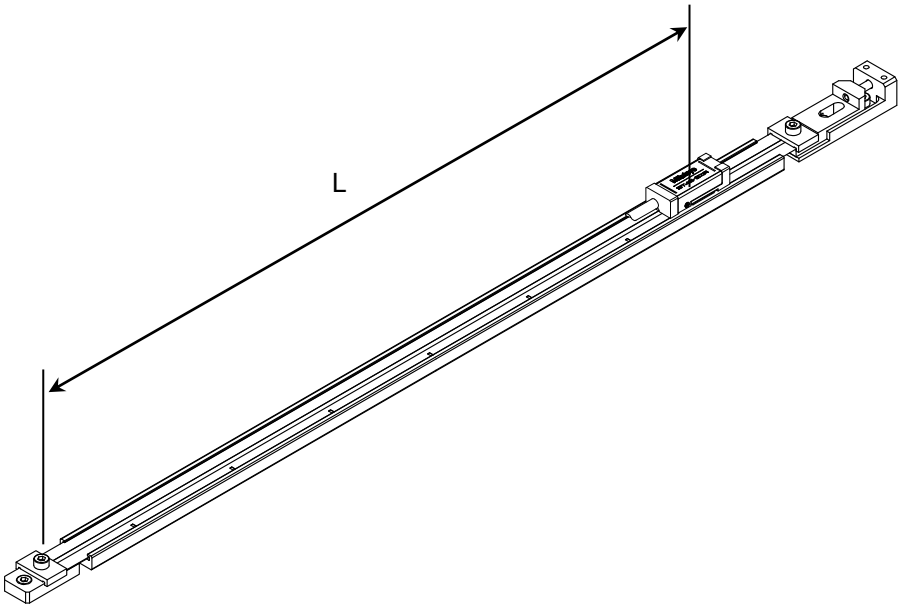


4 Display the Signal Monitor tab according to the instructions in "4.2 Checking the Signals" in the separate document "ST46-EZA Application Program User's Manual".



5 Press the Detector against the scale retaining block on the scale fixing block side and click [ZERO] on the Signal Monitor tab.

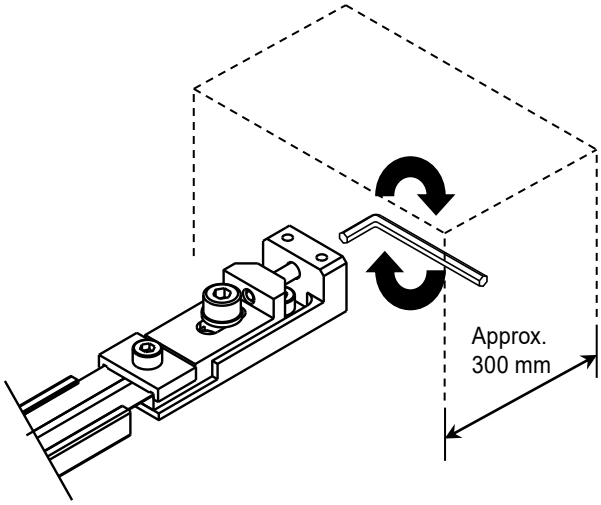
6 While checking [Position] on the Signal Monitor tab, move the Detector to an appropriate position.



Tips

Move the Detector to a position where the pulling amount of the tape scale can be easily calculated such as 1000 mm.

7 Turn the hex socket head cap screw (M3 x 14) installed on the scale pull block B. Then, while checking [Position] on the Signal Monitor tab, pull the tape scale.



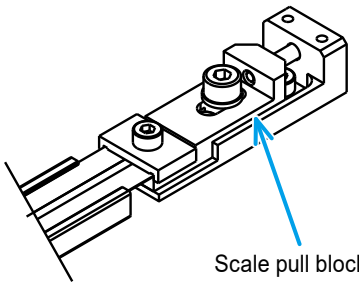
Pull the tape scale until the [Position] value reaches the amount calculated by the following formula:

[Position] value = Detector position (L) - Detector position (L) x 0.00025

For example, when the Detector position is 1000 mm, pull the tape scale until the [Position] value reaches the following amount:

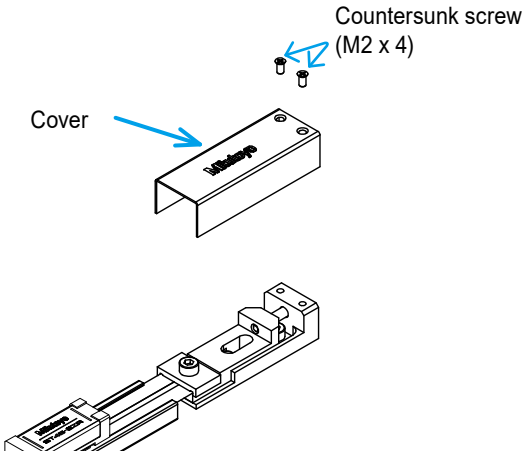
[Position] value = 1000 - 1000 x 0.00025 = 999.75

7 Fully tighten the scale pull block B.

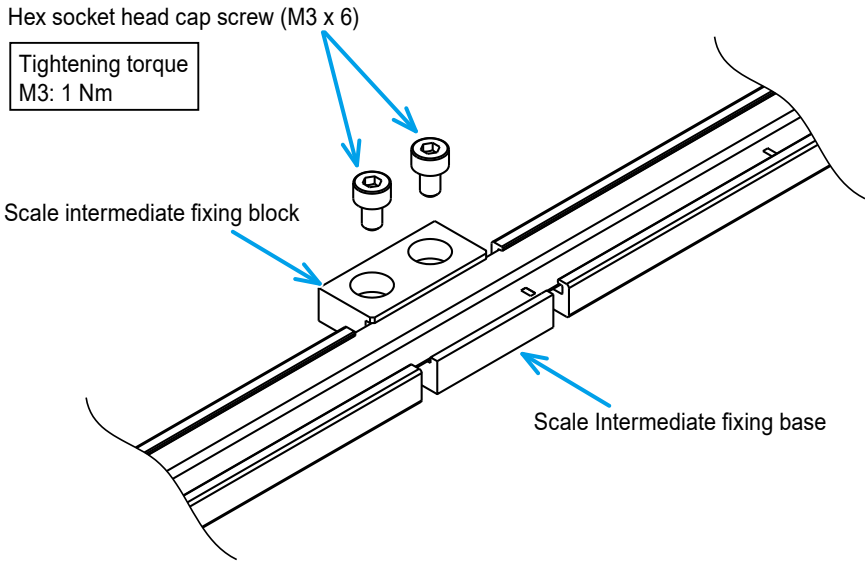


Tightening torque
M4: 3 Nm–4 Nm

8 Put the cover.



9 Mount and fix the scale intermediate fixing block.

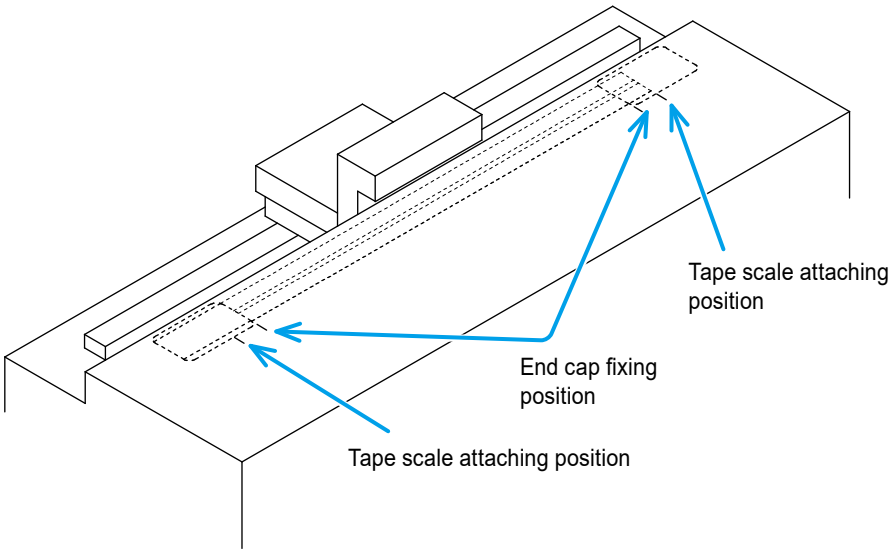


The scale intermediate fixing block is used for the scale with the effective length of 1100 mm or more.

3.2.2 Specifications for Fixing with Double-Sided Tape

■ Effective length of 10 mm–150 mm

1 **Mark with a felt pen to the side of the tape scale attaching position and end cap fixing position.**



Tips

The end cap fixing position must be 10 mm inside the tape scale attaching position.

2 **Peel the release paper of the double-sided tape on the tape scale.**

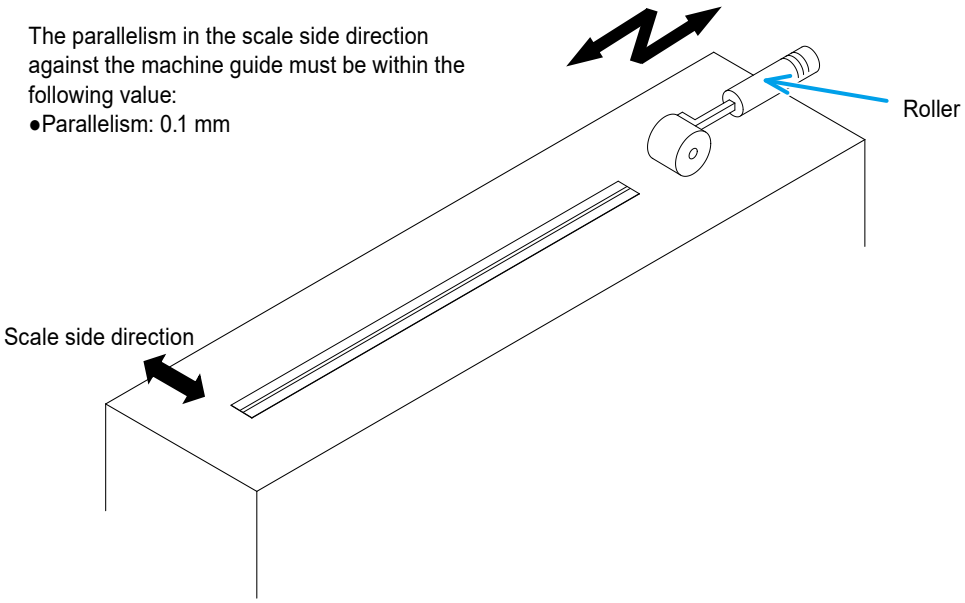
Tips

Do not touch the adhesive surface of the double-sided tape.

3 **Attach the tape scale.**

4 **Press the roller on the top surface of the tape scale to level the adhesive surface against the machine unit.**

The parallelism in the scale side direction against the machine guide must be within the following value:
●Parallelism: 0.1 mm

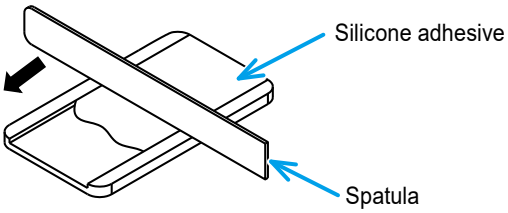


Tips

Apply a gentle force on the roller first and then gradually increase it so that the tape scale is attached evenly.

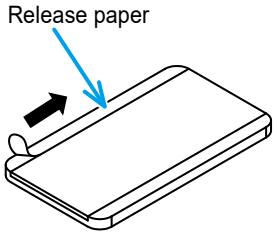
5 **Peel the protection tape on the front of the tape scale.**

6 **Apply silicone adhesive to the concave area of the back of each end cap and spread it evenly with a spatula.**



A recommended silicone adhesive is Shin-Etsu Silicones' KE441T.

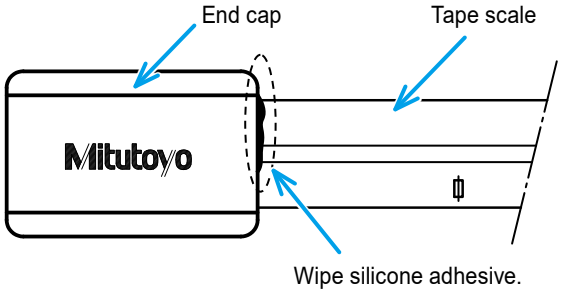
7 **Peel the release paper of the tape on the back of each end cap and attach the end cap while aligning with the marked end cap fixing position.**



Tips

Attach the end caps to the end cap fixing position at both ends of the tape scale while aligning the concave part with the tape scale.

8 **Wipe any silicone adhesive that spills out.**



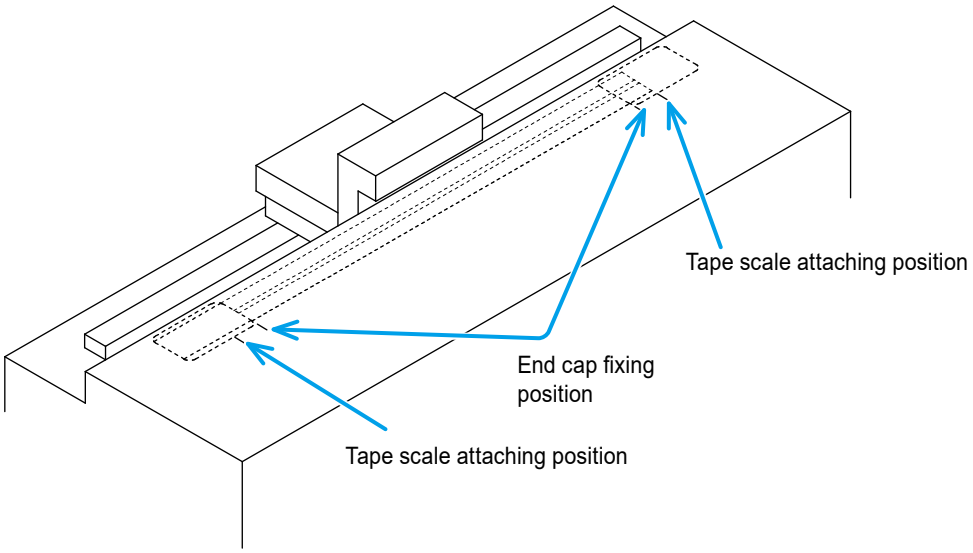
9 **Clean the tape scale again with ethanol.**

■ Effective length of 200 mm–3000 mm

Tips

To attach the tape scale with the specifications for fixing with double-sided tape with the effective length of 200 mm–3000 mm, it is recommended that the optional scale attaching auxiliary tool (P/N: 06AEJ690) should be used.

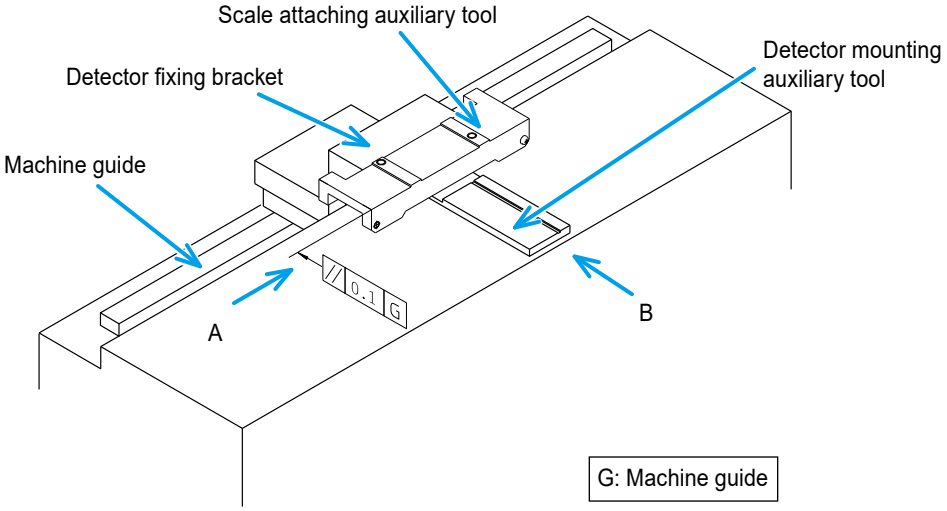
1 **Mark with a felt pen to the side of the tape scale attaching position and end cap fixing position.**



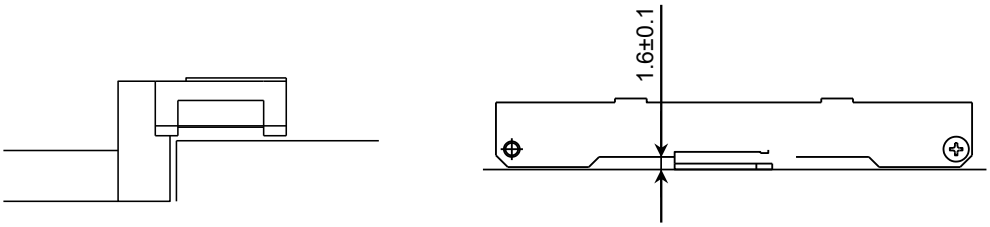
Tips

The end cap fixing position must be 10 mm inside the tape scale attaching position.

2 Mount the scale attaching auxiliary tool on the Detector bracket.



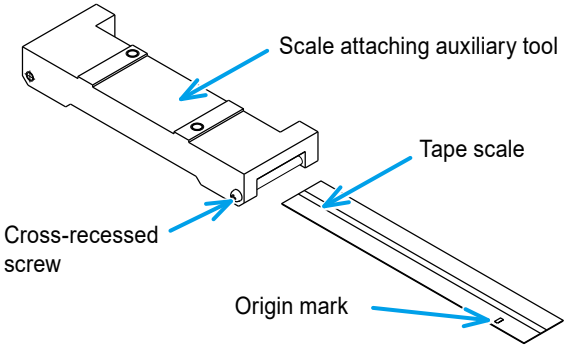
Use the Detector mounting auxiliary tool so that the gap between the scale attaching auxiliary tool and the tape scale mounting surface is 1.6 ±0.1 mm.

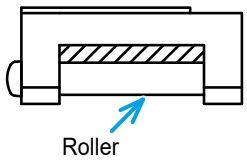


View from A

View from B

3 Put the tape scale in between the scale attaching auxiliary tool and the roller.



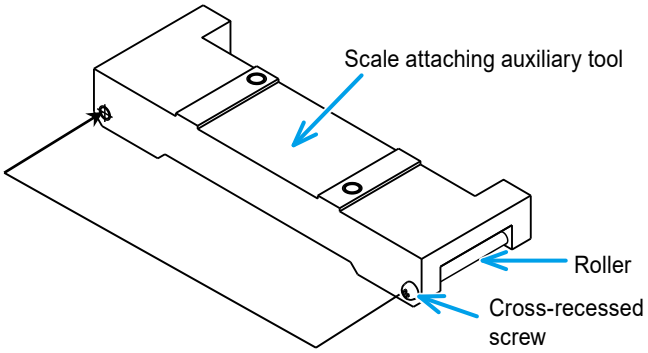


Side view of scale attaching auxiliary tool

Pay attention to the origin mark position when putting the tape scale through.

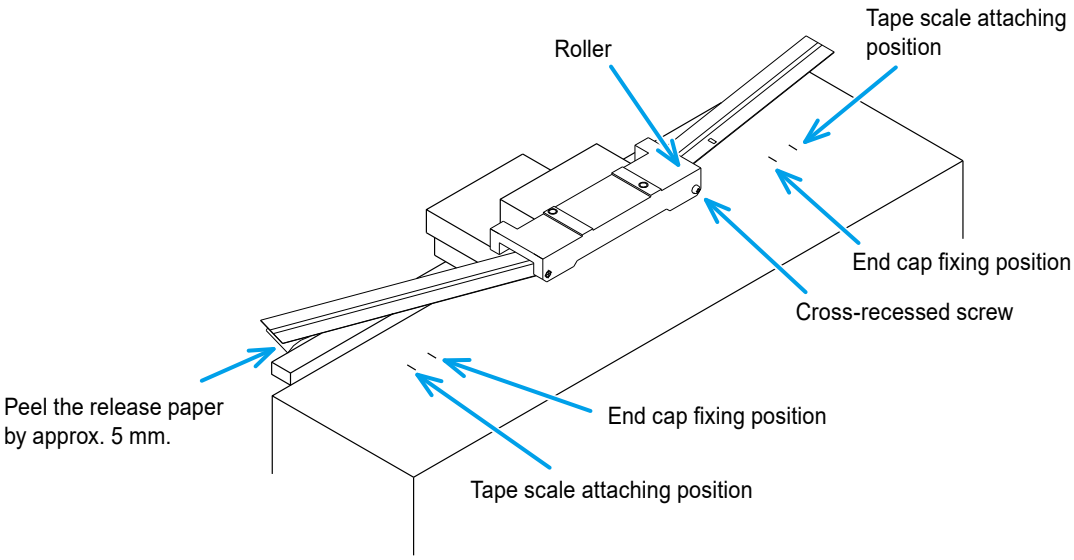
Tips

In this example, the tape scale is attached from the left-handed side using the scale attaching auxiliary tool. To attach it from the right-handed side, change the roller position of the scale attaching auxiliary tool.



4 **Pull out the tape scale by about 50 mm.**

5 **Peel the release paper of the tape on the tape scale by about 5 mm.**

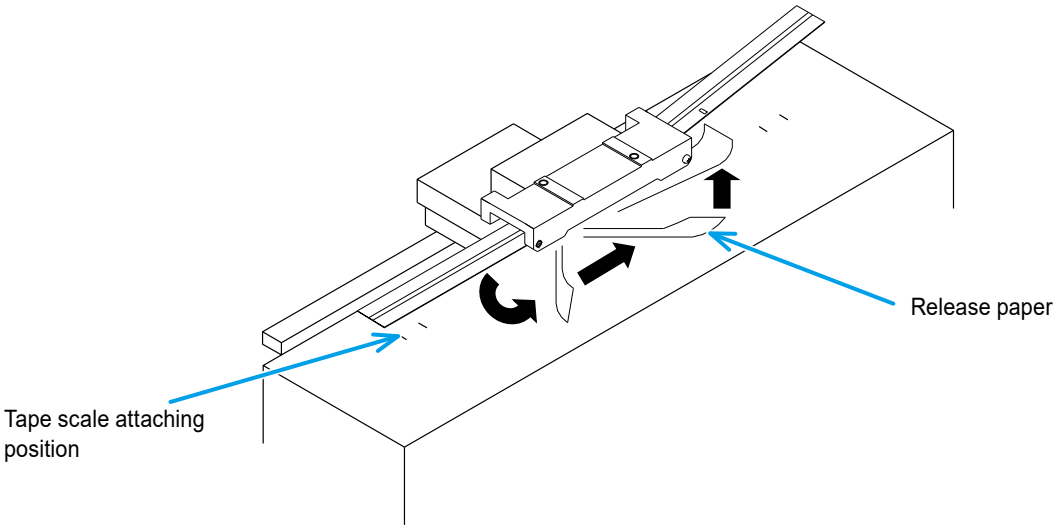


6 **Attach the tape scale while aligning both ends with the marked scale attaching position.**

Tips

Do not touch the adhesive surface of the double-sided tape.

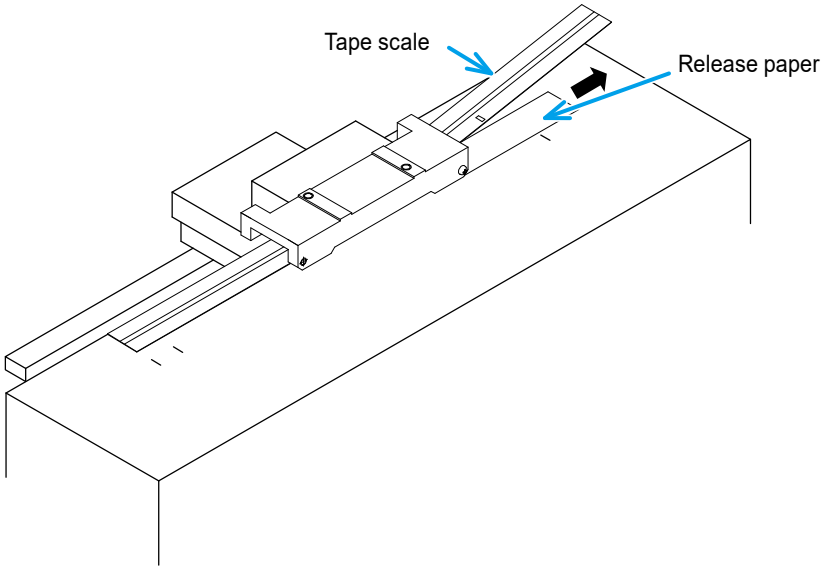
7 **Peel the release paper of the tape and fold it to the roller of the scale attaching auxiliary tool.**



Tips

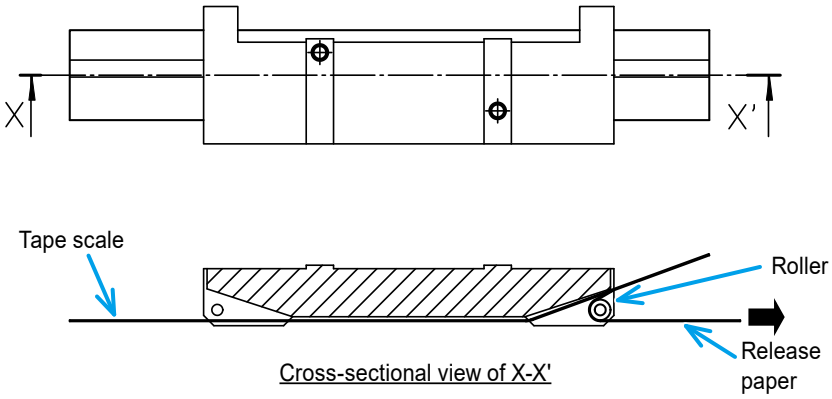
If you pull the release paper forcibly, it may be torn in the middle.

8 **Attach the tape scale by moving the scale attaching auxiliary tool while peeling the release paper.**



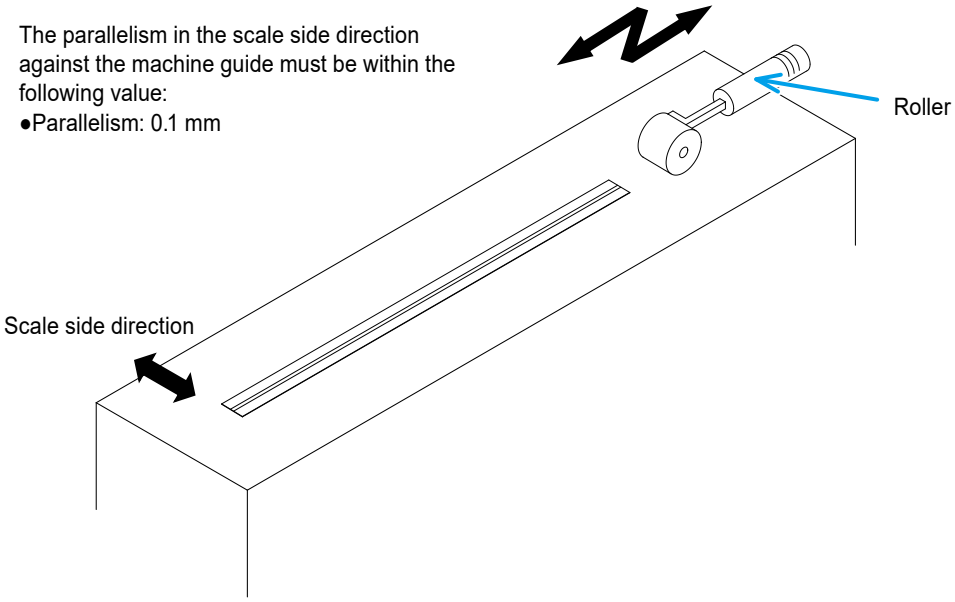
Tips

- The release paper must be peeled by hand, parallel to the tape scale. If you pull the release paper diagonally or forcibly, it may be torn in the middle.
- If the travel range of the machine guide is shorter than the tape scale full length, you cannot attach the tape scale by moving the scale attaching auxiliary tool to the end of the tape scale. In such a case, remove the roller of the scale attaching auxiliary tool before attaching the tape scale.



9 **Press the roller on the top surface of the tape scale to level the adhesive surface against the machine unit.**

The parallelism in the scale side direction against the machine guide must be within the following value:
●Parallelism: 0.1 mm

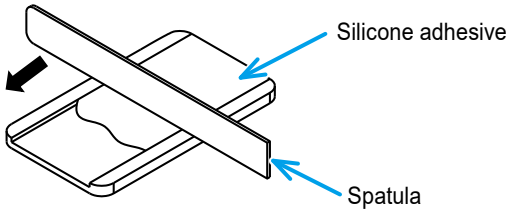


Tips

Apply a gentle force on the roller first and then gradually increase it so that the tape scale is attached evenly.

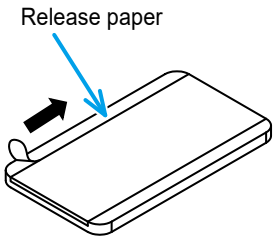
10 **Peel the protection tape on the front of the tape scale.**

11 **Apply silicone adhesive to the concave area of the back of each end cap and spread it evenly with a spatula.**



A recommended silicone adhesive is Shin-Etsu Silicones' KE441T.

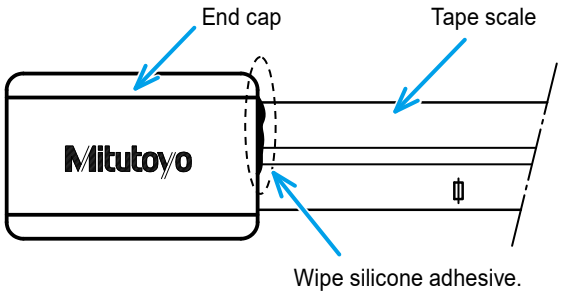
12 **Peel the release paper of the tape on the back of each end cap and attach the end cap while aligning with the marked end cap fixing position.**



Tips

Attach the end caps to the end cap fixing position at both ends of the tape scale while aligning the concave part with the tape scale.

13 **Wipe any silicone adhesive that spills out.**



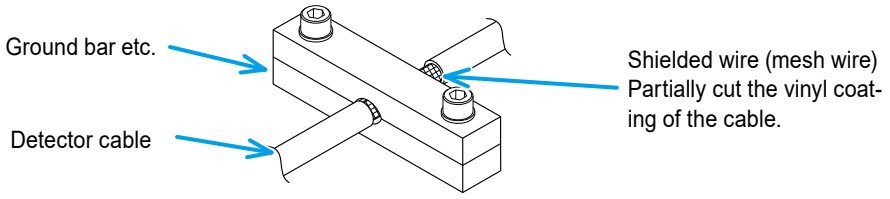
14 **Clean the tape scale again with ethanol.**

3.3 Mounting the Detector Bracket and Detector

NOTICE

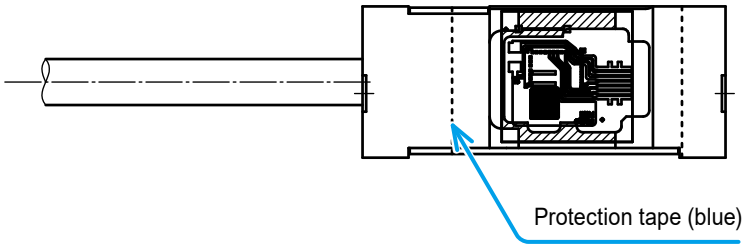
Do not directly touch the connector shell pins during installation. Otherwise, electronic parts may be damaged by static electricity. Be sure to take measures to prevent static electricity for installation.

To use the scale with the Detector mounted, the machine main unit, as well as the attachment bracket, must be electrically grounded. Failure to do so may cause the scale unit and the Detector to be affected by external noise. When it is difficult to ground due to the characteristics of the bracket material, make sure that the shielded part of the Detector cable is grounded using a ground bar.



Example: Drawing of using a ground bar

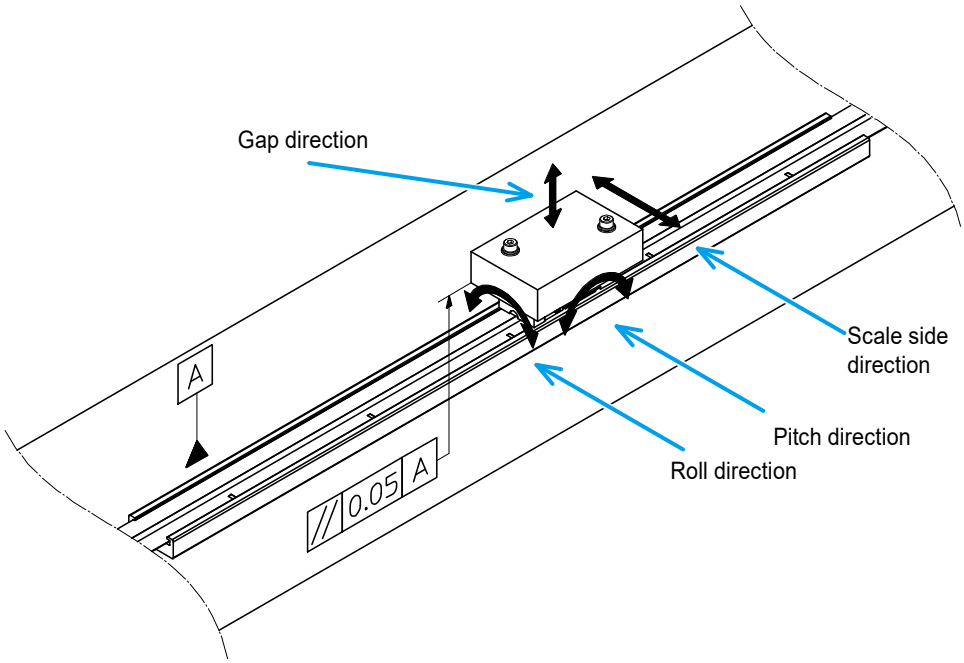
1 Peel the protection tape (blue) off the detecting surface of the Detector.



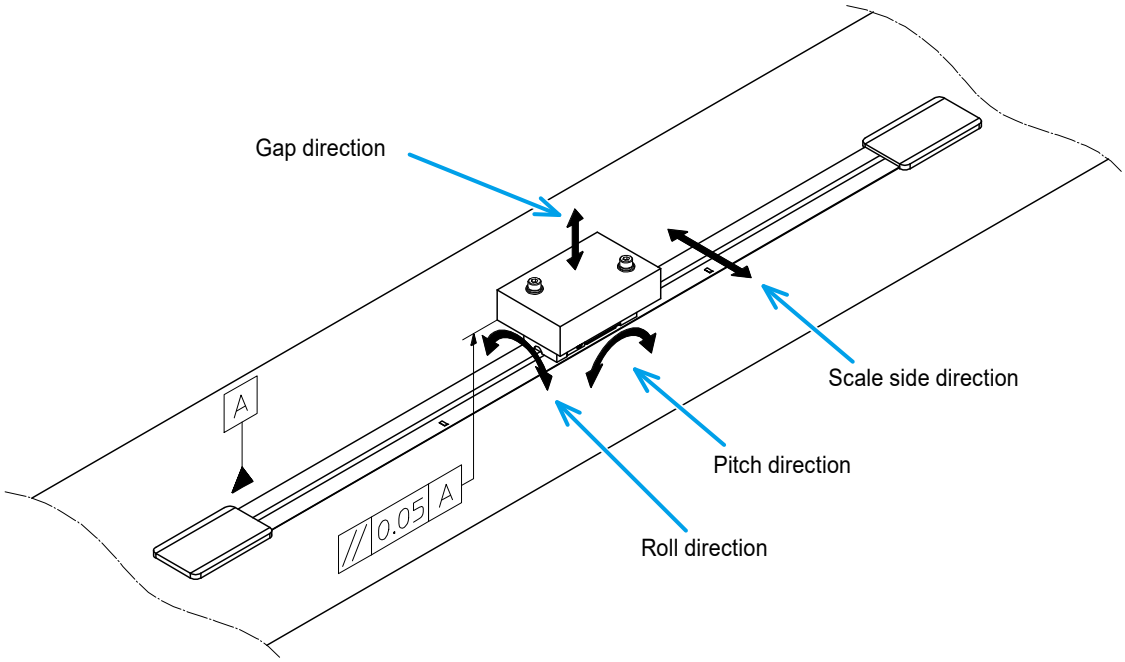
Back of the Detector

2 **Attach the Detector to the Detector bracket.**

■ Specifications for fixing at both ends



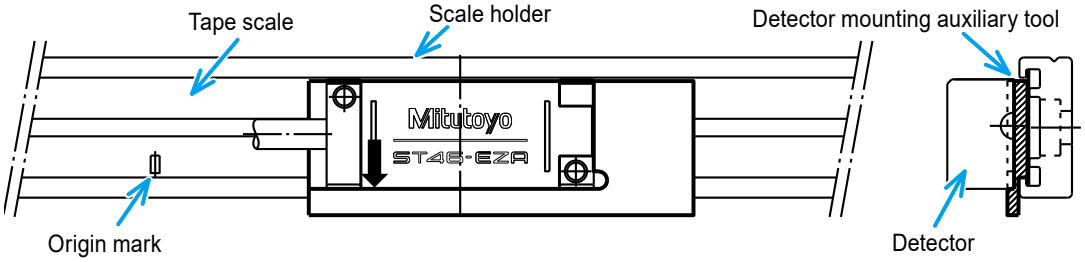
■ Specifications for fixing with double-sided tape



3 Insert the Detector mounting auxiliary tool between the tape scale and the Detector.

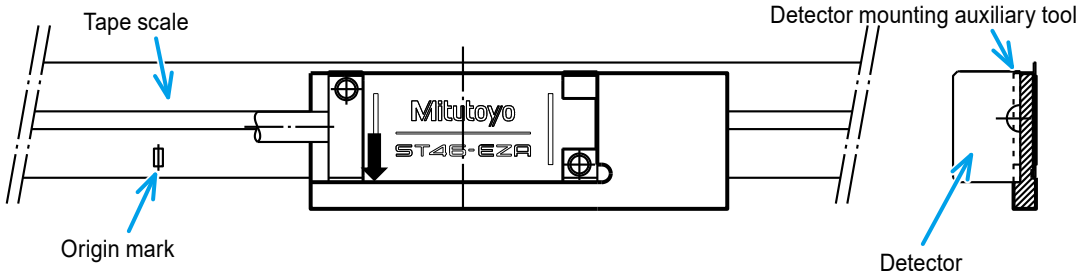
■ Specifications for fixing at both ends

1 Press the Detector mounting auxiliary tool against the tape scale origin mark side of the scale holder.
2 Put the Detector on the Detector mounting auxiliary tool, press it against the tape scale origin mark side, and temporarily fix it.



■ Specifications for fixing with double-sided tape

1 Press the Detector mounting auxiliary tool against the tape scale origin mark side.
2 Put the Detector on the Detector mounting auxiliary tool, press it against the tape scale origin mark side, and temporarily fix it.



4 Check the parallelism of the Detector against the tape scale with a lever-type dial indicator or electric micrometer.

The parallelism of the Detector against the tape scale must be within 0.05 mm.

5 Make sure that the distance between the Detector and the tape scale is within the specified value (gap: 1.5 ±0.1 mm) with the Detector mounting auxiliary tool.

6 Fix the Detector (recommended screw tightening torque: 0.4 Nm–0.6 Nm).

3.4 Connecting the Feedback Cable

- Be sure to turn off the control unit before connecting the scale unit to the control unit with a feedback cable.
- A feedback cable must be prepared by the user. Find a cable that supports your model according to "4.4 Production of Feedback Cable" (page 45).

1 **Connect the connector shell of the detection unit to the control unit with the feedback cable.**

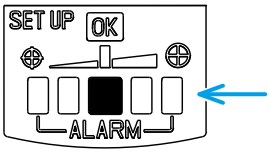
2 **Turn on the control unit.**

» The connector shell light turns on or flashes.

Ignore the connector shell light state and be sure to perform signal adjustment described in "3.5 Adjusting the Detector Signals" (page 35).

Tips

When the Detector mounting state is correct, if you turn on the control unit, the setup indicator center LED (blue) turns on.

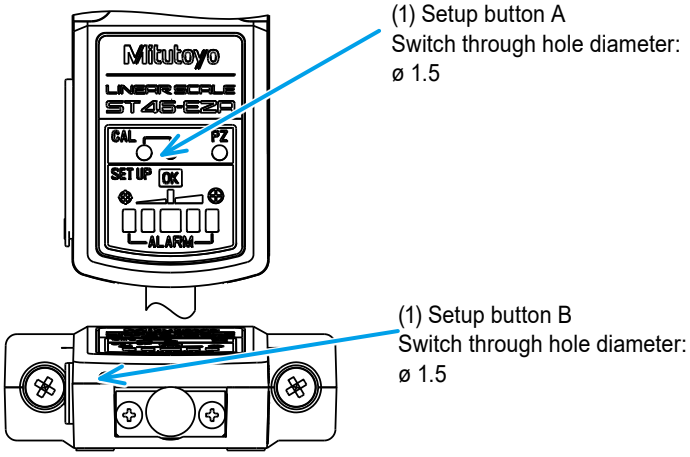


3.5 Adjusting the Detector Signals

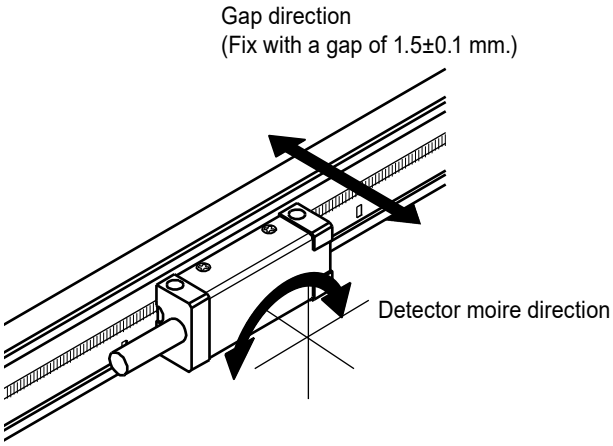
After mounting the tape scale and Detector and connecting the feedback cable, adjust the signals using the connector shell.

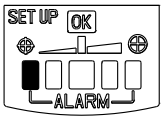
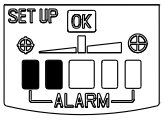
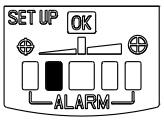
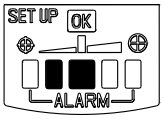
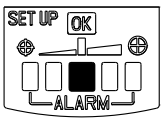
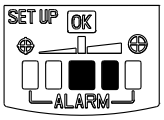
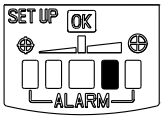
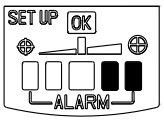
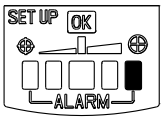
1 Press the setup button A or B on the connector shell with a thin stick of ø 1.0–ø 1.4 (hex wrench key nominal 1.3 (for hex socket head cap screw M2.5)).

» The CAL light flashes in red (at intervals of 1 second) and enters the mode to adjust the Detector mounting position.



2 Adjust the moire direction of the Detector so that the signal strength judgment results in "OK" on the setup indicator.



	Light indication	Color	Signal strength judgment
State 1		Red	NG
State 2		Left: Red Right: Yellow	NG
State 3		Yellow	NG
State 4		Left: Yellow Right: Blue	NG
State 5		Blue	OK
State 6		Left: Blue Right: Yellow	NG
State 7		Yellow	NG
State 8		Left: Yellow Right: Red	NG
State 9		Red	NG

Lower signal

Higher signal

Tips

When the setup indicator does not light up in blue, adjust the gap direction of the Detector.

3 Press the setup button A or B again.

» The CAL light changes from flashing red to solid red and enters the auto-tuning mode.

4 Move the Detector or tape scale at a speed of 5 mm/s–50 mm/s by 15 mm or more in the measurement direction.

» The CAL light turns off, and auto-tuning is finished.

- Move the Detector or tape scale in one specific direction. If it is moved in the reverse direction during auto-tuning, a CAL error occurs.
- In case of a CAL error, adjust the signals again from scratch. You do not need to turn off the power for signal adjustment.

5 Make sure that the signal strength judgment is "OK" on the setup indicator throughout the effective length.

Tips

If the scale travel distance is short, a CAL error may occur. If you need to use on a unit with the scale travel distance of 15 mm or less, contact the nearest Mitutoyo sales office.

3.6 Handling the Cables and Checking the Mounting State

3.6.1 Handling the Cables

After adjusting the signals, fix the feedback cable.

1 Perform wiring paying attention to the twisting or bends of the cables.

NOTICE

Note that the feedback cable may malfunction if bundled with other cables that may cause electrical noise, or if it is located near a switching relay dealing with a large current.

2 Fix the feedback cable with cable clamps.

Clamp the feedback cable to a nearby part that moves along with the Detector so that force is not applied to the Detector when the machine unit is running.

Be sure to fix the connector shell to the machine main unit with screws.

3.6.2 Checking the Mounting and Adjustment States

After fixing the feedback cable, check the mounting and adjustment states of the tape scale and Detector again.

Tips

Perform this operation while making sure that the Detector does not make contact or interfere with any part of the machine unit or tape scale.

1 Make sure that all the part screws and clamps are firmly tightened.

2 Turn off the control unit and turn it on again after 5 to 10 seconds.

Tips

Turning off the control unit resets the alarm that occurred during adjustment.

3 Make sure that the setup indicator on the connector shell lights up in blue throughout the travel range of the machine unit.

Tips

If the setup indicator lights up in red or yellow, check the tape scale for any dirt or the moire/gap directions again.

3.6.3 Putting the Protection Cover

After checking the mounting and adjustment states of the tape scale and Detector again, put the protection cover.

- Make sure that the protection cover does not make contact with any machine unit part or scale unit cable.
- Check the above for the entire travel range of the machine unit.

MEMO

4 Specifications

4.1 Specifications

Item	Specification
Detection method	Optical reflection type linear encode
Tape scale grid pitch	20 µm
Output signal type	Type B: Two-phase square wave, origin signal pulse, external reset input Type C: Two-phase square wave, origin signal pulse, two-phase sine wave
Effective length	Specifications for fixing at both ends (effective length of 500 mm–3000 mm) Specifications for fixing with double-sided tape (effective length of 10 mm–3000 mm)
Indication accuracy (20 °C) (*1)	Effective length of 10 mm–1000 mm: ±5 µm Effective length of 1100 mm–3000 mm: ±5 µm/m
Coefficient of linear expansion	≈ 11 x 10^{-6}/K
Maximum response speed	2.6 m/s (at sine wave amplitude of -3 dB)
Scale origin	Available (50 mm pitch, center point for effective length of 10 mm–75 mm)
Power supply voltage	5 VDC ±5 %
Maximum current consumption	250 mA
Used temperature range	0 °C–40 °C
Storage temperature range	-20 °C–60 °C
Used/storage humidity range	20 %RH–80 %RH (non condensation)
Alarm display function	A scale unit alarm is indicated with a LED on the connector shell.
CE marking/UKCA marking	EMC Directive/Electromagnetic Compatibility Regulations: EN 61326-1 Immunity test requirement: Clause6.2 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

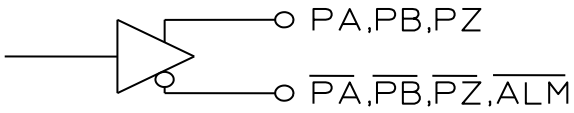
*1: The inspection precision for the specifications for fixing at both ends is one before pulling with the specified amount.

4.2 Output Circuits and Signal Waveforms

4.2.1 Main Signal Type: Type B, Type C

■ Output circuit

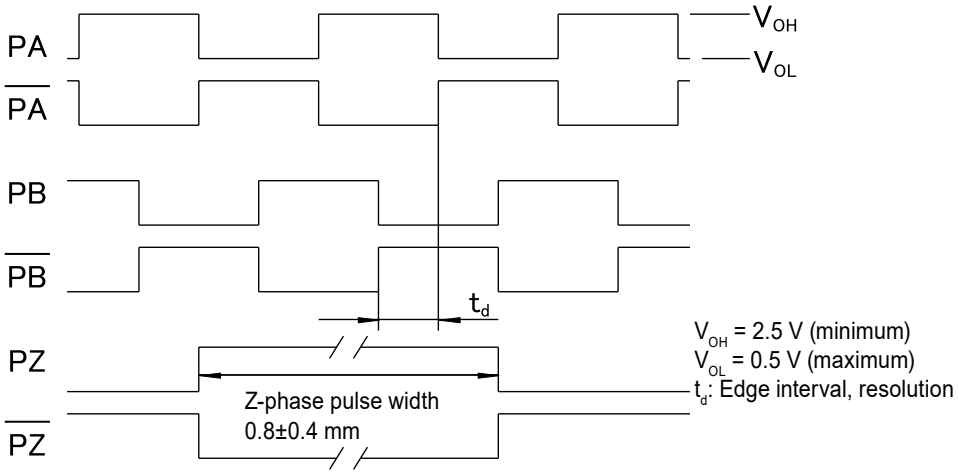
The output circuit of the square wave output signals (PA-phase, PB-phase), origin signal, and alarm signal is as shown in the figure below.



Differential line driver
equivalent to AM26C31

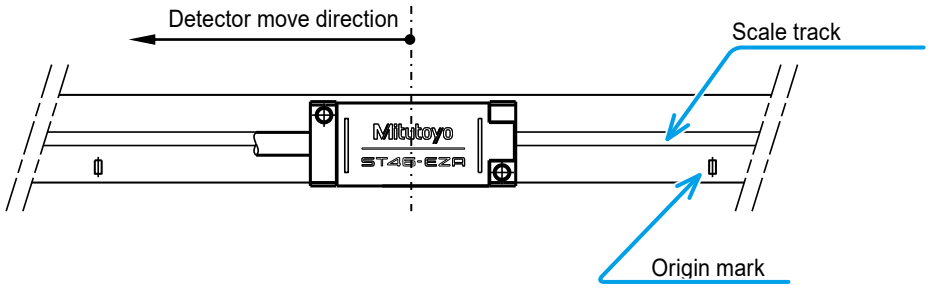
■ Signal waveform

The waveforms of the square wave output signals (PA-phase, PB-phase) and origin signal are as shown in the figure below.



Tips

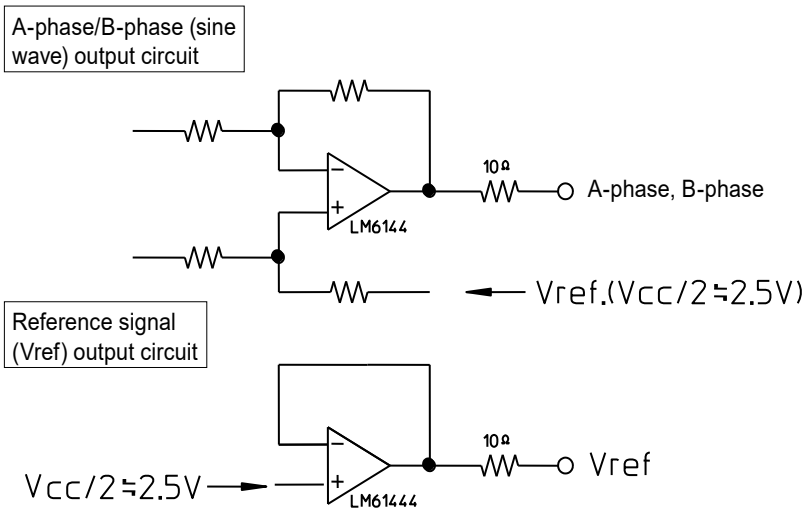
The above figure shows waveforms when the Detector moves as follows with the direction switch on the connector shell set to "positive". The phase relationship (counting direction) between output PA and PB changes according to the direction switch state.



4.2.2 Main Signal Type: Type C

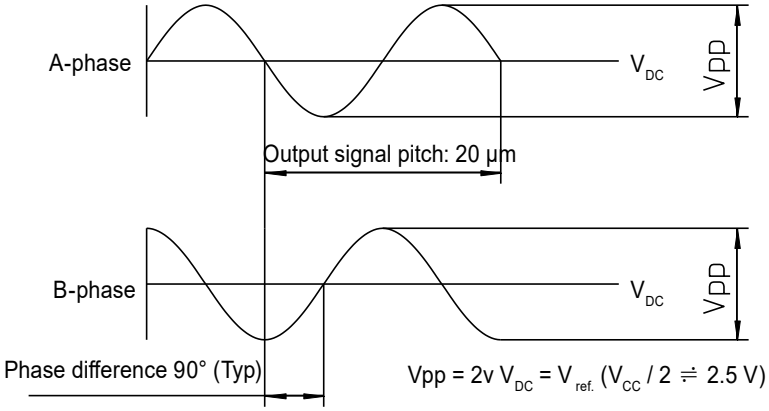
■ Output circuit

The output circuits of the sine wave output signals (A-phase, B-phase) and reference signal are as shown in the figure below.



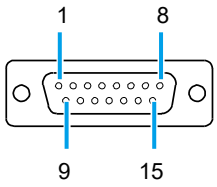
■ Signal waveform

The waveforms of the sine wave output signals (A-phase, B-phase) are as shown in the figure below.



4.3 Pin Assignment

4.3.1 Main Signal Type: Type B

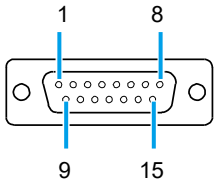


Pin No.	Signal	Pin No.	Signal
1, 2	0 V (GND)	9	$\overline{\text{ALM}}$ (alarm)
3, 4	+5 V (Vcc)	10	PA (main signal pulse_positive phase)
5	Reset input AL (anode)	11	$\overline{\text{PA}}$ (main signal pulse_reverse phase)
6	Reset input AL (cathode)	12	PB (main signal pulse_ positive phase)
7	N.C.	13	$\overline{\text{PB}}$ (main signal pulse_reverse phase)
8	PZ (origin signal pulse_positive phase)	14	$\overline{\text{PZ}}$ (origin signal pulse_reverse phase)
		15	F.G

Tips

The applicable connector (accessory) is HDAB-15S.

4.3.2 Main Signal Type: Type C



Pin No.	Signal	Pin No.	Signal
1, 2	0 V (GND)	9	$\overline{\text{ALM}}$ (alarm)
3, 4	+5 V (Vcc)	10	PA (main signal pulse_positive phase)
5	A-phase (sine wave)	11	$\overline{\text{PA}}$ (main signal pulse_reverse phase)
6	B-phase (sine wave)	12	PB (main signal pulse_ positive phase)
7	Vref (≒ Vcc/2)	13	$\overline{\text{PB}}$ (main signal pulse_reverse phase)
8	PZ (origin signal pulse_positive phase)	14	$\overline{\text{PZ}}$ (origin signal pulse_reverse phase)
		15	F.G

Tips

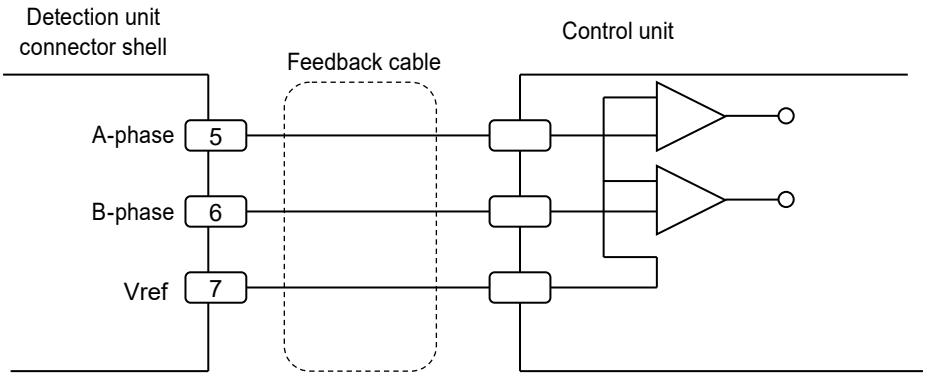
The applicable connector (accessory) is HDAB-15S.

4.4 Production of Feedback Cable

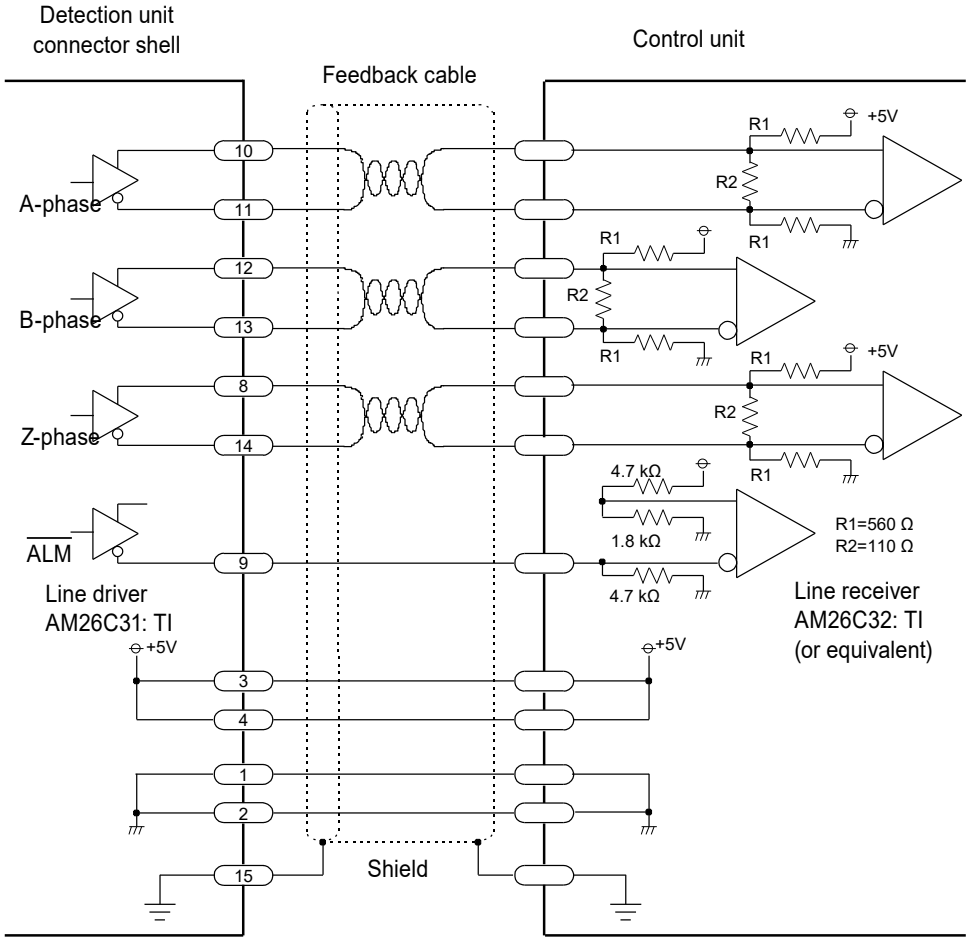
The following conditions must be met for the feedback cable:

- Use a mesh shielded cable.
- Clamp the shield (FG) to the metal case of the supplied connector. If it is difficult to clamp, connect it to pin No. 15.
- Set the cable impedance and length so that the power voltage is 4.75 V or more on the connector shell.
  V_{sp} - (R_c ÷ 2) x L x 2 x 0.25 ≧ 4.75 V
  V_{sp}: Power voltage supplied from the control unit (Volts)
  R_c: Cable power, ground wire impedance (Ω/m)
  L: Cable length (m)
  0.25: Maximum current consumption of the scale unit (A)

To use the sine wave output signals, connect the output signal cable as shown in the figure below.



To use the square wave output signals, connect the output signal cable as shown in the figure below.



- When the control unit has the Disconnection Detection function for A-phase/B-phase (PA, $\overline{PA}$, PB, $\overline{PB}$), you do not need to connect the $\overline{ALM}$ output. In this case, use a scale unit with the alarm output type of H (high impedance) specification.
- If the control unit has no Disconnection Detection function or putting the A-phase/B-phase output in high impedance causes a problem for the system, connect the $\overline{ALM}$ output. In this case, use a scale unit with the alarm output type of S (alarm signal) specification.

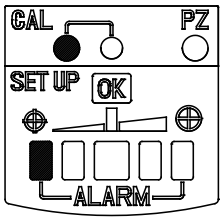
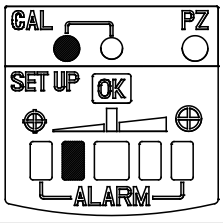
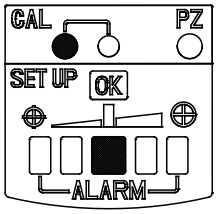
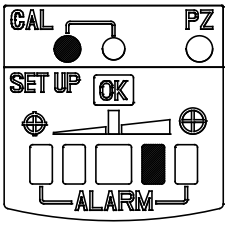
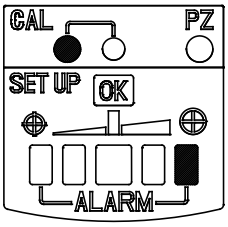
4.5 Alarm Function

4.5.1 Detection Details

When an alarm is detected, the CAL light on the connector shell turns on and off at intervals of 2 seconds. While the CAL light is lit, the setup indicator display light represents the error details as follows.

Tips

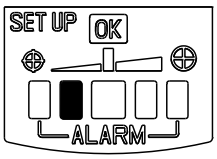
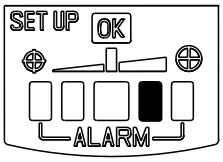
When multiple errors occur, all the corresponding lights on the setup indicator turn on.

Display	Error name	Cause
	Over range error*1	The waveform of the input sine wave signal is too large or too small.
	Over speed error	The travel speed exceeds the maximum response speed.
	Hardware error	Internal processing error (part failure, communication error)
	Calibration error	Signal adjustment error
	LED current error	- LED deterioration - Sensor overcurrent - Insufficient adjustment of the Detector mounting position

*1 While the CAL light is not lit, the alarm details about over range are not shown.

Tips

- If the scale is within the error range when the waveform of the input sine wave signal is too large or too small, an over range error occurs.
- If the scale is within the caution range when the waveform of the input sine wave signal is too large or too small, no alarm occurs, but the accuracy of division is reduced.

	Light indication when the scale is within the caution range	Color
Caution range		Yellow
		

4.5.2 Resetting the Alarm

■ Turning on the power again

1 **Eliminate the cause of the alarm.**

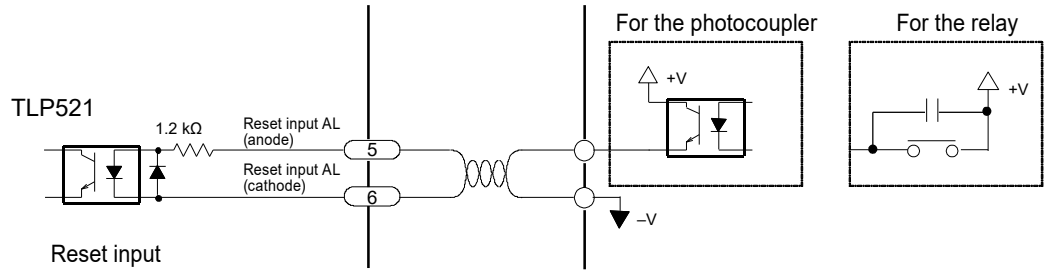
2 **Turn off the control unit and turn it on again after 10 seconds or more.**

■ Alarm reset signal

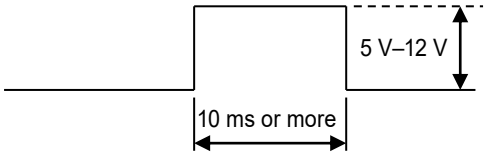
1 **Eliminate the cause of the alarm.**

2 **Input the alarm reset signal (pulse width of 10 ms or more).**

- The alarm can be reset by the alarm reset signal only when the main signal output type is B (two-phase square wave + external reset input).
- Connect the alarm reset input circuit so that the current is 3 mA–10 mA.
- Since the product is equipped with a resistor (1.2 kΩ) inside, applying 5 V–12 V between the reset input AL (anode) and reset input AL (cathode) resets the alarm.



Input signal pin No. 5



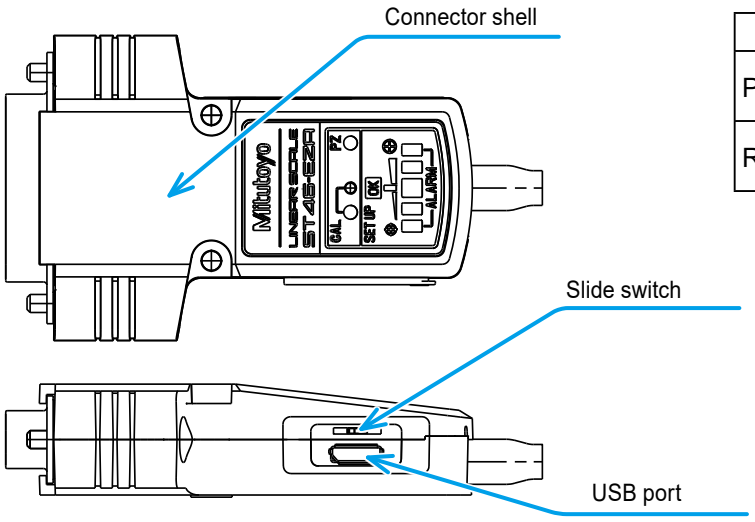
- To apply 12 V or more, add a resistor externally.

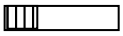
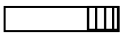
4.6 Changing the Direction

1 **Turn off the control unit.**

2 **Remove the rubber cap.**

3 **Change the position of the slide switch on the connector shell.**



	Switch state	Direction
Positive		Sine wave and phase
Reverse		Sine wave and anti-phase

4.7 Maintenance Parts

There are the following maintenance parts available for the ST46-EZA Tape Scale.

■ Specifications for fixing at both ends

Name	Part number	Note
Detector mounting auxiliary tool	06AEJ649	
Scale pull block A	06AEF277	
Scale pull block B	06AEF278	
Scale fixing block	06AEJ676	
Scale retaining block	06AEF280	
Scale intermediate fixing base	06AEF281	
Scale intermediate fixing block	06AEF282	
Cover	06AEF292	
Countersunk screw M2 x 4	09ZAA012	For fixing the cover
Output connector	09AAA355	

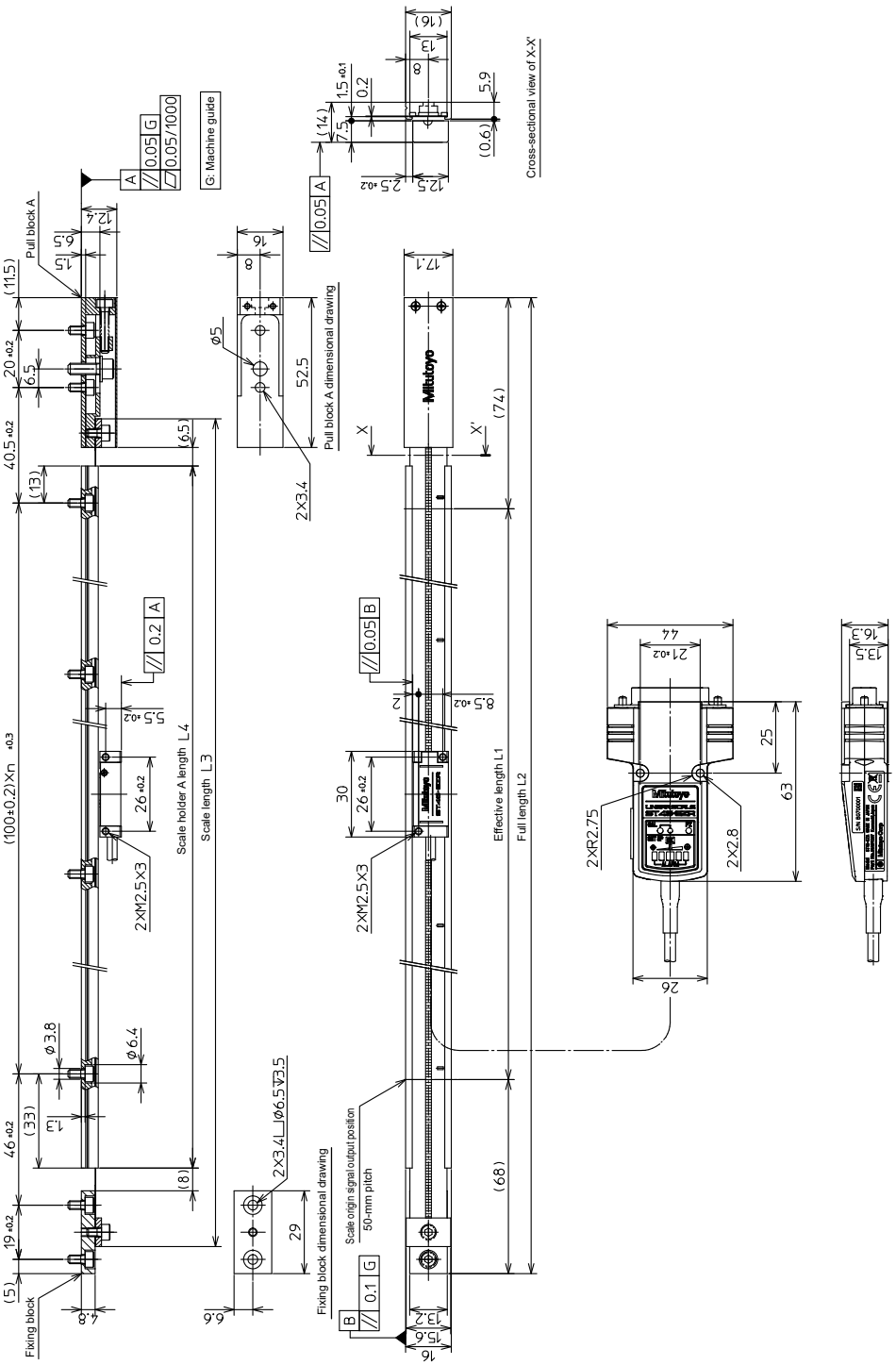
■ Specifications for fixing with double-sided tape

Name	Part number	Note
Detector mounting auxiliary tool	06AEJ650	
End cap	06AEF304	
Roller	06AEJ505	
Silicone adhesive KE441T (100 g)	06AEK700	For fixing the end cap
Scale mounting auxiliary tool (for specifications for fixing with double-sided tape)	06AEJ690	Used when mounting the scale
Output connector	09AAA355	

4.8 External View and Dimensional Drawings

4.8.1 Specifications for Fixing at Both Ends (Effective Length of 500 mm–1000 mm)

■ Dimensional drawings



■ Dimensional drawings table

Code No. (*1)	Model number (*2)	Effective length L1 (mm)	Scale full length L2 (mm)	Scale length L3 (mm)	Scale holder A length L4 (mm)	n (quantity)
579-678-□4	ST46EZA◇-500D	500	642	590	546	5
579-679-□4	ST46EZA◇-600D	600	742	690	646	6
579-680-□4	ST46EZA◇-700D	700	842	790	746	7
579-681-□4	ST46EZA◇-800D	800	942	890	846	8
579-682-□4	ST46EZA◇-900D	900	1042	990	946	9
579-683-□4	ST46EZA◇-1000D	1000	1142	1090	1046	10

*1: The □ mark in Code No. represents as follows:

1: Two-phase square wave + external reset input

2: Two-phase sine wave + two-phase square wave

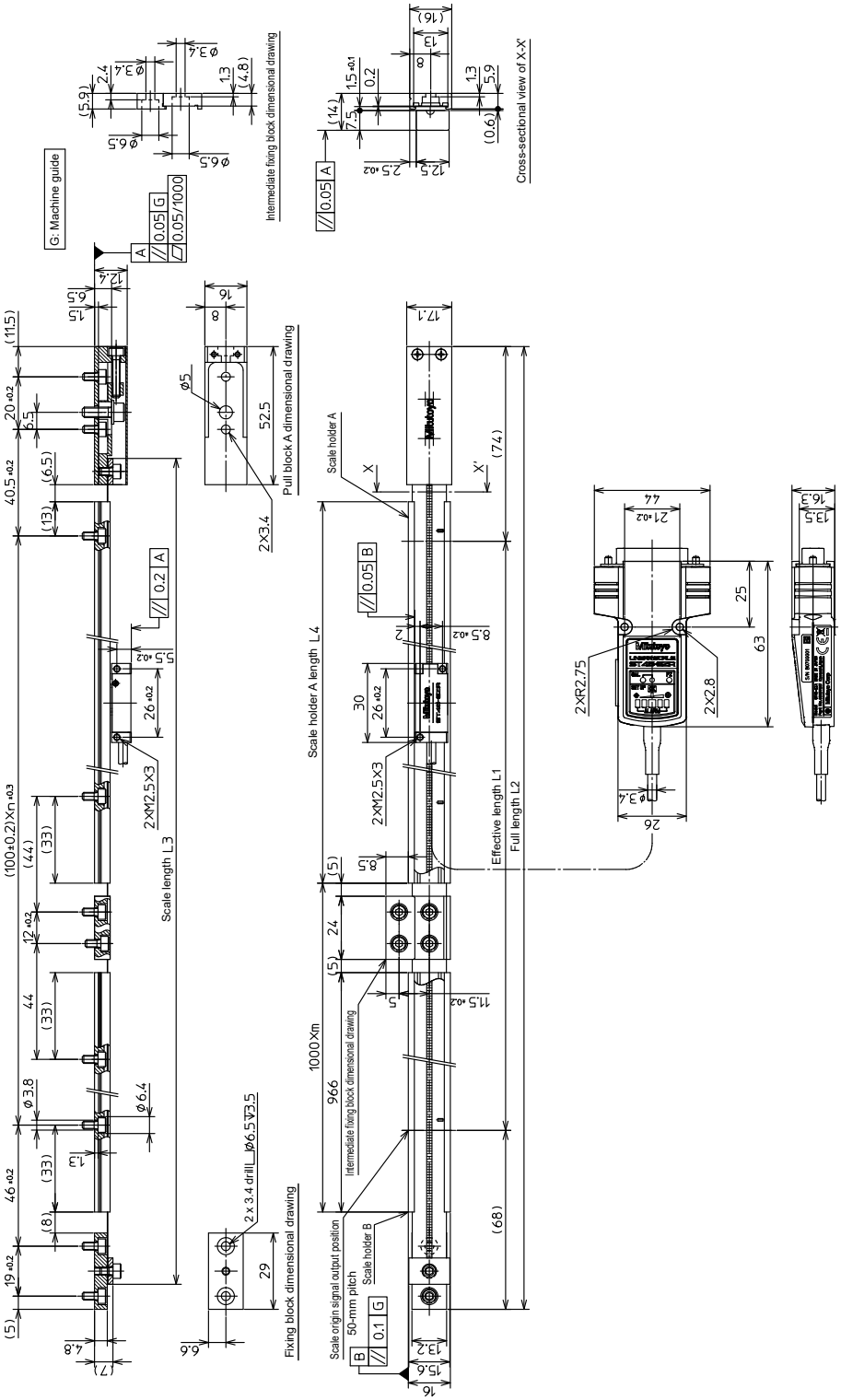
*2: The ◇ mark in Model number represents as follows:

B: Two-phase square wave + external reset input

C: Two-phase sine wave + two-phase square wave

4.8.2 Specifications for Fixing at Both Ends (Effective Length of 1100 mm–3000 mm)

■ Dimensional drawings



■ Dimensional drawings table

Code No. (*1)	Model number (*2)	Effective length L1 (mm)	Scale full length L2 (mm)	Scale length L3 (mm)	Scale holder A length L4 (mm)	Scale holder B quantity m (number of holders)	n (quantity)
579-684-□4	ST46EZA◇-1100D	1100	1242	1190	146	1	11
579-685-□4	ST46EZA◇-1200D	1200	1342	1290	246	1	12
579-686-□4	ST46EZA◇-1300D	1300	1442	1390	346	1	13
579-687-□4	ST46EZA◇-1400D	1400	1542	1490	446	1	14
579-688-□4	ST46EZA◇-1500D	1500	1642	1590	546	1	15
579-689-□4	ST46EZA◇-1600D	1600	1742	1690	646	1	16
579-690-□4	ST46EZA◇-1700D	1700	1842	1790	746	1	17
579-691-□4	ST46EZA◇-1800D	1800	1942	1890	846	1	18
579-692-□4	ST46EZA◇-2000D	2000	2142	2090	1046	1	20
579-693-□4	ST46EZA◇-2200D	2200	2342	2290	246	2	22
579-694-□4	ST46EZA◇-2400D	2400	2542	2490	446	2	24
579-695-□4	ST46EZA◇-2500D	2500	2642	2590	546	2	25
579-696-□4	ST46EZA◇-2600D	2600	2742	2690	646	2	26
579-697-□4	ST46EZA◇-2800D	2800	2942	2890	846	2	28
579-698-□4	ST46EZA◇-3000D	3000	3142	3090	1046	2	30

*1: The □ mark in Code No. represents as follows:

1: Two-phase square wave + external reset input

2: Two-phase sine wave + two-phase square wave

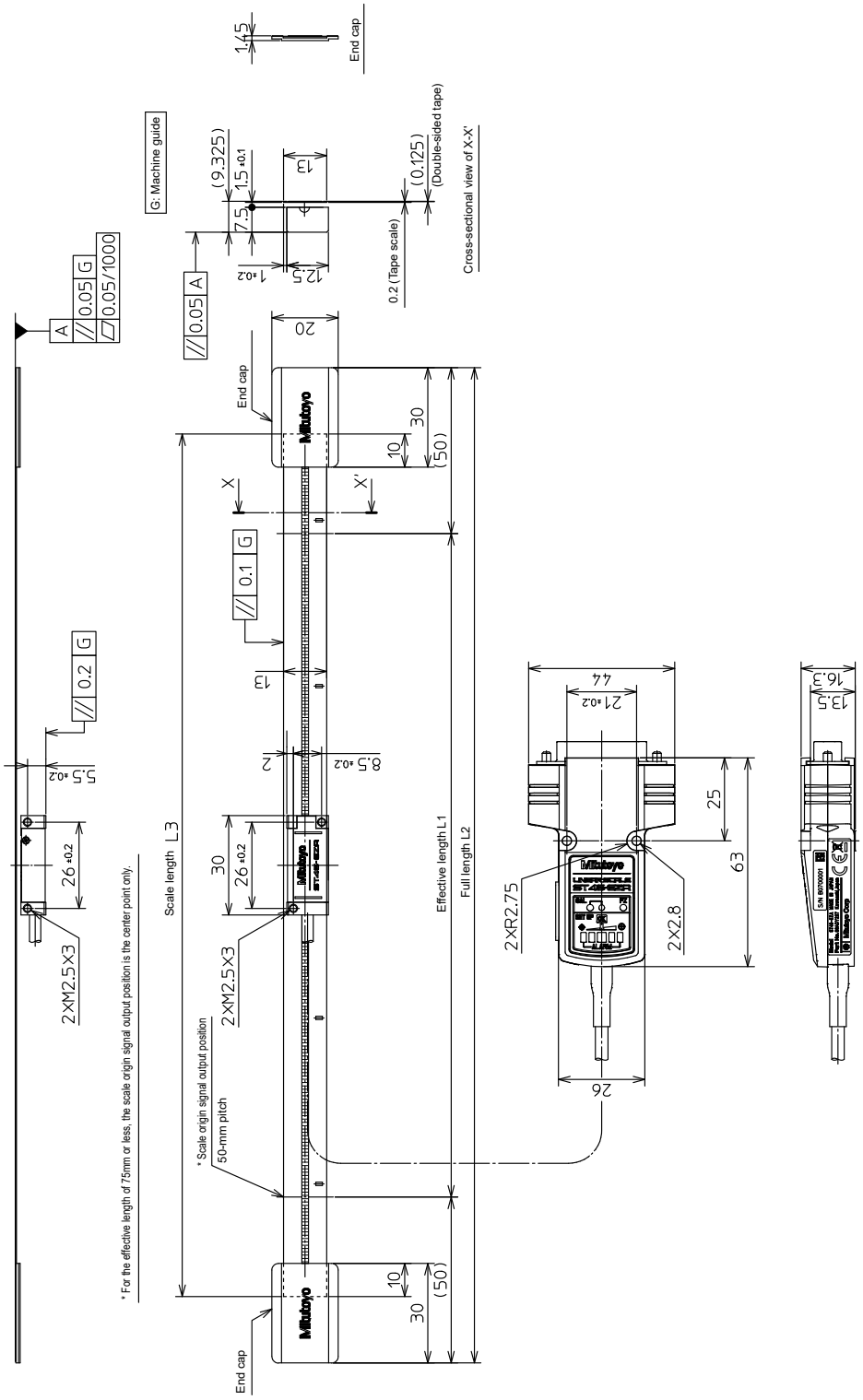
*2: The ◇ mark in Model number represents as follows:

B: Two-phase square wave + external reset input

C: Two-phase sine wave + two-phase square wave

4.8.3 Specifications for Fixing with Double-Sided Tape (Effective Length of 10 mm–3000 mm)

■ Dimensional drawings



■ Dimensional drawings table

Code No. (*1)	Model number (*2)	Effective length L1 (mm)	Scale full length L2 (mm)	Scale length L3 (mm)
579-665-□5	ST46EZA◇-10E	10	110	70
579-666-□5	ST46EZA◇-25E	25	125	85
579-667-□5	ST46EZA◇-50E	50	150	110
579-668-□5	ST46EZA◇-75E	75	175	135
579-670-□5	ST46EZA◇-100E	100	200	160
579-671-□5	ST46EZA◇-150E	150	250	210
579-672-□5	ST46EZA◇-200E	200	300	260
579-673-□5	ST46EZA◇-250E	250	350	310
579-674-□5	ST46EZA◇-300E	300	400	360
579-675-□5	ST46EZA◇-350E	350	450	410
579-676-□5	ST46EZA◇-400E	400	500	460
579-677-□5	ST46EZA◇-450E	450	550	510
579-678-□5	ST46EZA◇-500E	500	600	560
579-679-□5	ST46EZA◇-600E	600	700	660
579-680-□5	ST46EZA◇-700E	700	800	760
579-681-□5	ST46EZA◇-800E	800	900	860
579-682-□5	ST46EZA◇-900E	900	1000	960
579-683-□5	ST46EZA◇-1000E	1000	1100	1060
579-684-□5	ST46EZA◇-1100E	1100	1200	1160
579-685-□5	ST46EZA◇-1200E	1200	1300	1260
579-686-□5	ST46EZA◇-1300E	1300	1400	1360
579-687-□5	ST46EZA◇-1400E	1400	1500	1460
579-688-□5	ST46EZA◇-1500E	1500	1600	1560
579-689-□5	ST46EZA◇-1600E	1600	1700	1660
579-690-□5	ST46EZA◇-1700E	1700	1800	1760
579-691-□5	ST46EZA◇-1800E	1800	1900	1860
579-692-□5	ST46EZA◇-2000E	2000	2100	2060
579-693-□5	ST46EZA◇-2200E	2200	2300	2260
579-694-□5	ST46EZA◇-2400E	2400	2500	2460
579-695-□5	ST46EZA◇-2500E	2500	2600	2560
579-696-□5	ST46EZA◇-2600E	2600	2700	2660
579-697-□5	ST46EZA◇-2800E	2800	2900	2860
579-698-□5	ST46EZA◇-3000E	3000	3100	3060

*1: The □ mark in Code No. represents as follows:

1: Two-phase square wave + external reset input

2: Two-phase sine wave + two-phase square wave

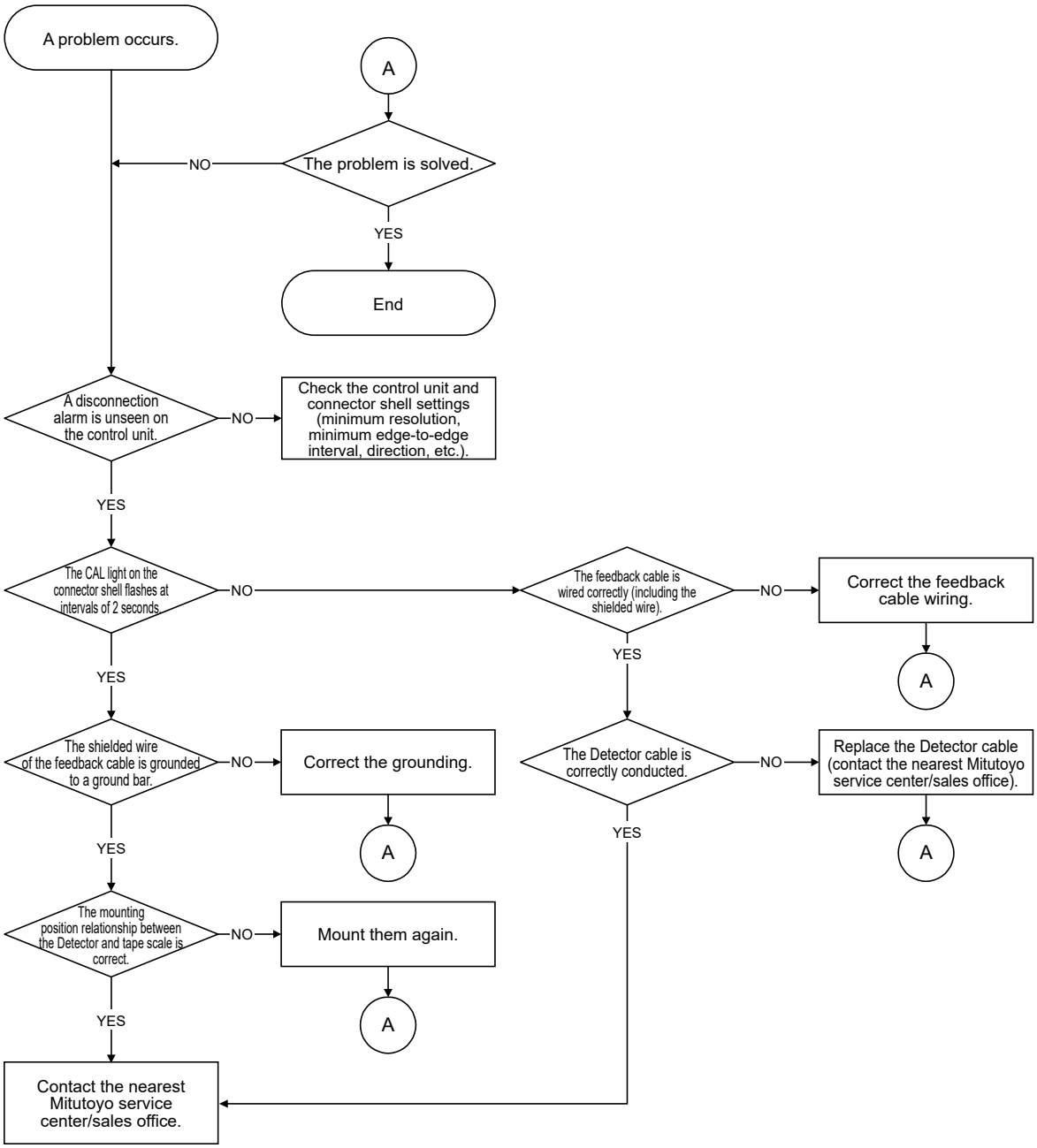
*2: The ◇ mark in Model number represents as follows:

B: Two-phase square wave + external reset input

C: Two-phase sine wave + two-phase square wave

5 Troubleshooting

This chapter describes how to check the causes for the trouble at the initial power-on, or for the alarm sounded during operation.



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