



Assembly Type ABSOLUTE Linear Scale

ABS AT1300 SERIES



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.

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■ Product names and model numbers covered in this document

Product name	Model number
Assembly Type ABSOLUTE Linear Scale	ABS AT134* ABS AT135* ABS AT137*A ABS AT138*A ABS AT130*A

■ 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.
- Read this document thoroughly before operating the product. In particular, be sure to fully understand "Safety Precautions" on page 5 and "Precautions for Use" on page 5.
- The contents of this document are based on information current as of May 2025.
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*  indicates the link to a video.



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*  indicates the link to a video.

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About This Document

■ Positioning of this document in document map

This describes the positioning of this document and its relationship with other installments.

ABS AT1300 Series
User's Manual
(This Document)

This chapter describes the specifications of ABS AT1300 and how to install it.

ABS AT1300 Series
Signal Check Program
User's Manual

This chapter describes how to use the program for initial diagnosis of ABS AT 1300 series.

■ Intended readers and purpose of this document

● Intended readers

This product can be attached to various equipment such as NC machine tools and semiconductor manufacturing equipment.

This document is intended for those who perform the installation work.

They are also assumed to be able to understand individual instructions by reading screen displays.

● Purpose

This document is intended to help you understand the specifications of this product and how to install it properly.

Conventions Used in This Document

■ Safety reminder conventions warning against potential hazards

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

■ Conventions 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 indicating referential information or reference location

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: For details about XX, see  "1.2 Name and Functions of Each Part" on page 12.

■ Conventions indicating video content

	<p>A QR code that can be read with a smartphone or other device to view a video.</p>
	<p>A button that can perform in PDF format User's Manuals. Click the button to view a video.</p>

*Video content does not include audio. Video size is 1280 x 720.

■ Other conventions

<p>(): Round brackets</p>	<p>Represent a paraphrase of an immediately preceding phrase or a supplementary explanation.</p>
<p>" ": Double quotation marks</p>	<p>Represent a highlighted phrase. They also indicate an index where information to be referenced is described.</p>
<p>[]: Square brackets</p>	<p>Represent a menu name on the screen, screen name, dialog name, button, display item, tab name, or key on the keyboard. They also indicate an item to be purposely entered or selected by the customer.</p>
<p>1, 2, 3 1, 2, 3, ...</p>	<p>Indicates the order and the contents of tasks. (1: indicates main tasks, 1: indicates detailed tasks)</p>
<p>»</p>	<p>Indicates the action resulted from some operation(s).</p>

■ Example of conventions use

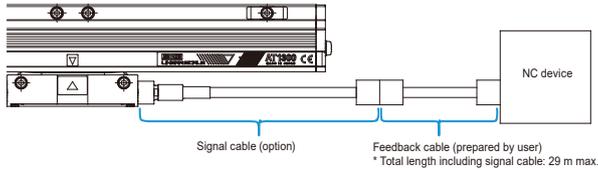
3 Installation onto the Machine Main Unit

3.4 Connecting and Fixing the Signal Cable

3.4.1 Cable Connection and Operation Check

An example of the system configuration is shown below.

For the details of the cables, refer to **4 Specifications** (page 33)



■ Connect the cables and check operations

1 According to "3.4.2 Connecting the Signal Cable", connect the Detector and the signal cable.

2 Connect the signal cable to the NC device.

3 Make sure the screws on the connector plug are fully tightened.

Tips

When connecting our signal cable to the your ordered cable, the total length of the cables should be 29 m maximum.

4 After connection of cables etc. is completed, turn on the power and check the operations, functions, and performance of the scale.

NOTICE

- After turning on the power, if the scale unit does not operate normally, check the connections first. If the scale does not operate normally even after the status of connections is checked and the power is supplied again, investigate the cause, following the instructions in "5 Troubleshooting".
- When checking the scale operations, be very careful that no cables are being pinched by the machinery.
- When connecting the connectors, if chips or other foreign objects are sandwiched in, that may cause malfunctions.

Indicates supplementary information.

Indicates an operating procedure to be performed or its outline.

Safety Precautions

Observe the following to fully demonstrate the performance of this product.

CAUTION

There is a risk of injury due to improper installation and misoperation.



- Be sure to read this document thoroughly before use.
- Before installing this product on the machine, make sure that the power of the control unit is off. There is a risk of injury or damage to the machine due to unexpected operation.



Be sure to tighten the screws of the connectors of each connecting cable to ensure that they are dust-proof, waterproof, and anti-noise. In addition, Never touch the connector, otherwise contact failure may occur.

Precautions for Use

■ Use and handling of the product

- Connect this product to a compatible NC machine tool or semiconductor manufacturing equipment.

This product cannot be used for NC machine tools and semiconductor manufacturing equipment that are not compatible with this product.

For information about NC machine tools and semiconductor manufacturing equipment compatible with this product, contact your dealer or our company "SERVICE NETWORK" on page App-1.

- This product is for industrial usage.

Do not use this product for purposes other than for industrial usage.

- The product is a precision instrument.

- Do not give a sudden shock such as falling or apply excessive force.
- Do not disassemble or modify. It is also out of warranty.

If the product is used under conditions other than those specified in the specifications ( "4 Specifications" (page 43)), the function and performance cannot be guaranteed.

Required Environment for Installation

■ Vibration

To install this product onto a 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 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 unit.

■ Ambient temperature and humidity

This product should be operated in an environment where the temperature is 0 °C–50 °C and where the relative humidity is between 20 %–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 the Export Trade Control Order or under Category 16 of the Appended Table of Foreign Exchange Control Order, based on the 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-provision of the technology (including program), you are obligated to 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 and/or List-Control Technology (including Programs) under Category 1 - 15 of Appended Table 1 of the Export Trade Control Order or under Category 1 - 15 of the 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-provision of the technology (including program), you are obligated to observe the regulations of your country. Please contact Mitutoyo in advance.

Notes on Export to European Countries

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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	○	○	○	○	○	○

部件名称	有害物质			
	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 丁基苯酯 (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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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 ( "SERVICE NETWORK" on page App-1).

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 instrument 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 instrument is properly installed and operated in conformance with the instructions in this manual within the original country of the installation.

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

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1 Overview

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

1.1 Features	9
1.2 Name and Functions of Each Part	10
1.3 The Flow of Main Tasks	11

1.1 Features

See an example of a sliding device with ABS AT1300H attached.



See an example of a sliding device with ABS AT1300S attached.



The linear scale will output a moving amount and displacement as digital amounts based on a linear scale graduated in certain fixed pitches.

This can precisely measure moving amounts of various instruments including electronic/semiconductor manufacturing units and machine tools.

This product adopts an imaging method based on the double-sided telecentric optical system to detect the moving amount of the scale. With this a focal depth and a wide imaging range, this method is less susceptible to scale undulation and dirt, and it has excellent environmental resistance.

Also, this product does not require an origin return step at the starting time of work or during a power failure, and does not require batteries for backup, which will contribute much labor saving.

Moreover, this product can be used in harsh environments where cutting oil or chips occur.

This product has the following two types and specifications with different effective measuring lengths.

Items	High precision specification	High rigidity specification
Features	Since the aluminum frame that fixes the scale main unit is not in contact with the mounting surface of the machine, it has excellent stability in the origin position with respect to temperature change	Since the aluminum frame that fixes the scale main unit is in contact with the mounting surface of the machine, it has excellent vibration resistance or impact resistance
Effective length	100 mm–1000 mm (15 types)	100 mm–2200 mm (19 types)

In addition, the following interface specifications compatible with the high-speed serial interface of the companies are available.

Mitsubishi Electric Corporation Specifications

FANAC Corporation Specifications

Panasonic Corporation Specifications

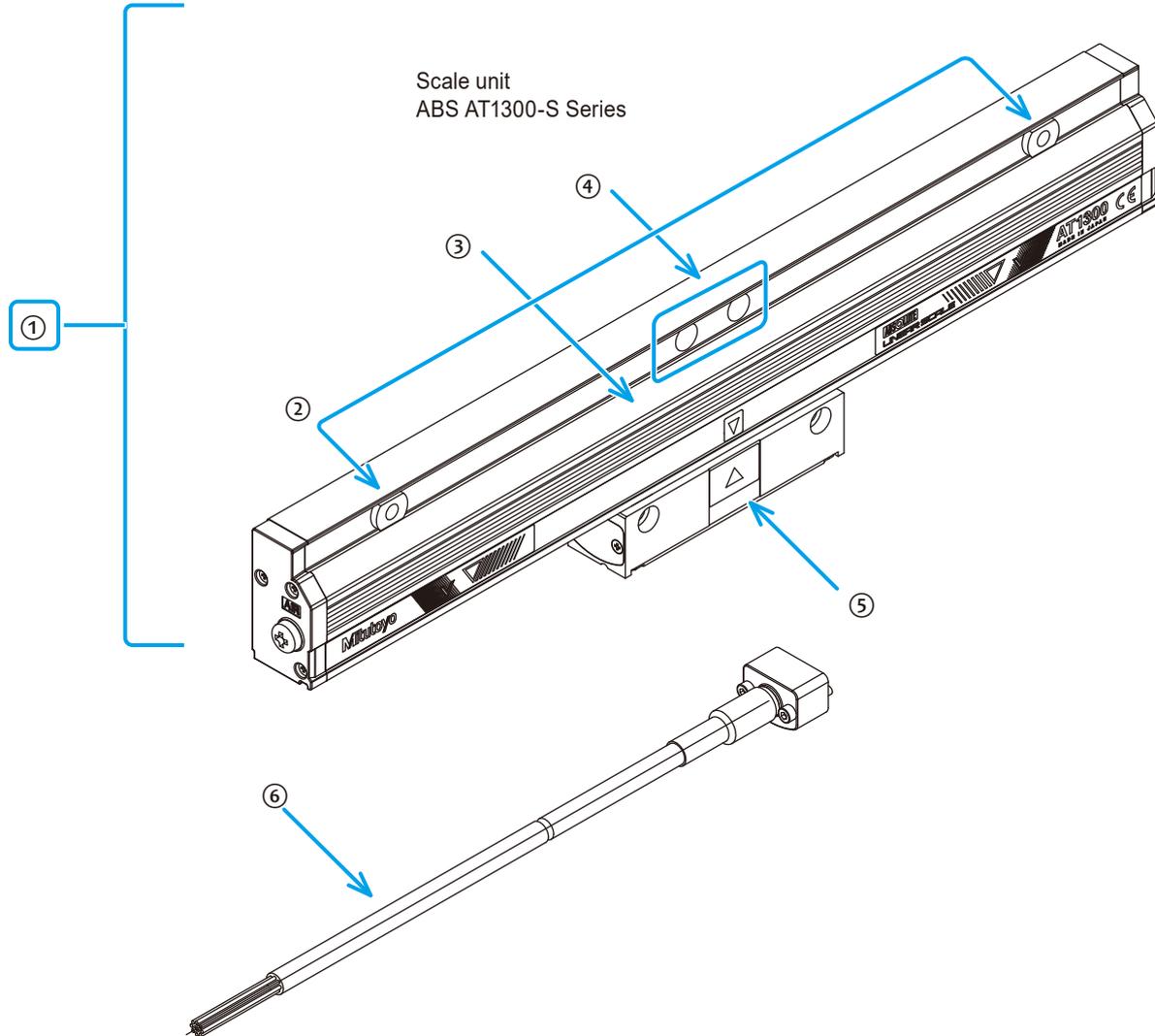
YASKAWA Electric Corporation Specifications

Mitutoyo ENSIS Specifications

1.2 Name and Functions of Each Part

We call this product the "scale unit" generically. The scale unit is composed of the scale main unit and the Detector.

Here, the high rigidity specification is used as an example.

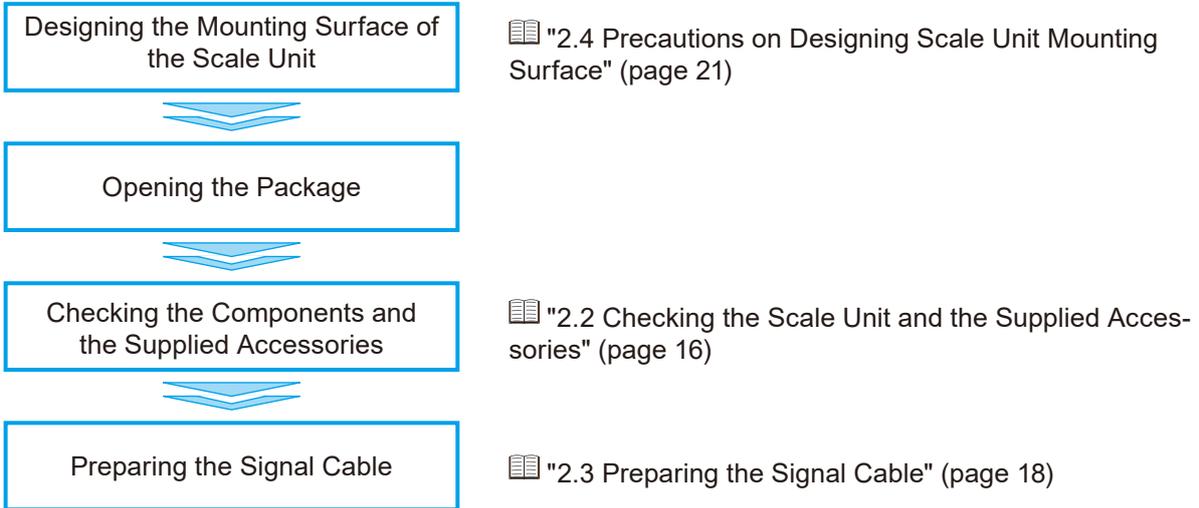


No.	Name	Description
①	Scale unit	The generic name of this product. It indicates the state that the Detector has been mounted on the scale main unit.
②	Elastic-fixing part	The point to be fixed later during installation onto the machine main unit.
③	Scale main unit	It represents the linear scale's main unit.
④	Full-fixing part	The datum position for length variation due to changes in temperature (reference point for the scale's mechanical expansions and contractions due to changes in temperature). The point to be fixed first during installation onto the machine main unit.
⑤	Detector	The part to detect a measurement point.
⑥	Signal cable (option)	The cable to connect this product and the connection destination controller. You can connect the signal cable to either left or right side of the Detector.

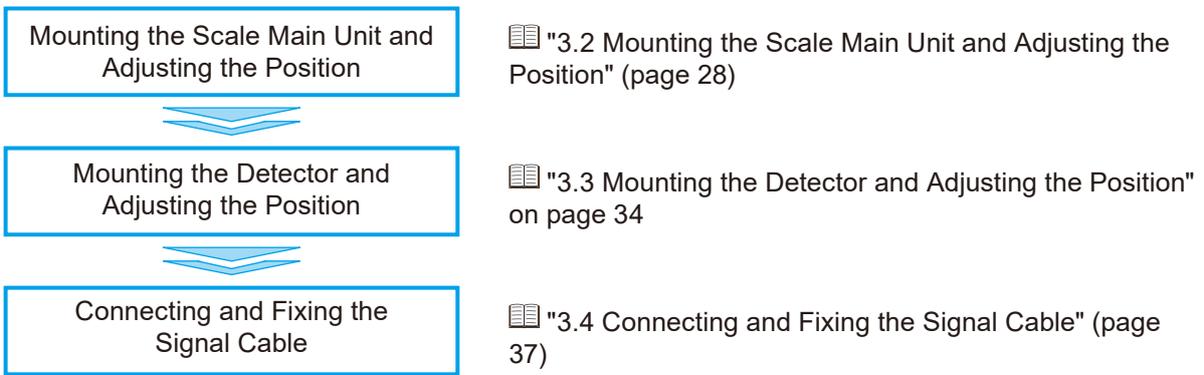
1.3 The Flow of Main Tasks

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

■ Preliminary preparation



■ Installation onto the machine main unit



MEMO

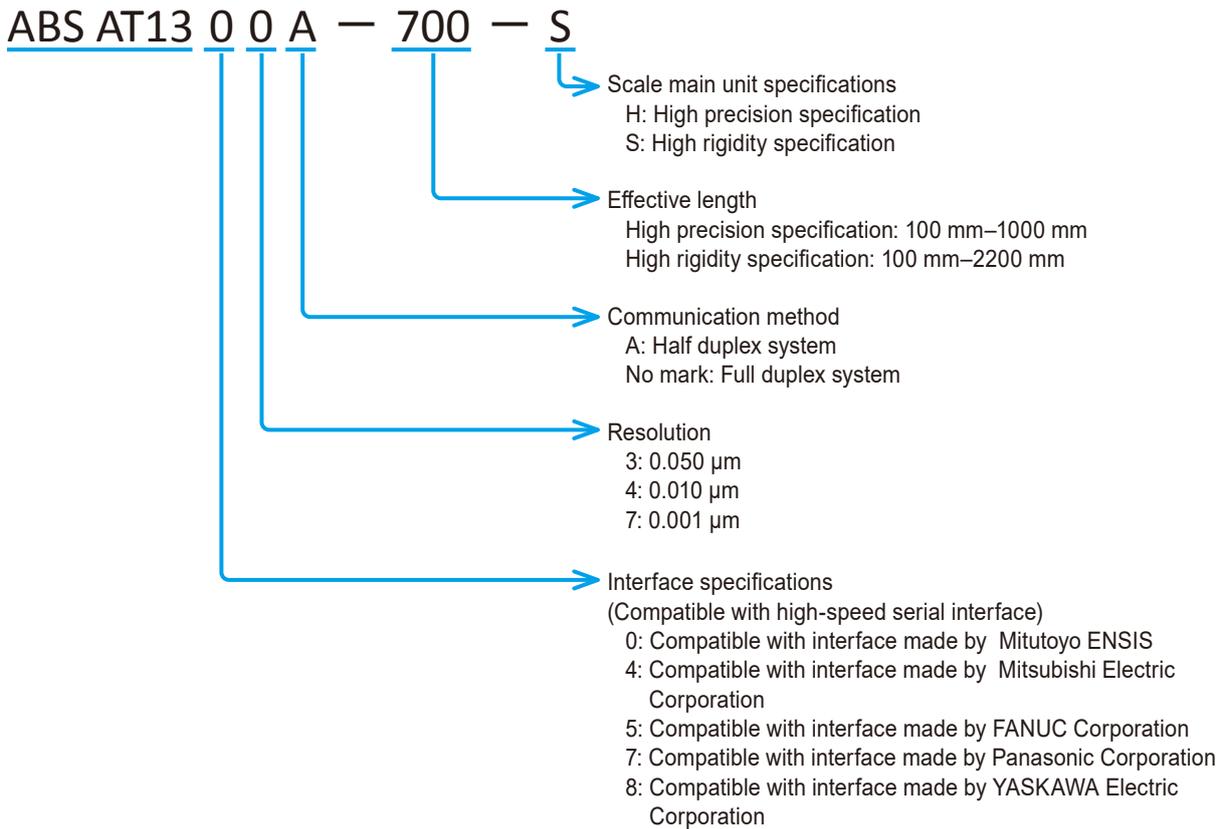
2 Setup for Installation

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

2.1	Checking the Equipment Model	13
2.2	Checking the Scale Unit and the Supplied Accessories	14
2.3	Preparing the Signal Cable	16
2.4	Precautions on Designing Scale Unit Mounting Surface	19

2.1 Checking the Equipment Model

This document describes the models configured as shown below. First, be sure to check which model will be used.



For the details of the effective length, refer to "4 Specifications" (page 43)

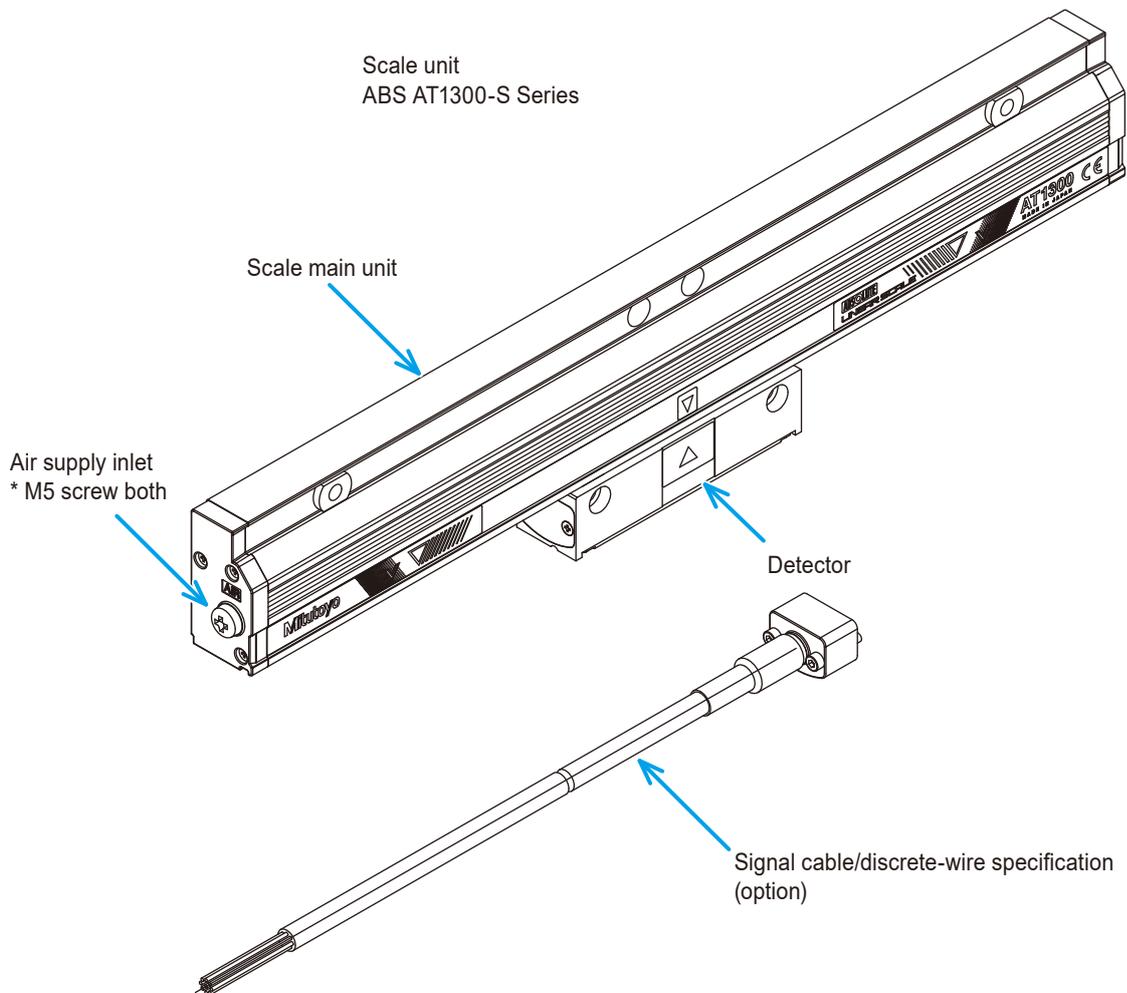
2.2 Checking the Scale Unit and the Supplied Accessories

A configuration of this product is shown below.

The accessories of this product are different depending on the specifications of the scale main unit. First, make sure that there are no missing components in the accessories.

Also, check for any damage that may have occurred during transportation.

If 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.



Items	Scale main unit specifications		Note
	H: High precision specification	S: High rigidity specification	
Scale unit	One axis	One axis	
Accessories	Screw set	Leaf spring, screw set	
User's Manual	One (this manual)	One (this manual)	
Warranty card	One copy	One copy	
Inspection certificate	One copy	One copy	

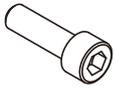
For the details of the signal cable, refer to "2.3 Preparing the Signal Cable" (page 18)

2 Setup for Installation

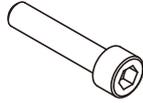
■ Accessories (mounting screws, etc.)

For the details of the quantity of the accessories, refer to  "6.1 Quantity of the Supplied Accessories for Installation" (page 75)

● ABS AT1300-H (high precision specification)



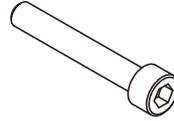
Hex socket head cap
screw
M4 x 10



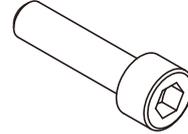
Hex socket head cap
screw
M4 x 16



Spring washer,
nominal 4



Hex socket head cap
screw
M4 x 25

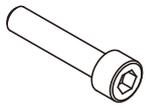


Hex socket head cap
screw
M6 x 25

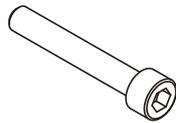


Spring washer,
nominal 6

● ABS AT1300-S (high rigidity specification)



Hex socket head cap
screw
M4 x 16



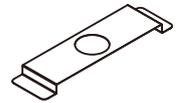
Hex socket head cap
screw
M4 x 25



Spring washer, nominal 4
Small round



Plain washer, nominal 4
Small round



Dedicated leaf spring

2.3 Preparing the Signal Cable

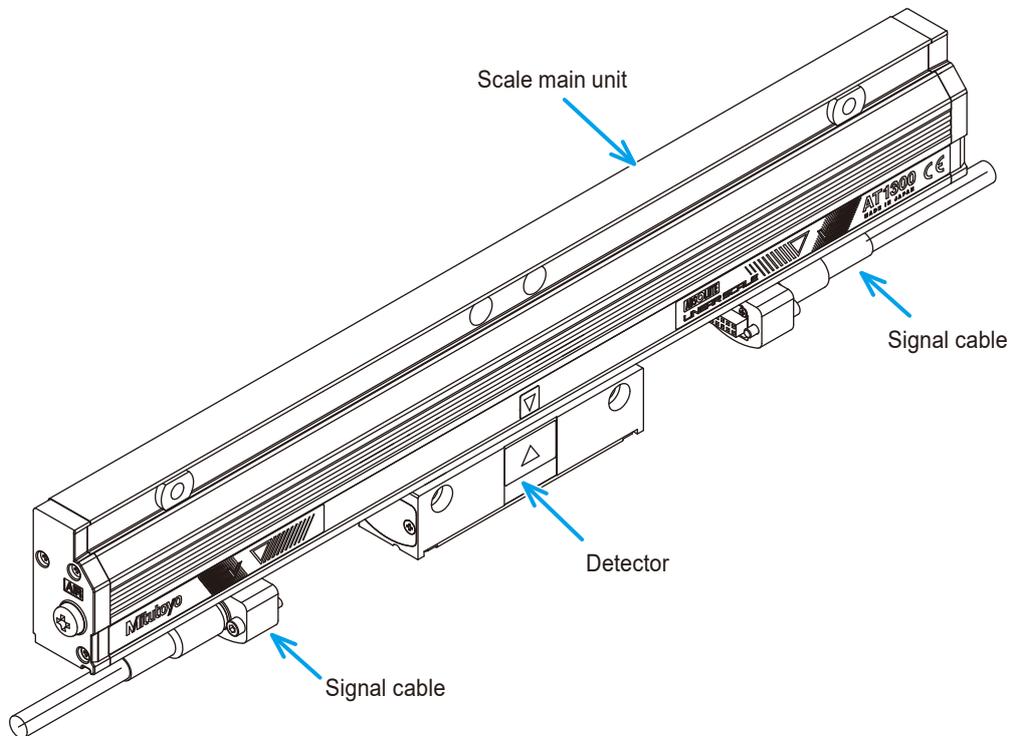
This section describes the configuration of the signal cable to be used with this product. The signal cables are separately sold. Select an appropriate one according to your specifications.

2.3.1 Configuration of the Signal Cable

Connect the signal cable to the electronic components with one of the connectors provided on either side of the Detector.

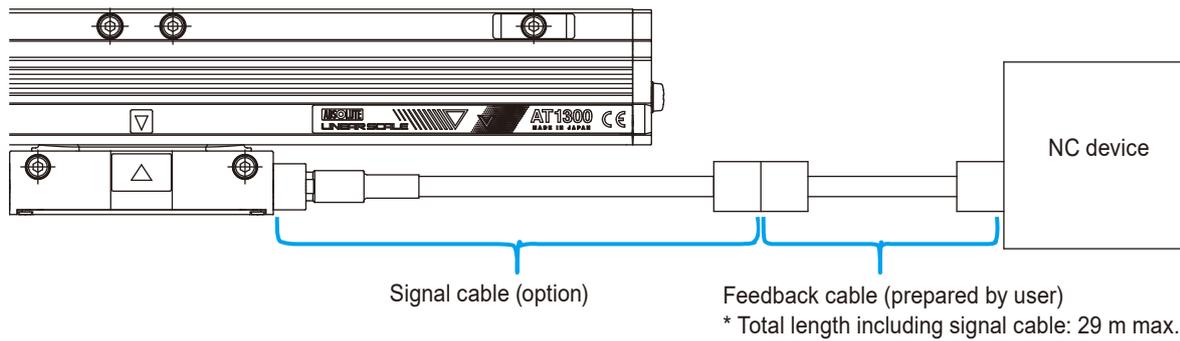
For the details of the connecting method, refer to  "3.4 Connecting and Fixing the Signal Cable" (page 37)

For the specifications of the signal cable, select an appropriate cable length and output connector type.



■ Available signal cable (option)

Items	Specifications
Cable length	1 m–9 m (every 1 m) 12 m
Cable material	PVC sheath $\phi 6.5$, no conduit
Output connector	(1) Discrete-wire specification (2) Specification with alarm display function (3) FANUC connector specification (4) Mitsubishi connector specification (5) Panasonic connector specification (6) YASKAWA connector specification



Tips

- The signal cable is an option. Select an appropriate one according to your requirements.
- For the specifications of the signal cable output signals, etc., refer to "4 Specifications" (page 43)
- When connecting our signal cable to the your ordered cable, the total length of the cables should be 29 m maximum.

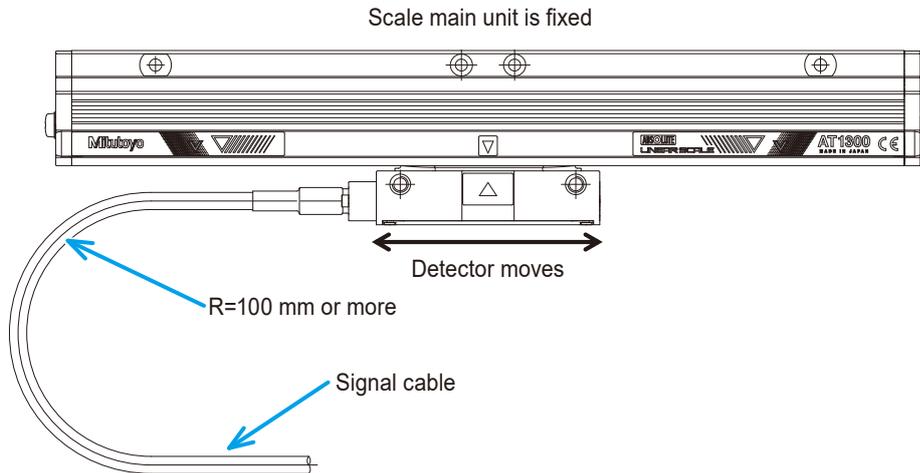
2.3.2 Bend Radius of the Signal Cable

The bend radius of the cable shall be kept within the following range.

The bend radius indicated below also applies to the case when the signal cable is extended.

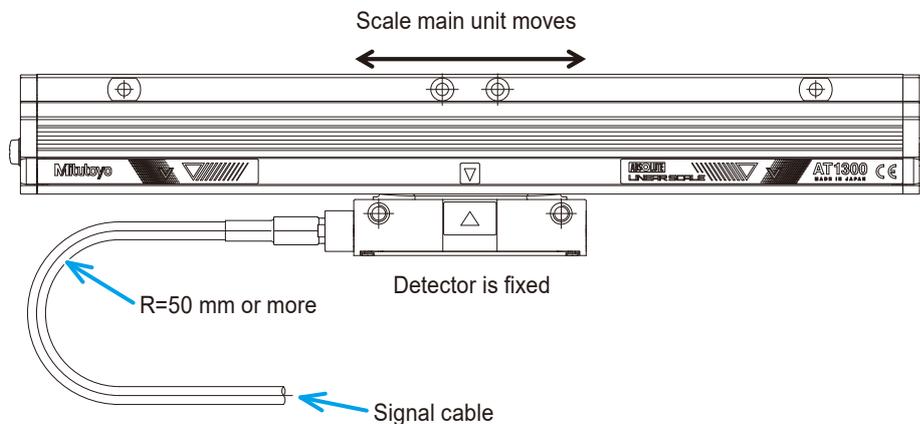
■ When the Detector moves (cable is repeatedly bent)

-> Bend radius of the cable: 100 mm or more



■ When the Detector is fixed (cable is fixed)

-> Bend radius of the cable: 50 mm or more



NOTICE

If a cable bend radius exceeds the allowable range, it could result in breakage of the wires or other problems. Also, note with caution that the scale is no longer guaranteed in such a case.

Tips

- The signal cable is an option. Also, the cable clamps or other fasteners are not supplied as accessories, therefore, they must be prepared by the user.
- For the details of how to fix the cable, refer to "3.4.3 Precautions on Fixing the Cables" (page 40)

2.4 Precautions on Designing Scale Unit Mounting Surface

The following describes some design points regarding the “mounting surface” for installing the scale unit onto the machine main unit.

In addition, refer to "4.7 External View and Dimensional Drawings of the Scale Main Unit".

2.4.1 Datum Point Position for the Length Variation and ABS Origin

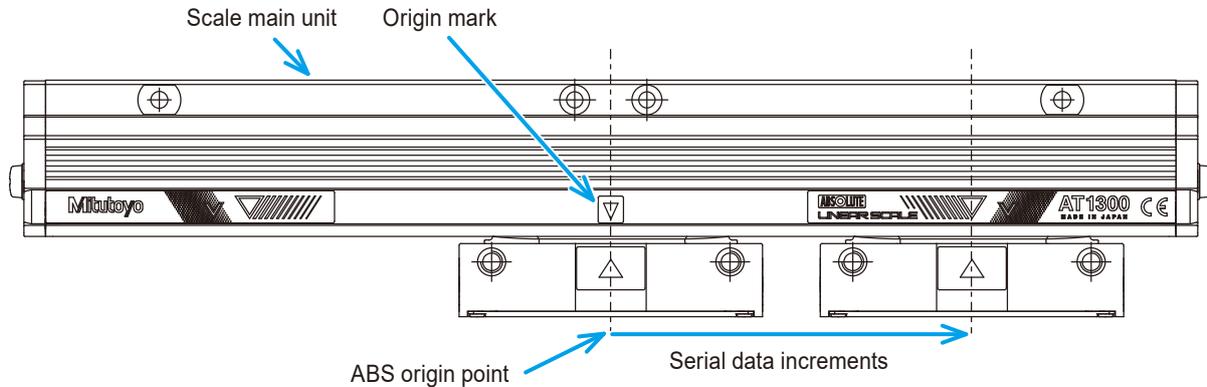
The fixing parts of the scale unit are divided into the full-fixing part (one in longitudinal direction) and the elastic-fixing parts. The position of this full-fixing part becomes "datum point position for length variation of the scale main unit", which is the reference point for the scale's mechanical expansions and contractions due to changes in temperature change. Note with caution that users are not able to change this datum point position.

The internal electrical "ABS origin" is set at the center of the effective length for all models.

Scale main unit specifications			External view
Specifications	Datum point position for length variation	ABS origin	
High precision	Effective length center	Effective length center	
High rigidity	Effective length center	Effective length center	

2.4.2 Counting Direction

The absolute value data becomes zero at the origin mark position of the scale main unit (ABS origin: the center of the effective measurement length). Also, when the Detector is moved rightward in the diagram below, the output serial data will increase the count (i.e., to the + side).

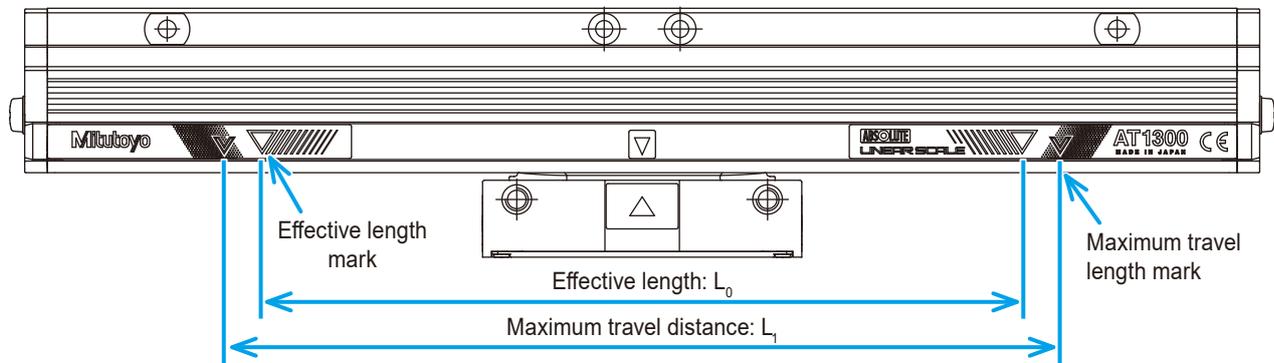


2.4.3 Checking the Maximum Travel Distance and Effective Length

Make sure that the scale's maximum travel distance (L_1) is greater than the maximum travel distance of the machine.

For the details of the effective length (L_0) and the maximum moving amount (L_1), refer to ["4.7 External View and Dimensional Drawings of the Scale Main Unit"](#) (page 69)

Also, note that the specified accuracy guaranteed range is limited to within the effective length.



Tips

- When checking the travel range of the scale installed on the machine, make sure the maximum travel range of the machine main unit does not exceed the L_1 shown above and that the required accuracy range is within the L_0 shown above.
- If the maximum travel distance or the effective length of the scale is insufficient, a larger-size scale may have to be used.

2.4.4 Scale Main Unit Mounting Directions and Cover Preparations

When installing this product, be sure to install the cover also so that cutting oil, chips, etc. do not splatter onto the scale main unit.

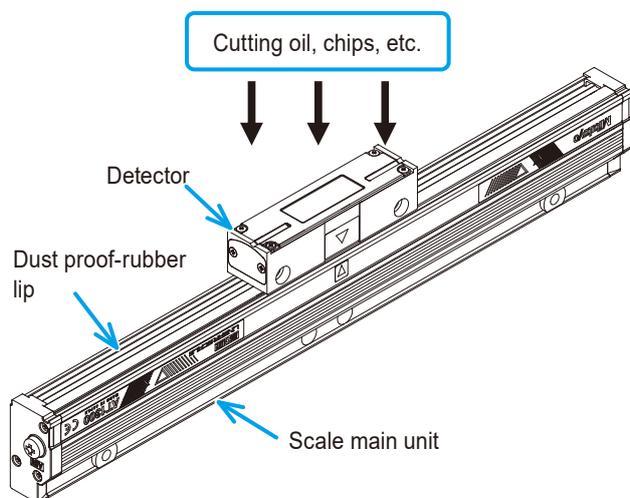
Only the dust proof-rubber lips are used to protect the scale opening side from the intrusion of foreign objects.

Therefore, when deciding the mounting direction of the scale main unit, give consideration to the splattering directions of the cutting oil, chips, etc., since the opening side poses a greater hazard of foreign matter intrusion than the other sides.

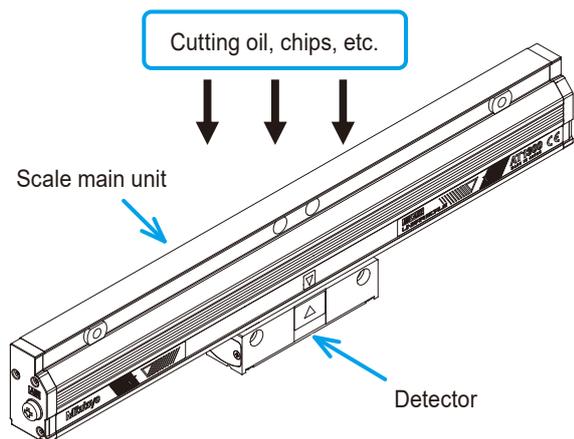
Check installation orientation of the scale main body.



- The direction from which the cutting oil, chips, etc. comparatively tend to intrude

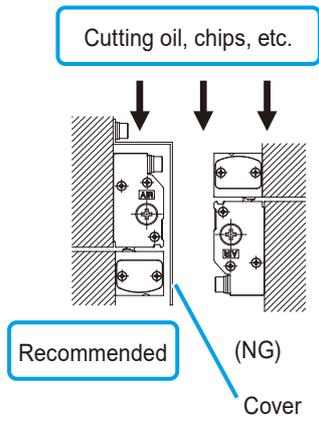


- The direction from which the cutting oil, chips, etc. comparatively tend not to intrude

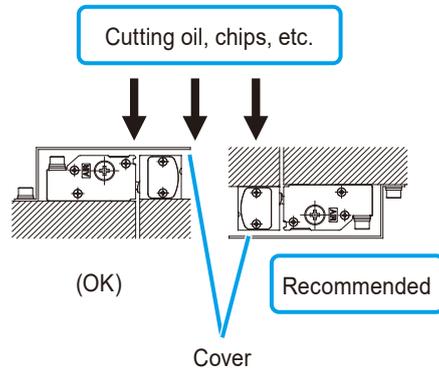


■ Mounting direction of scale main unit

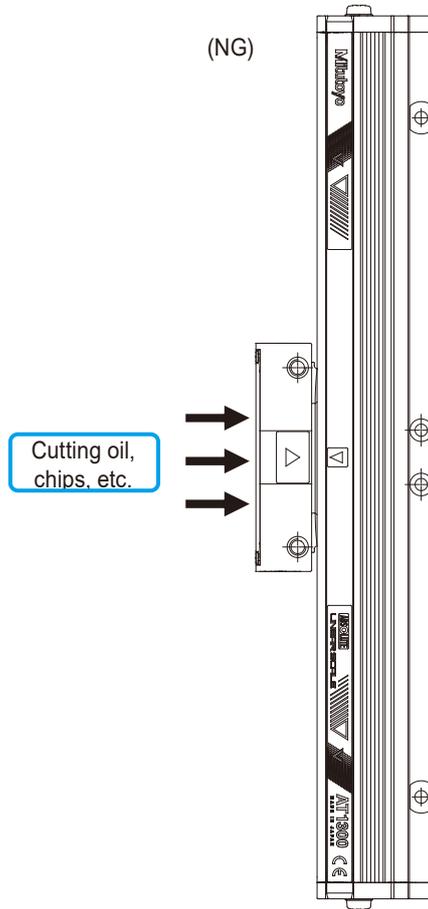
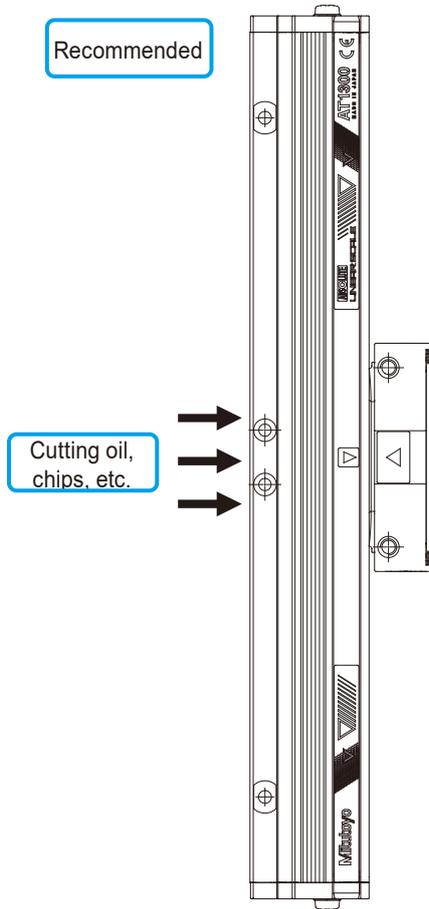
● Longitudinal direction



● Horizontal direction



● Vertical direction



2.4.5 Precautions on Designing the Mounting Surface

The following describes precautions on designing the mounting surface.

For details of the mounting specifications, refer to  "4.7 External View and Dimensional Drawings of the Scale Main Unit" (page 69)

For details of the mounting procedures, refer to  "3 Installation onto the Machine Main Unit" (page 27)

Check precautions for design of the installation surface.



■ Precautions

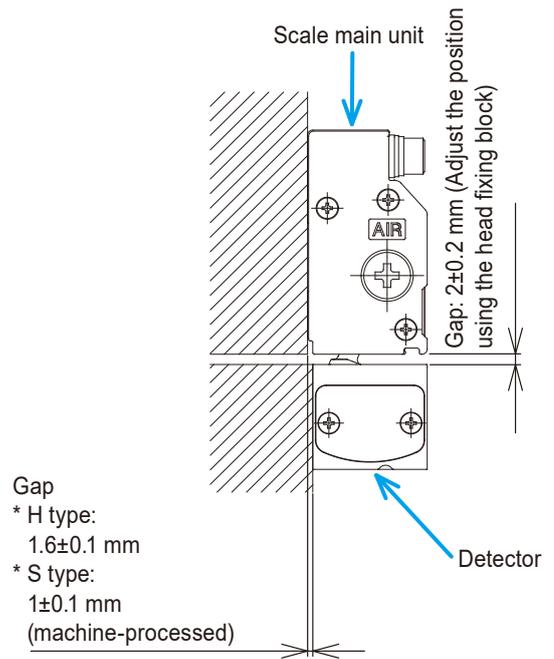
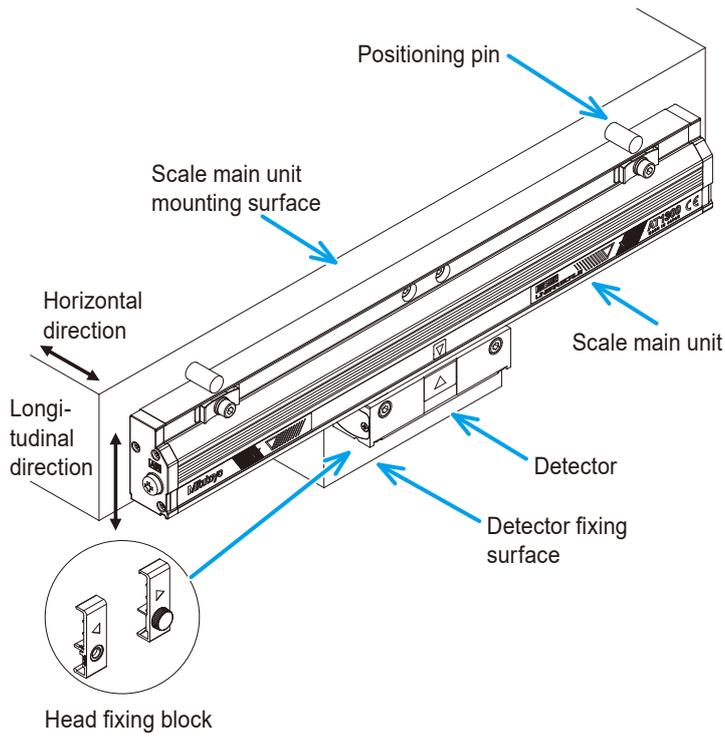
- The mounting surfaces of the scale main unit and the Detector must be machine-processed to be that.

Tips

Position dimensions and surface precision required for the machined surface differ depending on the scale main unit specification (H: high precision specification. S: high rigidity specification).

- There is a gap between the scale main unit and the Detector mounting surfaces. Therefore, remove it by the machine processing so that the gap is within the following processing tolerance. When adjusting the position by inserting a spacer, etc., be sure to measure the gap before mounting the scale.
 - ABS AT1300-H (high precision specification): 1.6 ± 0.1 mm
 - ABS AT1300-S (high rigidity specification): 1 ± 0.1 mm
- When mounting the scale main unit, the position must be adjusted in the longitudinal direction, as indicated in the figure in the next page. It is recommended to use positioning pins, etc. to simplify the position adjustment. Note that the longitudinal reference for positioning the scale main unit is the aluminum frame surface.
- The horizontal mounting reference of the scale main unit are as follows.
 - ABS AT1300-H (high precision specification): mounting block surface
 - ABS AT1300-S (high rigidity specification): aluminum frame surface
- Use the head fixing blocks to adjust the clearance between the scale main unit and the Detector.
- Here, the diagram of ABS AT1300-S is used for the explanation. Follow it for ABS AT1300-H as well.

2 Setup for Installation



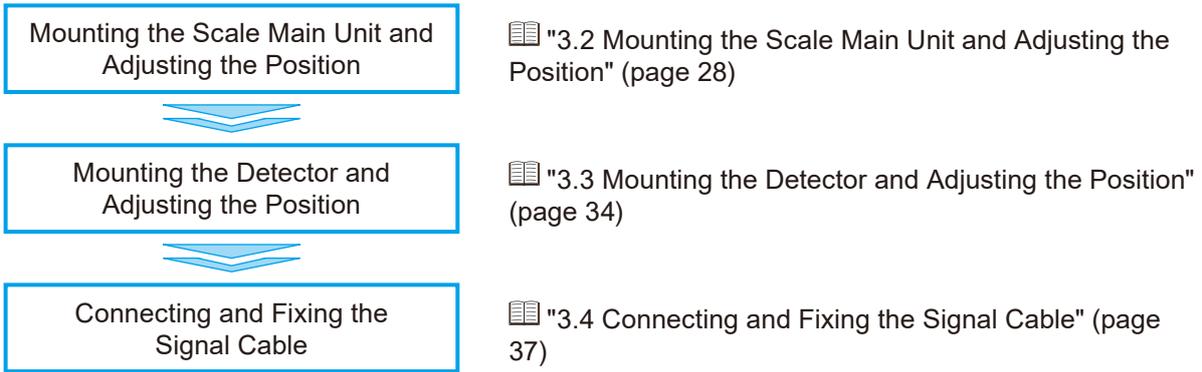
3 Installation onto the Machine Main Unit

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

3.1	Procedure for Installation onto the Machine Main Unit	25
3.2	Mounting the Scale Main Unit and Adjusting the Position	26
3.3	Mounting the Detector and Adjusting the Position	32
3.4	Connecting and Fixing the Signal Cable	35

3.1 Procedure for Installation onto the Machine Main Unit

The following describes the summary of the procedure for installing this product onto the machine main unit.



Details of each step are described in the following pages.

Tips

The installation procedure and method for ABS AT1300-H (high precision specification) and ABS AT1300-S (high rigidity specification) are different. See the explanation for the corresponding model.

3.2 Mounting the Scale Main Unit and Adjusting the Position

3.2.1 Checking the Mounting Surface, etc.

Refer to "2.4.5 Precautions on Designing the Mounting Surface" and "4.7 External View and Dimensional Drawings of the Scale Main Unit", and make sure that the positional accuracy between the scale main unit and the Detector mounting surfaces and the surface accuracy are within the specified ranges.

3.2.2 Mounting the Scale Main Unit

■ ABS AT1300-H (high precision specification)

You can check the installation procedure for the scale main body.



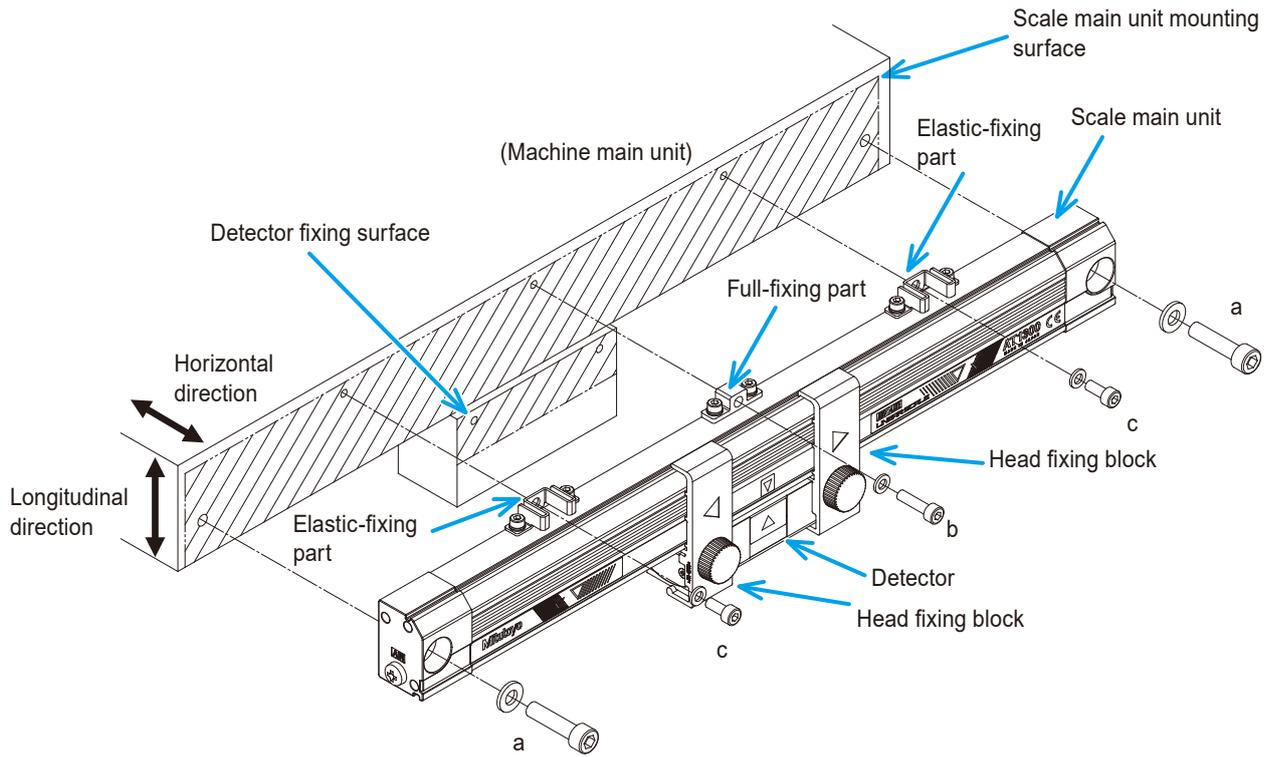
- 1 Temporarily fix it to the scale main unit fixing surface of the machine main unit with the supplied screws (to the extent that it does not move even if you release your hands from the scale main unit).

NOTICE

When temporarily fixing the scale unit, do not fix the Detector.

Target	Screw to use	Effective length	Quantity
Mounting block (both end parts of scale main unit)	a: Hex socket head cap screw M6 x 25 + spring washer (M6) combined	100 mm–1000 mm	Two each
Full-fixing part (Datum point position for length variation due to temperature changes)	b: Hex socket head cap screw M4 x 16 + spring washer (M4) combined	100 mm–1000 mm	One each
Elastic-fixing parts	c: Hex socket head cap screw M4 x 10 + spring washer (M4) combined	100 mm–500 mm	—
		600 mm–1000 mm	Two each

3 Installation onto the Machine Main Unit



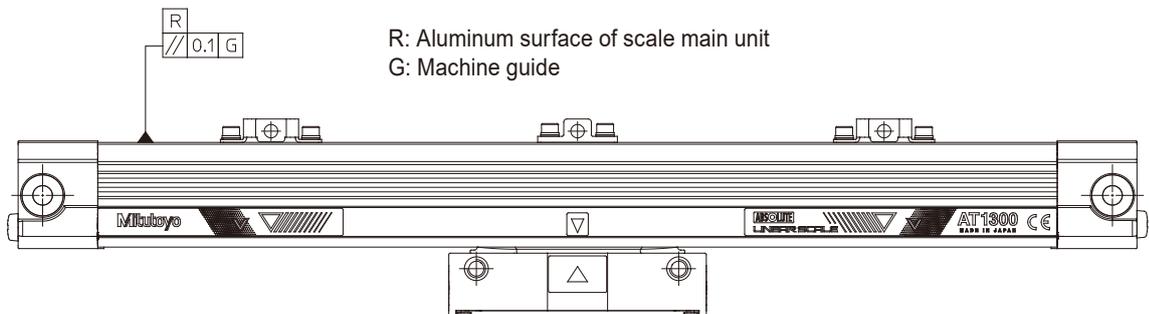
NOTICE

The head fixing blocks that fix the Detector define the positional relationship between the scale main unit and the Detector.
 When mounting the scale unit on the machine main unit, do not remove the head fixing blocks in order to keep the positional relationship.

2 Adjust the longitudinal direction of the scale.

NOTICE

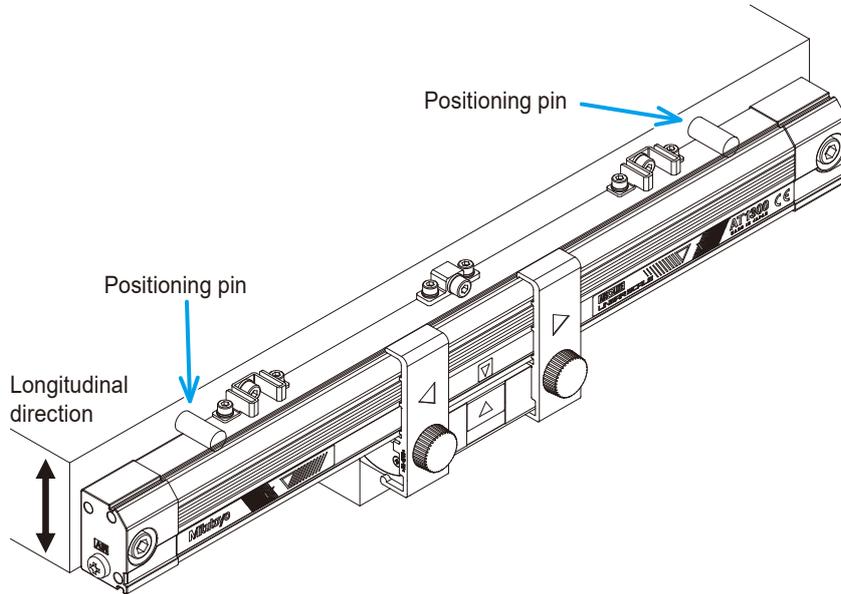
The position of the scale unit of this product does not need to be adjusted in the horizontal direction (it depends on the accuracy of the machine main unit mounting surface). However, the position and dimension in the longitudinal direction must be adjusted and checked.
 Adjust and check the position and dimension of the scale main unit R reference surface by referring to the external view and dimensional drawings of the scale unit.
 For details of the external view and dimensional drawings, refer to "4.7 External View and Dimensional Drawings of the Scale Main Unit" (page 69)



3 Installation onto the Machine Main Unit

NOTICE

As described in "2.4.5 Precautions on Designing the Mounting Surface", this task can be simplified by using the positioning pins, etc. However, after mounting, the dimensions must be checked.



- 3 After adjusting and checking the position and dimensions in the longitudinal direction of the scale main unit, fully tighten the fixing screws.

NOTICE

Note the following:

* Tightening torque of screw

M4: 3 N·m

M6: 9 N·m

* Tightening procedure of screw

Be sure to tighten the full-fixing part (center part of scale main unit) first, and then tighten the elastic-fixing parts.

■ ABS AT1300-S (high rigidity specification)

You can check the installation procedure for the scale main body.

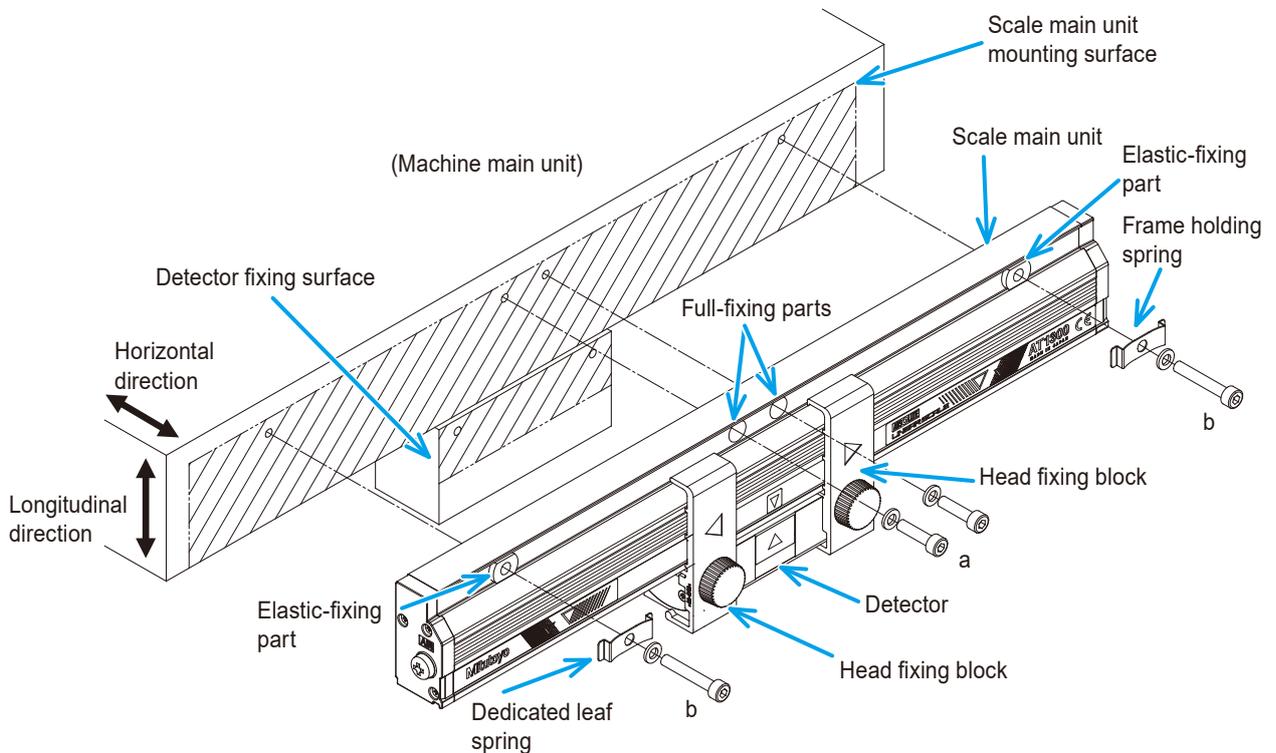


- 1 Temporarily fix it to the scale main unit fixing surface of the machine main unit with the supplied screws (to the extent that it does not move even if you release your hands from the scale main unit).

NOTICE

When temporarily fixing the scale main unit, do not fix the Detector.

Target	Screw to use	Effective length	Quantity
Full-fixing parts (two locations at the center of the scale main unit)	a: Hex socket head cap screw M4 x 16 + spring washer (M4) combined	100 mm–2200 mm	Two each
Elastic-fixing parts	b: Hex socket head cap screw M4 x 25 + spring washer (M4) + Dedicated leaf spring combined	100 mm–450 mm	Two each
		500 mm–800 mm	Four each
		900 mm–1200 mm	Six each
		1300 mm–1600 mm	Eight each
		1800 mm–2000 mm	10 each
		2200 mm	12



NOTICE

The head fixing blocks that fix the Detector define the positional relationship between the scale main unit and the Detector.

When mounting the scale unit on the machine main unit, do not remove the head fixing blocks in order to keep the positional relationship.

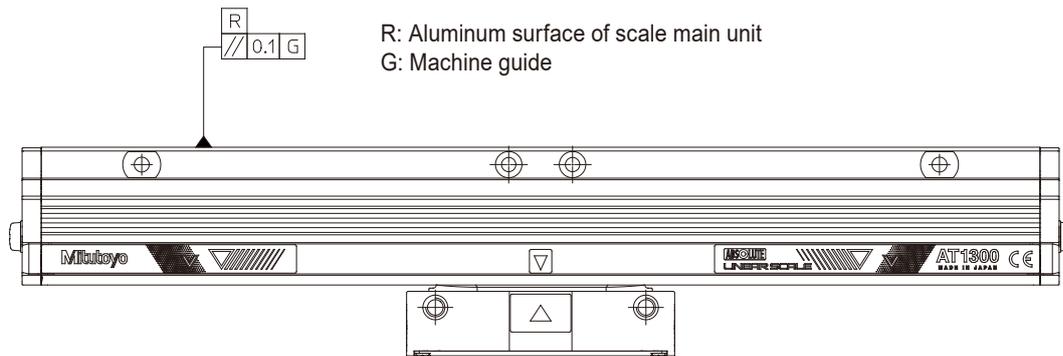
3 Installation onto the Machine Main Unit

2 Adjust the longitudinal direction of the scale.

NOTICE

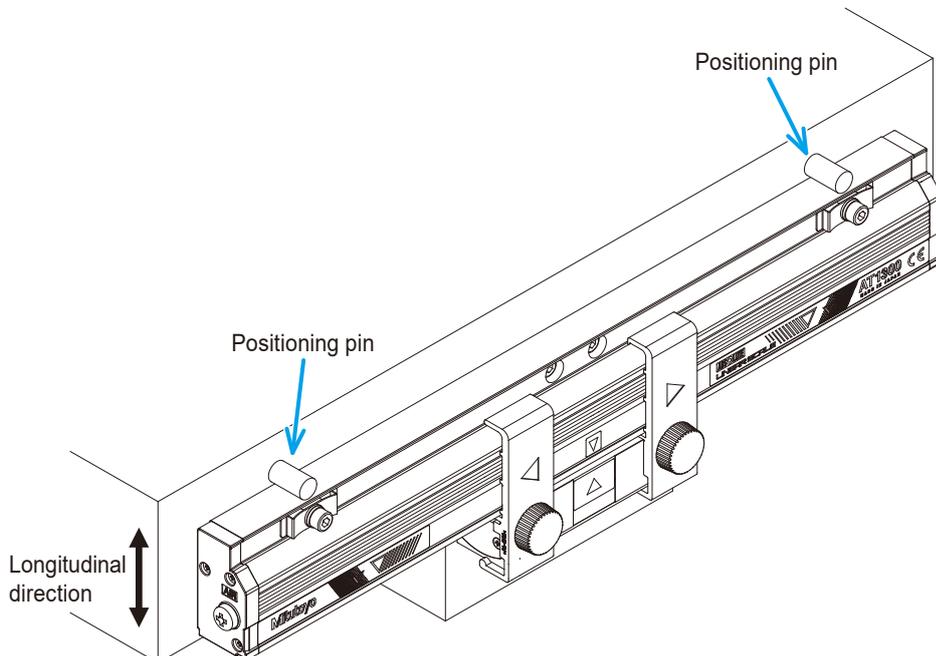
The position of the scale unit of this product does not need to be adjusted in the horizontal direction (it depends on the accuracy of the machine main unit mounting surface). However, the position and dimension in the longitudinal direction must be adjusted and checked.

Adjust and check the position and dimension of the scale main unit R reference by referring to the external view and dimensional drawings of the scale unit.



NOTICE

As described in "2.4.5 Precautions on Designing the Mounting Surface", this task can be simplified by using the positioning pins, etc. However, after mounting, the dimensions must be checked.



- 3** After adjusting and checking the position and dimensions in the longitudinal direction of the scale main unit, fully tighten the fixing screws.

NOTICE

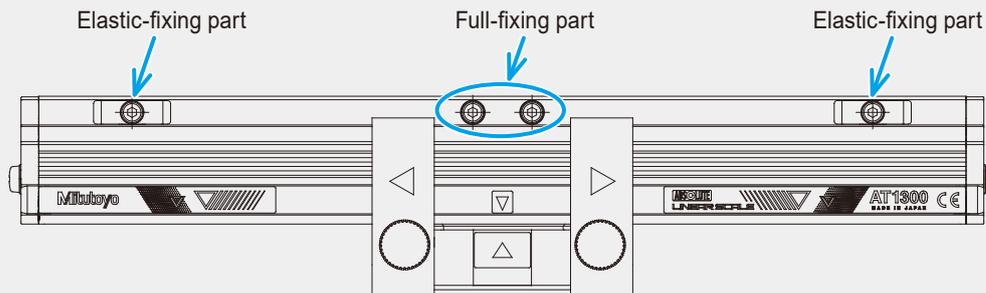
Note the following:

* Tightening torque of screw

M4: 3 N·m

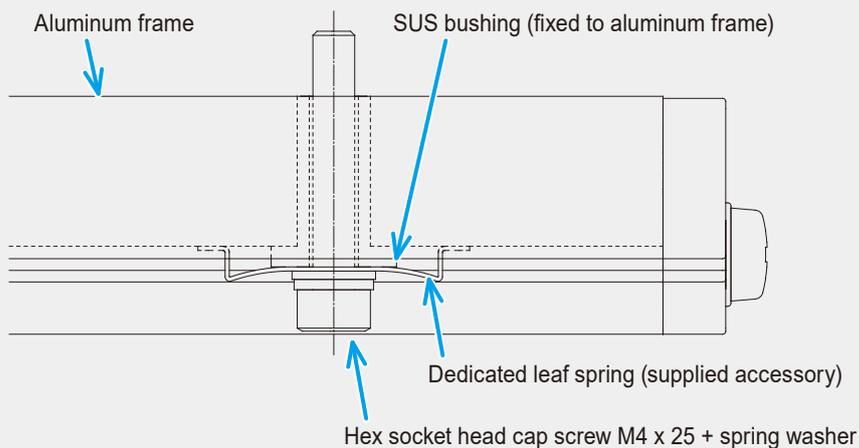
* Tightening procedure of screw

Be sure to tighten the full-fixing parts (two locations at center part of scale main unit) first, and then tighten the elastic-fixing parts.



* Fixed state of elastic-fixing parts

The fixing state of the elastic-fixing part is shown below.



3.3 Mounting the Detector and Adjusting the Position

After completing the steps described in "3.2 Mounting the Scale Main Unit and Adjusting the Position", follow the procedures below to attach the Detector.

Check the head installation procedure.



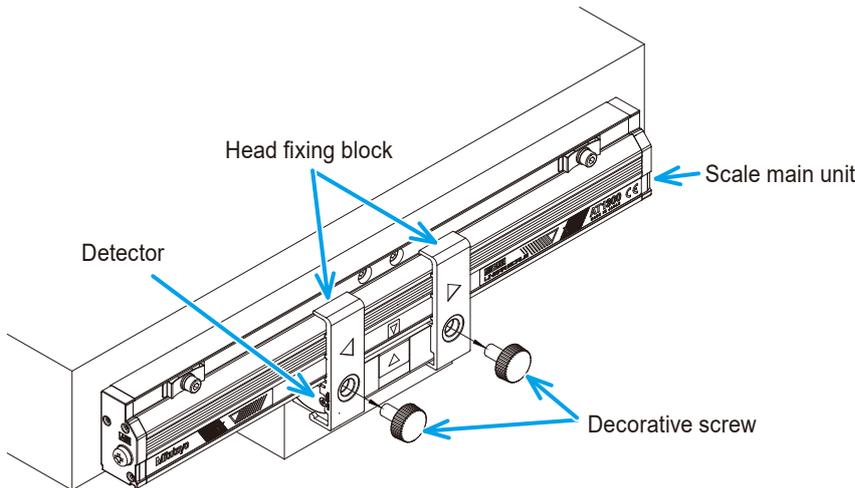
The procedure for mounting the Detector is the same for H specification (high precision specification) and S specification (high rigidity specification).

3.3.1 Installing the Detector

1 Check the parallelism of the Detector mounting surface.

For details, refer to "4.7 External View and Dimensional Drawings of the Scale Main Unit" (page 69)

2 Remove the decorative screws (two locations) of the head fixing blocks.

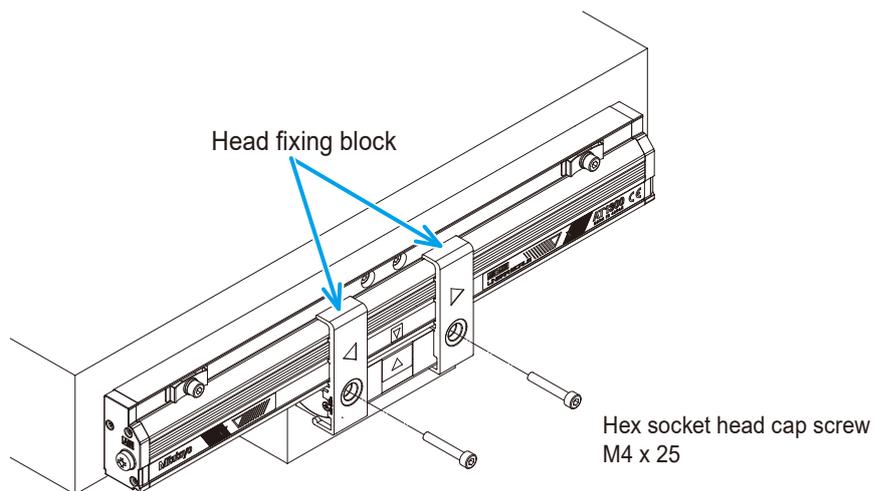


3 Fix the detector with the supplied screws.

Screw to use	Quantity
Hex socket head cap screw M4 x 25	two

Screw tightening torque (M4): 3 N·m

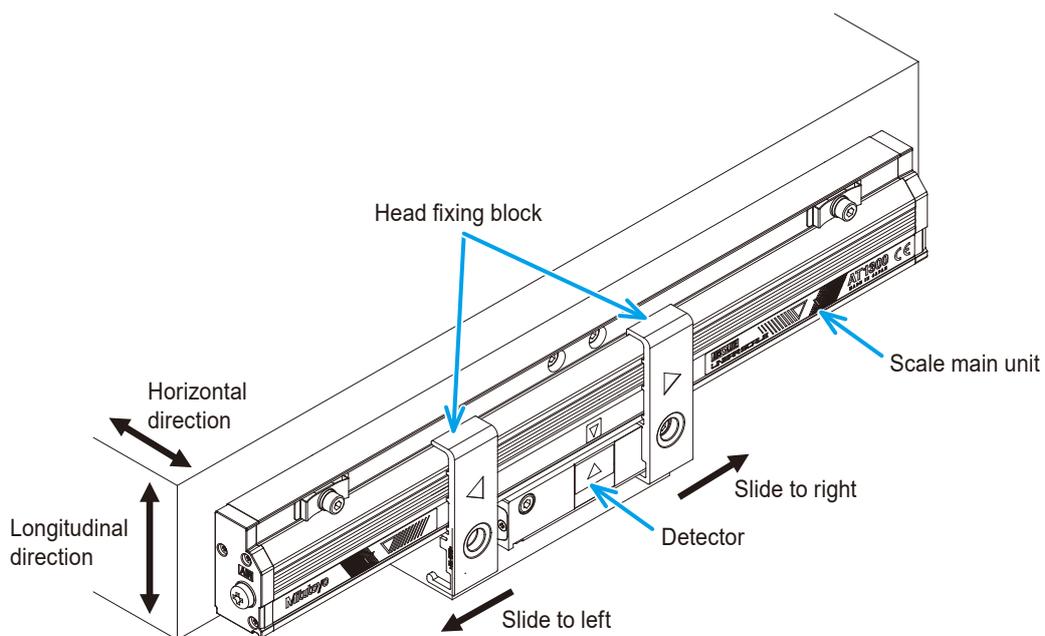
3 Installation onto the Machine Main Unit



NOTICE

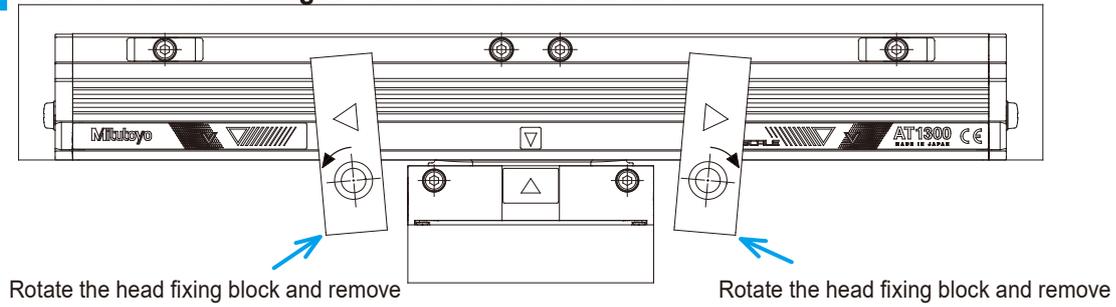
Do not remove the head fixing blocks during the operation.

4 Slide the head fixing blocks.



3 Installation onto the Machine Main Unit

5 Remove the head fixing blocks from scale main unit.

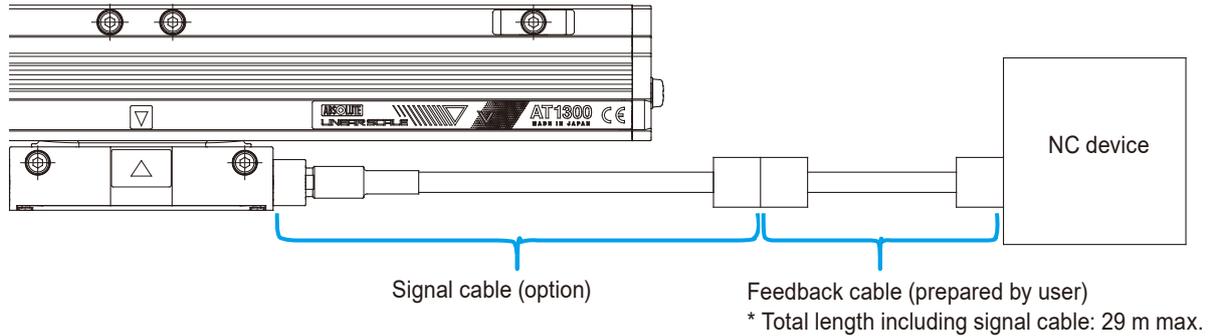


3.4 Connecting and Fixing the Signal Cable

3.4.1 Cable Connection and Operation Check

An example of the system configuration is shown below.

For the details of the cables, refer to  "4 Specifications" (page 43)



■ Connect the cables and check operations

- 1 According to "3.4.2 Connecting the Signal Cable", connect the Detector and the signal cable.
- 2 Connect the signal cable to the NC device.
- 3 Make sure the screws on the connector plug are fully tightened.

Tips

When connecting our signal cable to the your ordered cable, the total length of the cables should be 29 m maximum.

- 4 After connection of cables etc. is completed, turn on the power and check the operations, functions, and performance of the scale.

NOTICE

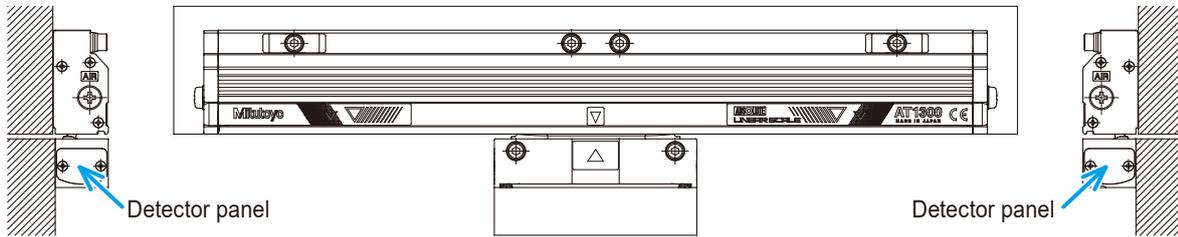
- After turning on the power, if the scale unit does not operate normally, check the connections first. If the scale does not operate normally even after the status of connections is checked and the power is supplied again, investigate the cause, following the instructions in "5 Troubleshooting".
- When checking the scale operations, be very careful that no cables are being pinched by the machinery.
- When connecting the connectors, if chips or other foreign objects are sandwiched in, that may cause malfunctions.

3.4.2 Connecting the Signal Cable

Check the signal cable connection procedure.



1 Decide the mounting direction of the signal cable.

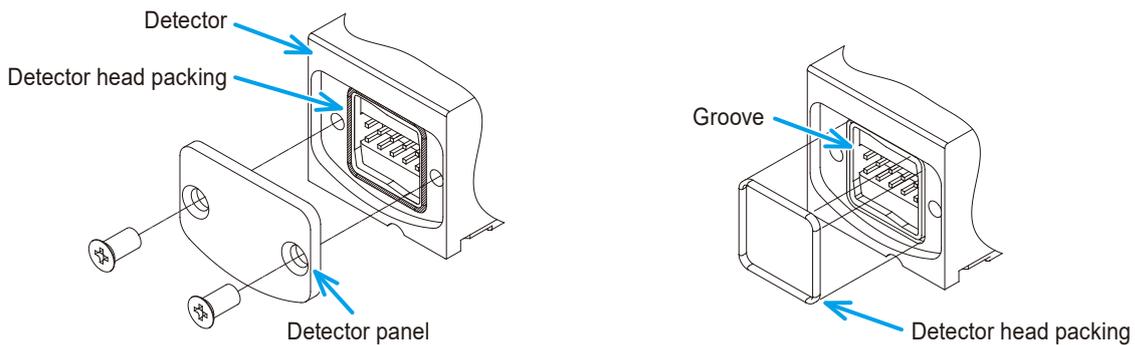


2 Remove the cable outlet panel at the mounting side of the signal cable.

3 Check that the detector head packing is attached to the Detector side.

NOTICE

The detector head packing is fitted between the Detector panel and the Detector. When removing the Detector panel, make sure that the detector head packing does not come off. If it comes off, insert it into the groove of the Detector.



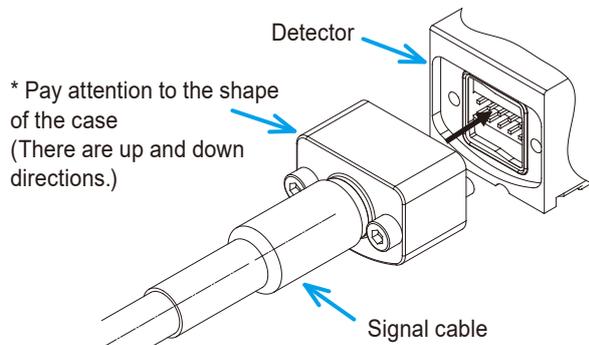
3 Installation onto the Machine Main Unit

4 Connect the Detector and the signal cable.

NOTICE

Connect it engaging the convex part of the cable outlet with the concave part of the connector.

A detector head packing is set between the Detector and the connector to ensure water-resistance performance. When connecting the cable, make sure to confirm that the detector head packing is set in the groove of the signal cable outlet.



Tightening torque of connector fixing screw

Hex socket head cap screw (M2.6): 0.8 N·m

3.4.3 Precautions on Fixing the Cables

Check the cable fastening procedure.



Be sure to note the following content when fixing the cables.

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

NOTICE

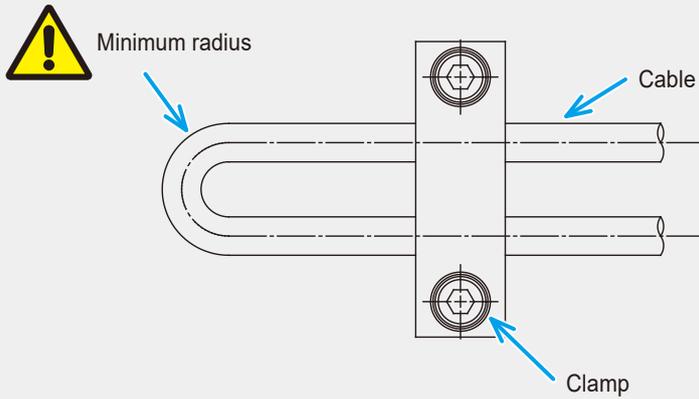
Note that the signal cable and feed back cable may malfunction if bundled with other cables that may cause electrical noise, or if they are located near a switching relay dealing with a large current.

2 Use cable clamps or other fasteners to secure the cables.

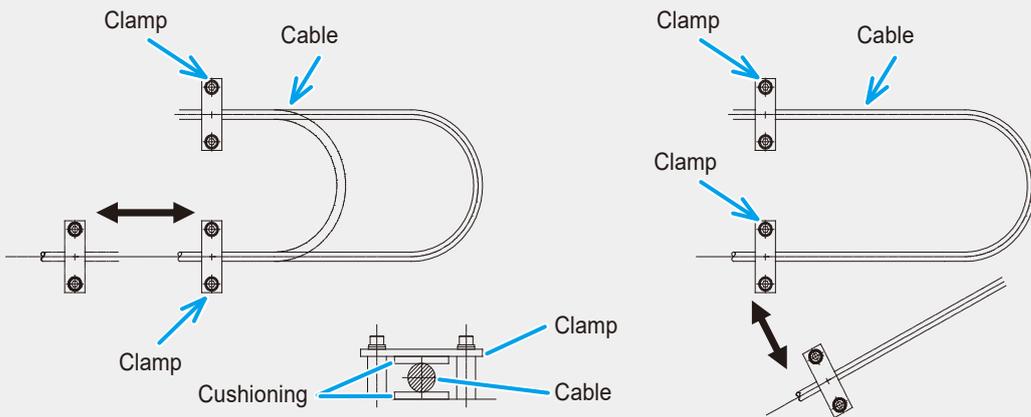
NOTICE

Note the following:

- Do not bend the cables.
Also, do not bend the cables beyond the bend radius range specified in "2.3.2 Bend Radius of the Signal Cable" (page 20).



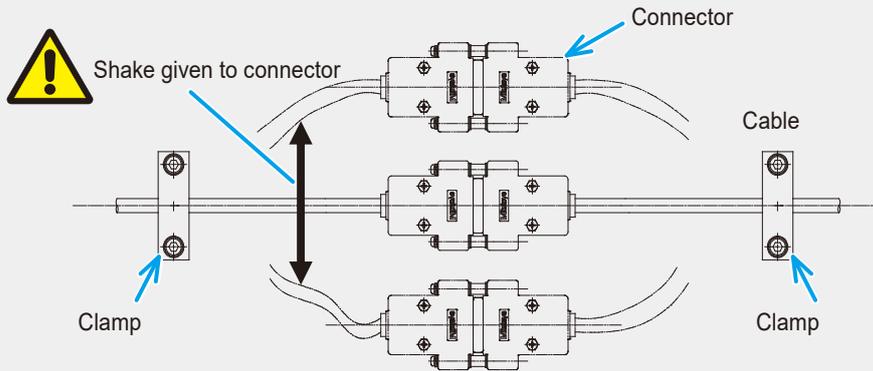
- If the cables are going to be repeatedly bent, try to reduce stress applied to near the root of the clamping part.



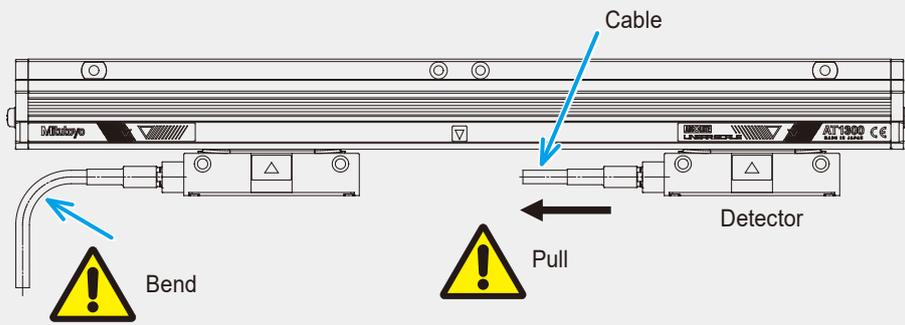
3 Installation onto the Machine Main Unit

NOTICE

- Consider the shake due to vibration, etc. given to connectors.



- Make sure that excessive bends do not occur on the root of on the signal cable in the full stroke.



MEMO

4 Specifications

This chapter describes the specifications of this product.

4.1 Specifications.....	41
4.2 Signal Cable Specifications.....	42
4.3 System Configuration (Example)	49
4.4 Production of Feedback Cable (Example).....	50
4.5 Alarm Detection Function.....	57
4.6 Air Purging	63
4.7 External View and Dimensional Drawings of the Scale Main Unit	67

4.1 Specifications

Items	High precision specification	High rigidity specification
	ABS AT1300-H Series	ABS AT1300-S Series
Scale main unit installation specifications	Elastic fixing at three or five points	Elastic fixing at multiple points
Datum point position for length variation due to temperature changes	Center of effective measurement length	
ABS origin point (output data is 0)	Center of effective measurement length	
Effective measurement length (mm)	100, 150, 200, 250, 300 350, 400, 450, 500, 600 700, 750, 800, 900, 1000	100, 200, 300, 400, 500, 600 700, 800, 900, 1000, 1100 1200, 1300, 1400, 1500 1600, 1800, 2000, 2200
Detection method	Photoelectric type ABS linear encoder	
I/O method	High-speed serial interface	
Resolution (μm)	0.001/0.01/0.05	
Maximum response speed (mm/s)	3000	
Indication precision (μm) at 20 °C	$2+2L_0/1000$ L ₀ : Effective measurement length (mm)	$3+3L_0/1000$ L ₀ : Effective measurement length (mm)
Coefficient of thermal expansion	$\approx 8 \times 10^{-6}/K$	
Vibration resistance (55 Hz–2000 Hz)	$\leq 147 \text{ m/s}^2$	$\leq 196 \text{ m/s}^2$
Shock resistance (1/2 sin, 11 ms)	$\leq 196 \text{ m/s}^2$	$\leq 343 \text{ m/s}^2$
Power supply voltage/current consumption	5 VDC \pm 10 % / 270 mA (maximum value)	
Signal cable length	Maximum 29 m (signal cable + feedback cable)	
Used/storage temperature and humidity range	0 °C–50 °C / -20 °C–70 °C, 20 %–80 % RH (non condensation)	
Interface	Specifications made by Mitutoyo ENSIS, Mitsubishi Electric Corporation, FANUC Corporation, Panasonic Corporation, and YASKAWA Electric Corporation	

Items	High precision specification	High rigidity specification
	ABS AT1300-H Series	ABS AT1300-S Series
CE marking/UKCA marking	EMC Directive/Electromagnetic Compatibility Regulations : EN 61326-1 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	

■ Relationship between resolution and maximum response speed

Interface	Maximum response speed mm/s	
	Resolution 0.001 μm	Resolution 0.01 μm/0.05 μm
Mitutoyo ENSIS	3000	3000
Mitsubishi Electric Corporation	3000	3000
FANUC Corporation	3000	3000
Panasonic Corporation	400	3000
YASKAWA Electric Corporation	3000	3000

4.2 Signal Cable Specifications

4.2.1 Output Signal

■ Discrete-wire specification cable

Cable color	Signal	Cable color	Signal
Brown	DT	White	+5 V
Red	/DT	Black	GND
Orange	RQDT	Shielded wire	Frame ground
Yellow	/RQDT		

* Connect the shielded wire to the ground bar.

■ Specification cable with alarm indication function (D sub connector: pin contact, 15 pins)

Pin number	Signal	Pin number	Signal
1, 2, 13	GND	7	RQDT
3, 4, 11	+5 V	8	/RQDT
5	DT	15	Frame ground
6	/DT		

■ FANUC connector specifications

Pin number	Signal	Pin number	Signal
1	SD	12,14	GND
2	*SD	18,20	+5 V
5	RQ(REQ)	16	Frame ground
6	*RQ(REQ)	3,4,7 ~ 13,15,17,19	Not used

■ Mitsubishi connector specifications

Pin number	Signal	Pin number	Signal
1	5 V	7	DT
2	GND	8	$\overline{\text{DT}}$
3	RQDT	5,6,9,10	Not used
4	$\overline{\text{RQDT}}$		
		Connector shell	Frame ground

■ Panasonic connector specification

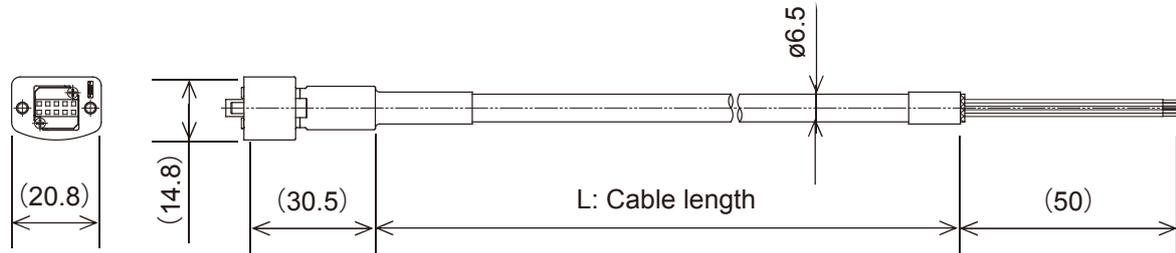
Pin number	Signal	Pin number	Signal
1	E5V	Connector shell	Frame ground
2	E0V		
3	PS	5 ~ 10	Not used
4	/PS		

■ YASKAWA connector specification

Pin number	Signal	Pin number	Signal
1	VCC	Connector shell	Frame ground
2	GND		
5	S	3, 4	Not used
6	/S		

4.2.2 Cable Dimensions

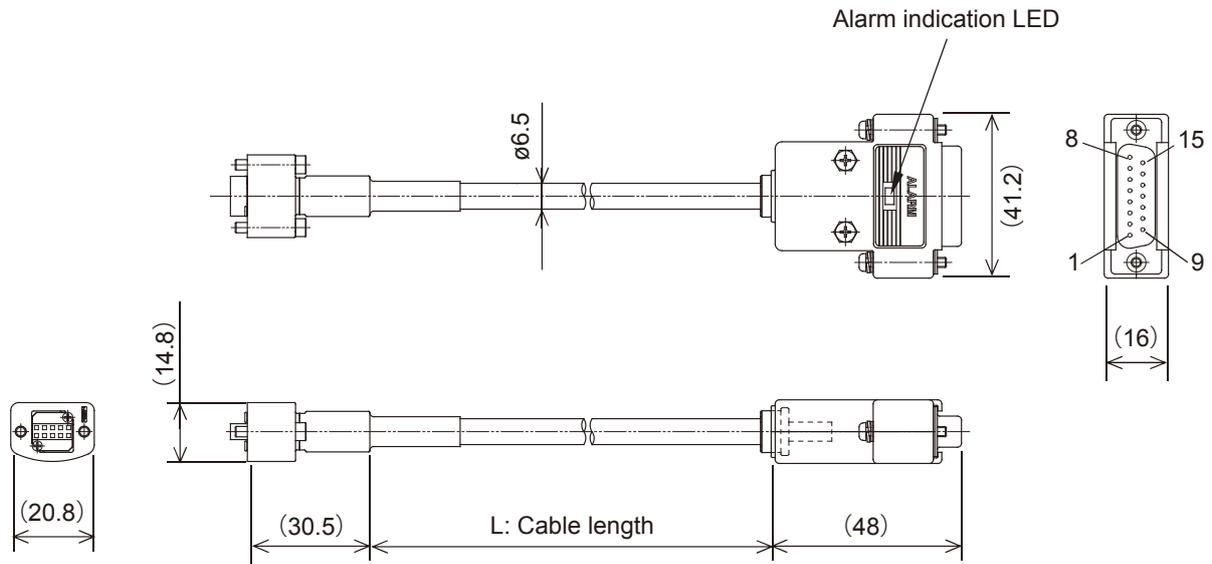
■ ABS AT135*/134*/137*/138*/130*(A) (discrete-wire specification)



Part No.	Part name	Cable length (m)
06AFS310-1	AT1300 signal cable Ass'y (discrete-wire) 1 m	1
06AFS310-2	AT1300 signal cable Ass'y (discrete-wire) 2 m	2
06AFS310-3	AT1300 signal cable Ass'y (discrete-wire) 3 m	3
06AFS310-4	AT1300 signal cable Ass'y (discrete-wire) 4 m	4
06AFS310-5	AT1300 signal cable Ass'y (discrete-wire) 5 m	5
06AFS310-6	AT1300 signal cable Ass'y (discrete-wire) 6 m	6
06AFS310-7	AT1300 signal cable Ass'y (discrete-wire) 7 m	7
06AFS310-8	AT1300 signal cable Ass'y (discrete-wire) 8 m	8
06AFS310-9	AT1300 signal cable Ass'y (discrete-wire) 9 m	9
06AFS310-12	AT1300 signal cable Ass'y (discrete-wire) 12 m	12

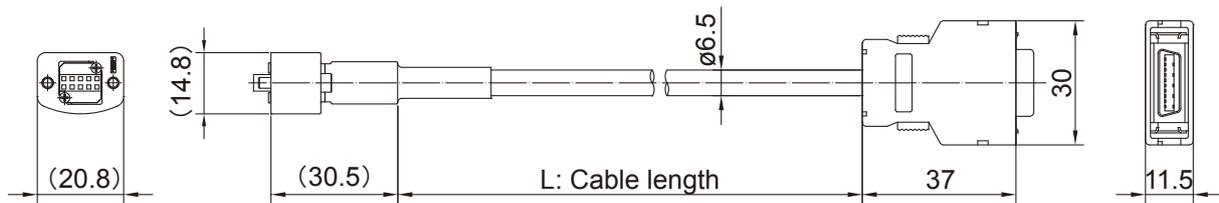
4 Specifications

- ABS AT135*/134*/137*/138*/130*(A) specification cable with alarm indication function (D sub connector: pin contact, 15 pins)



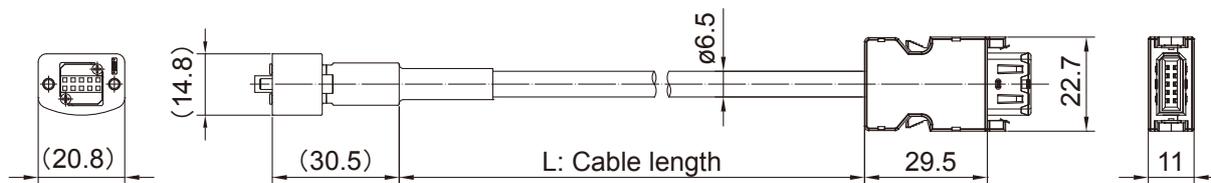
Part No.	Part name	Cable length (m)
06AFS313-1	AT1300 signal cable Ass'y (D-sub) 1 m	1
06AFS313-2	AT1300 signal cable Ass'y (D-sub) 2 m	2
06AFS313-3	AT1300 signal cable Ass'y (D-sub) 3 m	3
06AFS313-4	AT1300 signal cable Ass'y (D-sub) 4 m	4
06AFS313-5	AT1300 signal cable Ass'y (D-sub) 5 m	5
06AFS313-6	AT1300 signal cable Ass'y (D-sub) 6 m	6
06AFS313-7	AT1300 signal cable Ass'y (D-sub) 7 m	7
06AFS313-8	AT1300 signal cable Ass'y (D-sub) 8 m	8
06AFS313-9	AT1300 signal cable Ass'y (D-sub) 9 m	9
06AFS313-12	AT1300 signal cable Ass'y (D-sub) 12 m	12

■ ABS AT135* (FANUC connector specification)



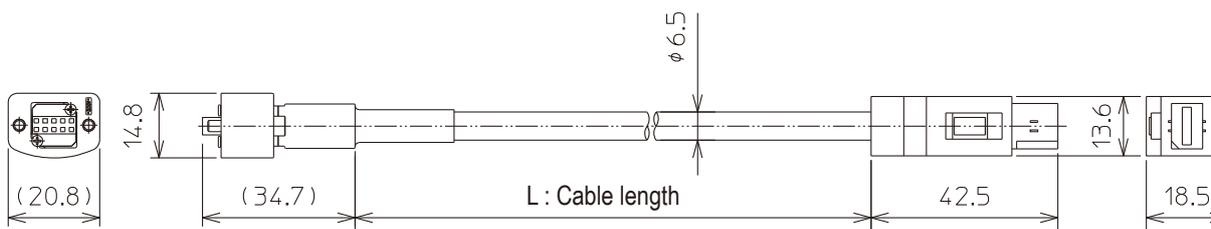
Part No.	Part name	Cable length (m)
06AFS312-1	AT1300 signal cable Ass'y (FANUC) 1 m	1
06AFS312-2	AT1300 signal cable Ass'y (FANUC) 2 m	2
06AFS312-3	AT1300 signal cable Ass'y (FANUC) 3 m	3
06AFS312-4	AT1300 signal cable Ass'y (FANUC) 4 m	4
06AFS312-5	AT1300 signal cable Ass'y (FANUC) 5 m	5
06AFS312-6	AT1300 signal cable Ass'y (FANUC) 6 m	6
06AFS312-7	AT1300 signal cable Ass'y (FANUC) 7 m	7
06AFS312-8	AT1300 signal cable Ass'y (FANUC) 8 m	8
06AFS312-9	AT1300 signal cable Ass'y (FANUC) 9 m	9
06AFS312-12	AT1300 signal cable Ass'y (FANUC) 12 m	12

■ ABS AT134*(A) (Mitsubishi connector specification)



Part No.	Part name	Cable length (m)
06AFS311-1	AT1300 signal cable Ass'y (Mitsubishi) 1 m	1
06AFS311-2	AT1300 signal cable Ass'y (Mitsubishi) 2 m	2
06AFS311-3	AT1300 signal cable Ass'y (Mitsubishi) 3 m	3
06AFS311-4	AT1300 signal cable Ass'y (Mitsubishi) 4 m	4
06AFS311-5	AT1300 signal cable Ass'y (Mitsubishi) 5 m	5
06AFS311-6	AT1300 signal cable Ass'y (Mitsubishi) 6 m	6
06AFS311-7	AT1300 signal cable Ass'y (Mitsubishi) 7 m	7
06AFS311-8	AT1300 signal cable Ass'y (Mitsubishi) 8 m	8
06AFS311-9	AT1300 signal cable Ass'y (Mitsubishi) 9 m	9
06AFS311-12	AT1300 signal cable Ass'y (Mitsubishi) 12 m	12

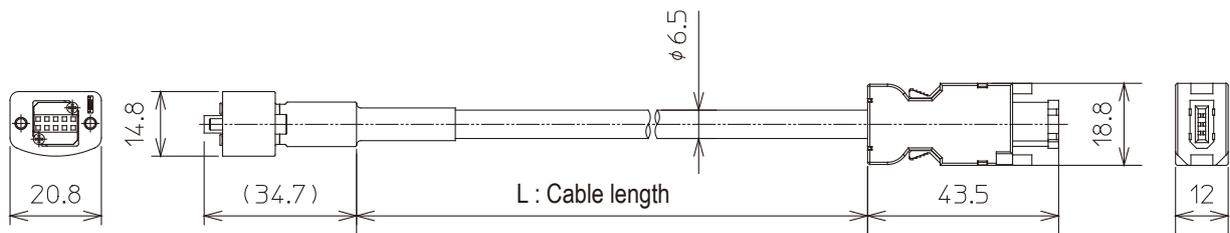
■ ABS AT137*A (Panasonic connector specification)



Part No.	Part name	Cable length (m)
06AGN987-1	AT1300 signal cable Ass'y(Panasonic) 1m	1
06AGN987-2	AT1300 signal cable Ass'y (Panasonic) 2 m	2
06AGN987-3	AT1300 signal cable Ass'y (Panasonic) 3 m	3
06AGN987-4	AT1300 signal cable Ass'y (Panasonic) 4 m	4
06AGN987-5	AT1300 signal cable Ass'y (Panasonic) 5 m	5
06AGN987-6	AT1300 signal cable Ass'y (Panasonic) 6 m	6
06AGN987-7	AT1300 signal cable Ass'y (Panasonic) 7 m	7
06AGN987-8	AT1300 signal cable Ass'y (Panasonic) 8 m	8
06AGN987-9	AT1300 signal cable Ass'y (Panasonic) 9 m	9
06AGN987-12	AT1300 signal cable Ass'y (Panasonic) 12 m	12

4 Specifications

■ ABS AT138*A (YASKAWA connector specification)

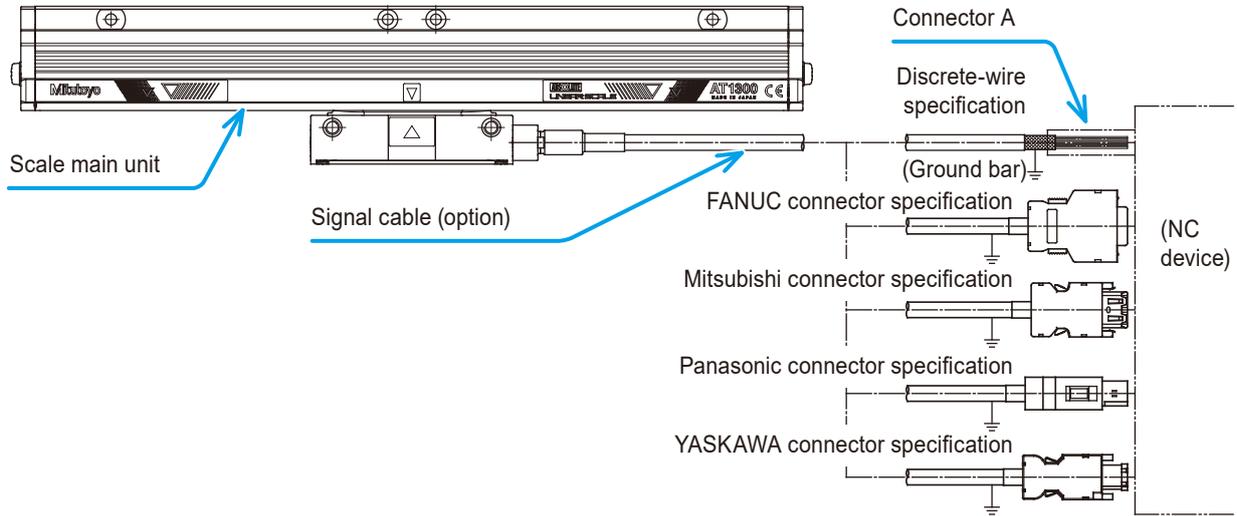


Part No.	Part name	Cable length (m)
06AGN986-1	AT1300 signal cable Ass'y(YASUKAWA) 1m	1
06AGN986-2	AT1300 signal cable Ass'y (YASUKAWA) 2 m	2
06AGN986-3	AT1300 signal cable Ass'y (YASUKAWA) 3 m	3
06AGN986-4	AT1300 signal cable Ass'y (YASUKAWA) 4 m	4
06AGN986-5	AT1300 signal cable Ass'y (YASUKAWA) 5 m	5
06AGN986-6	AT1300 signal cable Ass'y (YASUKAWA) 6 m	6
06AGN986-7	AT1300 signal cable Ass'y (YASUKAWA) 7 m	7
06AGN986-8	AT1300 signal cable Ass'y (YASUKAWA) 8 m	8
06AGN986-9	AT1300 signal cable Ass'y (YASUKAWA) 9 m	9
06AGN986-12	AT1300 signal cable Ass'y (YASUKAWA) 12 m	12

4.3 System Configuration (Example)

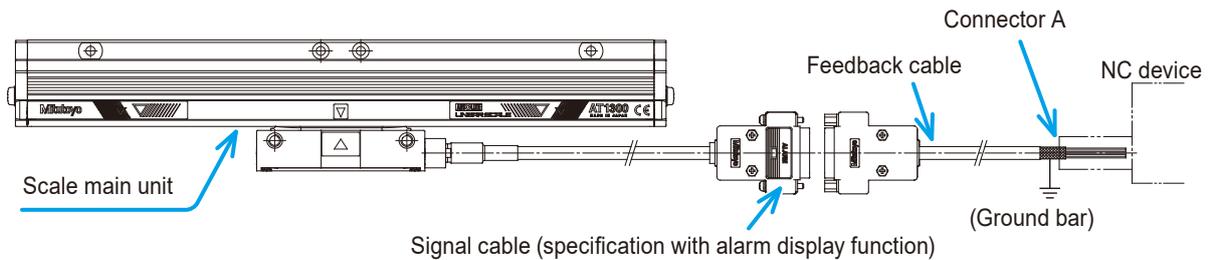
The following describes an example of the system configuration.
Please note that some parts need to be prepared by the user.

■ Connection example 1



- Tips**
- The signal cable is an option. Prepare one according to your needs.
 - The connector A shall be prepared by the user.
 - Connection work for the connector A and the ground bar shall be done by the user.

■ Connection example 2



- * Connector A on the NC device is prepared by user.
- * Connection work of connector A and ground bar is performed by user.
Follow the manual of the NC device for wiring details.
- * When using the feedback cable (prepared by user), refer to the following information.
Maximum cable length (signal cable + feedback cable)... 29 m
Recommended cable material: A66L-0001-0286 (Hitachi Cable or Oki Electric Cable)

NOTICE

- When using any cable other than a recommended cable, make sure to use a shield cable and set the total amount of the impedance of the power supply line (+5 V and 0 V) to "0.65 Ω or less/total length".
- Use the feedback cable so that repeated bending does not occur.

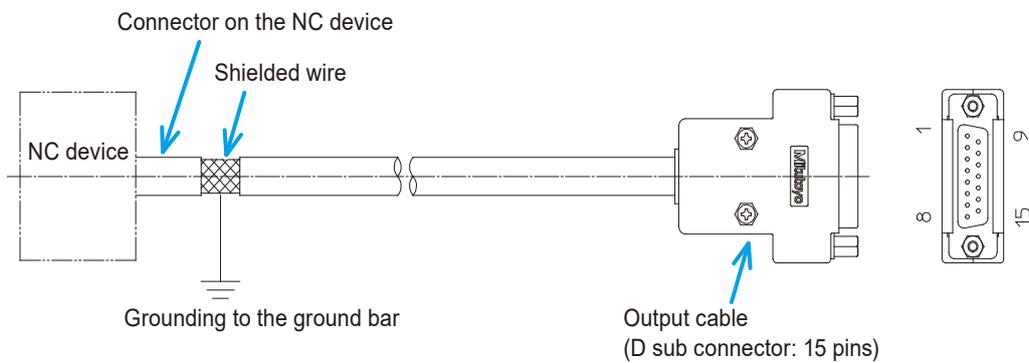
4.4 Production of Feedback Cable (Example)

The production example of the feedback cable is shown below.

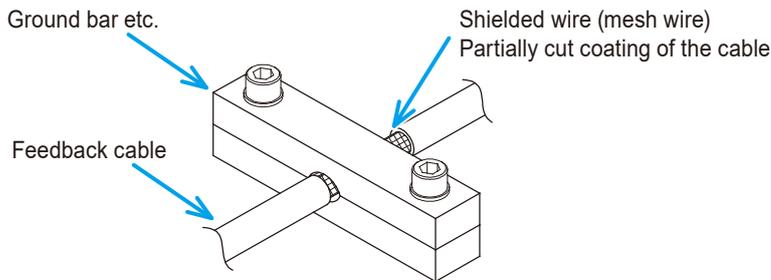
This example shows the feedback cable connected to the signal cable with alarm indication function (D sub connector 15 pins). Also follow this example for other cases.

Follow the method recommended by the NC device manufacturer to wire the connector on the NC device and cable.

4.4.1 Appearance Image of Feedback Cable and Grounding to Ground Bar



When assembling the D sub connector, make sure to conduct electricity from the cable shielded wire to the metal shell. Also, peel part of the sheath (coating) of the cable on the NC device and make sure to use the ground bar to ground the shielded wire.



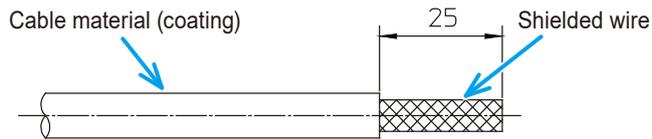
4.4.2 Assembly of D Sub Connector

- 1** Cut the sheath (coating) of the cable material into the length of the following figure.

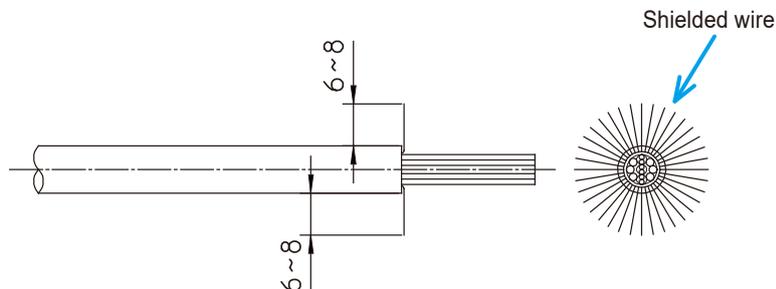
NOTICE

Make sure not to damage the internal shielded wire.

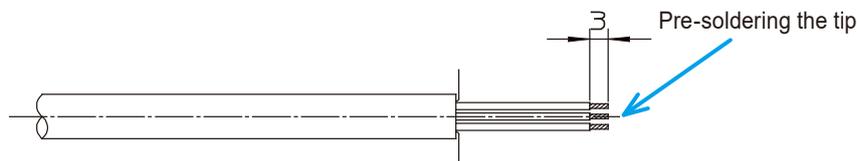
4 Specifications



- 2** Untangle the exposed shielded wire to spread radially and cut it against the sheath.



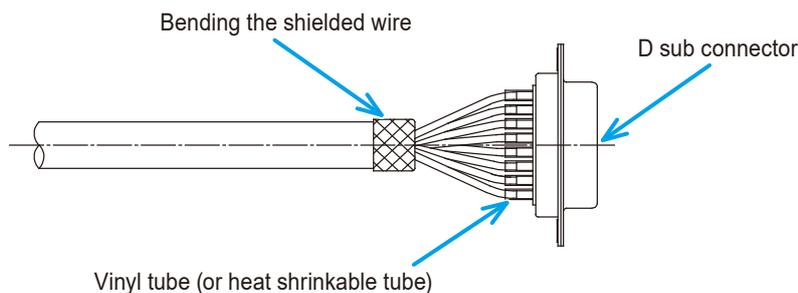
- 3** Peel the tip of the coating of the wire about 3 mm, and make a preliminary solder after twisting the conducting wires.



- 4** Solder each line to D sub connector (socket contact, 15 pins).

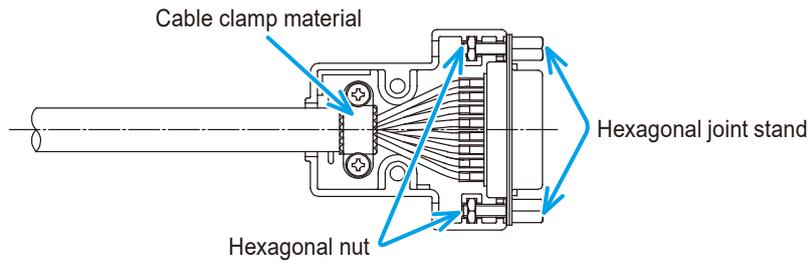
NOTICE

Insert a vinyl tube (\varnothing 2 mm, L = 6 mm–8 mm) or heat shrinkable tube into each terminal part.
Bend the shielded wire to the sheath.



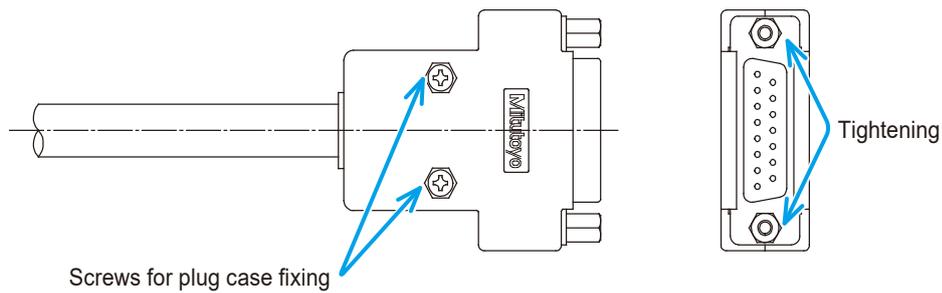
- 5** Set the connector on the plug case.
- 6** Screw the shielded wire folded back at step 4 with a cable clamp material.
- 7** Set the hex nuts in the plug case.
- 8** Insert the hexagonal joint stand from the connector and tighten the screws (temporary fixing).

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9 Place the other plug case and fix it with screws (M2.6 x 14, hex nut).

10 Tighten the hexagonal joint stand temporarily fixed in step 8.



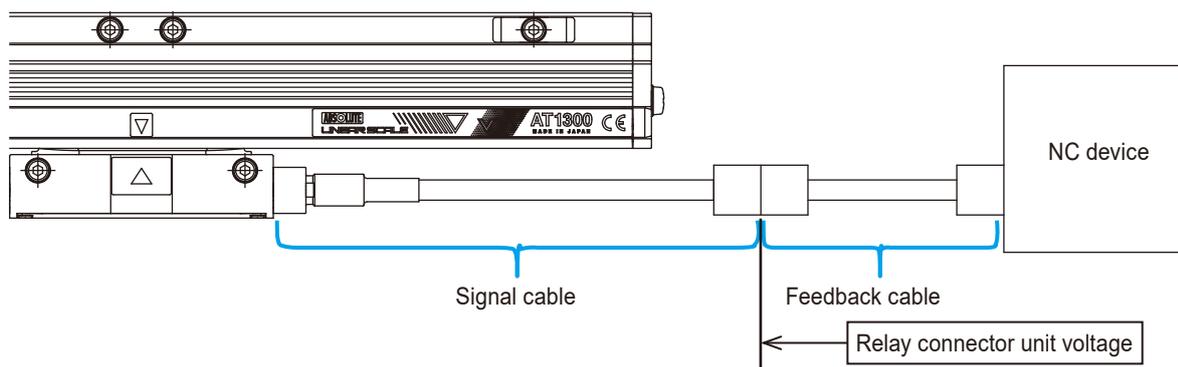
NOTICE

Apply screw locking glue for the screw units.

4.4.3 Calculation of Feedback Cable Length

When making a feedback cable, refer to the following calculation method of maximum cable length.

■ Configuration



■ Condition: When the signal cable length is 1 m

Name	Specifications and symbols	Unit
Maximum cable length (Signal cable length + feedback cable length)	L	m
Wire resistance of used wire material	a	Ω/m
Number of pairs used for power supply line	b	wires
Supply voltage (minimum value) from the NC device	4.95 *1	V
Current consumption value	0.27	A
Relay connector unit voltage (minimum value)	4.5 + 0.035 *2, *3	V

*1 It is usually the standard supply voltage of the NC device.

*2 When the signal cable length is 1 m or more, a voltage drop of 0.035 V per 1 m occurs.
Consider the voltage drop in the signal cable.

*3 Confirm that the input voltage of the relay connector unit is the minimum value or more in the table above .

■ Calculation formula

Allowable voltage drop \geq (Current consumption x wire material resistance x 2 x max cable length) ÷
Number of pairs used for power supply line (1)

Applying the conditions in the above table to formula (1) gives the following result.

$$(4.95 - (4.5 + 0.035)) [V] \geq (0.27 [A] \times a [\Omega/m] \times 2 \times L [m]) \div b [wires] \quad (2)$$

Modify formula (2) above to the following one.

$$L [m] \leq \frac{b (4.95 - 4.535)}{0.54 a} \quad (3)$$

Produce the feedback cable of the max cable length (L[m]), wire resistance of used wire material (a[Ω/m]) and Number of pairs used for power supply line (b[wires]) satisfying formula (3) above.

4.4.4 Wiring with NC Device (Example)

The "Signal cable" and the "Connector on the signal cable" in the table below indicate the connection in the case D-sub connectors are used.

If other connectors were to be used, the connection shall be performed by the user.

When the signal cable is a discrete one, and in the case not using a feedback cable, refer to "4.2.1 Output Signal" (page 44)" to connect the lead wire directly to the connector on the NC device.

Follow the connection method recommended by the manufacturer of the connector.



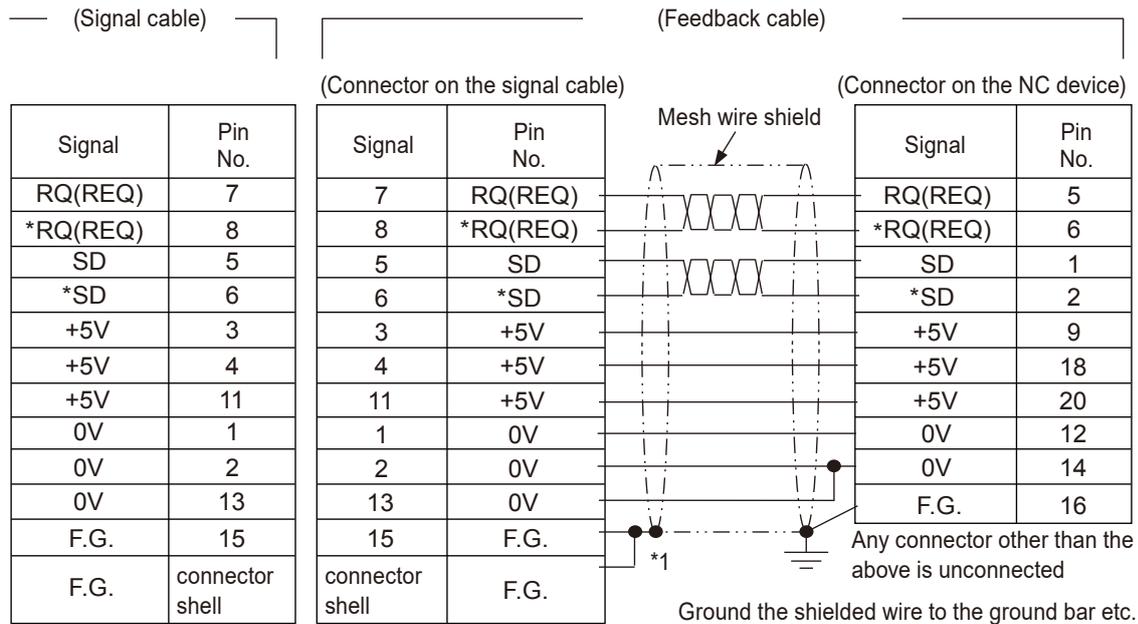
Make sure to ground the metal shield of the feedback cable to the ground bar, etc. immediately in front of the NC device.

Tips

Specifications of recommended cable material for feedback cables (A66L-0001-0286):

- Wire material for power supply: 0.5 mm² three black wires, three red wires
- Wire material for signal: 0.18 mm² Twisted pair wire (black × red, black × white, red × white)

■ AT135* (interface specifications: manufactured by FANUC Corporation)



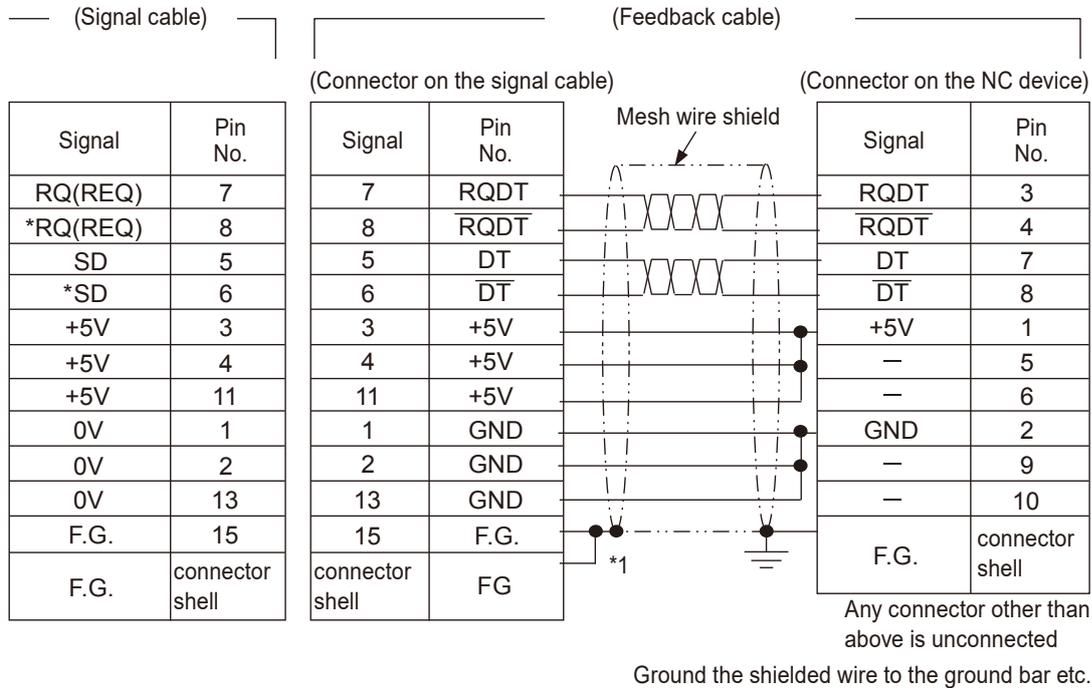
NOTICE

*1:
When a drain wire is attached to the metal shield, connect it to the 15th pin of the D sub connector.

■ AT134* (interface specifications: manufactured by Mitsubishi Electric Corporation)

● CNC 700 series connection

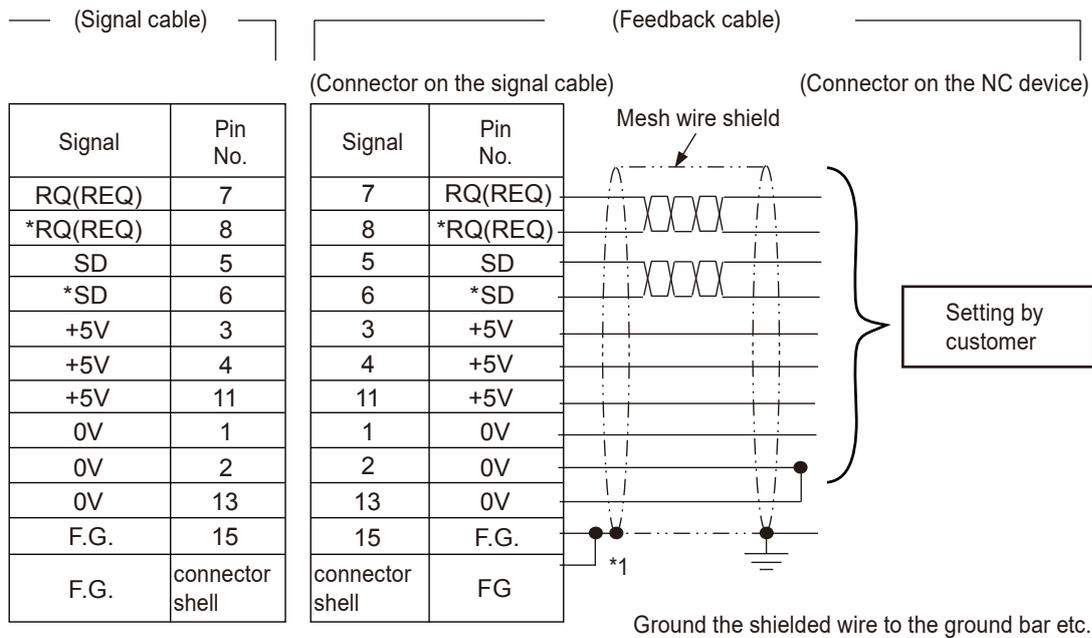
Corresponding servo-amplifier: MDS-D, MDS-DH, MDS-Dn



NOTICE

*1:
When a drain wire is attached to the metal shield, connect it to the 15th pin of the D sub connector.

■ AT130*A (interface specifications: manufactured by Mitutoyo ENSIS)

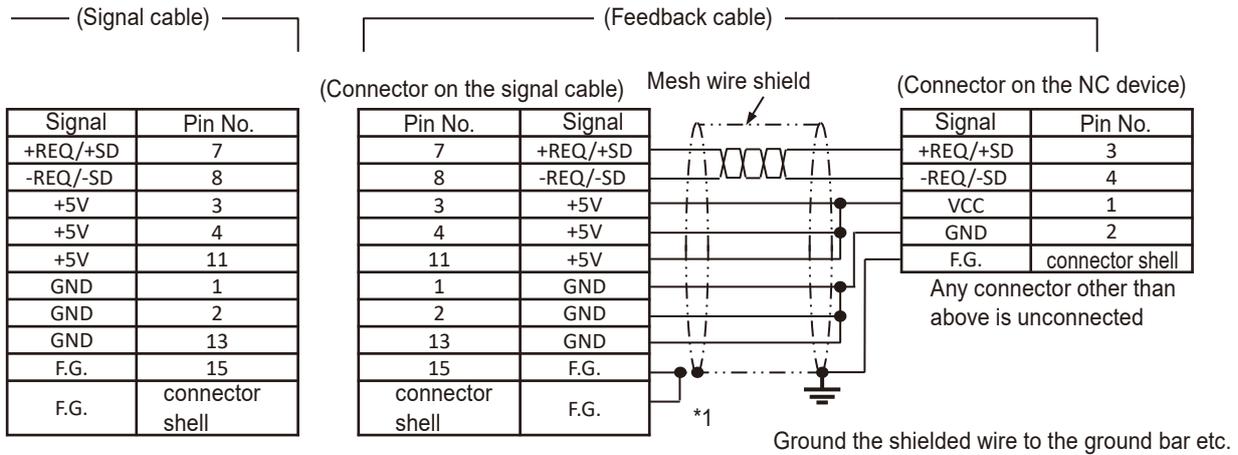


NOTICE

*1:
When a drain wire is attached to the metal shield, connect it to the 15th pin of the D sub connector.

■ AT137*A (interface specifications: manufactured by Panasonic Corporation)

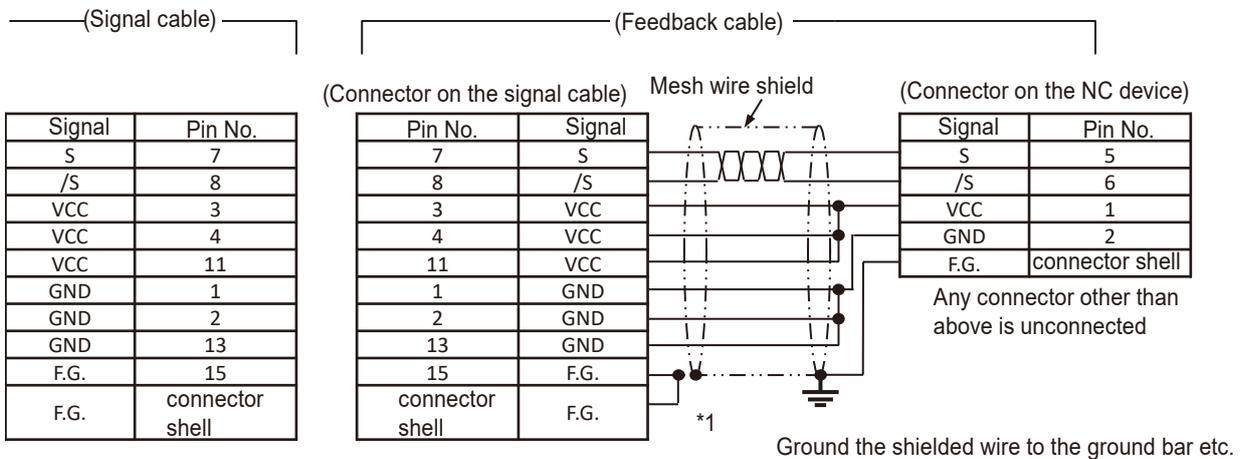
● Panasonic MINAS A5/A6



NOTICE

*1:
When a drain wire is attached to the metal shield, connect it to the 15th pin of the D sub connector.

■ AT138*A (interface specification: manufactured by YASKAWA Electric Corporation)



NOTICE

*1:
When a drain wire is attached to the metal shield, connect it to the 15th pin of the D sub connector.

4.5 Alarm Detection Function

This product is equipped with various alarm detection functions inside the Detector.

4.5.1 Alarm Detection Function

Alarms can be categorized into two groups: Caution and Error.

The cautions indicate low-level signal intensity or the temperature error inside the Detector. In those cases, once troubleshoot the causes, the normal state can be restored.

As for the errors, signal intensity errors or absolute values detection errors, etc. are detected. Once these errors occur, the error detection state will be maintained until they are reset, or the power is re-supplied.

<<List of alarm detections>>

Alarm type		Description
Caution	Signal intensity alarm	It is output when the signal strength of the scale is excessive or too small. * When the signal strength returns to the predetermined range, the alarm is canceled.
	Thermal alarm	An alarm is output as a warning when the temperature inside the Detector rises above 65 °C. * There is no error in the position data, but continuing to use it may cause a malfunction. * Review the usage conditions or the installation environment.
Error	Signal strength error	This signal is output when the signal strength of the scale is excessive or too small and there is a possibility of abnormality in the output data.
	Absolute value detection error	It is output when absolute position cannot be detected.
	Absolute value combination error	It is output when an error occurs in the combination of absolute positions.
	Hardware error	It is output when abnormality occurs in self-diagnosis.
	Initialization error	It is output when an error cause occurs during initialization immediately after turning on the power.
	Overspeed error	It is output when the speed exceeding specification occurs.

4.5.2 Alarm Code Content

This section describes the alarm code, their causes and remedies for each company interface.

■ For models compatible with FANUC Corporation

The table below shows the relationship between the ABS AT1300 alarm and the alarm code displayed on the servo amplifier made by FANUC Corporation. Note that the alarm code differs between alarm code of NC device when using scale with fully closed control and when using scale with linear motor.

Servo alarm Alarm code	Description	Cause and Remedy
LED error <ul style="list-style-type: none"> • During fully closed connection => 380 • During linear motor => 365 	Scale error occurred <ul style="list-style-type: none"> • Hardware error 	<<Cause>> <ul style="list-style-type: none"> • The scale detected an error. <<Remedy>> <ul style="list-style-type: none"> • Turn on the power again. • If an error is detected again, it is necessary to replace the scale unit.
Phase error <ul style="list-style-type: none"> • During fully closed connection => 381 • During linear motor => 361 	Scale error occurred <ul style="list-style-type: none"> • Signal strength error • Signal intensity alarm • Absolute value detection error • Absolute value combination error • Initialization error • Overspeed error 	<<Cause>> <ul style="list-style-type: none"> • The scale detected an error. <<Remedy>> <ul style="list-style-type: none"> • Check the mechanical fixing state of the scale. • Check the power supplied to the scale (power ripple noise) and electrical noises. • If there is no defect in the mounting condition or the power-related state, the scale unit needs to be replaced.
Serial data Error <ul style="list-style-type: none"> • During fully closed connection => 385 • During linear motor => 368 	Communication error occurred <ul style="list-style-type: none"> • No response 	<<Cause>> <ul style="list-style-type: none"> • An error occurred in which data from the scale could not be received due to communication between the scale and the NC device. (No response) <<Remedy>> <ul style="list-style-type: none"> • Check the connections of cables and connectors. • Check the routing of the cable (influence of noise such as large current cable).
Data transfer error <ul style="list-style-type: none"> • During fully closed connection => 386 • During linear motor => 369 	Communication error occurred <ul style="list-style-type: none"> • Communication error 	<<Cause>> <ul style="list-style-type: none"> • A CRC error and a stop bit error occurred in the serial data from the scale in communication between the scale and the NC device. (Communication error) <<Remedy>> <ul style="list-style-type: none"> • Check the routing of the cable (influence of noise such as large current cable).

Servo alarm Alarm code	Description	Cause and Remedy
Hardware dis-connection alarm <ul style="list-style-type: none"> • During fully closed connection => 447 • During linear motor => 446 	Communication error occurred <ul style="list-style-type: none"> • Cable disconnection 	<<Cause>> <ul style="list-style-type: none"> • An error caused by cable disconnection occurred in communication between the scale and the NC device. <<Remedy>> <ul style="list-style-type: none"> • Check the connections of cables and connectors.

* The NC device alarm code is common to the α interface and α i interface of FANUC interface specification for position detection.

■ For models compatible with Mitsubishi Electric Corporation

The table below shows the relationship between the ABS AT1300 alarm and the alarm code displayed on the servo amplifier made by Mitsubishi Electric Corporation.

Servo alarm Alarm code	Description	Cause and Remedy
<ul style="list-style-type: none"> • AL2A 	Scale error occurred <ul style="list-style-type: none"> • Signal strength error • Absolute value detection error • Absolute value combination error • Hardware error • Initialization error • Overspeed error 	<<Cause>> <ul style="list-style-type: none"> • The scale detected an error. <<Remedy>> <ul style="list-style-type: none"> • Check the mechanical fixing state of the scale. • Check the power supplied to the scale (power ripple noise) and electrical noises. • If there is no defect in the mounting condition or the power-related state, the scale unit needs to be replaced.
<ul style="list-style-type: none"> • AL28 	Scale alarm occurred <ul style="list-style-type: none"> • Signal intensity alarm • Thermal alarm 	<<Cause>> <ul style="list-style-type: none"> • The scale detected a caution. The position data is correct; however, it is necessary to check the fixing state and the operating condition. <<Remedy>> <ul style="list-style-type: none"> • Check the mechanical fixing state of the scale. • Is the ambient temperature of the Detector over 60 °C? => In case of high temperature, it is necessary to review the operation conditions (speed, acceleration).

Servo alarm Alarm code	Description	Cause and Remedy
<ul style="list-style-type: none"> AL16 	<p>Communication error occurred (during servo amplifier initialization)</p> <ul style="list-style-type: none"> When an error is received consecutively three times on the servo amplifier side (including no response) 	<p><<Cause>></p> <ul style="list-style-type: none"> Communication error between scale and servo amplifier occurred. (Communication impossible from the time of turning on the servo amplifier) <p><<Remedy>></p> <ul style="list-style-type: none"> Check the connections of cables and connectors. Check the routing of the cable (influence of noise such as large current cable).
<ul style="list-style-type: none"> AL20 	<p>Communication error occurred (during servo amplifier control)</p> <ul style="list-style-type: none"> When an error is received consecutively three times on the servo amplifier side (including no response) 	<p><<Cause>></p> <ul style="list-style-type: none"> Communication error between scale and servo amplifier occurred. (Occurred while controlling by the servo amplifier) <p><<Remedy>></p> <ul style="list-style-type: none"> Check the connections of cables and connectors. Check the routing of the cable (influence of noise such as large current cable).

■ For models compatible with Panasonic Corporation

The table below shows the relationship between the ABS AT1300 alarm and the alarm code displayed on the servo amplifier made by Panasonic Corporation.

Servo alarm Alarm code	Description	Cause and Remedy
<ul style="list-style-type: none"> Err51.0 	<p>Scale error occurred</p> <ul style="list-style-type: none"> Overspeed error 	<p><<Cause>></p> <ul style="list-style-type: none"> The scale detected an overspeed error. <p><<Remedy>></p> <ul style="list-style-type: none"> Review the driving condition (command speed).
<ul style="list-style-type: none"> Err51.1 	<p>Scale alarm occurred</p> <ul style="list-style-type: none"> Initialization error 	<p><<Cause>></p> <ul style="list-style-type: none"> The scale detected an error during initialization. <p><<Remedy>></p> <ul style="list-style-type: none"> Check the mechanical fixing state of the scale. Check the power supplied to the scale (power ripple noise) and electrical noises. If there is no defect in the mounting condition or the power-related state, the scale unit needs to be replaced.
<ul style="list-style-type: none"> Err51.2 	<p>Scale error occurred</p> <ul style="list-style-type: none"> Hardware error 	<p><<Cause>></p> <ul style="list-style-type: none"> The scale detected an error. <p><<Remedy>></p> <ul style="list-style-type: none"> Turn on the power again. If an error is detected again, it is necessary to replace the scale unit.

4 Specifications

Servo alarm Alarm code	Description	Cause and Remedy
<ul style="list-style-type: none"> • Err51.3 	<p>Scale error occurred</p> <ul style="list-style-type: none"> • Absolute position detection error (inconsistent) 	<p><<Cause>></p> <ul style="list-style-type: none"> • The scale detected an error. <p><<Remedy>></p> <ul style="list-style-type: none"> • Check the mechanical fixing state of the scale. • Check the power supplied to the scale (power ripple noise) and electrical noises. • If there is no defect in the mounting condition or the power-related state, the scale unit needs to be replaced.
<ul style="list-style-type: none"> • Err51.4 	<p>Scale error occurred</p> <ul style="list-style-type: none"> • Absolute position detection error (detection stopped) 	<p><<Cause>></p> <ul style="list-style-type: none"> • The scale detected an error. <p><<Remedy>></p> <ul style="list-style-type: none"> • Check the mechanical fixing state of the scale. • Check the power supplied to the scale (power ripple noise) and electrical noises. • If there is no defect in the mounting condition or the power-related state, the scale unit needs to be replaced.
<ul style="list-style-type: none"> • Err51.5 	<p>Scale error occurred</p> <ul style="list-style-type: none"> • Signal intensity error 	<p><<Cause>></p> <ul style="list-style-type: none"> • The scale detected a caution. The position data is correct; however, it is necessary to check the fixing state and the operating condition. <p><<Remedy>></p> <ul style="list-style-type: none"> • Check the mechanical fixing state of the scale. • Check the power supplied to the scale (power ripple noise) and electrical noises. • If there is no defect in the mounting condition or the power-related state, the scale unit needs to be replaced.
<ul style="list-style-type: none"> • Err50.0 • Err50.1 	<p>Communication error occurred</p>	<p><<Cause>></p> <ul style="list-style-type: none"> • Communication error between scale and servo amplifier occurred. <p><<Remedy>></p> <ul style="list-style-type: none"> • Check the connections of cables and connectors. • Check the routing of the cable (influence of noise such as large current cable).

■ For models compatible with Yasukawa Corporation

The table below shows the relationship between the ABS AT1300 alarm and the alarm code displayed on the servo amplifier made by Yasukawa Electric Corporation.

Servo alarm Alarm code	Description	Cause and Remedy
<ul style="list-style-type: none"> • A.8A3 *1 • A.84U *2 	Scale error occurred <ul style="list-style-type: none"> • Signal intensity error • Absolute value detection error • Absolute value combination error • Initialization error 	<<Cause>> <ul style="list-style-type: none"> • The scale detected an error. <<Remedy>> <ul style="list-style-type: none"> • Check the mechanical fixing state of the scale. • Check the power supplied to the scale (power ripple noise) and electrical noises. • If there is no defect in the mounting condition or the power-related state, the scale unit needs to be replaced. .
<ul style="list-style-type: none"> • A.8A5 *1 • A.85U *2 	Scale error occurred <ul style="list-style-type: none"> • Overspeed error 	<<Cause>> <ul style="list-style-type: none"> • The scale detected an overspeed error. <<Remedy>> <ul style="list-style-type: none"> • Review the driving condition (command speed).
<ul style="list-style-type: none"> • A.8A6 *1 • A.860 *2 	Scale alarm occurred <ul style="list-style-type: none"> • Thermal alarm • Signal intensity alarm 	<<Cause>> <ul style="list-style-type: none"> • The scale detected a caution. The position data is correct; however, it is necessary to check the fixing state and the operating condition. <<Remedy>> <ul style="list-style-type: none"> • Check the mechanical fixing state of the scale. • Is the ambient temperature of the Detector over 60 °C? => In case of high temperature, it is necessary to review the operation conditions (speed, acceleration).
<ul style="list-style-type: none"> • A.8A1 *1 • A.891 *2 	Scale error occurred <ul style="list-style-type: none"> • Hardware error 	<<Cause>> <ul style="list-style-type: none"> • The scale detected an error. <<Remedy>> <ul style="list-style-type: none"> • The scale needs to be replaced.
<ul style="list-style-type: none"> • A.CF1 *1 • C90 *2 	Communication error occurred (during servo amplifier control)	<<Cause>> <ul style="list-style-type: none"> • Communication error between scale and servo amplifier occurred. (Occurred while controlling by the servo amplifier) <<Remedy>> <ul style="list-style-type: none"> • Check the connections of cables and connectors. • Check the routing of the cable (influence of noise such as large current cable).

*1 When using the scale with fully closed control

*2 When using scale with linear motor

4.6 Air Purging

There is a method to improve environmental resistance (coolant resistance, dust resistance) of assembly type linear scale by supplying clean compressed air into the scale main unit. Set up pipe to one of the M5 screw holes on both sides of the scale main unit and supply compressed air.

NOTICE
<ul style="list-style-type: none"> • Air supply is an auxiliary method for cleaning inside the scale main unit. • For air supply, mounting posture is important. Follow the instructions in this manual. • When supplying air, it is necessary to periodically replace the air filter due to the contamination of the air source. If you continue to use the dirty filter, dirt will enter the scale and cause trouble, so pay attention to this issue.

4.6.1 Input Air Specification

The table below shows the input air specification.
This specification corresponds to ISO8573-1 Class 1.4.1.

Items	Specifications
Maximum particle diameter (µm)	0.1
Lowest pressure dew point (°C)	+3
Oil concentration (mg/m ³)	0.01

4.6.2 Air Flow Supplied to the Scale

Supply air of 10 L/min–20 L/min per scale axis.
Air should slightly come out from the closed part of the dust-proof rubber lips.
Adjust the air flow referring to the table below.

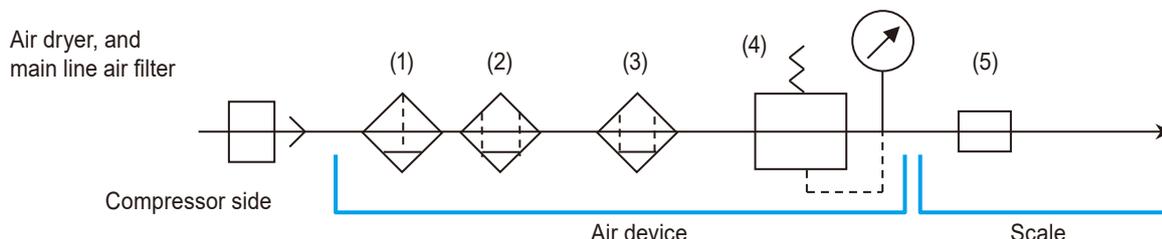
Conditions	Air flow rate		
Using Mitutoyo's fixed diaphragm (ID: ø0.9)	Make adjustment with the air pressure, so that the air flow becomes 10 L/min–20 L/min (per scale unit). Reference values when supplying air to one axis are as follows. <ul style="list-style-type: none"> • If air pressure is 0.1 MPa: approx. 12.7 L/min • If air pressure is 0.2 MPa: approx. 19 L/min 		
Using other fixed diaphragms	Make adjustment with the air pressure, so that the air flow becomes 10 L/min–20 L/min (per scale unit). For information on the air flow and pressure relationships, refer to the flow characteristics (ID of the fixed diaphragm and flow-pressure relations) provided by each pneumatic component manufacturer.		
Using flow rate adjustable valves	Make adjustment with the air pressure, so that the air flow becomes 10 L/min–20 L/min (per scale unit). <table border="1" style="margin-top: 10px;"> <tr> <td style="text-align: center;">NOTICE</td> </tr> <tr> <td>Make sure not to supply a large amount of air before making adjustments. Otherwise, it may cause components to break thereby resulting in malfunctions.</td> </tr> </table>	NOTICE	Make sure not to supply a large amount of air before making adjustments. Otherwise, it may cause components to break thereby resulting in malfunctions.
NOTICE			
Make sure not to supply a large amount of air before making adjustments. Otherwise, it may cause components to break thereby resulting in malfunctions.			

4.6.3 Air Supply Unit

The specifications for recommended air devices and the manufacturer models are described in the following.

If the specifications are the same, you can use air equipment made by another company.

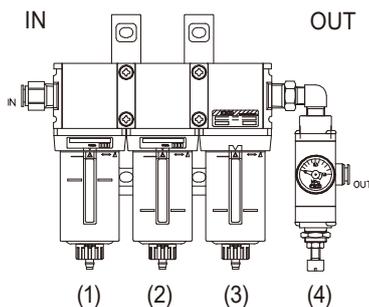
Estimated time of element replacement for each filter is one year.



No.	Component	Appearance	Specifications	Part No.	
				Part No. (Mitutoyo)	Manufacturer Model
(1)	Air filter		<ul style="list-style-type: none"> Fluid: Compressed air Maximum operating pressure: 1.0 MPa Proof pressure: 1.5 MPa Maximum particle diameter (filtration): 5 μm Secondary oil concentration: - 	-	F1000-8-W (CKD)
(2)	Oil mist filter		<ul style="list-style-type: none"> Fluid: Compressed air Maximum operating pressure: 1.0 MPa Proof pressure: 1.5 MPa Maximum particle diameter (filtration): 0.01 μm Secondary oil concentration: 0.01 mg/m³ or below Element replacement: one year (6000 hours) or when pressure is lowered to 0.1 MPa or lower 	-	M1000-8-W (CKD)
(3)	High performance oil mist filter		<ul style="list-style-type: none"> Fluid: Compressed air Maximum operating pressure: 1.0 MPa Proof pressure: 1.5 MPa Maximum particle diameter (filtration): 0.01 μm Secondary oil concentration: 0.001 mg/m³ or below Element replacement: one year (6000 hours) or when pressure is lowered to 0.1 MPa or lower 	-	MX1000-8-W (CKD)

4 Specifications

(4)	Regulator		<ul style="list-style-type: none"> • Fluid: Compressed air • Maximum operating pressure: 1.0 MPa • Proof pressure: 1.5 MPa • Set pressure range: 0.1 MPa–0.7 MPa • Oil proof treatment type 	-	-
(5)	Fixed dia- phragm		<ul style="list-style-type: none"> • Fluid: Air • Set pressure range: 0.1 MPa–0.9 MPa • Screw tightening torque: 1.0 N·m–1.5 N·m • Flow rate at pressure 0.1 MPa: Approx. 12.7 L/min (per axis) • Flow rate at pressure 0.2 MPa: Approx. 19 L/min (per axis) 	06ACJ155	PC6-M5M-0.9 (Pisco custom order)
(1) to (4)	Air unit	See the next figure.	<p>Equivalent to ISO-8573-1 Class 1.4.1</p> <ul style="list-style-type: none"> • Maximum particle diameter (filtration): 0.01 μm • Lowest pressure dew point: - • Oil concentration (oil mist concentration): 0.001 mg/m³ or less • Flow rate at pressure 0.1 MPa: 12.7 L/min (per axis) • Insertable flow rate (maximum): 75 L/min • When to replace each element: 1 year 	-	-



- (1) Air filter
- (2) Oil mist filter
- (3) High performance oil mist filter
- (4) Regulator

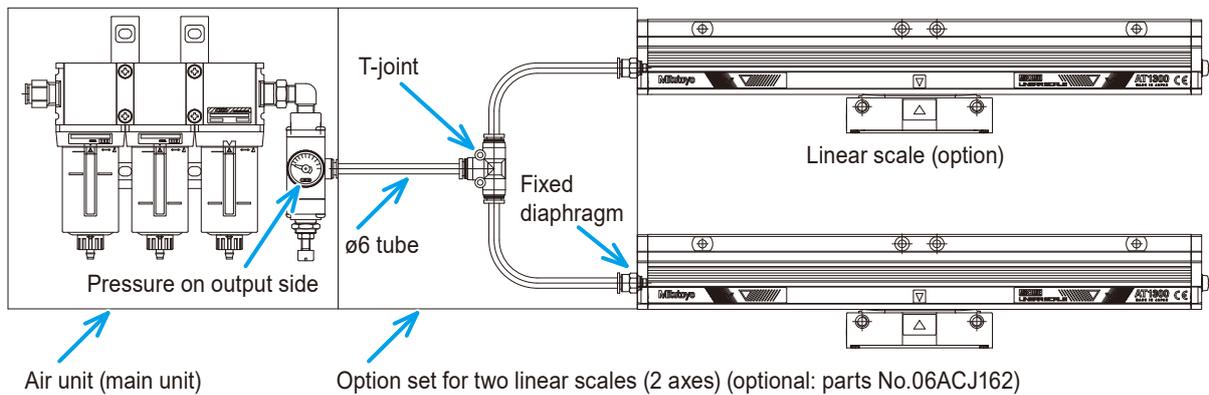
Appearance of air unit

4.6.4 Connection Method

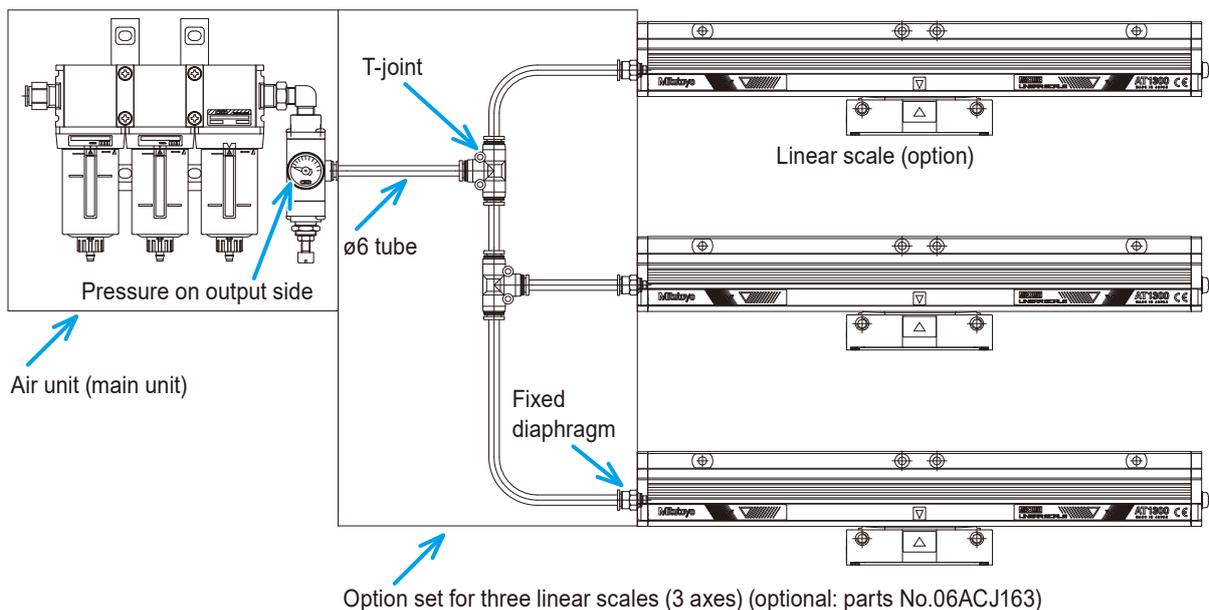
Do not directly supply air from the compressor to the air unit. Make sure to use dry compressed air through the air dryer or main line air filter.

Attach the fixed diaphragm to the scale side.

■ When supplying air to two linear scales (2 axes)



■ When supplying air to three linear scales (3 axes)



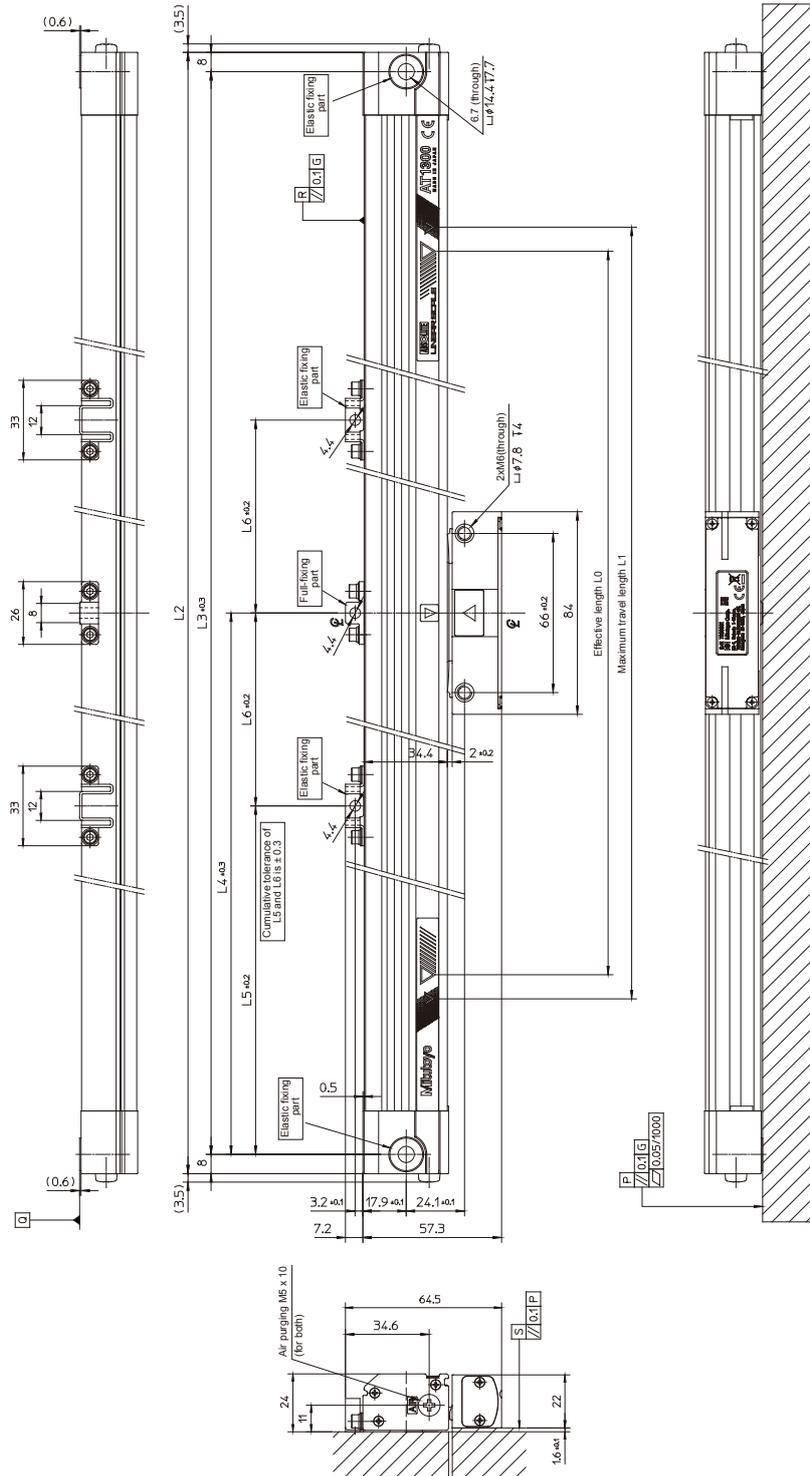
Tips

- For each air unit, air can be supplied up to five axes.
- You can connect up to four to five axes by combining option sets for two axes (No.06ACJ162) and three axes (No.06ACJ163).
A ø6 air tube (length: 20 m) is included in each option set.
- An estimate of the element replacement period for parts No.06ACJ159, 06ACJ160, 06ACJ161 is one year. The time of replacement differs according to the operating conditions.
- For information on maintenance, refer to the manual supplied with the unit.

4.7 External View and Dimensional Drawings of the Scale Main Unit

4.7.1 ABS AT1300-H (High Precision Specification)

■ Dimensional drawings



4 Specifications

Tips

- G represents the machine guide.
- P represents the opposite side of the scale main unit. Also, S represents the opposite side of the Detector mounting surface.
- Q and R represent the linear scale's reference surfaces for mounting.
- For descriptions L_0 to L_6 in the figure, refer to the next section.

■ Dimensional Drawings

Unit: mm

Effective length L_0	Maximum travel distance L_1	Full length L_2	Mounting pitch L_3	L_4	L_5	L_6
100	120	265	249	124.5		
150	170	315	299	149.5		
200	220	365	349	174.5		
250	270	415	399	199.5		
300	320	465	449	224.5		
350	370	515	499	249.5		
400	420	565	549	274.5		
450	470	615	599	299.5		
500	520	665	649	324.5		
600	620	765	749	(374.5)		
700	720	865	849	(424.5)	224.5	200
750	770	915	899	(449.5)	224.5	225
800	820	965	949	(474.5)	244.5	230
900	920	1065	1049	(524.5)	264.5	260
1000	1020	1165	1149	(574.5)	284.5	290

4 Specifications

NOTICE

- G represents the machine guide.
- P represents the opposite side of the scale main unit. Also, S represents the opposite side of the Detector mounting surface.
- Q and R represent the linear scale unit's reference surfaces for mounting.
- For descriptions of L0 to L5, P, and n in the figure, refer to the next section.

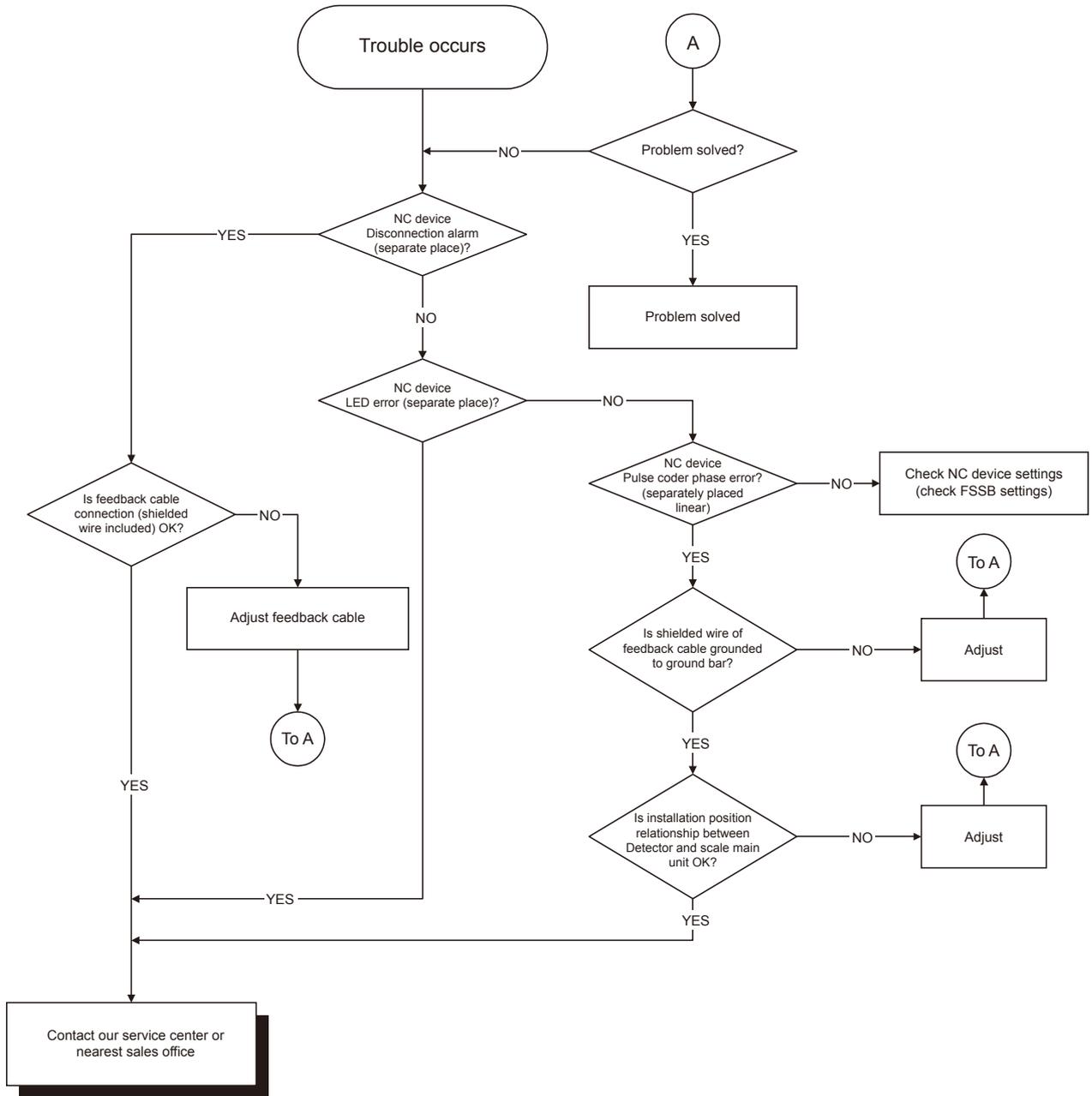
■ Dimensional drawings table

Unit of L0 to L5 and P: mm

Effective length L_0	Maximum travel distance L_1	Full length L_2	L_3	L_4	L_5	P	n
100	120	225	112.5	37.5	150	75	2
200	220	325	162.5	37.5	250	125	2
300	320	425	212.5	37.5	350	175	2
400	420	525	262.5	62.5	400	200	2
500	520	625	312.5	62.5	500	125	4
600	620	725	362.5	62.5	600	150	4
700	720	825	412.5	62.5	700	175	4
800	820	925	462.5	62.5	800	200	4
900	920	1025	512.5	62.5	900	150	6
1000	1020	1125	562.5	37.5	1050	175	6
1100	1120	1225	612.5	87.5	1050	175	6
1200	1220	1325	616.5	62.5	1200	200	6
1300	1320	1425	712.5	112.5	1200	150	8
1400	1420	1525	762.5	62.5	1400	175	8
1500	1520	1625	812.5	112.5	1400	175	8
1600	1620	1725	862.5	62.5	1600	200	8
1800	1820	1925	962.5	87.5	1750	175	10
2000	2020	2125	1062.5	62.5	2000	200	10
2200	2220	2325	1162.5	112.5	2100	175	12

5 Troubleshooting

This chapter describes how to check for the reasons why problems occur when initially powering on, or for when alarms are generated during operation.



Tips

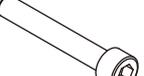
We provide software which makes it possible for the user to initially judge failure/error of this product. For details, contact a Mitutoyo sales office/service center.

MEMO

6 Appendix

6.1 Quantity of the Supplied Accessories for Installation

6.1.1 ABS AT1300-H (High Precision Specification)

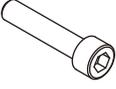
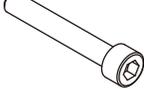
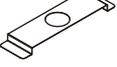
Effective length	Hex socket head cap screw M4 x 10 	Hex socket head cap screw M4 x 16 	Spring washer, nominal 4 	Hex socket head cap screw M4 x 25 	Hex socket head cap screw M6 x 25 	Spring washer, nominal 6 
100	2	1	3	2	2	2
150	2	1	3	2	2	2
200	2	1	3	2	2	2
250	2	1	3	2	2	2
300	2	1	3	2	2	2
350	2	1	3	2	2	2
400	2	1	3	2	2	2
450	2	1	3	2	2	2
500	2	1	3	2	2	2
600	2	1	3	2	2	2
700	2	1	3	2	2	2
750	2	1	3	2	2	2
800	2	1	3	2	2	2
900	2	1	3	2	2	2
1000	2	1	3	2	2	2

Details of usage quantities are as follows:

 "■ ABS AT1300-H (high precision specification)" in "3.2.2 Mounting the Scale Main Unit's" (page 28)

 "3.3.1 Installing the Detector" (page 34)

6.1.2 ABS AT1300-S (High Rigidity Specification)

Effective length	Hex socket head cap screw M4 x 16 	Hex socket head cap screw M4 x 25 	Spring washer, nominal 4 Small round 	Plain washer, nominal 4 Small round 	Dedicated leaf spring 
100	4	8	12	12	6
200	4	8	12	12	6
300	4	8	12	12	6
400	4	8	12	12	6
500	4	8	12	12	6
600	4	8	12	12	6
700	4	8	12	12	6
800	4	8	12	12	6
900	4	8	12	12	6
1000	4	8	12	12	6
1100	4	8	12	12	6
1200	4	8	12	12	6
1300	4	14	18	18	12
1400	4	14	18	18	12
1500	4	14	18	18	12
1600	4	14	18	18	12
1800	4	14	18	18	12
2000	4	14	18	18	12
2200	4	14	18	18	12

Details of usage quantities are as follows:

 "■ ABS AT1300-S (high rigidity specification)" in "3.2.2 Mounting the Scale Main Unit's" (page 31)

 "3.3.1 Installing the Detector" (page 34)

SERVICE NETWORK

*As of May 2025

Europe

Mitutoyo Europe GmbH

Borsigstrasse 8-10, 41469 Neuss, GERMANY
TEL: 49 (0)2137 102-0 FAX: 49 (0)2137 102-351

Mitutoyo CTL Germany GmbH

Von-Gunzert-Strasse 17, 78727 Oberndorf, GERMANY
TEL: 49 (0)7423 8776-0 FAX: 49 (0)7423 8776-99

KOMEG Industrielle Messtechnik GmbH

Zum Wasserwerk 3, 66333 Völklingen, GERMANY
TEL: 49 (0)6898 91110 FAX: 49 (0)6898 911100

Germany

Mitutoyo Deutschland GmbH

Borsigstrasse 8-10, 41469 Neuss, GERMANY
TEL: 49 (0)2137 102-0 FAX: 49 (0)2137 86 85

M³ Solution Center Hamburg

Tempowerkring 9-im HIT-Technologiepark 21079
Hamburg, GERMANY
TEL: 49 (0)40 791894-0 FAX: 49 (0)40 791894-50

M³ Solution Center Berlin

Ernst-Lau-Straße 6, 12489 Berlin, GERMANY
TEL:49(0)30 2611 267 FAX: 49 30 67988729

M³ Solution Center Eisenach

Neue Wiese 4, 99817 Eisenach,GERMANY
TEL: 49 (0)3691 88909-0 FAX: 49 (0)3691 88909-9

M³ Solution Center Ingolstadt

Marie-Curie-Strasse 1A, 85055 Ingolstadt, GERMANY
TEL: 49 (0)841 954920 FAX: 49 (0)841 9549250

M³ Solution Center Leonberg

Am Längenbühl 3, 71229 Leonberg, GERMANY
TEL: 49 (0)7152 6080-0 FAX: 49 (0)7152 608060

Mitutoyo Deutschland GmbH - Small Tool Sales Division

Am Längenbühl 4, 71229 Leonberg, GERMANY
TEL: 49 (0)7152 9237-0 FAX: 49 (0)7152 9237-29

U.K.

Mitutoyo (UK) Ltd. HQ

Joule Road, West Point Business Park,
Andover, Hampshire SP10 3UX, UNITED KINGDOM
TEL: 44 (0)1264 353123 FAX: 44 (0)1264 354883

Coventry M³ Solution Centre

Unit6, Banner Park, Wickmans Drive, Coventry,
West Midlands CV4 9XA, UNITED KINGDOM
TEL: 44 (0)2476 426300

Halifax M³ Solution Centre

Lowfields Business Park, Navigation Close, Elland,
West Yorkshire HX5 9HB, UNITED KINGDOM
TEL: 44 (0)1422 375566

East Kilbride M³ Solution Centre

The Bairds Building, Rankine Avenue, Scottish
Enterprise Technology Park, East Kilbride G75
0QF, UNITED KINGDOM
TEL: 44 (0)1355 581170

France

Mitutoyo France

Paris Nord 2-123 rue de la Belle Etoile, BP 59267
ROISSY EN FRANCE 95957 ROISSY CDG
CEDEX, FRANCE
TEL: 33 (0)149 38 35 00

M³ Solution Center LYON

Parc Mail 523, cours du 3ème millénaire, 69791
Saint-Priest, FRANCE
TEL: 33 (0)149 38 35 70

M³ Solution Center STRASBOURG

Parc de la porte Sud, Rue du pont du péage,
67118 Geispolsheim, FRANCE
TEL: 33 (0)149 38 35 80

M³ Solution Center CLUSES

290 Avenue des Lacs, 74950 Scionzier,
FRANCE
TEL: 33 (0)1 49 38 35 90

M³ Solution Center TOULOUSE

Aeroparc Saint Martin Cellule B08 ZAC de Saint
Martin du Touch 12 rue de Caulet 31300
Toulouse, FRANCE
TEL: 33 (0)1 49 38 42 90

M³ Solution Center RENNES

2, rue Claude Chappe, PA le Vallon - ZAC
Mivoie, 35230 Noyal-Châtillon-sur-Seiche,
FRANCE
TEL: 33 (0)1 49 38 42 10

Italy

Mitutoyo Italiana S.r.l.

Corso Europa, 7 - 20045 Lainate (MI), ITALY
TEL: 39 02 935781 FAX: 39 02 93578255

M³ Solution Center BOLOGNA

Via Stalingrado 67/22D 40128 Bologna, ITALY
TEL: 39 02 93578215

M³ Solution Center CHIETI

Contrada Santa Calcagna - 66020 Rocca S. Giovanni (CH), ITALY
TEL: 39 02 93578280 FAX: 39 02 93578255

M³ Solution Center PADOVA

Via G. Galilei 21/F - 35035 Mestrino (PD), ITALY
TEL: 39 02 93578268 FAX: 39 02 93578255

Netherlands

Mitutoyo Nederland B.V.

Storkstraat 30, 3905 KX Veenendaal,
THE NETHERLANDS
TEL: 31(0)318-534911

Mitutoyo Nederland B.V. / M³ Solution Center Enschede

Institutenweg 50, 7521 PK Enschede,
THE NETHERLANDS
TEL: 31(0)318-534911

Mitutoyo Nederland B.V. / M³ Solution Center Eindhoven

De Run 1115, 5503 LB Veldhoven,
THE NETHERLANDS
TEL: 31(0)318-534911

Mitutoyo Research Center Europe B.V.

De Rijn 18, 5684 PJ Best, THE NETHERLANDS
TEL:31(0)499-320200 FAX:31(0)499-320299

Belgium

Mitutoyo Belgium N.V. / M³ Solution Center Melsele

Schaarbeekstraat 20, B-9120 Melsele, BELGIUM
TEL: 32 (0)3-2540444

Sweden

Mitutoyo Scandinavia AB

Släntvägen 6, 194 61 Upplands Väsby, SWEDEN
TEL: 46 (0)8 594 109 50

Mitutoyo Scandinavia AB / M³ Solution Center Alingsås

Ängsvaktaregatan 3A, 441 38 Alingsås, SWEDEN
TEL: 46 (0)8 594 109 50

Mitutoyo Scandinavia AB / M³ Solution Center Värnamo

Kalkstensvägen 7, 331 44 Värnamo, SWEDEN
TEL: 46 (0)8 594 109 50

Switzerland

Mitutoyo (Schweiz) AG

Steinackerstrasse 35, 8902 Urdorf, SWITZERLAND
TEL: 41 (0)447361150

Mitutoyo (Suisse) SA

Rue Galilée 4, 1400 Yverdon-les Bains, SWITZERLAND
TEL: 41 (0)244259422

Poland

Mitutoyo Polska Sp.z o.o.

Skrzypowa 1, 54-530 Wrocław, POLAND
TEL: 48 (0)71354 83 50 FAX: 48 (0)71354 83 55

Czech Republic

Mitutoyo Česko s.r.o.

Dubská 1626, 415 01 Teplice, CZECH REPUBLIC
TEL: 420 417-514-011 Email: info@mitutoyo.cz

Mitutoyo Česko s.r.o. M³ Solution Center Ivančice

Ke Karlovu 62/10, 664 91 Ivančice, CZECH REPUBLIC
TEL: 420 417-514-011 Email: info@mitutoyo.cz

Mitutoyo Česko s.r.o. M³ Solution Center Ostrava Mošnov

Mošnov 314, 742 51 Mošnov, CZECH REPUBLIC
TEL: 420 417-514-050 Email: info@mitutoyo.cz

Mitutoyo Česko s.r.o. Slovakia Branch

Šoltésovej 346/1, 017 01 Považská Bystrica,
SLOVAKIA
TEL: 421 948-595-590 Email: info@mitutoyo.sk

Hungary

Mitutoyo Hungária Kft.

Galamb József utca 9, 2000 Szentendre, HUNGARY
TEL: 36 (30) 6410210

Romania

Mitutoyo Romania SRL

1A Drumul Garii Odai Street, showroom, Ground Floor, 075100 OTOPENI-ILFOV, ROMANIA
TEL: 40 (0)311012088 FAX: +40 (0)311012089

Showroom in Brasov

Strada Ionescu Crum Nr.1, Brasov Business Park Turnul 1, Mezanin, 500446 Brasov-Judetul Brasov, ROMANIA
TEL/FAX: 40 (0)371020017

Finland**Mitutoyo Scandinavia AB Finnish Branch**

Autokeskuksentie 16B, 33960 Pirkkala, FINLAND

TEL: 358 (0)40 355 8498

Austria**Mitutoyo Austria GmbH**

Salzburger Straße 260/2 und 260/3, 4600 Wels, AUSTRIA

TEL: 43 (0)7242 219 998

Mitutoyo Austria GmbH Goetzis Regional showroom

Lastenstrasse 48a, 6840 Götzis, AUSTRIA

Singapore**Mitutoyo Asia Pacific Pte. Ltd.****Head office / M³ Solution Center**

24 Kallang Avenue, Mitutoyo Building, SINGAPORE 339415

TEL:(65)62942211 FAX:(65)62996666

Malaysia**Mitutoyo (Malaysia) Sdn. Bhd.****Kuala Lumpur Head Office / M³ Solution Center**

Mah Sing Integrated Industrial Park, 4, Jalan Utarid U5/14, Section U5, 40150 Shah Alam, Selangor, MALAYSIA

TEL:(60)3-78459318 FAX:(60)3-78459346

Penang Branch office / M³ Solution Center

30, Persiaran Mahsuri 1/2, Sunway Tunas, 11900 Bayan Lepas, Penang, MALAYSIA

TEL:(60)4-6411998 FAX:(60)4-6412998

Johor Branch office / M³ Solution Center

70 (Ground Floor), Jalan Molek 1/28, Taman Molek, 81100 Johor Bahru, Johor, MALAYSIA

TEL:(60)7-3521626 FAX:(60)7-3521628

Thailand**Mitutoyo (Thailand) Co., Ltd.****Bangkok Head Office / M³ Solution Center**

2327 Onnut Road Kwaeng Onnut Khet Suanluang Bangkok 10250, THAILAND

TEL:(66)2080 3500

Chonburi Branch / M³ Solution Center

7/1, Moo 3, Tambon Bowin, Amphur Sriracha, Chonburi 20230, THAILAND

TEL:(66)2080 3563 FAX:(66)3834 5788

ACC Branch / M³ Solution Center

122/8, 122/9, Moo 6, Tambon Donhuaroh, Amphur Muangchonburi, Chonburi 20000, THAILAND

TEL:(66)2080 3565

Indonesia**PT. Mitutoyo Indonesia****Head Office / M³ Solution Center**

Jalan Sriwijaya No.26 Desa cibatu Kec. Cikarang Selatan Kab. Bekasi 17530, INDONESIA

TEL: (62)21-2962 8600 FAX: (62)21-2962 8604

Batam Branch Office

Business Center Adhya Building 3rd Floor Kompleks Permata Niaga Blok A No. 1, Jalan jendral Sudirman Kelurahan Sukajadi, Kecamatan Batam Kota, Kepulauan Riau 29444, INDONESIA

TEL: (62)-778-4888000

Vietnam**Mitutoyo Vietnam Co., Ltd****Hanoi Head Office / M³ Solution Center**

1st & 2nd floor, MHDI Building, No. 60 Hoang Quoc Viet Road, Nghia Do Ward, Cau Giay District, Hanoi, VIETNAM

TEL:(84)24-3768-8963 FAX:(84)24-3768-8960

Ho Chi Minh City Branch Office / M³ Solution Center

Unit No. B-00.07, Ground Floor, C1 Building, No. 6, Street D9, An Loi Dong Ward, Thu Duc City, Ho Chi Minh City, VIETNAM

TEL:(84)28-3840-3489 FAX:(84)28-3840-3498

Hai Phong City Branch Office

Room 511, 5th Floor, Thanh Dat 3 Building, No. 4 Le Thanh Tong Street, May To Ward, Ngo Quyen District, Hai Phong City, VIETNAM

TEL:(84)22-5398-9909

Philippines**Mitutoyo Philippines, Inc.****Head Office / M³ Solution Center**

Unit 1B & 2B LTI, Administration Building 1, Annex 1, North Main Avenue, Laguna Technopark, Binan Laguna 4024, PHILIPPINES

TEL/FAX:(63) 49 544 0272

India**Mitutoyo South Asia Pvt. Ltd. Head Office**

C-122, Okhla Industrial Area, Phase-I, New Delhi-110 020, INDIA

TEL: (91) 11-40578485/86

MSA Technical Center

Plot no. 65, Ground Floor, Udyog Vihar, Phase-4 Gurgaon, Haryana - 122016, INDIA

TEL : (91) 124-2340286/287

Mumbai Region Head office

303, Sentinel Hiranandani Business Park Powai,
Mumbai-400 076, INDIA

TEL: (91) 22-25700684/685/837/839

Pune Office / M³ Solution Center

G4/G5, Pride Kumar Senate, Off. Senapati Bapat
Road, Pune-411 016, INDIA

TEL:(91) 20-25660043/44/45

Ahmedabad Office / M³ Solution Center

A-104 & A-105, First Floor, Solitaire Corporate
Park, Near Divya Bhaskar Press, S.G. Road,
Ahmedabad - 380 015, INDIA

TEL: (91) 079 - 29704902/903

Bengaluru Region Head office / M³ Solution Center

116/117-2, Ground Floor, Sy. No. 93 & 94, 3rd
Phase, Peenya Industrial Area, Bengaluru-560
058, INDIA

TEL: (91) 80-25630946/47/48/49

Coimbatore Office

Regus, Srivari Srimath, 3rd Floor, Door No:1045,
Avinashi Road, Coimbatore - 641 018,INDIA

TEL: (91) 9345005663

Chennai Office / M³ Solution Center

No. 624, Anna Salai Teynampet, Chennai-600 018, INDIA

TEL: (91) 44-24328823/24/25

Kolkata Office

Unit No. 1208,Om Tower, 32,J.L.Nehru Road,
Kolkata-700 071, INDIA

TEL: (91) 33-22267088/40060635/22266817

Taiwan**Mitutoyo Taiwan Co., Ltd. / M³ Solution Center Taipei**

4F., No.71, Zhouzi St., Neihu Dist.,Taipei City 114,
TAIWAN

TEL:886(2)5573-5900 FAX:886(2)8752-3267

Taichung Branch / M³ Solution Center Taichung

1F., No. 299, Gaotie 1st Rd., Wuri Dist., Taichung
City 414, TAIWAN

TEL:886(4)2338-6822 FAX:886(4)2338-6722

Kaohsiung Branch / M³ Solution Center Kaohsiung

1F., No.31-1, Haibian Rd., Lingya Dist.,
Kaohsiung City 802, TAIWAN

TEL:886(7)334-6168 FAX:886(7)334-6160

South Korea**Mitutoyo Korea Corporation****Head Office / M³ Solution Center**

33, Eungyejungang-ro 306beon-gil, Siheung-si,
Gyeonggi-do, 15120 KOREA

TEL:82(31)361-4200 FAX:82(31)361-4201

Busan Office / M³ Solution Center

(3150-3, Daejeo 2-dong) 8,Yutongdanji 1-ro
49beon-gil, Gangseo-gu, Busan, 46721 KOREA

TEL:82(51)324-0103 FAX:82(51)324-0104

Daegu Office / M³ Solution Center

(Galsan-dong, Daegu Business Center), 301-Ho, 217,
Seongseogongdan-ro, Dalseo-gu, Daegu 42704 KOREA

TEL:82(53)593-5602 FAX:82(53)593-5603

China**Mitutoyo Measuring Instruments (Shanghai) Co., Ltd.**

18/F, NEW BUND Shun Tak Center, No.18, Lane
666, West Haiyang Road, Pudong New District,
Shanghai 200124, CHINA

TEL:86(21)5836-0718 FAX:86(21)5836-0717

Suzhou Office / M³ Solution Center China (Suzhou)

1/2 Floor, Building 4, No.175 Songbei Road,
Suzhou Free Trade Zone, Suzhou City, Jiangsu
215000, CHINA

TEL:86(512)6522-1790 FAX:86(512)6251-3420

Wuhan Office / M³ Solution Corner

Room 1701, Wuhan Wanda Center, No. 96,
Linjiang Road, Wuchang District, Wuhan
Hubei 430060, CHINA

TEL:86(27)8544-8631 FAX:86(27)8544-6227

Chengdu Office

Room 1-102, 1st Floor, Unit 1, Building 1, No. 24,
Wannian Road (Wanniancang Cool), Chenghua
District, Chengdu City, Sichuan 610056, CHINA

TEL:86(28)8671-8936 FAX:86(28)8671-9086

Hangzhou Office

Room 329, 3F, Building D, West Square of
Hangzhoudong Railway Station, No. 260 Xin-
feng Road, Shangcheng District, Hangzhou City,
Zhejiang 310002, CHINA

TEL: 86(571)8288-0319 FAX: 86(571)8288-0320

Tianjin Office / M³ Solution Center China (Tianjin)

Room D 12/F, TEDA Building, No.256 Jie-fang
Nan Road Hexi District,Tianjin 300042, CHINA

TEL:86(22)5888-1700 FAX:86(22)5888-1701

Changchun Office

Room 815, 8F, Building A1, Upper East
International No.3000 Dongsheng Street,
Erdao District, Changchun, Jilin, 130031, CHINA

TEL:86(431)8192-6998 FAX:86(431)8192-6998

Chongqing Office

Room 1312, Building 3, Zhongyu Plaza, No.86,
Hongjin Avenue,Longxi Street, Yubei District,
Chongqing, 400000, CHINA

TEL:86(23)6595-9950 FAX:86(23)6595-9950

Qingdao Office

Room 638, 6F, No.192 Zhengyang Road, Chengyang District, Qingdao, Shandong, 266109, CHINA
TEL:86(532)8096-1936 FAX:86(532)8096-1937

Xi'an Office

Room 1503 Jianke Building, No.99 Yanta Road, Beilin District, Xi'an City, Shaanxi 710054, CHINA
TEL:86(29)8538-1380 FAX:86(29)8538-1381

Dalian Office / M³ Solution Center China (Dalian)

Room A-106 Shuijing SOHO, No.16 Harbin Road, Economic Development Zone, Dalian, 116600 CHINA
TEL:86(411)8718 1212 FAX:86(411)8754-7587

Zhengzhou Office

Room 5003, 50th Floor, South Tower of Greenland Centre, No.36 Yulin North Road, Zhengdong New District, Zhengzhou, Henan, 450000, CHINA
TEL:86(371)6097-6436 FAX:86(371)6097-6981

Dongguan Office / M³ Solution Center China (Dongguan)

Room 801, No 65, Chang'an Section Guanchang Road, Chang'an Town, Dongguan City, Guangdong 523841, CHINA
TEL:86(769)8541 7715 FAX:86(769)-8541 7745

Fuzhou Office

Unit 03, 7th floor of East Tower, Sansheng International Center, No.118 Wusi Road, Gulou District, Fuzhou City, Fujian 350001, CHINA
TEL: 86 (591) 8761 8095
FAX: 86 (591) 8761 8096

Changsha Office

Room 2207, Building 1, Shiner International Plaza, No. 88, Kaiyuan Middle Road, Changsha City, Hunan 410100, CHINA
TEL: 86 (731) 8401 9276
FAX: 86 (731) 8401 9376

Changzhou Office

Room 1502, Joint Financial Tower, No.255, Tongjiang North Road, Tianning District, Changzhou City, Jiangsu 2130002, CHINA
TEL:86(519)8815 8319 FAX:86(519)8815 8319

Wenzhou Office

Room 512, Building 4, Xinjingdujiayuan, Sanyang Street, Ouhai District, Wenzhou City, Zhejiang 325014, CHINA
TEL:86(577)8641 5280

Shunde Office

Room 1603, Building 26, Vanke Golden Riverside Plaza Phase II, No.13 Mid DeSheng Road, Shunde District, Foshan City, Guangdong 528300, CHINA
TEL/FAX: 86(757)2228 8621

Hefei Office

UnitB3111-1, 1F, Block B3, Huliabaodi Huiyuan, Heping Road, Yaohai District, Hefei City, Anhui 230001, CHINA
TEL: 86(551)6560 1006

Mitutoyo Measuring Technology (Suzhou) Co., Ltd.

1/2 Floor, Building 4, No.175 Songbei Road, Suzhou Free Trade Zone, Suzhou City, Jiangsu 215000, CHINA
TEL:86(512)6252-2660 FAX:86(512)6252-2580

USA**Mitutoyo America Corporation**

965 Corporate Blvd., Aurora, IL 60502, U.S.A.
TEL:1-(630)820-9666 Toll Free No. 1-888-648-8869
FAX:1-(630)978-3501

Headquarters (Aurora) / M³ Solution Center

965 Corporate Blvd., Aurora, IL 60502, U.S.A.

Seattle (Renton) Office / M³ Solution Center

1000 SW 34th St. Suite G, Renton, WA 98057 U.S.A.
TEL:1-(888)-648-8869

Houston Office / M³ Solution Center

4560 Kendrick Plaza Drive Suite 120 Houston, TX 77032, U.S.A.
TEL:1-(888)-648-8869 FAX:1-(281)227-0937

Cincinnati (Mason) Office / M³ Solution Center

6220 Hi-Tek Ct., Mason, OH 45040, U.S.A.
TEL:1-(888)-648-8869 FAX:1-(513)754-0718

Detroit (Novi) Office / M³ Solution Center

46850 Magellan Drive, Suite 100 Novi, MI 48377, U.S.A.
TEL:1-(888)-648-8869 FAX: 1-(248)-926-0928

Los Angeles (City of Industry) Office / M³ Solution Center

16925 E. Gale Ave., City of Industry, CA 91745, U.S.A.
TEL:1-(888)-648-8869 FAX:1-(626)369-3352

Charlotte (Huntersville) Office / M³ Solution Center

11515 Vanstory Dr., Suite 140, Huntersville, NC 28078, U.S.A.
TEL:1-(888)-648-8869 FAX:1-(704)875-9273

Boston (Marlborough) Office / M³ Solution Center

753 Forest Street, Suite 110, Marlborough, MA 01752, U.S.A.
TEL:1-(888)648-8869 FAX:1-(508)485-0782

West Chester (Ohio) / Metrology Service Center

8876 Beckett road, West Chester, OH 45069, USA

TEL:1-(888)-648-8869

Mitutoyo America Corporation Calibration Lab

965 Corporate Blvd., Aurora, IL 60502, U.S.A.

TEL:1-(888)-648-8869 FAX:1-(630)978-6477

Mitutoyo America Corporation CT-Lab Chicago

965 Corporate Blvd., Aurora, IL 60502, U.S.A.

TEL: 1-(888)-648-8869 FAX: 1-(630)-820-3418

Mitutoyo Research & Development America, Inc.

11533 NE 118th St., Kirkland, WA 98034-7111, U.S.A.

TEL:1-(425)821-3906 FAX:1-(425)821-32280

Mitutoyo Research & Development America, Inc. - California Office

16925 Gale Ave. City of Industry, CA 91745-1806 U.S.A.

TEL: 1-(425)821-3906 FAX: 1-(425)821-3228

Canada

Mitutoyo Canada Inc.

2121 Meadowvale Blvd., Mississauga, Ont. L5N 5N1., CANADA

TEL:1-(905)821-1261 FAX:1-(905)821-4968

Montreal Office

7075 Place Robert-Joncas Suite 129, Montreal, Quebec H4M 2Z2, CANADA

TEL:1-(514)337-5994 FAX:1-(514)337-4498

Brazil

Mitutoyo Sul Americana Ltda.

Head office / M³ Solution Center

Avenida Mimes nº 25 – Loteamento Multivias II, Jardim Ermida I, CEP 13212-216 Jundiaí - SP, BRASIL

TEL: 55 (11) 5643-0004/0041

Filial Curitiba / M³ Solution Center

Rua Sergipe, nº 101, Sala A, Bairro Boneca do Iguaçú, São José dos Pinhais – Paraná – BRASIL CEP 83040120

TEL: 55 (41) 3534-1728

Filial Joinville / M³ Solution Center

Rua Sorocaba, No.265, Bairro Floresta, Joinville, Santa Catarina, BRASIL, CEP 89212-210

TEL: 55 (47) 3025-8062

Filial Porto Alegre / M³ Solution Center

Rua Emilio Boeckel nº 325, Bairro: Flao, São Leopoldo - RS, BRASIL CEP 93020-600

TEL: 55 (51) 3037-9383

Argentina

Mitutoyo Sul Americana Ltda.

Argentina Branch / M³ Solution Center

AV. MITRE 1249 Piso. PB– FLORIDA – BUENOS AIRES ARGENTINA

TEL:54 (11) 4730-1433 FAX:54 (11) 4730-1411

Mexico

Mitutoyo Mexicana, S.A. de C.V.

Industria Eléctrica No.15, Parque Industrial, Nautcalpan de Juárez, Estado de México C.P.53370, MÉXICO

TEL: 52 (01-55) 5312-5612

FAX: 52 (01-55) 5312-3380

Monterrey Office / M³ Solution Center

Blv. Interamericana No. 103, Parque Industrial FINSA, C.P. 66636 Apodaca, N.L., MÉXICO

TEL: 52(01-81) 8398-8227/8228/8242/8244

FAX: 52(01-81) 8398-8226

Tijuana Office / M³ Solution Center

Calle José María Velazco 10501-C, Col. Cd. Industrial Nueva Tijuana, C.P. 22500 Tijuana, B.C., MÉXICO

TEL: 52 (01-664) 647-5024

Querétaro Office / M³ Solution Center

Av. Cerro Blanco No.500-1, Colonia Centro Sur, Querétaro, Querétaro, C.P. 76090, MÉXICO

TEL: 52 (01-442) 340-8018, 340-8019 and 340-8020

FAX: 52 (01-442) 340-8017

Mitutoyo Mexicana, S.A. de C.V. Querétaro Calibration Laboratory

Av. Cerro Blanco 500 30 Centro Sur, Querétaro, Querétaro, C.P. 76090, MÉXICO

TEL: 52 (01-442) 340-8018, 340-8019 and 340-8020

FAX: 52 (01-442) 340-8017

Aguascalientes Office / M³ Solution Center

Av. Aguascalientes No. 622, Local 15 Centro Comercial El Cilindro Fracc. Pulgas Pandas Norte, C.P. 20138, Aguascalientes, Ags. MÉXICO

TEL: 52 (01-449) 174-4140 and 174-4143

Irapuato Office / M³ Solution Center

Boulevard a Villas de Irapuato No. 1460 L.1 Col. Ejido Irapuato C.P. 36643

Irapuato, Gto., MÉXICO

TEL: 52 (01-462) 144-1200 and 144-1400

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Mitutoyo Corporation

20-1, Sakado 1-Chome, Takatsu-ku, Kawasaki-shi, Kanagawa 213-8533, Japan
Tel: +81 (0)44 813-8230 Fax: +81 (0)44 813-8231
Home page: <https://www.mitutoyo.co.jp/global.html>

For the EU Directive, Authorized representative and importer in the EU:
Mitutoyo Europe GmbH
Borsigstrasse 8-10, 41469 Neuss, Germany

For the UK Regulation, Authorized representative and importer in the UK:
Mitutoyo (UK) Ltd.
Joule Road, West Point Business Park, Andover, Hampshire SP10 3UX, UNITED KINGDOM