



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.

No. 99MBE097B2

Date of publication: May 1, 2022 (1)



■ Product names and model numbers covered in this document

Product name	Model number
Assembly Type ABSOLUTE Linear Scale	ABS AT134* ABS AT135* 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 4 and "Precautions for Use" on page 4.
- The contents of this document are based on information current as of May 2022.
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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 10.

Other conventions

(): Round brackets	Represent a paraphrase of an immediately preceding phrase or a supplementary explanation.
" ": Double quotation marks	Represent a highlighted phrase. They also indicate an index where information to be referenced is described.
[]: Square brackets	Represent 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.
1, 2, 3 1, 2, 3, ...	Indicates the order and the contents of tasks. (1: indicates main tasks, 1: indicates detailed tasks)
»	Indicates the action resulted from some operation(s).

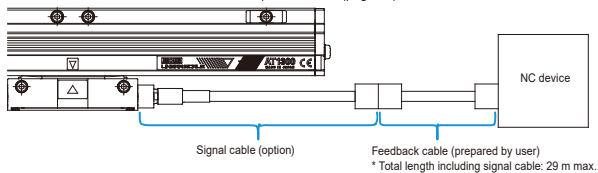
Example of conventions use

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)



Signal cable (option) Feedback cable (prepared by user)
* Total length including signal cable: 29 m max.

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

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

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.

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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" (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 41)), 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

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

Disposal of Products outside the European Countries

Please follow the official instruction in each community and country.

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



This symbol on the product or on its packaging is based on WEEE Directive (Directive on Waste Electrical and Electronic Equipment), and this symbol indicates that this product shall not be treated as household waste.



To reduce the environmental impact and minimize the volume of landfills, please cooperate in reuse and recycle.

For how to dispose of the product, please contact the agent where you purchased the product or a Mitutoyo sales office.

China RoHS Compliance Information

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

产品中有害物质的名称及含量

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
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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电器电子产品只要按照安全及使用说明内容在正常使用情况下,从生产日期算起,在此期限内产品中含有的有毒有害物质不致发生外泄或突变,不致对环境造成严重污染或对其人身、财产造成严重损害。

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

另外,此期限不同于质量/功能的保证期限。

Warranty

This product has been manufactured under strict quality management, but should it develop problems within one year of the date of purchase in normal use, repair shall be performed free of charge. Please contact the agent where you purchased the product or a Mitutoyo sales office ( "SERVICE NETWORK" on page App-1). This warranty, however, shall not affect any provisions of the Mitutoyo Software End User License Agreement.

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

- Failure or damage owing to fair wear and tear
- Failure or damage owing to inappropriate handling, maintenance or repair, or to unauthorized modification
- Failure or damage owing to transport, dropping, or relocation of the 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.

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

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

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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.

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

1.1 Features

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

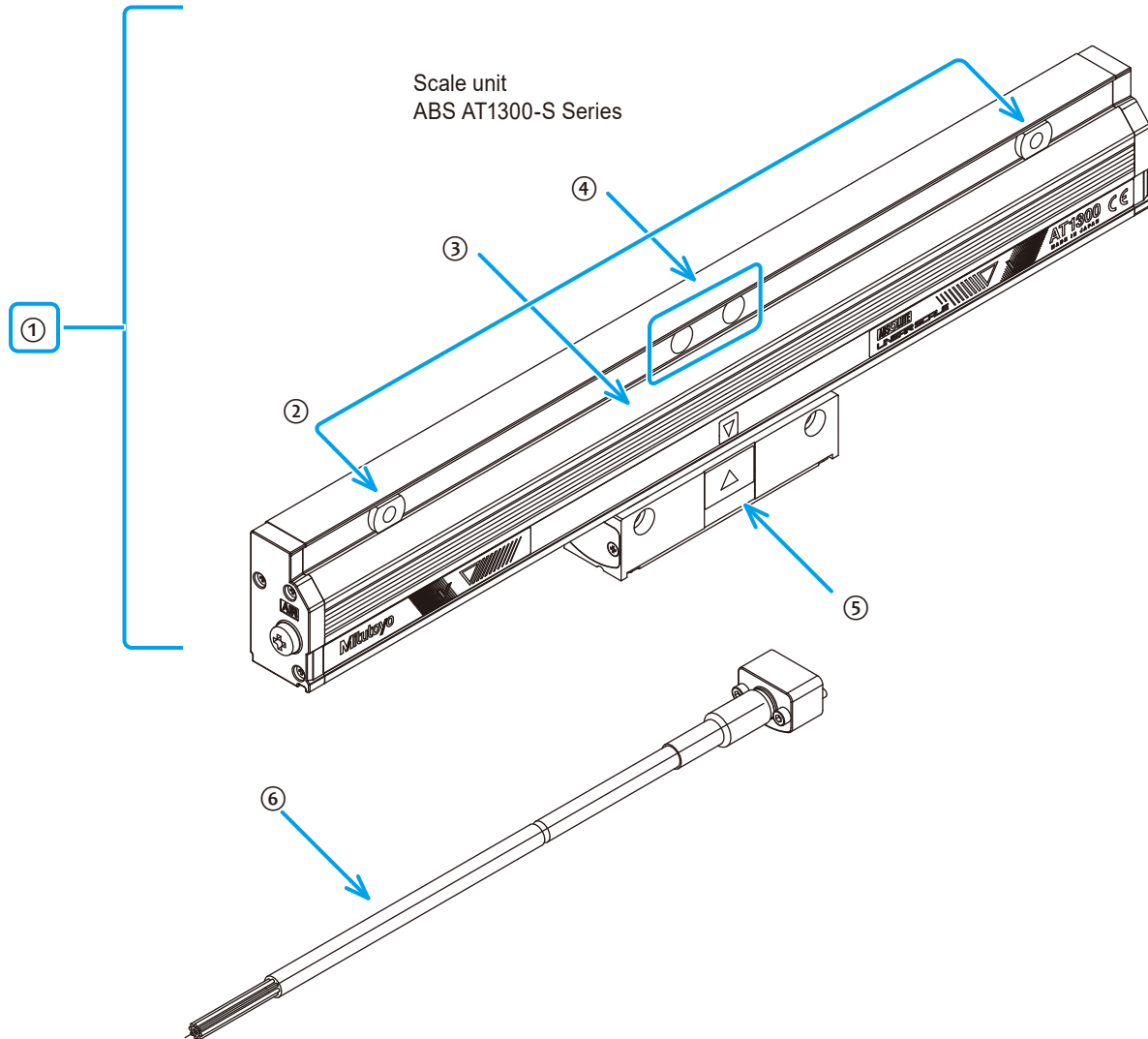
YASKAWA Electric Corporation Specifications

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

Designing the Mounting Surface of the Scale Unit

📖 "2.4 Precautions on Designing Scale Unit Mounting Surface" (page 19)



Opening the Package



Checking the Components and the Supplied Accessories

📖 "2.2 Checking the Scale Unit and the Supplied Accessories" (page 14)



Preparing the Signal Cable

📖 "2.3 Preparing the Signal Cable" (page 16)

■ Installation onto the machine main unit

Mounting the Scale Main Unit and Adjusting the Position

📖 "3.2 Mounting the Scale Main Unit and Adjusting the Position" (page 26)



Mounting the Detector and Adjusting the Position

📖 "3.3 Mounting the Detector and Adjusting the Position" on page 32



Connecting and Fixing the Signal Cable

📖 "3.4 Connecting and Fixing the Signal Cable" (page 35)

MEMO

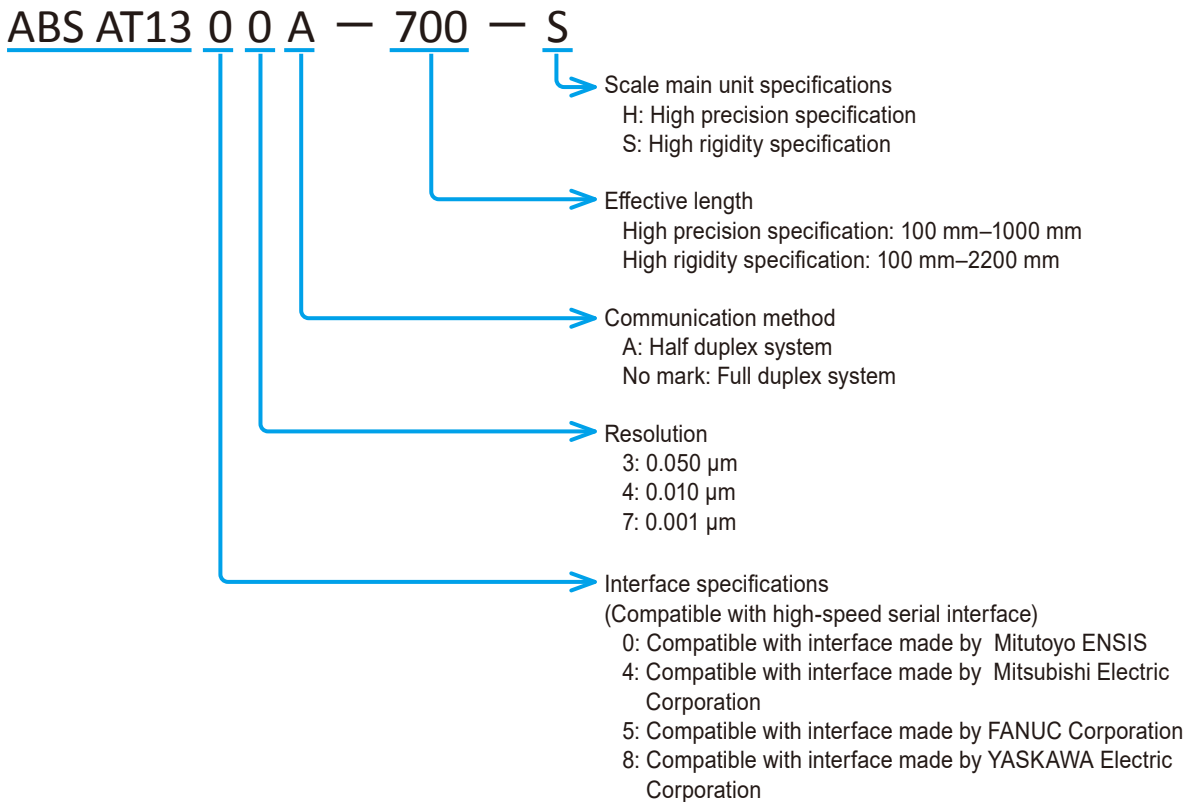
2 Setup for Installation

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 41)

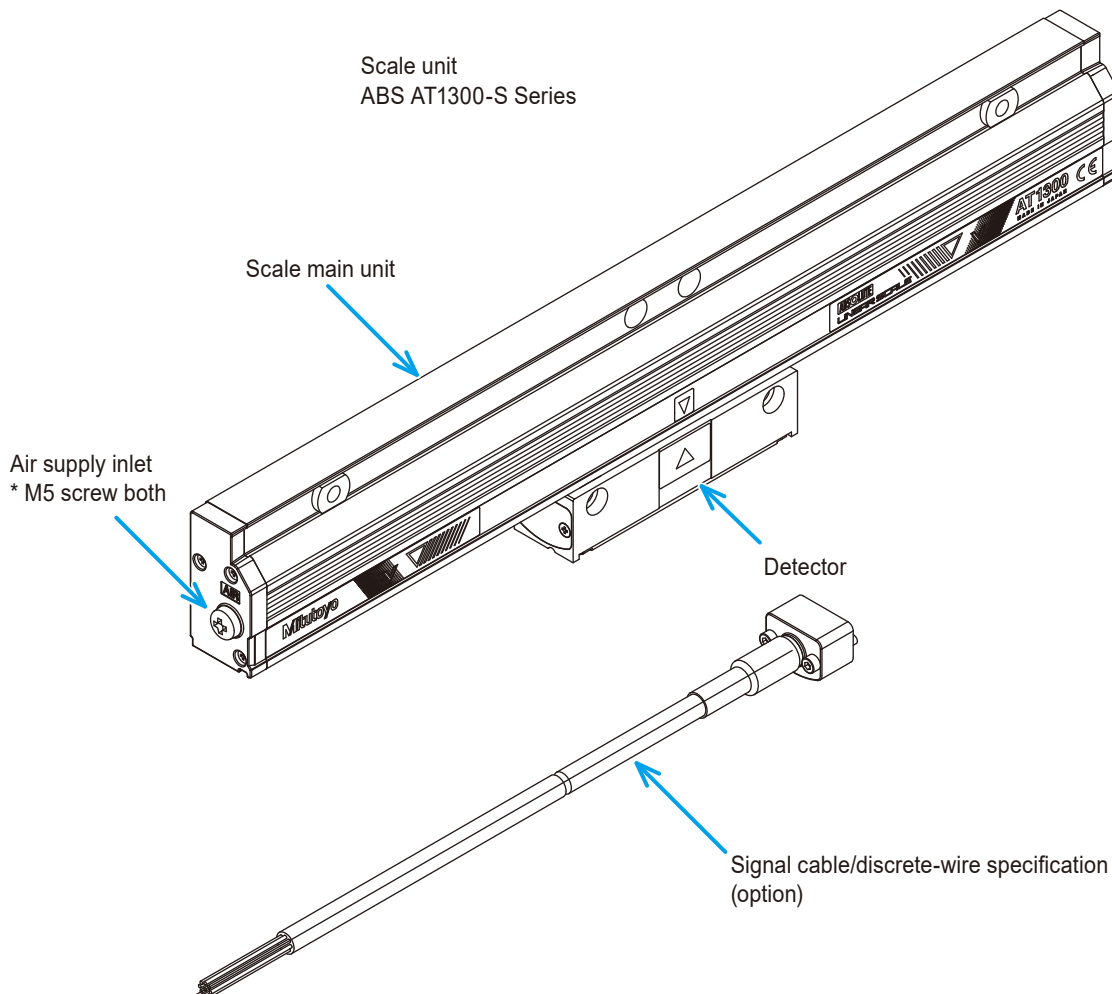
2.2 Checking the Scale Unit and the Supplied Accessories

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	

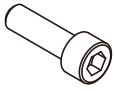
For the details of the signal cable, refer to "2.3 Preparing the Signal Cable" (page 16)

2 Setup for Installation

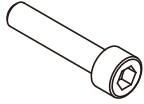
■ Accessories (mounting screws, etc.)

For the details of the quantity of the accessories, refer to  "6.1 Quantity of the Supplied Accessories for Installation" (page 73)

● ABS AT1300-H (high precision specification)



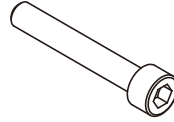
Hex socket head cap
screw
M4 x 10



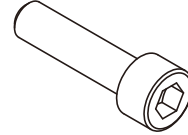
Hex socket head cap
screw
M4 x 16



Spring washer,
nominal 4



Hex socket head cap
screw
M4 x 25

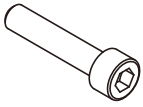


Hex socket head cap
screw
M6 x 25

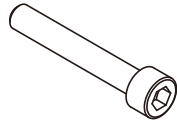


Spring washer,
nominal 6

● ABS AT1300-S (high rigidity specification)



Hex socket head cap
screw
M4 x 16



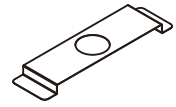
Hex socket head cap
screw
M4 x 25



Spring washer, nominal 4
Small round



Plain washer, nominal 4
Small round




Dedicated leaf spring

2.3 Preparing the Signal Cable

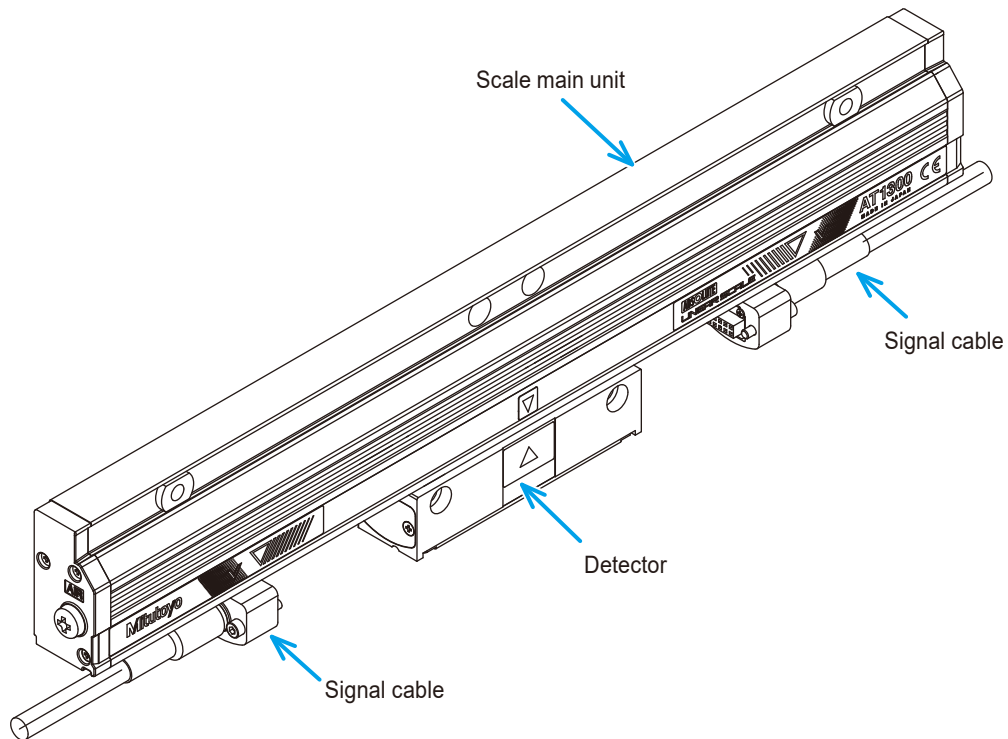
This section describes the configuration of the signal cable to be used with this product. The signal cables are separately sold. Select an appropriate one according to your specifications.

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.

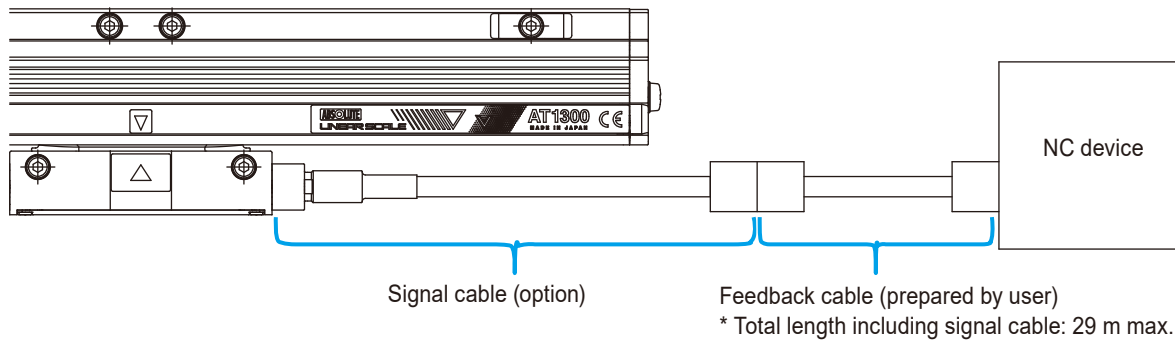
For the details of the connecting method, refer to  "3.4 Connecting and Fixing the Signal Cable" (page 35)

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 ø6.5, no conduit
Output connector	(1) Discrete-wire specification (2) Specification with alarm display function (3) FANUC connector specification (4) Mitsubishi connector specification (5) 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 41)
- When connecting our signal cable to the your ordered cable, the total length of the cables should be 29 m maximum.

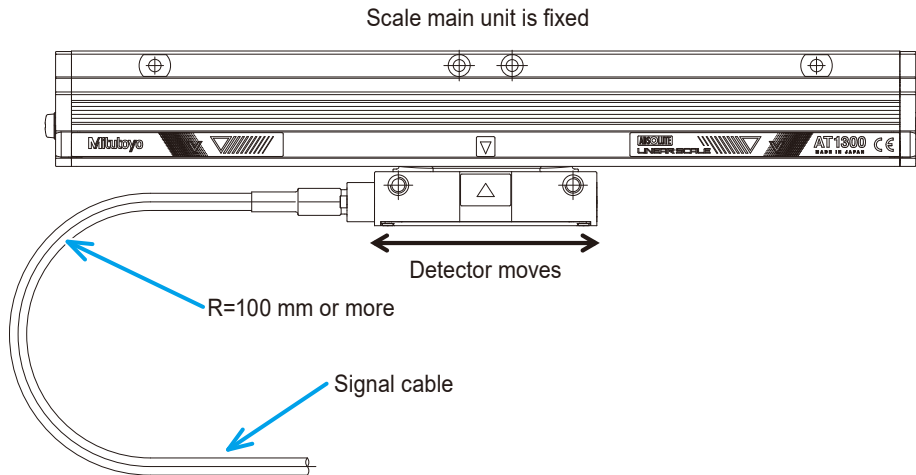
2.3.2 Bend Radius of the Signal Cable

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.

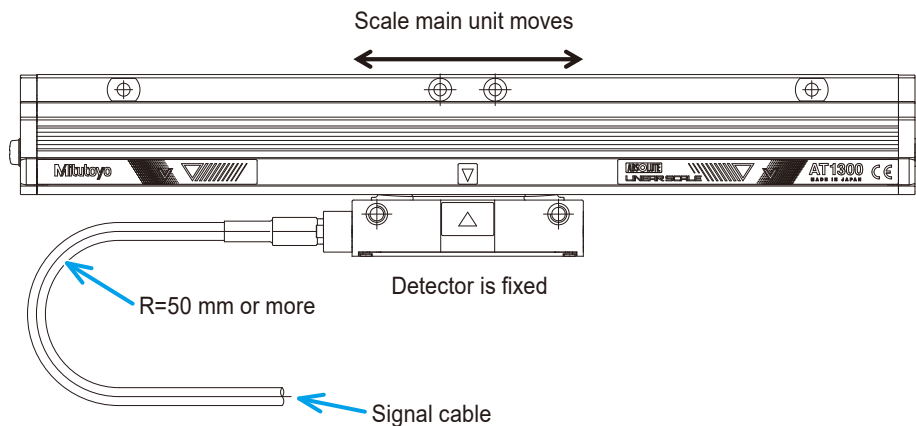
■ When the Detector moves (cable is repeatedly bent)

-> 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 38)

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

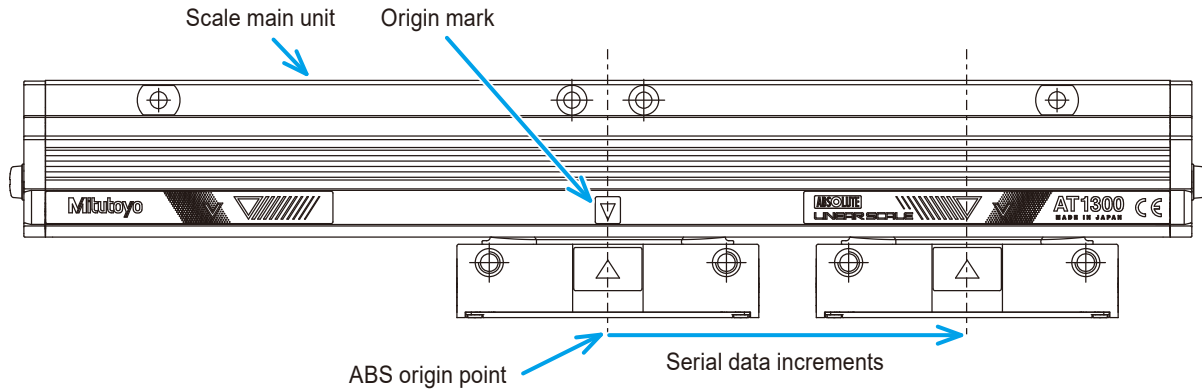
The fixing parts of the scale unit are divided into the full-fixing part (one in longitudinal direction) and the elastic-fixing parts. The position of this full-fixing part becomes "datum point position for length variation of the scale main unit", which is the reference point for the scale's mechanical 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).

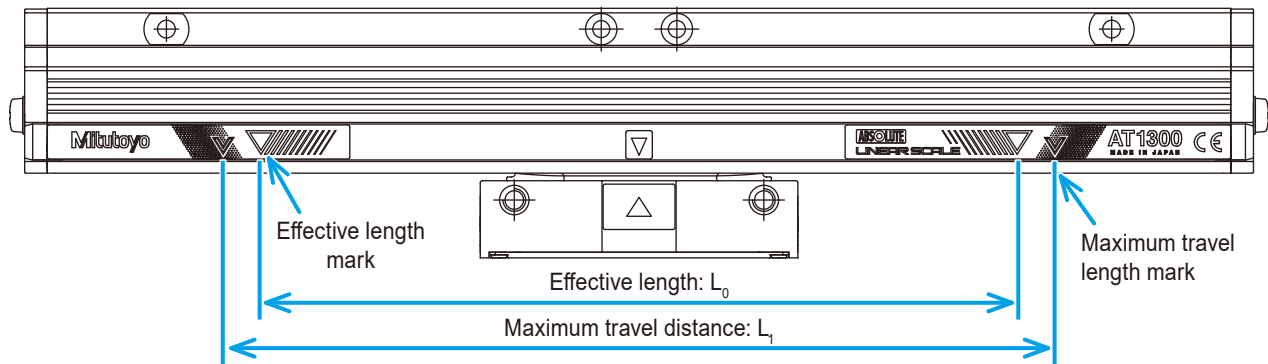


2.4.3 Checking the Maximum Travel Distance and Effective Length

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 66)

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.

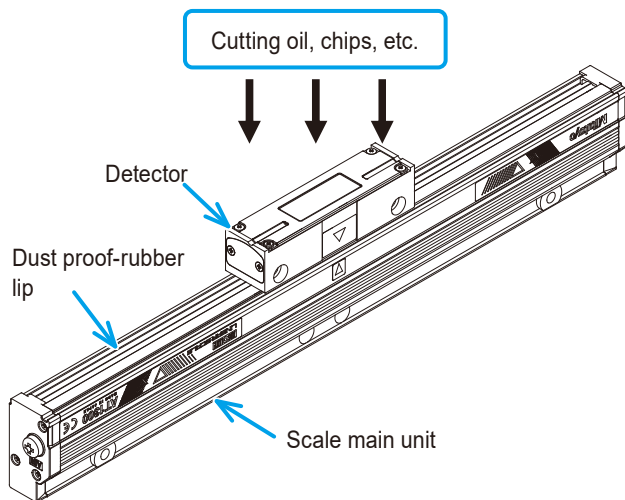
2.4.4 Scale Main Unit Mounting Directions and Cover Preparations

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.

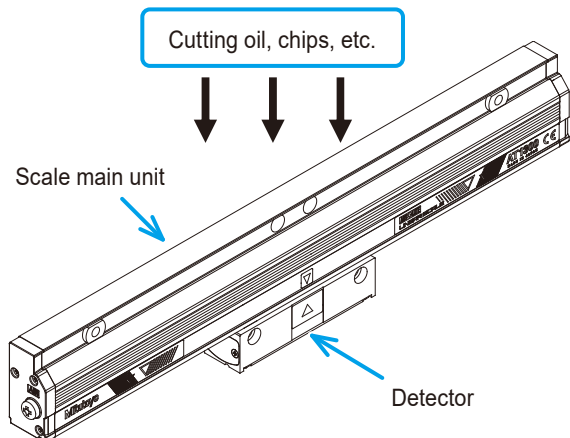
Only the dust proof-rubber lip is used to protect the scale opening side from the intrusion of foreign objects.

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.

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

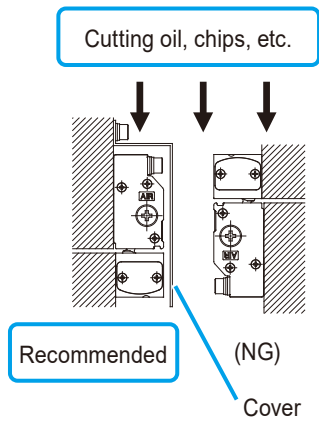


- The direction from which the cutting oil, chips, etc. comparatively tend not to intrude

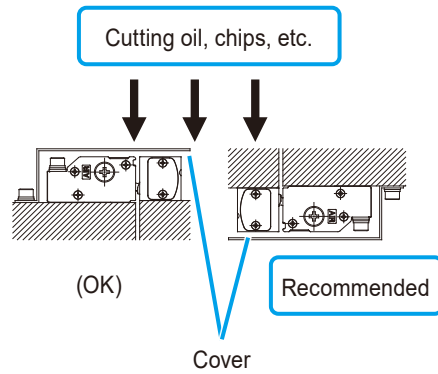


■ Mounting direction of scale main unit

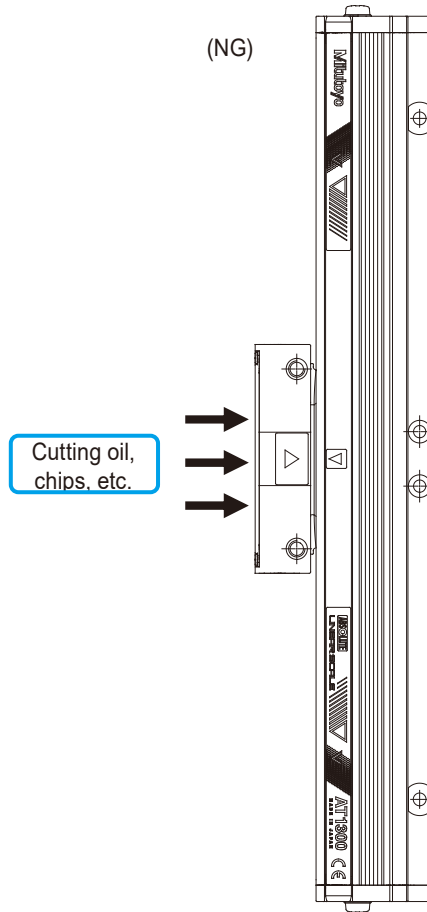
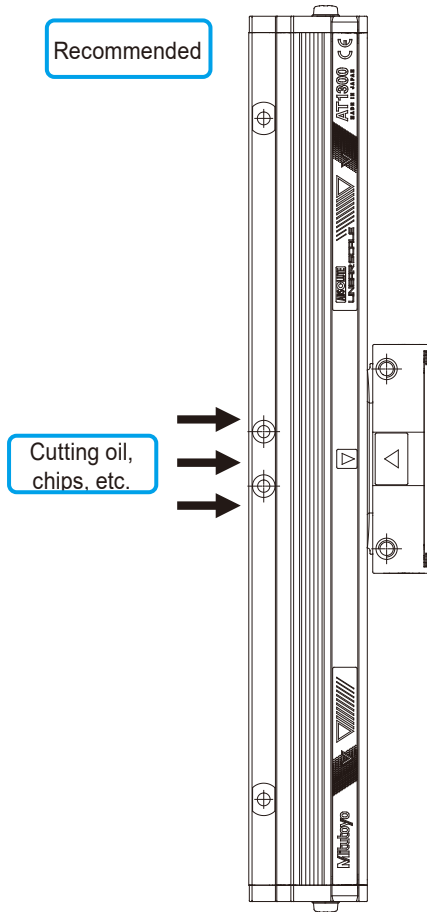
● Longitudinal direction



● 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 66)

For details of the mounting procedures, refer to  "3 Installation onto the Machine Main Unit" (page 25)

■ Precautions

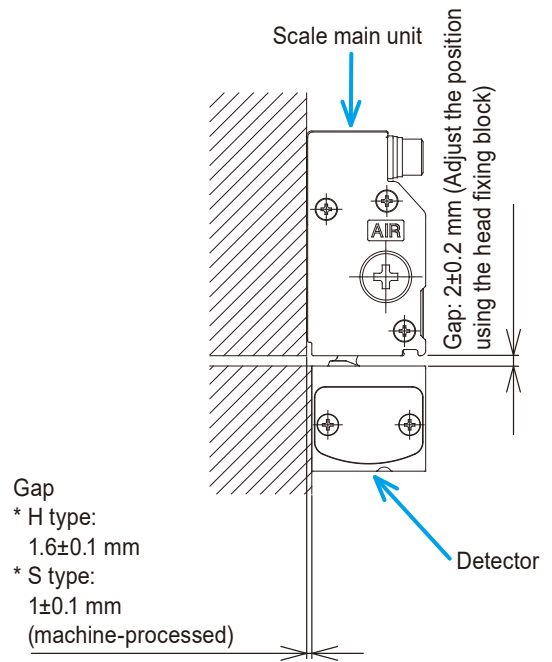
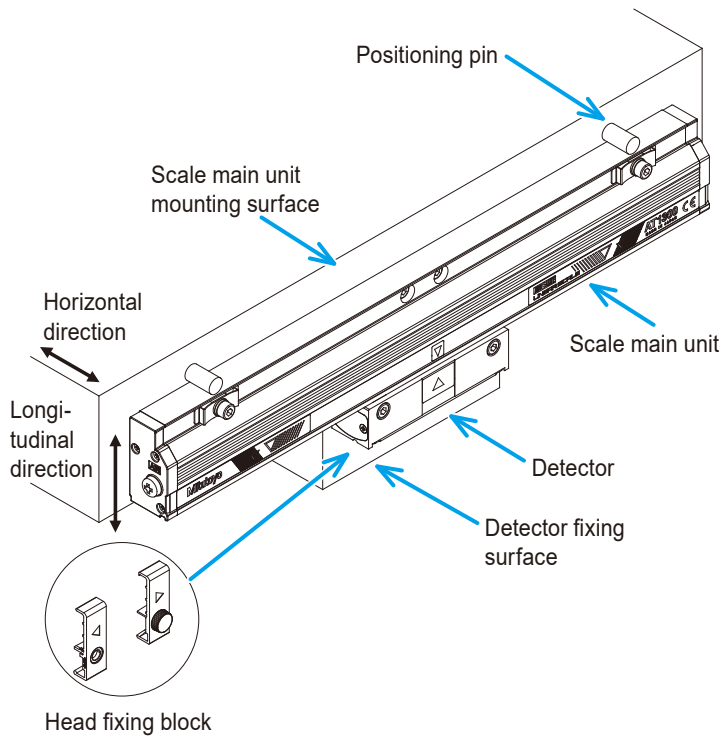
- The mounting surfaces of the scale main unit and the Detector must be machine-processed to be that.

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



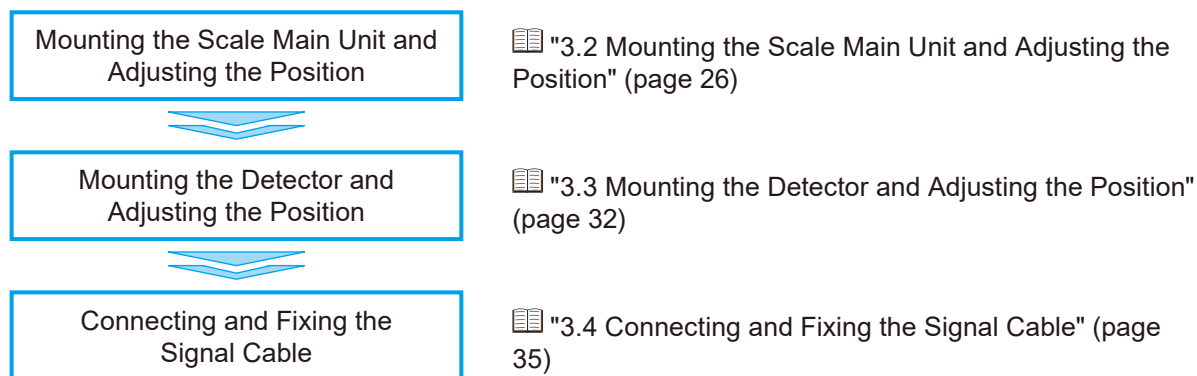
3 Installation onto the Machine Main Unit

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)

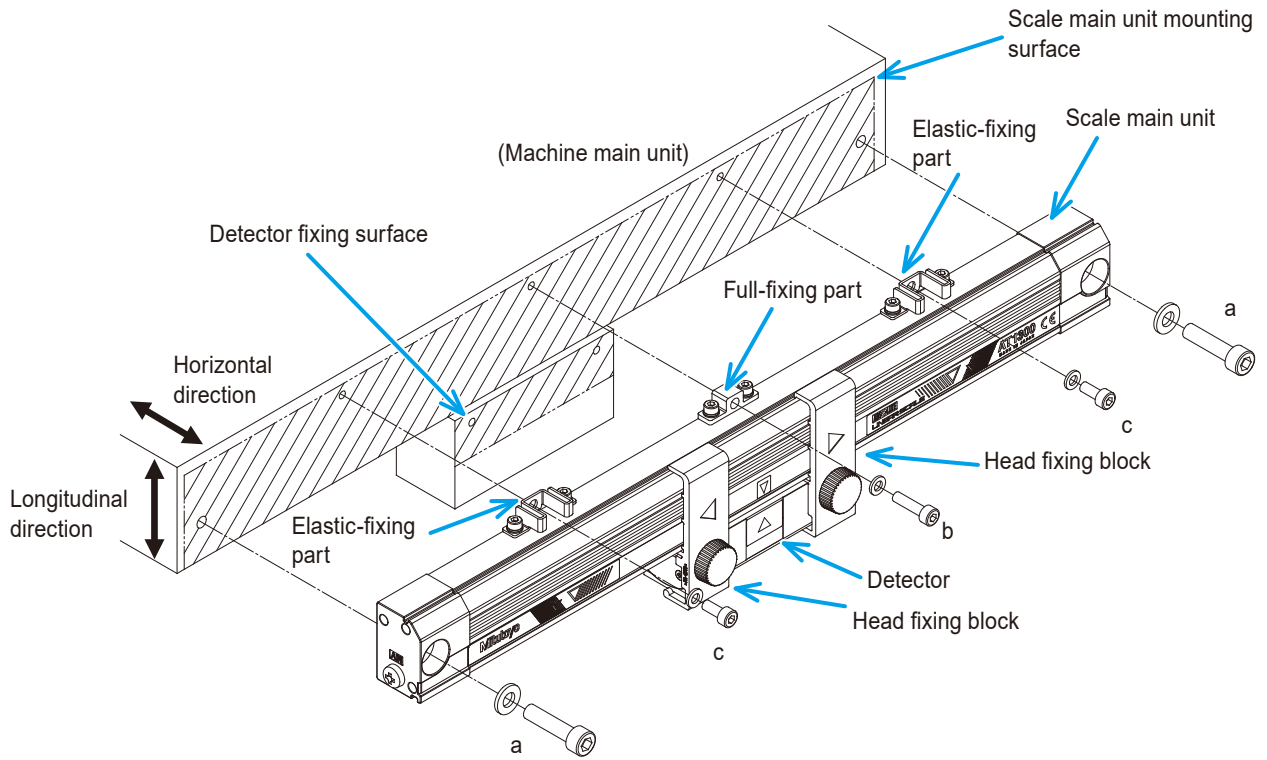
- 1** Temporarily fix it to the scale main unit fixing surface of the machine main unit with the supplied screws (to the extent that it does not move even if you release your hands from the scale main unit).

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.

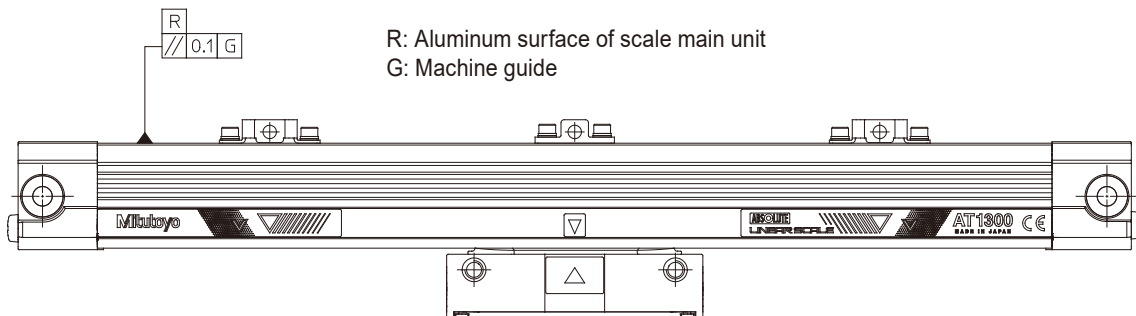
2 Adjust the longitudinal direction of the scale.

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.

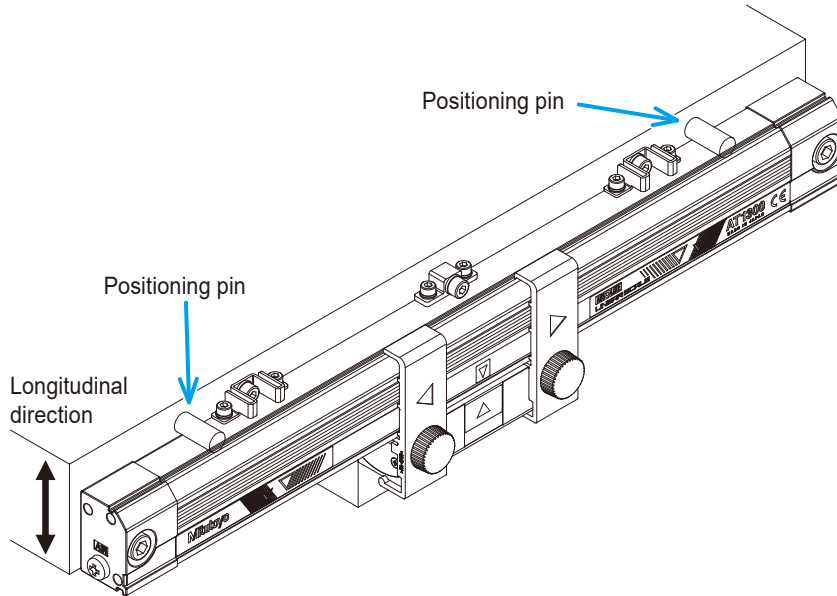
For details of the external view and dimensional drawings, refer to "4.7 External View and Dimensional Drawings of the Scale Main Unit" (page 66)



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.

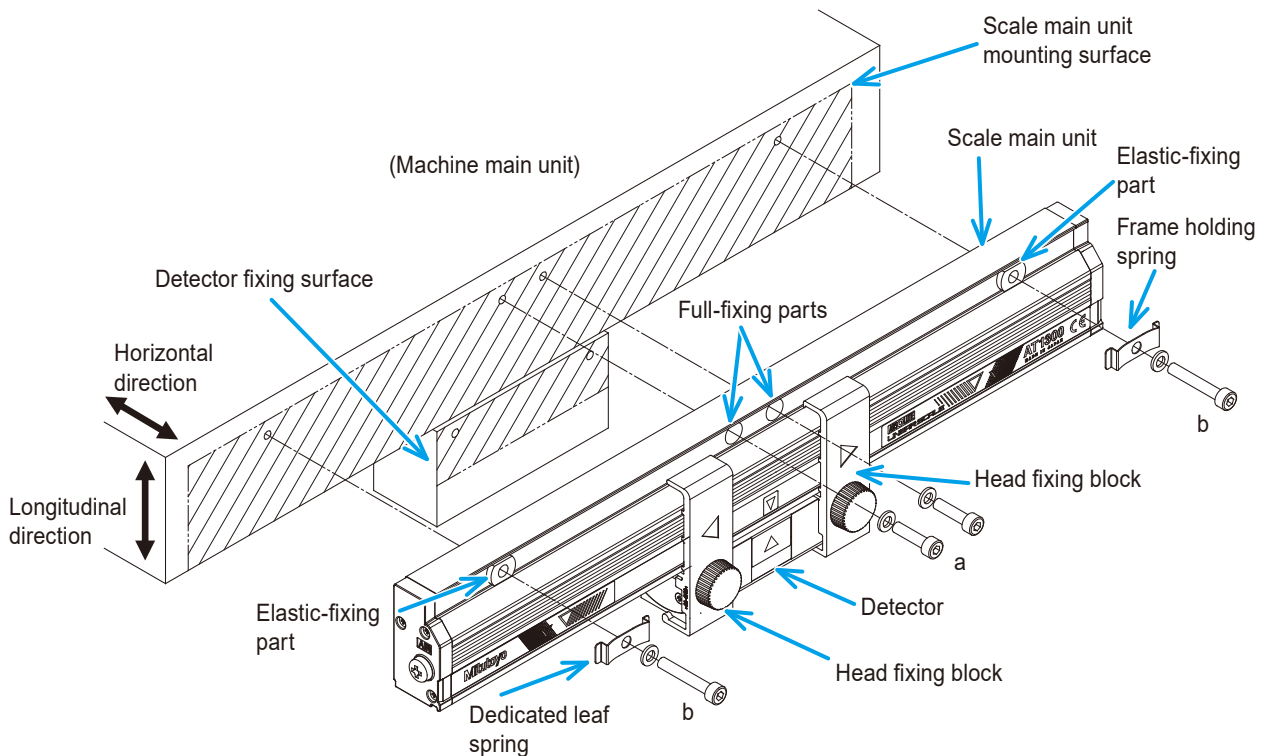
■ ABS AT1300-S (high rigidity specification)

- 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.

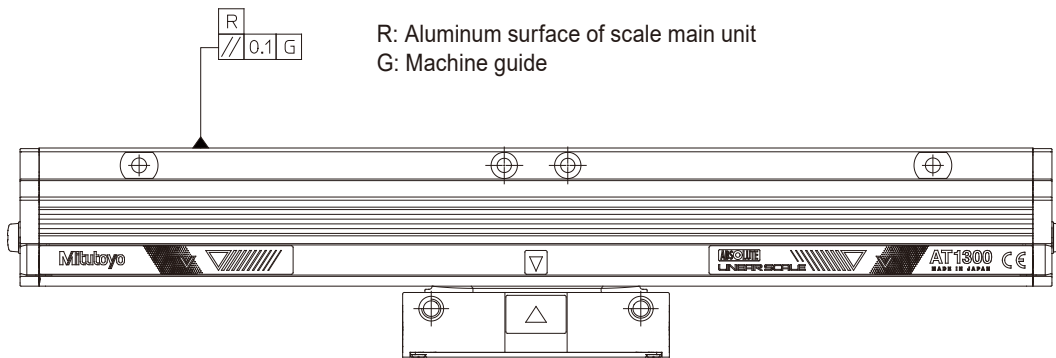
3 Installation onto the Machine Main Unit

2 Adjust the longitudinal direction of the scale.

NOTICE

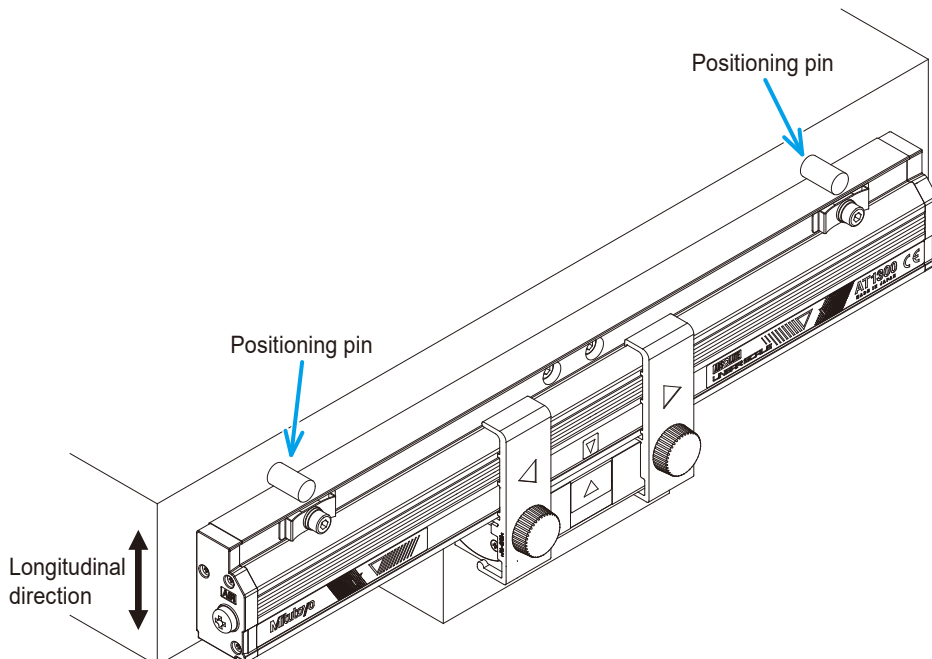
The position of the scale unit of this product does not need to be adjusted in the horizontal direction (it depends on the accuracy of the machine main unit mounting surface). However, the position and dimension in the longitudinal direction must be adjusted and checked.

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

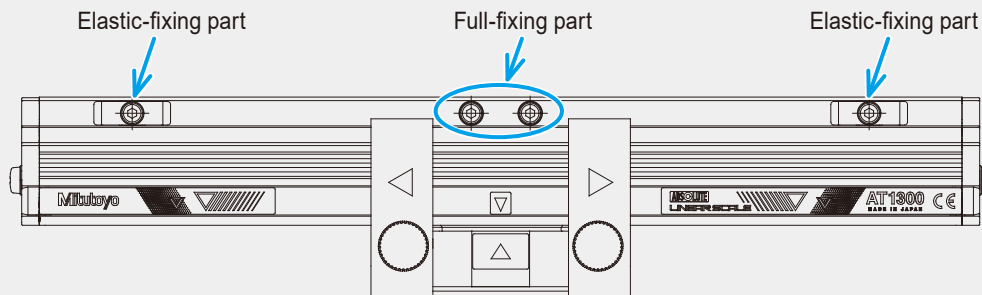
Note the following:

* Tightening torque of screw

M4: 3 N·m

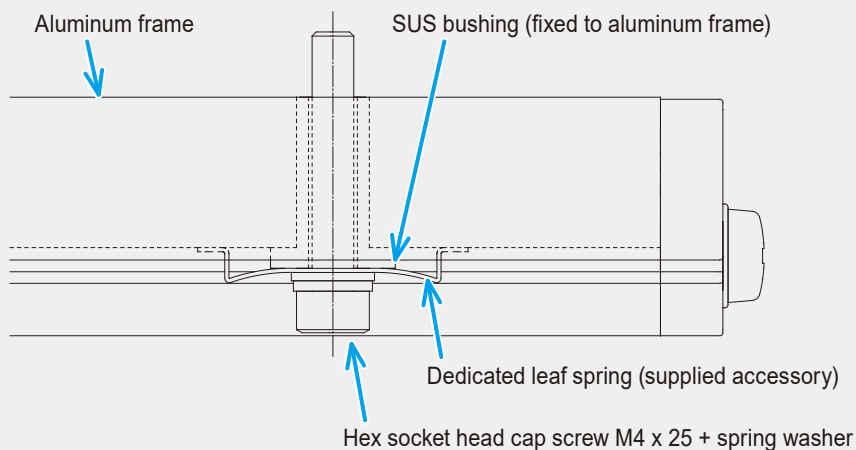
* Tightening procedure of screw

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.

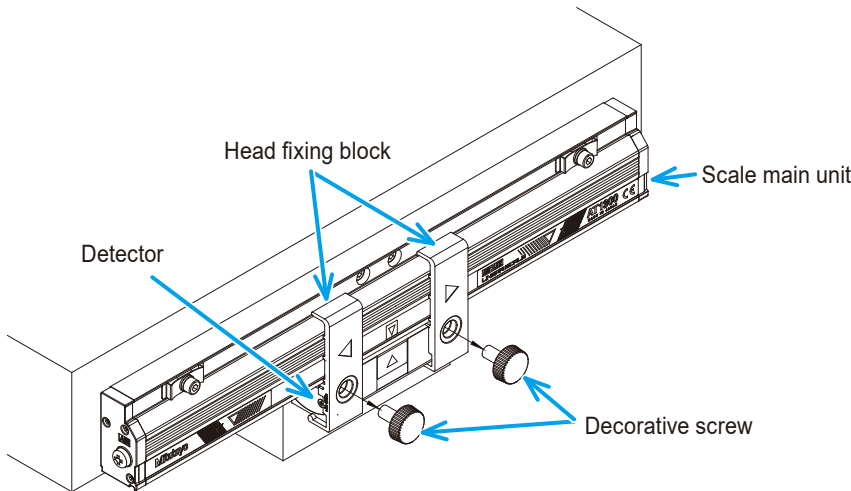
The procedure for mounting the Detector is the same for H specification (high precision specification) and S specification (high rigidity specification).

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 66)

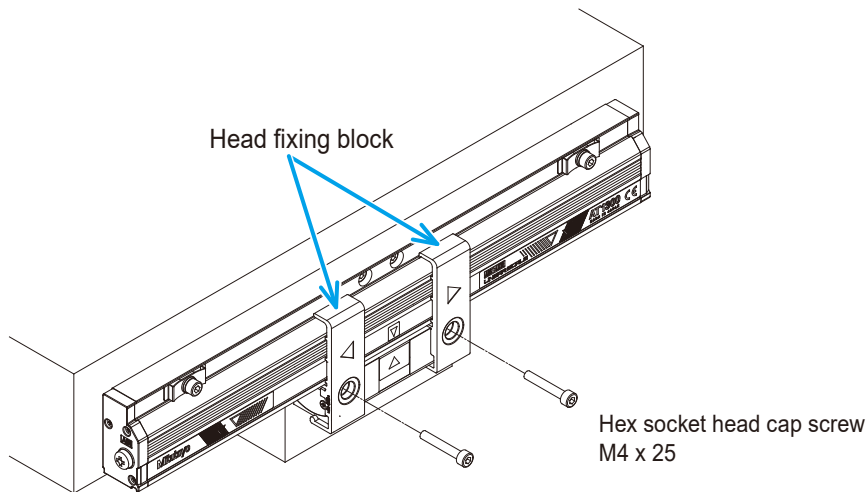
- 2 Remove the decorative screws (two locations) of the head fixing blocks.



- 3 Temporarily fix the Detector with the supplied screws (to the extent that it does not move even if you release your hands from the Detector).

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

3 Installation onto the Machine Main Unit



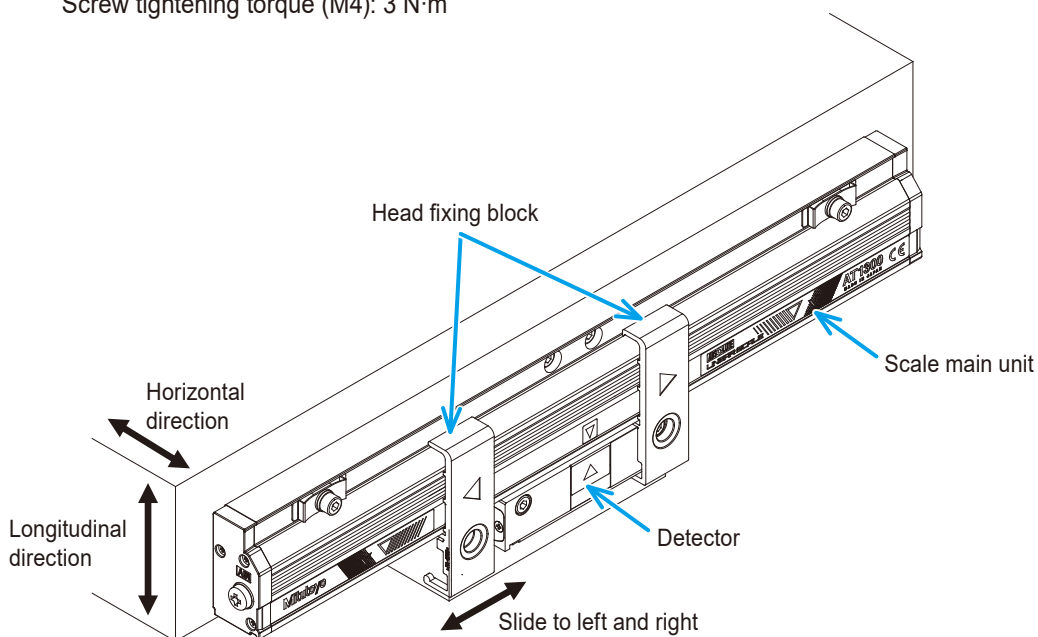
NOTICE

Do not remove the head fixing blocks during the operation.

4 Adjust the position of the Detector and then fully fix it.

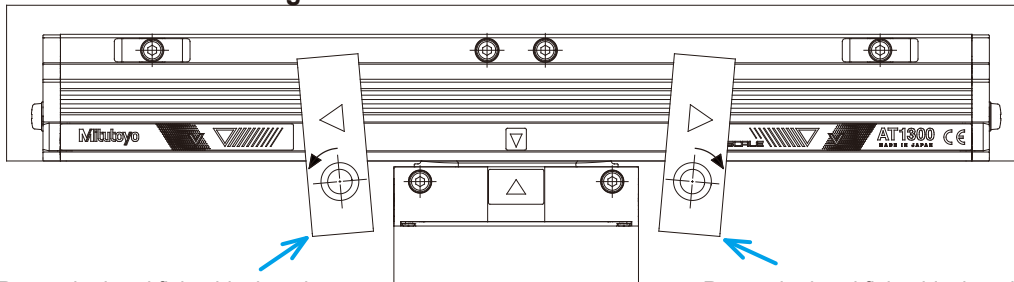
The position of the Detector does not need to be adjusted in the horizontal direction (it depends on the accuracy of the machine main unit mounting surface). However, the position and dimension in the longitudinal direction (gap between the aluminum frame of the scale main unit and the Detector) must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

- 1 Slide the head fixing blocks left and right.
 - 2 Adjust the Detector to the following position with respect to the head fixing blocks on both sides.
 - » Position where the head fixing blocks smoothly enter between the Detector and the scale main unit.
 - 3 Fully fix the Detector.
 - » After adjusting and checking the position and dimensions in the longitudinal direction of the Detector, fully tighten the fixing screws.
- Screw tightening torque (M4): 3 N·m



3 Installation onto the Machine Main Unit

5 Remove the head fixing blocks from scale main unit.



Rotate the head fixing block and remove

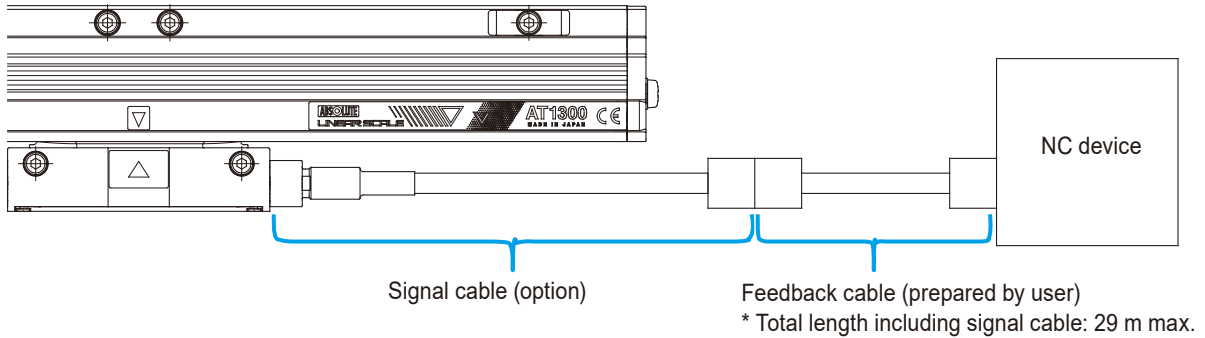
Rotate the head fixing block and remove

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 41)



■ 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.

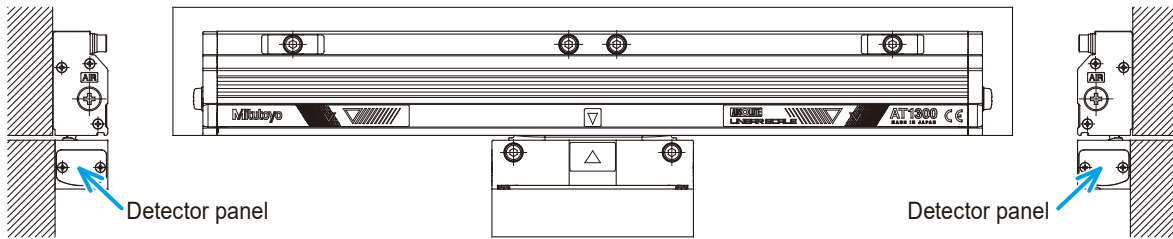
- 4 After connection of cables etc. is completed, turn on the power and check the operations, functions, and performance of the scale.

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

- 1 Decide the mounting direction of the signal cable.



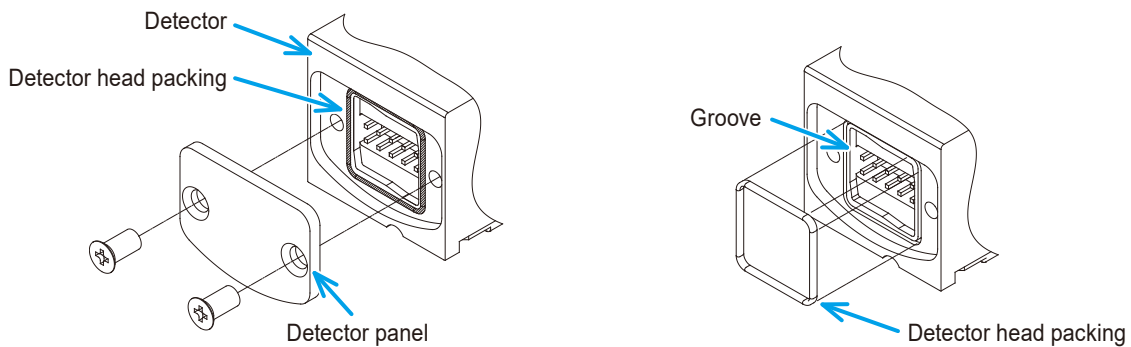
- 2 Remove the cable outlet panel at the mounting side of the signal cable.

- 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.



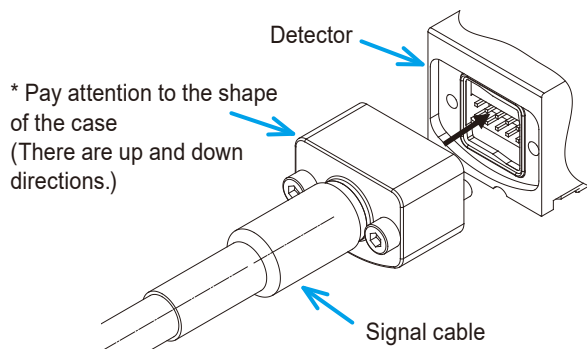
3 Installation onto the Machine Main Unit

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

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

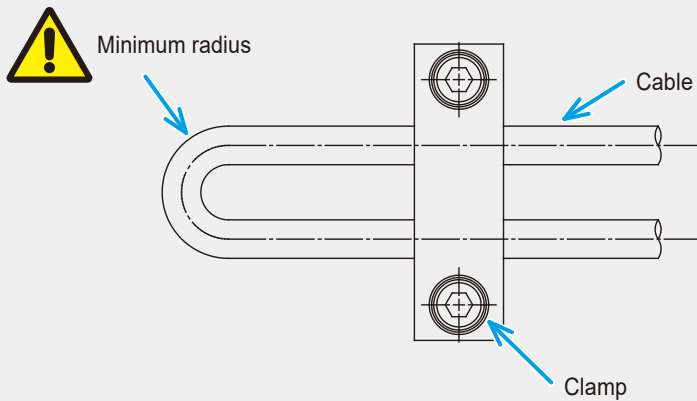
Note that the signal cable and feed back cable may malfunction if bundled with other cables that may cause electrical noise, or if they are located near a switching relay dealing with a large current.

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

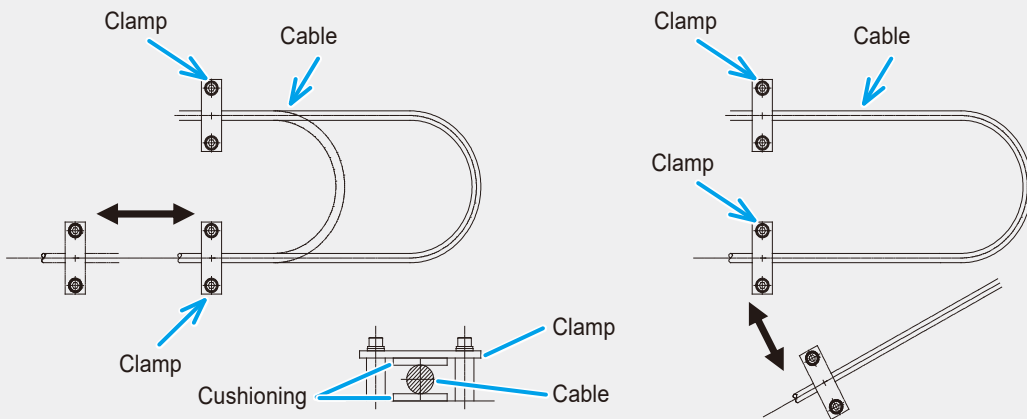
NOTICE

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 18).



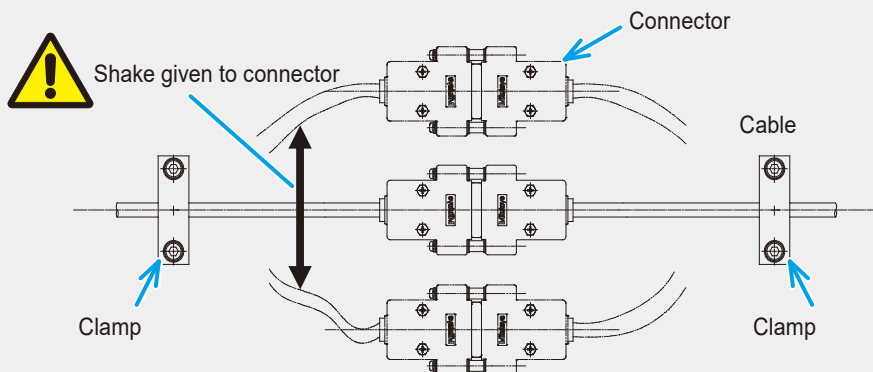
- If the cables are going to be repeatedly bent, try to reduce stress applied to near the root of the clamping part.



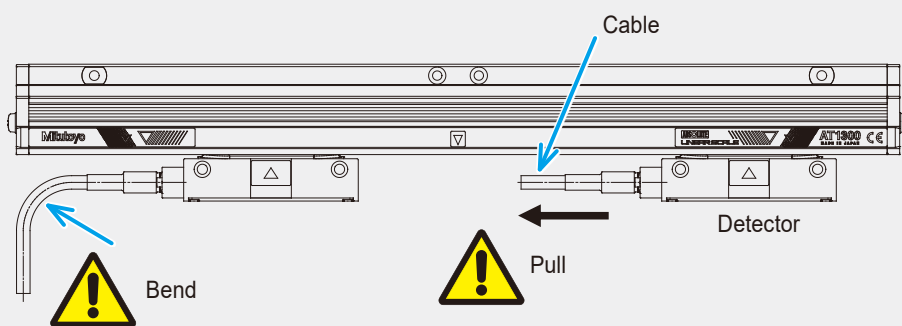
3 Installation onto the Machine Main Unit

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	62
4.7 External View and Dimensional Drawings of the Scale Main Unit	66

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 (m/min)	180	
Indication precision (μm) at 20 °C	$2+2L_0/1000$ Lo: Effective measurement length (mm)	$3+3L_0/1000$ Lo: Effective measurement length (mm)
Coefficient of thermal expansion	$\approx 8 \times 10^{-6}/\text{K}$	
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 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	

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

4 Specifications

■ Mitsubishi connector specifications

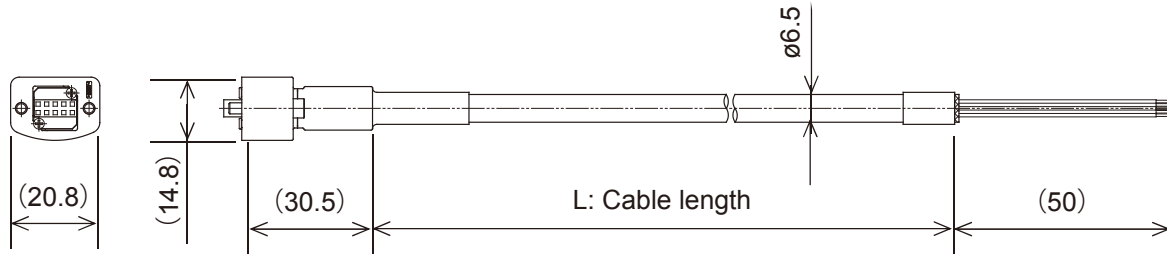
Pin number	Signal	Pin number	Signal
1	5 V	7	DT
2	GND	8	$\overline{\text{DT}}$
3	$\overline{\text{RQDT}}$	5,6,9,10	Not used
4	$\overline{\text{RQDT}}$		
		Connector shell	Frame ground

■ 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

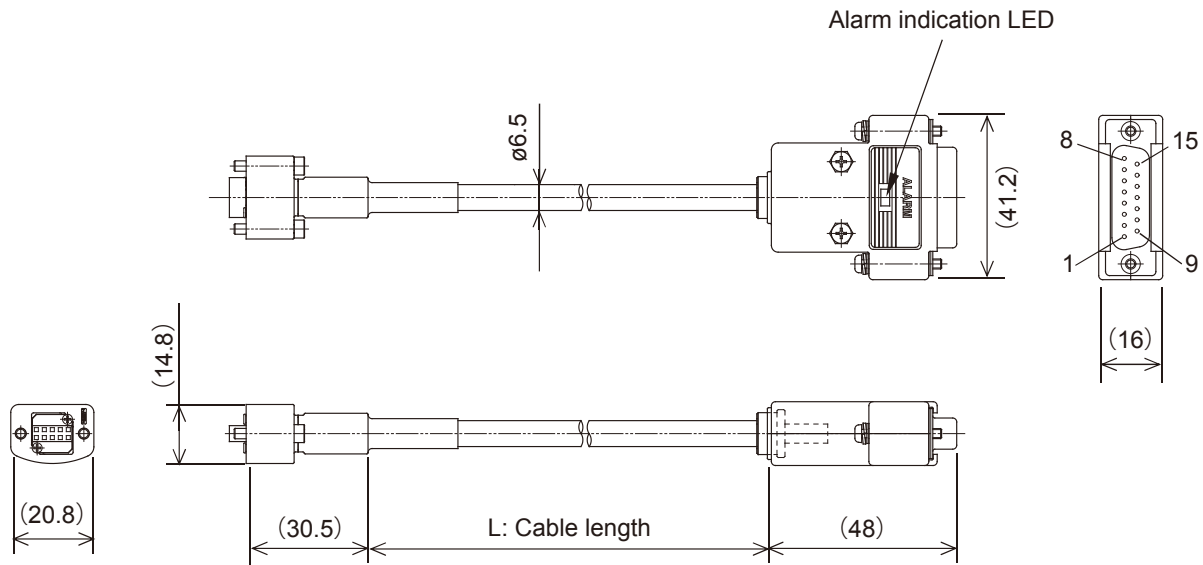
■ ABS AT135*/134*/138*/130*(A) (discrete-wire specification)



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

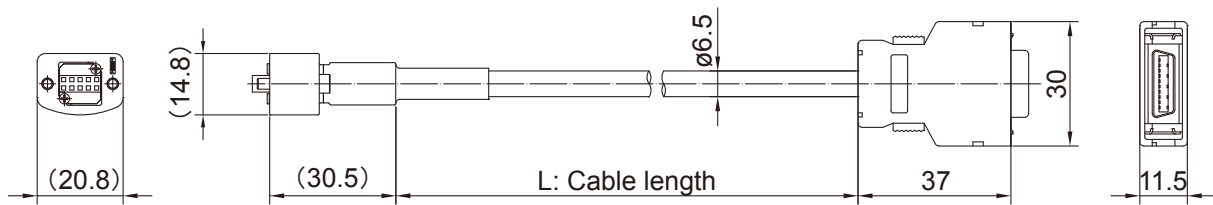
4 Specifications

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



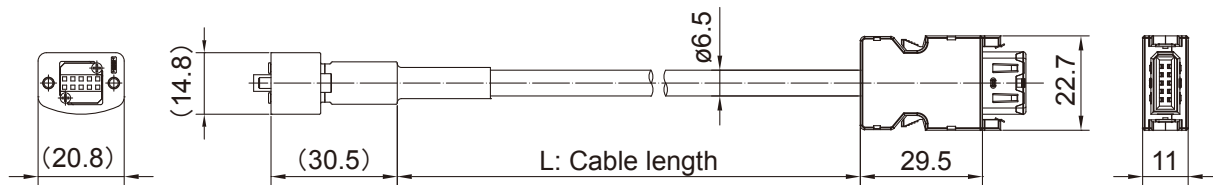
Part No.	Part name	Cable length (m)
06AFS313-1	AT1300 signal cable Ass'y (D-sub) 1 m	1
06AFS313-2	AT1300 signal cable Ass'y (D-sub) 2 m	2
06AFS313-3	AT1300 signal cable Ass'y (D-sub) 3 m	3
06AFS313-4	AT1300 signal cable Ass'y (D-sub) 4 m	4
06AFS313-5	AT1300 signal cable Ass'y (D-sub) 5 m	5
06AFS313-6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

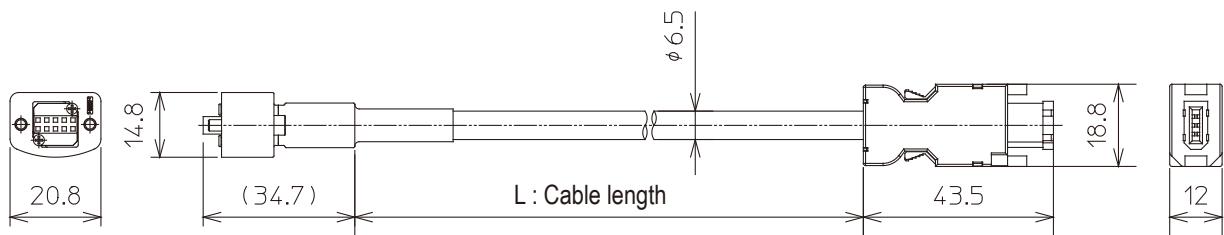
■ ABS AT134*(A) (Mitsubishi connector specification)



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

4 Specifications

■ ABS AT138*A (YASKAWA connector specification)

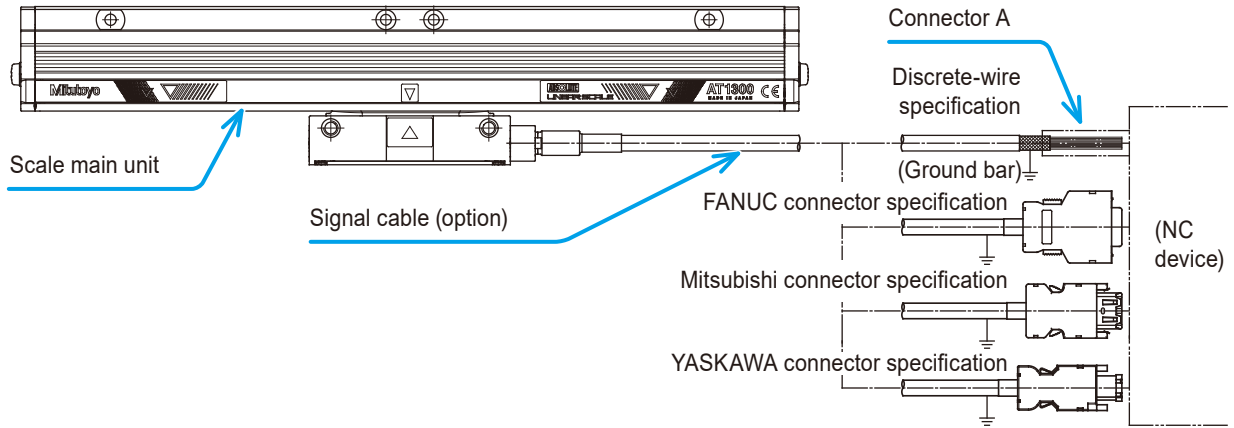


Part No.	Part name	Cable length (m)
06AGN986-1	AT1300 signal cable Ass'y(YASUKAWA) 1m	1
06AGN986-2	AT1300 signal cable Ass'y (YASUKAWA) 2 m	2
06AGN986-3	AT1300 signal cable Ass'y (YASUKAWA) 3 m	3
06AGN986-4	AT1300 signal cable Ass'y (YASUKAWA) 4 m	4
06AGN986-5	AT1300 signal cable Ass'y (YASUKAWA) 5 m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

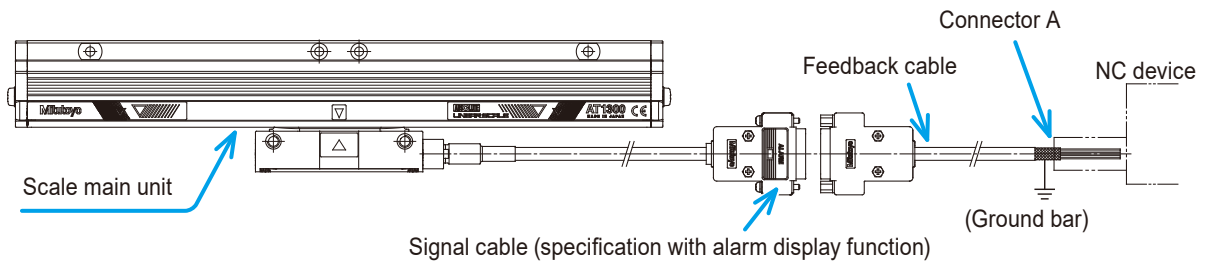
The following describes an example of the system configuration.
Please note that some parts need to be prepared by the user.

■ 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.

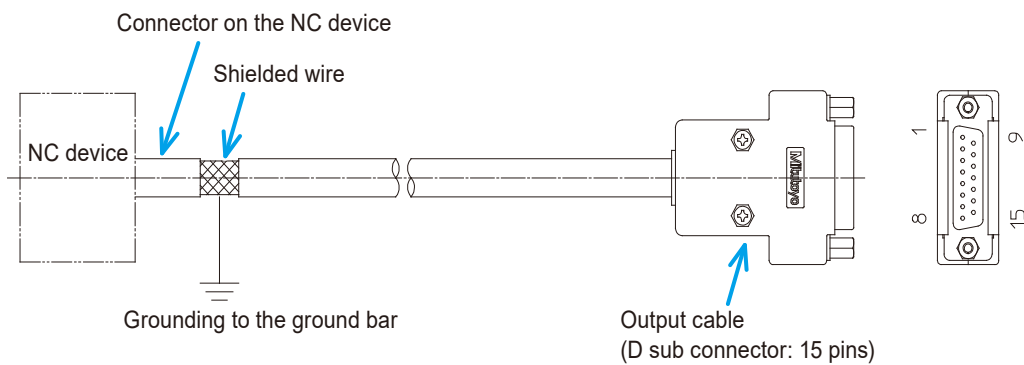
4.4 Production of Feedback Cable (Example)

The production example of the feedback cable is shown below.

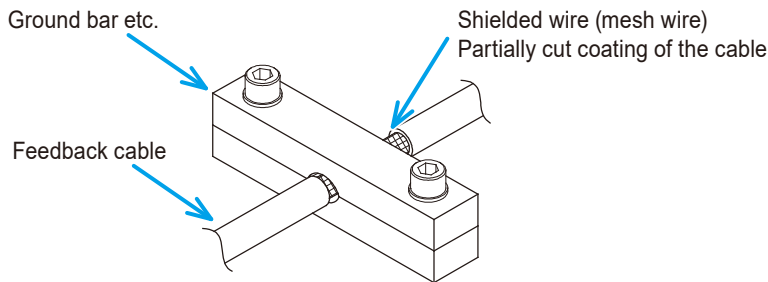
This example shows the feedback cable connected to the signal cable with alarm indication function (D sub connector 15 pins). Also follow this example for other cases.

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.



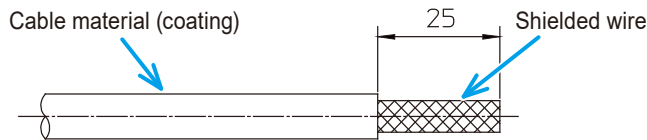
4.4.2 Assembly of D Sub Connector

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

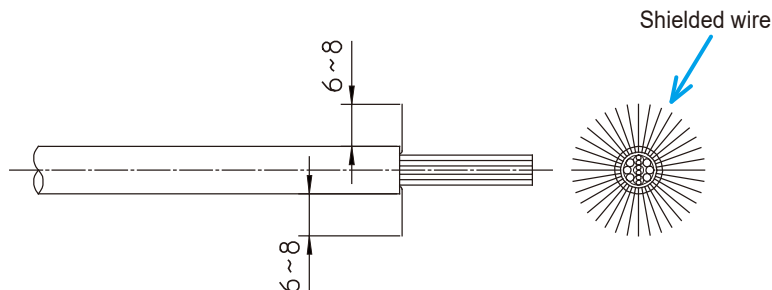
NOTICE

Make sure not to damage the internal shielded wire.

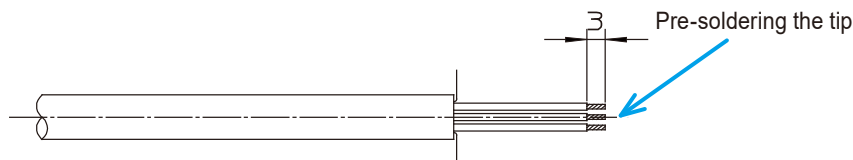
4 Specifications



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



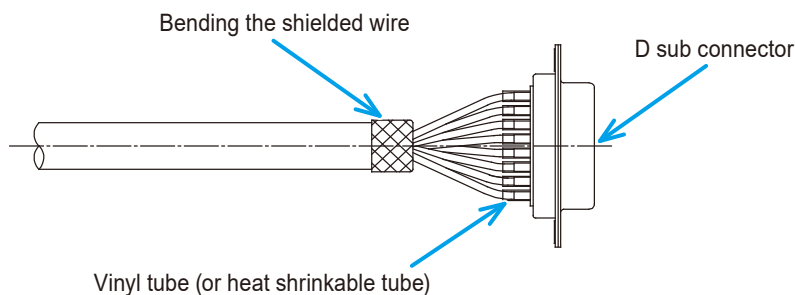
- 3** Peel the tip of the coating of the wire about 3 mm, and make a preliminary solder after twisting the conducting wires.



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

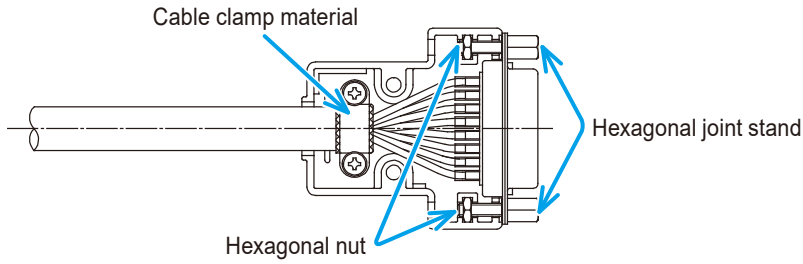
NOTICE

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.



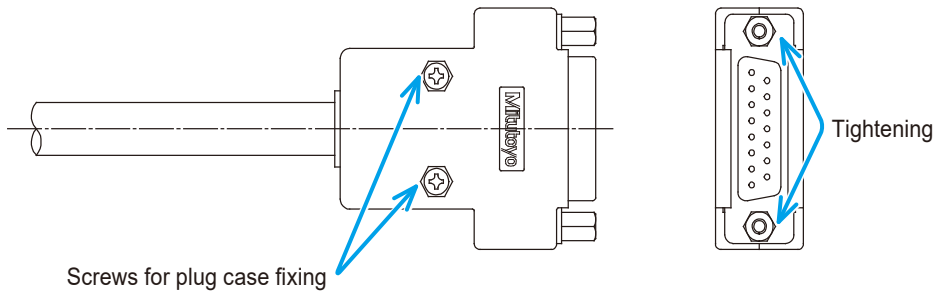
- 5** Set the connector on the plug case (supplied accessory).
- 6** Screw the shielded wire folded back at step 4 with a cable clamp material (supplied accessory).
- 7** Set the hex nuts (supplied accessory) in the plug case.
- 8** Insert the hexagonal joint stand (supplied accessory) from the connector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

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

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



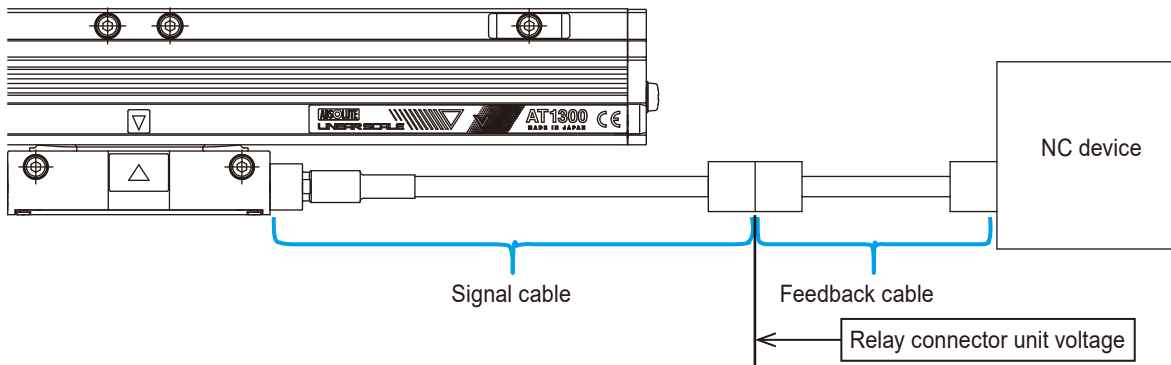
NOTICE

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.

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

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 42)" to connect the lead wire directly to the connector on the NC device.

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



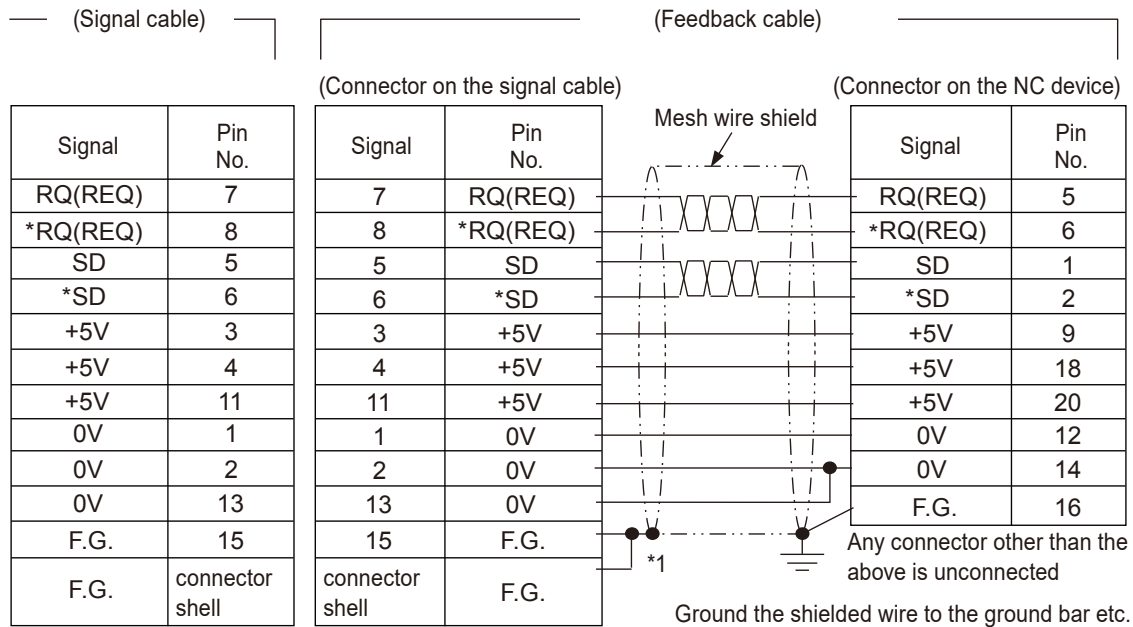
Make sure to ground the metal shield of the feedback cable to the ground bar, etc. immediately in front of the NC device.

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)



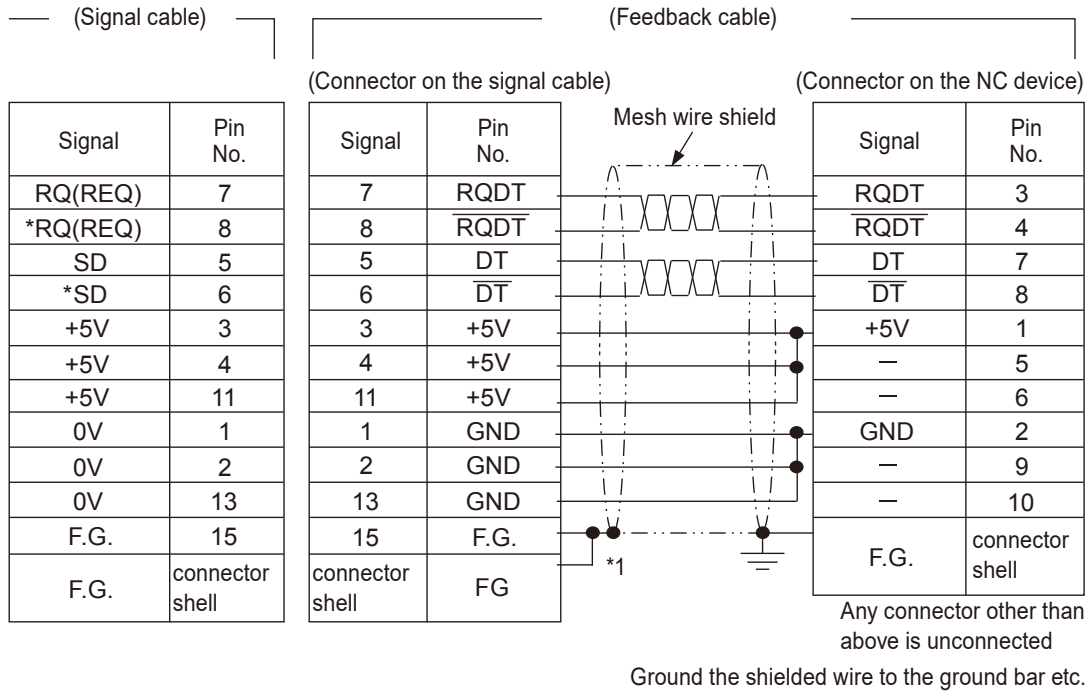
NOTICE

*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

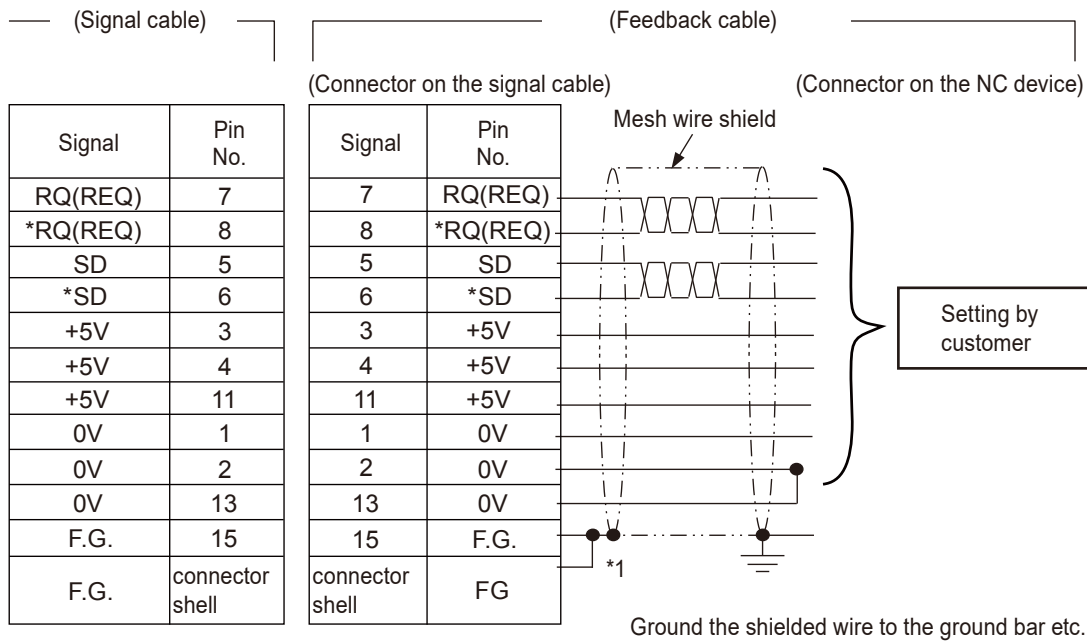


NOTICE

*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)

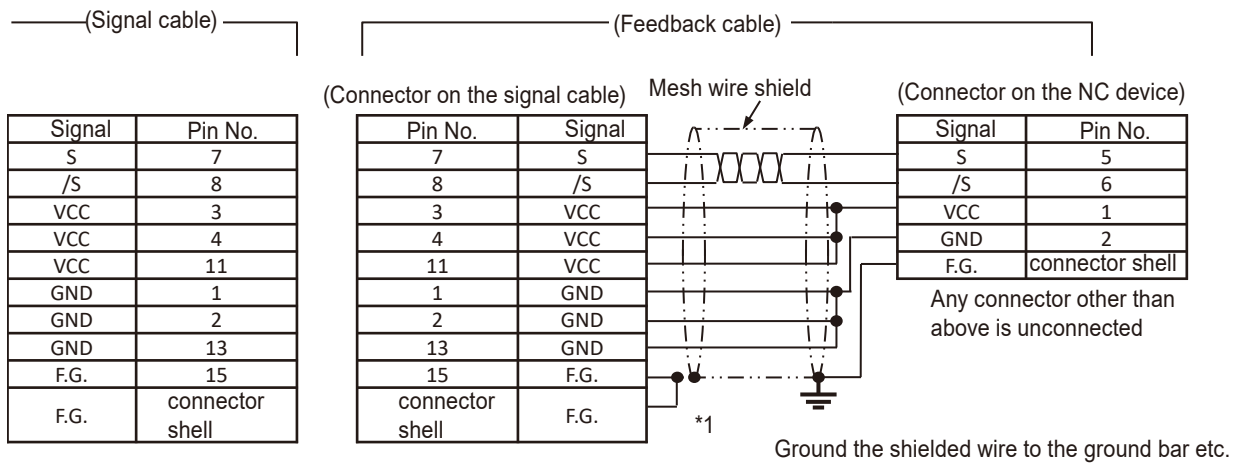


NOTICE

*1:

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

■ 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 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 	<p>Scale error occurred</p> <ul style="list-style-type: none"> • Signal intensity error • Absolute value detection error • Absolute value combination error • Initialization error 	<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"> • A.8A5 *1 • A.85U *2 	<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).

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Servo alarm Alarm code	Description	Cause and Remedy
<ul style="list-style-type: none"> • A.8A6 *1 • A.860 *2 	<p>Scale alarm occurred</p> <ul style="list-style-type: none"> • Thermal alarm • Signal intensity alarm 	<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. • 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 	<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"> • The scale needs to be replaced.
<ul style="list-style-type: none"> • A.CF1 *1 • C90 *2 	<p>Communication error occurred (during servo amplifier control)</p>	<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).

*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

- 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.

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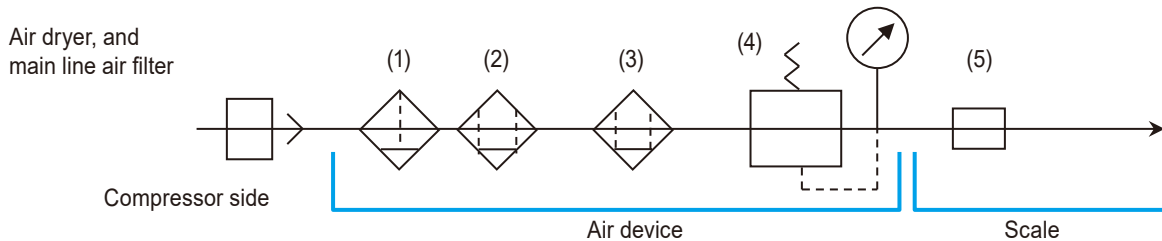
Using flow rate adjustable valves	Make adjustment with the air pressure, so that the air flow becomes 10 L/min–20 L/min (per scale unit).
	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">NOTICE</div> <p>Make sure not to supply a large amount of air before making adjustments. Otherwise, it may cause components to break thereby resulting in malfunctions.</p>



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.

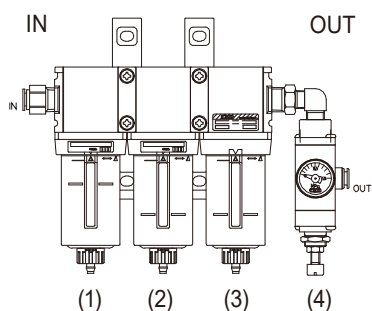
Estimated time of element replacement for each filter is one year.



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)

4 Specifications

(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)	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 	-	RA-050-L (CKD)
(5)	Fixed diaphragm		<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 	06ACJ154	-



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

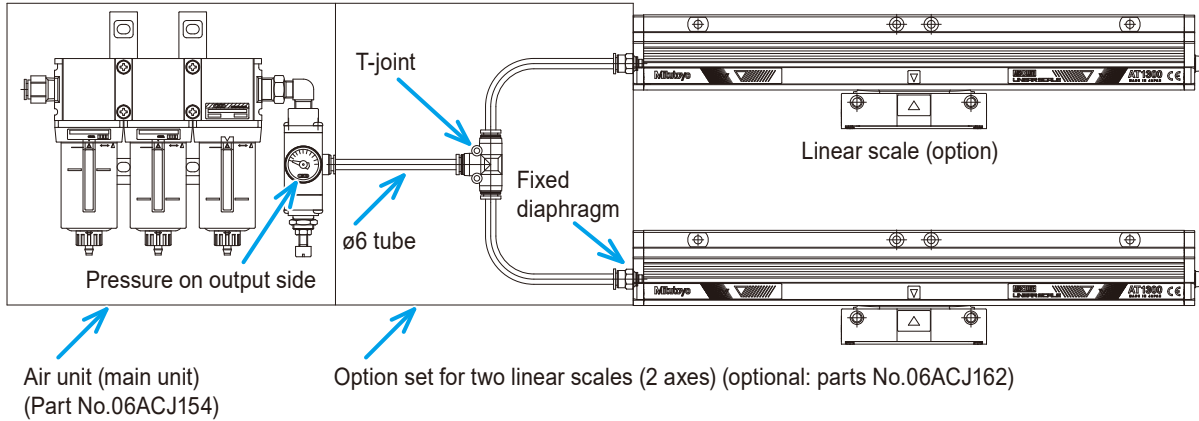
Appearance of air unit

4.6.4 Connection Method

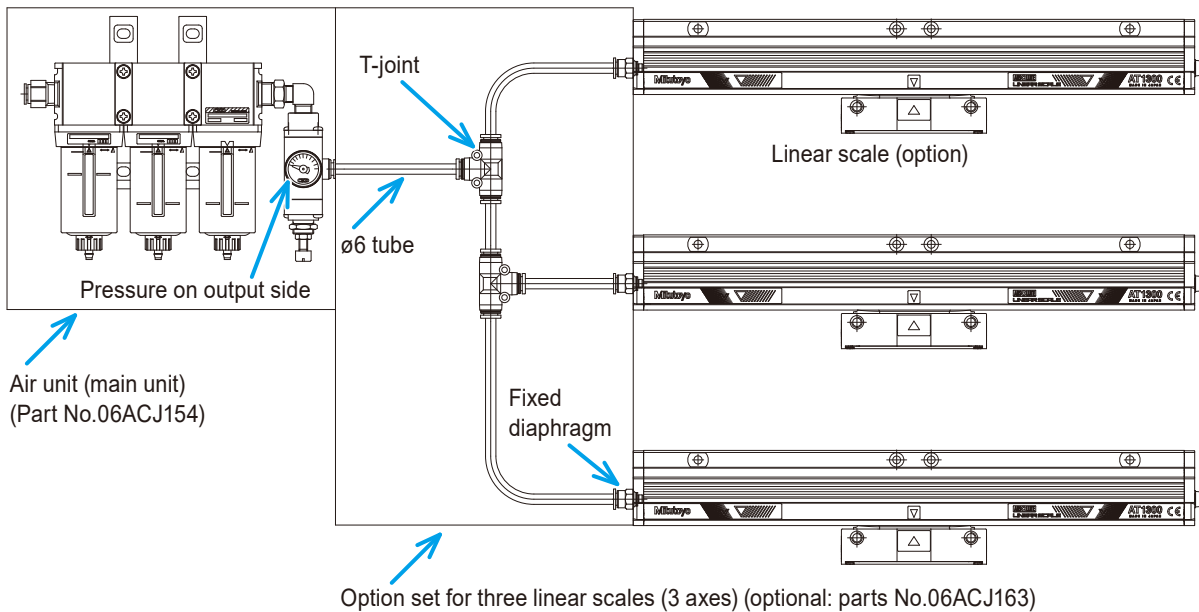
Do not directly supply air from the compressor to the air unit. Make sure to use dry compressed air through the air dryer or main line air filter.

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)



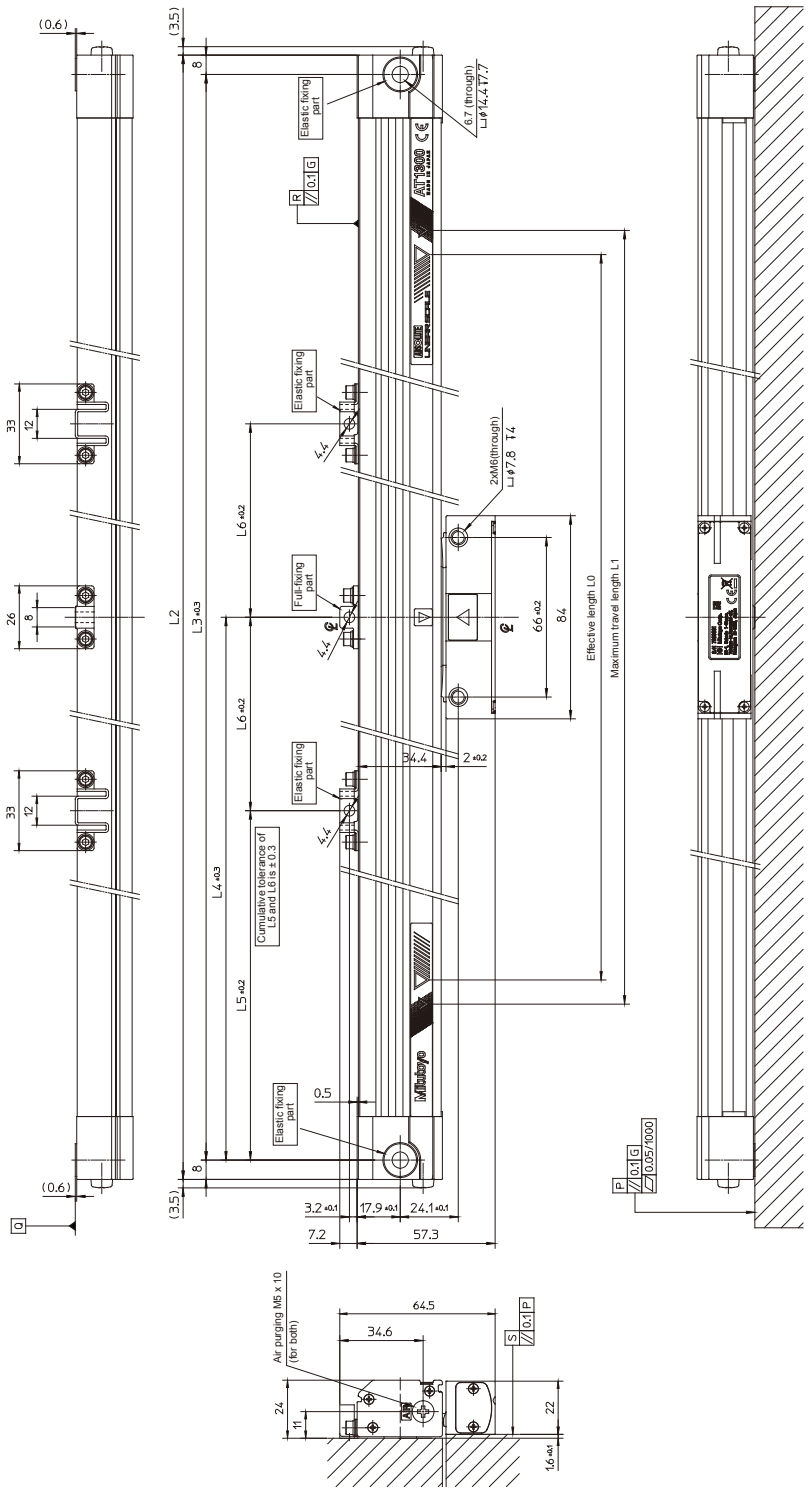
Tips

- 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 aluminum frame mounting surface. 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.

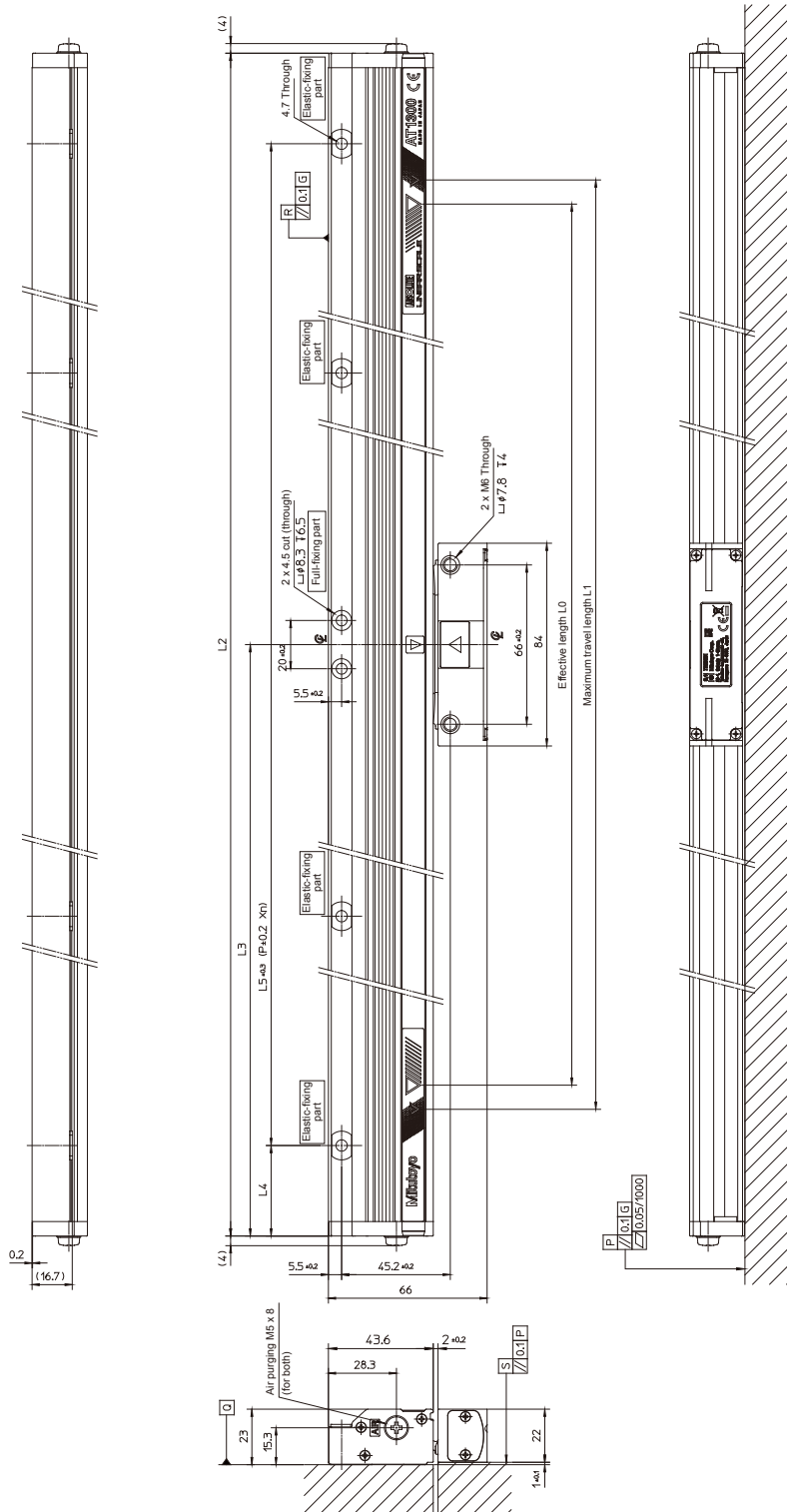
■ Dimensional Drawings

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

4.7.2 ABS AT1300-S (High Rigidity Specification)

■ Dimensional drawings



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

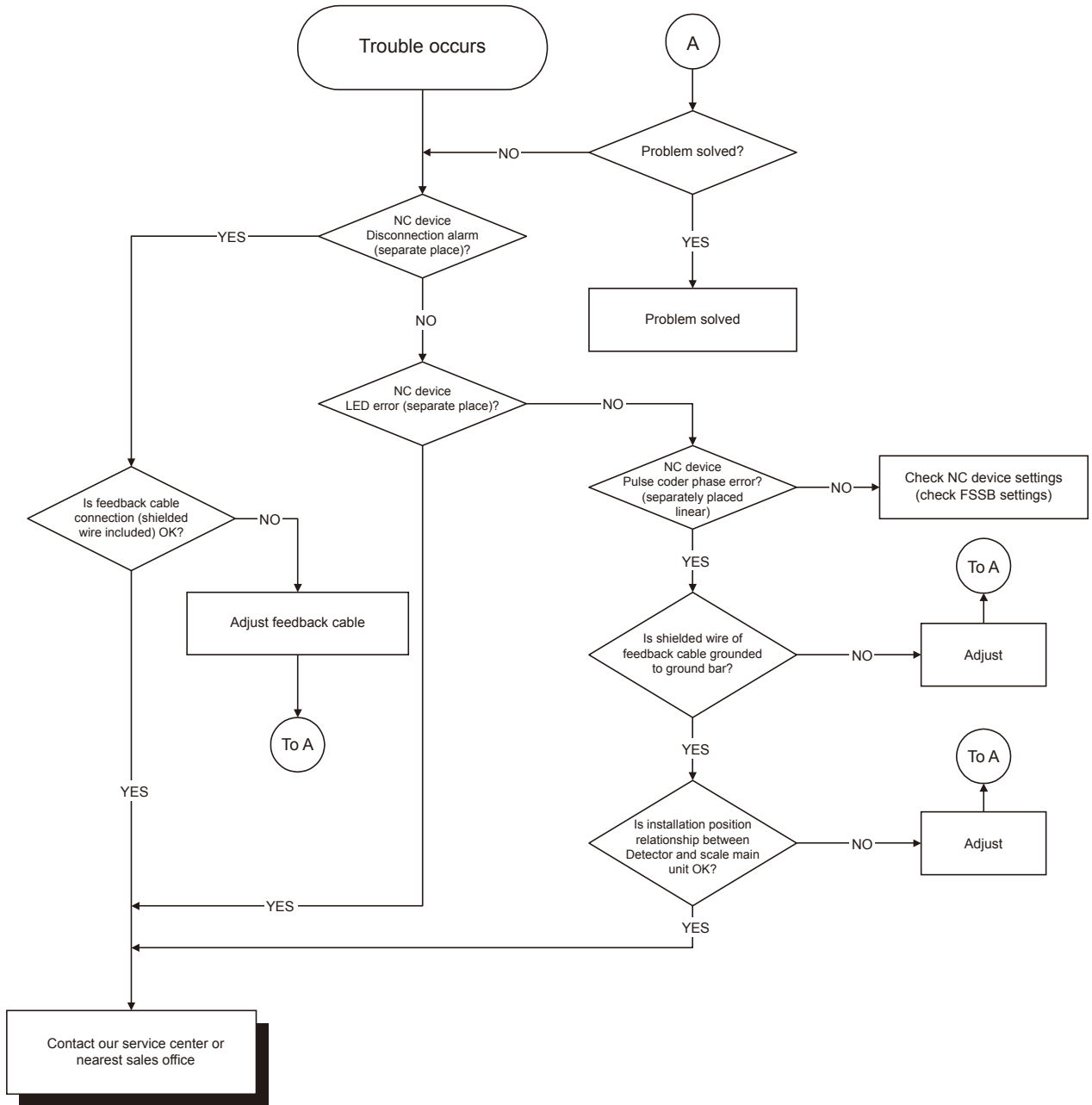
Unit of L0 to L5 and P: mm

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

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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




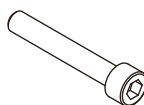
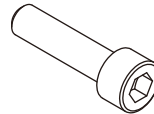

We provide software which makes it possible for the user to initially judge failure/error of this product. For details, contact a Mitutoyo sales office/service center.

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6 Appendix


6.1 Quantity of the Supplied Accessories for Installation

6.1.1 ABS AT1300-H (High Precision Specification)

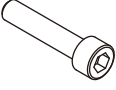
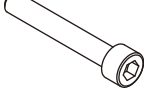


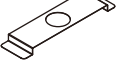
Effective length	Hex socket head cap screw M4 x 10 	Hex socket head cap screw M4 x 16 	Spring washer, nominal 4 	Hex socket head cap screw M4 x 25 	Hex socket head cap screw M6 x 25 	Spring washer, nominal 6 
100	2	1	3	2	2	2
150	2	1	3	2	2	2
200	2	1	3	2	2	2
250	2	1	3	2	2	2
300	2	1	3	2	2	2
350	2	1	3	2	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 26)

 "3.3.1 Installing the Detector" (page 32)

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 29)

 "3.3.1 Installing the Detector" (page 32)

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*As of March 2022

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