Mitutoyo

Rectangular Gauge Blocks Accessories

RGA-22
RGA-14

User's Manual

- Instructions for use -

Read this User's Manual thoroughly before operating the instrument. After reading, retain it close at hand for future reference.

No. 99MAK002B1
Date of publication: February 1, 2018 (1)

Product names and model numbers

Product name	Model number
Rectangular Gauge Blocks Accessories (22 pcs)	RGA-22
Rectangular Gauge Blocks Accessories (14 pcs)	RGA-14

Notice regarding this document

- Mitutoyo Corporation assumes no responsibilities for any damage to the instrument, caused by its use not conforming to the procedure described in this User's Manual.
- Upon loan or transfer of this product, be sure to attach this User's Manual to the product.
- In the event of loss or damage to this manual, immediately contact a Mitutoyo sales office or your dealer.
- Thoroughly read this manual to comprehend its contents before using this product.
- Particularly, for full understanding of information, carefully read "Safety Precautions" and "Precautions for Use" at the outset of this manual before using the instrument.
- The contents in this document are based on the information current as of October, 2017.
- No part or whole of this manual may be transmitted or reproduced by any means without prior written permission of Mitutoyo Corporation.
- The corporation, organization and product names that appear in this manual are their trademarks or registered trademarks.

CONVENTIONS USED IN MANUALS

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

■ Safety reminder conventions and wording warning against potential hazards

General	DANGER	Indicates an immediately hazardous situation which, if not avoided, will result in serious injury or death.
	WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.
	CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor injury.
	NOTICE	Indicates a potentially hazardous situation which, if not avoided, may result in property damage.
Specific		Alerts the user to a specific hazardous situation that means "Caution, risk of electric shock".

■ Conventions and wording indicating prohibited actions and mandatory actions

General	Prohibited	Indicates concrete information about prohibited actions.
	Mandatory	Indicates concrete information about mandatory actions.
Specific		Indicates that grounding needs to be implemented.

■ Conventions and wording indicating referential information or referential locations

Tips Indicates referential information such as that for when the operating methods and procedures which are printed in these sentences are to be applied to specific conditions.

Indicates referential locations if there is information that should be referred to in this document or an extraneous manual.

Example: For details about xxx, see  "2. Accessory Applications" (page 3).

Safety Precautions

Read these "Safety Precautions" thoroughly before operating the system to use it properly.

These safety precautions include such information as to prevent an injury to the operator and other persons or damage to property. Be sure to observe the precautions.

This product has sharp ends and other sharp parts that can cause injury or loss of eyesight. It must be carefully handled.

NOTICE Do not exert external forces to this product. Doing so may cause malfunction or breakage.

Precautions for Use

■ Product applications and handling

- This product is an accessory set for Rectangular Gauge Blocks.

  Do not use it for any purposes other than its prescribed uses such as measuring and precision scribing.
- This product is precision equipment.

  It must be carefully handled. Be careful not to apply excessive shock or force to any of the parts during storage or use.
- Before use, use a soft cloth soaked in solvent, etc., to wipe off any rust-preventive oil or dirt. Do not use organic solvents such as thinner or benzine.

■ Operating environment

Only use this product in the following environments.

- Areas free of dirt and dust
- Areas free of vibrations
- Areas in the recommended temperature of 20 °C or so with minimal temperature change
- When using this product, be sure to perform sufficient thermal stabilization.
- Areas with low humidity
- Usage upon a surface plate is recommended.

Avoid using the product in the following environments.

- Areas directly subject to drafts of hot air, cool air, or air conditioning

■ Disassembly or modification of the holder and base

Do not disassemble or modify the holder or the base.
Doing so may cause an injury.

■ Maintenance

After use, wipe dirt off the product with a soft cloth soaked in solvent, etc., and then apply anti-rust oil in a thin layer (for rust prevention). Do not use organic solvents such as thinner or benzine.

Tips

- Recommended solvent: Normal heptane
- Recommended anti-rust oil: Molycoat Super Grease (Dow Corning Toray Co.,Ltd.)

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-exporting the product from a country other than Japan, re-selling the product in a country other than Japan, or re-providing the technology (including program), you shall observe the regulations of your country.

Also, if an option is added or modified to add a function to this product, this product may fall under the category of List-Control Goods 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 EU Member Countries

When you intend exporting this product to any of the EU member countries, it may be required to provide User's Manual(s) in English and EU Declaration of Conformity in English (under certain circumstances, User's Manual(s) in the destination country's official language and EU Declaration of Conformity in the destination country's official language). For detailed information, please contact Mitutoyo in advance.

Warranty

In the event that this product should prove defective in workmanship or material, within one year from the date of original purchase for use, it will be repaired or replaced free of charge. Please contact your dealer or the nearest Mitutoyo sales office.

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

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

- Failure or damage owing to fire, salt, gas, abnormal voltage, lightning surge, or natural disaster.
- Failure or damage owing to use in combination with hardware or software other than that 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 document within the original country of the installation.

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

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

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About This Document

■ Intended readers and purpose of this document

● Intended readers

This document is intended for those who have experience using gauge blocks.

They are also assumed to be able to understand usage methods of general measuring instruments.

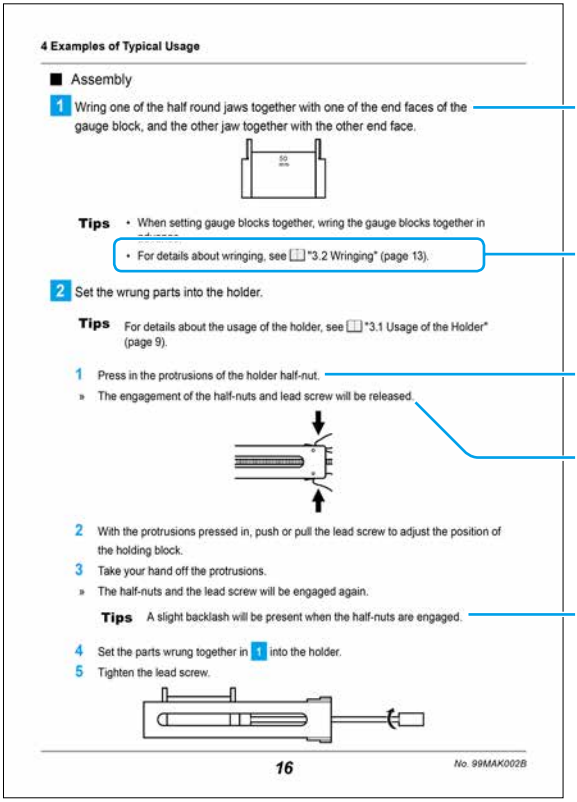
● Purpose

To use this product safely and correctly, read this document thoroughly.

After reading, keep it in a safe place close to the product.

The purpose of this document is to help you understand the basic knowledge, basic work procedures, and various functions of Rectangular Gauge Block accessories.

■ How to read this document



4 Examples of Typical Usage

■ Assembly

1 Wring one of the half round jaws together with one of the end faces of the gauge block, and the other jaw together with the other end face.

Tips • When setting gauge blocks together, wring the gauge blocks together in

• For details about wringing, see "3.2 Wringing" (page 13).

2 Set the wrung parts into the holder.

Tips For details about the usage of the holder, see "3.1 Usage of the Holder" (page 9).

1 Press in the protrusions of the holder half-nut.

» The engagement of the half-nuts and lead screw will be released.

2 With the protrusions pressed in, push or pull the lead screw to adjust the position of the holding block.

3 Take your hand off the protrusions.

» The half-nuts and the lead screw will be engaged again.

Tips A slight backlash will be present when the half-nuts are engaged.

4 Set the parts wrung together in 1 into the holder.

5 Tighten the lead screw.

16 No. 99MAK002B

Indicates an operating procedure to be performed or its outline.

Indicates the referential location.

Indicates specific work procedures.

Indicates the results of work operations.

Indicates supplementary information.

■ Representation of brackets or marks

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

( ): Round brackets	Represent a paraphrase of an immediately preceding phrase or a supplementary explanation.
" ": Double quotation marks	Represent a highlighted phrase. They also indicate an index where information to be referenced is described.

Contents

1 Overview

■ Overview of Rectangular Gauge Blocks Accessories

This product is an accessory set to better-effectively use Rectangular Gauge Blocks. Rectangular Gauge Blocks are precisely machined end standards that have a rectangular cross section. They are provided in different sizes to obtain accurate dimensions directly.

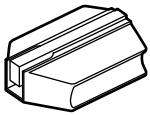
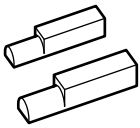
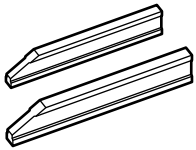
These products can be used with both steel Rectangular Gauge Blocks and ceramic Rectangular Gauge Blocks (CERA Blocks).

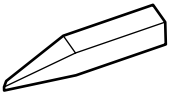
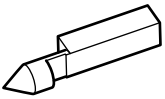
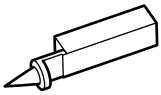
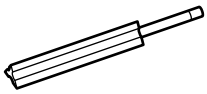
Accessories for Rectangular Gauge Blocks are available in the following sets. Accessories may also be purchased individually. Select a set based on the purpose of usage.

- 22-piece set (code No. 516-601)
- 14-piece set (code No. 516-602)

■ Included items in the set

The following accessories are included in the storage case.

Holder	Base	Half round jaws	Plain jaws (B type)
			
No. 619002: 60 mm, 1 pc* No. 619003: 100 mm, 1 pc No. 619004: 160 mm, 1 pc No. 619005: 250 mm, 1 pc	No. 619009: 35 mm, 1 pc	No. 619010: 2 mm, 2 pc set No. 619011: 5 mm, 2 pc set No. 619012: 8 mm, 2 pc set No. 619013: 12 mm, 2 pc set** No. 619014: 20 mm, 2 pc set**	No. 619018: 160 mm, 2 pc set**

Scriber point	Center point	Tram point	Triangular straight edge
			
No. 619019: 1 pc	No. 619020: 1 pc	No. 619021: 2 pc set**	No. 619022: 100 mm, 1 pc No. 619023: 160 mm, 1 pc**

*: No. 516-602 (14-piece set) only

**: No. 516-601 (22-piece set) only

2 Accessory Applications

This section explains the application of each accessory.

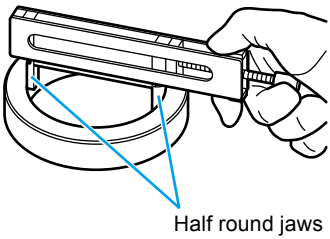
For examples of accessory usage, see "4 Examples of Typical Usage" (page 15).

Half round jaws

Primary application: Limit gage for inside diameters/Reference gage for inside measurement

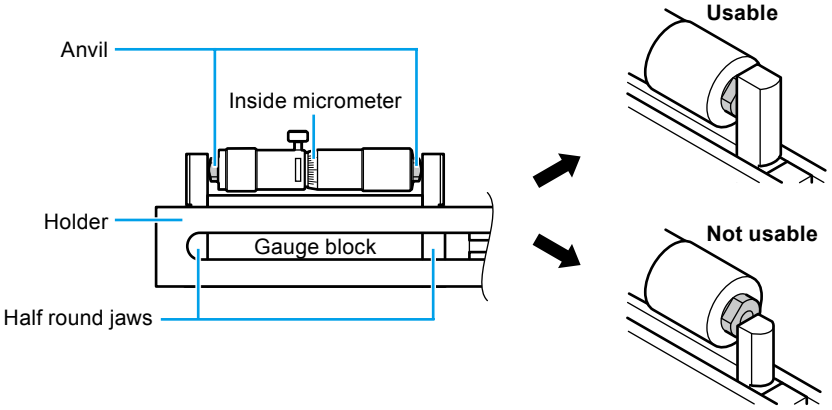
The limit gage is made by assembling the jaws together with gauge blocks into the holder. It can perform GO/NG judgment for a large number of parts effectively.

Furthermore, the inner surfaces (surfaces for wringing) of the jaws can be used as a reference gage that is used for the zero setting for inside micrometers and bore gages or the accuracy check for vernier calipers in inside measurement.



Tips

- The nominal size of the jaws are marked on them.
- If the anvil of the inside micrometer protrudes from the half round jaws, the inside micrometer cannot be used.



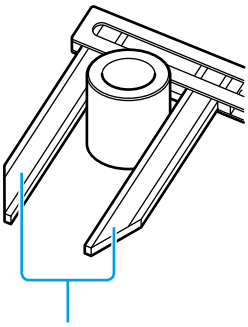
■ Plain jaws (B type)

Primary application: Limit gage for outside diameters/Reference gage

The limit gage is made by assembling the jaws together with gauge blocks into the holder. It can perform GO/NG judgment for a large number of parts effectively.

Furthermore, the jaws can be used as a reference gage that is used for the zero setting for inside micrometers and bore gages or the accuracy check for vernier calipers in inside measurement.

Tips The jaw length of 160 is marked on the sides of the surfaces for wringing.



Plain jaws (B type)

■ Base

Primary application: Base for using the holder in a vertical orientation

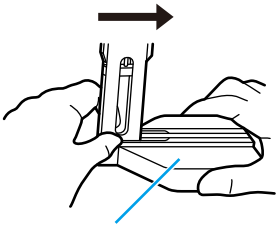
The base is used with the holder inserted vertically.

When removing the holder, take it out in the opposite direction of the arrow in the right figure.

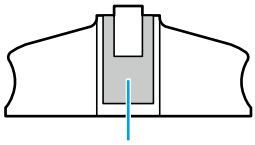
The holder can be secured by pressing the gauge blocks and half round jaws, etc., on the base with the lead screw.

Tips

- The nominal size of the base is marked on it.
- The gray area in the right figure is the holder mounting space. The holder should be inserted fully into the base to set it in place.



Base



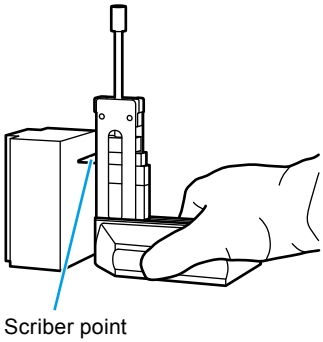
Holder mounting space

■ Scriber point

Primary application: High accuracy scribing

The scriber point is assembled together with gauge blocks into the holder to use as a scriber.

The tip position of the scriber point assembled becomes at the same position (height) as the surface for wringing to allow for high accuracy scribing.



CAUTION

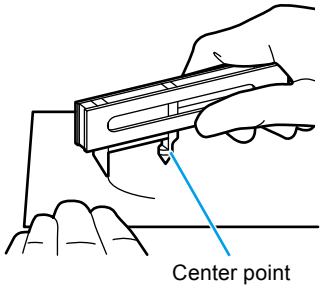
The tip is sharp, so be careful to avoid injury.

■ Center point

Primary application: Fulcrum for arc scribing

The center point is assembled together with gauge blocks and the scriber point into the holder to use as an arc scribing fulcrum.

The tip position of the center point assembled becomes at the same position as the surface for wringing to allow for high accuracy scribing.



CAUTION

The tip is sharp, so be careful to avoid injury.

NOTICE

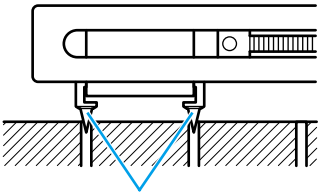
This part cannot be used as a scriber. The tip will be damaged.

■ Tram points

Primary application: Inspection of intervals (pitch, span) between holes or grooves

The tram points are assembled together with gauge blocks into the holder to check the interval (pitch, span) between holes or grooves.

The tip positions of the tram points assembled become at the same positions as the surfaces for wringing to allow for high accuracy checking.



CAUTION The tip is sharp, so be careful to avoid injury.

NOTICE This part cannot be used as a scriber. The tip will be damaged.

■ Triangular straight edge

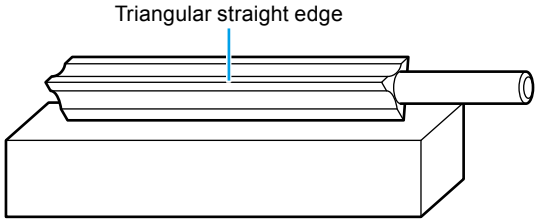
Primary application: Visual checking of straightness and depths of concavities

The edge part (straight part) is set against the flat surface of the target object (measurement workpiece, etc.). The straightness can be checked by gaps between the edge and the flat surface. Visual confirmation of gaps of 2 µm to 3 µm is possible.

CAUTION The edge is sharp, so be careful to avoid injury.

Tips If a gap or groove is large enough to fit in a gauge block, its depth can also be checked.

"4.6.2 Checking Depth (Using the Triangular Straight Edge)" (page 27)



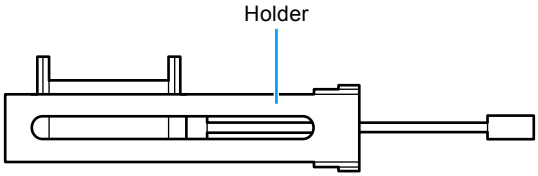
■ Holder

Primary application: Joining and securing the assembled jaws and gauge blocks, etc.

The wrung gauge blocks and half round jaws, etc., are assembled into the holder. They are secured with the lead screw.

Tips

- For holders with a clamping adapter (parts No. 619004 and No. 619005), their working range can be adjusted. For details about clamping adapters, see "■ Moving the holding block" (page 9).
- For details about the maximum dimensions applicable to a holder, see "6 Specifications" (page 33).



MEMO

3 Cautions for Assembly

3.1 Usage of the Holder

CAUTION

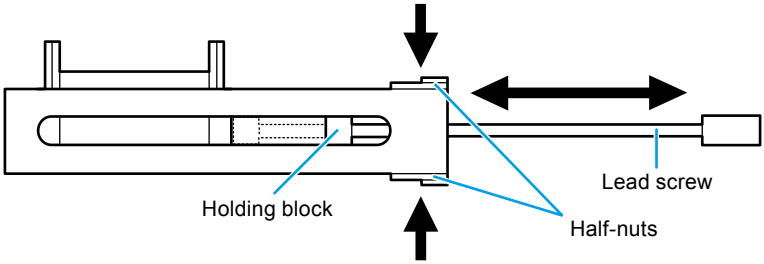
- Do not disassemble or modify the holder. Doing so may cause an injury.
- Be careful when attaching or removing half round jaws, etc., from the holder so as not to pinch or strike the fingers. Doing so may cause an injury.

NOTICE Do not apply excessive force (such as dropping or impacts) to the holder. Doing so may cause malfunction or breakage.

■ Moving the holding block

Turn the lead screw connected to the holding block to move the holding block.

Pushing in protrusions of the half-nut on either side releases the engagement of the lead screw, allowing the holding block to be moved without turning the lead screw. This is convenient when moving the holding block a long distance.



Tips For details about the maximum dimensions applicable to a holder, see "6 Specifications" (page 33).

■ Clamping adapter

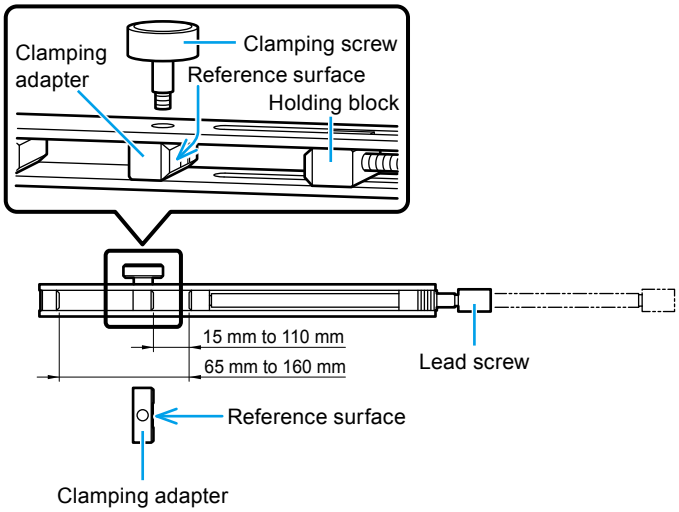
A clamping adapter and clamping screw are supplied with holders of parts No. 619004 and No. 619005.

The clamping adapter can be attached in the holder using the clamping screw to adjust its working range.

When attaching the clamping adapter, insert the clamping adapter into the holder so that its reference surface faces toward the holding block, and then tighten it using the clamping screw.

Tips For details about the maximum dimensions applicable to a holder, see "6 Specifications" (page 33).

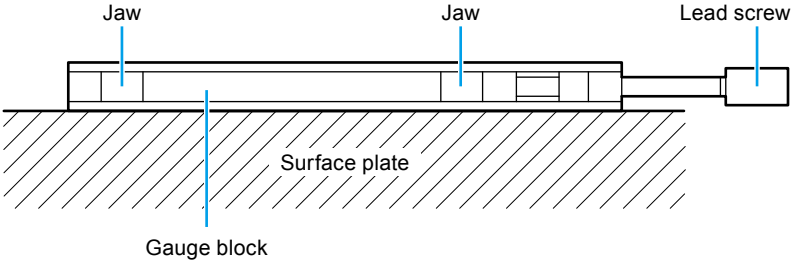
Example: Part No. 619004



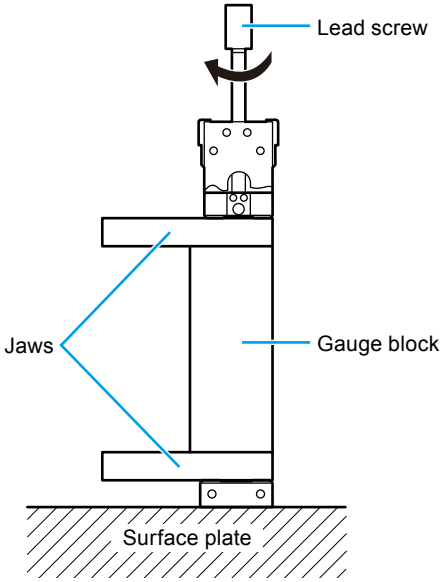
■ Method for assembly into holder

After wringing the jaws and gauge block together, insert them into the holder, and then secure them with "Method 1" or "Method 2" shown below.

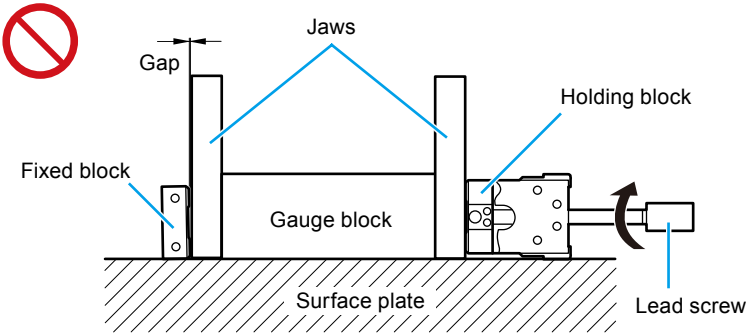
Method 1: Secure the jaws, gauge block, and holder in lying down on a surface plate as shown in the figure below.



Method 2: Secure the jaws, gauge block, and holder standing on a surface plate as shown in the figure below.



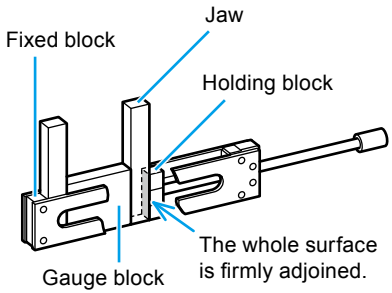
NOTICE When jaws, gauge block, and the holder are set as shown in the figure below and tightened with the lead screw, a gap may form between the fixed block and a jaw due to the shape of the holder. Be careful if there are any gaps, it will affect accuracy.



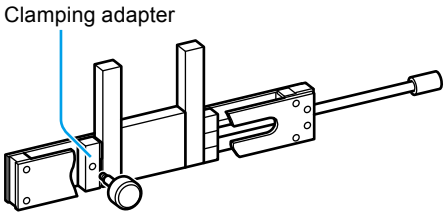
■ Surface for wringing

When wringing, make full use of the surfaces for wringing of jaws, gauge block, the holding block, the fixed block, and the clamping adapter. If surfaces are only partially adjoining, be careful as this may affect the accuracy.

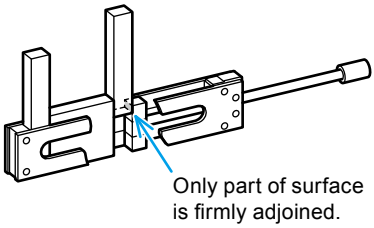
Good example



Good example
(using a clamping adapter)



Bad example



3.2 Wringing

The process of firmly setting gauge blocks together or firmly setting gauge blocks against half round jaws, etc., is called "wringing". Steel and ceramic gauge blocks can also be wrung together.

NOTICE When handling gauge blocks and accessories, do not touch them with bare hands. Wear gloves for precision work. When steel gauge blocks and accessories are handled with bare hands, the resulting heat conduction can alter the parts' dimensions, and oils and sweat can cause rusting to occur.

1 Wipe wringing surfaces with lens cleaning paper soaked in solvent (such as normal heptane), and then finally wipe the surface dry with a dry portion of the paper.

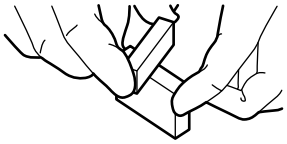
NOTICE If small dirt or grease is left on surfaces for wringing, dimensions after wringing may increase, or the gauge blocks or half round jaws, etc., may be scratched, so make sure to wipe the surfaces clean before wringing.

Tips For wiping, use lens cleaning paper or other material which does not leave paper fibers.

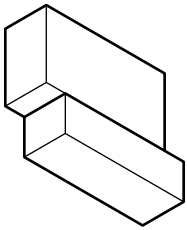
2 Slightly spread vaseline or grease onto the surfaces for wringing.

Tips Wipe until the oil layer is almost completely gone.

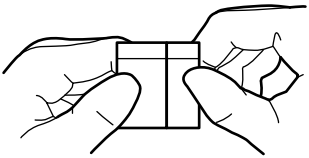
3 Intersect the surfaces for wringing of the gauge blocks at a 90° angle.



4 Lightly apply force and rotate the gauge blocks until they are parallel and firmly set together.



5 Align the edges of the gauge blocks.



4 Examples of Typical Usage

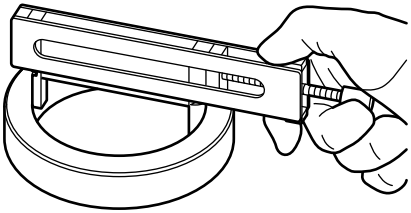
This section explains parts configurations and assembly procedures for examples of typical usage.

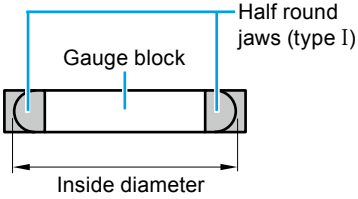
4.1 Reference Gage for Inside Measurements / Limit Gage for Inside Diameters (Using Half Round Jaws)

This section explains how to assemble a limit gage for checking of inside diameters.

This limit gage can be used for calibration of inside measurement of calipers.

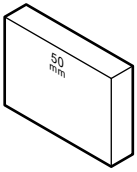
As an example, this procedure explains the assembly of a gage for checking a 60 mm inside diameter.



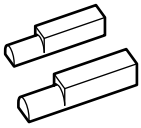


■ Preparation

Required accessories and gauge blocks



Gauge block 50 mm



Half round jaw 5 mm×2

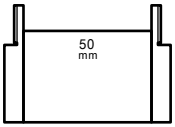
Holder 100 mm

Tips

- Inside diameter = half round jaw + gauge block + half round jaw
  60 mm = 5 mm + 50 mm + 5 mm
- When a 50 mm gauge block is not available, wring together two gauge blocks, such as a 30 mm and a 20 mm gauge block.
- For details about the maximum dimensions applicable to a holder, see "6 Specifications" (page 33).
- When using a holder with a clamping adapter (parts No. 619004 or No. 619005), see "■ Moving the holding block" (page 9) for the clamping adapter attachment method.

■ Assembly

1 Wring one of the half round jaws together with one of the end faces of the gauge block, and the other jaw together with the other end face.



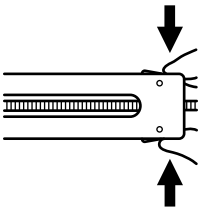
Tips
- When setting gauge blocks together, wring the gauge blocks together in advance.
- For details about wringing, see "3.2 Wringing" (page 13).

2 Set the wrung parts into the holder.

Tips For details about the usage of the holder, see "3.1 Usage of the Holder" (page 9).

1 Press in the protrusions of the holder half-nut.

» The engagement of the half-nuts and lead screw will be released.



2 With the protrusions pressed in, push or pull the lead screw to adjust the position of the holding block.

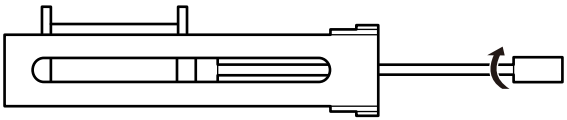
3 Take your hand off the protrusions.

» The half-nuts and the lead screw will be engaged again.

Tips A slight backlash will be present when the half-nuts are engaged.

4 Set the parts wrung together in **1** into the holder.

5 Tighten the lead screw.



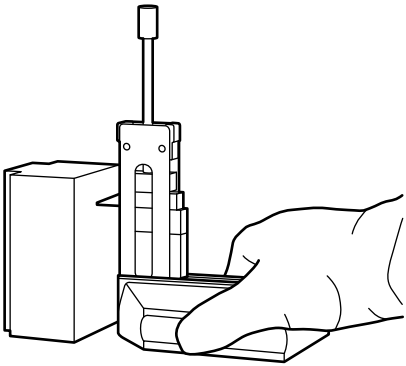
Tips
- A torque driver is recommended for tightening the lead screw.
- The recommended tightening torque is 600 mN•m.

This completes assembly.

4.2 Precision Scribing (Using the Base and Scriber Point)

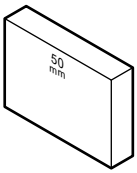
This assembly is for performing precision scribing at a specific height.

This section explains how to perform scribing at a height of 85 mm as an example.

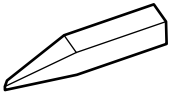


■ Preparation

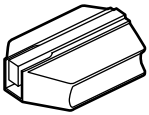
Required accessories and gauge blocks



Gauge block 50 mm



Scriber point



Base (height: 35 mm)

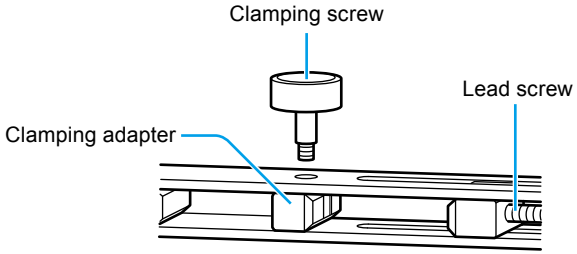
Holder 100 mm

Tips

- Scribing height = base + gauge block
  85 mm = 35 mm + 50 mm
- When a 50 mm gauge block is not available, wring together two gauge blocks, such as a 30 mm and a 20 mm gauge block.
- For details about the maximum dimensions applicable to a holder, see "6 Specifications" (page 33).

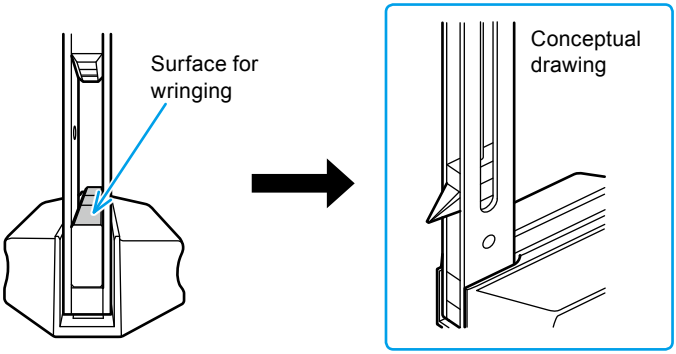
■ Assembly

1 When a clamping adapter is attached to the holder, remove the clamping screw and take the clamping adapter out from the holder.



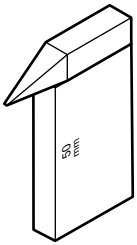
2 Set the holder into the base.

NOTICE Before setting the holder into the base, wipe the surface for wringing of the base with lens cleaning paper soaked in solvent (such as normal heptane), and be careful not to let any dust, etc., enter between it and the gauge block.



Tips For details about the holder mounting space of the base, see "■ Base" (page 4).

3 Wring the gauge block together with the scriber point.



CAUTION

The tip of the scriber point is sharp, so be careful to avoid injury.

Tips

- When setting gauge blocks together, wring the gauge blocks together in advance.
- For details about wringing, see "3.2 Wringing" (page 13).

4 Set the wrung parts into the holder.

Tips For details about the usage of the holder, see "3.1 Usage of the Holder" (page 9).

1 Press in the protrusions of the holder half-nut.

» The engagement of the half-nuts and lead screw will be released.

2 With the protrusions pressed in, push or pull the lead screw to adjust the position of the holding block.

3 Take your hand off the protrusions.

» The half-nuts and the lead screw will be engaged again.

Tips A slight backlash will be present when the half-nuts are engaged.

4 Set the parts wrung together in **3** onto the surface for wringing of the base.

5 Tighten the lead screw.

Tips

- A torque driver is recommended for tightening the lead screw.
- The recommended tightening torque is 600 mN•m.

This completes assembly.

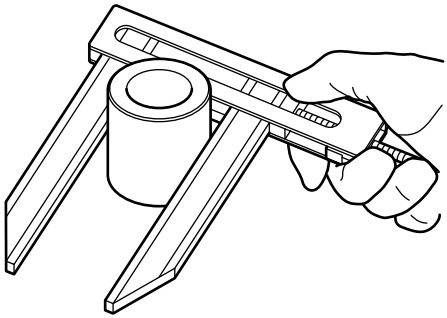
Support the base while sliding it across the surface plate to perform precision scribing of objects.

4.3 Limit Gage for Outside Diameters (Using Plain Jaws or Half Round Jaws)

This section explains how to assemble a limit gage for checking of outside diameters.

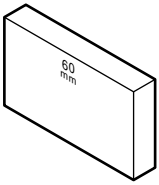
Assembling two limit gages with different sizes, they can be used as GO and NO-GO gages.

As an example, this procedure explains the assembly of a gage for checking a 60 mm outside diameter.

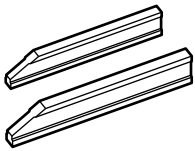


■ Preparation

Required accessories and gauge blocks



Gauge block 60 mm



Plain jaw (B type)* 160 mm×2

* Half round jaws can also be used.

Holder 100 mm

Tips
- Outside diameter = Gauge block
  60 mm = 60 mm
- When a 60 mm gauge block is not available, wring together two gauge blocks, such as a 50 mm and a 10 mm gauge block.
- For details about the maximum dimensions applicable to a holder, see "6 Specifications" (page 33).

Assembly

1 Wring one of the plain jaws (or half round jaws) together with one of the end faces of the gauge block, and the other jaw together with the other end face.

Tips
- When setting gauge blocks together, wring the gauge blocks together in advance.
- For details about wringing, see "3.2 Wringing" (page 13).

2 Set the wrung parts into the holder.

Tips For details about the usage of the holder, see "3.1 Usage of the Holder" (page 9).

1. Press in the protrusions of the holder half-nut.

» The engagement of the half-nuts and lead screw will be released.

2. With the protrusions pressed in, push or pull the lead screw to adjust the position of the holding block.
3. Take your hand off the protrusions.

» The half-nuts and the lead screw will be engaged again.

Tips A slight backlash will be present when the half-nuts are engaged.

4. Set the parts wrung together in **1** into the holder.
5. Tighten the lead screw.

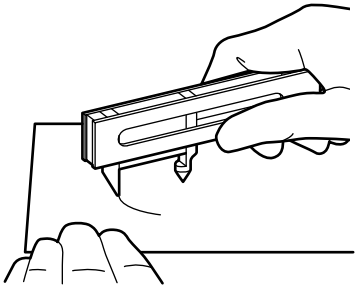
Tips
- A torque driver is recommended for tightening the lead screw.
- The recommended tightening torque is 600 mN•m.

This completes assembly.

4.4 Arc Precision Scribing (Using the Center Point and Scriber Point)

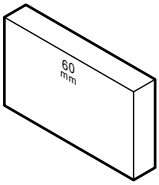
This section explains how to assemble a precision compass for arc scribing.

As an example, this procedure explains the assembly of a precision compass for arc scribing with a radius of 60 mm.

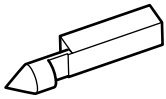


■ Preparation

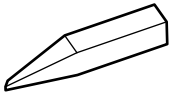
Required accessories and gauge blocks



Gauge block 60 mm



Center point



Scriber point

Holder 100 mm

Tips

- Precision compass radius = Gauge block
  60 mm = 60 mm
- When a 60 mm gauge block is not available, wring together two gauge blocks, such as a 50 mm and a 10 mm gauge block.
- For details about the maximum dimensions applicable to a holder, see "6 Specifications" (page 33).

■ Assembly

1 Wring the center point together with one of the end faces of the gauge block, and the scriber point together with the other end face.

The tips of the center point and scriber point are sharp, so be careful to avoid injury.

NOTICE The center point cannot be used as a scriber. The tip will be damaged.

Tips
- When setting gauge blocks together, wring the gauge blocks together in advance.
- For details about wringing, see "3.2 Wringing" (page 13).

2 Set the wrung parts into the holder.

Tips For details about the usage of the holder, see "3.1 Usage of the Holder" (page 9).

1 Press in the protrusions of the holder half-nut.

» The engagement of the half-nuts and lead screw will be released.

2 With the protrusions pressed in, push or pull the lead screw to adjust the position of the holding block.

3 Take your hand off the protrusions.

» The half-nuts and the lead screw will be engaged again.

Tips A slight backlash will be present when the half-nuts are engaged.

4 Set the parts wrung together in **1** into the holder.

Tips Set the center point and scriber point tips parallel to the holder. The levelness may affect the measurement error.

5 Tighten the lead screw.

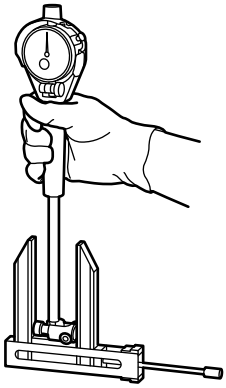
Tips
- A torque driver is recommended for tightening the lead screw.
- The recommended tightening torque is 600 mN•m.

This completes assembly.

4.5 Reference Gage for Measuring Tools (Using Plain Jaws or Half Round Jaws)

This section explains how to assemble a reference gage for measuring tools.

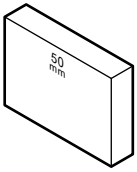
As an example, this procedure explains the assembly of a 50 mm length reference gage for bore gages.



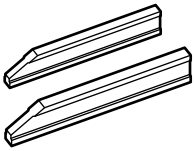
Tips Select appropriate plain jaws or half round jaws for the bore gage being used.

■ Preparation

Required accessories and gauge blocks



Gauge block 50 mm



Plain jaw (B type)* 160 mm×2

* Half round jaws can also be used.

Holder 100 mm

Tips

- Length of reference gage = Gauge block
  50 mm = 50 mm
- When a 50 mm gauge block is not available, wring together two gauge blocks, such as a 30 mm and a 20 mm gauge block.
- For details about the maximum dimensions applicable to a holder, see "6 Specifications" (page 33).

■ Assembly

1 Wring one of the plain jaws (or half round jaws) together with one of the end faces of the gauge block, and the other jaw together with the other end face.

Tips
- When setting gauge blocks together, wring the gauge blocks together in advance.
- For details about wringing, see "3.2 Wringing" (page 13).

2 Set the wrung parts into the holder.

Tips For details about the usage of the holder, see "3.1 Usage of the Holder" (page 9).

1. Press in the protrusions of the holder half-nut.

» The engagement of the half-nuts and lead screw will be released.

2. With the protrusions pressed in, push or pull the lead screw to adjust the position of the holding block.
3. Take your hand off the protrusions.

» The half-nuts and the lead screw will be engaged again.

Tips A slight backlash will be present when the half-nuts are engaged.

4. Set the parts wrung together in **1** into the holder.
5. Tighten the lead screw.

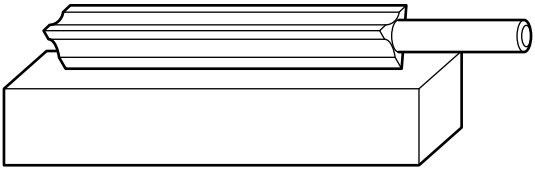
Tips
- A torque driver is recommended for tightening the lead screw.
- The recommended tightening torque is 600 mN•m.

This completes assembly.

4.6 Other Usage Examples

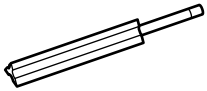
4.6.1 Checking Straightness (Using the Triangular Straight Edge)

The triangular straight edge is set against the flat surface of the target object or jig, etc., as shown in the figure below, and the straightness can be checked from the gaps. A minimum gap of 2 µm or 3 µm can be confirmed visually.



■ Preparation

Required accessories



Triangular straight edge 100 mm or 160 mm

■ Methods for the checking

1 Wipe the edges of the triangular straight edge and the surface to be checked with lens cleaning paper soaked in solvent (such as normal heptane).

NOTICE Be careful not to let any dust, etc., enter between the edge and the surface to be checked.

2 Set the edge of the triangular straight edge on the surface to be checked, and visually check straightness with gaps between the edge and the surface to be checked.

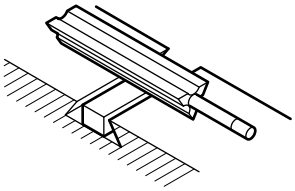
3 Estimate the straightness using the visibility of the gaps.

Tips A certain level of skill is required for the check; however, turning the gaps toward the light can facilitate their observation.

4.6.2 Checking Depth (Using the Triangular Straight Edge)

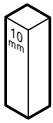
The triangular straight edge and gauge blocks can be used to visually check the depths of grooves, etc.

As an example, this procedure explains for checking a groove of 10 mm in depth.

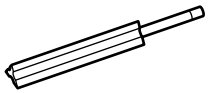


■ Preparation

Required accessories and gauge blocks



Gauge block 10 mm



Triangular straight edge 100 mm or 160 mm

■ Methods for the checking

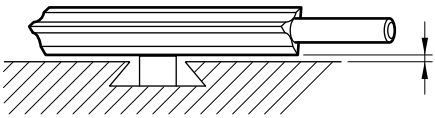
1 Wipe the edges of the triangular straight edge, the reference surface of the groove, and the gauge block surface for measurement with cleaning agent, etc.

NOTICE Be careful not to let any dust, etc., enter between the reference surface and the gauge block.

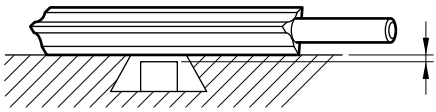
2 Insert the gauge block into the groove.

3 Set the edge of the triangular straight edge on the reference surface of the groove, and visually check for any gaps between it and the reference surface.

Bad example: Groove is shallower than the design value.



Bad example: Groove is deeper than the design value.

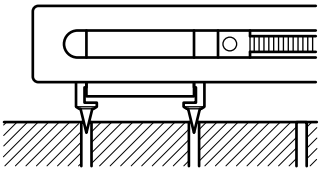


4.6.3 Checking Hole Pitch (Using Tram Points)

This section explains how to assemble a gage for checking hole pitch.

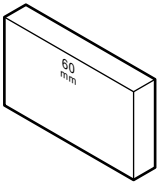
As an example, this procedure explains for checking for a hole pitch of 60 mm.

Tips The same assembly can be used for inspecting single pitch.

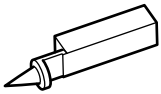


■ Preparation

Required accessories and gauge blocks



Gauge block 60 mm



Tram point ×2

Holder 100 mm×2

Tips

- Hole pitch = Gauge block
  60 mm = 60 mm
- When a 60 mm gauge block is not available, wring together two gauge blocks, such as a 50 mm and a 10 mm gauge block.

■ Assembly

1 Wring one of the tram points together with one of the end faces of the gauge block, and the other point together with the other end face.

The tips of the tram points are sharp, so be careful to avoid injury.

Tips

- When setting gauge blocks together, wring the gauge blocks together in advance.
- For details about wringing, see "3.2 Wringing" (page 13).

2 Set the two tram point tips parallel to the holder.

Tips

- For details about the usage of the holder, see "3.1 Usage of the Holder" (page 9).
- The levelness may affect the measurement error.

3 Insert the points into the two target holes to check the hole pitch.

This completes assembly.

MEMO

5 Maintenance

This section explains the regular inspection and cleaning of this product.

In order to use this product with sufficient performance safely and for a long period, follow the below items to perform maintenance and inspection.

■ Regular Inspection

Check the appearance for dirt/dust, scratches, wear, or reduction.

To check for surface for wringing wear, use a tool such as an optical flat to check for interference fringes.

If there are any burrs or nicks, use a Ceraston* as with gauge blocks to remove them.

To maintain quality, we recommend periodic inspection (calibration) to be performed by Mitutoyo.

* Ceraston: Part No. 601644 or No. 601645

■ Cleaning

After use, wipe dirt off the product with a soft cloth soaked in solvent, etc., and then apply anti-rust oil in a thin layer before housing and storing it in a safe place (for rust prevention). Do not use organic solvents such as thinner or benzine.

Tips

- Placing evaporative anti-rust paper into the storage case provides more effective storage.
- Recommended solvent: Normal heptane
- Recommended anti-rust oil: Molycoat Super Grease (Dow Corning Toray Co.,Ltd.)

MEMO

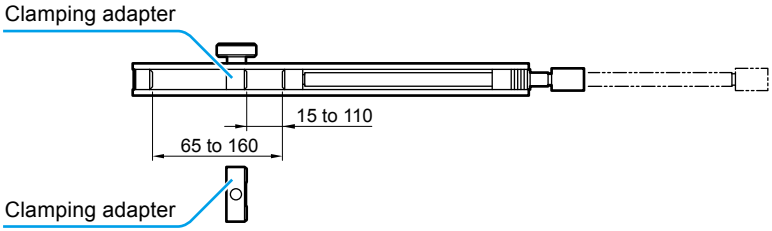
6 Specifications

- Rectangular Gauge Blocks Accessories (22 pcs) (Code No. 516-601)
- Rectangular Gauge Blocks Accessories (14 pcs) (Code No. 516-602)
- Holder

Part No.	Nominal size (mm)	Working range (mm)
619002	60	15 to 60
619003	100	5 to 100

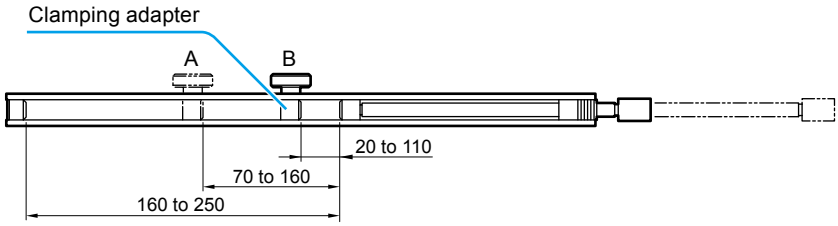
Part No.	Nominal size (mm)	Working range (mm)	Clamping adapter
619004	160	65 to 160	When not used
		15 to 110	When used

When mounting it onto a base, the working range is the same as when the clamping adapter is not used.

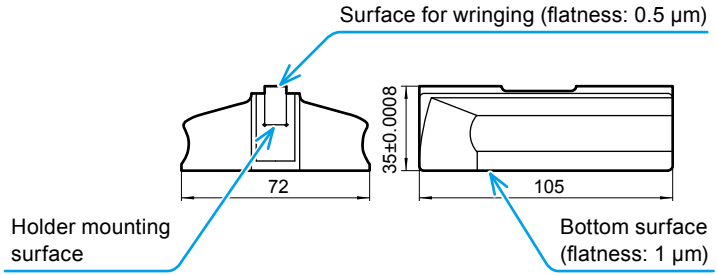


Part No.	Nominal size (mm)	Working range (mm)	Clamping adapter
619005	250	160 to 250	When not used
		70 to 160	When used at position A
		20 to 110	When used at position B

When mounting it onto a base, the working range is the same as when the clamping adapter is not used.



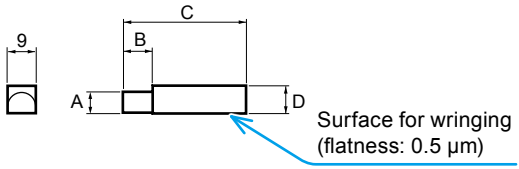
■ Base (Part No. 619009)



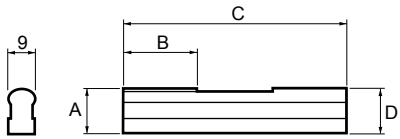
■ Half round jaws

Part No.	Type	Nominal size (mm)	A (mm)	B (mm)	C (mm)	D (mm)
619010	I	2	2±0.0005	5.5	40	7.5
619011		5	5±0.0005	15.5	45	7.5
619012		8	8±0.0005	20	50	8.5
619013	II	12	12±0.0005	25	75	13
619014		20	20±0.0005	25	125	20.5

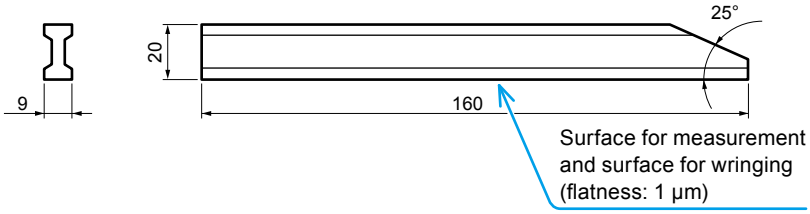
Type I



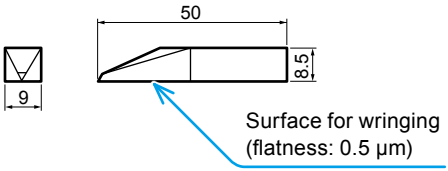
Type II



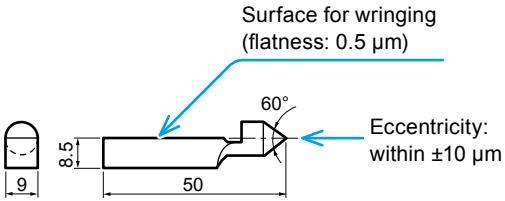
■ Plain jaw (B type) (Part No. 619018)



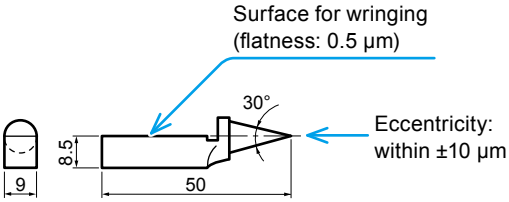
■ Scriber point (Part No. 619019)



■ Center point (Part No. 619020)

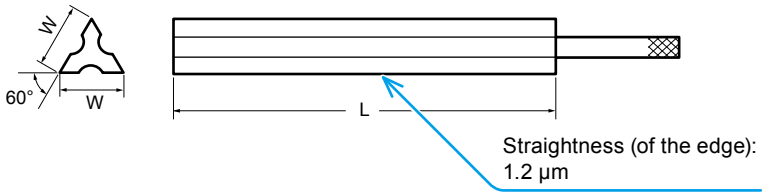


■ Tram point (Part No. 619021)



■ Triangular straight edge

Part No.	L (mm)	W (mm)
619022	100	16
619023	160	19.5



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Revision History

Date of publication	No. of revisions	Revision details
February 1, 2018	First edition	Printed

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Printed in Japan

No. 99MAK002B