Mitutoyo

# High-Precision Linear Gage LGH Series

## LGH-1010-B-EH
## LGH-1010C-B-EH

# User's Manual

## - Instructions for use -

Read this document thoroughly before operating the product. After reading, retain it close at hand for future reference.

No. 99MBC122A4
Date of publication: December 1, 2020 (1)

## Correspondence of product names and model numbers

| Product name | Model number |
|---|---|
| High-Precision Linear Gage<br>LGH Series | LGH-1010-B-EH<br>LGH-1010C-B-EH |

## 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 a Mitutoyo sales office or your dealer.
- Before operation of the product, thoroughly read this document to comprehend its contents.
- Particularly, for full understanding of information, carefully read "Safety Precautions" and "Precautions for Use" at the outset of this document before using the product.
- The contents in this document are based on the information current as of December, 2020.
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- Some screen displays in this document may be highlighted, simplified or partially omitted for convenience of explanation. In addition, some of them may differ from actual ones to the extent that no user will misunderstand the functions and operations.
- The corporation, organization and product names that appear in this document are their trademarks or registered trademarks.

# Conventions Used in Manuals

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

## ■ Safety reminder conventions and wording warning against potential hazards

| | |
|---|---|
| DANGER | Indicates 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. |
|  | Alerts the user to a specific hazardous situation that means "Caution, risk of electric shock". |

## ■ Conventions and wording indicating prohibited and mandatory actions

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

## ■ Conventions and wording indicating referential information or referential locations

**Tips** Indicates 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 User's Manual.

E.g.: For details about XX, see "1.2 Part Names and Functions" (page 2).

# 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.

**⚠ WARNING**

Do not remove the cover or disassemble the product. Otherwise you may be subject to electric shock, and there is a risk of breakage or fire due to a short circuit caused by metallic powders that have gotten inside the product.

# Precautions for Use

## ■ Product applications and handling

### ● This product is a measuring instrument.

Do not use it for any purposes other than measuring.

### ● This is an industrial product.

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

### ● This product is precision equipment.

- Handle this product with care. Do not apply excessive shock or force to any of the parts during operation.
- Be sure to mount the gage head securely.
- When handling the gage head, hold it by a part near the stem.Do not hold by the spindle/rubber cap or cable.

## ■ Installation environment

This product is designed for indoor use. To ensure optimal performance for this precision equipment, take the following conditions into account when installing this product.

- Vibration
  Install this product in an environment where it will be subject to minimal vibration. Using this product in a place with significant vibration for an extended period of time may result in malfunction of the precision components. If using this product in a place with significant vibration is unavoidable, lay a vibration-proof rubber sheet, etc., under this product in order to reduce the vibration.
- Dust
  Dust in the installation site negatively affects the electrical components in the Display. Install this product in an environment where it will be subject to minimal dust.
- Sunlight
  If this product is exposed to direct sunlight, the heat will cause deformations in the main body, negatively affecting its operation. If installing this product in an environment that is exposed to direct sunlight, such as near a window, is unavoidable, protect it from the sunlight by curtaining it off, etc.
- Ambient temperature, humidity
  Avoid using it in a place that is subject to sudden changes in temperature or humidity.

When using this product in the following environments, take necessary shielding measures.

- In locations subject to electric noise, such as from static electricity
- In locations subject to strong electric fields
- In locations near power supply lines/power lines
- In locations where it may directly exposed to chips, cutting fluids, water, etc.
- In locations that may be exposed to radiation
- In locations that may be exposed to corrosive gas

## ■ Maintenance

Gently wipe dirt off of the product with a soft, tightly woven cloth. Do not use organic solvents such as thinner or benzine.

## ■ Power source

- Turn off the power switch after use.
- Do not connect the AC adapter to high-current power used by machine tools or large CNC measuring instrument.
- If you use a commercial power source, use a power cable measuring 30 m or shorter for the instrument, and connect the instrument to the power source one-to-one.

- Use only a power source for this product that is rated at 12 V to 24 V and an output current of 1 A or more. Never use this power source with other electric equipment that runs at a high voltage and/or large current.
- Avoid outdoor wiring.

- Be sure to connect this product to ground.
- Connect the AC adapter to a grounding three-slot outlet.

# Electromagnetic Compatibility (EMC)

This product complies with the EU EMC Directive. Note that in environments where electromagnetic interference exceeds EMC requirements defined in this directive, appropriate countermeasures are required to assure product performance.

# Export Control Compliance

This product falls into the Catch-All-Controlled Goods and/or Catch-All-Controlled Technologies (including Programs) under Category 16 of Appended Table 1 of Export Trade Control Order or under Category 16 of Appended Table of Foreign Exchange Control Order, based on Foreign Exchange and Foreign Trade Act of Japan.

If you intend re-export of the product from a country other than Japan, re-sale of the product in a country other than Japan, or re-providing of the technology (including Programs), you shall observe the regulations of your country.

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

# Notes on Export to EU Member Countries

When you intend exporting of 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.

# Disposal of Products outside the European Union and Other European Countries

Please follow the official instruction in each community and country.

# Disposal of Old Electrical & Electronic Equipment (Applicable in the European Union and Other 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), which is a regulation in EU member countries, 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 your dealer or the nearest 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 | × | ○ | ○ | ○ | ○ | ○ |
| 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

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, at Mitutoyo's option, free of charge upon its prepaid return to Mitutoyo, without prejudice to the provisions of the Mitutoyo Software End User License Agreement.

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

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

This warranty is effective only where the product is properly installed and operated in conformance with the instructions in this document within the original country of the installation.

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

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

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

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

# About This Document

## ■ Positioning of this document in document map

The manuals for this product and related products are as follows.

### ● Linear Gage related

LGH-1010-B-EH
LGH-1010C-B-EH
High-Precision Linear Gage
LGH Series
User's Manual (this manual)

### ● Software related

SENSORPAK
User's Manual

### ● Other

DP-1VA LOGGER
Digimatic Mini-Processor
User's Manual

## ■ Intended readers and purpose of this document

### ● Intended readers

This document is intended for beginners of LGH-series Linear Gages.
The readers is assumed to have been familiar with basic operation of a PC.
They are also assumed to be able to understand instructions by reading technical drawings.

### ● Purpose

The objective of this document is to help you to understand the functional outline of the product, functions of each part and how to use.

## ■ How to read this document

### ● To measure

Setup of this product and the setting of parameters (if necessary) are required in advance.
📖 "1 Overview" (page 1) to 📖 "3.4 Overview of Parameter Setting" (page 28)
For basic operation, see 📖 "4 Basic Operations" (page 31)
For applied operation, see 📖 "4.7 CEL-Specific Parameter Setting" (page 37) in addition to the above chapter.

### ● When you do not know the appropriate operation while using this product

Look for the page with the desired operation in the table of contents.

### ● Terms and definitions

- Internal counter (CEL): Four internal counters (CEL1–CEL4) which perform the origin setup, tolerance judgment, and peak detection for the input counter value.
- BANK: Switchable display unit. BANK1 displays CEL1 and CEL2, BANK2 displays CEL3 and CEL4.
- UNIT: Six input circuits for various measurements.

#### Tips

For details about BANK, CEL, and UNIT, see 📖 "3.3.1 Internal Structure of the Counter" (page 22).

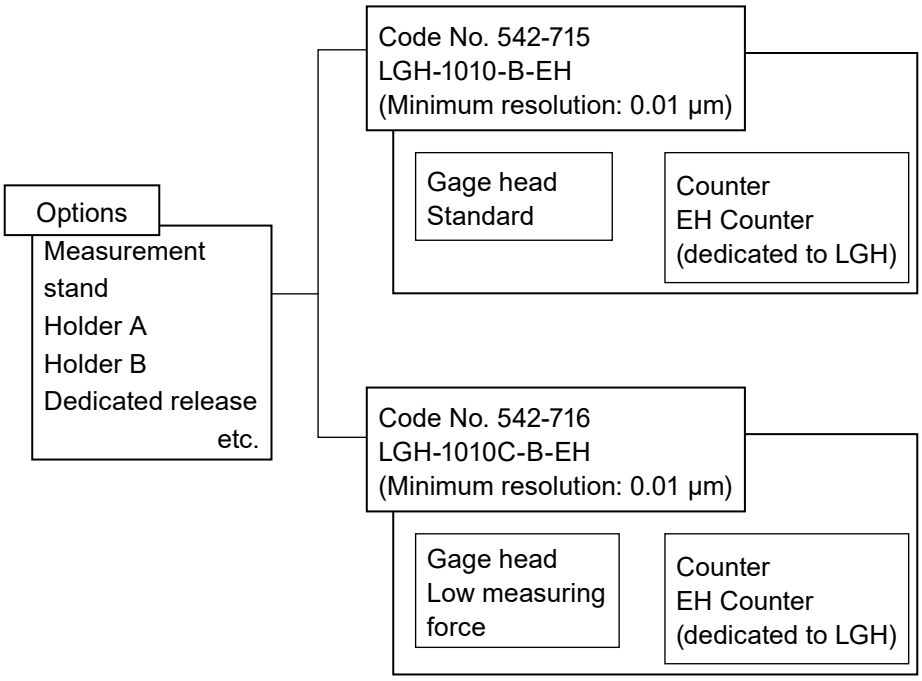
# Contents

# 1 Overview

This section describes product features and part names.

## 1.1 Main Configurations

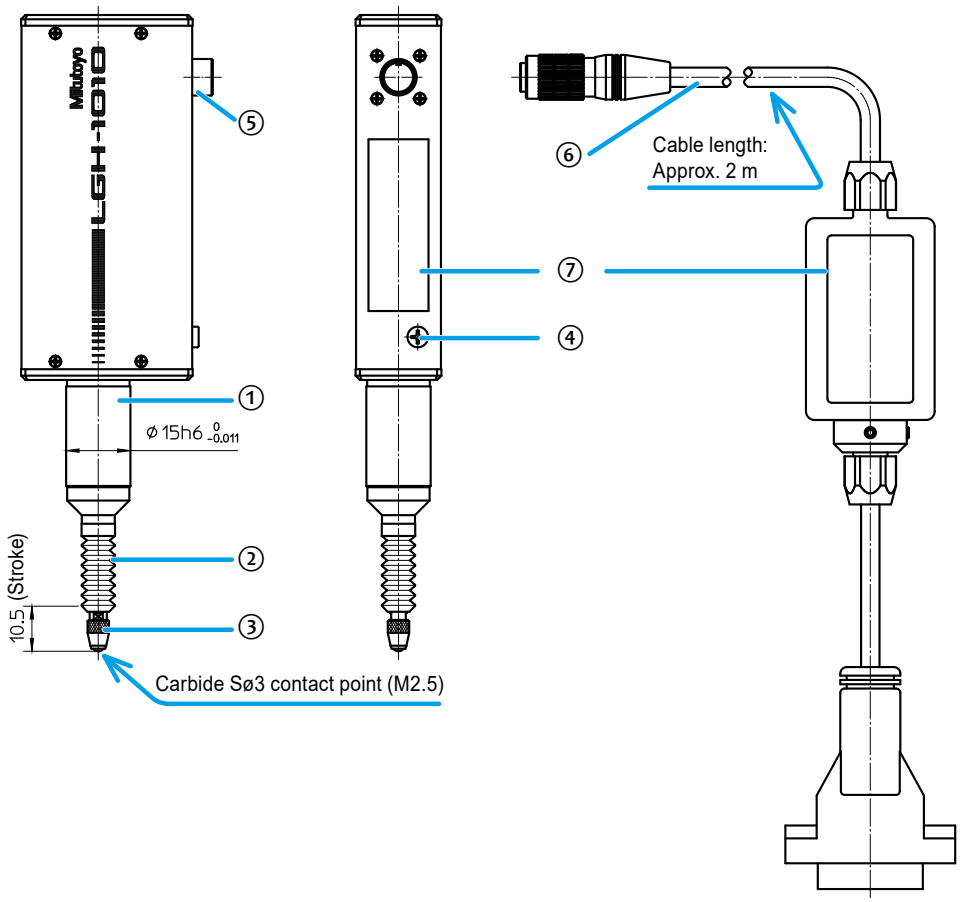
This product is a high-resolution, high-precision length measuring instrument included in the high-end series of our Linear Gage products.Be sure to use it in combination with the supplied EH Counter (dedicated to LGH) .




For details on the functions of the supplied counter, see "4 Basic Operations" (page 31).

# 1.2 Part Names and Functions

## 1.2.1 Gage Head/Signal Connection Cable

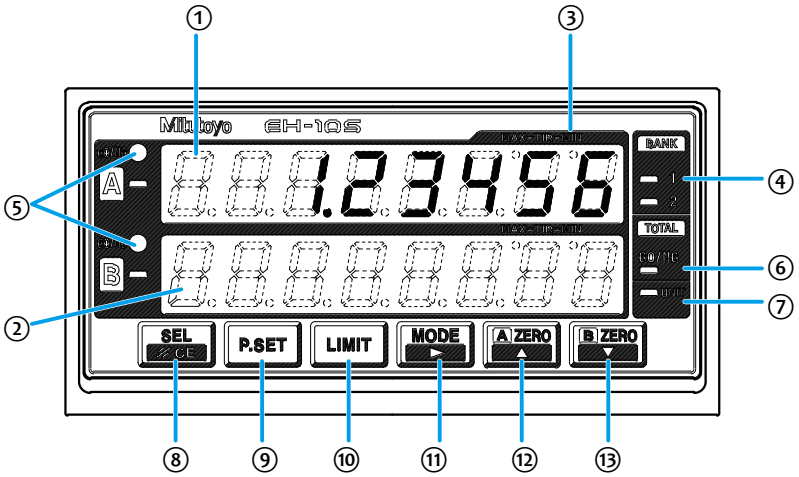



| No. | Name | Notes |
|---|---|---|
| ① | Stem | |
| ② | Spindle/rubber cap | LGH-1010C-B-EH does not have a rubber cap. |
| ③ | Contact point | Part No. 901312 |
| ④ | Release mount screw | |
| ⑤ | Connection cable connector | |
| ⑥ | Signal connection cable | Detachable |
| ⑦ | Serial label | |

### Tips

The gage head and the signal connection cable have the same serial number as the counter.

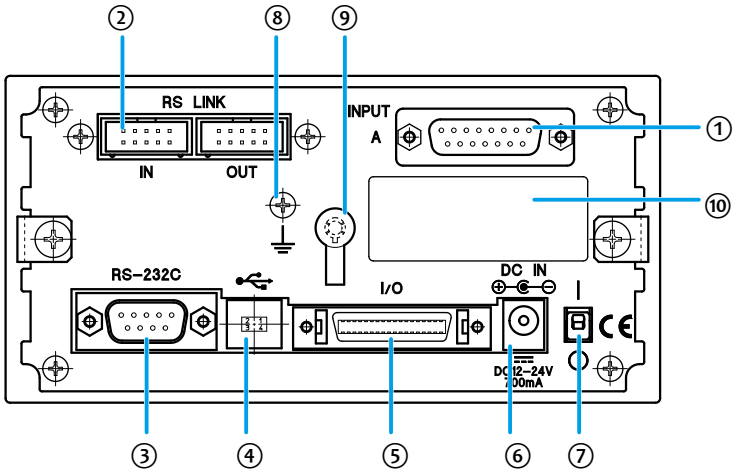
## 1.2.2 Counter Front




| No. | Name | Description |
|---|---|---|
| ① | Ach (upper display) | Displays the counter value from INPUT A (gage input connector). |
| ② | Bch (lower display) | Displays the peak, speed, or other value from INPUT A (gage input connector) if assigned (nothing by factory default). |
| ③ | Peak indicator | Indicates the Peak-mode type. |
| ④ | BANK indicator | Indicates the currently selected BANK number (fixed to BANK1 by factory default). For details about BANK, see "4.2 Switching the Displayed BANK" (page 31). |
| ⑤ | GO/NG indicator | Indicates the result of the tolerance judgment. |
| ⑥ | Total judgment indicator | Indicates the result of the total tolerance judgment by color. |
| ⑦ | UNIT indicator | • Blinks while a HOLD signal is being input when the I/O connector is connected.<br>• Lights when an E unit has been selected for the corresponding parameter. |
| ⑧ | [SEL] key | • Switches between Ach (upper display) and Bch (lower display) (fixed to BANK1 by factory default).<br>• Cancels an error. |
| ⑨ | [P.SET] key | Sets a Preset value.<br>**Tips**<br>When setting a parameter, this sets the parameter number. |
| ⑩ | [LIMIT] key | Sets the tolerance value. |
| ⑪ | [MODE] key | Sets Peak mode.<br>**Tips**<br>When setting the tolerance, preset, or optional constant value, this moves the current input digit from left to right. |
| ⑫ | [A_ZERO] key | Sets the current value in Ach (upper display) to 0.<br>**Tips**<br>• When setting a parameter, this advances the set value.<br>• When setting the tolerance, preset, or optional constant value, this increases the value of the selected digit. |

| No. | Name | Description |
|---|---|---|
| ⑬ | [B_ZERO] key | Sets the current value in Bch (lower display) to 0.<br>**Tips**<br>When setting the tolerance, preset, or optional constant value, this decreases the value of the selected digit. |

## 1.2.3 Counter Back




| No. | Name | Description |
|---|---|---|
| ① | INPUT A (gage input connector) | For connecting the signal connection cable. |
| ② | RS LINK connector (also used for printer output) | For connecting an RS LINK connection cable. Also used for the SENSORPAK dongle and for the Digimatic output. |
| ③ | RS-232C connector | For connecting an RS-232C connecting cable. |
| ④ | USB connector | For connecting a USB connecting cable. |
| ⑤ | I/O connector | For connecting an I/O connecting cable. |
| ⑥ | DC jack | For connecting the AC adapter. |
| ⑦ | Power switch | For turning the power on and off. |
| ⑧ | Grounding terminal | For connecting a grounding wire. |
| ⑨ | Cable clamp | For securing the power cable. |
| ⑩ | Serial label | The serial number is stated.The serial number of this counter is the same as those of the gage head and the signal connection cable. |

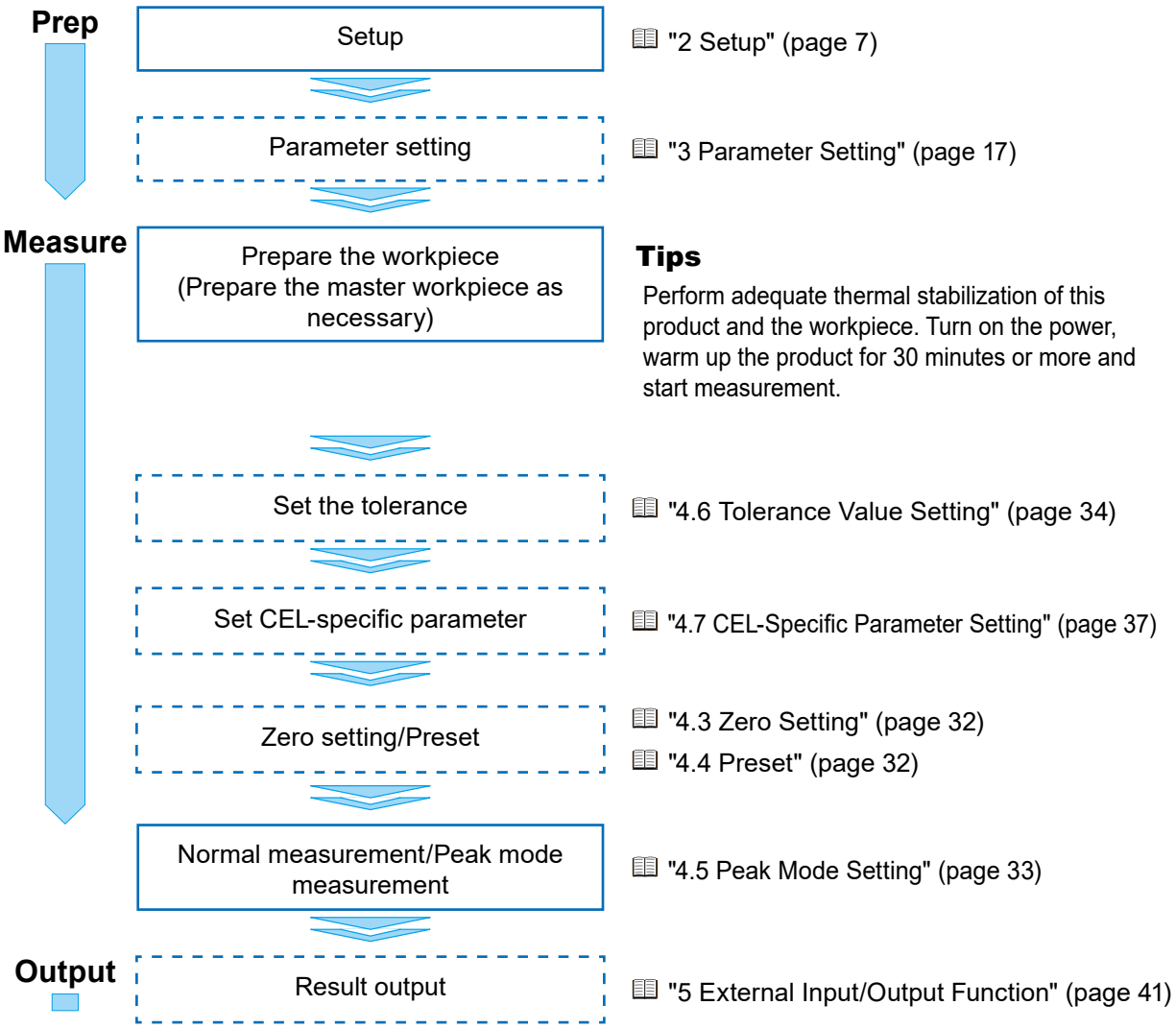
### Tips

- After connecting the power cable, secure with the cable clamp to prevent it from falling.
- The counter (EH Counter) supplied together is dedicated to LGH. Some specifications are different from those of the standard model in our catalog.
- You cannot purchase the counter alone.
- If calibration or repair is required, send the entire set of the gage head, the signal connection cable, and the supplied counter for calibration or repair.We will not service any one of them separately.

# 1.3 Operation Flow

The basic operation flow is explained below.

Do not omit the operations enclosed with a solid line. Perform the operations enclosed with a dashed line as necessary.

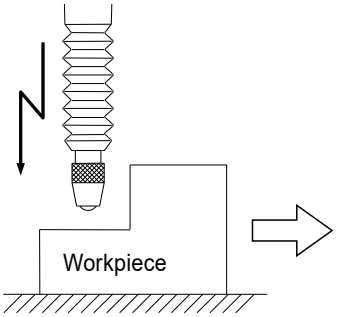


# 1.4 For Accurate Measurement

## 1.4.1 Precautions for Measurement

- For accurate measurement, turn on the power, warm up the product for 30 minutes or more and start measurement.
- Be sure to perform adequate thermal stabilization of this product and the workpiece.
- Wipe off the tip of the contact point and the measuring surface to remove dust or dirt before measuring.
- This product does not guarantee accuracy in a range of 0.2 mm from the bottom dead center (spindle in the state protruded most).Lift the spindle 0.2 mm or higher from the bottom dead center when performing Zero setting and preset setting.

A steep level difference may cause a miscount or error. Fully consider the measuring method.




## 1.4.2 Effect of Temperature Environment on Accuracy

The prescribed accuracy may not be obtained when the product is used at a temperature other than 20 °C. Pay particular attention to the temperature environment.

# 2 Setup

## 2.1 Unpacking and checking items included

When unpacking for the first time, check that the following components are contained in the box.

| Name | Quantity | Part No. |
|---|---|---|
| LGH gage head | 1 | - |
| Signal connection cable | 1 | - |
| EH Counter (dedicated to LGH) | 1 | - |
| Spanner (for replacing the contact point) | 1 | 538610 |
| Rubber foot | 4 | - |
| Stand (for EH Counter) | 1 | - |
| Washer (for EH Counter) | 6 | - |
| AC adapter | 1 | 357651 |
| AC adapter power cable (for use in Japan and other countries) | 1 | 02ZAA000 |
| DC plug (MP-121M) | 1 | 214938 |
| Inspection report | 1 | - |
| User's Manual (this document) | 1 | 99MBC122J (Japanese) |
| | | 99MBC122A (English) |
| Warranty | 1 | - |

**NOTICE**

The LGH gage head, signal connection cable, and EH Counter should have the same serial number.Please make sure that they have the same serial number. Connecting parts with different serial numbers may lead to gage failure, and accuracy cannot be guaranteed.

# 2.2 Mounting

## 2.2.1 Gage Head

### ■ Contact point replacement procedure

Various optional special contact points and extender rods for the dial indicators are available.

**⚠CAUTION**

A sharp tipped contact point may cause injury.Be extremely careful in handling when replacing and using it.

**NOTICE**

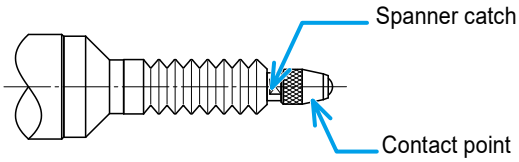
When replacing the contact point, use the supplied spanner and do not apply a strong turning or lateral force to the spindle. Doing so may cause damage or malfunction of the spindle.

**Tips**

- A new contact point may change the external dimensions and measuring force, and the measuring direction may be limited.
- Depending on the shape, use of a contact point other than those supplied may cause errors to accumulate.

1 Remove the gage head from the stand.

2 Set the supplied spanner to the spanner catch at the tip of the spindle (see the figure below) to lock the rotation of the spindle.




3 Use pliers over a soft cloth to pinch the contact point to protect the contact point and remove it.

4 Attach the contact point in reverse order of removal.

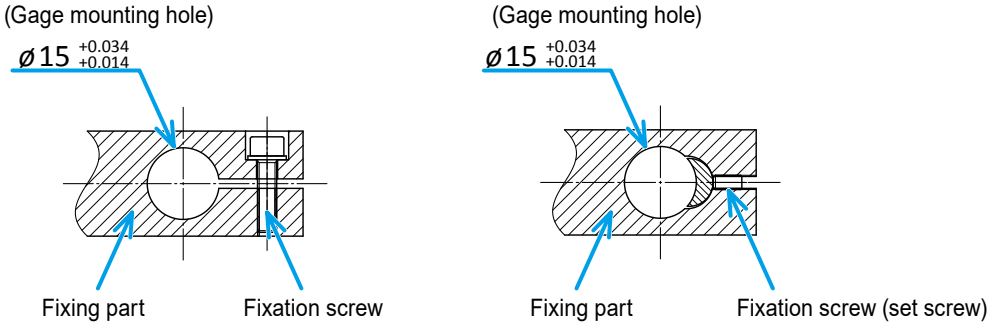
**Tips**

- The recommended tightening torque is 0.5 N・m.
- After attaching the contact point, make sure that it is not loose.
- For the contact points of the dial indicator, see the General Catalog.

## ■ Procedure for mounting to the stand (optional) or fixture

**1** Loosen the fixation screw on the dedicated stand (optional) or other device.

**2** Insert the stem into the gage mounting hole.

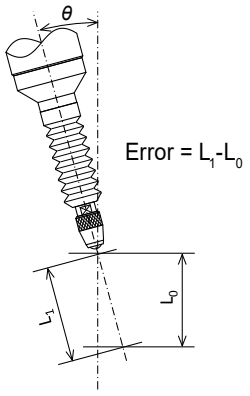



### Tips

The above diagrams show examples of how to make a fixation part of the gage head.

**3** Tighten the fixation screw to secure the gage.

Process the gage mounting hole to be parallel to the measurement direction.A tilted gage will result in a measurement error.




**NOTICE**

- To secure the gage, use a tightening torque of approximately 0.5 N • m.Overtightening the stem may cause malfunction or failure.
- When measuring by moving the gage head, make sure that the cable will not be strained and no excessive force will be applied to the gage main body. It may cause damage.

For the dedicated stand and other options, see 📖 "7.3 Option" (page 62).

## ■ Procedure for mounting the release (optional)

1 Unscrew the release mounting screw on the side of the gage body.

2 Attach the tip of the dedicated release (optional).

**NOTICE**

If the release is not used, put the factory-mounted release mounting screw in place.Dust entering the screw hole will cause failure.

For the release (optional), see "7.3 Option" (page 62).

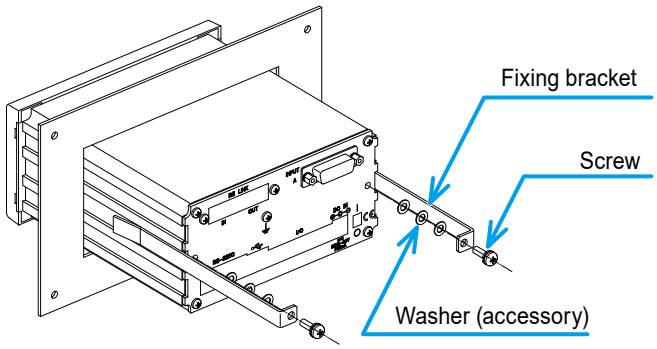
# 2.2.2 Counter

## ■ Procedure for mounting to a panel

1 Cut a rectangular opening in the panel for mounting the counter.

| Width (mm) | Height (mm) | Panel thickness (mm) |
|---|---|---|
| 138.5–139 | 68.3–68.7 | 1.0–3.2 |

2 Loosen the fixing bracket screws (see the following figure), and then remove the fixing brackets.




3 Insert the counter main body from the front side of the panel.

4 From the back of the panel, reattach the fixing brackets which you removed in step 2 to the counter and secure them.

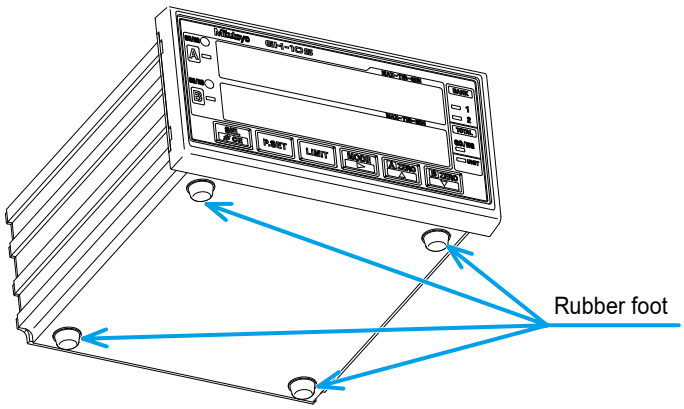
### Tips

Refer to the table below and select the number of washers to use according to the thickness of the panel.

| Panel thickness (mm) | Number of washers |
|---|---|
| 1.0 to 1.3 | 0 |
| 1.4 to 1.7 | 1 |
| 1.8 to 2.4 | 2 |
| 2.5 to 3.2 | 3 |

## ■ Placing on a desk

When the counter is used in a horizontal position on a desk, attach the supplied four rubber feet as shown in the figure below.

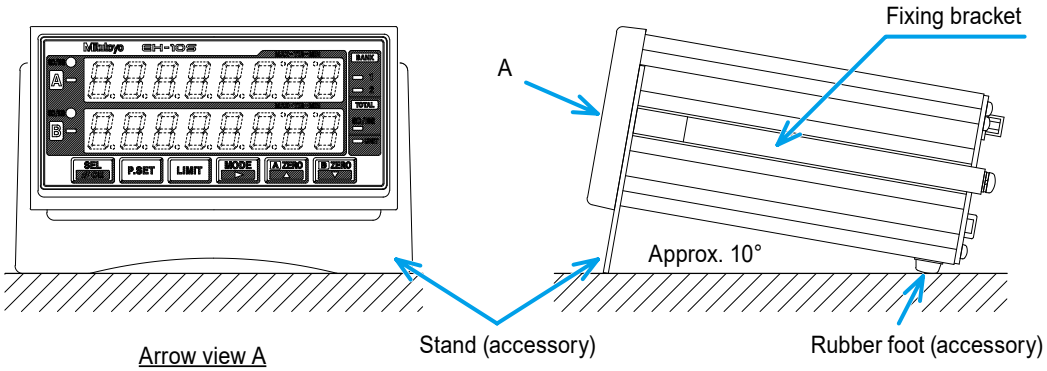



### Tips

This product cannot be mounted in a panel with the rubber feet attached.

To use the counter tilted (approx. 10°) on a desk, attach the stand to the counter using the fixing brackets.The procedure for attaching the fixing brackets is the same as for mounting on a panel.Use six washers.

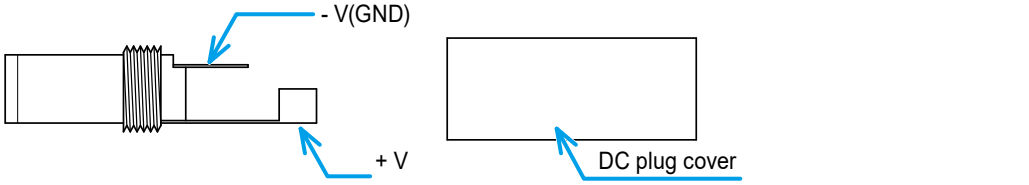
"■ Procedure for mounting to a panel" (page 10)



# 2.3 Connections

## 2.3.1 Power Source

Use the supplied AC adapter and power cable.If you do not plan to use the supplied AC adapter, prepare a DC power source (voltage: 12 V–24 V, output current: 1 A or more) for each counter.Solder the power cable to the terminals of the supplied DC plug as shown in the figure below.




* To prevent short circuit, solder the cable before putting the cover on the DC plug.

### Tips

- The power of the gage head is supplied from the counter.
- If you use a commercial power source, use a power cable measuring 30 m or shorter. Avoid outdoor wiring.

Never use this power source with other electric equipment that runs at a high voltage and/or large current.

## 2.3.2 Connecting Cables for External Equipment

You must prepare USB, RS-232C, and I/O connector connecting cables for connecting external equipment.

Use a Mitutoyo-approved connecting cable for RS LINK connections.

For details about USB connecting cables, see "5.2 USB Communication Function" (page 41).
For details about RS-232C connecting cables, see "5.3 RS-232C Communication Function" (page 42).
For details about I/O connecting cables, see "5.5 I/O Connector Terminal Function" (page 48).
For details about RS LINK, see "5.4 RS LINK Function" (page 46).

## 2.3.3 Connection Procedure

**NOTICE**

The LGH gage head, signal connection cable, and EH Counter should have the same serial number.When using multiple units, connect parts that have the same serial number.Connecting parts with different serial numbers may lead to gage failure, and accuracy cannot be guaranteed.

Make sure that the power switch is off before connecting the gage head to the counter.

Do not run the power cable and the signal connection cable through a cable duct together with other power lines.

**Tips**

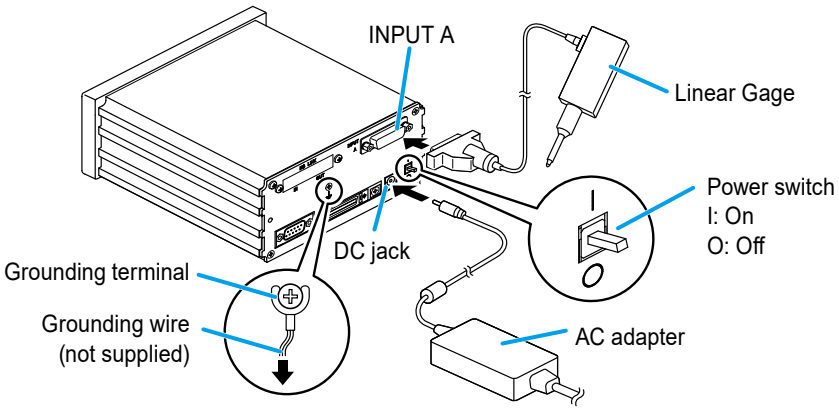
Secure the power cable and connecting cables for external equipment to your equipment with a cable tie, cable holder, etc.

Be sure to connect this product to ground. If this product is not grounded, it will be more susceptible to electrical noise.

### ■ Procedure for connecting gage head and counter

**1** Make sure that the gage head, signal connection cable, and counter have the same serial number.

**2** Connect as illustrated below.




**Tips**

Tighten the connector screws firmly.

# 2.4 Operation Check

Check the cable connections with the following procedure to confirm that the connections are correct.

**1** Turn on the power switch on the back of the counter.

» The counter enters the stand-by state.

**2** Press [SEL].

» The counter enters the counter value status.

**Tips**

Pressing [A_ZERO] performs Zero setting for each axis, and then the counter enters the counter value status.

**3** Check that the counter value is shown on the Display.

**4** Make sure that the counter value on the counter changes by moving the contact point of the gage head up and down.

- For accurate measurement, turn on the power, warm up the product for 30 minutes or more and start measurement.
- Be sure to perform adequate thermal stabilization of this product and the workpiece.

# 2.5 Checking the Spindle Condition

A high-precision linear ball bearing is used for the spindle guide of the LGH gage head. Therefore if the spindle is pushed in for a long time, or if the LGH gage head is used for a long time, the contact will not return to the normal bottom dead center.

If the contact point becomes not to reach the reference plane or measuring surface or the display value becomes unstable, make sure the spindle condition by the following procedrue.

**Tips**

The cause is the misalignment of the retainer of the linear ball bearing. This phenomenon is inevitable due to the structure.

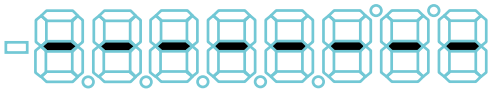
In this document, this is called a "retainer misalignment".

## ■ Procedure for checking and correcting retainer misalignment

Check the retainer misalignment after power-on and before thermal stabilization.

**1** Turn on the power switch on the back of the counter.

» The counter enters the stand-by state.



**2** With the contact point free, press [A_ZERO] or [B_ZERO] on the counter.

» The Ach (upper display) or Bch (lower display) is set to zero.

**3** Lightly and slowly push in the contact point by hand until it stops, and check the counter reading.

**Tips**

The retainer is normal when the counter reading is 10.5 mm or more.

**4** If the counter reading is less than 10.5 mm, retainer misalignment has occurred. Slowly pull the tip of the contact point.

» The retracted spindle is pulled out, which corrects the retainer misalignment.

**NOTICE**

Pull out the spindle to the end position where the movement stops. Be careful not to apply excessive force when pulling out the spindle. Also, avoid turning force on the spindle.

**Tips**

The pull force should be around 5 N.

**5** Perform steps 1 to 3 to check for retainer misalignment.

**MEMO**

# 3 Parameter Setting

You can set parameters to specify the counter direction, the minimum readout, and other items.Set parameters before you begin measuring.

You also connect the UNIT with the four internal counters called CEL.

For details, see "4.7.1 Procedure for Setting CEL-Specific Parameters" (page 37).

## 3.1 Procedure for Setting Parameters

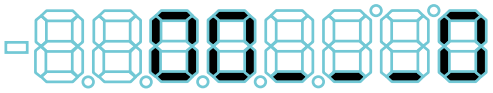
Use Parameter mode to set parameters.

**1** Turn on the power switch.

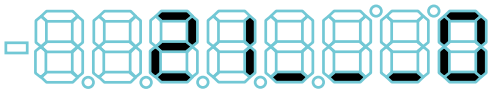
» The counter enters the stand-by state.

**2** Press and hold [P.SET], and then press [A_ZERO].

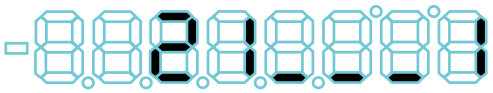
» The counter enters Parameter mode.



**3** Press [P.SET] repeatedly to display the parameter number to be modified.



**4** Press [A_ZERO] repeatedly to modify the value of the parameter.



**Tips** For an item that can be set for each axis (INPUT A/INPUT B), set the parameter per axis.Set as appropriate for each axis (gage head).

Setting for INPUT A

Setting for INPUT B

**5** When the setting of parameters is completed, press and hold [P.SET], and then press [A_ZERO].

» The counter changes to the counter value status.

# 3.2 List of Parameters

| No. | Setting item | Description/Set values<br>(The values in bold indicate initial values.) |
|---|---|---|
| 00 | Parameter mode | Used for setting/saving/loading parameters or setting the optional constant value.<br><br>**0: Setting parameters**<br>1: Setting CEL-specific parameters<br>2: Setting optional constants<br>3: Saving parameters<br>4: Loading parameters<br>**Tips**<br>For details about saving and loading parameters, see "5.3.3 Saving and Loading Parameters" (page 44). |
| 01 | Parameter initialization | If you set the value of this parameter to 1, the set values for all parameters, except for the unit setting, can be reset to their factory defaults.<br>Once this setting has been enabled, this parameter is initialized to reset the set value to 0 (disable).<br><br>**0: Disabled (one shot)**<br>1: Clear (reset to the initial values) |
| 02 | Key protect | Disables key operations to prevent operation errors.<br><br>**0: Normal**<br>1: Disable key inputs |
| 05 | (Modification prohibited) | 0:-<br>1: (Not available) |
| 06 | Display mode selection | Selects the UNIT (counting method) that is assigned to each CEL. The UNIT to be set can be selected as desired.<br><br>0: Two-coordinate display<br>1: Calculation display<br>2: Dual display<br>3: Memory display<br>4: Speed display<br>**5: Optional one-axis display**<br>6: Optional two-axis display<br>7: Optional four-axis display<br>**Tips**<br>For details about the display modes, see "3.3.2 Details of Display Mode Selection (Parameter Number 06)" (page 24). |
| 07 | Display at startup | Selects whether to display the standby state or the counter display at startup.<br><br>**0: [- - - -] display**<br>1: 0.000 |

| No. | Setting item | Description/Set values<br>(The values in bold indicate initial values.) |
|---|---|---|
| 09 | Unit system selection | The unit for displayed values can be set to "mm" or "E units". E=1/25.4 mm. After the unit is set, the initial value will not be restored even if the parameters are re-initialized.<br>When the set value is set to 1 or 2, the UNIT indicator turns on.<br><br>**0: mm**<br>1: E 5/100,000 reading<br>2: E 1/10,000 reading<br>3: (Not available) |
| 10 | Output signal pitch | You can set the output signal pitch of the gage head per axis.Since this product does not allow input for the B-axis (INPUT B), the setting of the B-axis is disabled.<br><br>0: (Not available)<br>**1: 4 µm**<br>2: (Not available)<br>3: (Not available) |
| 11 | Selection of counter direction | You can set whether the numeral will increase or decrease when the spindle is pushed in, per axis.Since this product does not allow input for the B-axis (INPUT B), the setting of the B-axis is disabled.<br><br>**0: + counting**<br>1: - counting |
| 12 | Resolution | You can set the resolution of the gage head per axis.Since this product does not allow input for the B-axis (INPUT B), the setting of the B-axis is disabled.<br><br>0: (Not available)<br>1: (Not available)<br>2: 1 µm<br>3: 0.5 µm<br>4: 0.1 µm<br>5: 0.05 µm<br>**6: 0.01 µm**<br>7: (Not available)<br>8: (Not available) |
| 13 | µm decimal point display | If enabled, the decimal point will be displayed at the µm position.<br><br>**0: Disabled**<br>1: Enabled |
| 14 | (Not used) | 0:-<br>1:- |
| 15 | Smoothing | Averages the counter value and then displays it. (This reduces fluctuation of the lowest-order digit.) You can specify the number of measurements to average.<br><br>0: None<br>**1: 16 times**<br>2: 32 times |

| No. | Setting item | Description/Set values<br>(The values in bold indicate initial values.) |
|---|---|---|
| 16 | Peak value preset | Sets whether to perform presetting based on the peak value during Peak mode.<br><br>**0: Disabled**<br>1: Enabled |
| 18 | Speed sampling cycle | In Display mode selection, selects the sampling cycle when Speed display is selected.<br><br>**0: 10 ms**<br>1: 50 ms<br>2: 100 ms |
| 20 | Tolerance/BCD output mode switching *1 | Switches between tolerance judgment result output and BCD output.<br><br>**0: 3-step tolerance**<br>1: 5-step tolerance<br>2: BCD output |
| 21 | BCD output logic *1 | Selects whether to use positive logic (0) or negative logic (1) for BCD output. For +000000 output, the values in [ ] and ( ) indicate the voltages of the DATA line and the sign, respectively.<br><br>**0: DATA [L] (sign H)**<br>1: DATA [H] (sign L) |
| 24 | RS-232C/USB/ Digimatic output (for DP-1VA LOGGER) switching *2 | Selects which output terminal to use.<br><br>**0: RS-232C**<br>1: USB<br>2: DP-1VA LOGGER (printer) |
| 25 | Data transfer speed *2 | Selects the data transfer speed for RS-232C.<br><br>0: 4800 bps<br>**1: 9600 bps**<br>2: 19200 bps |
| 26 | Parity check *2 | Selects the parity check method for RS-232C.<br><br>0: None<br>1: Odd numbered<br>**2: Even numbered** |
| 27 | Data bit *2 | Selects the length of the data bit for RS-232C.<br><br>**0: 7 bit**<br>1: 8 bit |
| 28 | Output trigger *2 | Selects the output trigger method for RS-232C.<br><br>**0: RS-232 command (normal state)**<br>1: RS-232 command (with channel synchronization function)<br>2: HOLD trigger OUT |

| No. | Setting item | Description/Set values<br>(The values in bold indicate initial values.) |
|---|---|---|
| 30 | Analog output range | Selects the range (resolution range) of the measurement of the analog output.<br><br>**0: 1999–-1999**<br>1: 19990–-19990<br>2: 199900–-199900 |

*1 Modifying this parameter clears the preset and tolerance values.

*2 Turn off the power switch after changing the setting. The setting will be applied when you turn on the power switch again.

Do not change the initial value of Parameter Number 10.Otherwise, no correct counter value will be displayed.

## Tips

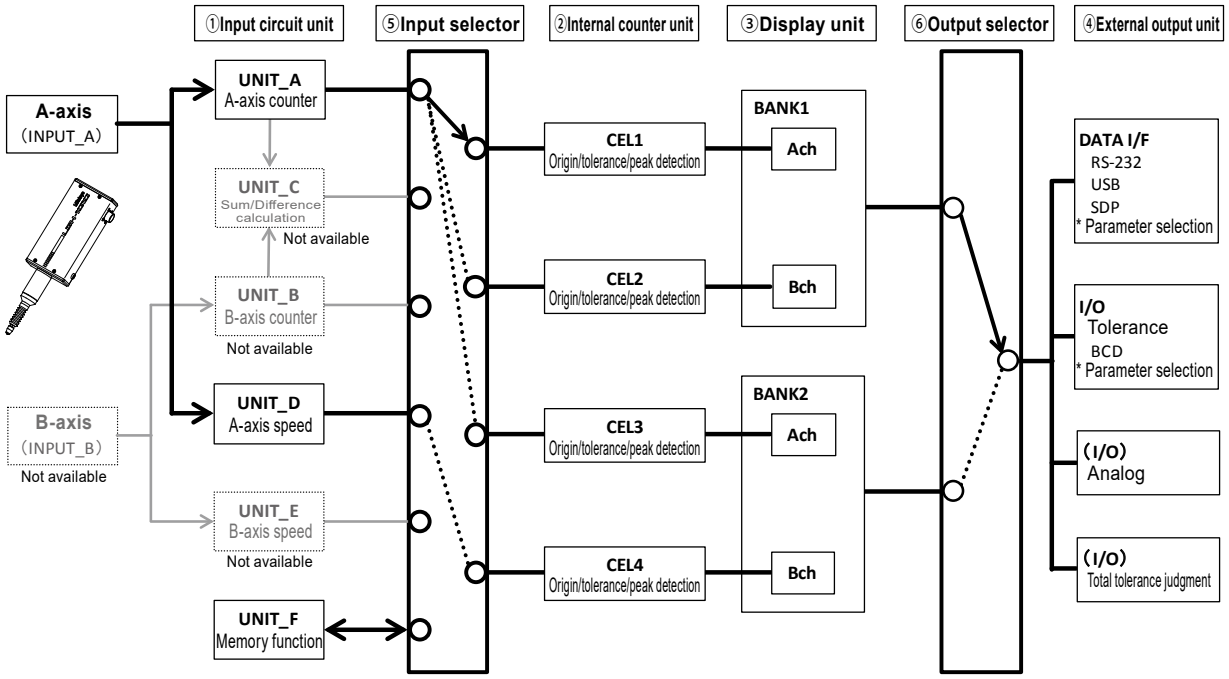
When "Error90" appears, press the [SEL] key to clear the error, and then enter a valid set value for the parameter.

# 3.3 Details of Display Mode

## 3.3.1 Internal Structure of the Counter

This counter has six input circuits (UNIT_A-F) for various measurements and four internal counters (CEL1-4).

Various measurement views are available by changing the connection between UNIT and CEL using the input selector.




| | |
|---|---|
| ①Input circuit unit | UNIT_A–UNIT_F are provided for functions.<br>• UNIT_A: Performs a counter measurement for A-axis.<br>• UNIT_D: Performs a simple speed measurement for A-axis.<br>• UNIT_F: Saves the displayed value.(Enabled even when the power switch is turned off)<br>UNIT_B, UNIT_C, or UNIT_E cannot be used. |
| ②Internal counter | Performs the origin setup, tolerance judgment, and peak detection operations on the input counter value. |
| ③Display unit | There are two switchable display units, BANK1 and BANK2.<br>• BANK1: Ach = CEL1 display/Bch = CEL2 display<br>• BANK2: Ach = CEL3 display/Bch = CEL4 display<br>As the factory default, Parameter Number 06 is set to "5" (optional one-axis display), disabling the display unit B and BANK switchover.Setting Parameter Number 06 to "6" (optional two-axis display) enables the display unit B, and setting it to "7" (optional four-axis display) enables BANK switchover as well. |
| ④External output unit | You can use a parameter to select the output interface to use. |
| ⑤Input selector | Connects UNIT to any CEL. |
| ⑥Output selector | Outputs either the BANK_1 or BANK_2 display. |

Connection between UNIT and CEL can be specified by the display mode selection of Parameter Number 06.

## Tips

Among the input circuit units, UNIT_B, UNIT_C, or UNIT_E cannot be used for this product.

For details about the parameter setting, see "3.1 Procedure for Setting Parameters" (page 17).
For details about the CEL-specific parameter setting, see "3.3.3 CEL-Specific Parameters" (page 27).
For details about the display modes, see "3.3.2 Details of Display Mode Selection (Parameter Number 06)" (page 24).

## 3.3.2 Details of Display Mode Selection (Parameter Number 06)

For this counter, Display mode can be selected by setting Parameter Number 06 as follows:

| Set value | Display mode | BANK1 | | BANK2 | |
|---|---|---|---|---|---|
| | | CEL1 | CEL2 | CEL3 | CEL4 |
| 0 | Two-coordinate display | UNIT_A (A-axis counter) | UNIT_B (B-axis counter) | UNIT_A (A-axis counter) | UNIT_B (B-axis counter) |
| 1 | Calculation display | UNIT_C (A±B) | UNIT_A (A-axis counter) | UNIT_C (A±B) | UNIT_B (B-axis counter) |
| 2 | Dual display | UNIT_A (A-axis counter) | UNIT_A (A-axis counter) | UNIT_B (B-axis counter) | UNIT_B (B-axis counter) |
| 3 | Memory display | UNIT_A (A-axis counter) | UNIT_F (Memory) | UNIT_B (B-axis counter) | UNIT_F (Memory) |
| 4 | Speed display | UNIT_A (A-axis counter) | UNIT_D (A-axis speed) | UNIT_B (B-axis counter) | UNIT_E (B-axis speed) |
| 5 (Default value) | Optional one-axis display | UNIT_A (A-axis counter) | - | - | - |
| 6 | Optional two-axis display | UNIT_A (A-axis counter) (Default value) | UNIT_B (B-axis counter) (Default value) | - | - |
| 7 | Optional four-axis display | UNIT_A (A-axis counter) (Default value) | UNIT_B (B-axis counter) (Default value) | UNIT_C (A±B) (Default value) | UNIT_A (A-axis counter) (Default value) |

### Tips

- The set values 0–4 of Parameter Number 06 do not allow the connection from UNIT to CEL to be modified.
- The set values 5–7 of Parameter Number 06 allow CEL to be connected to any UNIT.
- With the set value 0–4, CEL assigned to UNIT_B (B-axis counter), UNIT_C (A±B), or UNIT_E (B-axis speed) cannot be used, showing "Error40".

For details about the parameter setting, see 📖 "3.1 Procedure for Setting Parameters" (page 17).

### ■ Display mode type

#### ● Two-coordinate display (set value: 0)

A set of two counters (CEL) of BANK1 and 2 is used to display the two coordinates.

| | BANK1 | | BANK2 | |
|---|---|---|---|---|
| Ach (upper display) | CEL1 | UNIT_A (A-axis counter) | CEL3 | UNIT_A (A-axis counter) |
| Bch (lower display) | CEL2 | **Error 40** (UNIT_B (B-axis counter)) | CEL4 | **Error 40** (UNIT_B (B-axis counter)) |

### Tips

- CEL assigned to UNIT_B (B-axis counter) cannot be used, showing "Error40".
- The origin (preset) and tolerance can be set per BANK.

For details about BANK switchover, see 📖 "4.2 Switching the Displayed BANK" (page 31).
For details about the origin setting (preset), see 📖 "4.4 Preset" (page 32).
For details about the tolerance setting, see 📖 "4.6 Tolerance Value Setting" (page 34).

## ● Calculation display (set value: 1)

The Sum/Difference calculation display cannot be used.

## ● Dual display of current value/peak value (set value: 2)

The current and peak values of one gage are simultaneously displayed.

| | BANK1 | | BANK2 | |
|---|---|---|---|---|
| Ach (upper display) | CEL1 | UNIT_A (A-axis counter) | CEL3 | **Error 40** (UNIT_B (B-axis counter)) |
| Bch (lower display) | CEL2 | UNIT_A (A-axis counter) | CEL4 | **Error 40** (UNIT_B (B-axis counter)) |

### Tips

- CEL assigned to UNIT_B (B-axis counter) cannot be used, showing "Error40".
- The origin sets of Ach (upper display) and Bch (lower display) are independent.

## ● Memory display (set value: 3)

The value of Ach (upper display) is saved in Bch (lower display).In addition to the most recently saved data, the maximum and minimum values from past data can also be read out.The saved data are not cleared even if the power switch is turned off.

| | BANK1 | | BANK2 | |
|---|---|---|---|---|
| Ach (upper display) | CEL1 | UNIT_A (A-axis counter) | CEL3 | **Error 40** (UNIT_B (B-axis counter)) |
| Bch (lower display) | CEL2 | UNIT_F (Memory) | CEL4 | UNIT_F (Memory) |

### Tips

- CEL assigned to UNIT_B (B-axis counter) cannot be used, showing "Error40".
- The memory unit is shared between BANK1 and BANK2.Used gages must have the same signal cycle output.
- The B_HOLD signal from the I/O connector can be used for external control.

For details about the procedures for saving, reading out, and clearing memory, see 📖 "4.8 Registering, Reading, and Clearing Memory" (page 39).
For details about input/output from the I/O connector, see 📖 "5.5 I/O Connector Terminal Function" (page 48).

## ● Speed display (set value: 4)

Displays the moving speed of the spindle simply.The display unit of speed is mm/s. In addition to the current speed, it displays the maximum speed when the maximum value (MAX) is selected in Peak mode.

| | BANK1 | | BANK2 | |
|---|---|---|---|---|
| Ach (upper display) | CEL1 | UNIT_A (A-axis counter) | CEL3 | **Error 40** (UNIT_B (B-axis counter)) |
| Bch (lower display) | CEL2 | UNIT_D (A-axis speed) | CEL4 | **Error 40** (UNIT_E (B-axis speed)) |

### Tips

- CEL assigned to UNIT_B (B-axis counter) or UNIT_E (B-axis speed) cannot be used, showing "Error40".
- The display of the last 1 to 3 digits may be fixed depending on the sampling cycle.
- The maximum speed in the reverse direction is displayed when the minimum value (MIN) is selected in Peak mode.
- The speed display is simplified and may not be correct.

## ● Optional one-axis display (set value 5), optional two-axis display (set value 6), optional four-axis display (set value 7)

Select the number of CELs to use from 1, 2, and 4, and connect each CEL to any UNIT.You can configure any measurement mode other than the set values 0–4 of Parameter Number 06.Set Parameter Number 06 to a value between 5–7, and connect UNIT according to the CEL-specific parameter.

### Tips

UNIT_B (B-axis counter), UNIT_C (A±B), and UNIT_E (B-axis speed) cannot be used.If they are connected to CEL, they show "Error40".

For details about the CEL-specific parameters, see 📖 "3.3.3 CEL-Specific Parameters" (page 27).

## 3.3.3 CEL-Specific Parameters

This section describes the parameters that can be set per CEL.

| No. | Set value | Description/Set values<br>(The values in bold indicate initial values.) |
|---|---|---|
| 40 | Individual CEL display selection | Selects UNIT (counting method) to be displayed for each CEL when Parameter Number 06 is set to a value between 5–7.<br>Modifying the value of Parameter Number 40 clears the preset and tolerance values.<br><br>**0: UNIT_A (A-axis counter)**<br>1: (Not available)<br>2: (Not available)<br>3: UNIT_D (A-axis speed)<br>4: (Not available)<br>5: UNIT_F (Memory) |
| 41 | Calculation with a constant | Sets whether or not to multiply the internal counter value by one of the predetermined values or an arbitrary value.The internal counter value multiplied by the specified constant value is displayed as the measurement result.<br><br>**0: None**<br>1: 1/2 times<br>2: 2 times<br>3: 10 times<br>4: Arbitrary value |
| 42 | Lowest-order digit blank | Hides the lowest-order digit.<br>However, the lowest-order digit will be included in RS-232C output and in printouts.<br><br>**0: Display all digits**<br>1: The lowest-order digit is blank |

### Tips

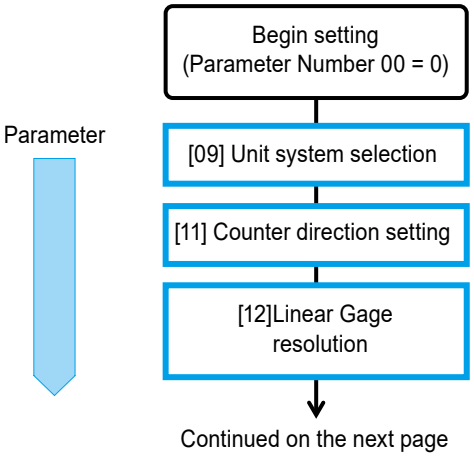
- For this product, Parameter Number 40 cannot be set to 1, 2, or 4.
- When Parameter Number 41 is set to 4 (arbitrary value), accuracy guarantee is disabled.
- For details about the CEL-specific parameter setting, see "4.7.1 Procedure for Setting CEL-Specific Parameters" (page 37).

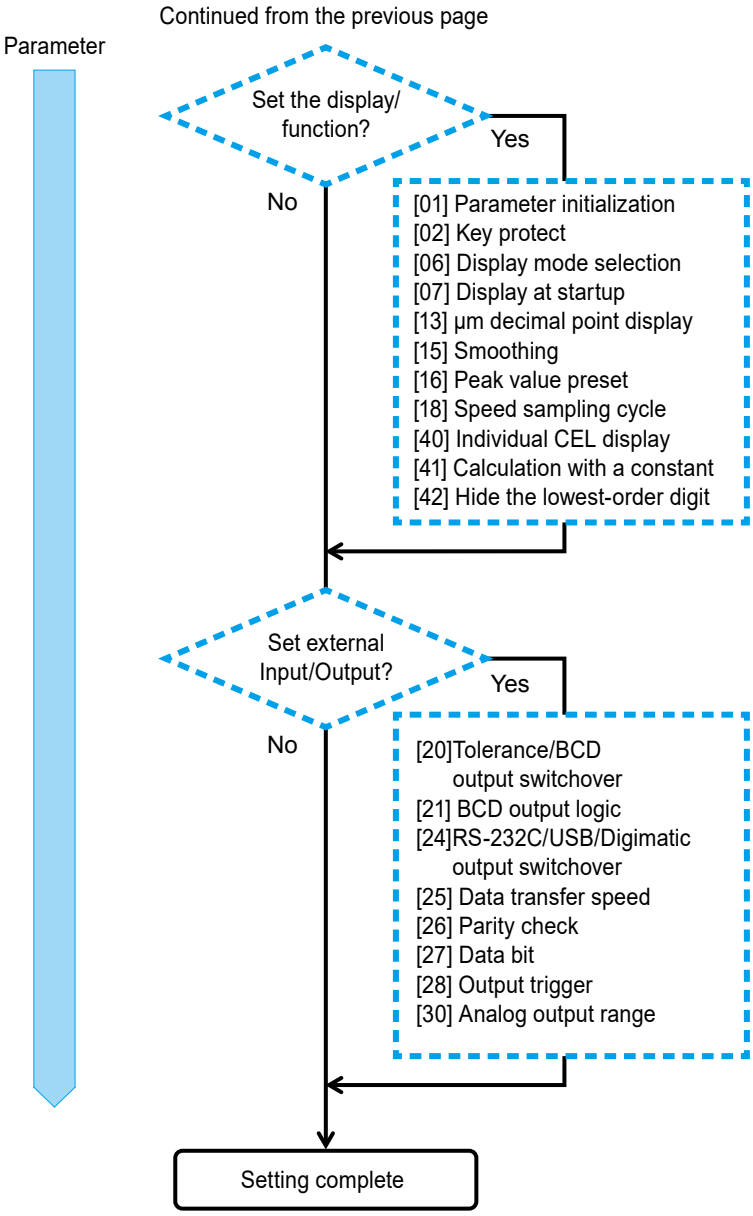
# 3.4 Overview of Parameter Setting

This section gives an overview of parameter setting.

### Tips

- The following figure does not illustrate the steps to set parameters.
- When setting parameters, each time you press [P.SET], the parameter number will advance from 00. When the number advances to the last number, it then returns to 00.
- If you select a set value 1 (CEL-specific parameter setting) for Parameter Number 00, you go to Parameter Number 40.When the number advances to 42, it then returns to 40.
- Be sure to set the parameters enclosed by a solid line.Set the parameters enclosed by a dashed line as necessary.






For details about the parameters, see 📖 "3.2 List of Parameters" (page 18).
For details about the CEL-specific parameters, see 📖 "3.3.3 CEL-Specific Parameters" (page 27).

## MEMO

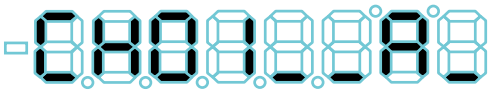
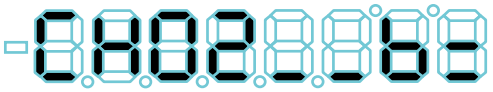
# 4 Basic Operations

## 4.1 Selection of Display A/B

For preset, peak measurement mode, and tolerance settings, specify Ach (upper display) or Bch (lower display).

**1** Press [SEL].

» The selected channel (Ach (upper display) or Bch (lower display)) blinks.

| Display example | Display contents | |
|---|---|---|
|  <br>Channel number (CEL number) UNIT number | "CH01":<br>"A": | Ach (upper display/CEL1)<br>UNIT_A connected |
|  <br>Channel number (CEL number) UNIT number | "CH02":<br>"b":<br>(LSD) "=": | Bch (lower display/CEL2)<br>UNIT_B connected<br>Setting of the calculation with a constant (out of accuracy guarantee) |

### Tips

- The channel number used when switching the operation axis is the one used for RS-232 communication. For details, see "5.4 RS LINK Function" (page 46).
- When the calculation with a constant is set, [=] is displayed in the LED of the least significant digit of Bch (lower display).
- When an error occurs, press [SEL] to restore the counter value status.

## 4.2 Switching the Displayed BANK

This counter can use the key or the input signal from the I/O connector to switch the internal counters CEL1–CEL4 per BANK.

**1** Press and hold [P.SET], and then press [MODE].

» The displayed BANK will be switched.

### Tips

- The BANK currently displayed appears in the BANK indicator.
- BANK cannot be switched when the display mode is set to the optional one- or two-axis display.
- For details on the measurement mode, see "3.3.2 Details of Display Mode Selection (Parameter Number 06)" (page 24).

# 4.3 Zero Setting

Set Ach (upper display) and Bch (lower display) to zero when measuring.

1 Press [A_ZERO] or [B_ZERO].

» Pressing [A_ZERO] sets the counter value of Ach (upper display) to zero.
» Pressing [B_ZERO] sets the counter value of Bch (lower display) to zero.

**Tips**

Zero setting also clears the peak value and sets the maximum value (MAX), the minimum value (MIN), the current value, and the run-out width (TIR) to zero.

# 4.4 Preset

Replace the current value with an arbitrary value (Preset value).

**Tips**

The PA/PB signal input from the I/O connector can also be used for preset.When the I/O connector input/output is used, the Preset value set in advance is used for preset.

1 Press [SEL] to select one of the operation channels from Ach (upper display) and Bch (lower display).

2 Press [P.SET].

» The decimal point blinks, and the previous Preset value appears.

3 Press [MODE].

» The input digit will shift to the right.

4 Press [A_ZERO] or [B_ZERO].

» The Preset value will be modified.

**Tips**

For the most significant digit, select the sign ± also (0 ⇒ ... ⇒ 9 ⇒ -0 ⇒ ... ⇒ -9 ⇒ 0).

5 Repeat steps 3 and 4 until the desired Preset value is set.

6 Press [P.SET].

» The current value is replaced with the Preset value, and the counter display is restored.

**Tips**

To cancel the input, press [SEL]. The counter will return to the counter display.

# 4.5 Peak Mode Setting

In addition to the current value, the peak detection measurement can be made as the maximum value (MAX), the minimum value (MIN), and the run-out width (TIR).

| Peak mode | Peak indicator | Display contents |
|---|---|---|
| Current value | MAX–TIR–MIN<br>○ ○ | Current measured value of the gage head |
| Maximum value (MAX) | MAX–TIR–MIN<br>● ○ | Maximum value after the peak value is cleared |
| Minimum value (MIN) | MAX–TIR–MIN<br>○ ● | Minimum value after the peak value is cleared |
| Run-out width (TIR) | MAX–TIR–MIN<br>● ● | Run-out width during the measurement (maximum value - minimum value) |

**Tips**

The maximum response speed is different between the current value measurement and the peak measurement (MAX, MIN, and TIR).

For details, see "7.1 Basic Specifications" (page 59).

## 4.5.1 Procedure for Switching Peak Mode

1. Press [SEL] to select one of the operation channels from Ach (upper display) and Bch (lower display).
2. Repeatedly press [MODE] until the desired indicator display is obtained.

## 4.5.2 Procedure for Clearing Peak Value

This section explains how to clear the peak value in Peak mode.

1. Press [SEL] to select one of the operation channels from Ach (upper display) and Bch (lower display).
2. Press [MODE] to select Peak mode.
3. Press [A_ZERO] or [B_ZERO].
   » The peak value is cleared (MAX = MIN = current value, TIR = 0).

**Tips**

When the peak value is cleared for one CEL, it is also cleared for the other CELs if these CELs are all connected to the same UNIT.

# 4.6 Tolerance Value Setting

The Tolerance Judgment function supports the 3- and 5-step tolerance judgments.

### Tips

- Set the set value of Parameter Number 20 to 0 (3-step tolerance) or 1 (5-step tolerance) in advance.
- When Parameter Number 20 is set to 2 (BCD output), the number of the tolerance steps remains unchanged as just before the BCD output is set.

## 4.6.1 3-Step Tolerance Value Setting (3-Step Tolerance Zone Selection)

With S1 and S4 set as the tolerance values, the 3-step tolerance judgment will be performed as follows:

| | **GO/NG** indicator | **I/O** output |
|---|---|---|
| Measured value < S1 | Amber indicator on | AL1 / BL1 |
| S1 ≦ Measured value ≦ S4 | Green indicator on | AL3 / BL3 |
| S4 < Measured value | Red indicator on | AL5 / BL5 |

This section explains how to set the 3-step tolerance value.

**1** Press [SEL] to select one of the operation channels from Ach (upper display) and Bch (lower display).

**2** Press [LIMIT].

» The GO/NG indicator lights in amber. (Tolerance value S1 is selected.)
» The decimal point blinks, and the previous tolerance value appears.

**3** Press [MODE].

» The input digit will shift to the right.

**4** Press [A_ZERO] or [B_ZERO].

» The tolerance value will be modified.

### Tips

For the most significant digit, select the sign ± also (0 ⇒ ... ⇒ 9 ⇒ -0 ⇒ ... ⇒ -9 ⇒ 0).

**5** Repeat steps 3 and 4 until the desired tolerance value is set.

**6** Press [LIMIT].

» Tolerance value S1 will be applied.
» The GO/NG indicator lights in red. (Tolerance value S4 is selected.)

**7** Set the tolerance value S4 using the same procedure as steps 3–5.

**8** Press [LIMIT].

» The tolerance value S4 is determined, and the counter returns to the counter value status.

### Tips

An error will occur unless S1 ≤ S4. Press [SEL] to re-enter from S1.

## 4.6.2 5-Step Tolerance Value Setting (5-Step Tolerance Zone Selection)

With S1–S4 set as the tolerance values, the 5-step tolerance judgment will be performed as follows:

| | **GO/NG** indicator | **I/O** output |
|---|---|---|
| Measured value < S1 | Amber indicator on | AL1/BL1 |
| S1 ≦ Measured value < S2 | Amber indicator blinks | AL2/BL2 |
| S2 ≦ Measured value ≦ S3 | Green indicator on | AL3/BL3 |
| S3 < Measured value ≦ S4 | Red indicator blinks | AL4/BL4 |
| S4 < Measured value | Red indicator on | AL5/BL5 |

This section explains how to set the 5-step tolerance value.

**1** Press [SEL] to select one of the operation channels from Ach (upper display) and Bch (lower display).

**2** Press [LIMIT].

» The GO/NG indicator lights in amber. (Tolerance value S1 is selected.)

» The decimal point blinks, and the previous tolerance value appears.

### Tips

Tolerance values are set in the order S1, S2, S3, S4. The GO/NG indicator displays as follows: (The tolerance value to be set is selected.)

| Tolerance value | GO/NG indicator |
|---|---|
| S1 | Amber indicator on |
| S2 | Amber indicator blinks |
| S3 | Red indicator blinks |
| S4 | Red indicator on |

**3** Press [MODE].

» The input digit will shift to the right.

**4** Press [A_ZERO] or [B_ZERO].

» The tolerance value will be modified.

### Tips

For the most significant digit, select the sign ± also (0 ⇒ ... ⇒ 9 ⇒ -0 ⇒ ... ⇒ -9 ⇒ 0).

5 Repeat steps 3 and 4 until the desired tolerance value is set.

6 Press [LIMIT].

» Tolerance value S1 will be applied.

» The color of the OK/NG indicator changes to the one of the next tolerance value to be set.

7 Set the tolerance values S2, S3, and S4 with the similar operations in the steps 3–5.

8 Press [LIMIT].

» The tolerance value S4 is determined, and the counter returns to the counter value status.

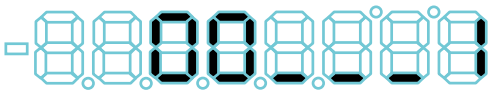
### Tips

An error occurs with the settings other than S1 < S2 < S3 < S4 or S1 = S2 = S3 = S4. Press [SEL] to re-enter from S1.

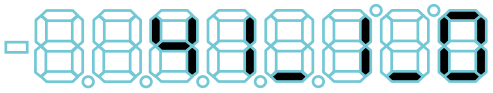
# 4.7 CEL-Specific Parameter Setting

## 4.7.1 Procedure for Setting CEL-Specific Parameters

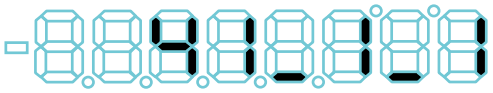
1. Press and hold [P.SET], and then press [A_ZERO].
   - » The counter enters Parameter mode.
2. Press [A_ZERO] once to set Parameter Number 00 to 1 (CEL-specific parameter setting).
   - » The counter enters CEL-specific parameter mode.



3. Press [P.SET] to display the parameter number to be modified.



4. Press [A_ZERO] to modify the set value of the parameter.



5. Press and hold [P.SET], and then press [A_ZERO].
   - » The counter returns to the counter value status.

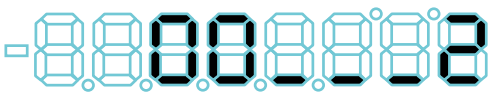
## 4.7.2 Procedure for Setting Desired Multiplication Factor

When Parameter Number 41 is set to 4 (arbitrary value), specify a constant value.

**Tips**

An optional constant value can be set for each CEL.

1. Press and hold [P.SET], and then press [A_ZERO].
   - » The counter enters Parameter mode.
2. Press [A_ZERO] twice to set Parameter Number 00 to 2 (optional constant setting).
   - » The counter enters optional constant setting mode.



**3** Press [P.SET].

» The previous set value and the CEL number appear in the upper and lower sections respectively.

Display A

Display B

**4** Press [MODE].

» The input digit will shift to the right.

**5** Press [A_ZERO].

» The value changes (available range: ±9.99999).

Display A

Display B

**6** Press and hold [P.SET], and then press [A_ZERO].

» The CEL number changes.

Display A

Display B

**7** Set CEL2, CEL3, and CEL4 using the same procedure as steps 4 and 5.

**8** Press and hold [P.SET], and then press [A_ZERO].

» The counter returns to the counter value status.

# 4.8 Registering, Reading, and Clearing Memory

This section describes the procedure to register, read, and clear the memory.

**Tips**

This operation is available when the set value of Parameter Number 06 is 3 (memory).

## ● Procedure for registering memory

1 Press [B_ZERO].

» The current value of Ach (upper display) is saved in Bch (lower display).

## ● Procedure for reading saved data

1 Press [SEL] to select Bch (lower display).

2 Press [MODE] (switch to Peak setting mode).

» Each time you press [MODE], the displayed memory value cycles through the maximum value → minimum value → run-out width.

## ● Procedure for clearing memory

1 Press [SEL] to select Bch (lower display).

2 Press [P.SET].

» The values in the memory (maximum value/minimum value/run-out width) are cleared, and then the current value in Ach (upper display) is displayed.

**MEMO**

# 5 External Input/Output Function

**This product is equipped with the following interfaces that enable the connection of external equipment.**

| Interface | Parameter setting (No. 24) | Connectable equipment | Functions |
|---|---|---|---|
| Digimatic output | 2 | Digimatic Mini-Processor (DP-1VA LOGGER) | • Printing the measurement data, statistical calculation results, etc. |
| USB | 1 | PC (for SENSORPAK) | • Data output to a PC |
| RS-232C | 0 | PC, PLC | • Data output to a PC, PLC<br>• Control from external system |
| I/O connector | - | Equipment such as a switch or control unit | • Data output to PLC<br>• External control of the counter |

### Tips

PLC: programmable logic controller

## 5.1 Digimatic Output Function (for DP-1VA LOGGER)

You can print the measurement data by connecting to the Digimatic Mini-Processor (DP-1VA LOGGER), which is sold separately.To do this, connect the Digimatic cable to the RS_LINK connector (OUT) of the counter.

### Tips

- A maximum of 6 digits can be printed. When the counter displays the value in 7 or 8 digits, the last 6 digits will be printed. For example, when "12.34567 mm", which has 7 digits, is output, it will be printed as "2.34567 mm".
- Set the DP-1VA LOGGER to compatible mode.
  For details on the setting method and operations, see 📖 "DP-1VA LOGGER Digimatic Mini-Processor User's Manual".
- When an error occurs, an asterisk is printed.
- If you use an old model instead of the Digimatic Mini-Processor DP-1VA LOGGER, contact your dealer or the nearest Mitutoyo sales office.

## 5.2 USB Communication Function

By installing SENSORPAK (Mitutoyo product) on a PC, you can load measurement data from the counter to the PC by connecting the counter to the PC with a USB connecting cable (A-B type). A USB connecting cable is not supplied. You must provide one.

### Tips

- The USB port for communication with SENSORPAK.
- SENSORPAK supports communication via USB 2.0 or later.
- For details on the SENSORPAK, see 📖 "SENSORPAK User's Manual".

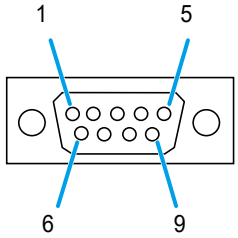
# 5.3 RS-232C Communication Function

By connecting to a PC or PLC via RS-232C, you can load measurement data and manipulate various settings of the counter through remote operation.
You can also save and load parameters.

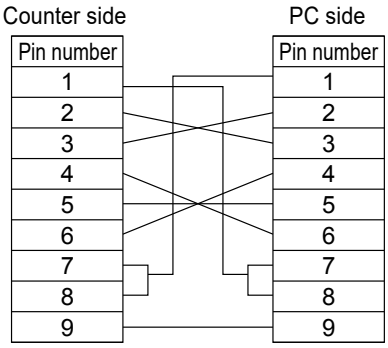
## 5.3.1 Connections

### ■ Compatible plug and pin assignment

Compatible plug: D-sub 9-pin (socket contact), inch screw type
Cable: A commercial RS-232C cross-type cable




| Pin number | Signal name | I/O |
|---|---|---|
| 2 | RXD | IN |
| 3 | TXD | OUT |
| 4 | DTR | OUT |
| 5 | GND | – |
| 6 | DSR | IN |
| 7 | RTS | OUT |
| 8 | CTS | IN |
| 1, 9 | NC | – |




### ■ Communication specification (conforming to EIA RS-232C)

| Item | Description |
|---|---|
| Home position | DTE (Data Terminal Equipment), use a cross-type cable. |
| Communication method | Half-duplex, non-procedural mode |
| Data transfer speed | 4800 bps/9600 bps/19200 bps |
| Bit configuration | Start bit: 1<br>Data bits: 7 bits/8 bits (ASCII code, upper-case characters)<br>Parity: None/Even parity/Odd parity<br>Stop bit: 2 |

### Tips

- Set the communication conditions using parameters.
  For details, see 📖 "3.2 List of Parameters" (page 18).
- Use commercial terminal software for communication with a PC.

## 5.3.2 Communication Commands

This section explains the command format from a PC or PLC, output from the counter, and operation details.

| Command format | Corresponding output | Operation details | Notes |
|---|---|---|---|
| GA**CRLF | G#**, +01234.567CRLF | Outputs "Display value" | See *1 |
| CN**CRLF | CH**CRLF | Switches the display to "Current value" | See *2 |
| CX**CRLF | CH**CRLF | Switches the display to "Maximum value" | See *2 |
| CM**CRLF | CH**CRLF | Switches the display to "Minimum value" | See *2 |
| CW**CRLF | CH**CRLF | Switches the display to "TIR" | See *2 |
| CR**CRLF | CH**CRLF | Zero setting | |
| CL**CRLF | CH**CRLF | Clears the peak value | |
| CP**,+01234567CRLF | CH**CRLF | Inputs the preset value | See *3 |
| CD**,+01234567CRLF | CH**CRLF | Inputs tolerance value S1 | See *4 |
| CE**,+01234567CRLF | CH**CRLF | Inputs tolerance value S2 | See *4 |
| CF**,+01234567CRLF | CH**CRLF | Inputs tolerance value S3 | See *4 |
| CG**,+01234567CRLF | CH**CRLF | Inputs tolerance value S4 | See *4 |
| CS**CRLF | CH**CRLF | Clear error | |
| CK**CRLF | CH**,%CRLF | Checks the HOLD status | See *5 |

*1 "**" denotes an RS-232C Linear Gage channel number (01 to 99) ("00" means all channels). Channels 01 to 04 correspond to CEL1 to CEL4, respectively.
A "#" after "G" in the output data denotes the type of data (N: Current value, X: Maximum value, M: Minimum value, W: TIR).

*2 If Peak mode is switched using an RS command, data will not be backed up in the internal memory.

*3 For the preset value and tolerance value, enter a value consisting of a +/- sign and an 8-digit of numeric value without a decimal point.

*4 Perform the tolerance setting in the order CD command→CG command for 3-step tolerance, and in the order CD command→CE command→CF command→CG command for 5-step tolerance.
An error will be output in the following cases. In this case, redo the settings from the CD command.
- If the order of the tolerance values is incorrect
- If the step count and sent data are different
- If incorrect data is sent

*5 The response output from the CK command ("%") shows the HOLD status.
%=0: Normal status/1: HOLD status
If Parameter Number 28 is set to 1 (channel synchronization), all counters connected via RS LINK will switch to the HOLD state when a CK command is sent.
The HOLD state will be canceled by reading out data with the GA command.
The CK command is valid only with channel number 1 (CK01CRLF).

### Tips

- CRLF means CR (carriage return) plus LF (line feed).
- The output when an error occurs is "CH**,Error$$CRLF". $$ is the error code.
  For details, see "6.2.1 List of Error Codes" (page 56).
- After you have received a response output corresponding to the command, send the next command. If there is no response from your command, clear the communication buffer, wait 1 second or more, and then send the command again.
- The RS Communication function will be suspended during key operations (e.g., setting parameters, the pre-set value, or tolerance values). Command and data output operations will resume when the counter returns to a state where counting is possible.
- To cancel the stand-by state, use "CS00CRLF" (all channels specified).
- You can perform the communication test to check a specific operation by sending an RS-232C command from the keyboard to the counter using the Hyperterminal (software installed with Windows by default).

## 5.3.3 Saving and Loading Parameters

You can output the set parameter data from the counter to a PC and save it to a text file.You can also load the parameter data saved in a PC to the counter.

This section explains how to save parameters.

### Tips

To communicate with a PC, you must have appropriate communication software on the PC. Use commercial terminal software.

### ■ Saving parameters

**1** Press and hold [P.SET], and then press [A_ZERO].

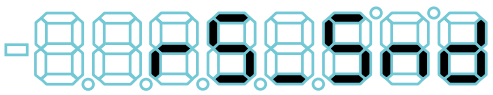
» The counter enters Parameter mode.

**2** Press [A_ZERO] three times to set the Parameter Number 00 to 3.

**3** Press [P.SET].

» The display to the right appears for 1 second, and then the data is output to the PC.

» After the data is transmitted, the counter returns to the stand-by state.



### Tips

- Transmission conditions (fixed): 9600 bps, 7-bit data, even parity, 2-bit stop bits
- Connect the counter to a PC one-to-one (LINK connection not permitted).

### ● Example of external output of parameters

An example of the output of parameters is shown below.

### Tips

The set values for the parameters in the table below are set by the user.

<<Output example>>

```
CQ01,**EH-S [200]**:00
CQ01,P02___=[0],0-1:02
CQ01,P05___=[0],0-1:03
        ¦
CQ01,P10_A_=[1],0-3:36
CQ01,P10_B_=[1],0-3:37
        ¦
CQ01,P40_1_=[0],0-5:42
CQ01,P40_2_=[1],0-5:43
CQ01,P40_3_=[2],0-5:44
CQ01,P40_4_=[0],0-5:45
        ¦
CQ01,*parameter END*:FF
```

Per-axis parameter example

Per-CEL parameter example

<<Data syntax>>

CQ01,P10_A_=[1],0-3:36

- Parameter No.
- Axis (INPUT) number, or CEL number
- Current parameter set value
- Parameter set value range
- Internal data

## ■ Loading parameters

This section explains how to load parameters.

### Tips

- When loading parameters, you cannot extract only one parameter to change it. Be sure to describe all parameters in one file and load them.
- If parameters are set incorrectly, the count value will not be displayed correctly. For details about the parameters, see "3.3 Details of Display Mode" (page 22).

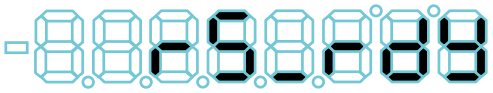
**1** Press and hold [P.SET], and then press [A_ZERO].

» The counter enters Parameter mode.

**2** Press [A_ZERO] four times to set the Parameter Number 00 to 4.

**3** Press [P.SET].

» The display appears as to the right.



**4** Send the parameter file from the PC.

» If it is successfully received, the display to the right will appear.

**5** Press [P.SET].

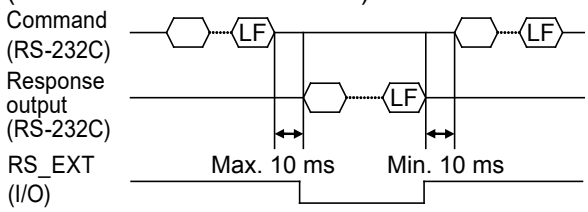
» The counter returns to the counter value status.

### Tips

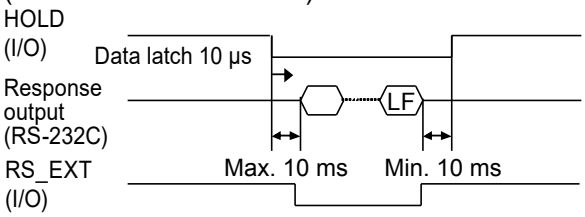
After loading the parameters, turn off the power switch once, and then turn it on again.

## 5.3.4 Timing Chart

**RS-232C command input and response output**
(Parameter Number 28: 0 or 1)




**HOLD input and response output**
(Parameter Number 28: 2)




### Tips

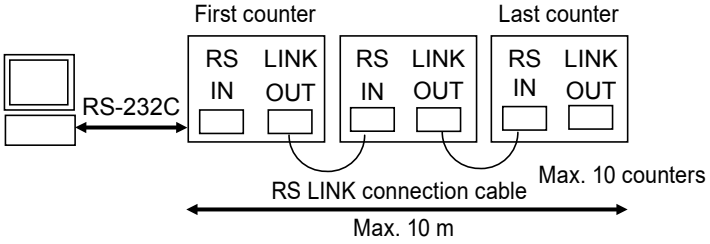
- RS output will be suspended during command operation.
- While the HOLD trigger is selected, the RS-232C commands are disabled.
- When connected via RS LINK, RS_EXT of the last counter is active.

# 5.4 RS LINK Function

With PC (including SENSORPAK) or PLC control, you can control a maximum of 10 counters using the RS LINK function.

## 5.4.1 Connections

Connect between IN and OUT of the RS_LINK connectors as shown in the following figure.




### Tips

- Do not connect anything to the RS_LINK connector (IN) of the first counter or to the RS_LINK connector (OUT) of the last counter.
- When the power switch is turned on and the settings are initialized, the channel numbers of the Linear Gage will automatically be assigned 01, 02, 03, and so on, from the first counter in the order in which they are connected.
- Contact Mitutoyo if you wish you connect 10 or more counters or use a total cable length of 10 m or more.
- For about the RS LINK connection cable, see "7.3 Option" (page 62).

### ■ Precautions for startup

- Either turn on the power switches of all the counters simultaneously or turn on the power switch of each counter sequentially, beginning with the first one.
- After startup, [- - - - -] will blink, and then, after the initial settings have completed, the counter en-

ters the stand-by state, where [- - - - -] is displayed. The RS LINK Function can be canceled using [SEL], an external HOLD signal, or an RS command.

**Tips**

For details, see "6.2.1 List of Error Codes" (page 56).

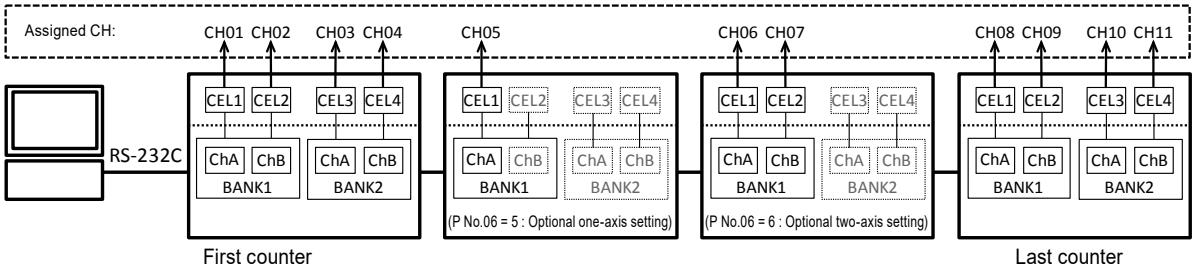
- Parameters relating to RS-232C (No. 25 to 28) can be modified only on the first counter.If you modify a parameter, reset the power switch of all the connected counters.

## 5.4.2 Assignment of CHs

When the power is turned on, the states of the counters are determined, and the CHs (channels) used by RS-232C commands are automatically assigned.

The CHs are assigned starting from 01, from the CELs of the first counter.

For counters with the display mode set to the optional one- or two-axis display, CHs are assigned to only the used CELs and not to unused CELs.




For details about the display modes, see "3.3 Details of Display Mode" (page 22).

## 5.4.3 RS-232C Data Output Duration

The maximum output duration of the command to output all data (GA00CRLF) can be calculated with the formulas below.

1) When the transmission rate is 9600 bps

   Maximum output duration [ms] = Number of connected counters × 5 + Number of connection channels × 17 + 6

   Calculation example

   One EH-102 + 1 channel connection = 1 x 5 + 1 x 17 + 6 = Max. 28 ms

   Ten EH-102 + 20 channels connection = 10 x 5 + 20 x 17 + 6 = Max. 396 ms

2) When the transmission rate is 19200 bps

   Maximum output duration [ms] = Number of connected counters × 5 + Number of connection channels × 8.5 + 3

   Calculation example

   One EH-102 + 1 channel connection = 1 x 5 + 1 x 8.5 + 3 = Max. 16.5 ms

   Ten EH-102 + 20 channels connection = 10 x 5 + 20 x 8.5 + 3 = Max. 223 ms

**Tips**

Processing time of the PC is not included.

# 5.5 I/O Connector Terminal Function

Through the I/O connector, the signal of tolerance judgment results, measurement data, etc. can be output to an external device. You can also switch the displayed BANK, switch Peak mode, activate the Preset function, clear the peak value, etc., by an external signal input.

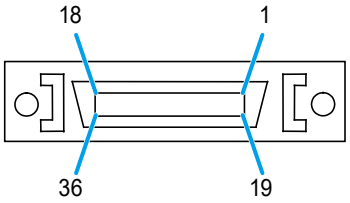
## 5.5.1 Connections

### ■ Compatible plug and pin assignment

Compatible plug:

- Option No. 02ADB440 (plug and cover set)
- Commercial plug 10136-3000PE (3M), cover 10336-52A0-008 (3M)
- Commercial plug DX40M-36P (HIROSE), cover DX30M-36-CV (HIROSE)

Cable: Use shielded wires and limit the connecting cable length to 3 m or less.




| Pin number | I/O | Tolerance judgment output mode | | BCD output mode | |
|---|---|---|---|---|---|
| | | Name | Functions | Name | Functions |
| 1, 2 | - | COM | Internally connected to GND | COM | Internally connected to GND |
| 3 | O | AL1 | Ach (upper display) tolerance judgment result output<br>• Relevant terminal output: "L"<br>• Output on error: AL1, AL5: "L" | A_bit0 | Ach (upper display) data |
| 4 | O | AL2 | | A_bit1 | |
| 5 | O | AL3 | | A_bit2 | |
| 6 | O | AL4 | | A_bit3 | |
| 7 | O | AL5 | | A_SIGN | |
| 8 | I/O | ALLGO | Total tolerance judgment result output<br>GO (OK): "H"<br>NG: "L" | READY | Data valid: "L" |
| 9 | O | RS_EXT | RS output in process: "L" | | |
| 10 | O | NOMAL | Output when counting is possible: "L", Output on error: "H" | | |
| 11 | O | BL1 | Bch (lower display) tolerance judgment result output<br>• Relevant terminal output: "L"<br>• Output on error: BL1, BL5: "L" | B_bit0 | Bch (lower display) data |
| 12 | O | BL2 | | B_bit1 | |
| 13 | O | BL3 | | B_bit2 | |
| 14 | O | BL4 | | B_bit3 | |
| 15 | O | BL5 | | B_SIGN | |
| 16 to 21 | - | - | Not connected | | |
| 22 | O | A_ANG | Ach (upper display) analog output | | |
| 23 | O | B_ANG | Bch (lower display) analog output | | |
| 24 | - | AGND | GND for analog | | |
| 25 | I | SET1 | During DISP, MODE, PA, or PB input: Function setup. During input, the decimal point will blink.<br>During BCD output: BCD output trigger (only SET1 used) | | |
| 26 | I | SET2 | | | |
| 27 | I | SET3 | | | |

| Pin number | I/O | Tolerance judgment output mode | | BCD output mode | |
|---|---|---|---|---|---|
| | | Name | Functions | Name | Functions |
| 28 | I | DISP | Displayed BANK specification: In combination with SET. During input, the decimal point will blink. | | |
| 29 | I | MODE | Peak switchover: In combination with SET. During input, the decimal point will blink. | | |
| 30 | I | BCDCK | BCD output specification: In combination with SET. During input, the decimal point will blink. | | |
| 31 | I | EXTTRG | USB trigger | | |
| 32 | I | A_HOLD | Ach (upper display) display: HOLD<br>During input, the decimal point will blink. | | |
| 33 | I | B_HOLD | Bch (lower display) display: HOLD<br>During input, the decimal point will blink. | | |
| 34 | I | HOLD | HOLD/Error cancel input<br>During input, the UNIT indicator will blink. | | |
| 35 | I | PA | Ach (upper display) Preset/Peak clear (in Peak, HOLD mode)<br>During input, the decimal point will blink. | | |
| 36 | I | PB | Bch (lower display) Preset/Peak clear (in Peak, HOLD mode)<br>During input, the decimal point will blink. | | |

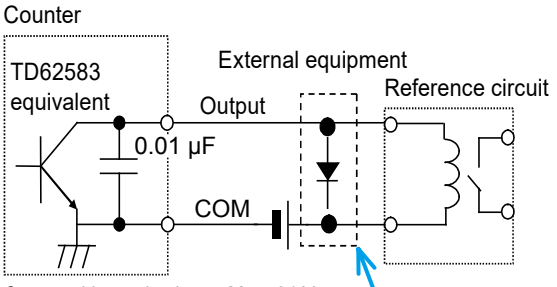
### Tips

- For external input, negative logic (L = enabled) is used.
- "I/O" refers to the first letters of "Input/Output" respectively. Refer to the input circuit for "I", and the output circuit for "O".

## ■ Input/Output circuit

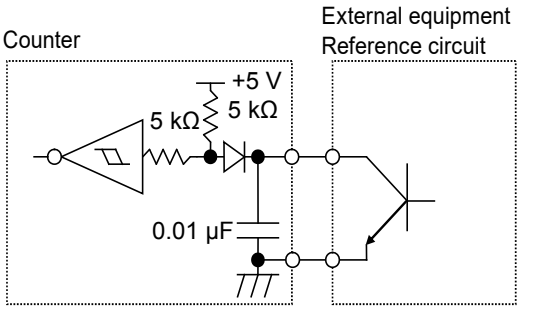
**Output circuit**

Transistor is on when the output is "L" (open collector).




**Input circuit**

Input is valid when the input voltage is "L".



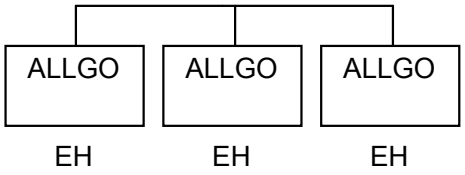

**NOTICE**

When using relays, incorporate a surge-current-absorbing diode or a protective circuit. If no protection is incorporated, the IC in the counter may be damaged.

# 5.5.2 Output Function

## ■ Output of total tolerance judgment result

The AND of the tolerance judgment results of all CELs is output.When multiple counters are connected, the total judgment can be output.




| Judgment | Total judgment indicator | External output ALL_GO |
|---|---|---|
| All counters OK | Green | H |
| All or some counters NG | Amber | L |
| Error | Red | L |

### Tips

- To enable this function, select 0 or 1 as the set value of Parameter Number 20.
- For the Total Judgment across multiple counters, wire the number 8 pins (ALLGO: total tolerance judgment result output) together.
- For USB output, the total judgment indicator lights in amber under normal conditions and in red when an error has occurred. Perform the total tolerance judgment with SENSORPAK (optional software).
- For BCD output, the total judgment indicator lights in green under normal conditions and in red when an error has occurred.
- For details on the timing chart, see "5.5.4 Timing Chart" (page 52).

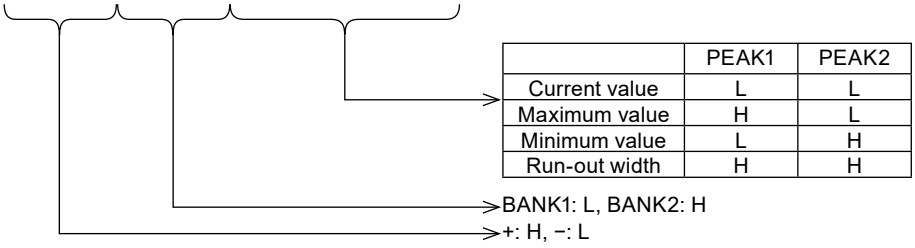
## ■ BCD output

Outputs measurement data in BCD format. Measurement data from Ach (upper display) and Bch (lower display) is output simultaneously in 4-bit units beginning with the least significant digit.

The following shows the data format when the Parameter Number 21 is set to "0".

LSD (Least significant digit) MSD (Most significant digit)

| | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|---|---|---|---|---|---|---|---|---|
| A_bit0/B_bit0 | $1\times10^0$ | $1\times10^1$ | $1\times10^2$ | $1\times10^3$ | $1\times10^4$ | $1\times10^5$ | $1\times10^6$ | $1\times10^7$ |
| A_bit1/B_bit1 | $2\times10^0$ | $2\times10^1$ | $2\times10^2$ | $2\times10^3$ | $2\times10^4$ | $2\times10^5$ | $2\times10^6$ | $2\times10^7$ |
| A_bit2/B_bit2 | $4\times10^0$ | $4\times10^1$ | $4\times10^2$ | $4\times10^3$ | $4\times10^4$ | $4\times10^5$ | $4\times10^6$ | $4\times10^7$ |
| A_bit3/B_bit3 | $8\times10^0$ | $8\times10^1$ | $8\times10^2$ | $8\times10^3$ | $8\times10^4$ | $8\times10^5$ | $8\times10^6$ | $8\times10^7$ |
| A_SIGN/B_SIGN | Sign | BANK | PEAK1 | PEAK2 | (Not used) | (Not used) | (Not used) | (Not used) |




| | PEAK1 | PEAK2 |
|---|---|---|
| Current value | L | L |
| Maximum value | H | L |
| Minimum value | L | H |
| Run-out width | H | H |

### Tips

When the Parameter Number 21 is set to "1", the output data logic is inverted.

For details about the parameters, see "3.2 List of Parameters" (page 18).

Example of output data (when the Parameter Number 21 is set to "0")

| | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|---|---|---|---|---|---|---|---|---|
| A_bit0 | H | L | L | H | L | H | L | H |
| A_bit1 | L | L | H | L | L | H | H | L |
| A_bit2 | L | L | H | H | H | L | L | L |
| A_bit3 | L | L | L | L | L | L | L | L |
| A_SIGN | H | H | L | L | (Not used) | (Not used) | (Not used) | (Not used) |

↓

+12345601/BANK2 Ach/Current value

### Tips

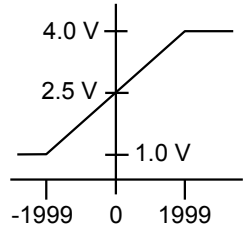
- To enable this function, select set value 2 (BCD output) of Parameter Number 20 (Tolerance/BCD output mode switching).
- It is possible to invert the data output logic by setting Parameter Number 21 (logic selection) to 1 (H).
- For details on the timing chart, see "5.5.4 Timing Chart" (page 52).

## ■ Analog output

Movement of the spindle of the gage head can be monitored as linear voltage by measuring the voltage between terminals with a pen recorder or oscilloscope.

Ach (upper display): Pin numbers 22–24

Bch (lower display): Pin numbers 23–24




Output voltage = 2.5 V + counter value × voltage resolution (0.75 mV)
(full-scale: 1.0 V–4.0 V)
Response speed: 10 Hz (update time: 5 ms)
Accuracy : ±1 % (1.0 V–4.0 V) (accuracy is rated at full-scale 4 V)
Load resistance 300 kΩ or more

| Parameter No. 30 | Measurement range [mm] (range resolution [mm]) | | | |
|---|---|---|---|---|
| | 10 µm resolution setting | 1 µm resolution setting | 0.1 µm resolution setting | 0.01 µm resolution setting |
| 0 | ±19.99 (0.01) | ±1.999 (0.001) | ±0.1999 (0.0001) | ±0.01999 (0.00001) |
| 1 | ±199.90 (0.1) | ±19.990 (0.01) | ±1.9990 (0.001) | ±0.19990 (0.0001) |
| 2 | ±1999.00 (1) | ±199.900 (0.1) | ±19.9900 (0.01) | ±1.99900 (0.001) |

# 5.5.3 Input Function

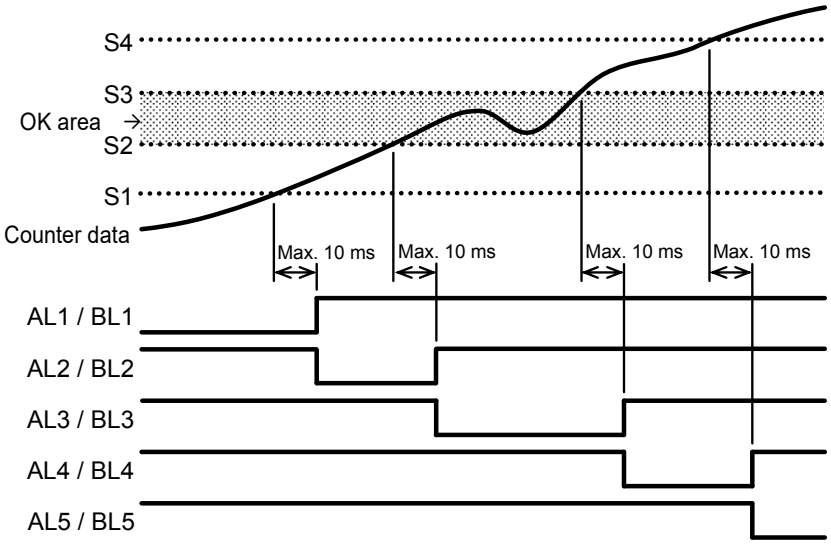
With an external signal input, you can switch the BANK, switch Peak mode, activate the Preset function, clear the peak value, set the memory, and clear the memory.You can also activate a HOLD on the counter values of Ach (upper display) and Bch (lower display) either separately or simultaneously.

### Tips

For details on the timing chart, see "5.5.4 Timing Chart" (page 52).

## 5.5.4 Timing Chart

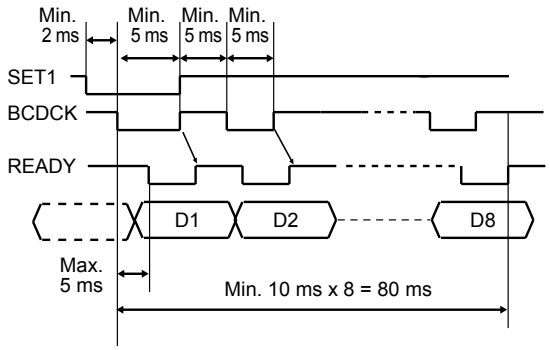
### ■ Tolerance judgment result output




**Tips**

After acquiring the counter data, there is a maximum 10 ms delay before the tolerance judgment result is output.

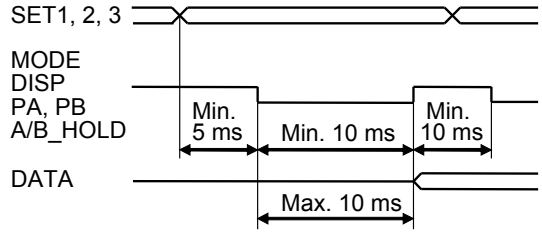
### ■ BCD output




**Tips**

- "SET1" and "BCDCK" (BCD clock) denote input signals, and "READY" denotes the output signal.
- The BCD data (D1, D2 in the figure above) will be modified at the fall of the BCD clock while SET1 is input. When the BCD data is accepted, the READY signal falls. The time to accept the data after the fall of the BCD clock is 5 ms maximum. The READY signal rises together with the BCD clock.
- If SET1 is turned to L during data output, the data output is stopped, and then a new data output starts from D1.

## External signal input




Refer to the following table to set the SET signal.

After setting, leave a gap of 5 ms or more, and then input the input signal of the function to change for at least 10 ms.

The data will be modified within 10 ms after the fall of the input is confirmed.

**DISP (pin number 28):**

**Switching the displayed BANK**

| | SET3 | SET2 | SET1 |
|---|---|---|---|
| BANK1 | H | H | H |
| BANK2 | H | H | L |

**PA/PB (pin numbers 35, 36):**

**Preset, Peak clear**

| | SET3 | SET2 | SET1 |
|---|---|---|---|
| Preset | H | H | H |
| Peak clear | H | H | L |

**MODE (pin number 29):**

**Switching Peak**

| | SET3 | SET2 | SET1 |
|---|---|---|---|
| NOMAL | H/L | H | H |
| MAX | H/L | H | L |
| MIN | H/L | L | H |
| TIR | H/L | L | L |

**A/B_HOLD (pin numbers 32, 33):**

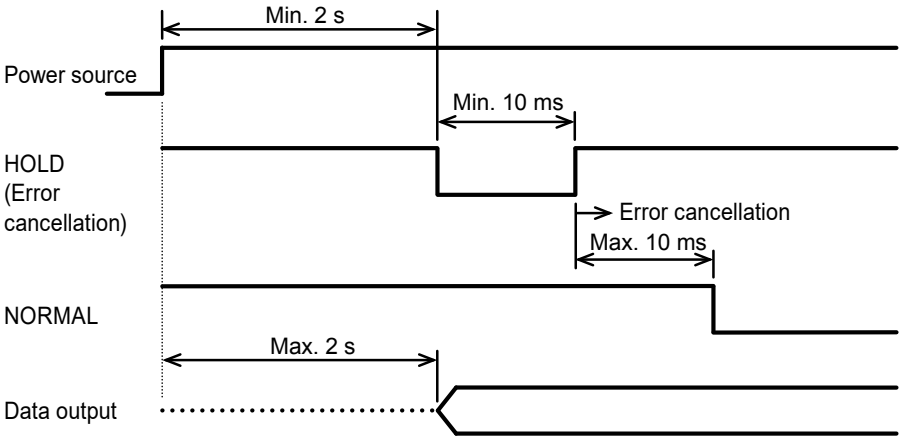
**Setting/clearing memory**

| | SET3 | SET2 | SET1 |
|---|---|---|---|
| Setting memory | H | H | H |
| Clearing memory | H | H | L |

### Tips

- During Peak mode, the peak value will be cleared when you input the PA/PB signal while HOLD is being input.
- When switching Peak mode, SET3 is H for Ach (upper display) and L for Bch (lower display).
- A/B_HOLD signal is available when the relevant channel is UNIT F (memory unit).

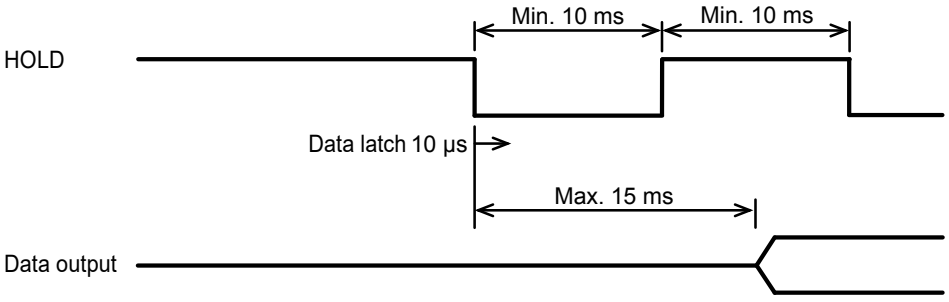
## ■ Power on/error cancellation




### Tips

When the power is turned on, NORMAL is H (error state).Cancel the error state before use.

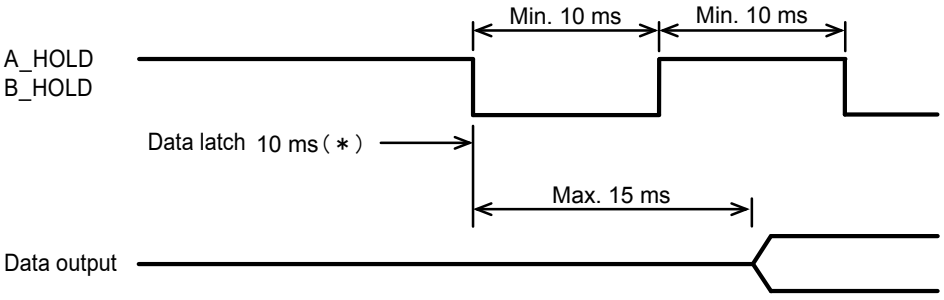
## ■ Data HOLD




### Tips

During the peak detection, the peak value will be cleared when PA/PB is input while HOLD is being input.

## ■ Display HOLD




### Tips

A delay of approximately 10 ms occurs between the internal counter data and the displayed data.

# 6 Troubleshooting

## 6.1 Troubleshooting

When the counter does not operate as expected, refer to the causes and solutions for trouble listed below.

| Problem | Cause | Solution |
|---|---|---|
| The counter value is incorrect (not counting). | Peak mode (MAX or MIN is lit) is active. | Cancel Peak mode.<br>For details, see 📖 "4.5.1 Procedure for Switching Peak Mode" (page 33). |
| | The HOLD signal (UNIT is blinking) is being input. | Check the external input. |
| | Calculation with a constant function is set. | Cancel the calculation with a constant function. (Set Parameter Number 41 to 0.) |
| | The gage output signal pitch is changed. | Set Parameter Number 10 to an appropriate value.<br>For details, see 📖 "3.2 List of Parameters" (page 18). |
| Cannot execute Zero setting. | Peak mode is active. | Cancel Peak mode.<br>For details, see 📖 "4.5.1 Procedure for Switching Peak Mode" (page 33). |
| Cannot establish RS-232C communication. | The RS-232C connecting cable is not properly connected. | Check the cable connection. |
| | RS-232C mode is not active. | Activate RS-232C mode. (Set Parameter Number 24 to 0.) |
| | The command or HOLD trigger setting is not appropriate. | Check the command or HOLD trigger setting (Parameter Number 28). |
| | The communication conditions are not set correctly. | Check the settings of the communication conditions.<br>For details, see 📖 "3.2 List of Parameters" (page 18). |

# 6.2 Error Messages

## 6.2.1 List of Error Codes

| Display/ total tolerance indicator | RS-232C output | NOM signal | Tolerance/ BCD | Cause | Solution/ Error cancellation method |
|---|---|---|---|---|---|
| Error 10<br>Red indicator on | Error_10 | H | L1 = L<br>L5 = L<br>FFFF10 | Abnormal power voltage | Connect to the specified voltage.<br>Automatic cancellation |
| [----] blinks<br>- | - | H | L1 = H<br>L5 = H<br>- | RS link is in its initial setting state | Re-check the RS LINK connection cable connection.<br>Automatic cancellation, or turn on the power switch again. |
| [--------]<br>Red indicator on | Error_15 | H | L1 = L<br>L5 = L<br>FFFF15 | In stand-by state after power-on or a power interruption | Re-check the power if a power interruption has occurred.<br>• [SEL]<br>• CS00CRLF (RS)<br>• HOLD input (I/O) |
| Error 20<br>Red indicator on | Error_20 | H | L1 = L<br>L5 = L<br>FFFF20 | Overspeed | Revise the measurement conditions.<br>• [SEL]<br>• CS00CRLF (RS)<br>• HOLD input (I/O) |
| Error 30<br>Red indicator on | Error_30 | H | L1 = L<br>L5 = L<br>FFFF30 | Counter value is 8 digits or more | Modify the preset value.<br>• [SEL]<br>• CS00CRLF (RS)<br>• HOLD input (I/O) |
| Error 40<br>Red indicator on | Error_40 | H | L1 = L<br>L5 = L<br>FFFF40 | Gage head malfunction, overspeed, or use of UNIT_B, UNIT_C, or UNIT_E | • Check that the gage head is connected properly.<br>• Revise the measurement conditions.<br>• Check the connection between CEL and UNIT.<br>• [SEL]<br>• CS00CRLF (RS)<br>• HOLD input (I/O) |
| Counter value<br>- | Error_50 | L | Counter value status<br>Counter value status | RS communication setting malfunction | Set the RS communication conditions again.<br>Automatic cancellation |

| Display/ total tolerance indicator | RS-232C output | NOM signal | Tolerance/ BCD | Cause | Solution/ Error cancellation method |
|---|---|---|---|---|---|
| Counter value<br>- | Error_52 | L | Counter value status<br>Counter value status | RS command malfunction | Revise the RS command.<br>Automatic cancellation |
| Error 55<br>Red indicator on | - | H | L1 = L<br>L5 = L<br>FFFF55 | RS LINK malfunction<br>HOLD signal malfunction | Check the unit's connection status, I/O connector peripheral circuit, power, etc.<br>Turn on the power switch again. |
| Error 80<br>Red indicator on | Error_80 | H | L1 = L<br>L5 = L<br>FFFF80 | Peak detection error<br>(Overspeed) | Revise the measurement conditions.<br>• [SEL]<br>• CS00CRLF (RS)<br>• HOLD input (I/O) |
| Error 90<br>- | Error_90 | L | Counter value status<br>Counter value status | Tolerance value setting error or parameter setting error | • Input the tolerance value again.<br>• Input the parameter value again.<br>[SEL] |
| Error 95<br>- | Normal output | L | Counter value status<br>Counter value status | Key protect | Cancel the key protection parameters.<br>Automatic cancellation |

## Tips

- In the "Solution/Error cancellation method" column, "RS" denotes an RS-232C command and "I/O" denotes an external HOLD signal.
- The error output format of RS-232C is "CH**,Error$$CRLF".
- "Error 40" (gage head malfunction) is also displayed when no gage head is connected.
- "Error 90" and "Error 95" are displayed when a tolerance value setting error occurs due to a key operation.
- "Error_90" in the RS-232C output means that a tolerance value setting error has occurred due to an RS command.
- If an error occurs while you are setting parameters, the preset value, or the tolerance value, the error will be output after the counter display return to the counter value status. However, the error signal will be output immediately to any external output.

## 6.2.2 Error Cancellation Method

The 3 main error cancellation methods are explained below, but the appropriate method differs depending on the cause.

- Automatic cancellation
- Press [SEL].
- Input an external HOLD signal.

### Tips

For details about error messages, see 📖 "6.2.1 List of Error Codes" (page 56).

# 7 Specifications

## 7.1 Basic Specifications

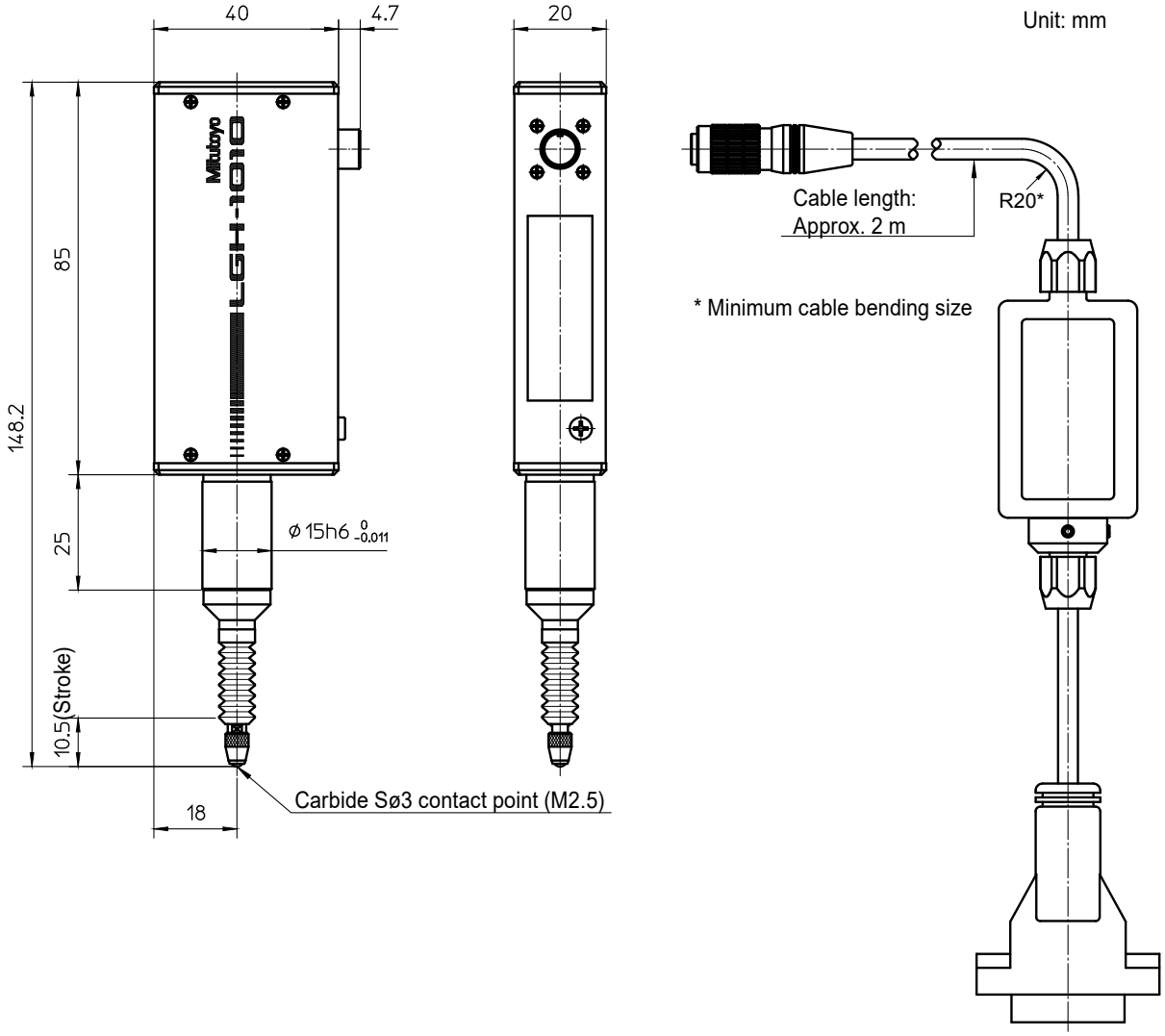
| Code No. | | 542-715 | 542-716 |
|---|---|---|---|
| Model No. | | LGH-1010-B-EH | LGH-1010C-B-EH |
| Minimum resolution *1 | | 0.00001 mm (0.01 µm)/0.0001 mm (0.1 µm) | |
| Measuring range | | 10 mm | |
| Indication accuracy (20 °C) *2 | | 0.2 µm | |
| Repeatability (2σ) *2 | | 0.1 µm | |
| Retrace error *2 | | 0.1 µm | |
| Maximum response speed *2 | | Normal measurement: 700 mm/s<br>Peak detection: 120 mm/s | |
| Stem diameter | | ø15 h6 (0/ -0.011) | |
| Contact point | | Carbide Sø3 (M2.5 x 0.45)/Part No. 901312 | |
| Measuring force | Contact point downwards | 0.65 N or less | Approx. 0.12 N |
| | Contact point horizontal | 0.55 N or less | Not available |
| | Contact point upwards | 0.45 N or less | Not available |
| Available counter | | EH Counter (dedicated to LGH-1010-B/Standard accessories) | |
| Power supply/Power consumption *2 | | Supplied AC adapter or DC +12 V–+24 V<br>Max. 8.4 W (Max. 700 mA)<br>For commercial power source, ensure at least 1 A power supply per unit. | |
| Operating temperature/humidity range | | 0 °C–40 °C/20 % –80 % RH (no condensation)<br>* Recommended operating temperature: 20 °C ± 1 °C | |
| Storage temperature/humidity range | | -10 °C–+60 °C/20 % –80 % RH (no condensation) | |
| Unit mass | | Gage head: Approx. 370 g (including the signal connection cable)<br>Counter: Approx. 900 g (excluding the AC adapter) | |
| CE Marking | | EMC Directive：EN 61326-1<br>Immunity test requirement：Clause 6.2 Table2<br>Emission limit：Class B<br>RoHS Directive：EN IEC 63000 | |

*1 The setting can be changed using the counter.

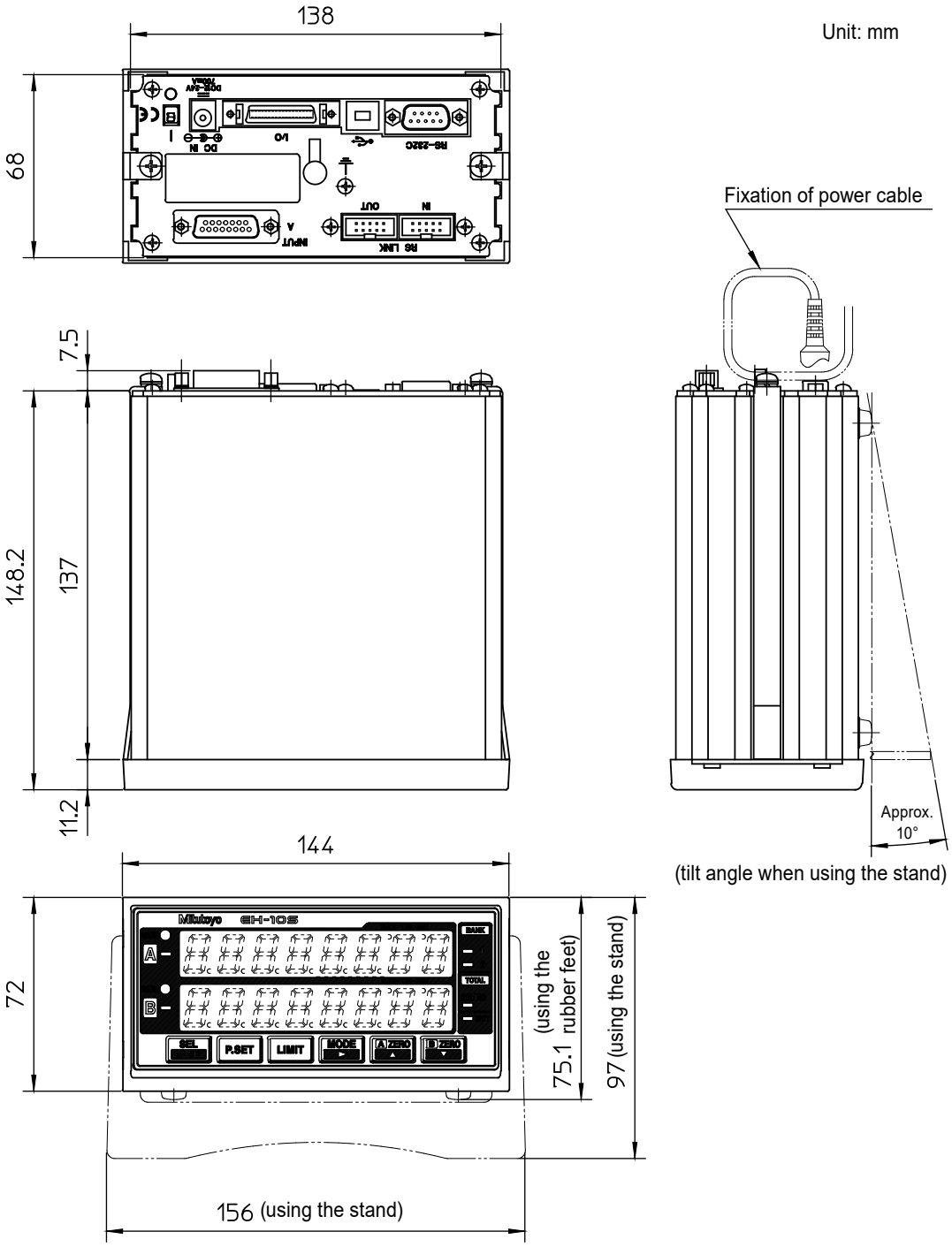
*2 When using the supplied counter

# 7.2 Outline Dimensional Drawing

## 7.2.1 Gage Head/Signal Connection Cable



## 7.2.2 Counter

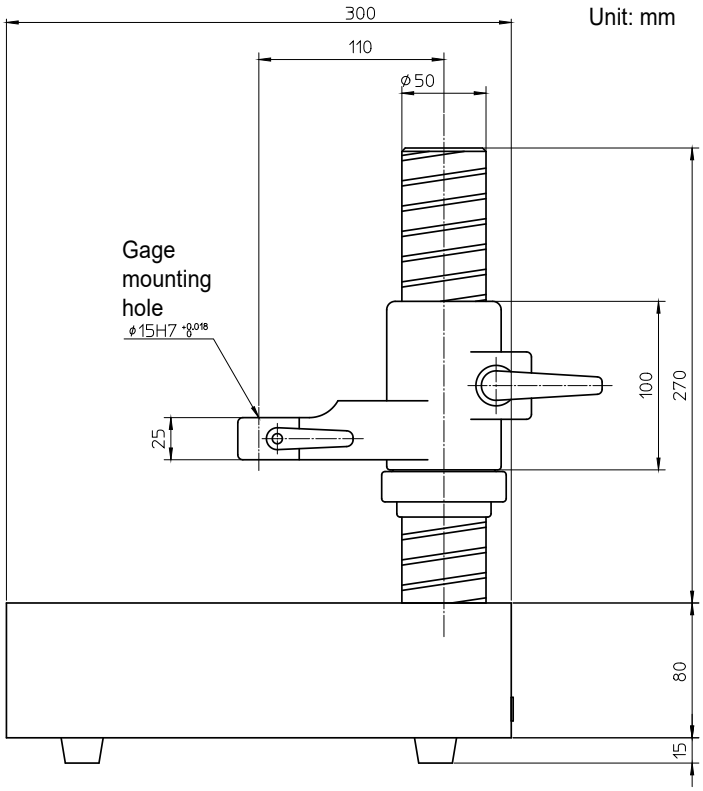

Unit: mm
138
68
7.5
148.2
137
11.2
144
72
Mitutoyo EH-105
A
B
SEL
P.SET
LIMIT
MODE
A ZERO
B ZERO
75.1 (using the rubber feet)
97 (using the stand)
156 (using the stand)
Fixation of power cable
Approx. 10°
(tilt angle when using the stand)

# 7.3 Option

| Code No./ Part No. | Name | Dimensional drawing |
|---|---|---|
| 971750 | LGH measurement stand | page 62 |
| 971751 | Holder A | page 63 |
| 971752 | Holder B | page 64 |
| 971753 | Release for LGH | page 64 |
| 02ADB440 | I/O output connector (with cover) | - |
| 02ADD950 | RS-LINK/Digimatic connection cable (0.5 m) | - |
| 936937 | RS-LINK/Digimatic connection cable (1 m) | - |
| 965014 | RS-LINK/Digimatic connection cable (2 m) | - |
| 02NGB070 | SENSORPAK (software for loading data to PC) | - |
| 21HZA137 | I/O CABLE SET FOR SENSORPAK (RS-232C cable) | - |
| 264-505 | Digimatic Mini-Processor DP-1VA LOGGER | - |
| - | Contact points for dial indicator<br>For details, see the General Catalog. | - |

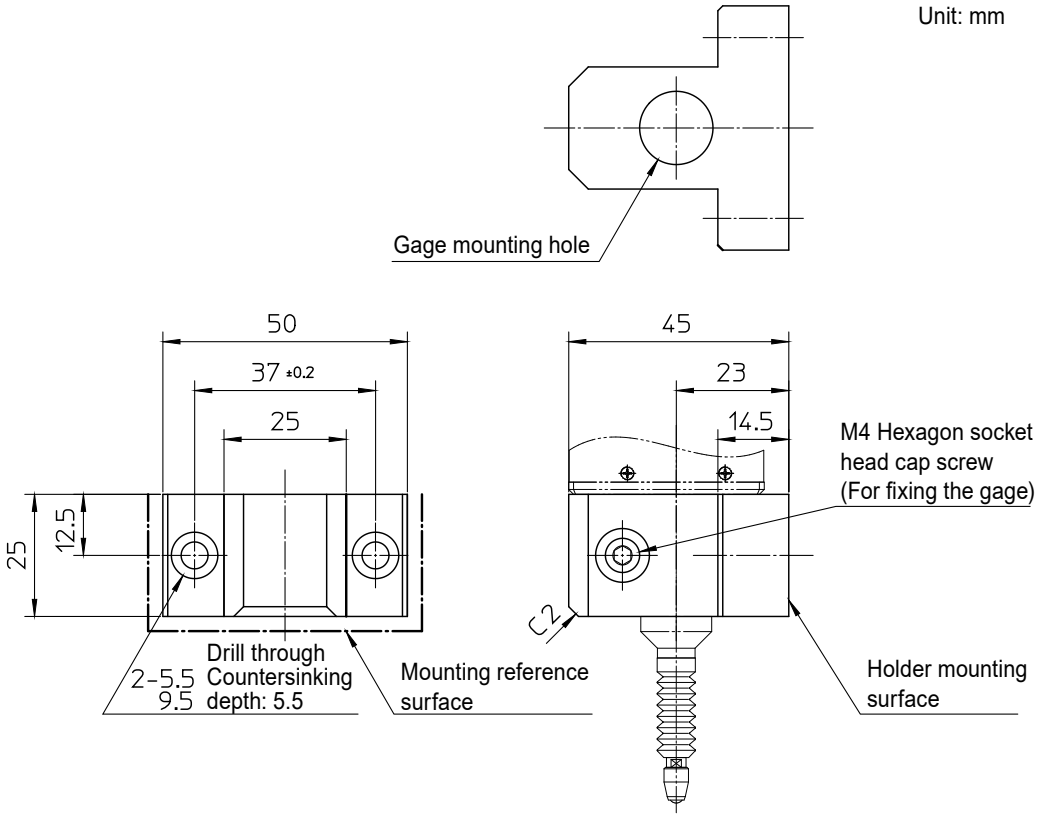
## ■ LGH measurement stand

- External dimensions: 250 (W) x 300 (D) x 365 (H) mm
- Mass: 23 kg
- Maximum measuring range: 0 mm–137 mm



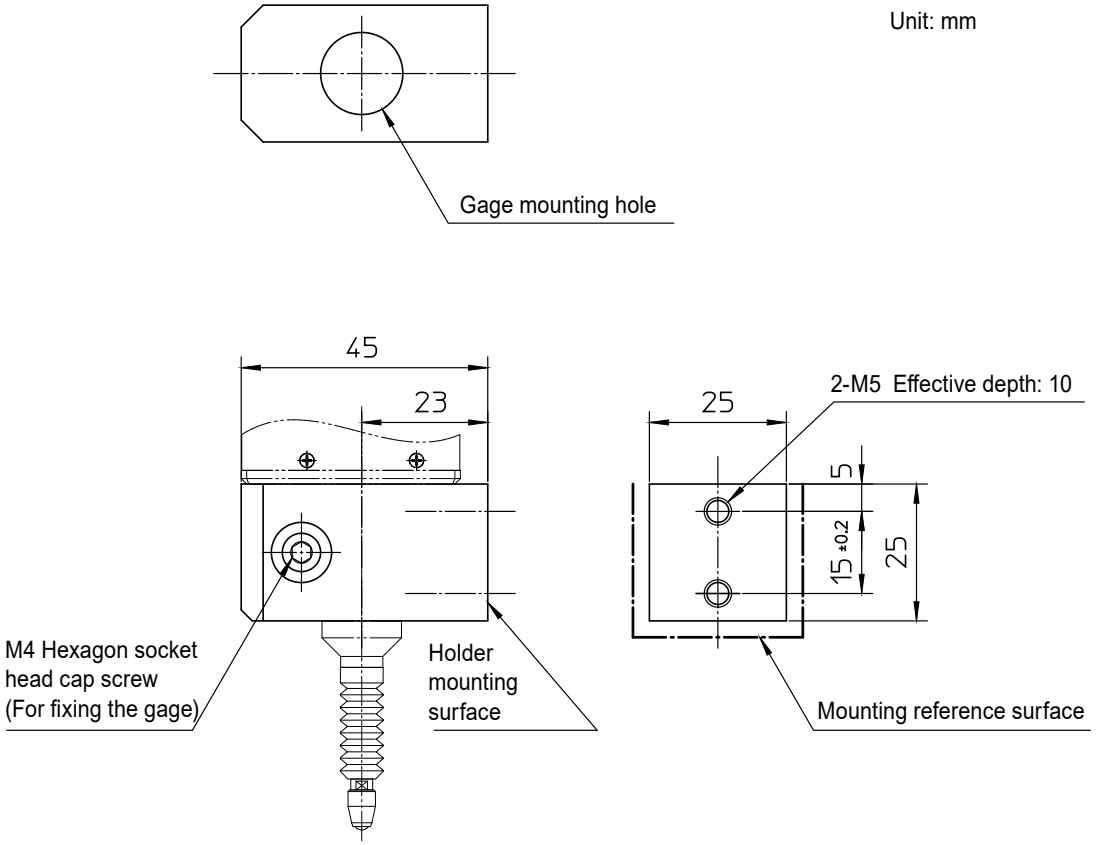
## ■ Holder A

Unit: mm

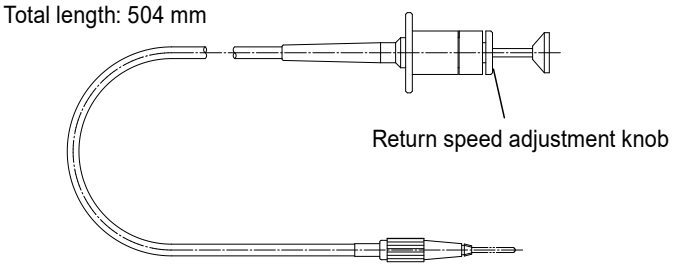


## ■ Holder B

Unit: mm




## ■ Release for LGH



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