Linear Gage Counter EH-101P/-102P/D/Z/S

User's Manual
No.99MBC109A1
SERIES No.542

Safety Precautions

This Product should be used according to the specifications, functions and precautions for use as described in this document. Using this Product in other ways may result in a loss of safe operation.

1. Introduction

In order to obtain the highest possible performance from your Linear Gage Counter and use it safely for an extended period of time, be sure to read this document prior to installation, setup, and operation. In addition, observe the following precautions.

Conformity to EC directives

This unit conforms to the following EC directives:
Standerd:EN61326:1997+A1+A2+A3:1998
Immunity test requirement :Annex A
Emission limit :Class B
* When you use a commercial power supply unit, establish an appropriate one-to-one connection with a cabling length of 30m or less between the two pieces of equipment. Moreover, please avoid any outdoor wiring.

Precautions for Use

WARNING

- **Neither remove the cover nor disassemble this unit. Otherwise you may be subject to electric shock or the unit may have a risk of causing breakage or fire as the result of short-circuiting due to metallic powders entered in the inside of the unit.**
- **Warning labels are located on the top surface of the main unit.**
- **This is a precision instrument. Handle this unit with your utmost care so as not to impact or apply an excessive force to any part of this unit.**
- **Use this unit in a place where the ambient temperature is within the range of 0 to 40˚C and subject to minimum variation without causing condensation.**
- **Avoid using this unit in the following environments :**
  - **Where this unit may be subject to cutting chips, machining oil, or significant vibration.**
  - **Where this unit may be exposed to direct sunlight.**
  - **Near from equipment which uses high voltage/large current.**

2. Warranty

The Linear Gage Counter EH-101P/-102P/D/Z/S has been manufactured under rigorous Mitutoyo quality control. Should it malfunction due to the workmanship or transportation, etc. within one year from the date of original purchase, it will be repaired free of charge according to the description of the warranty card. Contact your dealer or the nearest Mitutoyo sales office for more information.

3. Overview

The EH Counter is a mount-on-panel type counter conforming to DIN size(144x72mm), which greatly facilitates the incorporation into a system. It has incorporated diverse output functions including RS232C, USB, tolerance judgment or BCD, and analog outputs, providing various control capabilities.

Major functions

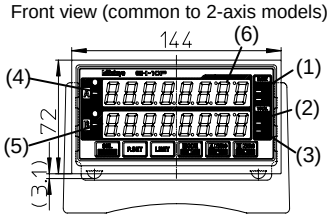
Key function	Presetting, Peak measurement, Tolerance limit setting, and BANK-switching type tolerance judgment
Tolerance function	3/5-step tolerance limits(2-BANK)
Output function	Tolerance output/BCD output (Parameter selection) RS232C/USB/Digimatic output (Parameter selection)
Input function	Preset, Hold, BANK switching, and Peak switching

Following four models are provided depending on the gage to be connected:

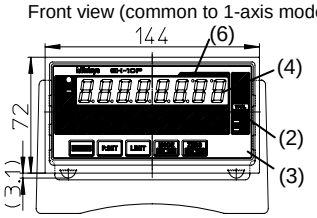
Model	Applicable gage	Features
EH-102P EH-101P	LGB, LGF, LGK, LGH etc.	Providing a high resolution down to 0.1μm and high-speed response of 1.5m/s(with LGF)
EH-102D	LGD, ID, SD, etc.	Provided with the ABS function, eliminating comparison with a standard each time when the power is turned on.
EH-102Z	LGF-Z, etc.	Provided with the origin function which gives a high-speed response and reducing troubles in comparing with a standard each time when the power is turned on.
EH-102S	LGH	Providing an ultra-high resolution display of 0.001μm

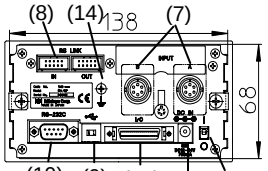
4. Appearance

Front view (common to 2-axis models)

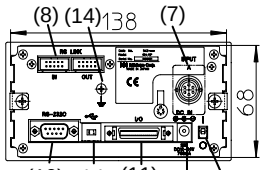


Front view (common to 1-axis models)

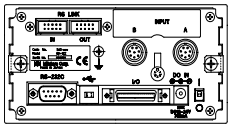




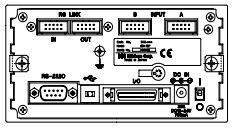
EH-102P



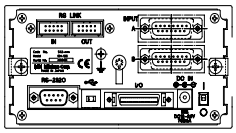
EH-101P



EH-102Z

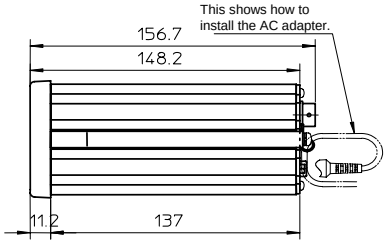


EH-102D



EH-102S

(1) BANK indicator
(2) Total judgment indicator
(3) UNIT indicator
(4) A-ch display
(5) B-ch display
(6) Peak indicator
(7) Gage input connector
(8) RS_LINK connector
(also used for Digimatic output)
(9) USB connector
(10) RS-232C connector
(11) I/O connector
(12) DC jack
(13) Power SW
(14) Cable clamp

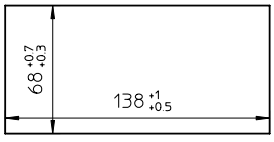


Side view (common to all models)

5. Setup

5.1 Panel Mounting Method

1) Drilling mounting holes on the panel



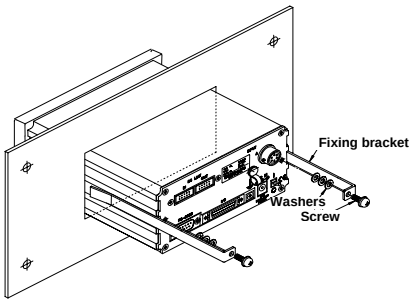
Panel thickness allowing it to be mounted:
1.0 to 3.2mm

2) Mounting the panel

The main body of the counter is put from the front side of the panel after the fixing bracket of the counter is detached once, and the counter is fixed from the back of panel with the fixing bracket. Adjust the number of supplied washers according to the thickness of the panel to use.

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

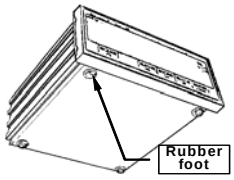
Mitutoyo



5.2 Attaching the Stand and Rubber Foot

1) Rubber foot

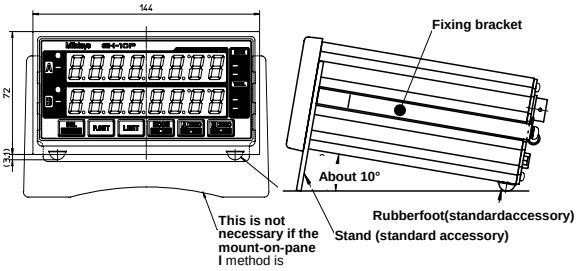
When you place this unit flat on a desk, attach four pieces of rubber feet under the bottom surface of the main unit case.



Note) This unit can not be assembled into the panel after these rubber feet are attached.

2) Stand

Attaching (with six pieces of washers) the supplied stand to this unit in the same way as the panel, you can use the counter main body as it is inclined.



5.3 Making Connections

1) Do not omit making any of the following connections:

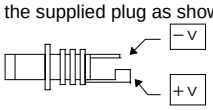
- Connect a Mitutoyo Linear Gage to the INPUT connector.
- Supply power into the DC IN connector (Use a Mitutoyo-specified AC adapter or the supplied DC plug).
- Connect the grounding wire to the grounding terminal.

2) Make the following connections as required:

- Connect a cable (D-sub 9-pin cross-type cable) to the RS-232C connector. This cable must be prepared by the user（Refer to "10. RS232C/USB/Digimatic Output Function").
- Connect the dedicated cable to the RS-LINK connector. Always use a Mitutoyo-specified cable (Refer to "17. Optional Accessories").
- Connect the dedicated cable to the I/O connector. This cable must be prepared by the user (Refer to “11. I/O Connector Terminal Function”).

3) Internal wiring of the DC plug

For using an external power supply, solder power cable wires to the terminals of the supplied plug as shown in the figure below.



Note the following when using this unit:

NOTE

- Use only a power source for this unit that is rated to 12 to 24V and control output current more than 1A. Never use this power source with other electric equipment that runs at a high voltage and/or large current.
- Do not let the power supply cable and gage cable run through a cable duct together with other power line.
- Be sure to use shielded wires for the I/O cable and limit the cable length to 3m or less.
- Never omit grounding this unit.
- Each connection cable must be secured to the main body of this unit, etc.
- Used a grounded 3-P AC outlet for the AC adapter.

6. Setting Parameters

Used to set the counting direction and minimum reading, etc. of the counter

Hereinafter [2-axis model] will be followed by the description regarding only the functions and operations of the 2-axis models.

6.1 How to Set Parameters

	Key operation	Corresponding display/output
1	Turns the unit power on.	The counter enters the stand-by state.
2	Press the [A_ZERO] ([ZERO]/1-axis model)key while holding down the [P.SET] key to change to the parameter mode.	The parameter 00 (PNo.00) will be displayed. Parameter Number / Set value
3	Press [P.SET] to advance the parameter number by one.	If [P.SET] is pressed four times (EH-P/Z/S):
4	**[2-axis model] [Setting the measurement mode]** Press [A_ZERO] to set the required number.	Example: Inter-axis calculation between A and B = 1. For detail refer to 8 Measurement Mode.
5	Press [P.SET] to advance the parameter number by one.	
6	**(For each axis) [Resolution setting]** Repeatedly press [P.SET] until the display as in the right appears. Set the resolution suitable for the gage to be used.	**Setting of INPUT A (EH-P/Z/S)** Parameter Number / INPUT Number / Set value
7	**[2-axis model]** Press [P.SET] to advance to the setting of INPUT B. [2-axis model]. Press [A_ZERO] to Modify the setting value.	**Setting of INPUT B** Parameter Number / INPUT Number / Set value
8	Press [P.SET] to advance the parameter number by one.	
9	Press [A_ZERO] while holding down [P.SET].	The counter enters the stand-by state.

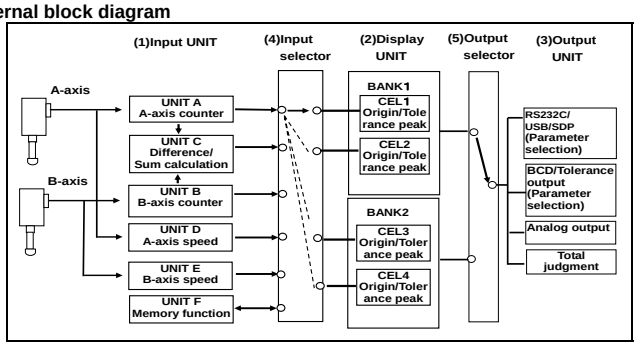
Note

- **In order to use the origin function with your EH-Z, set Parameter 5(PNo.5) to one(1).**

6.2 Reference: Detail of the Measurement Mode Selections [2-axis model]

The 2-axis counter for the EH models has four internal counters (CEL1-4). In addition, it has incorporated six input circuits (UNITA-F) corresponding to your measurement application so that various measurement displays can appear by changing the connection between UNIT and SEL with the input selector. This assignment of connection is specified in terms of measurement mode.

Internal block diagram



(1)Input : Supports UNIT A to UNIT F, which can be selected according to your application.

- UNIT A/B: Performs a counting measurement for either A axis or B axis.
- UNIT C: Performs a real-time difference/sum calculation between A axis and B axis.
- UNIT D/E: Performs a simplified moving speed measurement for A-axis or B-axis.
- UNIT F: Memorizes the display value. (This is active even during the power OFF.)

(2)Display: Possible to select which to display BANK1 or BANK2.
BANK1(CEL1-2),BANK2(CEL3-4)
Each CEL can be used independently for origin detection, peak detection, and tolerance judgment.

(3)Output: It is possible to select the output I/F to be used by the corresponding parameter.

(4)Input selector: It is possible to connect the input UNIT to an optional internal counter.

(5)Output selector: Outputs the displayed value of BANK1 or BANK2.

Measurement mode selections (Parameter No.6)

Parameter value	Measurement mode	BANK1 CEL1	BANK1 CEL2	BANK2 CEL3	BANK2 CEL4
0*2	2-coordinate measurement	UNITA (Count of A)	UNITB (Count of B)	UNITA (Count of A)	UNITB (Count of B)
1	Differential measurement	UNITC (A±B)	UNITA (Count of A)	UNITC (A±B)	UNITB (Count of B)
2	Dual-program measurement	UNITA (Count of A)	UNITA (Count of A)	UNITB (Count of B)	UNITB (Count of B)
3	Measurement with memory	UNITA (Count of A)	UNITF (Memory)	UNITB (Count of B)	UNITF (Memory)
4	Speed measurement	UNITA (Count of A)	UNITD (Speed of A)	UNITB (Count of B)	UNITE (Speed of B)
5*3	Optional 1-axis measurement	UNITA (Count of A)			
6*3	Optional 2-axis measurement	UNITA (Count of A)	UNITB (Count of B)		
7*3	Optional 4-axis measurement	UNITA (Count of A)	UNITB (Count of B)	UNITC (A±B)	UNITA (Count of A)

*1 When BANK1 is displayed with the setting specified to 1 (differential measurement), A-ch (upper row) shows the A±B calculation value, while B-ch (lower row) shows the INPUTA counting value. Otherwise when BANK2 is displayed, A-ch (upper row) shows the A±B calculation value, while B-ch (lower row) shows the INPUTB counting value.
*2 Settings at shipment is O (2-coordinate measurement mode)
*3 For detail refer to "8. Measurement Mode Functions".

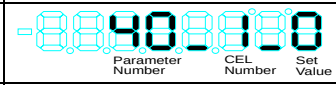
6.3 List of Parameters

No.	Parameter name	Axis specification setting				Initial value
00	Parameter mode selection		**0**:Parameter multiplier **3**:Parameter save	**1**:CEL-specific parameter **4**:Parameter load	**2**:Constant setting	**0**
01	User parameter clear	*1	**0**:Disable (One-shot)	**1**:Initialization (restores the initial value.)		**0**
02	Key protection Prevents operation mistake.		**0**:Normal	**1**:Key input disable		**0**
05	Origin function selections (only for EH-Z)	*2	**0**:Disable	**1**:Enable		**0**
06	Measurement mode selection (only for 2-axis models) *10	*12	**0**:2-coordinate **3**:Memory **6**:Optional 2 ch	**1**:Calculation **4**:Speed (excluding EH-D) **7**:Optional 4 ch	**2**:Simultaneous display **5**:Optional 1ch	**0**
07	Start-up mode (only for EH-P/D/S) Start-up mode (When origin function is enabled for EF-Z)		**0**:"----" display **0**:"----" display	**1**:0.000 **1**:Wait for origin point to be detected.		**0** **0**
09	mm/ E unit system display selection (E=1 / 25.4mm) initialization disable		**0**:mm **3**:mm *7	**1**:E 5/ 100,000 reading	**2**:E 1/ 10,000 reading	**0**
10	Gage/scale output signal pitch (only for EH-S)	For2 axes *12	**0**:20um	**1**:4um	**2**:0.25um (LGH)	**2**
11	Counting direction selection (when the spindle is retracted)	For2 axes	**0**:+count	**1**:-count		**0**
12	Gage resolution setting (only for EH-P/Z)	For2 axes *12	**0**:10um **3**:0.5um	**1**:5um **4**:0.1um	**2**:1um **5**:0.1(LGH)	**2**
	Gage type setting (only for EH-D) *4		**0**:INC	**1**:ABS		**1**
	Gage resolution setting (only forEH-S) When PNo10=0: 0 to 4 *9 When PNo10=1: 2 to 6 When PNo10=2: 4 to 8		**0**:10um **3**:0.5um **6**:0.01um	**1**:5um **4**:0.1um **7**:0.005um	**2**:1um **5**:0.05um **8**:0.001um	**6**
13	µ decimal point display		**0**:Disable	**1**:Enable		**0**
14	C-axis calculation setting [Only for 2-axis models]		**0**:A+B	**1**:A-B		**0**
15	Smoothing (averaging) (only for EH-P/Z/S)		**0**:None	**1**:16 times	**2**:32 times	**0**
16	Peak vale presetting	*11	**0**:Disable	**1**:Enable		**0**
18	Speed sampling cycle (only for EH-P/Z/S)		**0**:10ms	**1**:50ms	**2**:100ms	**0**
19	SDP input WAIT (EH-D)	*6	**0**:0 WAIT	**1**:100ms WAIT	**2**:200ms WAIT	**0**
20	Tolerance / BCD output mode switching	*12	**0**:3-step tolerance	**1**:5-step tolerance	**2**:BCD output	**0**
21	BCD output logic selection	*8 *12	**0**:DATA [L] (Sign H)	**1**:DATA [H] (Sign L)		**0**
24	RS232 / Digimatic selection	*5	**0**:RS232C	**1**:USB	**2**: SDP	**0**
25	Baud rate	*5	**0**:4800	**1**:9600	**2**:19200	**1**
26	Parity	*5	**0**:None	**1**:Odd	**2**:Even	**2**
27	Data bit	*5	**0**:7bit	**1**:8bit		**0**
28	RS232C output trigger selection	*5	**0**:RS232command (normal)	**1**:RS232Command (Cynchronizing)	**2**:HOLD trigger OUT	**0**
30	Analog output range		**0**:1999 to -1999	**1**:19990 to -19990	**2**:199900 to -199900	**0**
31	Origin detecting direction (only for EH-Z)	For2 axes	**0**:+count	**1**:-count		**0**
32	Origin re-detection (only for EH-Z)	*3	**0**:Disable	**1**:Enable		**0**
33	Origin initialization (only for EH-Z)		**0**:Disable	**1**:On initialization	On one-shot	**0**

*1 Clearing this parameter allows the unit to restore the unit conditions at shipment
*2 A type of gauge, like LGF-Z, which has the specific internal origin, will generate signals the moment when the spindle is moved and a reference point on it passes over the internal origin. Based on this mechanism the EH-Z will restore the preset position.
*3 Usually the origin point detection is performed only when the unit power is turned on. However, the unit operation will enter the wait state for origin re-detection at the rise of the HOLD signal where the origin re-detection function has been activated by the corresponding parameter. If the HOLD signal is inputted again after the origin is re-detected, the origin re-detection function will be canceled except during cancellation of any error.
*4 An ABS-type gauge continuously memorizes the origin even when the unit power is OFF. Make up this setting according to the type of gage to be used. Activate the INC mode when you want to make the displays on a gage like ID and SD and on the counter consistent.
*5 The operation is valid after the unit power is turned on.
*6 The EH-D may cause an error rarely when it is connected with a special type of gage. If this is the case, set PNo.19 to either 1 or 2.
*7 When a 7-inch gage is connected as to read 1/10,000 (only for EH-D).
*8 In relation to output of +000000, the [ ] shows the voltage of the numerical data line and ( ) shows the voltage of the sign.
*9 The setting range may be limited depending on the setting of PNo=10. Example) If PNo.10=0, a range of 0 to 4 is permitted for PNo.12.
*10 EH-D model can not perform speed measurement. Use EH-P/Z/S.
*11 During the peak mode the preset value is established based on the peak value.
*12 Modifying the parameter will clear preset values and tolerance values having been set.

6.4 How to Set CEL-specific Parameters

Set the LSD blank out and constant calculation individually for each CEL.

	Key operation	Corresponding display/output
1	With [P.SET]+ [A_ZERO] change to the parameter mode, and set as PNo.00=1.	
2	Press [P.SET].	
3		Similarly for other parameters set with [A_ZERO] and [P.SET].
4	Press [A_ZERO] while holding down [P.SET].	The counter enters the stand-by state.

CEL-specific parameters

No.	Parameter name					Initial value
40 *1	Individual CEL display selections [2-axis model] *2	CEL 1-4	**0**:UNIT A (Count of A) **3**:UNIT D (Speed of A)	**1**:UNIT B (Count of B) **4**:UNIT E Count of B)	**2**:UNIT C (calculation) **5**:UNIT F (Memory)	–
41	Calculation with a constant	CEL 1-4	**0**:None **3**:x10	**1**:x1/2 **4**:Optional setting *3	**2**:x2	**0**
42	LSD blank out	CEL 1-4	**0**:All-digit display	**1**:LSD blank out		**0**

*1 When PNo.6 = 5, 6 , or 7, you can assign an optional UNIT to each CEL. Modifying this parameter will clear preset values and tolerance values having been set.
*2 For EH-D the setting of PNo.40=3, 4 (speed) is invalid.
*3 For the method of setting constants, refer to Section 9.

6.5 Save and Load of Parameter File [2-axis models]

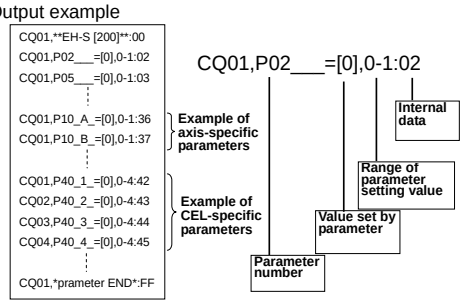
The parameter data you have set can be saved into or loaded from a text file through RS232C. In order to communicate with a PC, you must prepare appropriate communication software at the PC side. Use HyperTerminal (standard software supplied with Windows), etc.

1) Saving parameters [2-axis model]

	Key operation	Corresponding display/output
1	With [P.SET]+ [A_ZERO] change to the parameter mode and set as PNo.00=3, then press [P.SET].	A display like the following appears for one second while the data is outputted to the PC. 
2	After transmission	The counter enters the stand-by state.

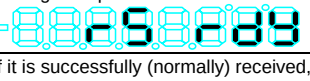
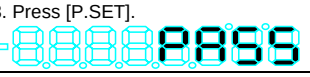
*Transmission conditions are fixed to 9600bps, 7-bit data, even parity, and 2 stop bits.
*Connect the counter to the PC one-to-one (LINK connection not permitted).

Output example



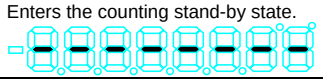
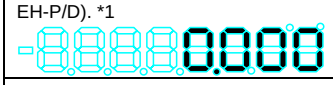
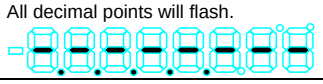
*Only the value set by the parameter can be modified within the range of parameter setting value.

2) Loading parameters [2-axis model]

	Key operation	Corresponding display/output
1	Set as PNo.00=4, then press [P.SET].	The display will look like the following while waiting for input. 
2	Send the parameter file from the PC.	If it is successfully (normally) received, the display will look like the following. 3. Press [P.SET]. 
3	Press [P.SET].	The counter enters the stand-by state.

7. Operation method

7.1 Turning the Power On

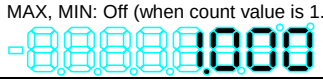
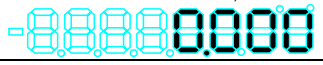
	Key operation	Corresponding display/output
1	Turn the power on.	Enters the counting stand-by state. 
2	Press [SEL].	The counter display is restored to (for EH-P/D). *1 
		Origin detection wait state (for EH-Z) All decimal points will flash. 
3	Push-in the spindle to make it pass over the origin.	The counter display is restored to (*2 only for EH-P/D).

Note

***1 For EH-D, pressing [SEL] can display the absolute position of the gage.**
***2 For origin detection, make the spindle surely pass over the origin. If the spindle shakes near the origin, the detection may not be sure.**

7.2 Zero Setting

Use the [A/B_ZERO] key to achieve zero-setting.

	Key operation	Corresponding display/output
1	Activate the normal measurement with the peak mode in advance.	MAX, MIN: Off (when count value is 1.000) 
2	[A_ZERO] or [B_ZERO] ([ZERO]/1-axis model)	This clears also the peak value, resulting that MAX = MIN = current value, and TIR = 0. 

* When an error occurs, press the [A/B_ZERO] or [SEL] key to cancel the error.

7.3 Switching to the Objective Display BANK [2-axis model]

The EH counter has incorporated two BANK counter sets, either of which can be used by switching to with the key or external signal.

	Key operation	Corresponding display/output
1	Press [MODE] while holding down [P.SET] to switch to the BANK for display.	The selected BANK will be identified by the BANK indicator. Contents of display

	BANK1	BANK2
A-ch (upper row)	CH1 (CEL1)	CH3 (CEL3)
B-ch (lower row)	CH2 (CEL2)	CH4 (CEL4)

7.4 Switching Objective Axis of Operation [2-axis model] and Canceling Error

For presetting, peak mode, or tolerance setting operation, specify A-ch (upper row) or B-ch (lower row) in advance with the SEL key. When an error occurs, positively cancel the error.

	Key operation	Corresponding display/output
1	Press the [SEL] key.	Display of the operated row will be flashing. Each time [SEL] is pressed, the flashing operation alternates between A-ch and B-ch.
		A: Upper row display  CH number (CEL number) Unit number
		B: Lower row display  CH number (CEL number) Unit number

* In the above example, UNITA (counting of A) and UNITB (counting of B) are assigned to A:Upper row display and B:Lower row display respectively. CH01 and CH02 are the gage channel numbers for RS232C.
* When the calculation with constant has been set, the LED display for the least significant digit will be "=" as with B-ch.

Note

While any error on EH-D is being canceled, all decimal points will be flashing for approximately 8 seconds.

7.5 Setting Peak Mode Selections

Select the objective value of display in this mode from among Maximum value (MAX), Minimum value (MIN), and [MAX - MIN] (TIR).

	Key operation		Corresponding display/output
1	Select either A-ch or B-ch with [SEL]. [2-axis model]		
2	Switch the display value for the peak mode.	MAX ○ TIR ○ MIN ○	Current value: Current position of contact point
		MAX ● TIR ○ MIN ○	MAX : Maximum value after clearing peak value
		MAX ○ TIR ○ MIN ●	MIN : Minimum value after clearing peak value
		MAX ● TIR ● MIN ●	TIR : MAX − MIN

7.6 Clearing Peak Value

In the peak mode the user can clear the current peak value.

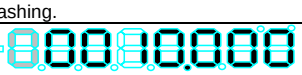
	Key operation	Corresponding display/output
1	Select either A-ch or B-ch with [SEL]. (2-axis model)	
2	Select either MAX, MIN, or TIR display with [MODE].	The peak indicator will turn on.
3	Clear the peak value with [A_ZERO] or [B_ZERO].	MAX=MIN=Current value TIR=0

* If the same UNIT is assigned to more than 1 CEL, it is possible to clear the peak value of all the same UNIT by clearing the peak value of one of them.

7.7 Presetting

Set the origin to an optional value. This is possible by means of external PA/PB signal.

1) Setting the Preset Value

	Key operation	Corresponding display/output
1	Select either A-ch or B-ch with [SEL] (2-axis model).	While [SEL] is being held down, the currently selected axis will be flashing.
2	Use [P.SET] to enter the setting mode.	The previous preset value will be displayed. (where the previous value is 10.000)  L1 of the LMIT indicator and decimal point are flashing.
3	Method of Entering Setting Values Move to the digit to enter the value with [MODE]. Use [A/B_ZERO] to enter the setting value.	 For only the most significant digit set the polarity sign. The MSD will change as follows : 0>9>-0>-9>0.
4	Use [P.SET] to exit the setting mode.	After the setting is completed, the counter display will be restored to.

* Cancel, if necessary, the entered value by [SEL] and return to the counter display.

7.8 Setting Tolerance Values

1) Setting 3-step tolerance limits (3-step tolerance zone selection)

With the tolerance limits being set as S1 and S4 below, the 3-step tolerance judgment will take effect as follows (S2 and S3 are not used).

	GO/NG indicator	I/O output
Measured value < S1	Amber indicator turns on.	L1
S1 ≤ Measured value ≤ S4	Green indicator turns on.	L3
S4 < Measured value	Red indicator turns on.	L5

	Key operation	Corresponding display/output
1	Select A: Upper row or B: Lower row by [SEL].	The upper or lower row display will be flashing (2-axis model).
2	Use [LMIT] to display the item to be set.	S1: Amber indicator turns on. S2: Red indicator turns on.
3	Set the value.	Use the [MODE] + [A/B_ZERO] key to set the numeric value.
4	Accept with [LMIT].	Set S1 and S4 in this order.

* An error will occur except the setting of S1 ≤ S4. If an error occurs, press [SEL] to redo from S1.

2) Setting 5-step tolerance limits (5-step tolerance zone selection)

User can select one of the 5-step tolerance zones by means of switching the parameter.
With the tolerance limits being set as S1 to S4 below, the 5-step tolerance judgment will take effect as shown in the table below.

	GO/NG indicator	I/O output
Measured value < S1	Amber indicator turns on.	L1
S1 ≤ Measured value < S2	Amber indicator flashes.	L2
S2 ≤ Measured value ≤ S3	Amber indicator turns on.	L3
S3 < Measured value ≤ S4	Red indicator flashes.	L4
S4 < Measured value	Red indicator turns on.	L5

	Key operation	Corresponding display/output
1	Select A: Upper row or B: Lower row by [SEL].	The upper or lower row display will be flashing.
2	Use [LMIT] to display the item to be set.	S1: Amber indicator turns on. S2: Amber indicator flashes. S3: Red indicator flashes. S4: Red indicator turns on
3	Set the numeric value.	Use the [MODE] + [A/B_ZERO] key to set the numeric value.
4	Accept with [LMIT].	Set S1, S2, S3, and S4 in this order.

*Similarly for 3-step tolerance limits, set in the order of S1, S2, S3, and S4.
An error will occur except the setting of S1<S2<S3<S4 or S1=S2=S3=S4.

8. Measurement Mode Functions [2-axis model]

The following describes measurement examples using diverse range of measurement functions provided in the EH counter.

8.1 2-Coordinate Display

This is to display two coordinates with a set of two counters called BANK1 and BANK2.
It is possible to set origin and tolerance limit for each BANK.

Parameter setting	PNo.6=0			
	BANK1		BANK2	
A: Upper row display	CH1	UNIT_A (A-axis counting)	CH3	UNIT_A (A-axis counting)
B: Lower row display	CH2	UNIT_B (B-axis counting)	CH4	UNIT_B (B-axis counting)
Operation	Press [MODE] while holding down [P.SET] to switch to the BANK for display.			

8.2 Differential/Sum Calculation Display

Displays A ± B calculation for thickness/step measurement.

Parameter setting	PNo.6=1 PNo.14= 0:A+B 1:A-B			
	BANK1		BANK2	
A: Upper row display	CH1	UNIT_C (A±B)	CH3	UNIT_C (A±B)
B: Lower row display	CH2	UNIT_A (A-axis counting)	CH4	UNIT_B (B-axis counting)

*For A and B use the gages providing an identical resolution.

8.3 Simultaneous Display of Current Value and Peak Value

Displays the current value and peak value of one gage at a time.
Possible to switch over INPUTA and INPUTB by means of switching BANK.

Parameter setting	PNo.6=2			
	BANK1		BANK2	
A: Upper row display	CH1	UNIT_A (A-axis counting)	CH3	UNIT_B (B-axis counting)
B: Lower row display	CH2	UNIT_A (A-axis counting)	CH4	UNIT_B (B-axis counting)

*Perform origin point setting independently for A: Upper row display and B: Lower row display

8.4 Simplified Speed Display (only for EH-P/Z/S)

Gives a simplified display of moving speed of the gage spindle.
In addition to the current speed, it is possible to display the maximum speed as MAX in the peak mode.

Parameter setting	PNo.6=4 PNo.18 (sampling interval) 0:10ms/1:50ms/2:100ms			
	BANK1		BANK2	
A: Upper row display	CH1	UNIT_A (A-axis counting)	CH3	UNIT_B (B-axis counting)
B: Lower row display	CH2	UNIT_D (A-axis speed)	CH4	UNIT_E (B-axis speed)

*In mm/sec display, display of the lower 1 to 3 digits might be fixed depends on the sampling time.
*Peak MIN gives the maximum speed in the reverse direction.
*This is not suitable for feedback control.

8.5 Memorizing Display Value [2-axis model]

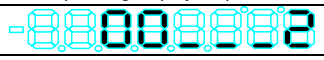
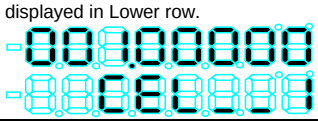
A: Upper display value can be memorized in B: Lower row. It is possible to recall the maximum and minimum values of the past data in addition to the latest data that has been saved in the memory. Contents of the memory remain valid even when the power is turned OFF.

Parameter setting	PNo.6=3			
	BANK1		BANK2	
A: Upper row display	CH1	UNIT_A (A-axis counting)	CH3	UNIT_B (B-axis counting)
B: Lower row display	CH2	UNIT_F (memory)	CH4	UNIT_F (memory)
Memory save	Memorizes with [B_ZERO].			
Recall of maximum/minimum	Recall of maximum/minimum value of the data memorized during the operation of peak mode setting.			
Memory clear	Specify B: Lower row with [SEL] and press [P.SET]. Value stored in memory(NOM, MAX, MIN)=A: Upper display value			

* The memory unit is common to both BANK1 and BANK2. For these BANKs, use the gages that have an identical resolution.
* Possible to externally control with B_HOLD signals.

9. How to Set Optional Constant Values

Use any constant you have set with parameter No.41 = 4.

	Key operation	Corresponding display/output
1	Parameter PNo.00="2"	
2	Press [P.SET].	The previously set value will be displayed in Upper row, and the CEL number will be displayed in Lower row. 
3	Set the numeric value with the[MODE][A/B_ZERO]key in the same way as for presetting.	 Range of setting values ±9.99999
4	Press [A_ZERO] while holding down [P.SET].	The next CEL setting value will be displayed. The counter display will be restored when the setting is completed up to CEL4.

Note

- During use of this function the accuracy certificate is invalid.

10. RS232C/USB/Digimatic Output Function

Use the corresponding parameter to select one from the RS232C/USB/Digimatic output.

10.1 RS_232C Communication Function

1) List of commands

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

*1 [**] denotes a gage channel number between 01 and 99("00" means all channels).Channels 01 thru Channel 04 are assigned to CEL1 to CEL4, respectively.
[#] denotes the type of data［N : Current value, X : Maximum value, M : Minimum value, W : TIR］.CRLF means CR（carriage return）plus LF（line feed). Output during error will be "CH**,Error$$CRLF"（$$ is the error code. Refer to "12. Error Displays").
*2 For presetting and tolerance limit setting, enter each value consisting of a sign and 8 digits of numeric value without a decimal point.

*3 Perform the tolerance limit setting in the order of CD and CG for the case of 3-step tolerance judgment, and in the order of CD, CE, CF, and CG for the case of 5-step tolerance judgment. When the order of tolerance limits is different from the correct order, or if the data according to the set number of steps is different from those which are actually sent out, an error will be outputted. If this is the case, redo the settings from the beginning of the CD command.

*4 A response output of CK command ("%") shows the HOLD status.
%=0 : Normal state, 1 : HOLD status
All counters which are LINK-connected by the CK command at the time of PNo28=1 (CH synchronization) enter the HOLD state. This HOLD state will be canceled when you attempt data read with the GA command. The CK command is valid only with CH1.

*5 If the peak mode is switched using an RS-232C command, peak values cannot be backed up in memory.

Note 1. After you have received a response output corresponding to the previous command, send the next command. When there is no response from your command, **clear the communication buffer, then send the command again after one second or more.**

Note 2. The RS communication function will be suspended during key operation (e.g. setting parameters, preset values, or tolerance limits). It automatically resumes the command and data output operation when the gage is recovered to such a condition that the counting is possible.

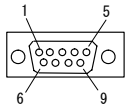
Note 3. For canceling the counting-standby state, use **CS00CRLF(specification of all channels)**.

2) Connectors and cables

- Receptacle specification : D-sub 9-pin (male), inch screw specification
- Applicable plug specification : D-sub 9-pin (female), inch screw specification
- Example of commercial cable :

For DOS/V : KRS-403XF1K (1.5m), manufactured by SANWA SUPPLY.

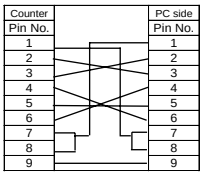
3) Pin assignment / Communication specifications (conforming to EIA RS232C)



Pin No.	Signal name	Input/ output	Description
2	RXD	IN	Received data
3	TXD	OUT	Sent data
4	DTR	OUT	Data Terminal Ready
5	GND	—	Ground (GND)
6	DSR	IN	Data Set Ready
7	RTS	OUT	Transmission request
8	CTS	IN	Clear to Send
1, 9-15	NC	—	Connection impossible

Home position	DTE (Data Terminal Equipment). Use a cross-type cable.
Communication method	Half-duplex, non-procedural mode
Data transfer rate	4800, 9600, 19200 bps
Bit configuration	Start bit: 1 Data bits: (7,8) ASCII, upper-case characters Number of parity bits: None, even, odd Number of stop bits: 2
Communication conditions setting	Use the parameters. Refer to "6. Setting Parameters".

4) Example of cable connection (D-sub 9-pin cross-type cable specification)

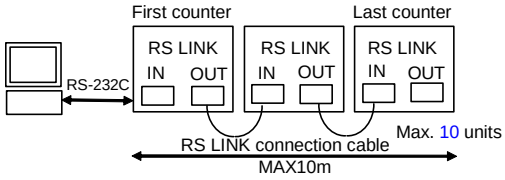


10.2 RS_LINK Function

Chain-linking more than 2 counter units as one connected to another with a single cable makes it possible to control maximum 10 counter units by the RS-232C interface of the first counter.

1) Connection method

Connect between IN and OUT of the RS-LINK connectors as shown below :



Note 1. Do not connect anything at the IN side of the LINK connector of the first counter and at the OUT side of the last counter.

Note 2. Channel number of each gage will be automatically assigned to 01, 02, and 03 in this order from the first counter during the initial setting after the power is tuned on.

Note 3. The maximum total cable length permitted for the entire system is 10m.

Note 4. Configuring such a system that more than ten counter units are included and/or the total cable length is longer than 10m, consult Mitutoyo.

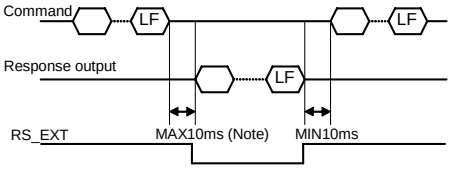
2) RS_LINK connection cable

Refer to the appropriate paragraph in "17. Optional Accessories".

3) Precautions for start-up

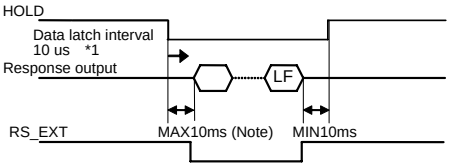
- Power ON : Either turn on the power of all counter units simultaneously or turn on the power of each counter unit sequentially beginning with the first one.
- Initial setting : After power on, "- - - - -" will be flashing. After the initial setting is completed, the counter unit enters the counting stand-by state where "- - - - -" is displayed. It is possible to cancel any error using the CLR key, external HOLD signal, or RS command (Refer to "12 Error Displays").
- RS-232C related parameters (Nos. 25 through 28) can only be modified on the first counter unit. When any parameter has been modified, reset the power of all counter units being connected.

4) RS command input and response output (Command: PNo.28=0 or 1)



＊While any key is being operated, the RS output will be suspended.

5) HOLD input and RS232C response output (HOLD trigger: PNo.28=2)



*1: For use of EH-P/R/S. Values for EH-D depend on the gage being used.

* While the response output is triggered by a HOLD signal, the RS232C command is disabled.
* In the RS-LINK connection mode, RS_EXT of the last counter unit is active.

6) RS232C data output duration

The maximum output duration with the Output_All_Data command (GA00CRLF) can be calculated from the following equation:
Maximum output duration [ms]
= Number of connected units x 5 + Number of connection channels x 17 (8.5) + 6 (3)
＊Transmission rate is 9600bps. The value enclosed in the parentheses shows the case of 19200bps. [Unit: ms]
(Calculation example)
One unit of EH-102 + 1 channel of gage = MAX 28 (16.5) ms
Ten units of EH-102 + 20 channels of gage = MAX 351 (178) ms
Note. Not including the processing time by the PC.

7) Communication test

Use Hyper Terminal (standard software supplied for Windows), etc., to send the RS232C command from the Keyboard to the target counter and check the specified operation.

10.3 USB Communication Function

Optional accessory: PC data input SW
This is available when connecting with SENSERPAK

Parameter setting	P24=1
Connection	Connect between the PC and any commercial USB with a cable.
Operation	Refer to the SENSERPAK Operation Manual.

10.4 Printer Output Function

You can use a DP-1VR Digimatic Mini-Processor to print-out the measurement data.

Parameter setting	P24=2
Connection	Plug the Digimatic cable in the RS LINK OUT connector for connecting with the DP1 Printer, and then reset the unit power.
Operation	When the DATA switch of the printer is pressed, the display value (for both A-ch and B-ch) will be printed out on the printer.

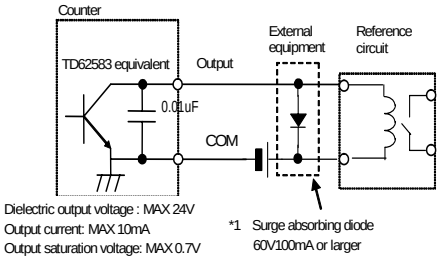
Note

An error occurs, an asterisk (*) will be automatically printed.
When the numeric value of more than 6 digits is being displayed, only the lower 6 digits is displayed.
Set the DP-1VR to the compatible mode.

11. I/O Connector Terminal Function

11.1 Output Circuit

Operation: Transistor is "ON" for output when the line is "L" (This is called an open-collector output).

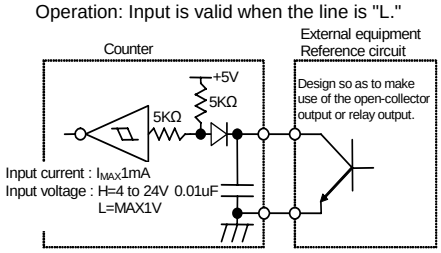


Note

***1 For using relays, always use a surge current absorbing diode or a relay which has a built-in surge current absorbing circuit in terms of protecting the output circuit.**

11.2 Input Circuit

Operation: Input is valid when the line is "L."



11.3 Pin Assignment

* External input uses negative true logic as "L" corresponding to "Valid."

Applicable plug:
Plug:10136-3000VE(3M)
Cover:10336-52A0-008(3M)
Plug: DX40M-36P(HIROSE)
Cover: DX30M-36-CV (HIROSE)

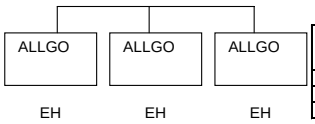
The pin functions vary depending on whether the tolerance judgment mode or the BCD output mode is active.

		Tolerance judgment output mode		BCD output mode	
PIN	I/O	Description	Function	Description	Function
1, 2		COM	Internally connected to GND.	COM	Internally connected to GND.
3	O	AL1	[A] Upper row tolerance output-relevant output terminal="L" When any error is displayed, AL1=L5="L".	A_bit0	[A] Upper row 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 result output "H"=OK "L"=NG	REDY	"L"=data is valid.
9	O	RS_EXT	RS output in process ="L"		
10	O	NOMAL	Normal output "L"=Normal output, "H"=abnormal output		
11	O	BL1	[B] Lower row tolerance output-relevant output terminal="L" When any error is displayed, L1=L5="L". [2-axis model]	B_bit0	[B] Lower row data [2-axis model]
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	A-ch analog output		
23	O	B_ANG	B-ch analog output [2-axis model]		
24		AGND	Analog GND		
25	I	SET1	Enter the setting value with SET in advance, and determine it with MODE and DISP.		
26	I	SET2			
27	I	SET3			
28	I	DISP	Specifies the BANK to be displayed: Combined operation with SET		
29	I	MODE	Switching of peak value: Combined operation with SET		
30	I	BCDCK	Specifies the BCD output: Combined operation with SET		
31	I	EXTTRG	USB trigger		
32	I	A_HOLD	[A] ch HOLD (Upper row display HOLD) *1		
33	I	B_HOLD	[B] ch HOLD (Lower row display HOLD) *1 [2-axis model]		
34	I	HOLD	HOLD/Error canceling error input *2		
35	I	PA	[A] Upper row preset/Peak clear (in the peak HOLD mode)		
36	I	PB	[B] Lower row preset/Peak clear (in the peak HOLD mode) [2-axis model]		

*1 During input the decimal point will be flashing.
*2 During input the UNIT indicator will be flashing.

11.4 Total Tolerance Result Output

The tolerance judgment results of all CELs will be ANDed for output. With two ALLGO terminals connected mutually as shown in the figure below it is possible to perform total tolerance judgment over multiple counters.



	TOTAL GO/NG indicator	External output ALL GO
Entire counters OK	Green	H
Entire or part NG	Amber	L
Error	Red	L

* In the USB output mode (PNo.24=1), TOTAL GO/NG=NG will always result unless the total tolerance judgment is not handled by SENSORPAK.
* In the BCD mode, the indicator also indicates Green for OK and Red for Error.

11.5 BCD Output Function

Simultaneously outputs both [A]-ch and [B]-ch in 4-bit units.

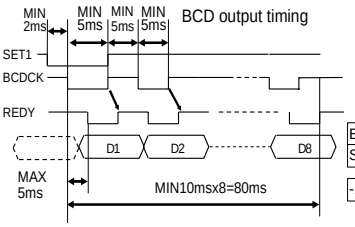
LSD(lower 4 digits) MSD (upper 4 digits)

	D1	D2	D3	D4	----	D8
A/B_bit0	$1x10^0$	$1x10^1$			----	$1x10^7$
A/B_bit1	$2x10^0$	$2x10^1$			----	$2x10^7$
A/B_bit2	$4x10^0$	$4x10^1$			----	$4x10^7$
A/B_bit3	$8x10^0$	$8x10^1$			----	$8x10^7$
A/BSIGN	Sign	BANK	PEAK1	PEAK2	Not used	Not used

+:H
-:L

BANK1:L
BANK2:H

	PEAK1	PEAK2
NOM	L	L
MAX	H	L
MIN	L	H
TIR	H	H



Data output example

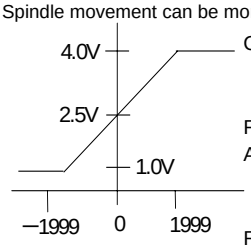
	D1	D2	D3	D4	D5	D6	D7	D8
Bit0-3	1	0	6	5	4	3	2	1
SIGN	L							

-1 2 3 4 5 6 0 1

* It is possible to invert the SIGN/BANK/PEAK/DATA output logic (PNo.21=1).

11.6 Analog Output

Spindle movement can be monitored with a pen recorder or oscilloscope, etc.



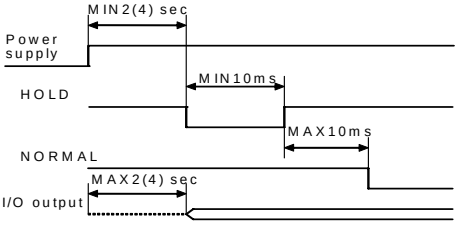
Output voltage = 2.5V + count value x voltage resolution (0.75mV)
*Full scale: 1.0 to 4.0V
Response speed: 10 Hz (update interval: 5ms)
Accuracy : ±1% (1.0 to 4.0V)
*This accuracy will be guaranteed for full scale of 4V.
Resistance load : 300 KΩ or more

Measurement range can be selected using an appropriate parameter .

Parameter No30	Measurement range [mm] (Range resolution [mm])		
	10um gage	1 um gage	0.1 um gage
0	±19.99 (0.01)	±1.999 (0.001)	±0.1999 (0.0001)
1	±199.90 (0.1)	±19.990 (0.01)	±1.9990 (0.001)
2	±1999.00 (1)	±199.900 (0.1)	±19.9900 (0.01)

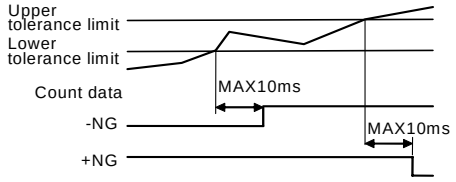
11.7 Timing Chart

1) Power ON characteristics



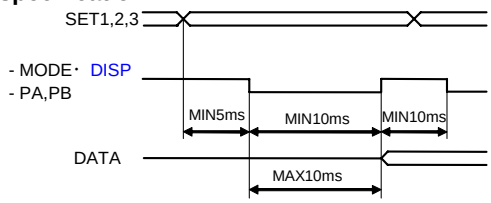
* ( ) shows the data for EH-D.

2) Tolerance limit output



*Data from EH-D depends on the gage being used.

3) External presetting, Peak clear, Peak mode, BANK specification



DISP: Switching of BANK to be displayed

	SET3	SET2	SET1
BANK1	H	H	H
BANK2	H	H	L

PA/PB: Presetting, Peak clear

	SET2	SET2	SET1
Preset *2	H	H	H
Peak clear	H	H	L

MODE: Peak switching mode

	SET3	SET2	SET1
NOMAL	*1	H	H
MAX	*1	H	L
MIN	*1	L	H
TIR	*1	L	L

*1 H:ChA L:ChB

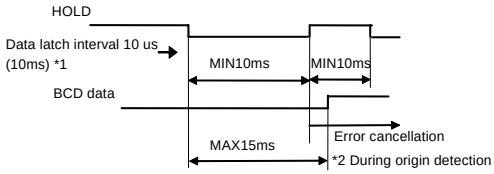
A/B_HOLD: Memory setting clear

	SET3	SET2	SET1
Memory setting	H	H	H
Memory clear	H	H	L

The relevant CH is UNITF (valid with the memory unit).

*2: In the peak mode, the PA/PB input while HOLD input is active will effect as peak clear.

4) HOLD/Error reset



*1: For use of EH-P/Z/S. Values for EH-D depend on the gage being used. ( ) shows the value during axis-specific HOLD.
*2: (Only for EH-Z) Origin re-input (PNo.42=1)
UNIT indicator is flashing while HOLD is active.
*3: In the peak mode, the PA/PB input while HOLD input is active will effect as peak clear.

12. Error Displays

NOM signal	Tolerance	BCD	Upper: Display Lower: Total tolerance Indicator	RS 232 output (*2)	Cause of error	Canceling method (*1)	Remedies
H	L1=L L5=L	FFFF10	Error10 Red On	Error_10	Abnormal power supply voltage	Automatic cancellation	Connect the equipment with the specified supply voltage.
H	L1=H L5=H	FFFFFF	[- - - -] Flashing Red On	No	Initial setting condition of RS link	Automatic cancellation Automatic cancellation or power resetting	Check the RS LINK cable for proper connection.
H	L1=L L5=L	FFFF15	[- - - -] Red On	Error _15	- Counting stand-by state at power on - Power interruption	[SEL] key CS00(RS) HOLD input (I/O)	When power interruption occurs, check the power supply.
H	L1=L L5=L	FFFF20	Error20 Red On	Error _20	Over-speed	[SEL] key CS00(RS) HOLD input (I/O)	Check the measurement conditions.
H	L1=L L5=L	FFFF30	Error30 Red On	Error _30	Counting value is more than 8 digits	[SEL] key CS00(RS) HOLD input (I/O)	Modify the preset values.
H	L1=L L5=L	FFFF40	Error40 Red On	Error _40	Gage malfunction (*3)	[SEL] key CS00(RS) HOLD input (I/O)	Check the gage connection.
L	Counting condition	Counting condition	Counter Off	Error _50	Abnormal RS communication setting	Automatic cancellation	Re-set the RS communication conditions.
L	Counting condition	Counting condition	Counter Off	Error _52	Abnormal RS command	Automatic cancellation	Check the RS command for validity.
H	L1=L L5=L	FFFF55	Error55 Red On	No	RS LINK malfunction	Resetting of power	Check the unit connections and supply power, etc.
H	L1=L L5=L	FFFF70	Error70 Red on	Error_70	Wrong resolution of the calculation axis	Automatic cancellation	Check the measurement condition
H	L1=L L5=L	FFFF80	Error80 Red On	Error_80	Peak detection error	[SEL]key CS00(RS) HOLD input (I/O)	Check the measurement conditions.
L	Counting condition	Counting condition	Error90(*4) Off	Error_90 (*5)	Tolerance setting error	[SEL] key	Re-enter the tolerance limits.
L	Counting condition	Counting condition	Error95(*4) Off	Normal output	Protection over keys	Automatic cancellation	Cancel the parameter for protection over keys.

*1 (RS):RS232C command, (I/O): External HOLD signal input
*2: The error output format will be CH**,Error$$CRLF.
*3: The error occurs if the CH is not connected to the gage.
*4: Displayed if a tolerance setup error occurs due to a key operation.
*5: Output if a tolerance setup error occurs due to an RS command.

Note

- If an error occurs during the setting operation of parameters, preset values and tolerance limits, the counter will output the corresponding error code after resuming the counting condition. However, the corresponding error code will be immediately forwarded to external output.

13. Backup Memory Function

The counter saves the following data even after the power is turned off.

Parameters, preset value, tolerance limits, UNIT_F memory value	Always saved.
Peak mode, BANK number	Saved only when set using keys.
Count value (excluding peak values)	Saved only by the EH-D (ABS mode) and EH-Z (origin mode).

14. Troubleshooting

When the unit operation looks odd, refer to the following examples:

- Counter value is odd (looks like not counting).
  - Have you set correct parameters corresponding to the gage type?
  - Isn't the Peak mode (MAX or MIN) active?
  - Isn't the HOLD signal (shown by flashing of UNIT) being inputted?
  - Haven't you set the function of calculation with constant?

- Impossible to perform zero-setting.
  - Isn't the Peak mode active?

- Can not achieve RS232C communication.
  - Is the cable connection correct?
  - Is the unit in the RS232C mode (PNo.24=0)?
  - What is the command or HOLD trigger (PNo.28) setting?
  - Check the settings of communication conditions.

15. Specifications

Code No.	542-075	542-071	542-073	542-074	542-072
Code	EH-101P	EH-102P	EH-102Z	EH-102S	EH-102D
Number of display axes	1 axis	2 axes			
Display	Sign + 8 digits (green LED)				
Minimum reading	0.01/0.005/0.001/0.0005/0.0001 mm .0005"/.00005"/.00005"/.000005"/.000005" (selection by the parameter)			0.01/0.001μm .0000005"/ .00000005"/	Automatic setting according to the gage being used
Maximum input frequency	2.5MHz(2-phase square wave)			1 MHz (SIN wave)	
Power supply/dissipation	From the supplied AC adapter or DC power supply of +12 to +24V (Max. 700mA) Max. 8.4W Have the commercial power supply unit, if used, secure more than 1A of power supply for each unit.				
Operation temperature/Storage temperature range	0 to 40˚C (20 to 80% RH without condensation) /-10 to 50˚C (20 to 80% RH without condensation)				
External dimensions (W×D×H)	144(W)×72(H)×156(D)mm				
Mass (g)	Approx.760	Approx.800	Approx.800	Approx.900	Approx.800

16. Standard Accessories

Part No.	Description	Q'ty
—	Washer (plain washer of nominal ϕ4)	6
99MBC109J	Operation Manual (this document)	1
02ADN460	AC adapter *1	1
	AC cord *1	1
302ADN471	Stand	1
A621-014	Rubber feet	4
C162-412	DC plug	1
	Certificate	1

*1:Not supplied with the 542-07x-1.

17. Optional Accessories (to be separately purchased)

Part No.	Description
02ADB440	I/O output connector (with cover)
02ADD950	RS LINK connection cable (0.5m)
936937	RS LINK connection cable (1m)
965014	RS LINK connection cable (2m)
02ADM270	SENSORPAK /E(with PC data input S/W and RS232 cable)

Mitutoyo