

# Speed ratio meter

Error ratio/ Simple ratio/ Composition ratio/ Passing speed/ Time lag

Standard input series      Differential input series  
**4961XA-RMT / 4961FA-DRT**

## Instruction Manual



Thank you for purchasing TSURUGA's Speed ratio meter. For instructions on how to use this product properly and optimally for a long period of time, please be sure to read this manual thoroughly before use.

When you purchase the product with optional equipment:  
Please refer to the operation manual of the optional equipment.

Before operation, maintenance and inspection, please carefully read this instruction manual and follow it for proper use.

After reading, be sure to store this manual in a safe, convenient place where operators can always refer to it easily.

# Safety Requirements

Be sure to observe

Before operation, maintenance and inspection, please carefully read this instruction manual and follow it for proper use. Please carefully read all information related to this unit and safety, and precautions before use.

This instruction manual categorizes safety precautions as "DANGER", "WARNING", and "CAUTION". Each of them is an important description related to safety. Be sure to observe.



**DANGER**

Improper use by neglecting the following precautions may result in the potential for fire, serious injuries, and/or death.



**WARNING**

Improper use may result in serious injuries.



**CAUTION**

Improper use may result in minor injuries or property damage.

### •Limited Warranty

- We are not responsible for damages resulting from negligence through failure to follow the instructions set out in this manual.
- We are not responsible for damages resulting from earthquake and/or fire unrelated to us, actions by third parties, or any other accidents, intentional or through customer negligence, as well as from accidents caused by misuse or improper use under abnormal conditions.
- For information regarding assurance provisions, please read the attached warranty certificate.

### ⚠ CAUTION



#### Electric Shock.

**Be sure to turn the power OFF when wiring as well as inspecting the unit.**

Failure to do so could result in electric shock.



#### DO NOT block the ventilation holes on the side of the main unit.

**DO NOT put any foreign objects or materials inside the unit through these holes.**

Failure to follow this could result in abnormal heat generation and/or malfunctions.



#### DO NOT touch the unit with wet (or sweaty) hands when inspecting or for wiring.

Failure to do this could result in electric shock.

### ⚠ Precautions before use

#### Power

- Be sure to use the unit under the specified voltage (AC power specifications: 85 - 264VAC / DC power specifications: 10.8 - 25.2VDC).
- Inverter power source cannot be used.

#### Input signal wire

- Connection wiring from sensors shall not be kept in the same or parallel conduit or cable as the power source, power or high voltage cables. If you fail to separate the wiring, noise may be superimposed on the signal wire, resulting in malfunctions.
- Use shielded wire for input power connections with the shortest possible metal conduit.

#### Terminal

- Check that the screws have not come loose due to vibrations after a certain period of time.

#### Operating environment

- Do not install the unit in the following places or conditions.
  - Places exposed to direct sunlight, or places where the ambient temperature exceeds a range of 0 - 45°C.
  - Places where the relative humidity percentage exceeds a range of 35 - 85%, or places subject to condensation due to rapid change in humidity.
  - Places subject to corrosive and/or combustible gases.
  - Places subject to a large amount of dust, salinity, and/or ferric substance.
  - Places susceptible to noise (including static electricity).

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## Installation to the Start of Operation

This unit is designed for use according to your measurement purposes.  
Before use, follow the procedures below from installation to the start of operation.

### Check before use

Check before use p.3 - 5

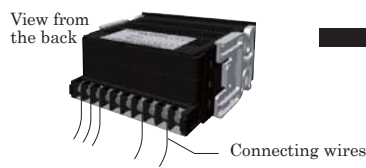
- Unit model
- Specifications
- Component part names and functions
- External dimensions

Installation to the panel p.5



- (1) Installation of waterproof gasket
- (2) Fixation to the panel

Connection with the power and sensor p.6 - 7



- (1) Connection with the power
- (2) Connection with various sensors

Memory function settings p.9 - 11

- (1) Press the **[MEM]** key once to display the MAX value.
- (2) Press the **[MEM]** key again to display the MIN value.
- (3) Press the **[MEM]** key again to show A-input value. (excluding mode 16)
- (4) Press the **[MEM]** key again to show B-input value. (excluding mode 16)
- (5) Press the **[MEM]** key once again to display the normal measurement value.

\*You can use the unit without setting various functions.

Function (action configuration) settings p.3 - 35

- (1) Press and hold the **[SHIFT]** + **[FUNC]** keys for 5 seconds or more and start setting.
- (2) Press the **[▲]** key to select the item, and press the **[ENT]** key to start changing the setting value.
- (3) Press the **[▶]** key to move to another digit, and after changing the value using the **[▲]** key, use the **[ENT]** key to finish the setting value change.
- (4) After setting all functions, use the **[SET]** key to finish setting.

Parameter settings p.12 - 29

- (1) Press and hold the **[SHIFT]** + **[PAR]** keys for 5 seconds or more and start setting.
- (2) Press the **[▲]** key to select the item, and press the **[ENT]** key to start changing the setting value.
- (3) Press the **[▶]** key to move to another digit, and after changing the value using the **[▲]** key, use the **[ENT]** key to finish the setting value change.
- (3) After setting all parameters, use the **[SET]** key to finish setting.

Mode (function) settings p.12 - 27

- (1) Press the **[SHIFT]** + **[MOD]** keys and start setting.
- (2) Use the **[▲]** key to set, and use the **[SET]** key to finish setting.

Start of operation

Teaching function settings P15 - 16, P23 - 24

- Parameter settings are not necessary. (excluding mode 16)

Simple setting

## Unit Model

Please check the model number of the equipment purchased.

4961X A - RMT  
4961F A - DRT

Optional equipment for output

Symbol	Output	Function
FVC	Analog Signal Output	Outputs voltage and current that correspond to displayed value
BCD	BCS Output	Open Collector, BCD Output Simple interface with the sequencer

Ratio meter optional equipment

Symbol	Function
RMT	Standard input : Supports the sensor input, including rotary encoders, and magnetic sensors
DRT	Differential input Supports the line driver output, including AC servo motors

Power

Symbol	Power
A	AC power (85 - 264VAC)

Input type

Symbol	Input type
4961X	Standard input : Supports the sensor input, including rotary encoders, and magnetic sensors
4961F	Differential input Supports the line driver output, including AC servo motors

# 1. Specifications

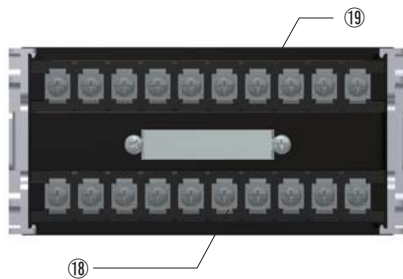
Unit model		4961XA-RMT、4961FA-DRT					
Display	Action mode	Error ratio	Simple ratio	Composition ratio	Revolution count difference	Passing speed	Time lag
	Display 1	-99999 ~ 99999 ±5 digits	0 ~ 99999 5 digits		-99999 ~ 99999 ±5 digits	0 ~ 99999 5 digits	0:00:00 ~ 0:59:59 (Hour:Minute:Second / base 60 display)
	Display 2						0:00 ~ 999:99 (Hour:Minute:Second / base 10 display)
With zero suppression function							
Decimal point position	0 to 4 digits after the decimal point(00000 ~ 0.0000)						-
Number indicator	Red 7 segment LED, Letter height 22mm, 6 digits, - display available						
Input range	0.0067Hz ~ 100kHz			10msec ~ 3600s			
Measurement accuracy	±0.1%						
Filter	Switches between 100kHz, 30kHz, 10kHz, and 20Hz using the parameter. Note that you can switch between only 10kHz and 20Hz in a magnetic sensor, and its contact is only 20Hz.						
Display cycle	0.2, 0.5, 1, 2, 5, 10, 15, 30, 60 sec. (changeable in the parameter settings) For transistor output and for BCD output, data is refreshed at the cycle time set here. For voltage output, data is refreshed every 10ms.						
Pre-scale function	Parameter setting system using the front panel keys. The teaching (combination) of display values are also available.						
Memory function	The maximum/minimum measurement values can be memorized and displayed in the indicator.						
Hi/Lo limit judgement	Hi/Lo limit judgement can be shown at main display						
Auto zero time	0.1 ~ 150 sec.			0.1 ~ 3600 sec.			
Pre-arithmetic function	Updates the displayed value according to the elapsed time after the pulse stops.						
Operating temperature	0 ~ 45°C(No condensation)						
Teaching function	Performs scaling automatically by setting the display value with a certain signal input. (only in the tachometer and flowmeter modes)						
Insulation resistance	10MΩ or more (at DC500V Mega)						
Voltage proof	AC1500V or more 1min						
Operating humidity	35 ~ 85%RH (No condensation)						
Operating atmosphere	No corrosive gas						
Protection function	Front panel: IP66 (or equivalent), Rear terminal block: IP20						
Casing material	ABS resin						
External dimensions	W96 × H48 × D92mm (DIN)						
Weight	approx. 250g / approx.300g including FVC or BCD option						

# 2. Component Part Names and Functions

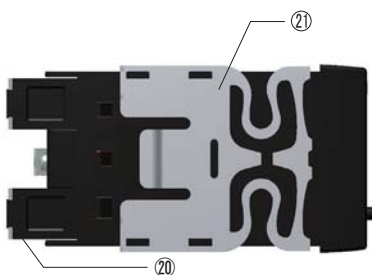
•Front



•Rear



•Side

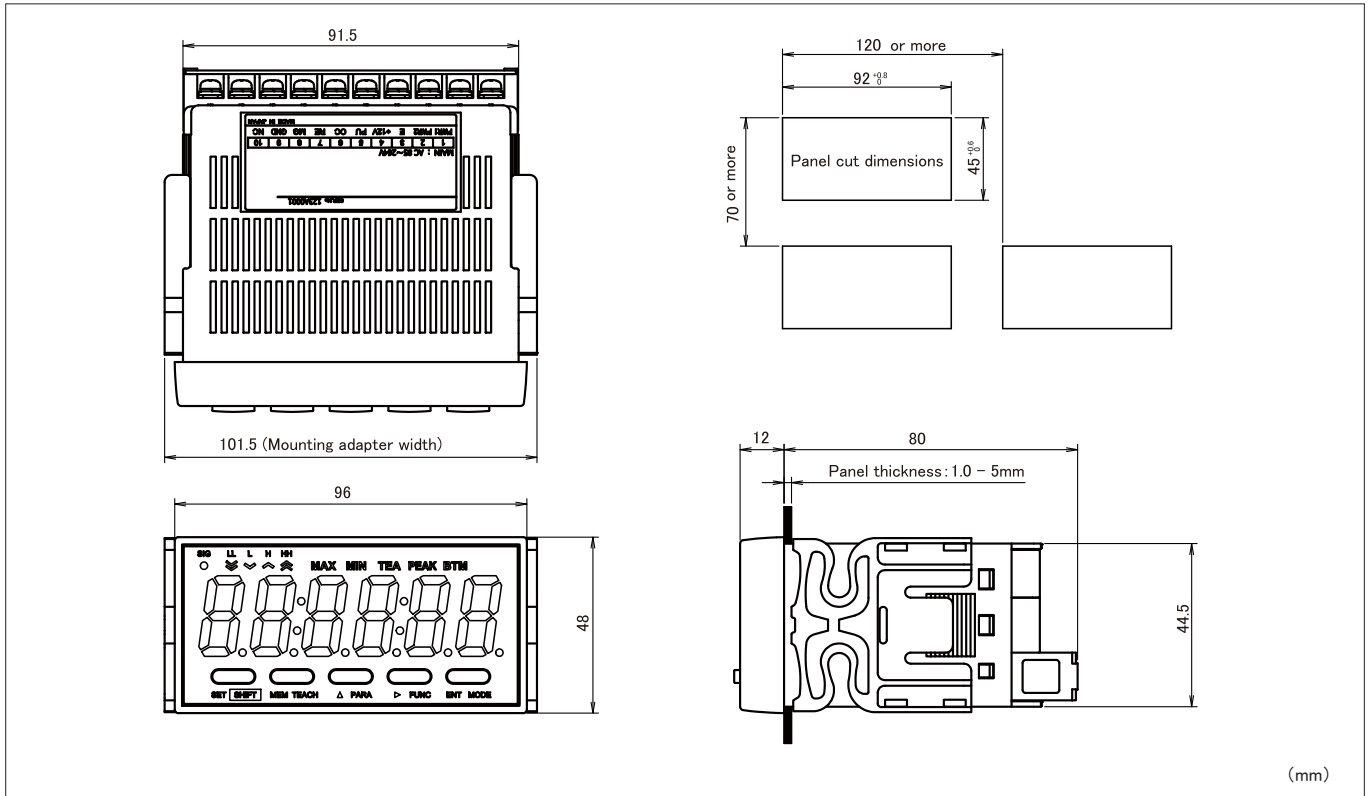


No	Name	Function
①	SIG lamp	Lights up when the sensor signal is input
②	LL lamp	Lights up when the Lo Lo limit is judged.
③	L lamp	Lights up when the Lo limit is judged.
④	H lamp	Lights up when the Hi limit is judged.
⑤	HH lamp	Lights up when the Hi Hi limit is judged.
⑥	MAX amp	Lights up when the maximum value is displayed
⑦	MIN lamp	Lights up when the minimum value is displayed
⑧	TEA lamp	Lights up when the teaching function is set
⑨	PEAK lamp	Not used
⑩	BTM lamp	Not used
⑪	Unit label space	Space for attaching the supplied unit labels
⑫	Main display	Displays the measurement value
⑬	SET/SHIFT key	Finishes the setting in various setting modes Pressing this key with other keys switches to various setting modes
⑭	MEM/TEACH key	Switches to the memory display Pressing this key with the SET key goes to the teaching setting mode
⑮	▲(UP)/PARA key	Changes the selected items in various setting modes, or numerical values Pressing this key with the SET key switches to the parameter setting mode
⑯	▶(NEXT)/FUNC key	Changes the selected digit in various setting modes Pressing this key with the SET key switches to the function setting mode
⑰	ENT/MODE key	Selects the changed item(s) in various setting modes Pressing this key with the SET key switches to the mode setting mode
⑱	Terminal block	
⑲	Rear panel	
⑳	Terminal block cover	
㉑	Mounting adapter	

unit sticker sheet

分	PS	ℓ	h	cm	m <sup>2</sup>	h	分	PS	ℓ	h	cm	m <sup>2</sup>	h	FVT
				min										CPT
秒	°C	kHz	rpm	ℓ	min	秒	°C	kHz	rpm	ℓ	min			TRT
														FVC
時:分:秒	sec	min	rps	Hz	h:m:s	sec	min	rps	Hz					TRC
														BCD
分:秒: $\frac{\text{秒}}{10}$	m	h	mm	s	ℓ	r	min	mm	s	ℓ	r	min		RMT
														DRT
	%	m	min	km	h	mm	min	%	m	min	km	h	mm	min
														SDT
														SDC

### 3. External Dimensions



### 4. Installation to the Panel

Mount this unit to the panel according to the following procedures.

Check that the mounting panel is thick enough (1.0 ~ 5mm) before mounting operation.

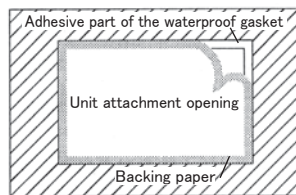
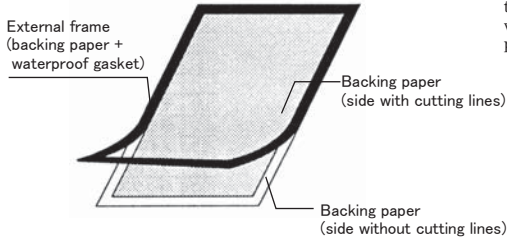
#### 1 Attach the provided waterproof gasket to the panel surface.

\* If waterproofing is not necessary, skip this step.

- (1) Remove the external frame with the cutting lines (backing paper + waterproof gasket) from the gasket sheet.  
(Adhesive paste is applied on the both sides of the waterproof gasket.)

- (2) Attach the provided waterproof gasket to the edges of the unit attachment panel and opening, aligning with its left and right sides, and then peel off the backing paper.

\* At this time, be sure not to displace or wrinkle the waterproof gasket. Also, do not expand the waterproof gasket vertically and/or horizontally past the attachment panel's edges.



#### CAUTION

About waterproofing

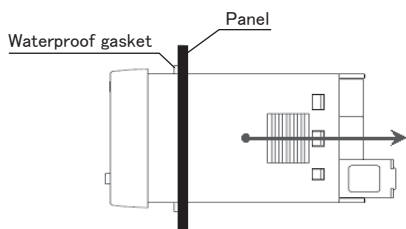
- Front panel: IP66 (or equivalent)
  - Rear terminal block: IP20 (non-waterproof)
- Do not install the unit in the following places or conditions.

- (1) Places regularly subject directly to water
- (2) Places subject to oil splashes and/or medical supplies
- (3) Places subject to water splashes on the rear or side face(s).

\* The front panel is IP66 (or equivalent) waterproofed, but if water is splashed on the unit, be sure to wipe it off the unit as soon as possible.

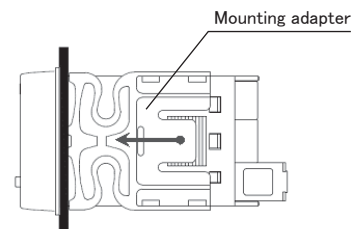
#### 2 Place the unit horizontally, and insert the gasket into the opening of the panel surface.

Push the unit until the waterproof gasket (adhesive part) securely reaches the panel surface of the unit.



#### 3 Attach the mounting adapter to the unit.

Slide the mounting adapter until it lightly touches the panel surface.



## 5. Wiring to Power Source and Sensors (4961XA)

### 5-1. Wiring to Power Source and Sensors (4961XA-RMT)

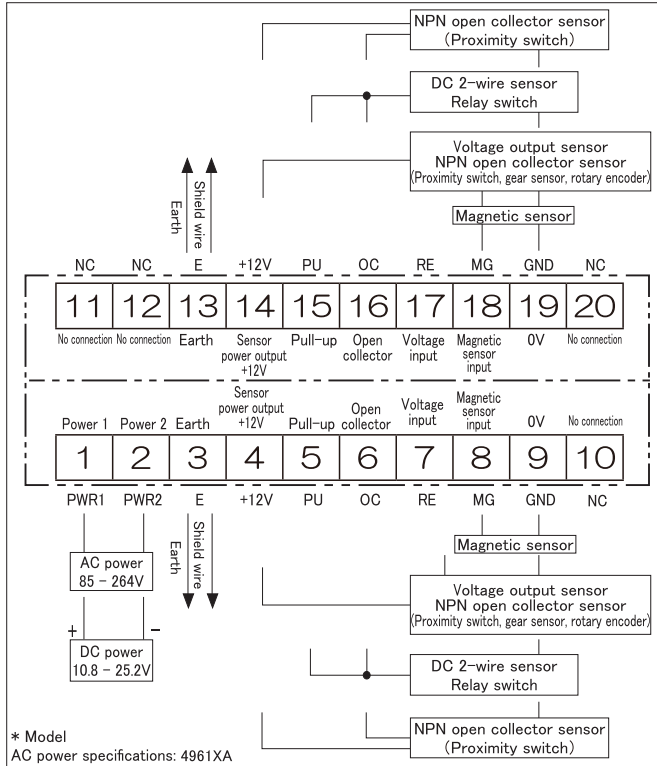
Note)

In order to prevent electric shock, be sure to turn the power OFF. Be sure to use the unit under the rated voltage (AC power specifications: 85 ~ 264VAC). The inverter output (output to connect a motor) cannot be used as power. Connection wiring from sensors shall not be kept in the same or parallel conduit or cable as the power source, power or high voltage cables. If you fail to separate the wiring, noise may be superimposed on the signal wire, resulting in malfunctions. Use shielded wire for input power connections with the shortest possible metal conduit.

© Please refer to Page 7 for the connecting precautions.

For 4961XA-RMT

#### Terminal block connection diagram



#### Input specifications (4961XA)

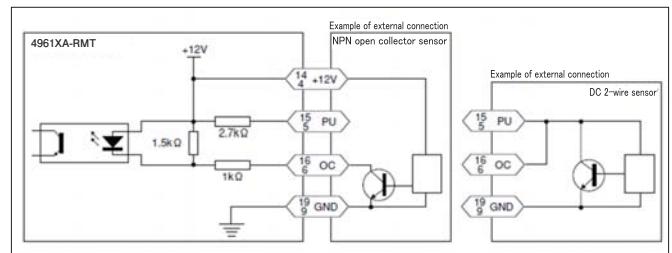
Item	Description		
Power	AC 85 ~ 264VAC(50/60Hz)		
Consumption power	10VA		
Sensor power output	DC+12V Max.100mA (When ratio measurement option RMTR is installed, the total amperage should be 100mA max.)		
Open collector input	Open collector (NPN) input		
	LO input	Load capacity 12mA or more 0 ~ 3V	
	HI input	Leakage current 0.5mA or less	
	Maximum frequency	100kHz(Minimum pulse width 5micro second)	
Contact input	For no-voltage contact. Short-circuit ⑤ and ⑥ to use.		
	Contact capacity	Voltage 12V, Current 15mA or more	
	Maximum frequency	20Hz(Minimum pulse width 25micro second)	
Voltage input	LO input	0 ~ 1.5V	
	HI input	4.0 ~ 30V	
	Input resistance	10kΩ	
	Maximum frequency	30kHz(Minimum pulse width 17micro second)	
Magnetic sensor input	Input resistance	10kΩ	
	Input voltage	1Hz ~ 100Hz	0.3 ~ 30Vp-p
		~ 1kHz	1.5 ~ 30Vp-p
		~ 10kHz	6 ~ 30Vp-p
	Maximum frequency	10kHz(Minimum pulse width 50micro second)	

#### Input specifications(-RMT)

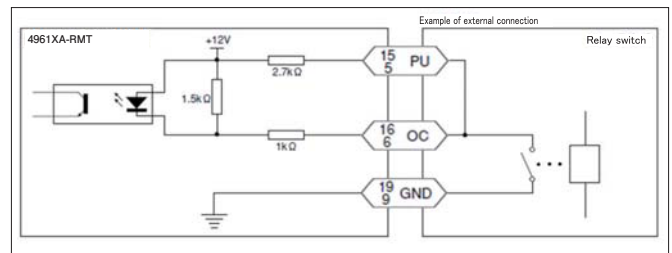
Item	Description		
Sensor power output	DC+12V Max.100mA The total amperage combined with the base power output of 12V is 100mA.		
Open collector input	Open collector (NPN) input		
	LO input	Load capacity 12mA or more 0 ~ 3V	
	HI input	Leakage current 0.5mA or less	
	Maximum frequency	100kHz(Minimum pulse width 5micro second)	
Contact input	For no-voltage contact. Short-circuit ⑤ and ⑥ to use.		
	Contact capacity	Voltage 12V, Current 15mA or more	
	Maximum frequency	20Hz(Minimum pulse width 25micro second)	
Voltage input	LO input	0 ~ 1.5V	
	HI input	4.0 ~ 30V	
	Input resistance	10kΩ	
	Maximum frequency	30kHz(Minimum pulse width 17micro second)	
Magnetic sensor input	Input resistance	10kΩ	
	Input voltage	1Hz ~ 100Hz	0.3 ~ 30Vp-p
		~ 1kHz	1.5 ~ 30Vp-p
		~ 10kHz	6 ~ 30Vp-p
	Maximum frequency	10kHz(Minimum pulse width 50micro second)	

#### Input circuit

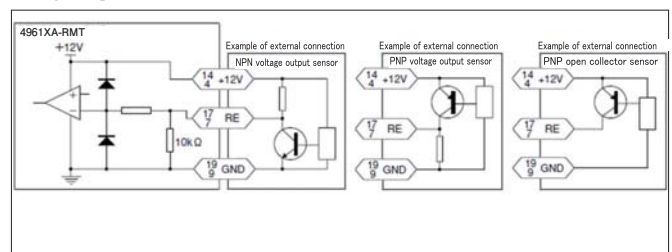
Open collector sensor



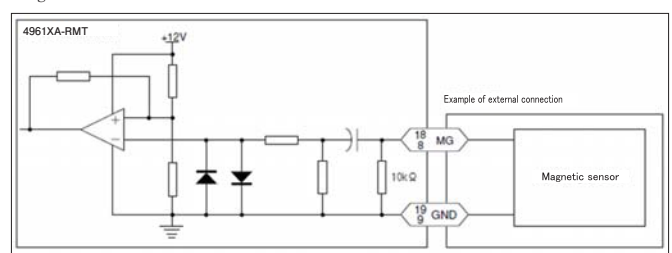
Relay switch



Voltage output sensor



Magnetic sensor





## 5-2. Wiring to Power Source and Sensors (4961FA-DRT)

### Note)

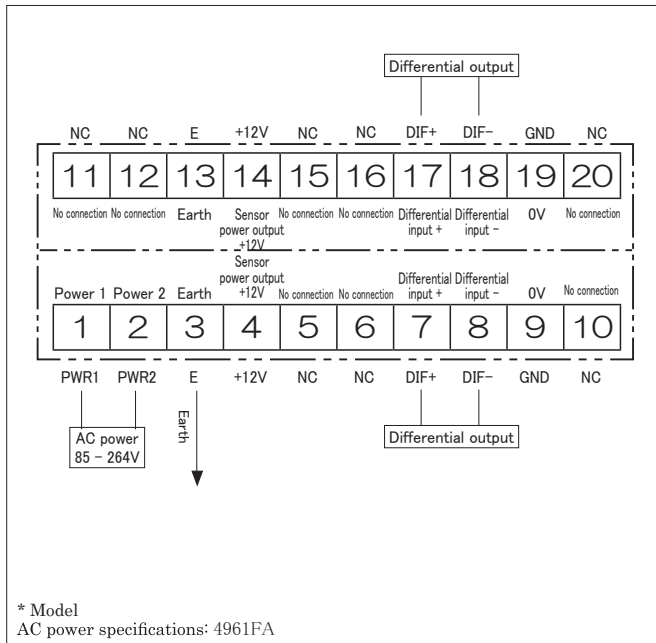
In order to prevent electric shock, be sure to turn the power OFF. Be sure to use the unit under the rated voltage (AC power specifications: 85 ~ 264VAC). The inverter output (output to connect a motor) cannot be used as power. Connection wiring from sensors shall not be kept in the same or parallel conduit or cable as the power source, power or high voltage cables. If you fail to separate the wiring, noise may be superimposed on the signal wire, resulting in malfunctions. Use shielded wire for input power connections with the shortest possible metal conduit.

### ◎ Wiring requirements

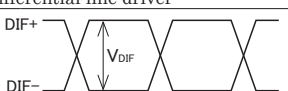
- Be sure to turn the power OFF before any wiring procedure.
- The crimped terminals for the connecting terminals should be for M3, with the width below 7mm.
- When the connection is completed, the transparent terminal cover must be attached.

For 4961FA-DRT

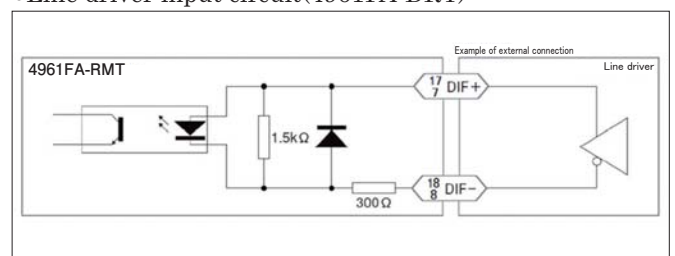
### ●Terminal block connection diagram



### ●Terminal block connection diagram(4961FA)

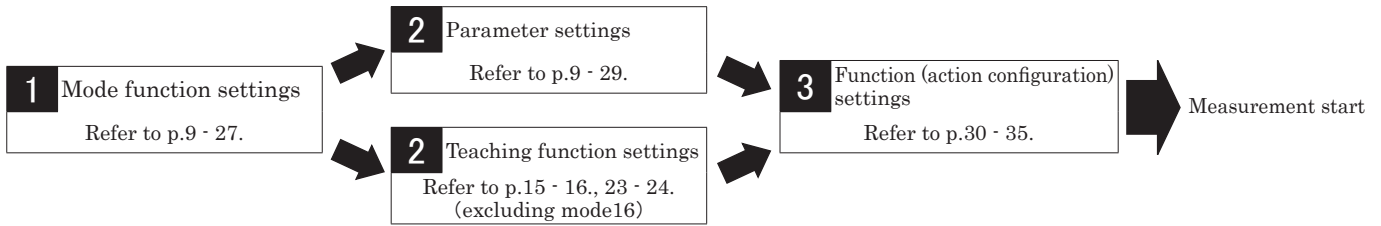
Item	Description	
Power	AC 85 ~ 264VAC(50/60Hz)	
Sensor power output	C+12V Max.100mA (When ratio measurement option RMTR is installed, the total amperage should be 100mA max.)	
Differential input	Connection to Differential line driver	
	Differential input voltage	
	$V_{DIF}$ Maximum voltage	$\pm 5.5V(15mA)$
	Minimum voltage	$\pm 3.0V$
Maximum frequency	100kHz(Minimum pulse width 5micro second)	

### ●Line driver input circuit(4961FA-DRT)



## 6. Basic Setting Procedure

Conduct settings as indicated below based on the intended use.



## 7. Keys to be Used for Various Settings and Their Applications

The front panel keys to be used for mode, parameter, and function settings, as well as various settings (teaching function / high and low set point 1 value setting / memory function) are described below.



### •Operation during the normal measurement display / memory display

No	Name	Function
①	SHIFT key	Pressing this key with other keys switches to various setting modes
②	MEM key	Switches to the memory display (Show A input and B input measurement values in mode11 ~ 14)
	TEACH key	Pressing and holding this key with the SHIFT key for 5 seconds switches to the teaching setting mode
③	PARA key	Pressing and holding this key with the SHIFT key for 5 seconds switches to the parameter setting mode
④	FUNC key	Pressing and holding with the SHIFT key for 5 seconds switches to the function setting mode
⑤	MODE key	Pressing and holding this key with the SHIFT key for 5 seconds switches to the mode setting mode

### •Operation in the various setting modes

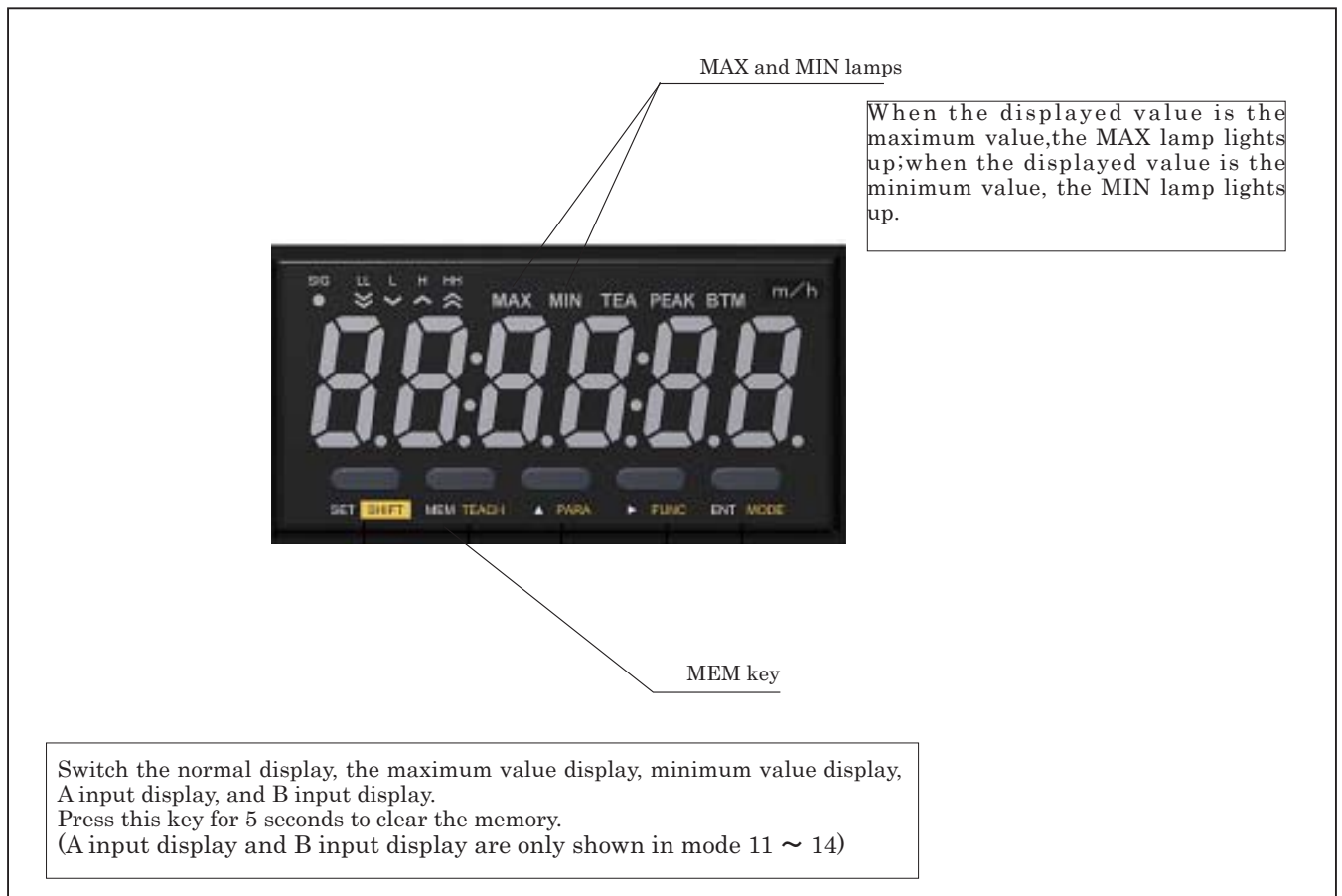
No	Name	Function
①	SET key	Setting completion key in various setting modes
②	▲(UP) key	Changes the selected items in various setting modes, or numerical values
③	▶(NEXT) key	Changes the selected digit in various setting modes
④	ENT key	Selects the changed item in various setting modes



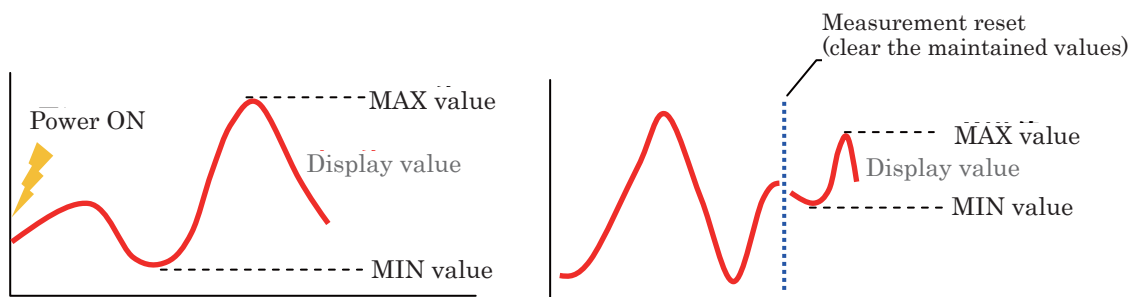
## 8. Memory Function / Input and display

### 8-1. Memory function

- Key to be used for the memory function and display



- During measurement, the maximum display value (MAX value) and minimum display value (MIN value) per display update cycle is always maintained.
- Pressing the **MEM** key allows you to check the maximum and minimum values maintained during the measurement.
- Refer to the graph below, the maintained MAX value and the MIN value would be cleared when measurement is reset (when mode or setting measurement is changed, or power is on). Can also erase the values by press the **MEM** key for 5 seconds.



### 8-2. Input and display

- Regarding mode 11 ~ 14, press **MEM** key to show A input and B input values during the MIN value is displayed.

8-3. Memory function/ Input and display Operation

Operation

Normal measurement display



MEM key

Press the **MEM** key once during the normal measurement to display the maximum value. (MAX lamp lights up)

Maximum value display



MEM key

Press the **MEM** key once when the maximum value is displayed to display the minimum value. (MIN lamp lights up)

Minimum value display



MEM key

Press the **MEM** key once when the minimum value is displayed to return to the normal measurement display. (mode 11 ~ 14 only)  
("A." is displayed in front of the value)

Input display function and operation

A input display



MEM key

Press MEM key once during A input to show B input measurement value. (mode 11 ~ 14 only)  
("B." is displayed in front of the value)

B input display



MEM key

Press MEM key once during B input to return to normal measurement display.

Normal measurement display



## Memory clear

- During normal measurement display or memory display, press **MEM** key for 5 seconds to clear maintained MAX and MIN values.

Normal measurement display



press **MEM** key

Press and hold the **MEM** key for 5 seconds during the normal measurement or when the maximum/minimum value is displayed, the MAX and MIN lamps blink for 2 seconds.

Memory clear



after 2 seconds

After the MAX and MIN lamps blink for 2 seconds, the memory is cleared and the display returns to the normal measurement display.

Normal measurement display

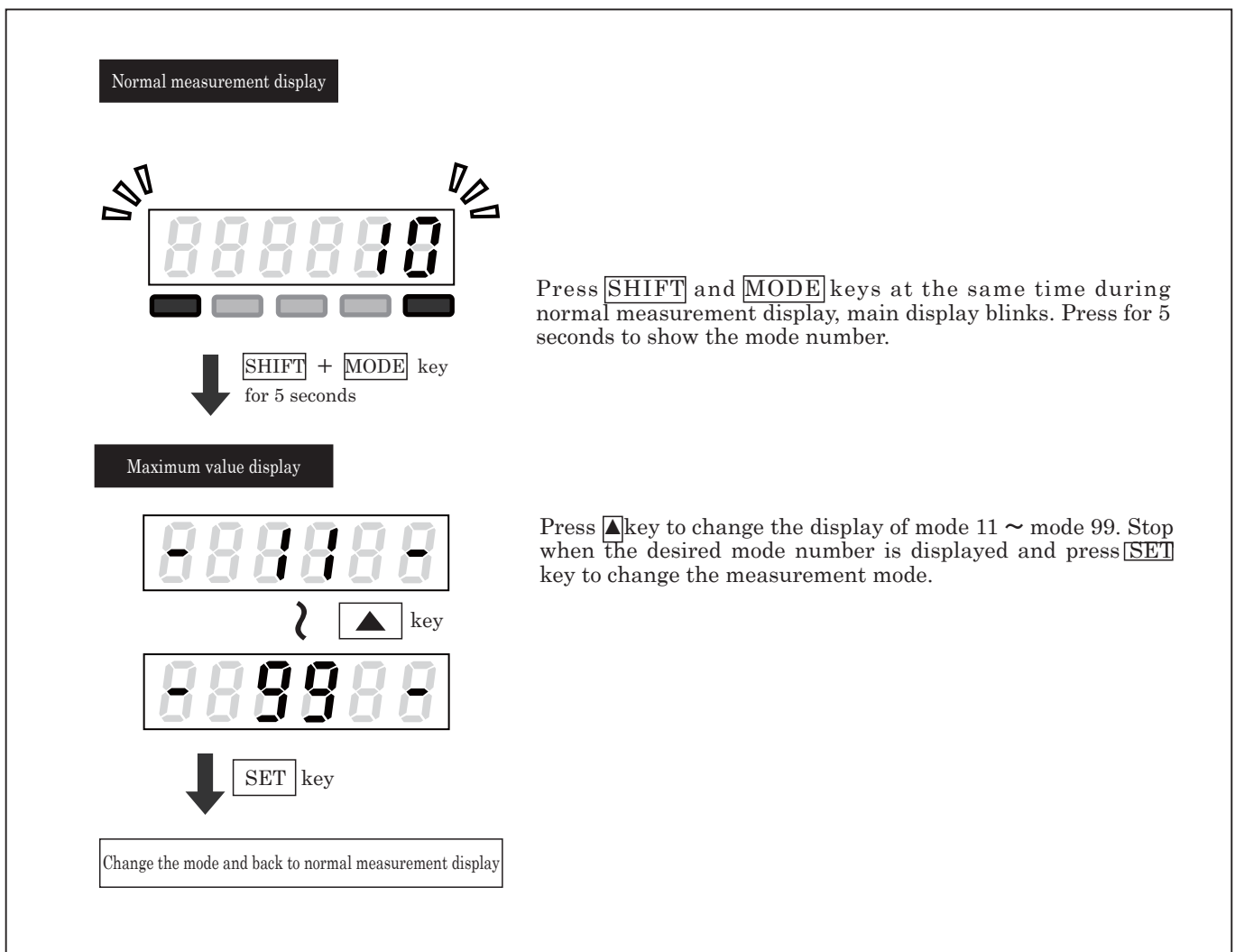


## 9. Mode Setting

There are 7 different modes to choose from. Each represents specific type of measurement.

Mode No.	Mode description	Details
11	Error ratio mode	displays $(B-A)/A$
12	Simple ratio mode	displays $B/A$
13	Composition ratio mode	displays $B/(A+B)$
14	Revolution speed difference mode	displays $B-A$
15	Passing speed mode	displays $60/T$ (see next mode)
16	Time lag mode	displays elapsed time, T, from A-input to B-input
99	Test mode	self diagnosis of the internal circuit

### 9-1. Procedures



- ※ Initial factory default setting is at mode 11 (error ratio mode).
- ※ When the mode is changed, each set value (parameter, function) defaults back to the factory shipment value.
- ※ When mode 99 is selected, no setting values will be initialized, and mode 99 selection will not be saved.

## 10. Mode 11 Error ratio mode

In mode 11 (error ratio mode), the error ratio is displayed by calculating from the display values of Input A and Input B.

### Mode 11 Error ratio mode

$$\text{Error ratio} = \frac{B - A}{A}$$

A : Input A display value (input basis)  
B : Input B display value (input comparison)

#### 10-1. Content

For the input frequency of Input A and Input B, obtain the display value using the calculation below.  
The P01-P07 values can be set in the parameter setting mode. (Refer to page 28 「17. Parameter setting」)

Display value calculation			
Input A	A(Hz)		External input pulse
	Parameter setting value	P01	Pulse count per revolution
		P02	Setting revolution speed (detection section)(rpm)
		P03	Value to be displayed
Input A Displayed value (A')		((A/P01)*60)×(P03/P02)	
Input B	B(Hz)		External input pulse
	Parameter setting value	P04	Pulse count per revolution
		P05	Setting revolution speed (detection section)(rpm)
		P06	Value to be displayed
Input B Displayed value (B')		((B/P04)*60)×(P06/P05)	
Ratio display	Parameter setting value	P07=0	(B'-A)/A'
		P07=1	((B'-A)/A')*100

• When setting P07 to "1", the value is displayed as a percentage.

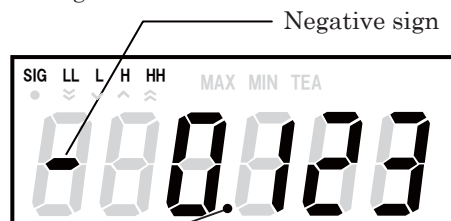
#### 10-2. Measurement display

The ratio display calculation results are displayed as below.  
Each display value for Input A and Input B can be checked in the memory mode.  
(Refer to page 9 「8. Memory Function/Input and display」)

● Positive value



● Negative value



The decimal point location is determined as specified in the parameter setting P08.

### 10-3. Parameter setting

In the parameter settings, the displayed values for each input, display cycle, auto zero time, and input filter can be set.

#### ① Parameters

The following parameters (P01-P12) can be set in mode 11.

●Parameters in mode 11					
No.	Setting item		Description	Input range	Default value
P01	Input A	Pulse count per revolution	Enter the pulse count per revolution	1 ~ 9999 P/r	1P/r
P02		Setting revolution speed (detection section)	Revolution speed in the detection section	1 ~ 99999	1000rpm
P03		Value to be displayed (with decimal point)	Actual value to be displayed on the panel in the above revolution speed	0.0001 ~ 99999.	1000
P04	Input B	Pulse count per revolution	Enter the pulse count per revolution	1 ~ 9999 P/r	1P/r
P05		Setting revolution speed (detection section)	Revolution speed in the detection section	1 ~ 99999	1000rpm
P06		Value to be displayed (with decimal point)	Actual value to be displayed on the panel in the above revolution speed	0.0001 ~ 99999.	1000
P07	Unit used for displayed value		Designate ×1 or %	Designate 0 (×1) or 1 (%)	0
P08	Decimal point location		Designate the decimal point location	00000 ~ 0.0000	No decimal point
P09	Display cycle		Sets the display update cycle	0.2/0.5/1.0/2.0/5.0/ 10/15/30/60 sec.	1 sec.
P10	Auto zero time		Sets the time from when the input pulse is gone to when the display becomes "0".	0.1 ~ 150 sec.	6 sec.
P11	Input filter		Selects a minimum frequency that is larger than the maximum frequency of the input signal.	Input A : 10/30/100/0.02kHz	10kHz
P12				Input B : 10/30/100/0.02kHz	10kHz

#### ● Display cycle (Parameter setting P09)

The display cycle for Input A, Input B, and ratio display can be set in P09.

Displays are updated every display cycle specified in P09, and new measurement results are indicated.

#### ● Auto zero time (Parameter setting P10)

• When the Input A value is not entered even after the auto zero time specified in P10 has elapsed, the display value for Input A will be 0.

• When the Input B value is not entered even after the auto zero time specified in P10 has elapsed, the display value for Input B will be 0.

※ When you set a smaller value than the input pulse cycle for Input A and Input B as auto zero time, normal measurement cannot be performed because the auto zero function operates with each pulse.

#### ● Input filter (Parameter setting P11, P12)

• The Input A filter can be set in P11.

• The Input B filter can be set in P12. When setting the filter, select a filter value that is larger than and closest to the frequency you want to input.

※ When the duty (proportion of ON time for one cycle) for the input signal is low, normal pulse reception may fail due to signal attenuation even if you have set the filter with a larger value than the input frequency. In such cases, set the filter with an even larger value.

## 10-4. Teaching function

### ① Teaching function

When the actual revolution speed can be measured, use the teaching function to make the settings easier. The teaching function can be used to automatically set the parameter values and display the desired values.

Input A in teaching function		
Input pulse in the teaching function setting	A	
Input A Teaching function setting value	$F_A$	
Parameter setting value	Pulse count per revolution	P01
	Setting revolution speed (detection section)	$P02 = A \times 60(\text{Hz})/P01$
	Value to be displayed	$P03 = F_A$

Set the teaching function setting value  $F_A$  in the teaching function setting mode (refer to the next section)

Automatically set the P02 and P03 values using the input pulse for Input A and the teaching function setting value  $F_A$ .

Input B in teaching function		
Input pulse in the teaching function setting	B	
Input B Teaching function setting value	$F_B$	
Parameter setting value	Pulse count per revolution	P04
	Setting revolution speed (detection section)	$P05 = B \times 60(\text{Hz})/P04$
	Value to be displayed	$P06 = F_B$

Set the teaching function setting value  $F_B$  in the teaching function setting mode (refer to the next section)

Automatically set the P05 and P06 values using the input pulse for Input A and the teaching function setting value  $F_B$ .

### ● Input revolution speed range

The revolution speed range where the teaching function can be performed is described below.

When the input revolution speed is beyond the input revolution speed range, "EE-2" is displayed. (Refer to P36. 「19. Error Display」)

$1\text{rpm} \leq \text{Input revolution speed} (\text{※}) < 99999\text{rpm}$

※ input revolution speed (Input A) =  $A \times 60(\text{Hz})/P01$   
input revolution speed (Input B) =  $B \times 60(\text{Hz})/P04$

When either Input A or Input B is beyond the input revolution speed range just before starting the teaching function setting mode.



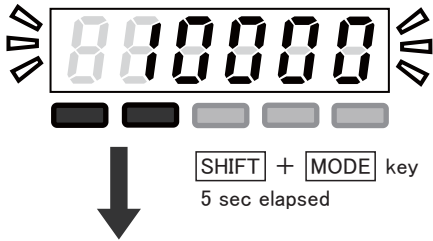
Displays "EE-2" for a second, and then returns to the normal measurement display.

- ※ Since the P02 and P05 calculation values are maintained after truncating the values after the decimal point, the teaching function setting value for the input you have entered may not be displayed depending on the input value and/or the the teaching function setting value.
- ※ When starting the teaching function setting mode with OVER displayed, "99999" is displayed at first.
- ※ The teaching function setting value can be entered within the range between 0.0001 and 99999. If you enter a value beyond the input range, and press SET key, the displayed value will blink for a second, and the display will return to the teaching function setting mode.

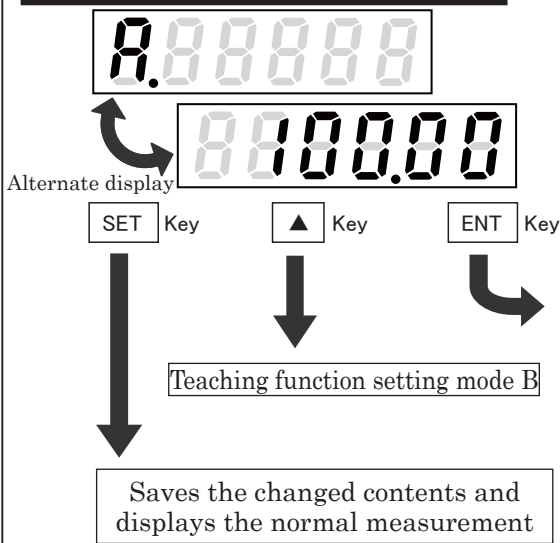


② Teaching function setting

Normal measurement display



Teaching function setting mode input A

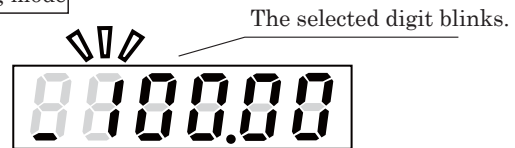


Press SHIFT and TEACH keys at the same time during normal measurement display, the main display blinks.  
Press the keys for 5 seconds to move to teaching function setting mode.  
TEA\_LED lights up during teaching function setting mode.

When the teaching function setting mode starts, the alternate display for Input A is performed.  
"A.□□□□" and the current display value for Input A are displayed alternately.

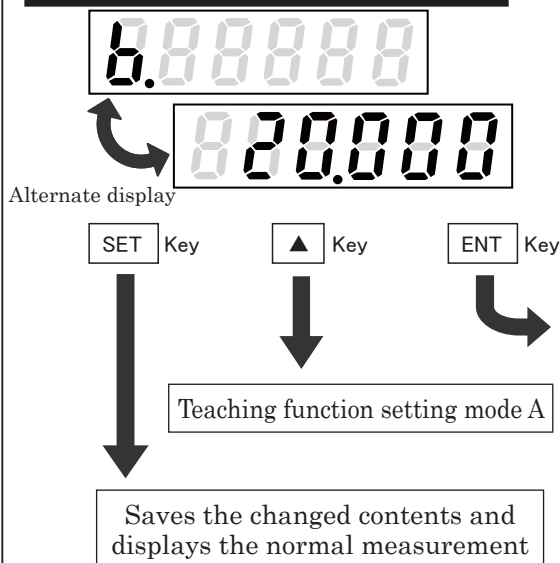
- On the alternate display, press▲to move to the Input B alternate display.
- On the alternate display, press ENT key to move to the Input A setting mode.
- On the alternate display, press SET key to save the changed contents, and return to the normal measurement display.

Setting mode



- Use▶ key to select the digit you want to change. Use▲key to change the value of the selected digit. Enter the value you want to display for Input A.
- Select the decimal point to change the decimal point display digit using▲key.
- While in the setting mode, press ENT key to move to the Input B alternate display.
- While in the setting mode, press SET key to save the changed contents and return to the normal measurement display.

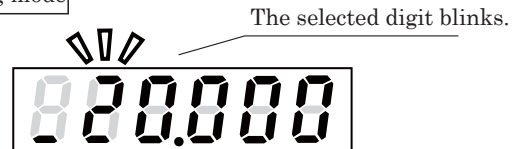
Teaching function setting mode input B



"b.□□□□" and the current display value for Input B are displayed alternately.

- On the alternate display, press▲to move to the Input A alternate display.
- On the alternate display, press ENT key to move to the Input B setting mode.
- On the alternate display, press SET key to save the changed contents, and return to the normal measurement display.

Setting mode



- Use▶ key to select the digit you want to change. Use▲key to change the value of the selected digit. Enter the value you want to display for Input B.
- Select the decimal point to change the decimal point display digit using▲key.
- While in the setting mode, press ENT key to move to the Input A alternate display.
- While in the setting mode, press SET key to save the changed contents and return to the normal measurement display.

## 11. Mode 12 Simple ratio mode

In mode 12 (simple ratio mode), the simple ratio is displayed by calculating from the display values of Input A and Input B.

### Mode 12 Simple ratio mode

$$\text{Simple ratio} = \frac{B}{A}$$

A : Input A display value (input basis)  
B : Input B display value (input comparison)

#### 11-1. Content

For the input frequency of Input A and Input B, obtain the display value using the calculation below.  
The P01-P07 values can be set in the parameter setting mode. (Refer to page 28 「17. Parameter setting」)

Display value calculation			
Input A	A(Hz)	External input pulse	
	Parameter setting	P01	Pulse count per revolution
		P02	Revolution speed in the detection section(rpm)
		P03	Value to be displayed
Input A Displayed value (A')		$((A/P01)*60) \times (P03/P02)$	
Input B	B(Hz)	External input pulse	
	Parameter setting	P04	Pulse count per revolution
		P05	Revolution speed in the detection section(rpm)
		P06	Value to be displayed
Input B Displayed value (B')		$((B/P04)*60) \times (P06/P05)$	
Ratio display	Parameter setting	P07=0	B'/A'
		P07=1	(B'/A')*100

- When setting P07 to "1", the value is displayed as a percentage.

#### 11-2. Measurement display

The ratio display calculation results are displayed as below.  
Each display value for Input A and Input B can be checked in the memory mode.  
(Refer to page 9 「8. Memory Function/Input and display」)



The decimal point location is determined as specified in the parameter setting P08.

#### 11-3. Parameter setting • Teaching function

Parameter and teaching function setting procedure in mode 12 is the same as mode 11.

## 12. Mode 13 Composition ratio mode

In mode 13 (composition ratio mode), the composition ratio is displayed by calculating from the display values of Input A and Input B.

### Mode13 Composition ratio mode

$$\text{Composition ratio} = \frac{B}{A + B}$$

A : Input A display value (input basis)  
B : Input B display value (input comparison)

#### 12-1. Content

For the input frequency of Input A and Input B, obtain the display value using the calculation below.  
The P01-P07 values can be set in the parameter setting mode. (Refer to page 28 「17. Parameter setting」)

Display value calculation			
Input A	A(Hz)	External input pulse	
	Parameter setting	P01	Pulse count per revolution
		P02	Revolution speed in the detection section(rpm)
		P03	Value to be displayed
Input A Displayed value (A')		$((A/P01)*60) \times (P03/P02)$	
Input B	B(Hz)	External input pulse	
	Parameter setting	P04	Pulse count per revolution
		P05	Revolution speed in the detection section(rpm)
		P06	Value to be displayed
Input B Displayed value (B')		$((B/P04)*60) \times (P06/P05)$	
Ratio display	Parameter setting	P07=0	$B'/(A'+B')$
		P07=1	$(B'/(A'+B'))*100$

- When setting P07 to "1", the value is displayed as a percentage.

#### 12-2. Measuremet display

The ratio display calculation results are displayed as below.  
Each display value for Input A and Input B can be checked in the memory mode.  
(Refer to page 9 「8. Memory Function/Input and display」)



The decimal point location is determined as specified in the parameter setting P08.

#### 12-3. Parameter setting • Teaching function

Parameter and teaching function setting procedure in mode 13 is the same as mode 11.

## 13. Mode14 Revolution speed difference mode

In mode 14 (revolution speed difference mode), calculates and displays the difference between the display values of Input A and Input B.

### Mode 14 Revolution speed difference mode

$$\text{Revolution speed difference} = B - A$$

A : Input A display value (input basis)  
B : Input B display value (input comparison)

#### 13-1. Content

For the input frequency of Input A and Input B, obtain the display value using the calculation below.  
The P01-P07 values can be set in the parameter setting mode. (Refer to page 28 「17. Parameter setting」)

Display value calculation			
Input A	A(Hz)	External input pulse	
	Parameter setting	P01	Pulse count per revolution
		P02	Revolution speed in the detection section(rpm)
		P03	Value to be displayed
Input A Displayed value (A')		$((A/P01)*60) \times (P03/P02)$	
Input B	B(Hz)	External input pulse	
	Parameter setting	P04	Pulse count per revolution
		P05	Revolution speed in the detection section(rpm)
		P06	Value to be displayed
Input B Displayed value (B')		$((B/P04)*60) \times (P06/P05)$	
Ratio display	B'-A'		

- When setting P07 to "1", the value is displayed as a percentage.

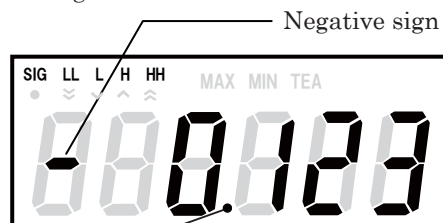
#### 13-2. Measuremet display

The ratio display calculation results are displayed as below.  
Each display value for Input A and Input B can be checked in the memory mode.  
(Refer to page 9 「8. Memory Function/Input and display」)

- Positive value



- Negative value



The decimal point location is determined as specified in the parameter setting P08.

### 13-3. Parameter setting

In the parameter settings, the displayed values for each input, display cycle, auto zero time, and input filter can be set.

#### ① Parameters

The following parameters (P01-P11) can be set in mode 14.

●Parameters in mode 14						
No.	Setting item		Description		Input range	Default value
P01	Input A	Pulse count per revolution	Input A	Pulse count per revolution	1 ~ 9999 P/r	1P/r
P02		Revolution speed in the detection section		Revolution speed in the detection section	1 ~ 99999	1000rpm
P03		Value to be displayed (with decimal poin)		Actual value to be displayed on the panel in the above revolution speed	0.0001 ~ 99999.	1000
P04	Input B	Pulse count per revolution	Input B	Pulse count per revolution	1 ~ 9999 P/r	1P/r
P05		Revolution speed in the detection section		Revolution speed in the detection section	1 ~ 99999	1000rpm
P06		Value to be displayed (with decimal poin)		Actual value to be displayed on the panel in the above revolution speed	0.0001 ~ 99999.	1000
P07	Decimal point location		Designate the decimal point location		00000 ~ 0.0000	No decimal point
P08	Display cycle		Sets the display update cycle		0.2/0.5/1.0/2.0/5.0/10/15/30/60 sec.	1 sec.
P09	Auto zero time		Sets the time from when the input pulse is gone to when the display becomes "0".		0.1 ~ 150 sec.	6 sec.
P10	Input filter		Selects a minimum frequency that is larger than the maximum frequency of the input signal.		Input A : 10/30/100/0.02kHz	10kHz
P11					Input B : 10/30/100/0.02kHz	10kHz

#### ● Display cycle (Parameter setting P08)

The display cycle for Input A, Input B, and ratio display can be set in P08.

Displays are updated every display cycle specified in P08, and new measurement results are indicated.

#### ● Auto zero time (Parameter setting P09)

• When the Input A value is not entered even after the auto zero time specified in P09 has elapsed, the display value for Input A will be 0.

• When the Input B value is not entered even after the auto zero time specified in P09 has elapsed, the display value for Input B will be 0.

※ When you set a smaller value than the input pulse cycle for Input A and Input B as auto zero time, normal measurement cannot be performed because the auto zero function operates with each pulse.

#### ● Input filter (Parameter setting P10、 P11)

• The Input A filter can be set in P10.

• The Input B filter can be set in P11. When setting the filter, select a filter value that is larger than and closest to the frequency you want to input.

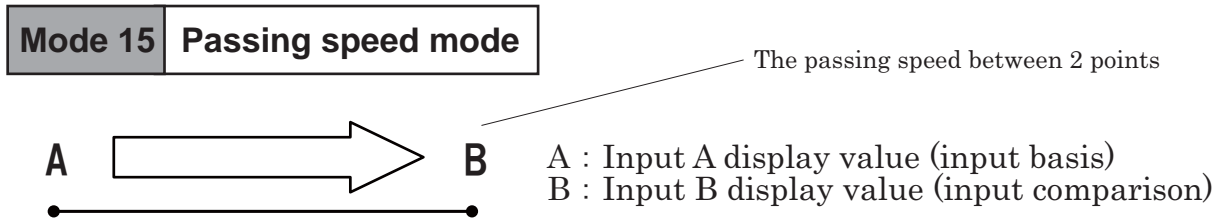
※ When the duty (proportion of ON time for one cycle) for the input signal is low, normal pulse reception may fail due to signal attenuation even if you have set the filter with a larger value than the input frequency. In such cases, set the filter with an even larger value.

### 13-4. Teaching function

Teaching function is the same as mode 11.

## 14. Mode 15 Passing speed mode

In mode 15 (passing speed mode), calculates and displays the passing speed between A and B.

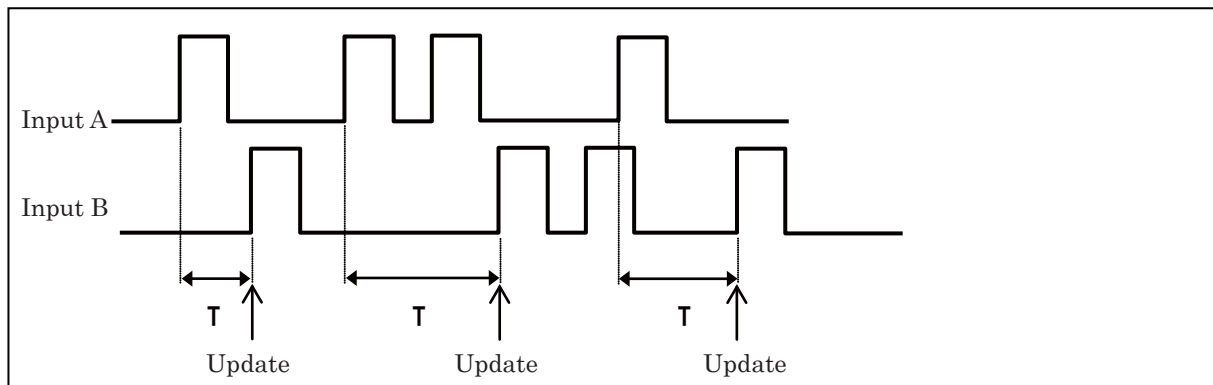


### 14-1. Content

For the input time lag  $T$  of Input A and Input B, obtain the passing speed between 2 points using the calculation below.

The P01-P03 values can be set in the parameter setting mode. (Refer to page 28 「17. Parameter setting」)

Display value calculation		
Time from the Input A rising edge to the Input B rising edge		$T(\text{sec.})$
Parameter setting value	P01	Distance between sensor A and sensor B(m)
	P02	Passing speed between 2 points(m/sec)
	P03	Value to be displayed
Display	Passing speed	$P01/T * (P03/P02)$



### 14-2. Measured value display

The calculation result of the passing speed between 2 points is displayed as below.



The decimal point location is determined as specified in the parameter setting P08.

※ When the time width between A and B is 10msec or less, the error display (EE-1) is indicated. (Refer to page 36 「19. Error display」)

### 13-3. Parameter setting

In the parameter settings, the displayed values for each input, auto zero time, and input filter can be set.

#### ① Parameters

The following parameters (P01-P06) can be set in mode 15.

●Parameters in mode 11				
No.	Setting item	Description	Input range	Default value
P01	Distance between 2 points	Distance input between sensors (fixed decimal point)	0.1 - 999.9 m	100.0
P02	Passing speed between 2 points	Passing speed input between sensors (No decimal point)	1 - 99999 m/sec	1000
P03	Value to be displayed	Value to actually be displayed on the panel (floating decimal point)	1 - 99999 msec	100.0
P04	Auto zero time	Sets the time from when the input pulse is gone to when the display becomes "0".	0.1 - 3600 sec.	3600
P05	Input filter	Selects a minimum frequency that is larger than the maximum frequency of the input signal.	Input A : 10/0.02kHz	10kHz
P06			Input B : 10/0.02kHz	10kHz

#### ● Auto zero time (Parameter setting P04)

- When Input A is not entered, the display for the passing speed between 2 points will not be updated.
  - When the Input B value is not entered even after the auto zero time specified in P04 has elapsed, the display value for the passing speed between 2 points will be 0.
- ※ When you set a smaller value than the input pulse cycle for Input A and Input B as auto zero time, normal measurement cannot be performed because the auto zero function operates with each pulse.

#### ● Input filter (Parameter setting P05、 P06)

- The Input A filter can be set in P05.
  - The Input B filter can be set in P06. When setting the filter, select a filter value that is larger than and closest to the frequency you want to input.
- ※ When the duty (proportion of ON time for one cycle) for the input signal is low, normal pulse reception may fail due to signal attenuation even if you have set the filter with a larger value than the input frequency. In such cases, set the filter with an even larger value.



## 13-4. Teaching function

### ① Teaching function

When the time lag between 2 points can be measured, use the teaching function to make the settings easier.

The teaching function can be used to automatically set the parameter values and display the desired values.

Display value calculation		
Time between Input A and Input B when the teaching function is set		T (min)
Teaching function setting value		F
Parameter setting value	P01 Distance between sensor A and sensor B(m)	P01
	P02 Passing speed between 2 points(m/sec)	$P02 = P01/T$
	P03 Value to be displayed	$P03 = F$
Display	Passing speed	F

Set the teaching function setting value F in the teaching function setting mode (refer to the next section)

Automatically set the P02 value based on the time T (sec) between Input A and Input B, and the P01 setting

Automatically set the P03 value to the same value as the teaching function setting value F

### ● Teaching function range

The the passing speed between 2 points (m/sec) range where the teaching function can be performed is described below. When the the passing speed is beyond the input range, "EE-2" is displayed. (Refer to page 36 「19. Error display」)

$$1 < \text{Passing speed between 2 points(m/sec)} < 99999$$

$$\text{※ Passing speed between 2 points(m/sec)} = P01/T$$

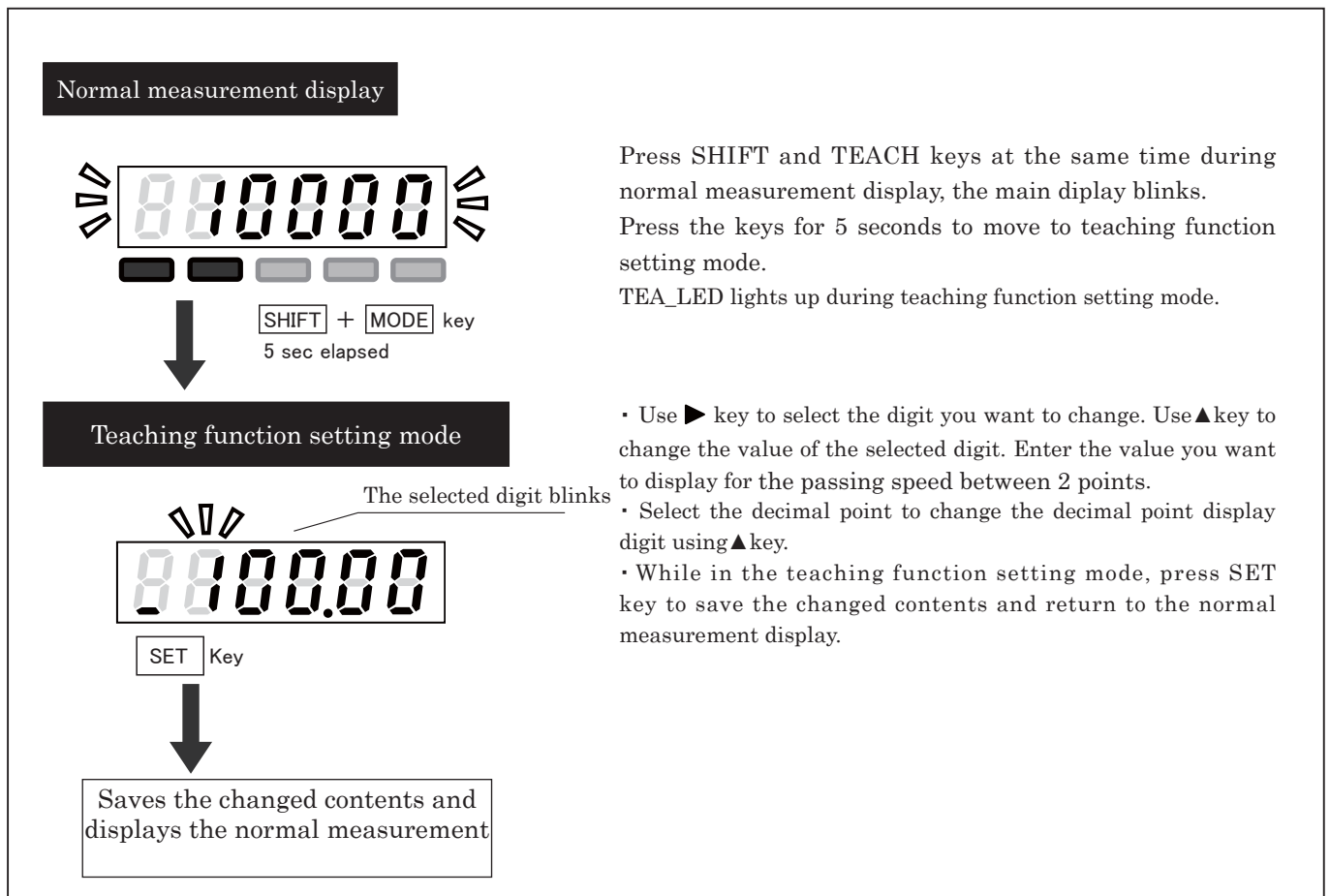
When the passing speed between 2 points is beyond the input range just before starting the teaching function setting mode



Displays "EE-2" for a second, and then returns to the normal measurement display.

- ※ Since the P02 calculation values are maintained after truncating the values after the decimal point, the teaching function setting value for the input you have entered may not be displayed depending on the input value and/or the the teaching function setting value.
- ※ When starting the teaching function setting mode with OVER displayed, "99999" is displayed at first.
- ※ The teaching function setting value can be entered within the range between 0.0001 and 99999.  
If you enter a value beyond the input range, and press SET key, the displayed value will blink for a second, and the display will return to the teaching function setting mode.

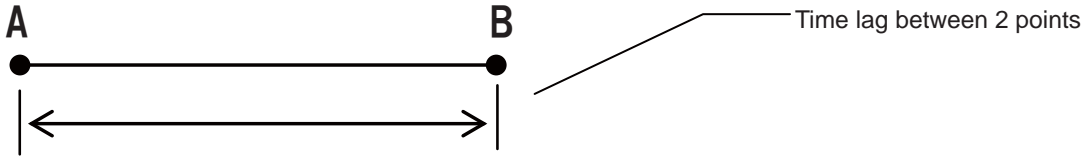
## ② Teaching function setting



## 15. Mode 16 Time lag mode

In mode 16 (time lag mode), the passing time between sensors on 2 points (A and B) is displayed.

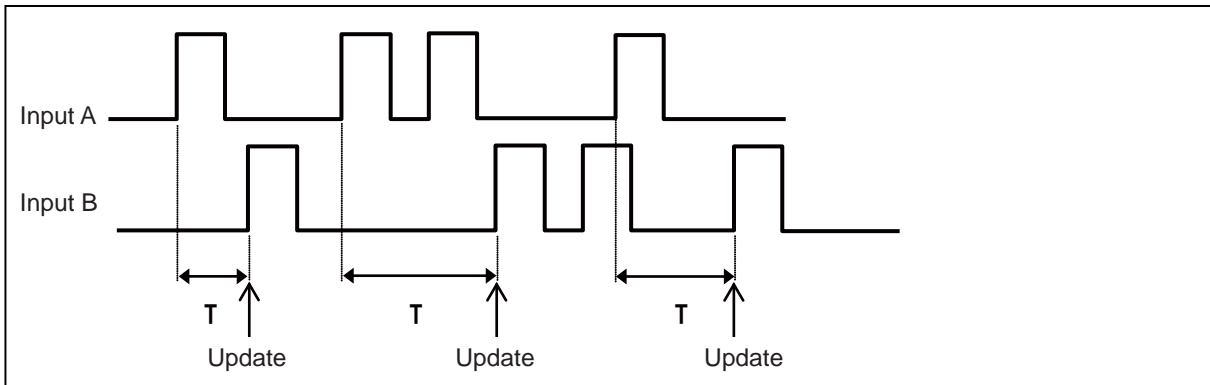
### Mode 16 Time lag mode



#### 15-1. Content

Display input time lag between input A and input B.

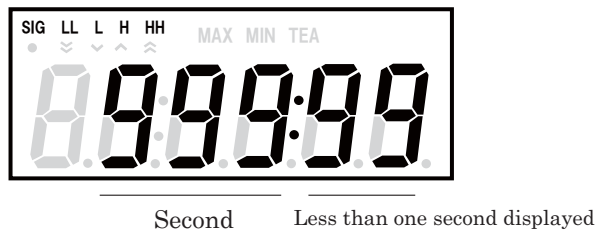
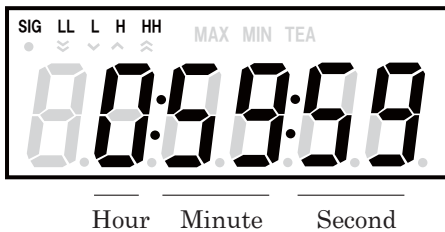
Display value calculation	
Time from the Input A rising edge to the Input B rising edge	T(sec.)



#### 15-2. Measured value display

The calculation result of the passing speed between 2 points is displayed as below.

- Hour:Minute:Second (P01 「0:00:00」 setting)
- 1/100 second display (P01 「000:00」 setting)



※ When the time width between A and B is 10msec or less, the error display (EE-1) is indicated.  
(Refer to page 36 「19. Error display」)

## 15-3. Parameter setting

In the parameter settings, the display mode, auto zero time, and input filter can be set.

### ① Parameters

The following parameters (P01-P04) can be set in mode 16.

●Parameters in mode 16				
No.	Setting item	Description	Input range	Default value
P01	Switch between HH:MM:SS and 1/100 seconds	Display mode selection	0:00:00(Hour:Minute:Second) /000:00(1/100Second display system)	1/100 seconds display
P02	Auto zero time	Sets the time from when the input pulse is gone to when the display becomes "0".	0.1 ~ 3600 sec.	3600 sec.
P03	Input filter	Selects a minimum frequency that is larger than the maximum frequency of the input signal.	Input A : 10/0.02kHz	10kHz
P04			Input B : 10/0.02kHz	10kHz

#### ● Auto zero time (Parameter setting P02)

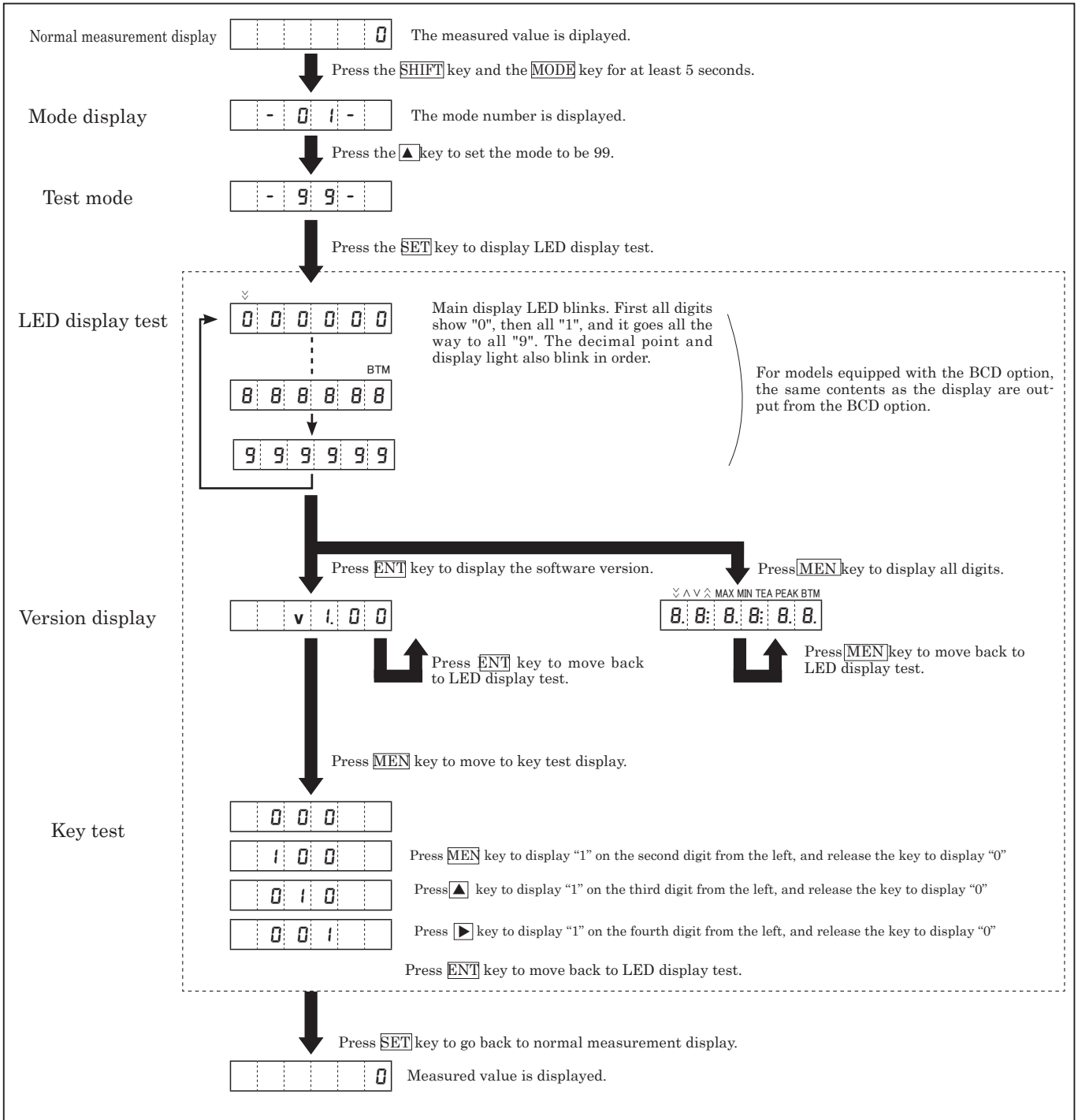
- When Input A is not entered, the display for the passing speed between 2 points will not be updated.
  - When the Input B value is not entered even after the auto zero time specified in P04 has elapsed, the display value for the passing speed between 2 points will be 「-.-.-.-.」 (OVER display).
- ※ When you set a smaller value than the input time lag of Input A and Input B as auto zero time, normal measurement cannot be performed because the auto zero function operates with each pulse.

#### ● Input filter (Parameter setting P03、P04)

- The Input A filter can be set in P03.
  - The Input B filter can be set in P04. When setting the filter, select a filter value that is larger than and closest to the input signal frequency you want to input. Set the input filter with a larger value than the input signal frequency.
- ※ When the duty (proportion of ON time for one cycle) for the input signal is low, normal pulse reception may fail due to signal attenuation even if you have set the filter with a larger value than the input frequency. In such cases, set the filter with an even larger value.

# 16. Mode 99 Test mode

Test mode is to make sure that the equipment is functioning properly. Please follow the procedure bellow to check the operation of the equipment.



# 17. Parameter setting

## 17-1 Content

Each mode has different contents of parameter setting procedures. Set each parameter item according to the description and range in the table below.

### • Parameters in mode 11, 12, 13

No.	Setting item		Input range	Default value
P01	Input A	Pulse count per revolution	[ _ 0001 ] ~ [ _ 9999 ] P/r	1P/r
P02		Setting revolution speed(detection section)	[ _ 00001 ] ~ [ _ 99999 ]	1000rpm
P03		Value to be displayed(with decimal point)	[ _ 0.0001 ] ~ [ _ 99999. ]	1000
P04	Input B	Pulse count per revolution	[ _ 0001 ] ~ [ _ 9999 ] P/r	1P/r
P05		Setting revolution speed(detection section)	[ _ 00001 ] ~ [ _ 99999 ]	1000rpm
P06		Value to be displayed(with decimal point)	[ _ 0.0001 ] ~ [ _ 99999. ]	1000
P07	Unit used for displayed value		Designate [ _ 0_ ] (×1) / [ _ 1_ ] (%)	0
P08	Decimal point location		[ _ 00000. ] ~ [ _ 0.0000 ]	00000.
P09	Display cycle		[ _ 0.2_ ]/[ _ 0.5_ ]/[ _ 1.0_ ]/[ _ 2.0_ ]/[ _ 5.0_ ]/[ _ 10_ ]/[ _ 15_ ]/[ _ 30_ ]/[ _ 60_ ] sec.	1 sec.
P10	Auto zero time		[ _ 000.1 ] ~ [ _ 150.0 ] sec.	6 sec.
P11	Input filter		Input A : [ _ 10_ ]/[ _ 30_ ]/[ _ 100_ ]/[ _ 0.02_ ]kHz	10kHz
P12			Input B : [ _ 10_ ]/[ _ 30_ ]/[ _ 100_ ]/[ _ 0.02_ ]kHz	10kHz

### • Parameters in mode 14

P01	Input A	Pulse count per revolution	[ _ 0001 ] - [ _ 9999 ] P/r	1P/r
P02		Setting revolution speed(detection section)	[ _ 00001 ] - [ _ 99999 ]	1000rpm
P03		Value to be displayed(with decimal point)	[ _ 0.0001 ] - [ _ 99999. ]	1000
P04	Input B	Pulse count per revolution	[ _ 0001 ] - [ _ 9999 ] P/r	1P/r
P05		Setting revolution speed(detection section)	[ _ 00001 ] - [ _ 99999 ]	1000rpm
P06		Value to be displayed(with decimal point)	[ _ 0.0001 ] - [ _ 99999. ]	1000
P07	Decimal point location		[ _ 00000. ] - [ _ 0.0000 ]	00000.
P08	Display cycle		[ _ 0.2_ ]/[ _ 0.5_ ]/[ _ 1.0_ ]/[ _ 2.0_ ]/[ _ 5.0_ ]/[ _ 10_ ]/[ _ 15_ ]/[ _ 30_ ]/[ _ 60_ ] sec.	1 sec.
P09	Auto zero time		[ _ 000.1 ] ~ [ _ 150.0 ] sec.	6 sec.
P10	Input filter		Input A : [ _ 10_ ]/[ _ 30_ ]/[ _ 100_ ]/[ _ 0.02_ ]kHz	10kHz
P11			Input B : [ _ 10_ ]/[ _ 30_ ]/[ _ 100_ ]/[ _ 0.02_ ]kHz	10kHz

### • Parameters in mode 15

P01	Distance between 2 points	[ _ 000.1 ] - [ _ 999.9 ] m (fixed decimal point)	100.0	
P02	Passing speed between 2 points	[ _ 00001 ] - [ _ 99999 ] m/sec	1000	
P03	Value to be displayed	[ _ 0.0001 ] - [ _ 99999. ] msec	100.0	
P04	Auto zero time	[ _ 0000.1 ] - [ _ 3600.0 ] sec.	3600	
P05	Input filter		Input A : [ _ 10_ ]/[ _ 0.02_ ]kHz	10kHz
P06			Input B : [ _ 10_ ]/[ _ 0.02_ ]kHz	10kHz

### • Parameters in mode 16

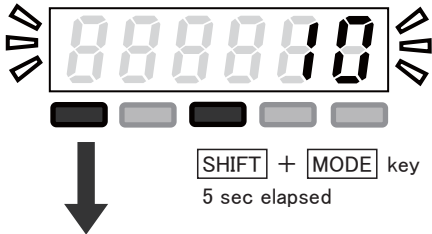
P01	Switch between HH:MM:SS and 1/100 seconds	[ _ 0:00:00 ](hour:minute:second display)/ [ _ 000:00_ ] (1/100 seconds display)	1/100 seconds display	
P02	Auto zero time	[ _ 0000.1 ] - [ _ 3600.0 ] sec.	3600 sec.	
P03	Input filter		Input A : [ _ 10_ ]/[ _ 0.02_ ]kHz	10kHz
P04			Input B : [ _ 10_ ]/[ _ 0.02_ ]kHz	10kHz

Please follow the procedure below to specify the parameter settings.

Note that the number of the parameter items and its contents depend on the mode.

In addition, when you change the mode, the specified parameter contents will be reset to the default values.

**Normal measurement display**



Press SHIFT and PARA keys at the same time during normal measurement display, the main display blinks.

Press the keys for 5 seconds to move to parameter setting mode.

SHIFT + MODE key  
5 sec elapsed

**Parameter setting mode「P01」**

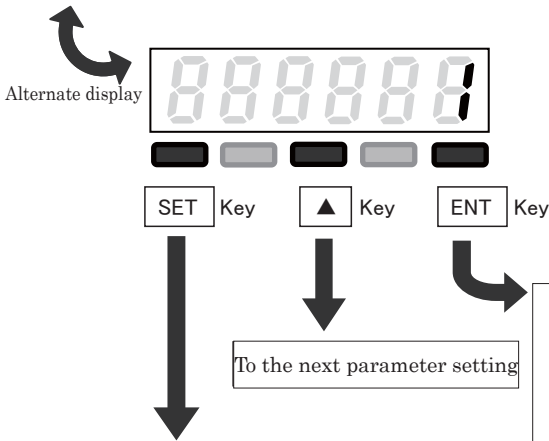


When the parameter setting mode starts, the alternate display for 「P01」 is performed.

「1 □ -P01」 and the current parameter P01 value are displayed alternately.

- Mode No. display      Parameter No.
- Mode 11 → 「11」
  - Mode 12 → 「12」
  - Mode 13 → 「13」
  - Mode 14 → 「14」

- On the alternate display, press ▲ to move to 「P02」 alternate display.
- On the alternate display, press ENT key to move to the 「P01」 setting mode. You can change the setting contents in the setting mode.
- On the alternate display, press SET key to save the changed contents, and return to the normal measurement display.



Saves the changed contents and displays the normal measurement

**Setting mode**



Use ► and ▲ to change the setting value and selection item.

For setting the numeric values	<ul style="list-style-type: none"> <li>• Use ► to move to the desired digit, and use ▲ to set the value of the selected digit. The selected digit blinks.</li> <li>• For parameters where the decimal point location can be set, use ► to select the decimal point, and use ▲ to change the decimal point display location.</li> </ul>
For selecting the setting	<ul style="list-style-type: none"> <li>• Use ▲ to select the setting contents.</li> </ul>

- While in the setting mode, press ENT key to move to 「P02」 alternate display.
- While in the setting mode, press SET key to save the changed contents and return to the normal measurement display.

● Use the same operation as above to perform the parameter settings for P02 and later.



## 18. Function setting

### 18-1 Functions

The following functions can be set in each mode.

#### • Function in mode 11, 12, 13, 14

No.	Setting item	Description	Input range	Default value
F01	Hi limit	Sets the Hi limit value	「_00000」 - 「_99999」	0
F02	Lo limit value	Sets the Lo limit value	「_00000」 - 「_99999」	0
F03	Hi Hi limit value	Sets the Hi Hi limit values	「_00000」 - 「_99999」	0
F04	Lo Lo limit value	Sets the Lo Lo limit value	「_00000」 - 「_99999」	0
F05	Hysteresis of the Hi and Lo limit values	Sets the Hysteresis of the Hi and Lo limit values	「__00」 - 「__99」	0
F06	Judgment output timer at startup	Sets the time when the comparator judgment is output at startup	「__00」 - 「__99」 sec.	0 sec.
F07	Minimum revolution speed	Sets the revolution speed to be displayed as zero	「_00000」 - 「_99999」	0
F08	Frequency of the moving average	Used when variation of the revolution speed is large and a stable display cannot be attained	「_0_」 (none)/「_1_」 (3)/ 「_2_」 (10)	0
F09	Pre-arithmetic function	Promptly performs the deceleration display when the signal is lost	「_0_」 (none)/「_1_」 (equipped)	0
F10	BCD output logic	Sets 0 for the negative logic, and 1 for the positive logic (logic of the decimal point output)	「_0_」 (negative logic) / 「_1_」 (positive logic)	0 (negative logic)
F11	Analog voltage output value	Sets the display value equivalent to the maximum value for each output (10V, 5V, 1V, 20mA)	「_00000」 - 「_99999」	1000
F12	Analog voltage output minimum value	For the value less than this display value, each output will be forced to be the minimum value (0V, 1V, 4mA)	「_00000」 - 「_99999」	10
F13	Analog signal output cycle	Becomes the fastest speed (10msec*) when this value is 0, and updates the analog signal output every display update cycle when it is 1 ※ *When the frequency is 200Hz or more	「_0_」 (Maximum speed )/ 「_1_」 (In synchrony with display renewal)	0 (Maximum speed)
F14	Analog signal output offset	Adds the value set in percentage to the maximum output (10V, 1V) regarded as 100%, and outputs	「_-100.0」 - 「_100.0」%	0%

#### • Function in mode 15

No.	Setting item	Description	Input range	Default value
F01	Hi limit	Sets the Hi limit value	「_00000」 - 「_99999」	0
F02	Lo limit value	Sets the Lo limit value	「_00000」 - 「_99999」	0
F03	Hi Hi limit value	Sets the Hi Hi limit values	「_00000」 - 「_99999」	0
F04	Lo Lo limit value	Sets the Lo Lo limit value	「_00000」 - 「_99999」	0
F05	Hysteresis of the Hi and Lo limit values	Sets the Hysteresis of the Hi and Lo limit values	「__00」 - 「__99」	0
F06	Judgment output timer at startup	Sets the time when the comparator judgment is output at startup	「__00」 - 「__99」 sec.	0 sec.
F10	BCD output logic	Sets 0 for the negative logic, and 1 for the positive logic (logic of the decimal point output)	「_0_」 (negative logic)/ 「_1_」 (positive logic)	0(negative logic)
F11	Analog voltage output value	Sets the display value equivalent to the maximum value for each output (10V, 5V, 1V, 20mA)	「_00000」 ~ 「_99999」	1000
F12	Analog voltage output minimum value	For the value less than this display value, each output will be forced to be the minimum value (0V, 1V, 4mA)	「_00000」 ~ 「_99999」	10
F13	Analog signal output cycle	Becomes the fastest speed (10msec*) when this value is 0, and updates the analog signal output every display update cycle when it is 1 ※ *When the frequency is 200Hz or more	「_0_」 (Maximum speed )/ 「_1_」 (In synchrony with display renewal)	0 (Maximum speed)
F14	Analog signal output offset	Adds the value set in percentage to the maximum output (10V, 1V) regarded as 100%, and outputs	「_-100.0」 ~ 「_100.0」%	0%

• Function in mode 16

No.	Setting item	Description	Input range	Default value	
F01	Hi limit	Sets the Hi limit value	Hour:Minute:Second	0:00:00 - 0:59:59	Second display system 0:00
			Second display system	0:00 - 999:99	
F02	Lo limit value	Sets the Lo limit value	Hour:Minute:Second	0:00:00 - 0:59:59	Second display system 0:00
			Second display system	0:00 - 999:99	
F03	Hi Hi limit value	Sets the Hi Hi limit values	Hour:Minute:Second	0:00:00 - 0:59:59	Second display system 0:00
			Second display system	0:00 - 999:99	
F04	Lo Lo limit value	Sets the Lo Lo limit value	Hour:Minute:Second	0:00:00 - 0:59:59	Second display system 0:00
			Second display system	0:00 - 999:99	
F05	Hysteresis of the Hi and Lo limit values	Sets the Hysteresis of the Hi and Lo limit values	0 - 99		0
F06	Judgment output timer at startup	Sets the time when the comparator judgment is output at startup	0 - 99 sec.		0 sec.
F10	BCD output logic	Sets 0 for the negative logic, and 1 for the positive logic (logic of the decimal point output)	「_ 0_」 (negative logic)/ 「_ 1_」 (positive logic)		0 (negative logic)
F11	Analog voltage output value	Sets the display value equivalent to the maximum value for each output (10V, 5V, 1V, 20mA)	Hour:Minute:Second	「_0:00:00」 - 「_0:59:59」	Second display system 10:00
			Second display system	「_000:00」 - 「_999:99」	
F12	Analog voltage output minimum value	For the value less than this display value, each output will be forced to be the minimum value (0V, 1V, 4mA)	Hour:Minute:Second	「_0:00:00」 - 「_0:59:59」	Second display system 10:00
			Second display system	「_000:00」 - 「_999:99」	
F13	Analog signal output cycle	Becomes the fastest speed (10msec*) when this value is 0, and updates the analog signal output every display update cycle when it is 1 ※*When the frequency is 200Hz or more	「_ 0_」 (Maximum speed )/ 「_ 1_」 (In synch with display renewal)		0 (Maximum speed)
F14	Analog signal output offset	Adds the value set in percentage to the maximum output (10V, 1V) regarded as 100%, and outputs	「_-100.0」 ~ 「_100.0」%		0%

※ F10 is only displayed when the BCD option is attached.

※ F11 ~ 14 are only displayed when the FVC option is attached.

① Comparator function (Hi Lo limit/Hi Hi Lo Lo limit judgment, Hysteresis) (F01 ~ F05)

- Hi Lo limit/Hi Hi Lo Lo limit judgment can be performed by setting function items F01-F04.

● Comparator function display



The corresponding lamp lights up according to the judgment result.

	name	function
①	LL lamp	Lights up when the Lo Lo limit is judged.
②	L lamp	Lights up when the Lo limit is judged.
③	H lamp	Lights up when the Hi limit is judged.
④	HH lamp	Lights up when the Hi Hi limit is judged.

● Content

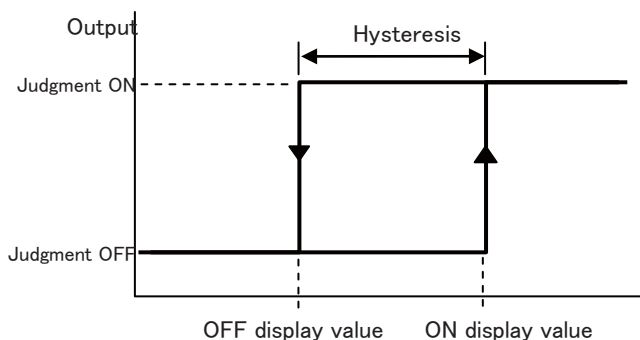
• Judgment conditions

Lo limit value $\leq$ displayed value $\leq$ Hi limit value and Lo Lo limit value $\leq$ displayed value $\leq$ Hi Hi limit value	GO judgment
When either the Hi Lo limit judgment or Hi Hi Lo Lo limit judgment is invalid, and the other is within the setting range	
displayed value > Hi Hi limit value	HH judgment
displayed value > Hi limit value	H judgment
displayed value < Lo Lo limit value	LL judgment
displayed value < Lo limit value	L judgment

- Judgment is performed in all measurement modes.
- The absolute measurement value is judged. None of the measurement values for Input A and Input B can be judged.
- The Hi Hi Lo Lo limit values and Hi Lo limit values are judged separately.
- When both the Hi Hi Lo Lo limit values are "0", the Hi Hi Lo Lo limit judgment is not performed.
- When both the Hi Lo limit values are "0", the Hi Lo limit judgment is not performed.
- When both the Hi Hi Lo Lo limit values and Hi Lo limit values are "0", no judgment is performed.

● Hysteresis

When hysteresis is set in function item F05, hysteresis is provided between judgment ON and OFF. The hysteresis setting value is common to Hi limit, Hi Hi limit, Lo limit, and Lo Lo limit judgments.



- Hi limit and Hi Hi limit judgment conditions

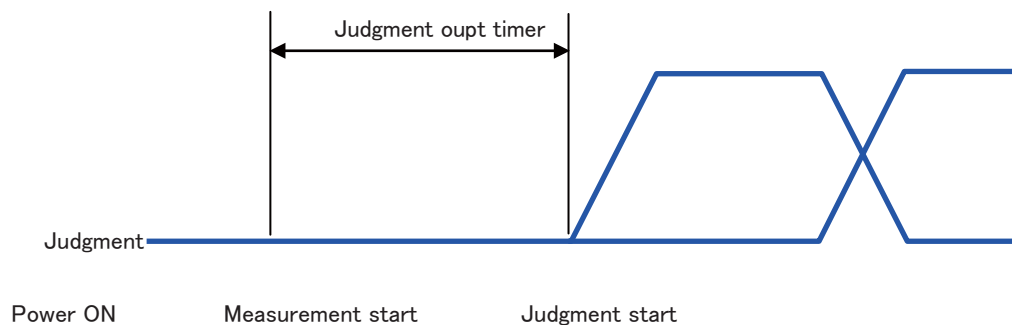
Judgment OFF→ON	Measured value > Judgment value
Judgment ON→OFF	Measured value $\leq$ Judgment value+Hysteresis

- Lo limit and Lo Lo limit judgment conditions

Judgment OFF→ON	Measured value < Judgment value
Judgment ON→OFF	Measured value $\geq$ Judgment value+Hysteresis

② Judgment output timer at startup (F06)

The judgment output timer function can be used by setting the value to 0 or more in function item F06. After the power is turned on, judgment starts when the judgment output timer setting time has elapsed since the time measurement starts.

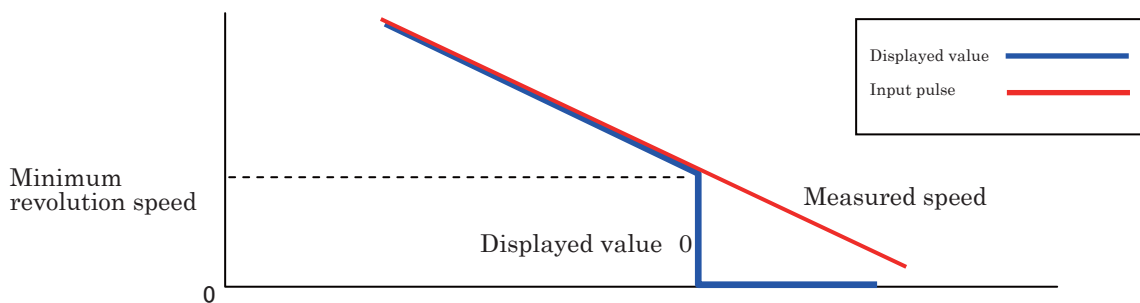


③ Minimum rotation speed (F07)

The following functions can be used by setting the value to 0 or more in function item F07.

- In modes 11, 12, 13, and 14, when the measurement revolution speed for Input A or Input B becomes the minimum revolution speed or less, the measurement value for Input A or Input B is specified as "0".

Input A : (Input signal frequency for Input A/Parameter item P01 setting value) x 60 < Minimum revolution speed -> Input A measurement value = "0"  
 Input B : (Input signal frequency for Input B/Parameter item P04 setting value) x 60 < Minimum revolution speed -> Input B measurement value = "0"



※ The input value of the minimum revolution speed becomes the lower two digits of the display value regardless of the decimal point location.

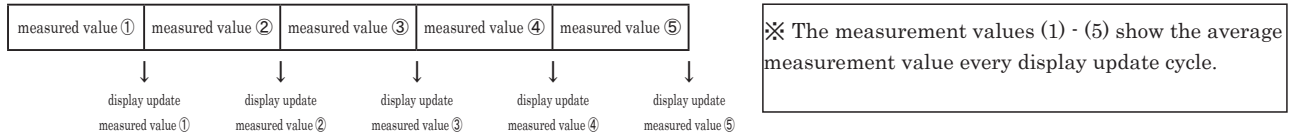
#### ④ Moving average calculation sample size (F08)

The moving average function can be used by setting a value other than "0" in function item "F08 Frequency of the moving average".

The measurement value every display cycle to be averaged using the moving average frequency is displayed.

- Without using the moving average (when the F08 setting value is "0")

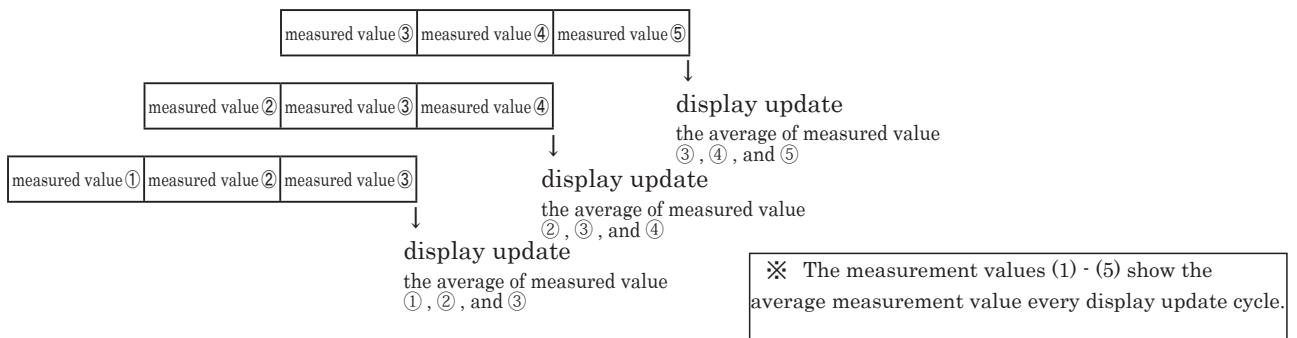
When hysteresis is set in function item F05, hysteresis is provided between judgment ON and OFF. The hysteresis setting value is common to Hi limit, Hi Hi limit, Lo limit, and Lo Lo limit judgments.



- With using the moving average (when the F08 setting value is "1" and "2")

The measurement value of every display cycle to be averaged using the moving average frequency is displayed.

The figure below shows the relationship between the display update and averaging when the F08 setting value is "0" (at a moving average of 3 times).

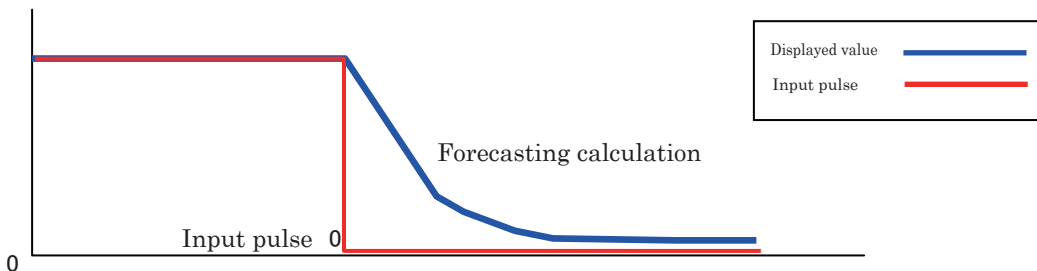


※ For mode 11-14, obtain the moving average for Input A and Input B respectively, and calculate the display value from their results.

#### ⑤ Forecasting calculation (F09)

The forecasting calculation function can be used by setting a value of "1" in function item "F09 Forecasting calculation".

When the input signal is no longer entered, reduced speed display is performed immediately.



※ For mode 11-14, obtain the forecasting calculation for Input A and Input B respectively, and calculate the display value from their results.

#### ⑥ BCD output logic (F10)

When the BCD output option is not attached, the function items are not displayed.

※ Refer to [p.37 「20. FVC function」](#) for the details.

#### ⑦ Analog output setting (F11 ~ 14)

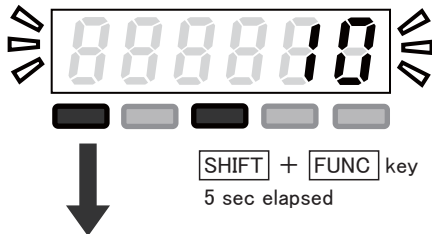
When the analog output option is not attached, the function items are not displayed.

Refer to [p.39 「21. BCD option」](#) for the details.

Please follow the procedure below to specify the function settings.

In addition, when you change the mode, the specified function contents will be reset to the default values.

### Measured value



Press SHIFT and FUNC keys at the same time during normal measurement display, the main display blinks.  
Press the keys for 5 seconds to move to function setting mode.

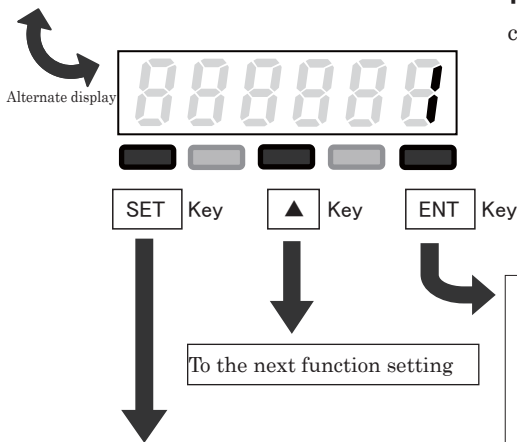
### Function setting mode 「F01」



When the parameter setting mode starts, the alternate display for 「F01」 is performed.  
"「1 □ -F01」" and the current display value for Input A are displayed alternately.

- Mode No.  
Mode 11 → 「11」  
Mode 12 → 「12」  
Mode 13 → 「13」  
Mode 14 → 「14」

- On the alternate display, press▲ to move to 「F02」 alternate display.
- On the alternate display, press ENT key to move to the 「F01」 setting mode. You can change the setting contents in the setting mode.
- On the alternate display, press SET key to save the changed contents, and return to the normal measurement display.



#### Setting mode



Use▶ and▲ to change the setting value and selection item.








For setting the numeric values	<ul style="list-style-type: none"> <li>• Use▶ to move to the desired digit, and use▲ to set the value of the selected digit. The selected digit blinks.</li> <li>• For functions where the decimal point location can be set, use▶ to select the decimal point, and use▲ to change the decimal point display location.</li> </ul>
For selecting the setting	<ul style="list-style-type: none"> <li>• Use▲ to select the setting contents.</li> </ul>

- While in the setting mode, press ENT key to move to the 「F02」 alternate display.
- While in the setting mode, press SET key to save the changed contents and return to the normal measurement display.

● Use the same operation as above to perform the parameter settings for P02 and later.

## 19. Error display

Abnormal events are alerted by displaying error codes.  
Please take proper action according to the table below.

	Display	Description	Action
1		Indicates display overflow (display value exceeded the number of displayable digits)	Measured value is displayed when value is within measuring range.
2 ※		Displayed when there is no input for either Input A or Input B in mode 11-13	Enter Input A and/or Input B.
3 ※		Displayed when there is no input for either Input A or Input B in mode 11-13	Enter Input A
4		Displayed when the time lag between Input A and Input B is 10ms or less in mode 15 and 16.	Use within the measurement range.
5		Displayed when the speed is out of the teaching function range. (input revolution count is above 99,999)	Please try teaching function at lower speed.
6		Displayed when an internal memory error occurs	Press ENT (MODE) key to release the error. Note that the mode, parameter, and function settings values are initialized.
7		Displayed when the setting value F01 is smaller than F02, or F03 is smaller than F04 in the function setting mode	After the error is displayed for 2 seconds, the display returns to the previous state before indicating EE-4. Modify the settings.

※ When the FVC option and BCD option are attached, each output when error code 2 or 3 is displayed maintains the state just before the error occurs.



## 20. FVC Option

When the FVC option is attached, the analog signal output (voltage/current) for the display value can be performed.

### 20-1. FVC option specifications

#### ● Specifications

Model	-FVC		
Output	Current output	4 ~ 20mA	
	Voltage output	0 ~ 10V	
		If negative value is displayed, the output is $\pm 10V$	
		1 ~ 5V	
Load	Current output	below 500ohm	
	Voltage output	above 1Kohm	
	Main body: PCS-E36LMD		
	Attachment: Plug PCS-E36SF, Cover PCS-E36LA (Both manufactured by HONDA TSUSHIN KOGYO CO., LTD.)		

\* Cables are to be connected by users.

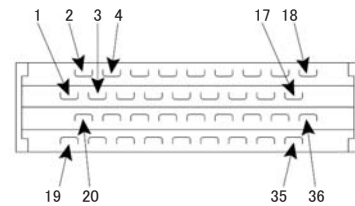
#### ● Connection (connector plugging)

Code	Pin number		Code
C+	1	19	C-
4 ~ 20mA+	2	20	4 ~ 20mA-
NC	3	21	NC
NC	4	22	NC
NC	5	23	NC
NC	6	24	NC
NC	7	25	NC
NC	8	26	NC
V10+	9	27	V10-
0 ~ 10V+	10	28	0 ~ 10V-
NC	11	29	NC
NC	12	30	NC
V5+	13	31	V5-
1 ~ 5V+	14	32	1 ~ 5V-
NC	15	33	NC
NC	16	34	NC
V1+	17	35	V1-
0 ~ 1V+	18	36	0 ~ 1V-

\*Select one out of these output options

#### Connector numbering

(as the plug is viewed from wire connection side)



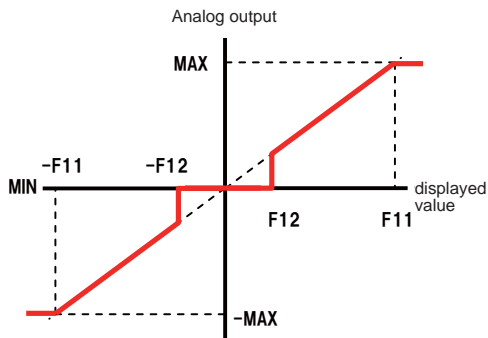
- The connector next to "1" marking is #2 terminal.
- Suggested wiring order is 1, 3, 5 ~ 20, 22, 24 ~ for the ease of finding the right numbering.
- The space between terminals is small. Be cautious about the short-circuit while soldering.

### 20-2. FVC option setting

When the FVC option is attached, the following settings can be specified in the function settings (refer to page 30 "18. Setting the function").

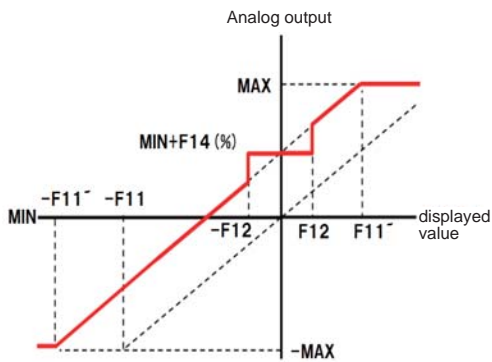
No.	Setting item	Description
F11	Maximum analog signal displayed value	Sets the display value equivalent to the maximum value for each output (10V, 5V, 1V, 20mA)
F12	Minimum analog signal displayed value	For the value less than this display value, each output will be forced to be the minimum value (0V, 1V, 4mA)
F13	Analog signal output cycle	Becomes the fastest speed (10msec*) when this value is 0, and updates the analog signal output every display update cycle when it is 1 ※ *When the frequency is 200Hz or more
F14	Analog signal output offset	Adds the value set in percentage to the maximum output (10V, 1V) regarded as 100%, and outputs

● When offset is OFF (off set F14 = 0)



Condition	Analog output value
displayed value $\geq$ F11set value	Maximum value (10V, 5V, 1V, 20mA)
F11 $\geq$ displayed value $\geq$ F12	(MAX/ F11) $\times$ Measured value for analog output
F12 > displayed value > -F12	Minimum value (0V, 1V, 4mA)
-F12 $\geq$ displayed value $\geq$ -F11	(MAX/ F11) $\times$ Measured value for analog output
-F11 > displayed value	-Maximum value (-10V, -1V)

● When offset is ON (off set F14 > 0)

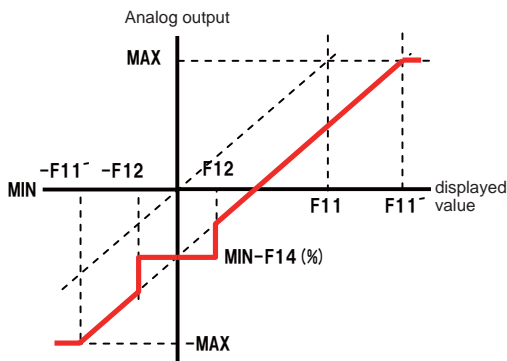


Condition	Analog output value
displayed value > F11	Maximum value (10V, 5V, 1V, 20mA)
F12 > displayed value > -F12	(MAX/F11) $\times$ Measured value for analog output + (F14(%)) of MAX output
F12 > displayed value > -F12	Minimum value (0V, 1V, 4mA) + (F14(%)) of MAX output
-F12 $\geq$ displayed value $\geq$ -F11'	(MAX/F11) $\times$ Measured value for analog output + (F14(%)) of MAX output
-F11' > displayed value	-Maximum value (-10V, -1V)

※ F11' is the display value when the output value to which F14(%)) of MAX output is added becomes the MAX value or larger

Example) For 10V output, setting F11=100 and F14=10(%) results in F11'=90, which means 10V is output when the display value is 90.

● When offset is ON (off set F14 < 0)



Condition	Analog output value
displayed value > F11'	Maximum value (10V, 5V, 1V, 20mA)
F11' $\geq$ displayed value $\geq$ F12	(MAX/F11) $\times$ Measured value for analog output + (F14(%)) of MAX output
F12 > displayed value > -F12	Minimum value (0V, 1V, 4mA) + (F14(%)) of MAX output
-F12 $\geq$ displayed value $\geq$ -F11'	(MAX/F11) $\times$ Measured value for analog output + (F14(%)) of MAX output
-F11' > displayed value	-Maximum value (-10V, -1V)

※ F11' is the display value when the output value to which F14(%)) of MAX output is added becomes the MAX value or larger

Example) For 10V output, setting F11=100 and F14=-10(%) results in F11'=110, which means 10V is output when the display value is 90.

※ For voltage output of 1V~5V, 1V or less cannot be output.  
For current output of 4~20mA, 4mA or less cannot be output.

# 21. BCD Option

## 21-1. BCD Option Specifications

### ● Specifications

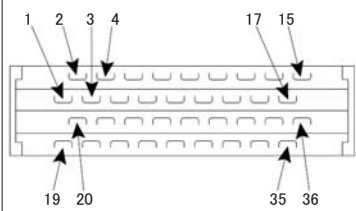
Model	-BCD	
NPN open collector output	Output capacity	DC30V 20mA
Open collector input	Input for open collector (NPN)	
	LO input	Load capacity above 5mA 0 ~ 1.5V
	HI input	Leakage current below 0.1mA
Data output	6 digits BCD code	
Decimal point output	DP1 ~ 4 (10 <sup>-1</sup> ~ 10 <sup>-4</sup> digits)	
Control output	PLUS	When data output is positive, this signal is LO.
	DT OUT	When this signal is HI, output signal is fixed.
	OVR	When the display value overflows, this signal is LO.
Control input	HOLD	While this signal is LO, data is not renewed.
	ENABLE	While this signal is LO, all outputs provide high impedance.
Connector specifications	Main body: PCS-E36LMD Attachment: Plug PCS-E36FS, Cover PCS-E36LA (Both manufactured by HONDA TSUSHIN KOGYO CO., LTD.)	

For BCD output and decimal point output, the positive and negative logic can be set (select in function 10)

\* Cables are to be connected by users.

### Connector numbering

(as the plug is viewed from wire connection side)

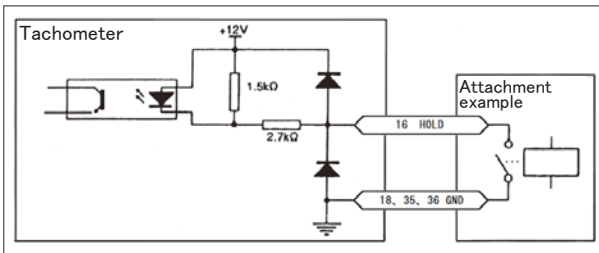


- The connector next to "1" marking is #2 terminal.
- Suggested wiring order is 1, 2, 5 ~ 20, 22, 24 ~ for the ease of finding the right numbering.
- The space between terminals is small. Be cautious about the short-circuit while soldering.

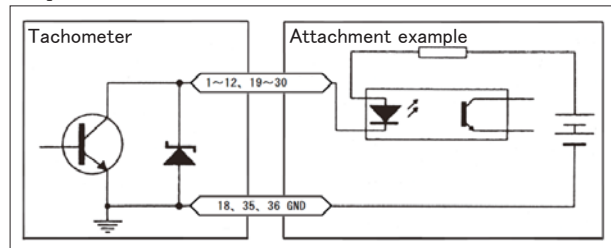
### ● Connection (connector plugging)

Input/output	Code	Pin number		Code	Input/output	
Output	×10 <sup>0</sup>	1	1	19	1	×10 <sup>3</sup>
		2	2	20	2	
		4	3	21	4	
		8	4	22	8	
	×10 <sup>1</sup>	1	5	23	1	×10 <sup>4</sup>
		2	6	24	2	
		4	7	25	4	
		8	8	26	8	
	×10 <sup>2</sup>	1	9	27	1	×10 <sup>5</sup>
		2	10	28	2	
		4	11	29	4	
		8	12	30	8	
Input	PLUS	13	31	DP1	Output	
	DT OUT	14	32	DP2		
	OVR	15	33	DP3		
	HOLD	16	34	DP4		
	ENABLE	17	35	GND		
	GND	18	36	GND		

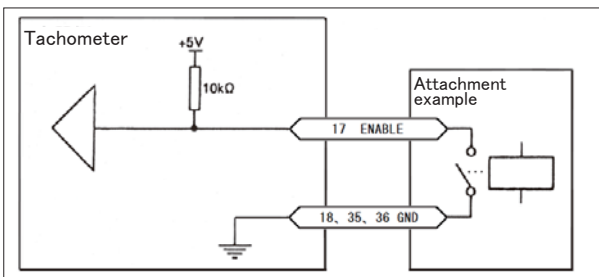
### HOLD input circuit



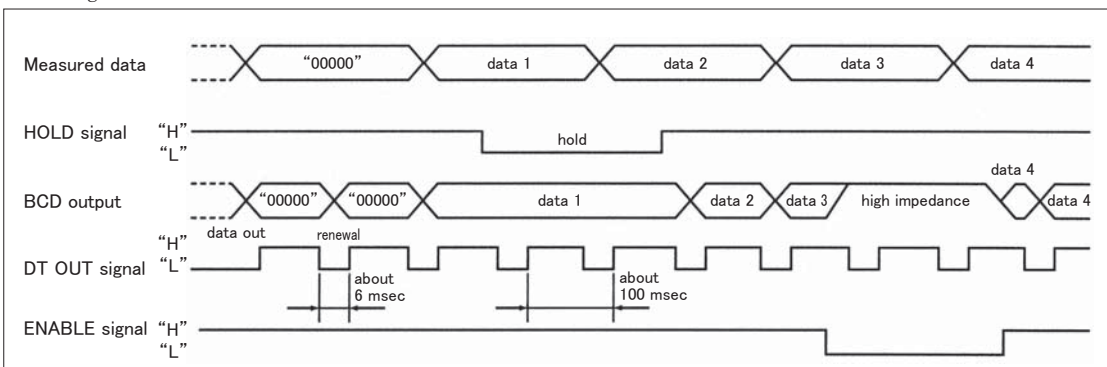
### Output circuit



### ENABLE input circuit



### ● Timing chart



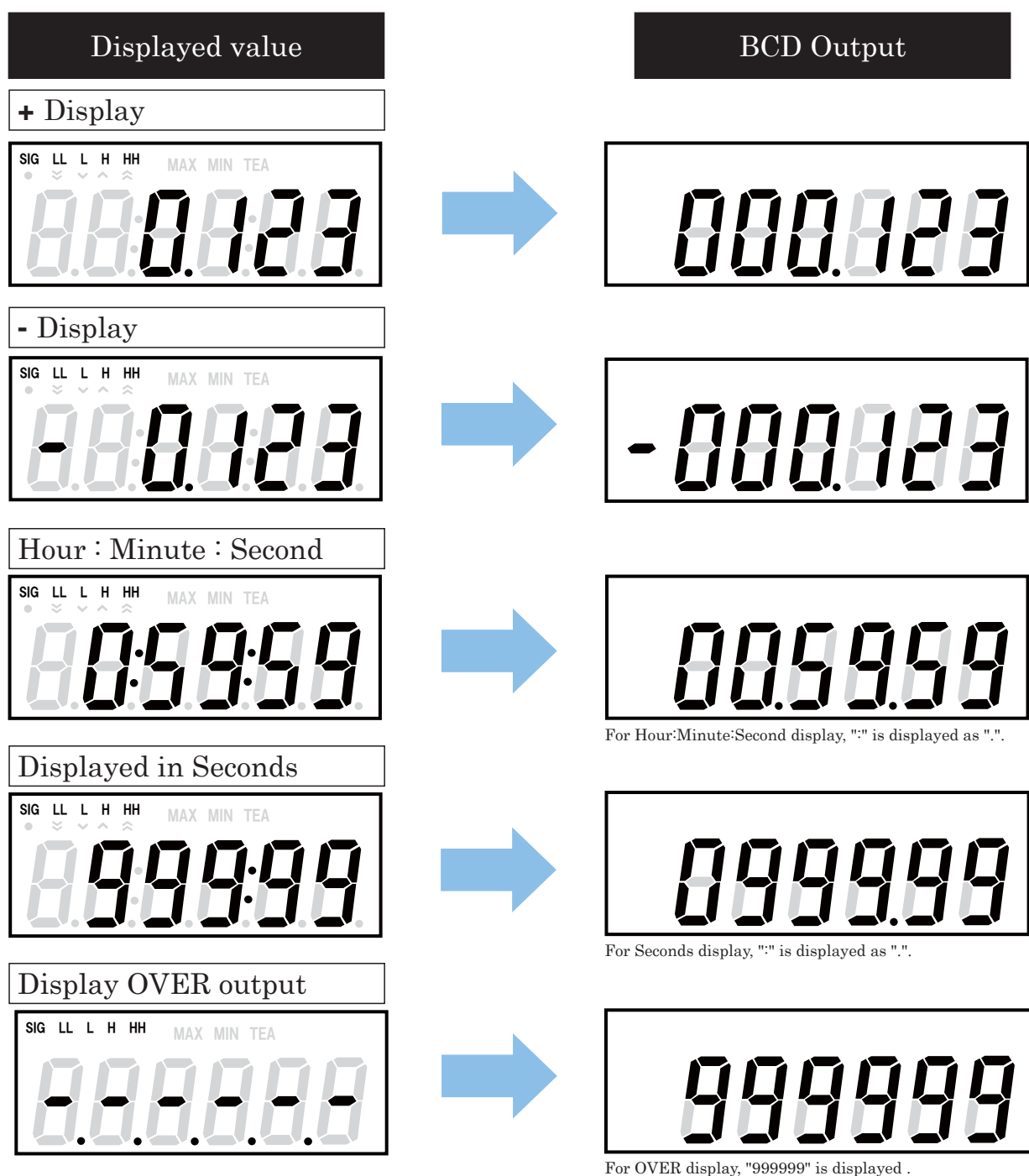
## 21-2. BCD option setting

When the BCD option is attached, the following settings can be specified in the function settings (refer to "18. Setting the function" on page 30).

No.	Setting item	Description	Input range	Default value
F10	BCD output logic	Sets 0 for the negative logic, and 1 for the positive logic ※	0(negative logic)/1(positive logic)	negative logic

※ For F10, only the positive and negative logic of BCD output, decimal point output, PLUS, and OVER can be set.

### ● Offset on (F14 < 0 )





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