LCD Multi Pulse Meter

LP3

USER'S MANUAL

Thank you for purchasing Hanyoung Nux products. Please read the instruction manual carefully before using this product, and use the product correctly. Also, please keep this manual where you can view it any time.

HANYOUNG NUX

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Safety information

Please read the safety information carefully before the use, and use the product correctly. The alerts declared in the manual are classified into Danger, Warning and Caution according to their importance

⚠ DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury
⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor injury or property damage

⚠ DANGER

• The input/output terminals are subject to electric shock risk. Never let the input/output terminals come in contact with your body or conductive substances.

⚠ WARNING

• Any use of the product other than those specified by the manufacturer may result in personal injury or property damage.
• If there is a possibility that a malfunction or abnormality of this product may lead to a serious accident to the system, install an appropriate protection circuit on the outside.
• Since this product is not equipped with a power switch and fuse, install them separately on the outside (fuse rating: 250 V a.c. 0.5 A).
• Please supply the rated power voltage, in order to prevent product breakdowns or malfunctions.
• To prevent electric shocks and malfunctions, do not supply the power until the wiring is completed.
• The product does not have an explosion-proof structure, so avoid using it in places with flammable or explosive gases.
• Never disassemble, modify, process, improve or repair this product, as it may cause abnormal operations, electric shocks or fires.
• Please disassemble the product after turning OFF the power. Failure to do so may result in electric shocks, product abnormal operations or malfunctions.
• Please use this product after installing it to a panel, because there is a risk of electric shock.

⚠ CAUTION

• The contents of this manual may be changed without prior notification.
• Please make sure that the product specifications are the same as you ordered.
• Please make sure that there are no damages or product abnormalities occurred during shipment.
• Please use the product in places where corrosive gases (especially harmful gases, ammonia, etc.) and flammable gases are not generated.
• Please use the product in places where vibrations and impacts are not applied directly.
• Please use the product in places without liquids, oils, chemicals, steam, dust, salt, iron, etc.
• Please do not wipe the product with organic solvents such as alcohol, benzene, etc. (use neutral detergents).
• Please avoid places where large inductive interference, static electricity, magnetic noise are generated.
• Please avoid places with heat accumulation caused by direct sunlight, radiations, etc.
• Please use the product in places with elevation below 2000 m.
• When water enters, short circuit or fire may occur, so please inspect the product carefully.
• When there is a lot of noise from the power, we recommend to use insulation transformer and noise filter. Please install the noise filter to a grounded panel or structure etc. and make the wiring of noise filter output and product power supply terminal as short as possible.
• Tightly twisting the power cables is effective against noise.
• Do not wire anything to unused terminals.
• Please wire correctly, after checking the polarity of the terminals.
• When you install this product to a panel, please use switches or circuit breakers compliant with IEC60947-1 or IEC60947-3.
• Please install switches or circuit breakers at close distance for user convenience.
• We recommend regular maintenance for the continuous safe use of this product.
• Some components of this product may have a lifespan or deteriorate over time.
• The warranty period of this product, is 1 year, including its accessories, under normal conditions of use.
• The preparation period of the contact output is required during power supply. If used as a signal to external interlock circuit, etc. please use a delay relay together.

Suffix code

| Model		Code			Content
LP	□-	□	□	□	LCD Multi Pulse Meter
Dimensions	3				96(W) × 48(H) ㎜
Display digits		5			5 digits
Power voltage			A		100 - 240 V a.c. 50/60Hz
Setting stages				N	Display only
				3	3-stage setting (H/GO/L)
				5	5-stage setting (HH/H/GO/L/LL)

Power supply
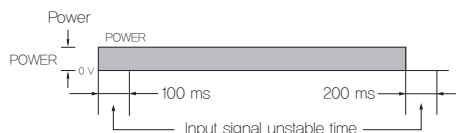
Since the rise and fall time of internal power and external output power is 100 ms after power on and 200 ms after power off, it does not not operate in unstable time to prevent malfunction due to unsafe output operation of external sensor.
• Apply the signal 100 ms after power on.
• Apply power 200 ms after power off.

Specifications

Model		LP3-5A5	LP3-5A3	LP3-5AN
Power voltage		100 - 240 V a.c. 50/60 Hz		
Power Consumption		max. 8 VA	max. 8 VA	max. 6 VA
Display		Negative LCD display		
Character height		counting unit (14.5 mm), setting unit (10 mm)		
Input frequency		contactless (max. 50 KHz, ON/OFF pulse width min. 10 us), contact (max. 30 Hz ON/OFF pulse width min. 16.6 ms)		
Input	voltage	[H] level (4.5 - 24 V d.c.), [L] level (0 - 1 V d.c.), input impedance (4.5 kΩ)		
	non-voltage	impedance during short-circuit (max. 300 Ω), residual voltage (max. 1 V), impedance during open (min. 100 kΩ)		
Measurement range		F1, F2, F10, F11, F12, F13 : 0.0005 ~ 50 KHz F3, F4, F5, F6 : 0.001 s ~ 3200 s F7, F8, F9 : 0 ~ 4×10^9		
Measurement accuracy		F1, F4, F10, F11, F12, F13 : F.S. ±0.05 % rdg ±1 digit F2, F3, F5, F6 : F.S. ±0.01 % rdg ±1 digit		
External power supply		12 V d.c. ±10 % 100 mA		
Display cycle		0.05 sec / 0.5 sec / 1 sec / 2 sec / 4 sec / 8 sec		
Display range		-99999 ~ 99999		
Power outage compensation		approx. 10 years (non-volatile EEPROM only)		
Control output		HH (SPST), H (SPST), GO (SPST), L (SPST), LL (SPST) * HH/H output COM common. * LL/L output COM common	H (SPDT), GO (SPST), L (SPDT)	–
		NO contact (250 V a.c. 5 A resistive load), NC contact (250 V a.c. 2 A resistive load)		
Relay life	electrical	100,000 times min.		
	mechanical	10,000,000 times min. (250 V a.c. 2A)		
Degree of protection		IP66 (product front)		
Vibration durability		10 - 55Hz double amplitude 0.75 mm X, Y, Z each direction, 2 h		
Insulation Resistance		100 MΩ min. (500 V d.c.), conductive part terminal – unfilled metal		
Dielectric strength		2,000 V a.c. 60Hz for 1 minute (different live part terminals)		
Noise immunity		±2000 V (pulse width I μs, square-wave noise by noise simulator is applied among the power terminals)		
Ambient temperature		-10 ~ 50 ℃ (without condensation)		
Storage temperature		-20 ~ 60 ℃ (without condensation)		
Ambient humidity		35 ~ 85 % RH		

Part names and functions
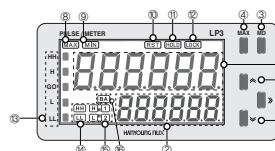
① PV display : displays measured value, maximum value, minimum value, parameter setting item
② SV display : displays HH/H/L/LL comparative value
③ MODE KEY
 : enters and quits function setting mode (hold for at least 3 seconds in ON state)
 : auto save function set value during termination
 : used to switch the SV display in operation mode
(HH comparative value / H comparative value / L comparative value / LL comparative value)
: used to switch the SV display in D output mode (comparative value / H deviation value / L deviation value)

④ MAX KEY : used to switch the PV display in operation mode (measured value / max. measured value / min. measured value)

⑤ Shift KEY
: Enters comparative value setting mode and shifts the comparative value digits in operation mode
: Enters comparative value and deviation value setting mode and shifts the comparative value/deviation value digits in D output mode

⑥ DOWN KEY
: reduces comparative value in function setting mode and comparative value setting mode
: initializes maximum and minimum values as current display value when the maximum value is displayed in operation mode, if you press and hold it for at least 1 second
: initializes minimum value as current display value when the minimum value is displayed in operation mode, if you press and hold it for at least 1 second
: saves current display value as comparative value if you press and hold it for at least 1 second in D output mode

⑦ UP KEY
: increases comparative value in function setting mode and comparative value setting mode
: used when switching BANK number in operation mode (hold for at least 1 second ON state) However, if BANK switch is set to 'KEY' in function setting mode

⑧ Max. indicator : illuminates when max. measured value is displayed to PV display in operation mode
⑨ MIN indicator : illuminates when min. measured value is displayed to PV display in operation mode
⑩ RESET input indicator: illuminates when external RESET signal is applied (illuminates only in F9)
⑪ HOLD input indicator : illuminates when external HOLD signal is applied
⑫ LOCK setting indicator : illuminates when LOCK is set in function setting mode
⑬ Timer setting indicator: illuminates when TIM/TTIM/BTIM operation modes are set, flashes during timing operation
⑭ SV display status indicator : in operation mode, the selected HH/H/L/LL comparative value indicators illuminate when switching SV display to HH comparative value, H comparative value, L comparative value, LL comparative value
⑮ BANK number indicator : the selected BANK number indicator illuminates when selecting BANK_1 or BANK_2
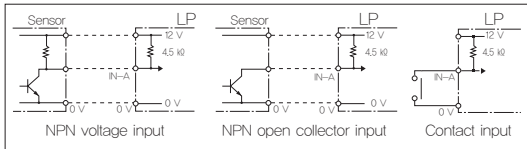⑯ BANK indicator : indicator illuminates when setting BANK use

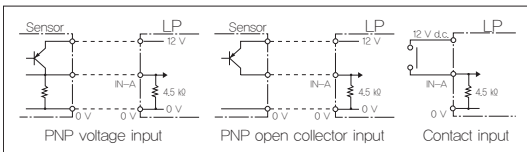## Input specifications and connection

■ Input specification

● Contactless input
· Input frequency : max. 50 KHz
· Input duty ratio : 50 % (1:1)
· Input ON/OFF pulse width : each min. 10 us
· Input voltage level : HIGH (4.5 - 24 V d.c.), LOW (0 – 1 V d.c.)

● Contact input
· Input frequency : max. 30 Hz
· Input duty ratio : 50 % (1:1)
· Input ON/OFF pulse width : min. 16.7 ms each
· Contact specifications : approx. 12 V d.c. 2 mA load current open / close contact
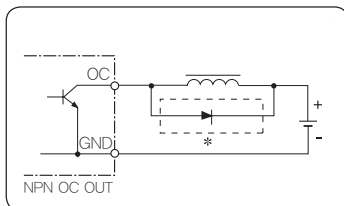
■ Input connection

● Non–voltage input (NPN)

NPN voltage input | NPN open collector input | Contact input

● Voltage input (PNP)

PNP voltage input | PNP open collector input | Contact input

· Set NPN / PNP input according to the the specifications of the sensors connected to external inputs IN–A and IN–B in function setting mode. (NPN set as default)

■ Output connection

NPN OC OUT

● Example of contactless (transistor) output
· When using inductive load (relay, etc.), connect surge absorber (diode, varistor),etc. at both load terminals. Internal circuit and contactless output are isolated, so please use same as GND. For the contactless output,select the power supply for the load and the load,in order not to exceed max. of 30 V 100 mA.
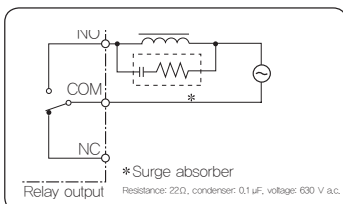
● Example of contact output
· Because of 250 V a.c. NO 5 A (load resistance), NC 2 A (load resistance) make sure that thetransient current does not flow. The wiring follows the normal iring method.

Relay output ＊Surge absorber Resistance: 22Ω, condenser: 0.1 μF, voltage: 630 V a.c.

Initial values of parameter

Setting item	Initial value	Setting item	Initial value
Operation mode	F 1	Start compensation timer	000
Input A sensor type	nPn-L	Power outage memory	CLEAr
Input B sensor type	nPn-L	BANK switching	oFF
Output mode	oUt-S	Lock	oFF
Input A prescale mantissa	6.00000	BANK number	1
Input A prescale index	10 1	Input A prescale mantissa	6.00000
Input B prescale mantissa	1.00000	Input A prescale index	10 1
Input B prescale index	10 0	Input B prescale mantissa	1.00000
Decimal point position	000000	Input B prescale index	10 0
Numeral system	10	Decimal point position	000000
Time range	0.01	Numeral system	10
Display cycle	0.05	Time range	0.01
Parameter initialization	oFF	Display cycle	0.05
Hysteresis	0000	HH comparative value	⌐99999
Input A AUTO–ZERO	99999	H comparative value	⌐99999
Input B AUTO–ZERO	99999	L comparative value	-99999
Output limit	L-oUt	LL comparative value	-99999

Output limit function table for each output mode

out. limit \ out. mode	OUT–S	OUT–H	OUT–L	OUT–B	OUT–F	OUT–D
Comparative output limit	O	X	X	O	X	O
Start compensation timer	O	O	O	O	O	O

Parameter table for each product

* There are some parameters that are not used for each product, please refer to this table. (O: used, X: not used)

parameter	operation mode	LP3–5AN	LP3–5A3	LP3–5A5
Basic functions (FUNC)	F–MD	O	O	O
	IN–A	O	O	O
	IN–B	O	O	O
	O–MD	X	O	O
	P–AX	O	O	O
	P–AY	O	O	O
	P–BX	O	O	O
	P–BY	O	O	O
	DOT SCAL	O	O	O
	DOT RANG	O	O	O
	D–REF	O	O	O
Extended functions (E–FUN)	F–INI	O	O	O
	HYS	X	O	O
	AZ–A	O	O	O
	AZ–B	O	O	O
	O–LIM	X	O	O
	S–TMR	X	O	O
	BACK	O	O	O
	B–CHG	O	O	O
	LOCK	O	O	O
BANK functions	BANK	O	O	O
	P–AX	O	O	O
	P–AY	O	O	O
	P–BX	O	O	O
	DOT SCAL	O	O	O
	DOT RANG	O	O	O
	D–REF	O	O	O
	Bx–HH	X	X	O
	Bx–H	X	O	O
	Bx–L	X	O	O
	Bx–LL	X	X	O
Comparative values	HH	X	X	O
	H	X	O	O
	L	X	O	O
	LL	X	X	O

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Parameter table for each operation mode

param / op.mode		F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13
Basic functions (FUNC)	F–MD	O	O	O	O	O	O	O	O	O	O	O	O	O
	IN–A	O	O	O	O	O	O	O	O	O	O	O	O	O
	IN–B	X	O	X	O	O	X	O	O	O	O	O	O	O
	O–MD	O	O	O	O	O	O	O	O	X	O	O	O	O
	P–AX	O	O	X	O	X	X	O	O	O	O	O	O	O
	P–AY	O	O	X	O	X	X	O	O	O	O	O	O	O
	P–BX	X	X	X	X	X	X	X	X	X	O	O	O	O
	P–BY	X	X	X	X	X	X	X	X	X	O	O	O	O
	DOT SCAL	O	X	O	X	X	O	X	O	X	O	X	O	X
	DOT RANG	X	X	X	O	O	O	O	X	X	X	X	X	X
	D–REF	O	X	X	X	X	X	X	X	X	O	O	O	O
Extended functions (E–FUN)	F–INI	O	O	O	O	O	O	O	O	O	O	O	O	O
	HYS	O	X	X	X	X	X	X	X	X	O	O	O	O
	AZ–A	O	X	X	O	X	X	X	X	X	O	O	O	O
	AZ–B	X	X	X	X	X	X	X	X	X	O	O	O	O
	O–LIM	O	O	O	O	O	O	O	O	X	O	O	O	O
	S–TMR	O	O	O	O	O	O	O	O	O	O	O	O	O
	BACK	X	X	X	X	X	X	X	X	O	X	X	X	X
	B–CHG	O	O	O	O	O	O	O	O	O	O	O	O	O
	LOCK	O	O	O	O	O	O	O	O	O	O	O	O	O

param / op.mode		F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13
BANK function	BANK	O	O	O	O	O	O	O	O	O	O	O	O	O
	P–AX	O	O	X	O	X	X	O	O	O	O	O	O	O
	P–AY	O	O	X	O	X	X	O	O	O	O	O	O	O
	P–BX	X	X	X	X	X	X	X	X	X	O	O	O	O
	P–BY	X	X	X	X	X	X	X	X	X	O	O	O	O
	DOT SCAL	O	X	O	X	O	X	O	X	O	X	O	X	O
	DOT RANG	X	X	O	O	X	O	X	O	O	X	X	X	X
	D–REF	O	X	X	X	X	X	X	X	X	O	O	O	O
	Bx–HH	O	O	O	O	O	O	O	O	O	O	O	O	O
	Bx–H	O	O	O	O	O	O	O	O	O	O	O	O	O
	Bx–L	O	O	O	O	O	O	O	O	O	O	O	O	O
	Bx–LL	O	O	O	O	O	O	O	O	O	O	O	O	O
Comp. values	HH	O	O	O	O	O	O	O	O	O	O	O	O	O
	H	O	O	O	O	O	O	O	O	O	O	O	O	O
	L	O	O	O	O	O	O	O	O	O	O	O	O	O
	LL	O	O	O	O	O	O	O	O	O	O	O	O	O

View and set comparative value

- If you press **MD** in operation mode HH/H/L/LL comparative value will be displayed on SV display sequentially.
- To change the HH/H/L/LL comparative value select the HH/H/L/LL comparative value to change and press **》** to enter comparative value setting mode.
- If you enter the comparative value setting mode, the comparative value will flash and you can change the comparative value with **》** / **⌄** / **⌃** .
- After setting the comparative value use **MD** to save the changed comparative value.
- Without key inputs for 1 minute in comparative value setting mode it returns to operation mode with the comparative value before change, without saving.
- In D output mode, you can set comparative value, H deviation value, L deviation value directly with **MD** (same setting method as comparative value).
- In D output mode, if you press and hold **⌄** for at least 1 sec. the current measured value will be changed and saved as comparative value.
- HH / H / L / LL comparative values are displayed only in the models that can set them (for LP3–5A3 model, only H/L comparative values are displayed).

■ Operation mode
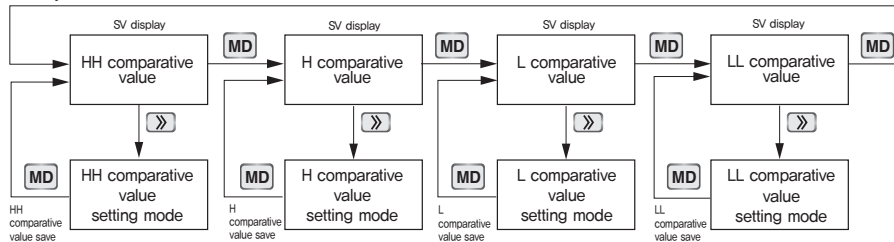
■ Operation mode (D output mode)

Comparative value set range

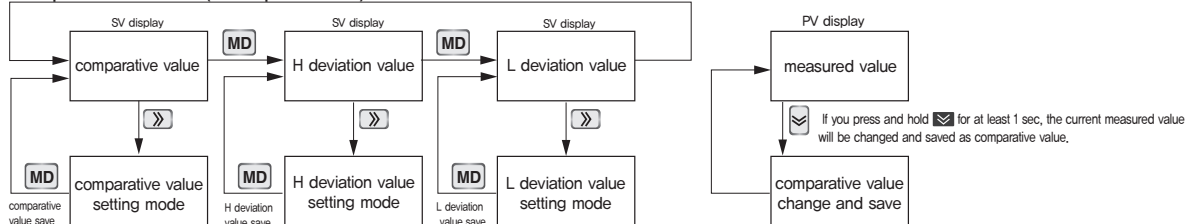| Operation mode	Comparative value setting range
F1, F2, F7, F8, F9, F10, F12	0 ~ 99999
F3, F4, F5, F6	0 ~ setting time range
F11, F13	–99999 ~ 99999

* The comparative value setting range depends on decimal point setting position.

Setting time range		
Parameter	Decimal number	Sexagesimal number
0.01	999.99s	9m59.99s
0.1	9999.9s	59m59.9s
SEC	99999s	9h59m59s
MIN	99999m	99h59.9m

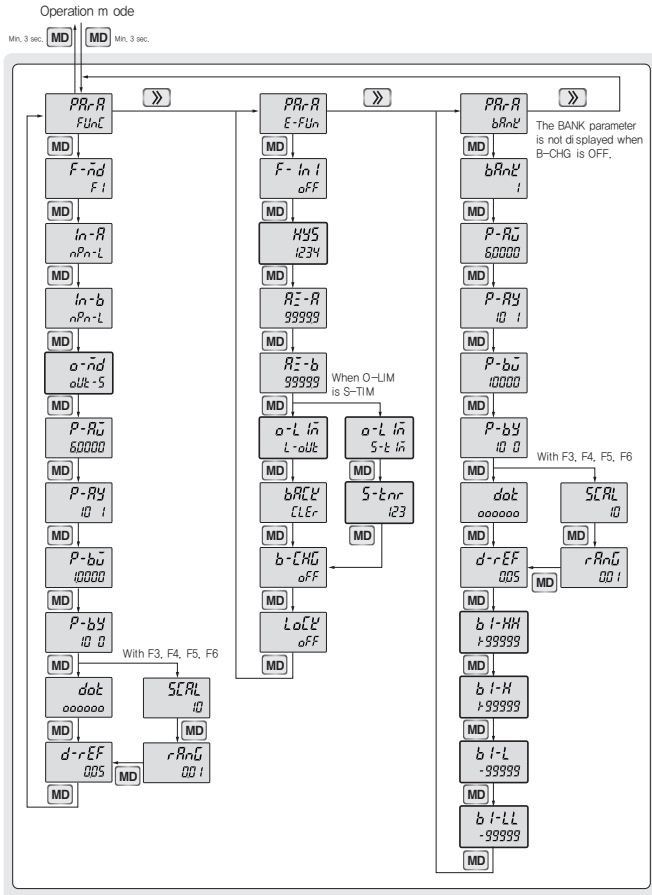## View and reset maximum and minimum values

- In operation mode, if you press **Max.** max. measured value and min. measured value will be displayed on PV display.
- When the max. measured value is displayed on PV display, the "MAX" indicator illuminates.
- When the min. measured value is displayed on PV display, the "MIN" indicator illuminates.
- When the max. measured value is displayed on PV display, if you press and hold **⌄** on ON state for at least 1 second, the max. measured value and min. measured value will be initialized as the current measured value.
- When the min. measured value is displayed on PV display, if you press and hold **⌄** on ON state for at least 1 second, the min. measured value will be initialized as the current measured value.
- The measurement for the input is active also while the max. measured value and min. measured value are displayed.
- Max. measured value and min. measured value are not displayed in F9 operation mode.
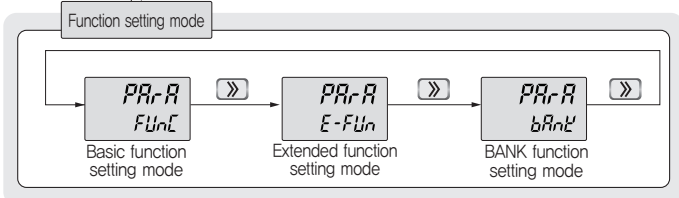
■ Operation mode
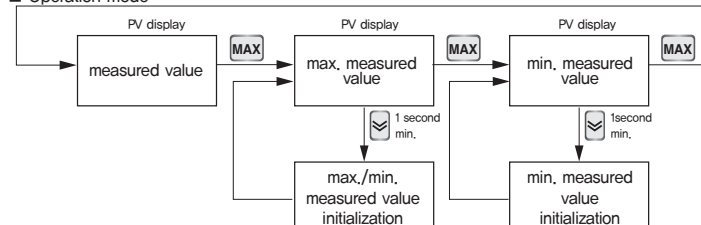
Parameter configuration

- In operation mode, if you press and hold **MD** for at least 3 seconds on ON state, you can enter to function setting mode.
- In function setting mode, if you press and hold **MD** for at least 3 seconds on ON state you can return to operation mode (changed parameter set value auto–save).
- The parameters contained in the rectangles with bold borders are only displayed on the comparative output models.
- There are parameters that are not displayed depending on the model and operation mode (see chart).

Function setting modes

LCD display	Name	Settings
PArA FUnC	Basic functions	● Configuration by parameter that sets basic items required for the pulse meter operations, such as operation mode, sensor type, output mode, prescale, decimal point position, time range, display cycle, etc.
PArA E-FUn	Extended functions	● Configuration by parameter that sets additional pulse meter items, such as parameter initialization, output hysteresis, AUTO–ZERO, output limit, start compensation timer, power outage memory, BANK switching, lock. etc.
PArA bAnk	BANK function	● Configuration by parameter that sets items required for the BANK function use, such as operation mode, sensor type, output mode, prescale, decimal point position, time range, display cycle, HH comparative value, H comparative value, L comparative value, LL comparative value, etc. ● It consists of 2 BANKs, and individually sets required items for each BANK number ● The BANK function setting is activated only when BANK switching of extended functions is set to 'KEY' or 'EX–IN'. ● BANK switching can be switched by KEY or external input.

* The measurement stops in function setting mode,.

■ Basic function setting modes

Setting item	LCD display	Settings	Initial value
F-nd F1	Operation mode	● selects operation mode (13 types) F1↔F2↔F3↔F4↔F5↔F6↔F7↔F8↔F9↔F10↔F11↔F12↔F13	F1
In-A nPn-L	Input A sensor type	● selects the sensor type of input A ● consists of NPN–L, NPN–H, PNP–L, PNP–H (select and use NPN–L or PNP–L for contact input) nPn-L↔nPn-H↔PnP-L↔PnP-H	NPN–L
In-b nPn-L	Input B sensor type	● selects the sensor type of input B – used only in F2, F5, F7, F8, F9, F10, F11, F12, F13 modes. ● consists of NPN–L, NPN–H, PNP–L, PNP–H (select and use NPN–L or PNP–L for contact input) nPn-L↔nPn-H↔PnP-L↔PnP-H	NPN–L
o-nd oUt-S	Output mode	● output mode selection – used in all operation modes except F9 mode (only used in comparative output models) ● consists of standard output mode (S), HIGH output mode (H), LOW output mode (L), ONE–SHOT output mode (F), deviation output mode (D) ● F9 mode is fixed to HIGH output mode (H). oUt-S↔oUt-H↔oUt-L↔oUt-b↔oUt-F↔oUt-d	OUT–S
P-Au 10000	Input A prescale mantissa	● sets input A prescale mantissa (AX) – used only in F1, F2, F4, F7, F8, F9, F10, F11, F12, F13 modes. ● setting range : 0.0000 ~ 9.9999 0.00000 ~ 9.99999	1.00000
P-AY 10 0	Input A prescale index	● sets input A prescale index (AY) – used only in F1, F2, F4, F7, F8, F9, F10, F11, F12, F13 modes. ● setting range : $10^{-9} \sim 10^{9}$ $10-9 \sim 10\ 9$	10^{0}
P-bu 10000	Input B prescale mantissa	● sets input B prescale mantissa (BX) – used only in F10, F11, F12, F13 modes. ● setting range : 0.0000 ~ 9.9999 0.00000 ~ 9.99999	1.00000
P-bY 10 0	Input B prescale index	● sets input B prescale index (BY) – used only in F10, F11, F12, F13 modes. ● setting range : $10^{-9} \sim 10^{9}$ $10-9 \sim 10\ 9$	10^{0}
dot 000000	Decimal point position	● selects decimal point position of display value – used only in F1, F2, F7, F8, F9, F10, F11, F12 modes. ● comparative value setting range differs according to the decimal point setting position. 000000↔0.00000↔00.0000↔000.000↔0000.00↔00000.0	000000
SCAL 10	Numeral system	● selects the numeral system of measured time – used only in F3, F4, F5, F6 modes. ● consists of decimal and sexadecimal 10↔60	10
rAnG 0.01	Time range	● selects measured time range – used only in F3, F4, F5, F6 modes. ● decimal time range : 0.01 (0~999.99S), 0.1 (0~9999.9S), SEC (0~99999S), MIN (0~99999M) ● sexadecimal time range : 0.01 (0~9M59.99S), 0.1 (0~59H59M59.9S), SEC (0~9H59M59S), MIN (0~99H59M59.9M) 0.01↔0.1↔SEC↔nIn	0.01
d-rEF 0.05	Display cycle	● selects display cycle – only in F1, F10, F11, F12, F13 ● consists of 0.05, 0.5, 1, 2, 4, and 8 sec. – The measured value is updated according to display cycle. 0.05↔0.5↔1↔2↔4↔8	0.05

4

■ Expansion function setting modes

Setting item	LCD display	Settings	Initial value
`F-Ini` `oFF`	Initial mode	● initializes all parameter set values ● consists of OFF and ON – when ON is selected, all parameter set values are initialized to the default set values `oFF ↔ on`	OFF
`HYS` `1234`	Hysteresis	● sets hysteresis value for output – only in F1, F10, F11, F12, F13 (only used with comparative output models) ● hysteresis range depends on decimal point setting position ● setting range : 00000 (0~9999), 0000.0 (0.0~999.9), 000.00 (0.00~99.99), 00.000 (0.000~9.999), 0.0000 (0.0000~0.9999) `0000 ~ 9999`	0000
`AZ-A` `99999`	Input A AUTO–ZERO	● sets input A AUTO–ZERO time - used only in F1, F4, F10, F11, F12, F13 modes. ● setting range : 0.0 ~ 9999.9 sec. `0000.0 ~ 99999`	9999.9
`AZ-b` `99999`	Input B AUTO–ZERO	● sets input B AUTO–ZERO time - used only in F10, F11, F12, F13 modes. ● setting range : 0.0 ~ 9999.9 sec. `0000.0 ~ 99999`	9999.9
`o-Lin` `L-oUt`	Output limit	● selects comparative output limit – used in all operation modes except F9 (only used in comparative output models) ● consists of L, LL output limit and start compensation timer. When L–OUT is selected, L output and LL output are limited. When S–TIM is selected, the comparative output is limited by start compensation timer. `L-oUt ↔ S-tim`	L–OUT
`S-tmr` `123`	Start compensation timer	● Sets comparative output limit time of start compensation timer – You can set output limit function when S–TIM is set ● setting range : 0.0 ~ 99.9 sec. `00.0 ~ 99.9`	0.0
`bACU` `CLEr`	Power outage memory	● Saves final count value when power is off – only in F9 ● Consists of CLEAR and SAVE ● When SAVE is selected, the final count value is saved. `CLEr ↔ SAuE`	CLEAR
`b-CHG` `oFF`	BANK switching	● Selects the activation of BANK function ● When the BANK function is activated, the comparative value, prescale, decimal point position,time range, display cycle are measured with the value set in BANK. ● OFF selection: deactivates BANK function ● KEY selection : switches BANK number by ⩒ (hold for at least 1sec, ON state) ● EX–IN selection:switches BANK number by external BANK input `oFF ↔ UEY ↔ Eu-In`	OFF
`LoCU` `oFF`	Lock	● Selects the activation of lock function ● OFF selection : unlocks keys and parameters ● KEY selection : locks ⩜, ⩒, ⩙ in operation mode (only comparative value checking is possible,not comparative value setting) ● PAR selection : locks parameters (parameter change is not possible, comparative value setting is possible) ● K–P selection : sets key lock and parameter lock simultaneously (comparative value setting and parameter change are not possible) ● BNK selection : locks BANK (BANK setting is not possible) `oFF ↔ UEY ↔ PAr ↔ U-P ↔ bnU`	OFF

■ BANK function setting modes

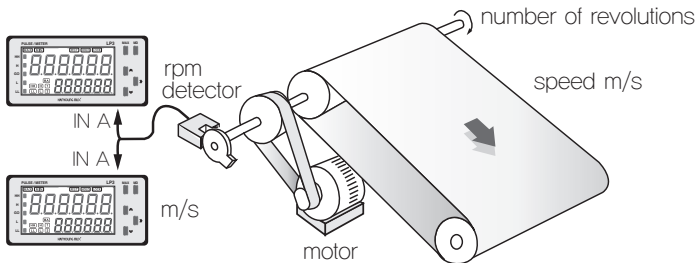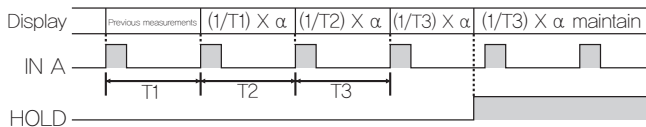| Setting item	LCD display	Settings	Initial value
`bAnU` `1`	BANK number	● selects BANK number ● consists of BANK_1 and BANK_2 - individually sets comparative value, prescale, decimal point position, time range, display cycle for each BANK `1 ↔ 2`	1
`P-Au` `10000`	Input A prescale mantissa	● sets BANK_1,2 input A prescale mantissa (AX) - used only in F1, F2, F4, F7, F8, F9, F10, F11, F12, F13 modes. ● setting range : 0.0000 ~ 9.9999 `000000 ~ 999999`	1.00000
`P-AY` `10 0`	Input A prescale index	● sets BANK_1,2 input A prescale index (AY) - used only in F1, F2, F4, F7, F8, F9, F10, F11, F12, F13 modes ● setting range : 10^{-9} ~ 10^9 `10-9 ~ 10 9`	10^0
`P-bu` `10000`	Input B prescale mantissa	● sets BANK_1,2 input B prescale mantissa (BX) - F10, F11, F12, F13 modes ● setting range : 0.0000 ~ 9.9999 `000000 ~ 999999`	1.00000
`P-bY` `10 0`	Input B prescale index	● sets BANK_1,2 input B prescale index (BY) - used only in F10, F11, F12, F13 modes ● setting range : 10^{-9} ~ 10^9 `10-9 ~ 10 9`	10^0

`dot`
`000000`
	Decimal point position	● selects display value decimal point position of BANK_1,2 - used only in F1, F2, F7, F8, F9, F10, F11, F12, F13 modes
		● The comparative value setting range depends on the decimal point setting position
		`000000 ↔ 0.00000 ↔ 00.0000 ↔ 000.000`
		`↔ 0000.00 ↔ 00000.0`
			000000

`SCAL` `10`	Numeral system	● selects BANK_1,2 measured time numeral system- used only in F3, F4, F5, F6 modes ● Consists of decimal and sexadecimal `10 ↔ 60`	10
`rAnG` `001`	Time range	● selects BANK_1,2 measured time range - used only in F3, F4, F5, F6 modes. ● decimal time range : 0.01 (0~999.99S), 0.1 (0~9999.9S), SEC (0~99999S), MIN (0~99999M) ● sexadecimal time range : 0.01 (0~9M59.99S), 0.1 (0~59M59.9S), SEC (0~9H59M59S), MIN (0~99H59.9M) `0.01 ↔ 0.1 ↔ SEC ↔ mIn`	0.01
`d-rEF` `005`	Display cycle	● selects BANK_1,2 display cycle - used only in F1, F10, F11, F12, F13 modes. ● consists of 0.05 sec., 0.5 sec., 1 sec., 2 sec., 4 sec., 8 sec. The measured value is updated according to display cycle. `0.05 ↔ 0.5 ↔ 1 ↔ 2 ↔ 4 ↔ 8`	0.05
`b1-HH` `+99999`	HH comparative value	● sets BANK_1,2 HH comparative value – not used in D output mode ● HH comparative value setting range depends on decimal point setting position. (refer to comparative value setting range) `-99999 ~ +99999`	+99999
`b1-H` `+99999`	H comparative value	● sets BANK_1,2 H comparative value - used as H deviation value in D output mode ● H comparative value setting range depends on decimal point setting position. (refer to comparative value setting range) `-99999 ~ +99999`	+99999
`b1-L` `-99999`	L comparative value	● sets BANK_1,2 L comparative value –used as L deviation value in D output mode ● L comparative value setting range depends on decimal point setting position. (refer to comparative value setting range) `-99999 ~ +99999`	–99999
`b1-LL` `-99999`	LL comparative value	● sets BANK_1,2 LL comparative value – not used in D output mode ● LL comparative value setting range depends on decimal point setting position. (refer to comparative value setting range) `-99999 ~ +99999`	–99999

Operation Modes

■ F1 mode (frequency / revolution / speed)

− Measures the pulse cycle of input A and displays it as frequency, number of revolutions, speed

- number of revolutions (rpm) = $f \times \alpha$ ($\alpha = 60$)   * in case of multiple detections $\alpha = \dfrac{60}{N}$
- frequency (Hz) = $f \times \alpha$ ($\alpha = 1$)
- speed (m/min) = $f \times \alpha$ ($\alpha = 60 \times \ell$)   * in case of multiple detections $\alpha = \dfrac{60\,\ell}{N}$
- $L = \pi \times D$
- $\ell = L / N$

* default unit: rpm

Display value	Unit	Prescale value (α)
Number of revolutions	rps	1
	rpm	60 (initial value)
Frequency	Hz	1
	KHz	0.001
Speed	mm/s	1000 ℓ
	cm/s	100 ℓ
	m/s	1 ℓ
	m/mon	60 ℓ
	km/hour	3.6 ℓ

※ α : prescale value
※ N : number of detections (pulses per revolution)
※ D : roller diameter
※ ℓ : Movement distance per pulse
※ π : 3.141592
※ f : Number of input pulses per second
※ L : roller circumference

■ F2 mode (moving speed)

− Measures and displays the moving speed from pulse ON of input A to pulse ON of input B

- moving speed (m/s) = $f \times \alpha$ ($\alpha = L$)

※ $f = \left(\dfrac{1}{\text{Time from ON of input A to ON of input B (sec)}} \right)$

※ α : prescale value
※ L : distance from sensor A to sensor B (m)

* default unit : m/s

Display value	Unit	prescale value (α)
Speed	mm/s	1000
	cm/s	100
	m/s	1 (initial value)
	m/Min.	60
	km/hour	3.6

* ta (return time) = 20ms
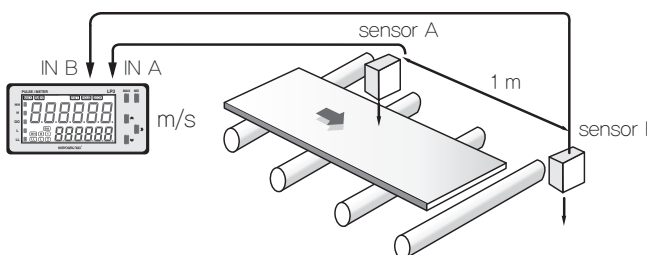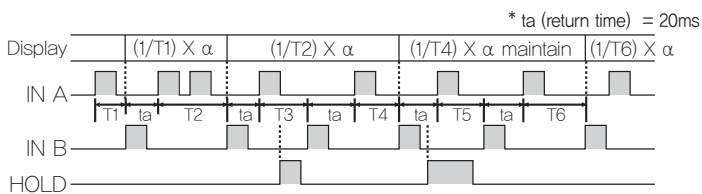
■ F3 mode (cycle)

− Measures and displays pulse cycle of input A by time
− The cycle indicates the time from the previous input to the current input.

- cycle (T) = t
- t : time from pulse ON of input A to next pulse ON (sec)

* default unit: 99.999s

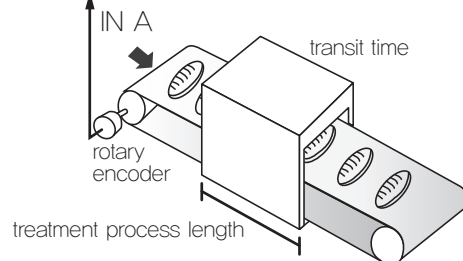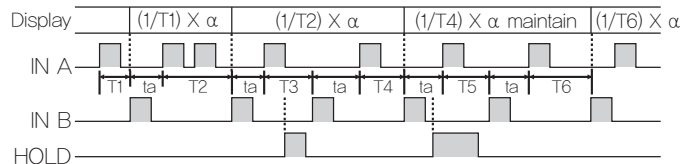| Setting time range		
Parameter	Decimal	Sexadecimal
0.01	999.99s	9m59.99s
0.1	9999.9s	59m59.9s
SEC	99999s	9h59m59s
MIN	99999m	99h59.9m
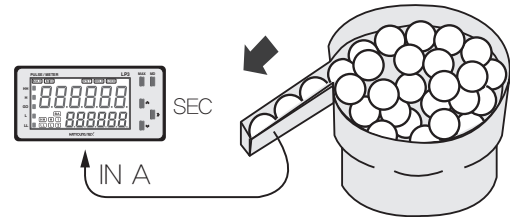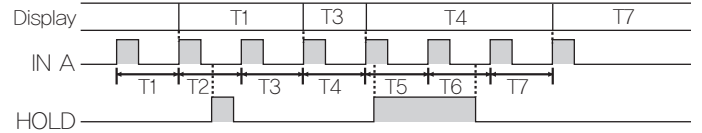
■ F4 mode (transit time)

− Measures the pulse cycle of input A by time and displays the arbitrary distance as transit time
− The period indicates the time from the previous input to the current input.

- transit time(T) = $t \times \alpha$ ($\alpha = \ell / L$)
- $L = \dfrac{\pi D\,(\text{roller circumference to move the belt})}{N\,(\text{number of pulses per encoder revolution})}$

* default unit: 99.999s

※ t : measured time
※ L : Movement distance per pulse
※ ℓ : Treatment process length (m)
※ D : roller diameter
※ π : 3.141592

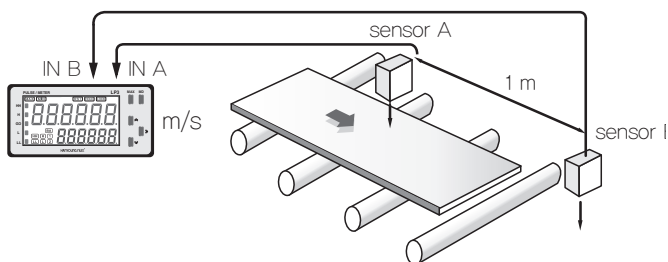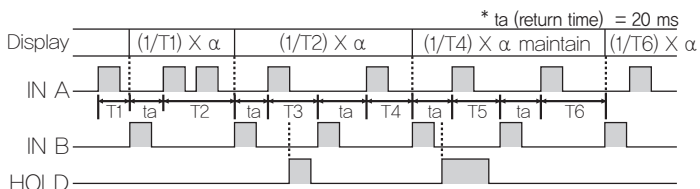| Setting time range		
Parameter	Decimal	Sexadecimal
0.01	999.99s	9m59.99s
0.1	9999.9s	59m59.9s
SEC	99999s	9h59m59s
MIN	99999m	99h59.9m

6

■ F5 mode (time difference)

– Measures and displays the time from pulse ON of input A to pulse ON of input B

- time difference (T) = t(INA ~ INB)
- t(INA ~ INB) : measured time from pulse ON of input A to pulse ON of input B

* default unit: 99.999s

Setting time range		
Parameter	Decimal	Sexadecimal
0.01	999.99s	9m59.99s
0.1	9999.9s	59m59.9s
SEC	99999s	9h59m59s
MIN	99999m	99h59.9m

* ta (return time) = 20 ms

■ F6 mode (time width)

– Measures and displays pulse ON time of input A

- time width (T) = t
- t : Pulse ON measured time of input A

* default unit: 99.999s

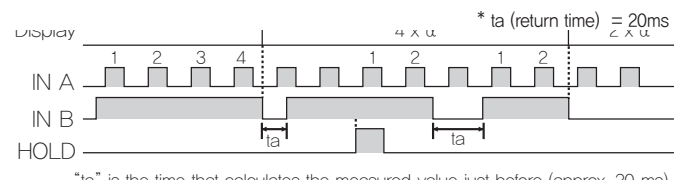| Setting time range		
Parameter	Decimal	Sexadecimal
0.01	999.99s	9m59.99s
0.1	9999.9s	59m59.9s
SEC	99999s	9h59m59s
MIN	99999m	99h59.9m

* ta (return time) = 20ms
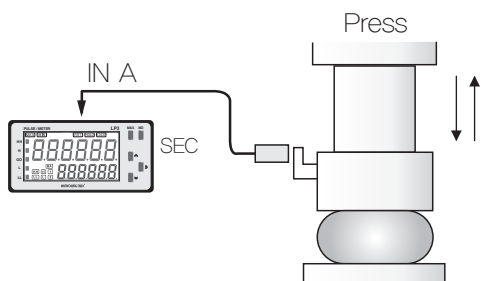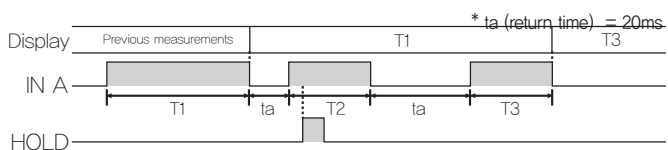
■ F7 mode (measured length)

– Counts and displays the number of pulses of input A while pulse of input B is ON

- Measurement length = P × α
- L = π × D
- ℓ = L / N

※ α : prescale value
※ L : roller circumference
※ D : roller diameter
※ π : 3.141592
※ P : number of pulses input to input A while sensor input B (IN B) is ON
※ N : number of pulses output from the encoder when the roller makes one turn
※ ℓ : movement distance per 1 input pulse

* default unit: count value (EA)

Display value	Unit	Prescale value (α)
Pulse width	mm	1000 ℓ
	cm	100 ℓ
	m	1 ℓ
Quantity	EA.	1 (initial value)

* ta (return time) = 20ms

"ta" is the time that calculates the measured value just before (approx. 20 ms)
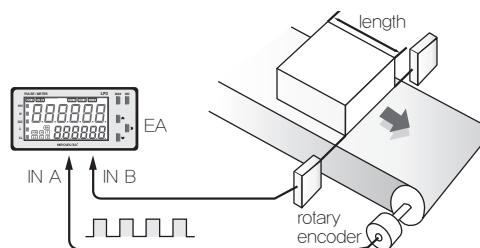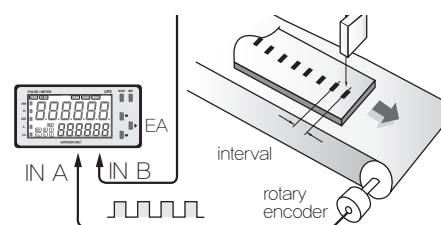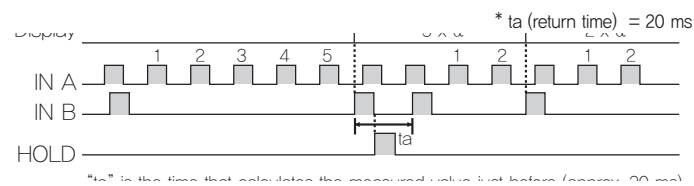
■ F8 mode (interval)

– Counts and displays the number of pulses of input A during the pulse cycle of input B

- interval = P × α (α = ℓ)
- L = π × D
- ℓ = L / N

※ α : prescale value
※ L : roller circumference
※ D : roller diameter
※ π : 3.141592
※ P : number of pulses input to input A during sensor input B pulse cycle
※ N : number of pulses output from the encoder when the roller makes one turn
※ ℓ : movement distance per 1 input pulse

* default unit: count value (EA)

Display value	Unit	Prescale value (α)
Pulse width	mm	1000 ℓ
	cm	100 ℓ
	m	1 ℓ
Quantity	EA.	1 (initial value)

* ta (return time) = 20 ms

"ta" is the time that calculates the measured value just before (approx. 20 ms)
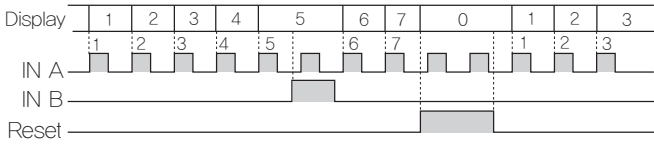
■ F9 mode (integration)

- Counts and displays the number of pulses of input A
- Count stops while input B pulse is ON
- When an external RESET signal is applied, the count value is initialized.
- The maximum counting speed is 50 Kcps.
- If the power outage memory function is set to SAVE, the current count value is saved even if the power is turned off (when the power is applied again, it is counted from the saved count value.)

• integration = P X α

※ P : number of pulses input to sensor input A
※ α : prescale value

* default unit: count value (EA)

Display value	Unit	Prescale value (α)
Quantity	EA.	1 (initial value)

Display | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | 1 | 2 | 3

IN A
IN B
Reset

EA
IN A
Proximity sensor

■ F10 mode (absolute ratio)

- Measures the pulse cycle of input B for the pulse cycle of input A and displays it as ratio

• absolute ratio (%) = $\dfrac{fb \times \beta}{fa \times \alpha}$ X 100(%)

※ fa : sensor input A frequency
※ fb : sensor input B frequency
※ α : sensor input A prescale value
※ β : sensor input B prescale value

Display value	Unit
Absolute ratio	%

fa
fb

※ When the HOLD signal is ON, the display value is maintained unchanged
※ When the HOLD signal is OFF, the display value changes to the measured value.

IN A   IN B   encoder   liquid 1   encoder   liquid 2
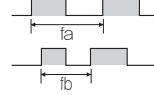motor   motor
mix (liquid 1 + liquid 2)

■ F11 mode (error ratio)

- Measures the pulse cycle difference of input B and input A for the pulse period of input A and displays it as ratio

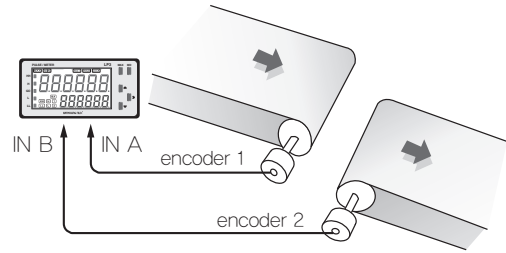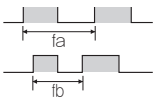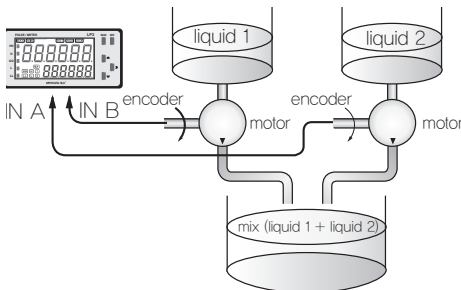• Error ratio (%) = $\dfrac{(fb \times \beta) - (fa \times \alpha)}{fa \times \alpha}$ X 100(%)

※ fa : sensor input A frequency
※ fb : sensor input B frequency
※ α : sensor input A prescale value
※ β : sensor input B prescale value

Display value	Unit
Error ratio	%

fa
fb

※ When the HOLD signal is ON, the display value is maintained unchanged.
※ When the HOLD signal is OFF, the display value changes to the measured value.
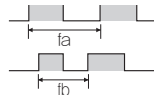

IN A   IN B   encoder 1   encoder 2

■F12 mode (density)

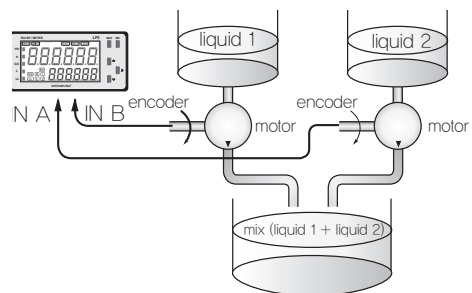- Measures the pulse cycle of input B for the sum of pulse cycles of input A and input B and displays it as ratio

• density (%)= $\dfrac{fb \times \beta}{(fa \times \alpha) + (fa \times \beta)}$ X 100(%)

※ fa : sensor input A frequency
※ fb : sensor input B frequency
※ α : sensor input A prescale value
※ β : sensor input B prescale value

Display value	Unit
Density	%

fa
fb

※ When the HOLD signal is ON, the display value is maintained unchanged.
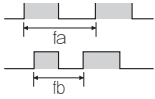※ When the HOLD signal is OFF, the display value changes to the measured value.

N A   IN B   encoder   liquid 1   encoder   liquid 2
motor   motor
mix (liquid 1 + liquid 2)

■ F13 mode (error)

– Measures the pulse cycle difference of input A for input B and displays it as ratio

• error (Hz) = (fb × β) − (fa × α)

※ fa : sensor input A frequency
※ fb : sensor input B frequency
※ α : sensor input A prescale value
※ β : sensor input B prescale value

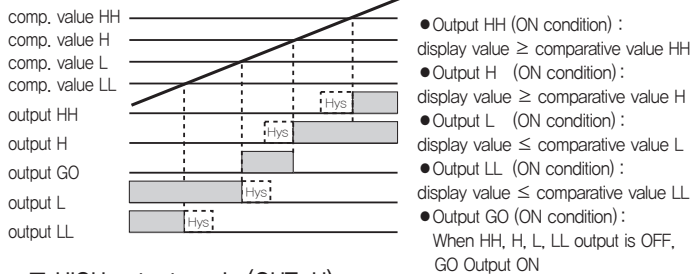| Display value	Unit	Unit
Error (frequency)	Hz	1
	KHz	0.001
Error (number of revolutions)	rps	1
	rpm	60
Error (speed)	mm/s	1000
	cm/s	100
	m/s	1
	m/min	60
	km/hour	3.6

※ When the HOLD signal is ON, the display value is maintained unchanged.
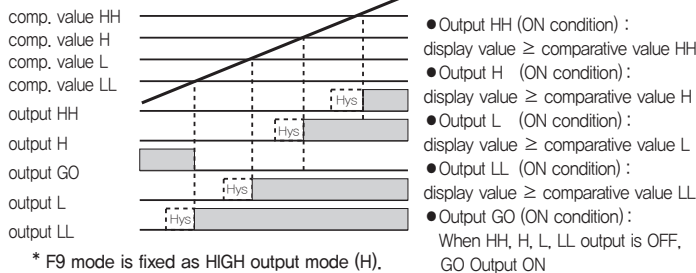※ When the HOLD signal is OFF, the display value changes to the measured value.

IN B   IN A   encoder 1

encoder 2

Output mode

■ Standard output mode (OUT−S)

● Output HH (ON condition) :
display value ≥ comparative value HH
● Output H　(ON condition) :
display value ≥ comparative value H
● Output L　(ON condition) :
display value ≤ comparative value L
● Output LL　(ON condition) :
display value ≤ comparative value LL
● Output GO (ON condition) :
When HH, H, L, LL output is OFF, GO Output ON

■ HIGH output mode (OUT−H)

● Output HH (ON condition) :
display value ≥ comparative value HH
● Output H　(ON condition) :
display value ≥ comparative value H
● Output L　(ON condition) :
display value ≥ comparative value L
● Output LL　(ON condition) :
display value ≥ comparative value LL
● Output GO (ON condition) :
When HH, H, L, LL output is OFF, GO Output ON

* F9 mode is fixed as HIGH output mode (H).

■ LOW output mode (OUT−L)

● Output HH (ON condition) :
display value ≤ comparative value HH
● Output H　(ON condition) :
display value ≤ comparative value H
● Output L　(ON condition) :
display value ≤ comparative value L
● Output LL　(ON condition) :
display value ≤ comparative value LL
● Output GO (ON condition) :
When HH, H, L, LL output is OFF, GO Output ON

■ BLOCK output mode (OUT−B)

● Output HH (ON condition) :
display value ≥ comparative value HH
● Output H (ON condition) :
comparative value HH > display value ≥ comparative value H
● Output L (ON condition) : comparative value L ≥
display value > comparative value LL
● Output LL　(ON condition) :
display value ≤ comparative value LL
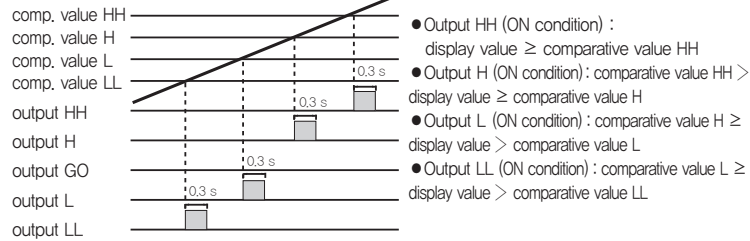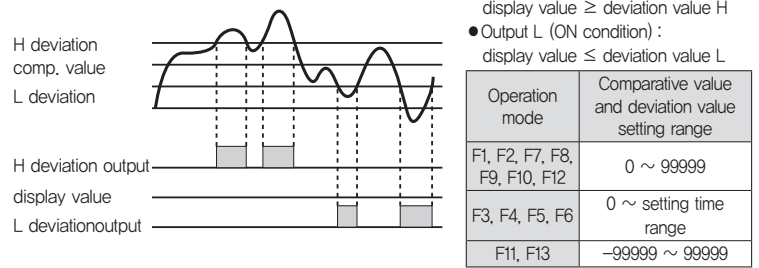● Output GO (ON condition) : When HH, H, L, LL
Output is OFF GO output ON

※The comparative value size order of B output mode must be set in the "HH〉H〉L〉LL" order.

■ ONE−SHOT output mode (OUT−F)

● Output HH (ON condition) :
display value ≥ comparative value HH
● Output H (ON condition) : comparative value HH >
display value ≥ comparative value H
● Output L (ON condition) : comparative value H ≥
display value > comparative value L
● Output LL (ON condition) : comparative value L ≥
display value > comparative value LL

※ F output mode does not have GO output.
※ F output mode does not have hysteresis
※ ONE−SHOT output time is fixed at 0.3 sec.

■ Deviation output mode (OUT−D)

● Output H (ON condition) :
display value ≥ deviation value H
● Output L (ON condition) :
display value ≤ deviation value L

Operation mode	Comparative value and deviation value setting range
F1, F2, F7, F8, F9, F10, F12	0 ~ 99999
F3, F4, F5, F6	0 ~ setting time range
F11, F13	−99999 ~ 99999

• D output mode consists of comparative value, H deviation value, L deviation value. (HH deviation value and LL deviation value are not used).
• For D output mode, H output and L output operate when display value exceeds the set H deviation and L deviation (HH output, H output, GO output are not used).
• You can set the comparative value manually or automatically by pressing and holding ⌄ in operation mode for at least 1 sec. (see operation mode)
• You can check the set comparative value with **MD** .
• H deviation value and L deviation value are set based on set comparative value.
• Comparative value and deviation value setting range : 0.0000 ~ 99999 (depending on the decimal point setting position, the setting range of comparative value and deviation value changes).

Function description

■ AUTO−ZERO function

• Function that forces display value to 0 when there is no input pulse during AUTO−ZERO setting time
• Please set the AUTO−ZERO setting time longer than the longest input pulse time.
• If the AUTO−ZERO setting time is too long, even without input pulse, the time to change the display value to "0" will be delayed, so please set the AUTO−ZERO time to match the input pulse.
• AUTO−ZERO setting time can be set individually for Input A and Input B.
• AUTO−ZERO time setting range : 0.1 ~ 9999.9s

■ Start compensation timer function

• Function to limit HH, H, L, LL, GO outputs during the set time until the measuring instrument stabilizes after power on
• Start compensation timer time setting range: 0.0 to 99.9s

comparative value L(LL)

display value

Power ON   set time
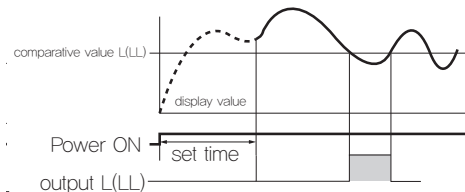
output L(LL)

■ Comparative output limit function

- Function that limits L output and LL output until H output and HH output operate after power on.
- Used only in standard output mode, BLOCK output mode, and deviation output mode.
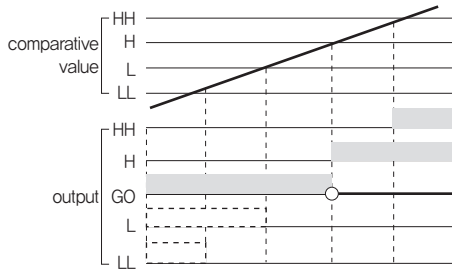
■ Hysteresis function

- If the measured value oscillates near the comparative value, the output will be unstable. Function that sets hysteresis value based on comparative value to prevent such output instability.
- The hysteresis value is applied when the measured value decreases from HH and H comparative values, and when the measured value increases from LL and L comparative values.
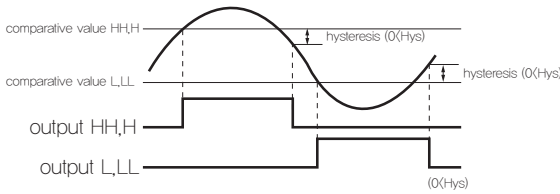
Decimal point position	Hysteresis value setting range
00000	0 ~ 9999
0000.0	0.0 ~ 999.9
000.00	0.00 ~ 99.99
00.000	0.000 ~ 9.999
0.0000	0.0000 ~ 0.999

■ Display cycle function

- Function that measures the detector during the set time of the display cycle, averages measured values during the set time and displays.
- The display value is changed by the setting time of the display cycle.
- Display cycle consists of 0.05 s, 0.5 s, 1 s, 2 s, 4 s, 8 s.
- When measuring high-speed pulse, display value can be stabilized by adjusting display cycle.
- For output models, if the display cycle is long, the output operation may be delayed.

■ Time unit selection function

- Function that displays measured value in several time units.
- Time units can be expressed in decimal and sexagesimal notations.
- Time units are available only in F3, F4, F5, F6 modes.

■ Maximum and minimum value display function

- Function that selects and displays the max. measured value and min. measured value of input pulse
- When displaying the maximum value, the display shows "MAX".
- When the minimum value is displayed, the display shows "MIN".
- To check max. measured value and min. measured value, if you press **MD** you can view them sequentially (see operation mode)
- In the maximum value display mode , if you press and hold ⩡ for at least 1 second, the maximum value will be initialized to the current measured value (see operation mode)
- In the minimum value display mode, if you press and hold ⩡ for at least 1 second, the minimum value will be initialized to the current measured value (see operation mode)

■ HOLD and RESET functions

- Function that makes the current display value to remain unchanged when the ON signal is input to the external HOLD terminal
- The display value is maintained only while the HOLD signal is ON.
- In F9 mode, the external HOLD terminal is used as RESET signal.
- When RESET signal is applied in F9 mode, count value is initialized to "0".

■ Power outage memory function

- Function that saves current count value when power is turned off
- Only used in F9 mode.
- If the parameter "BACK" is set to "SAVE", it saves the current count value when the power is turned off.
- It counts from the saved count value when power is re-applied.

■ Lock function

- Function that can set parameter, BANK, KEY operation lock

| Lock setting	Description
oFF	Unlocks parameters and keys
KEY	Locks ≫ , ⩡ , ⩞ Cannot set comparative values, can change parameters
PAr	Locks parameters Can set comparative values, cannot change parameters
K-P	Locks parameters and keys Cannot set comparative values, cannot change parameters
bnK	Locks BANK Can set comparative values and change parameters Can switch BANK 1, 2, cannot set BANK parameters

■ BANK function

- Function that enables the comparative value and the prescale value to be saved in advance in two BANKs, and to be easily switched and used on demand.
- The BANK function is used when the prescale value needs to be changed, such as changing the transmission ratio.
- Consists of two banks, such as BANK_1 and BANK_2.
- You can set prescale, decimal point position, display refresh cycle, comparative value, etc. to the BANK.
- When the BANK function is activated, the display shows "BA" and BANK number.
- When the BANK function is activated, it uses and measures the comparative value and prescale value that are saved in the relevant BANK
- The BANK switching is performed by ⩞ and external BANK terminal.
- If the BANK parameter "b-CHG" is set to "KEY", the BANK switching is performed by ⩞ (the BANK is switched every time you press and hold ⩞ for at least 1 second).
- If the BANK parameter "b-CHG" is set to "EX-IN", the BANK switching is performed by external BANK terminal input (BANK_1 is used when the BANK terminal is opened, and BANK_2 is used when the BANK terminal is short.)
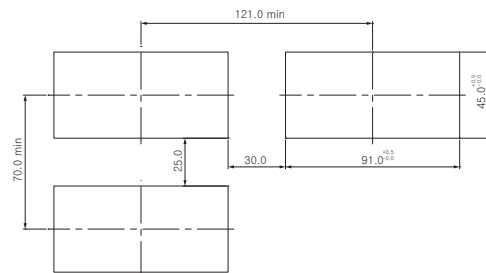
Dimensions and panel cutout
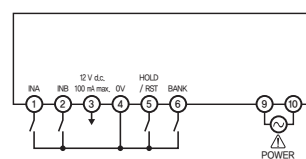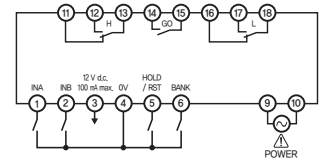
[Unit :㎜]

■ LP3

● Dimension
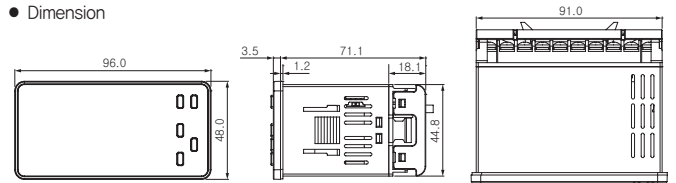
● Panel cutout

Connection diagrams

● LP3-5AN

● LP3-5A3

● LP3-5A5