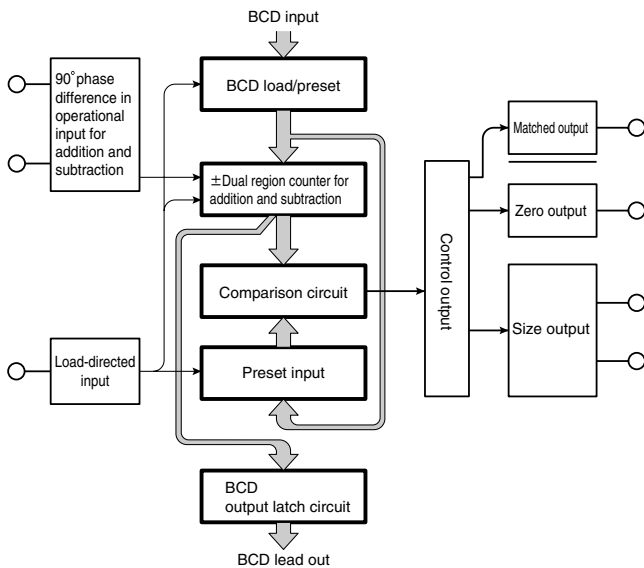


Maximum operating speed 20kHz

This counter is equipped with a read-out function, setting input, and writing via full-digit static BCD code. In addition, size-matched output and zero output are provided in this addition and subtraction counter for high-precision position determination.

Basic Composition



●The KCX-4RN and KCX-6RN consist of the following elements:

- 1) A counter with a positive and negative region for addition and subtraction.
- 2) Data input (load and preset use common terminals) for BCD coding.
- 3) Load-directed input for loading (writing) of BCD input data to a counter and presetting.
- 4) Output latch circuit for external output of count values in BCD code.
- 5) Comparison circuit for comparison of BCD preset data and count values.
- 6) Controlled output circuit that outputs matching, zero, and size signals using the logic circuit.

Count operations

Addition and subtraction counts can span both positive and negative regions.

Load (writing)

BCD data is written in the counter via the load-directed input.

Pre-setting

BCD input data is normally read by the comparison circuit.

Output

When count values=preset values/count values=0, respective controlled output is produced.



Merits

●Load input (writing of count values)/setting input/read-out (read-out/output of count values) are provided by means of input and output functions for static signals via total digit static BCD coding. Thus, it can work obtaining count data and preset data from units like programmable controllers and computers is possible.

●20 kHz high-speed operation

It can correspond to an input signal with a 90° phase difference or addition and subtraction input to allow 20 kHz high-speed operation. To that end, high-speed control naturally prevents miscounts due to mechanical vibrations or backlash to allow high-precision control.

●Dual region positive and negative operation

Counts are performed in both positive and negative regions for addition and subtraction. In addition, count values and preset values can also be loaded and preset in the positive and negative regions. With comparative output, matching, large, small, and zero outputs are provided, and comparison can be conducted in both positive and negative regions.

●Memory back-up upon power failure

The counter has memory back-up upon a power failure via a secondary NiCd battery. When power is OFF, count values are retained. In addition, gates are provided for individual input to prevent malfunctions via the power source turning ON and OFF.

Specifications

Model number		KCX-4RN(4-digit) KCX-6RN (6-digit)		
Input	Count input	Maximum operational speed	Dual phase : 20 kHz/500 Hz Addition and Subtraction: 20 kHz/500 Hz	
		VIH VIL IIL	4.5V Min.(30V Max.) 1.0V Max. 5mA Max. (Notes 3,4, and 5)	
		Input resistance	6kΩ	
	Disabled count input	Response	Ton 25μs / Toff 25μs (Notes 1 and 2)	
		VIH VIL IIL	4.5V Min.(30V Max.) 1.0V Max. 5mA Max.	
		Response	Ton 25μs / Toff 25μs	
	Latch input	Response	Ton 25μs / Toff 25μs	
		VIH VIL IIL	4.5V Min.(30V Max.) 1.0V Max. 5mA Max.	
		Response	Ton 25μs / Toff 25μs	
	Output-disabled input	Response	Ton 25μs / Toff 25μs	
		VIH VIL IIL	4.5V Min.(30V Max.) 1.0V Max. 5mA Max.	
		Response	Ton 25μs / Toff 25μs	
	Reset input	Response	Ton 25μs / Toff 25μs	
		VIH VIL IIL	4.5V Min.(30V Max.) 1.0V Max. 5mA Max.	
Response		Ton 25ms / Toff 25ms		
BCD load-directed input	Response	Ton 25μs / Toff 100 μs	Ton 25ms / Toff 25ms	
	VIH VIL IIL	4.5V Min.(30V Max.) 1.0V Max. 5mA Max. (Note 7)		
	Response	Ton 25ms / Toff 25ms		
BCD input Minus sign Writing/setting input	Voltage input			
	Response	Ton 10μs / Toff 10μs		
	VIH VIL	4.5~30V 2V Max.		
	Input resistance	6kΩ		
Output	C=P Offdelay output Zero Offdelay output C>P Output C<P Output	Open collector		
		Output current	100 mA Max. (residual voltage 1.5 V) Relay drive possible (internal protective circuit for counter electromotive force) (Note 6)	
		Response	50 μs	
		Maximum permitted voltage	DC45V	
	C=P output Zero output	Open collector		
		Output current	30 mA Max. (residual voltage 1 V) Relay drive not possible	
		Response	50 μs	
		Maximum permitted voltage	DC30V	
	BCD output C<P Output	Voltage output		
		No-load voltage	10-12 V (when +12 V is applied to LB1)	
		Output resistance	2.2kΩ	
		IOL	20 mA (residual voltage 2 V)	
Response		25μs		
Maximum permitted voltage	DC45V			
Internal power source	Source output for digital SW common	Preset OUT	DC12V 30mA	
		Load OUT	DC12V 30mA	
	Sensor power source	—	DC 12 V 100 mA (+10-14 V) ripple 5% rms	
Memory backup upon power failure	Memory duration	Approx. 2000 hrs (25°C)		
	Duration of input gate response upon power failure	50~200ms		
	Duration of input gate response during power recovery	50~500ms		

Electronic
Counters

KCV

KCN-A

KCN-S/W

KCN-B

KCN-T

KCY

KCX

KCX-FN

KCH-B

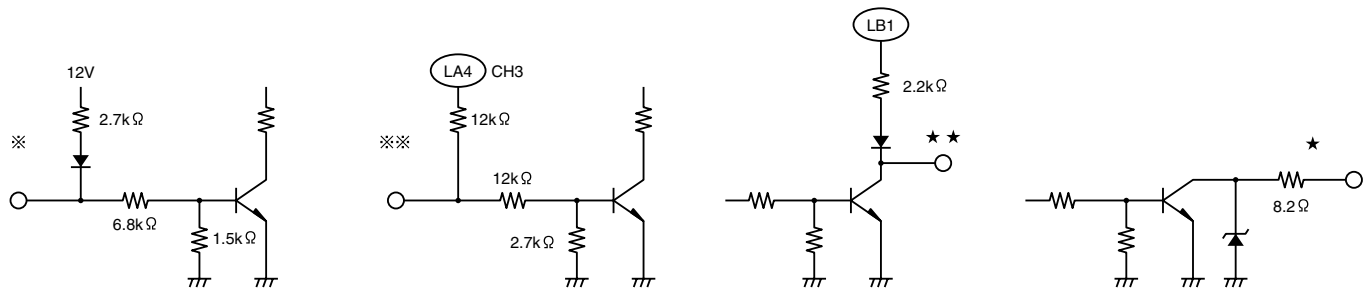
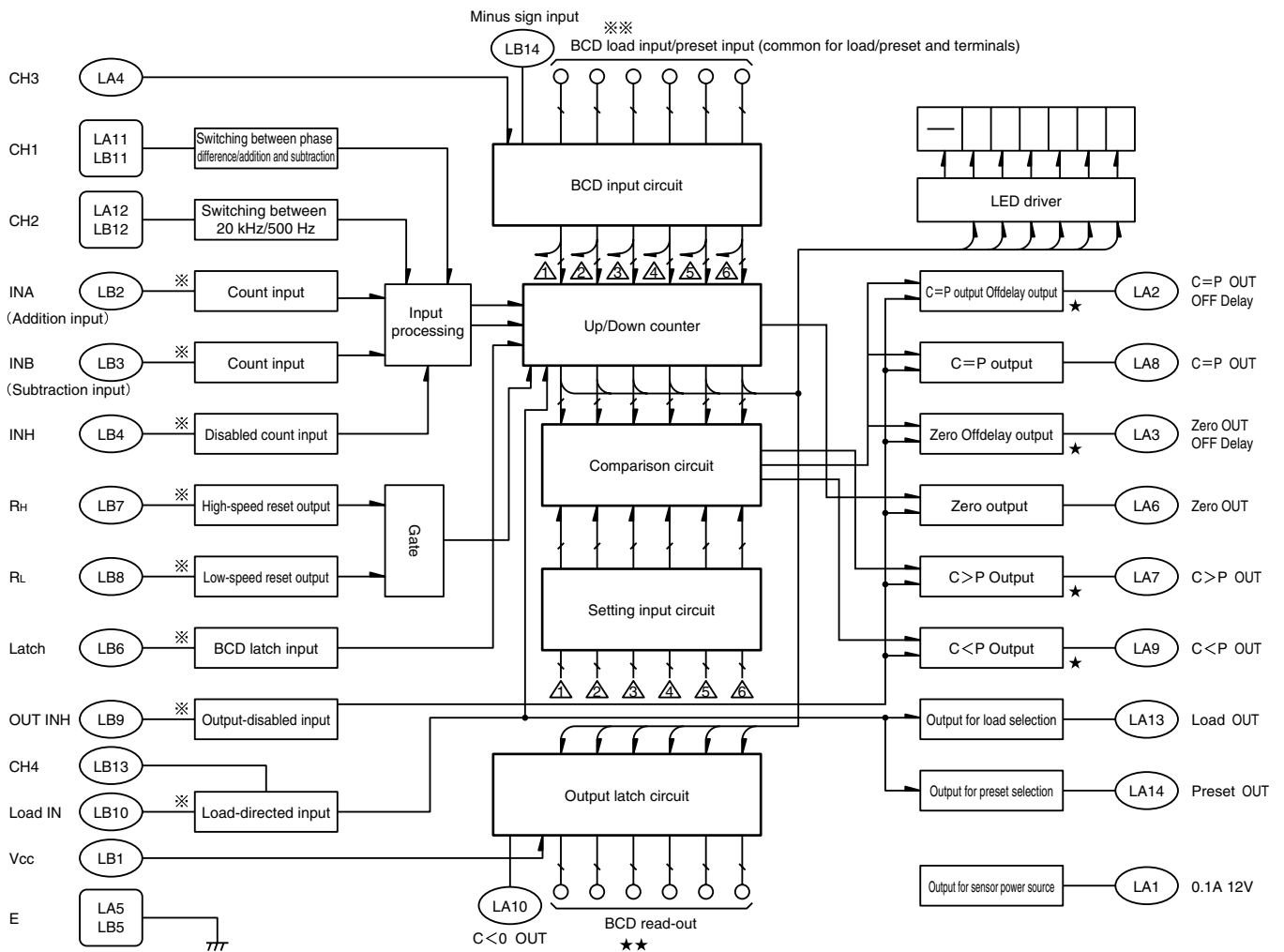
KCM

- Notes:
- 1) Ton: Ondelay duration
 - 2) Toff: Offdelay duration
 - 3) VIH: High-level input voltage (non-operational)
 - 4) VIL: Low-level input voltage (operational)
 - 5) IIL: Low-level input current (current flowing from counter input terminals to an input device)
 - 6) Output current: current that can flow to open collector transistors
 - 7) When CH4(LB13) and E(LA5 and LB5) are short-circuited

KCX-□RN

Model number	KCX-4RN(4-digit) KCX-6RN(6-digit)
Operational display	
Withstand voltage	AC2000 V 1 minute between ground and power source terminals
Vibration resistance	Conforms to JIS C 0911 Durability: displacement amplitude 0.5 mm 10-55 Hz along three axes No malfunction: displacement amplitude 0.35 mm 10-55 Hz along three axes
Insulation resistance	DC500 V more than 20 MΩ between ground and power source terminals
Source voltage	AC90~132V/AC180~264V 50/60Hz
Power consumption	16VA
Ambient temperature	-10~+50°C
Storage temperature	-20~+50°C (during transportation, -20~+70°C is possible on the order of 1 week)
Ambient humidity/storage humidity	35-85% RH (with no dewing)
Weight	1.0kg
Accessories	Metal fittings for installation and a card edge connector

Block Diagram



Operations

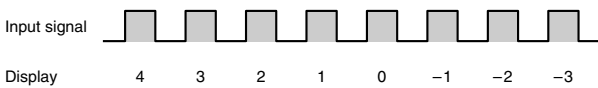
■ Setting input

Addition and subtraction counts are performed via an independent addition/subtraction signal or a dual-phase signal for a 90° phase difference. Switching operational speed between 20 kHz/500 Hz is possible.

■ Counting operations

Addition and subtraction counts are performed for counts in both positive and negative regions. After loading count values via BCD data, count signals are input and addition and subtraction counts are performed with this loaded data. Positive and negative display is indicated only with a minus sign.

Ex.: Subtraction count



■ Loading and presetting

The minus sign input terminal and BCD input terminal data is loaded (written) into the counter or becomes preset data input depending on the Load instruction state.

Load-directed input	BCD input and minus sign input
H	Preset data is input
L	Loaded data is input

Control output for load input terminals at the L level is locked out.

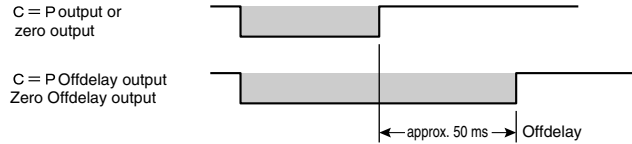
- Count input is given preference for loading (even when count input is added, forced loading will take place if the load-directed input is at the L level).
- If load-directed input is changed to BCD data and the like at the L level, the loaded data (count values) will also change accordingly.
- If load-directed input is at the H level, BCD data will become preset data. In this condition, changing the BCD data will change preset values accordingly.
- If the load-directed input is at the H level, preset data is usually compared to count values.
- When a load direction is via a relay, CH4(LB13) and E(LA5 and LB5) must be short-circuited.

■ Controlled output

Count values for load-directed input at the H level are usually compared to setting values. In this condition, the following controlled outputs are produced.

- C > P output
 - C = P output
 - C < P output
 - Zero output
- C: count values/P: setting values
Note) These outputs are output only in conditions for count values and setting values.

Outputs other than the 4 outputs above are the C=P Offdelay output and the zero Offdelay output.



All controlled output is in open collector format.

■ BCD read-out/minus sign output

Count values are usually output via BCD coding. In addition, minus sign data is usually output. These data outputs have a latch function and are held (latched) via BCD latch terminals at the L level. As a result, count data can be easily input into a programmable controller, computer, or the like.

■ BCD latch input

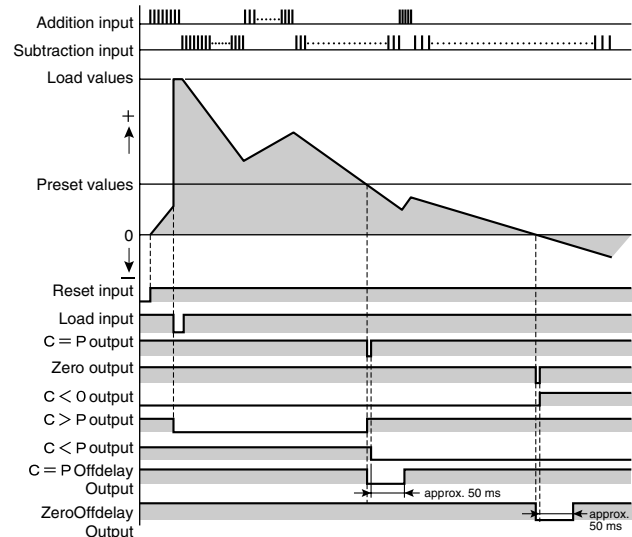
BCD latch input terminals at the L level, count display, BCD read-out data, and minus sign data are latched (retained). At this time, count values and minus sign values will change if there is count input. However, these outputs and count displays are latched as-is.

Note : Timing to perform latching of BCD data is a rise in BCD latch input terminals. When BCD latch input terminals reach the H level again, the BCD read-out and sign outputs will be output as current BCD data and sign data.

■ Reset input

- Count values are reset to 0.
- When count values are loaded, they are given preference in loading and count values will become 0.

■ Operational chart



KCV

KCN-A

KCN-S/W

KCN-B

KCN-T

KCY

KCX

KCX-FN

KCH-B

KCM

Terminal Arrangement

Name	Signal	LA	LB	Signal	Name	Name	Signal	UA	UB	Signal	Name	
Sensor power source	+12V	①	①	Vcc IN	Read-out voltage input	BCD load/setting input	1st digit	C ₁	①	①	A ₁	1st digit
Offdelay output	C=P OUT	②	②	INA	Count input		2nd digit	D ₁	②	②	B ₁	2nd digit
	OFF Delay	③	③	INB				C ₂	③	③	A ₂	
Zero OUT	④	④	INH	Disabled count input	3rd digit		D ₂	④	④	B ₂	3rd digit	
OFF Delay	⑤	⑤					C ₃	⑤	⑤	A ₃		
Switching to BCD input format	CH3	⑥	⑥				4th digit	D ₃	⑥	⑥	B ₃	4th digit
Ground	E	⑦	⑦					C ₄	⑦	⑦	A ₄	
Controlled output	Zero OUT	⑧	⑧	Latch	Latch input		5th digit	D ₄	⑧	⑧	B ₄	5th digit
	C>P OUT	⑨	⑨	R _H	High-speed reset input			C ₅	⑨	⑨	A ₅	
	C=P OUT	⑩	⑩	R _L	Low-speed reset input			D ₅	⑩	⑩	B ₅	
C<P OUT	⑪	⑪	OUT INH	Output-disabled input	6th digit		C ₆	⑪	⑪	A ₆	6th digit	
Minus sign output	C<0	⑫	⑫	Load IN			Load-directed input	D ₆	⑫	⑫		B ₆
Switching between dual phase/addition and subtraction input	CH1	⑬	⑬			BCD read-out	1C	⑬	⑬	1A	1st digit	
Switching between 20 kHz/500 Hz	CH2	⑭	⑭				1D	⑭	⑭	1B		
Selected output for digital SW common	Load OUT	⑮	⑮	CH4	Switching load input		2nd digit	2C	⑮	⑮	2A	2nd digit
	Preset OUT	⑯	⑯	⊖ IN	Minus sign input			2D	⑯	⑯	2B	
6th digit read-out	6C	⑰	⑰	6A	6th digit read-out		3rd digit	3C	⑰	⑰	3A	3rd digit
	6D	⑱	⑱	6B		3D		⑱	⑱	3B		
Empty terminals	—	⑲	⑲			4th digit	4C	⑲	⑲	4A	4th digit	
AC power source	AC180~264V	⑳	⑳				4D	⑳	⑳	4B		
Empty terminals	—	㉑	㉑			5th digit	5C	㉑	㉑	5A	5th digit	
AC power source	AC90~132V	㉒	㉒				5D	㉒	㉒	5B		
Empty terminals	—											
AC power source	AC0V											

Note: The signal ABCD in BCD input and BCD read-out corresponds to 1, 2, 4, and 8 codes in respective BCD codes.

Input operating mode/Output operating mode

● Input

Active Low input		Active High input	
Category	Terminal number	Category	Terminal number
INA	LB2	INA	LB2
Count input (dual phase)		Count input (addition and subtraction)	
INB	LB3	INB	LB3
Disabled count input	LB4		
High-speed reset input	LB7		
Low-speed reset input	LB8		
BCD latch input	LB6		
Output-disabled input	LB9		
Load-directed input	LB10	BCD input (load/preset)	UA1~12
		Minus sign input	UB1~12

● Output

Active Low output		Active High output	
Category	Terminal number	Category	Terminal number
C=P output	LA8		
C=P Offdelay output	LA2		
Zero output	LA6		
Zero Offdelay output	LA3		
C>P output	LA7		
C<P output	LA9		
		BCD read-out	UA13~22
			UB13~22
			LA15,16
			LB15,16
		Minus sign output	LA10

Terminals/Explanation of Their Functions

Terminal number	Signal	Explanation	Reference diagram
LA 1	+12V	Sensor power source 100 mA	
2	C=P OUT OFF Delay	Open collector format 100 mA internal protective circuit for counter electromotive force C=P OUT OFF Delay When output is ON(L), the C=P lamp lights up.	3
3	Zero OUT OFF Delay		
4	CH3	The E terminal or a +12 V terminal must be connected for the format output from an input device for BCD input.	4
5	E	Ground (0 V common)	
6	Zero OUT	Open collector format 30 mA relay drive not possible.	5
7	C>P OUT	Open collector format 100 mA internal protective circuit for counter electromotive force When output is ON(L), the C>P lamp lights up.	3
8	C=P OUT	Open collector format 30 mA relay drive not possible.	5
9	C<P OUT	Open collector format 100 mA internal protective circuit for counter electromotive force When output is ON(L), the C>P lamp lights up.	3
10	C<0 OUT	Minus sign output Voltage output format.	
11	CH1	When open, 90° phase differential input format/connection with the E terminal for addition and subtraction input.	2
12	CH2	Input speed is 500 Hz via connection with the E terminal.	2
13	Load OUT	Output for selection of setting devices for loading (H level for load-directed input L).	6
14	Preset OUT	Output for selection of setting devices for presetting (H level for load-directed input H).	6
15	6C	4 6th digit read-out	
16	6D	8 6th digit read-out	
17			
18		AC source input AC180-264 V	
19			
20		AC source input AC90-132 V	
21			
22		AC source input AC0 V	
LB 1	Vcc IN	Terminal that provides BCD read-out output voltage/connected to LA1(12 V) for output voltage of 12 V	1
2	IN A	Count input Dual phase/combined addition and subtraction	2
3	IN B		
4	INH	Disabled count input When input terminals are at the L level, counting is disabled.	
5	E	Ground (0 V common)	
6	Latch	BCD latch input Latches BCD lead-out and minus sign output. When input is ON(L), the Latch lamp lights up.	
7	R _H	High-speed reset input	
8	R _L	Reset input	
9	OUT INH	When output-disabled input is added, controlled output is disabled.	
10	Load IN	Load-directed input When input is added, BCD data is loaded in the counter. When input is ON(L), the Latch lamp lights up.	
11	CH1	Input format Terminal for switching between dual phase/addition and subtraction (same as LA11).	2
12	CH2	Operational speed Terminal for switching between 20 kHz/500 Hz (same as LA12).	2
13	CH4	Switching load-directed input When open, breakless input/connection with the E terminal for relay input.	
14	⊖IN	Minus tally input Minus tallies are loaded for load input. When input is ON(H), the -P lamp lights up.	
15	6A	1 6th digit read-out	
16	6B	2 6th digit read-out	
17			
18		AC source input AC180-264 V	
19			
20		AC source input AC90-132 V	
21			
22		AC source input AC 0V	

KCV

KCN-A

KCN-S/W

KCN-B

KCN-T

KCY

KCX

KCX-FN

KCH-B

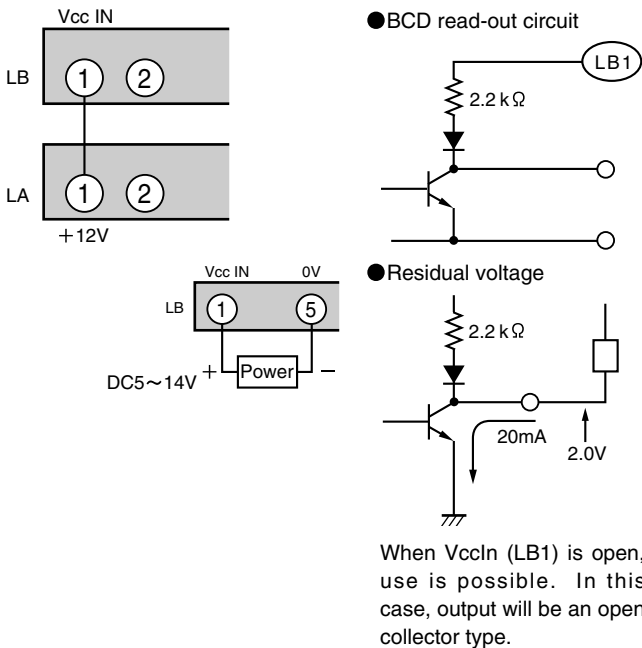
KCM

Terminal number	Signal	Explanation	Terminal number	Signal	Explanation
UA 1	C ₁	"4" 1st digit	UB 1	A ₁	"1" 1st digit
2	D ₁	"8" 1st digit	2	B ₁	"2" 1st digit
3	C ₂	"4" 2nd digit	3	A ₂	"1" 2nd digit
4	D ₂	"8" 2nd digit	4	B ₂	"2" 2nd digit
5	C ₃	"4" 3rd digit	5	A ₃	"1" 3rd digit
6	D ₃	"8" 3rd digit	6	B ₃	"2" 3rd digit
7	C ₄	"4" 4th digit	7	A ₄	"1" 4th digit
8	D ₄	"8" 4th digit	8	B ₄	"2" 4th digit
9	C ₅	"4" 5th digit	9	A ₅	"1" 5th digit
10	D ₅	"8" 5th digit	10	B ₅	"2" 5th digit
11	C ₆	"4" 6th digit	11	A ₆	"1" 6th digit
12	D ₆	"8" 6th digit	12	B ₆	"2" 6th digit
13	1C	"4" 1st digit	13	1A	"1" 1st digit
14	1D	"8" 1st digit	14	1B	"2" 1st digit
15	2C	"4" 2nd digit	15	2A	"1" 2nd digit
16	2D	"8" 2nd digit	16	2B	"2" 2nd digit
17	3C	"4" 3rd digit	17	3A	"1" 3rd digit
18	3D	"8" 3rd digit	18	3B	"2" 3rd digit
19	4C	"4" 4th digit	19	4A	"1" 4th digit
20	4D	"8" 4th digit	20	4B	"2" 4th digit
21	5C	"4" 5th digit	21	5A	"1" 5th digit
21	5D	"8" 5th digit	21	5B	"2" 5th digit

Note: BCD load input and BCD preset input use common terminals.

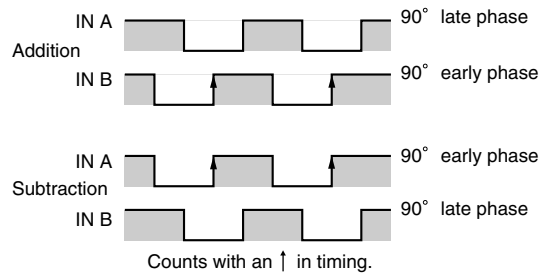
1 Treatment of Vcc IN terminal LB1

When the output voltage for BCD read-out is 12 V, the connection is per the following diagram (however, supply of DC12 V to the external load is not possible in this instance).



2 Count input signals

1) Dual-phase input



2) Addition and subtraction timing

Addition: Input in INA (INB is for the L level)
Subtraction: Input to INB (INA is for the L level)

Note: With dual-phase input at a 90° phase difference and count input for addition and subtraction, operating modes will differ so exercise caution.

3) Count input: switching between dual-phase input/addition and subtraction input

●Dual-phase input

Leave CH1 terminal LA11 open.

●Addition and subtraction input

Connect CH1 terminal LA11 and E terminal LA5.



4) Switching between count input 20 kHz/500 Hz

●20kHz

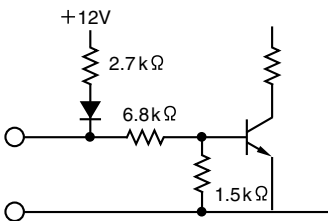
Leave CH2 terminal LA12 open.

●500Hz

Connect CH2 terminal LA12 and E terminal LA5.



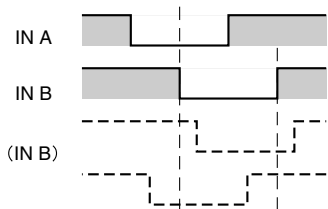
●Input circuits (common input circuits)



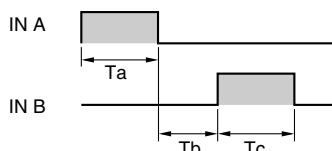
5) Conditions for count input

●Phase-differential input

Permitted operational range for input phase $90^\circ \pm 45^\circ$



●Input for addition and subtraction

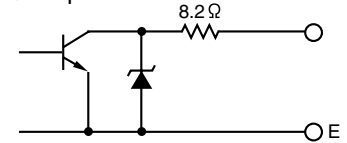


$T_a \geq 12.5 \mu s$
 $T_b \geq 12.5 \mu s$
 $T_c \geq 12.5 \mu s$

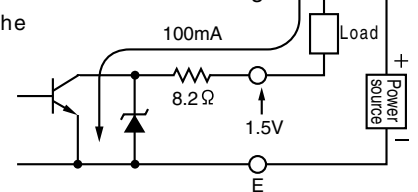
3 Composition of controlled output (1)

- C=P ffdelay output
- Zero Offdelay output
- C>P output
- C<P output

●Output circuit



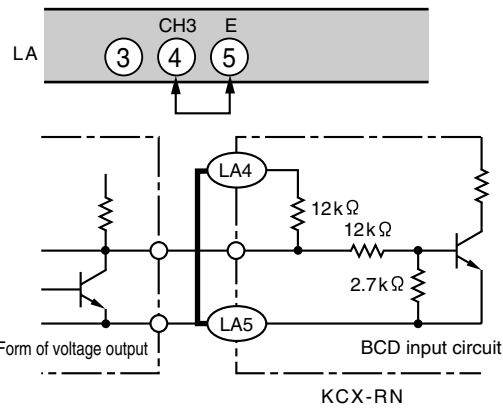
●Residual voltage



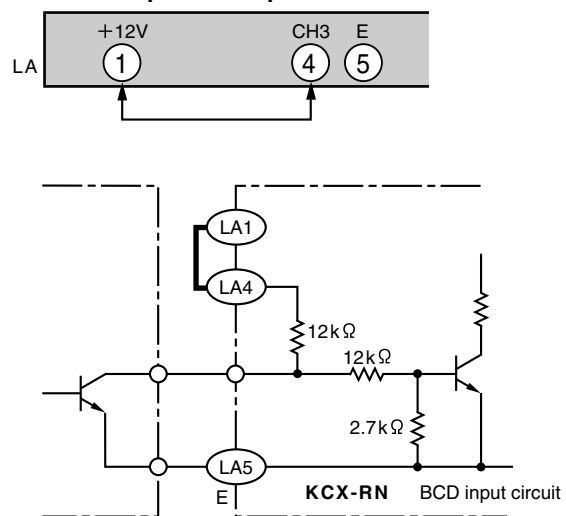
These outputs form the circuit structure in the figure.

4 Treatment of CH3 terminal LA4

1) When the signal source that is added to BCD input and ⊖IN input is voltage output



2) When the signal source that is added to BCD input and ⊖IN input is an open collector



Note: Treatment of step 1) or 2) must be performed. With CH3 open, data will become unstable. To this end, 1 will be input when it is open. Short-circuit output that is not used to E(LA5).

KCV

KCN-A

KCN-S/W

KCN-B

KCN-T

KCY

KCX

KCX-RN

KCH-B

KCM

KCV

KCN-A

KCN-S/W

KCN-B

KCN-T

KCY

KCX

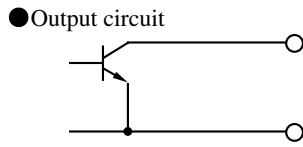
KCX-FRN

KCH-B

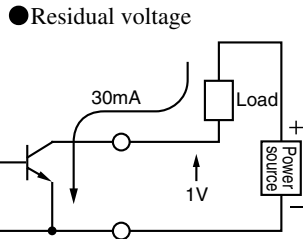
KCM

5 Composition of controlled output (2)

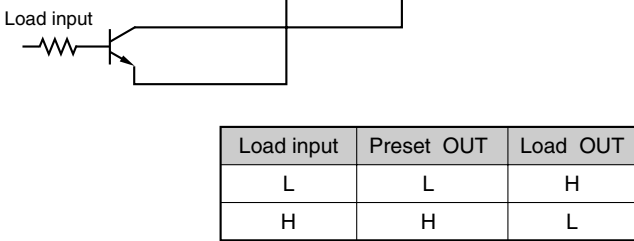
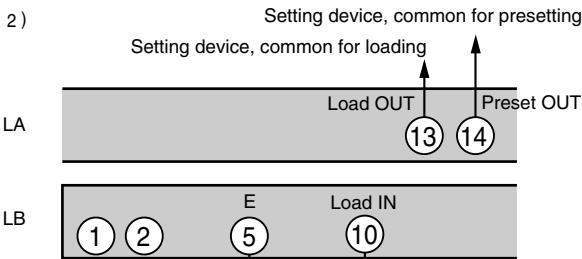
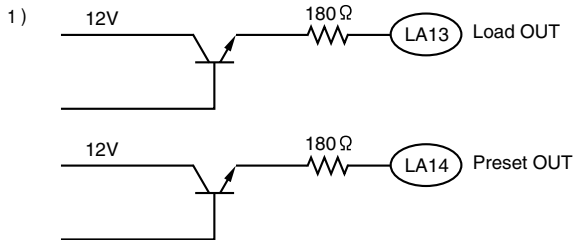
- C=P output
- Zero output



These outputs form the circuit structure in the figure. This is not a protective circuit for counter electromotive force.



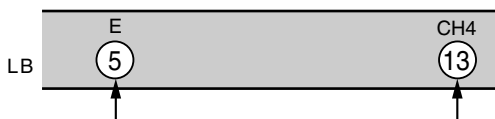
6 Composition and operation of the selected output for setting devices



Note: Even when Load OUT and Preset Out are at the L level, exercise caution since there is no current flow capacity.

7 Explanation of CH4(LB13)

- When load-directed input is breakless, open CH4(LB13).
- When load-directed input is relayed, connect CH4(LB13) and E (LB5 or LA5).



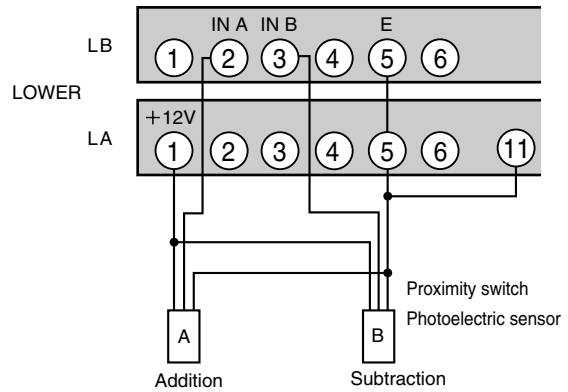
Memory backup upon a power failure

- A secondary battery is internally mounted, so count values can be retained in memory even during long-lasting power failures. The internal battery is charged while power is supplied to the power source (charging requires approx. 50 hrs). In this condition, the duration of memory retention when power to the power source is interrupted is approx. 2000 hrs (a standard value).
- Battery lifetime: When the duration of memory retention drops to 1000 hrs, this point is specified as the end of the battery's lifetime. In addition, having ambient temperature on the order of 5-30°C for the counter tends to prolong battery lifetime.

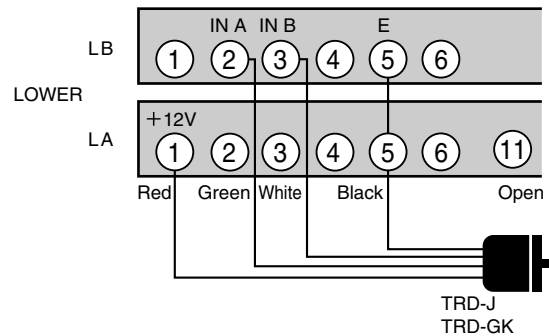
Connection examples

■ Sending signals to count input terminals

Proximity switch/photoelectric sensor

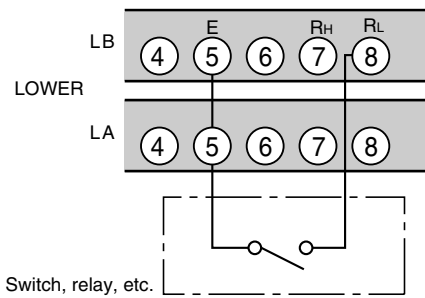
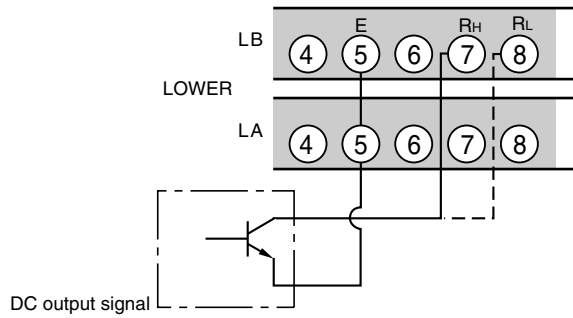


Rotary encoder

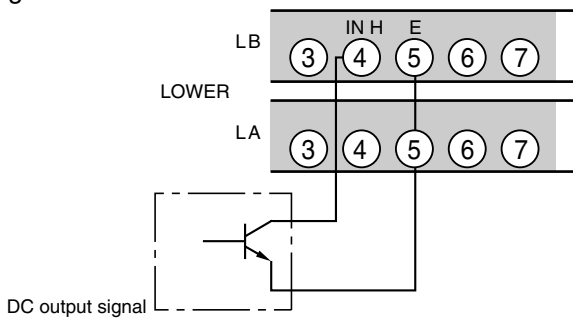


■ Sending signals to reset input terminals

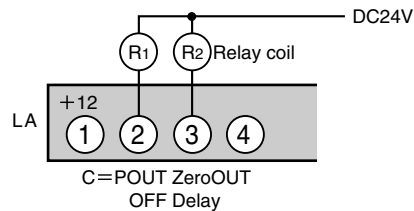
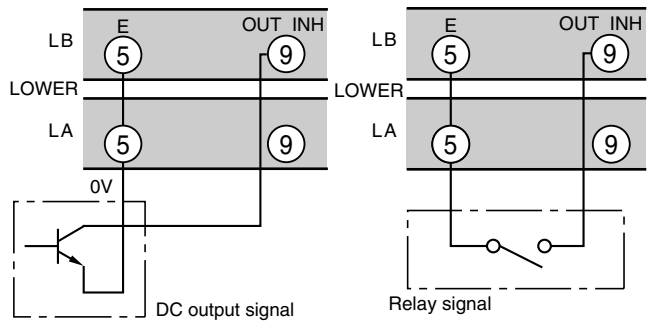
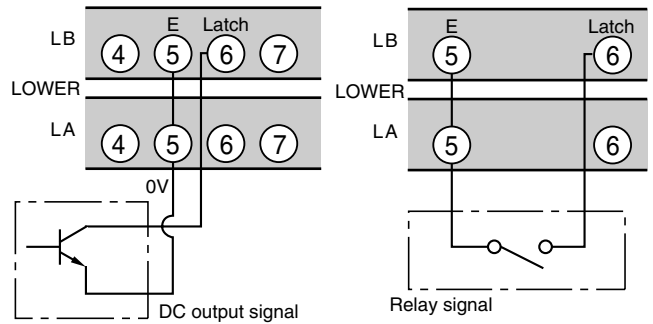
DC output signal (general)



Relay signal

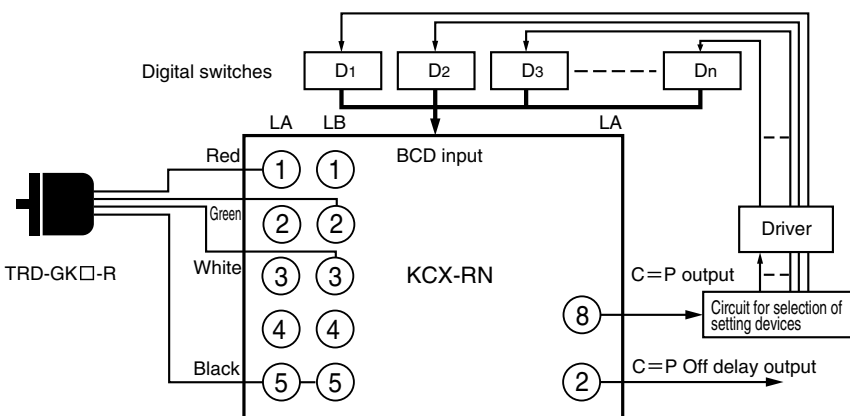


■ Sending signals to a disabled count input gate

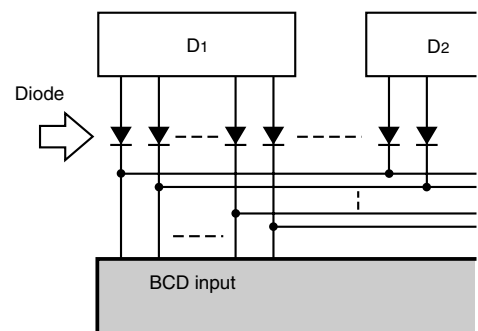


Application example

● Application to a multiplex preset counter



When aligned with a setting device as in the diagram on the left, diodes as shown in the illustration are required.



KCV

KCN-A

KCN-S/W

KCN-B

KCN-T

KCY

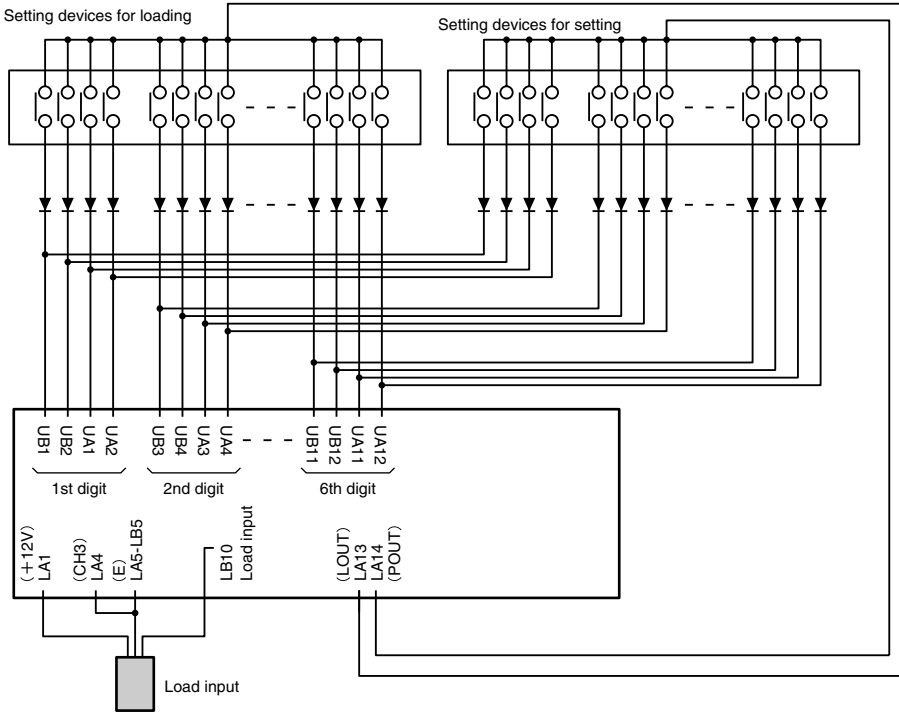
KCX

KCX-RN

KCH-B

KCM

●Digital switches for BCD data input

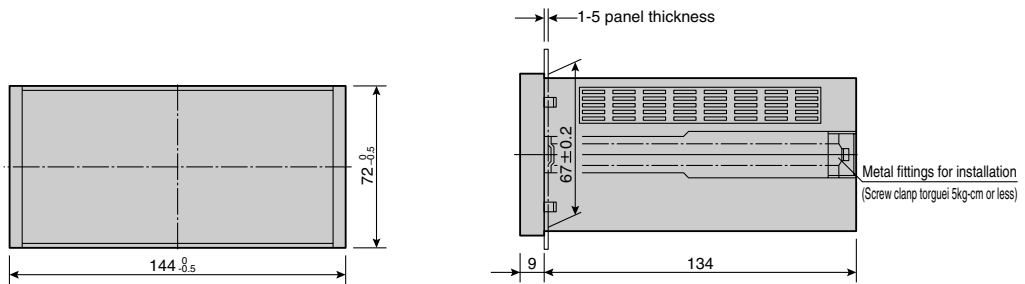


●Output for selection of setting devices

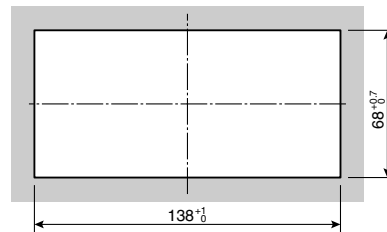
When a digital switch is used as BCD data, L OUT (terminal LA13) and P OUT (LA14) serve as the voltage power source that is applied to common terminals and are interlocked with the load-directed input (terminal LB10). When load-directed input is at the H level, voltage is produced for P OUT. At this time, L OUT becomes 0 V. Digital switch data for settings is input as setting values to the counter. When load-directed input is at the L level, the reverse occurs and voltage is produced for L OUT while P OUT becomes 0 V. When load-directed input is at the L level, loading (writing) is possible. Thus, digital switch data for loading is loaded into the counter. If load-directed data is at the H level, the counter is ready for setting again. At this point, previously loaded values will not change even if load-directed input is at the H level.

External Dimensions

(in mm)



Square holes for embeddable installation



●The character height of the numerical display device is 12.7 mm.

Connector accessories
 Upper.....Multi-connector with 17-18 keys 220D-44B-208
 Lower.....Multi-connector with 6-7 keys AB19/21 excluded 220D-40/44B-207