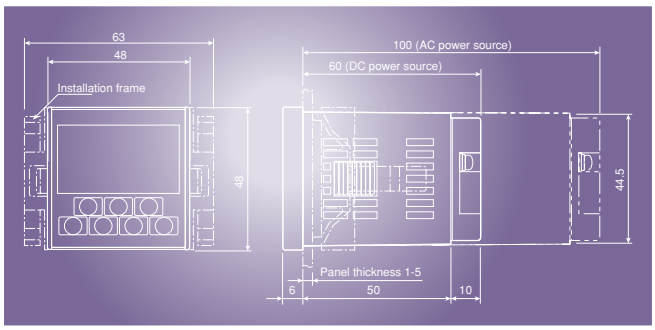
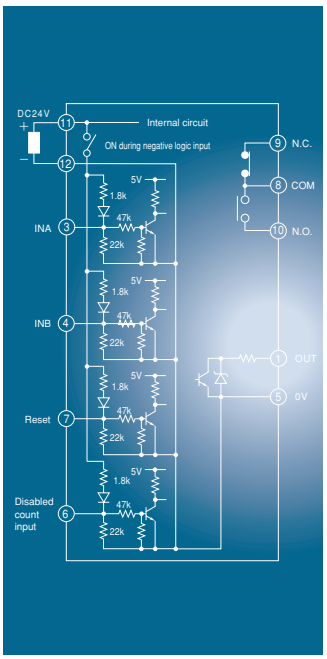
Koyo®

Electronic Counters / Controllers

Catalog Vol.4.5

- **Electronic Counters**
  KCV / KCN-A / KCX / KCM
- **Digital Tachometers**
  TC-V / TC-4L / TC-41 TC-4 / TC-4B /TC-4S
- **Digital Timers**
  KT-V
- **Programmable Cam**
  FC-81F-C / FC-161F-C / FC-321F-C / FC-80-C / FC-160 / FC-320 / FC-21





Value & Technology

KOYO ELECTRONICS INDUSTRIES CO., LTD.

Electronic Counters / Controllers

Catalog Vol.4.5

Providing our customers with the best in value and technology

KOYO ELECTRONICS INDUSTRIES CO., LTD.

ELECTRONIC COUNTERS

DIGITAL TACHOMETERS

DIGITAL TIMERS

PROGRAMMABLE CAM

SAFETY PRECAUTION

Notation Used in This Catalog

The following indications are used in this catalog to allow safe use of products.

⚠	**Warning**	Ignoring this indication and improperly handing the product can lead to a major malfunction possibly resulting in death or serious injury.
⚠	**Caution**	Ignoring this indication and improperly handing the product can lead to injury or physical damage to property.

Symbols

⃠ This symbol represents acts that are generally prohibited.

● This symbol represents items that are compulsory or prescribed.

Safety Precautions

The following safety precautions must be obeyed for handling of products noted in this catalog.

[Environment and conditions of use]

⚠ Warning	
⃠	Do not use in an environment where there is a possibility of combustion or explosion. Doing so may lead to accident involving death or injury or a fire.
⃠	Do not use this product for applications related to human safety. Use the product only for applications that will not lead to human injury even in the event of an accident or malfunction.
⚠ Caution	
●	Use and manage the product within the environmental ranges (vibration, impact, temperature, humidity, etc.) dictated in the specifications. Improper use may lead to a fire or damage to the product. Thoroughly understand the product before using it.
●	Understand your product well before use.

[Installation and wiring]

⚠ Warning	
●	Do not use with a power-supply voltage other than that noted in the specifications. Doing so may lead to a fire, electric shock, or a malfunction.
●	Do not mis-wire products. Doing so may lead to a fire or malfunction.
⚠ Caution	
●	Use the wiring and configuration dictated in the specifications. Not doing so may lead to a fire or malfunction.
●	Do not use wiring methods that subject wiring to stress. Doing so may lead to electric shock or a fire.
●	Perform wiring with power to the power source cut off. Not doing so may lead to electric shock or a malfunction.
●	Do not use screws other than those specified to be fixed to terminals. Doing so may lead to a fire or malfunction.

[For use]

⚠Warning	
	Do not touch terminals while the power is on. Doing so may lead to an accident resulting in a malfunction or electric shock.
	Do not use in methods other than as dictated in the specifications. Doing so may lead to an accident involving death or injury or a malfunction.
	Changing settings during operation may possibly lead to a major accident if operational procedures are not followed correctly and unintended settings are set when output is ON. Operate in ranges where safety for individuals and equipment can be maintained by licensed personnel.
	Do not place near combustibles. Doing so may lead to a fire.
	Do not insert metallic objects like a screwdriver in heat radiation slots. Doing so may lead to electric shock or a malfunction.
⚠Caution	
	Do not insert inappropriate items in product openings. Doing so may lead to electric shock or a malfunction.
	Do not block heat radiation slots. Doing so may lead to a rise in internal temperature, fire, or malfunction.

[For maintenance]

⚠Caution	
	Do not repair or disassemble the product. Doing so may lead to a fire, electric shock, or a malfunction.
	Maintenance and inspection should be performed with power to the power source cut off. There is a danger of electric shock when working with power supplied to the power source.

[For dispose]

⚠Warning	
	Use caution to follow the waste disposal policy of individual country in case of discarding the product.

A Request Regarding Use

Handling of our products is designed with the object of their use as general electronic equipment.
Do not use products for applications where a high level of reliability is needed with regard to human life.
In addition, please contact our Sales Division beforehand when considering use of the products in environments or under conditions other than those in specifications for general electronic equipment or for use in units related to safety and control of transportation equipment (trains, automobiles, etc.), traffic signal equipment, fire-fighting/fire prevention equipment, or the like.

■Corresponding CE Marking CE

Conformity with the Low Voltage Directive and EMC Directive is as follows:

(1) **Low Voltage Directive**

Conformity Specification- EN6 1010-1

Conformity is provided by ensuring basic insulation with respect to the load side that is connected to contact output when switching voltage of contact output exceeds 150 V.

(2) **EMC Directive**

Conformity specification — **EMI: EN55011**
EMS: EN50082-2*

* Conformity is provided by way of connection of an EMI/EMC filter (MR-2021 Tokin equivalent) to the power source when using a type with a DC power source.

- Please be advised beforehand that the contents of this catalog may change without warning due to product modifications.
- When exporting these products, fixed procedures must be followed in accordance foreign currency and export trade control laws.

Acquisition of ISO9001 / ISO14001 Certification

ISO9001

We acquired ISO9001 certification from certification organization BVQI, which authorized by authorization organization UKAS, at England form October 12, 1995.

Date of Accreditation: October 12, 1995 (for ISO9001:1994)
April 16, 2003 (for ISO9001:2000)

Target Factories: Headquarters (Tokyo) and
Ohizumi Factory (Yamanashi)

Target Products: Programmable Controllers
Electronic Counters
Digital Tachometers
Programmable Cams
Proximity Sensors
Rotary Encoders
Programmable Displays
Electronic Control Systems for Factory Automation (FA)
Automotive and Electronic Control Instruments

Inspecting Agency: BVQI
(Bureau Veritas Quality International)

Certificate No.: 102881

ISO14001

We acquired ISO14001 certification from certification organization BVQI, which authorized by authorization organization UKAS, at England form December 29, 2000.

Date of Accreditation: December 29, 2000

Target Factories: Headquarters (Tokyo) and
Ohizumi Factory (Yamanashi)

Inspecting Agency: BVQI
(Bureau Veritas Quality International)

Certificate No.: 143240

ELECTRONIC COUNTERS

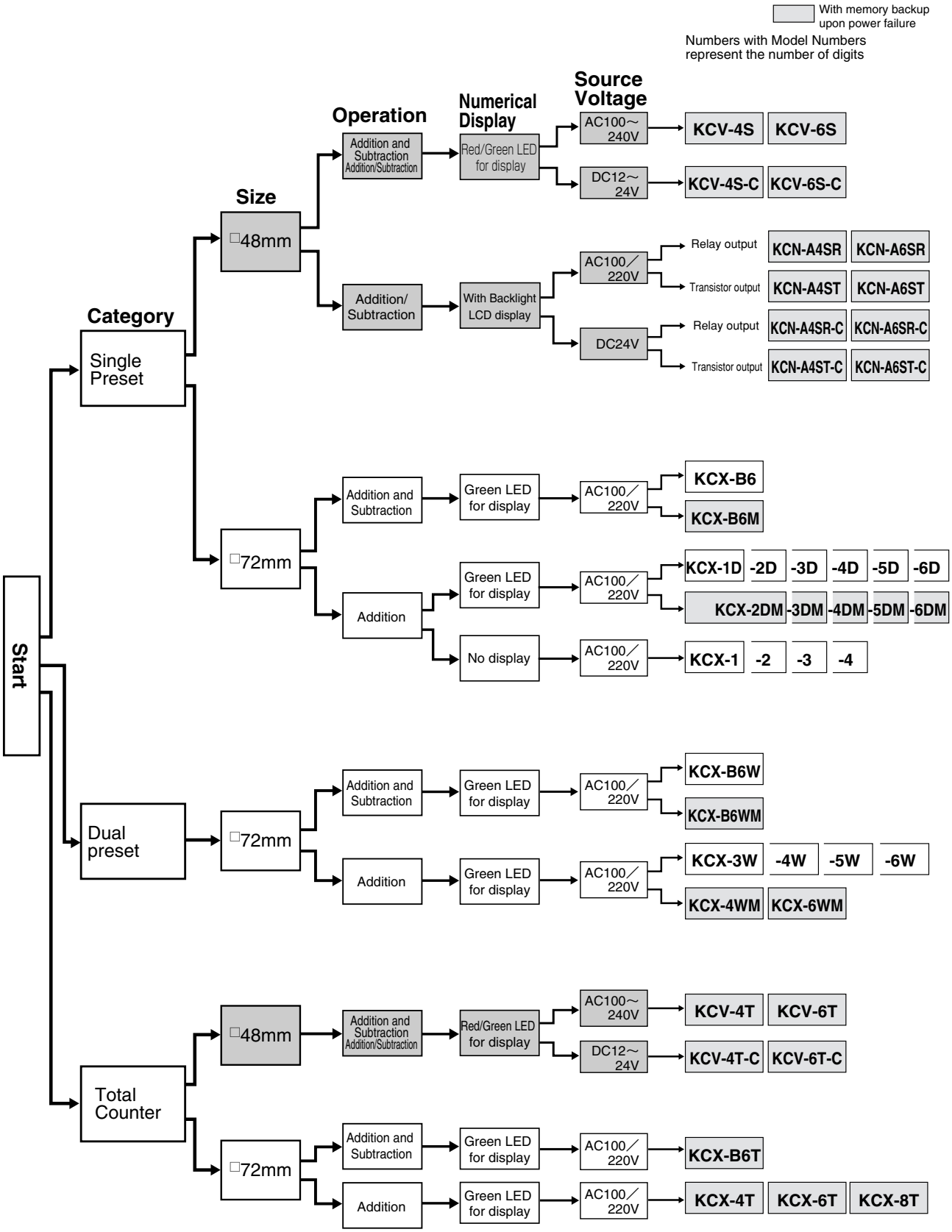
List

List of KOYO Electronic Counters

Category	Dimensions (mm)	Operation	Display		Model Number	Number of digits							
			Input/ Output	Numerical		1	2	3	4	5	6	8	
Single preset	48×48	Addition/ Subtraction		LCD	KCN-A□SR				●		●		
					KCN-A□SR-C				●		●		
					KCN-A□ST-C				●		●		
	72×72	Addition	●		KCX-□	●	●	●	●				
				Green LED	KCX-□D	●	●	●	●	●	●		
					KCX-□DM		●	●	●	●	●		
		Addition and Subtraction		Green LED	KCX-B6						●		
					KCX-B6M						●		
Single Preset (with Predicted Output)	48×48	Addition and Subtraction		Red LED	KCV-□S				●		●		
					KCV-□S-C				●		●		
Dual Preset	72×72	Addition		Green LED	KCX-□W			●	●	●	●		
					KCX-□WM				●		●		
		Addition and Subtraction		Green LED	KCX-B6W						●		
					KCX-B6WM						●		
Aggregate Counter	72×72	Addition		Red LED	KCM-50-(1)					●			
					KCM-50P-(1)					●			
					KCM-51-(1)					●			
					KCM-51P-(1)					●			
Total Counter	48×48	Addition and Subtraction		Red LED	KCV-□T				●		●		
					KCV-□T-C				●		●		
	72×72	Addition		Green LED	KCX-□T				●		●	●	
		Addition and Subtraction			KCX-B6T						●		

	Operational Speed	Source Voltage	Sensor Power	Memory Backup Upon Power Failure	Remarks	Refer to page
	30Hz 200Hz 1kHz 5kHz } Selectable	AC100/200V 50/60Hz	DC24V, 15mA	Optional	Individual digit keys can set for presetting. A large, backlit LCD for numerical display. Prescaling and decimal point display are also available.	B-19
		DC24V	—			
	1/2 digits: 10 Hz/200 Hz 3/4 digits: 10 Hz/1 kHz 5/6 digits: 10 Hz/5 kHz	AC100/200V 50/60Hz	DC12V, 50mA	—	General-purpose preset counter. Green LED for numerical display. Prescaling and decimal point display are also available. The 4-digit model has a timer.	B-33
				—		
				Yes		
	10Hz/20kHz	AC100/200V 50/60Hz	DC24V, 80mA	—	Preset counter capable of both addition and subtraction. Comparative output operation available.	B-51
				Yes		
	30Hz 200Hz 1kHz 10kHz } Switching	AC100～240V	DC24V, 60mA	Optional	Setting of individual digit keys for presetting. Large, red LED for display Predicted output and adjustment for dual output	B-5
		DC12～24V	—			
	3/4 digits: 10 Hz/2 kHz 5/6 digits: 10 Hz/5 kHz	AC100/200V 50/60Hz	DC12V, 50mA	—	General-purpose, dual preset counter	B-41
				Yes		
	10Hz/20kHz	AC100/200V 50/60Hz	DC24V, 80mA	—	Dual preset capable of addition and subtraction. Comparative output operation available.	B-51
				Yes		
	30Hz/500Hz	DC24V	—	Yes	Includes 9 internal counters that are triple preset. Pre-prediction lamp, predicted output, and suspended equipment output	B-73
					Includes 8 internal counters that are triple preset. Arbitrary counter reset and timer functions are available.	
	30Hz 200Hz 1kHz 10kHz } Switching	AC100～240V	DC24V, 60mA	Optional	Large, red LED for display Positional display function	B-5
		DC12～24V	—			
	4 digits: 10 Hz/1 kHz 6 digits: 10 Hz/5 kHz 8 digits: 10 Hz/10 kHz	AC100/200V 50/60Hz	DC12V, 50mA	Yes	General-purpose	B-47
	10Hz/20kHz		DC24V, 80mA		Positional display available.	B-63

Koyo® Electronic Counters Selection Guide



Aggregate counter is provided as special counters. For details, refer to page B-2.

High-speed	**30 Hz/10 Hz (with Dipswitch selected)** **200 Hz/1 kHz (with Set-up Mode selected)**

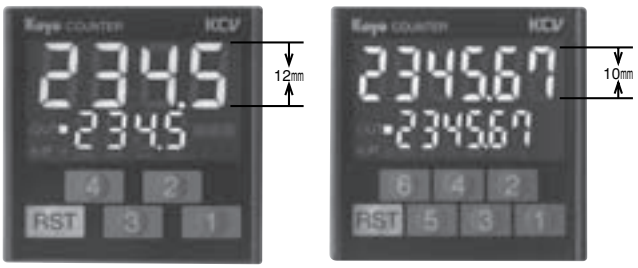
A preset counter that aggregates counts with functions that provide a large, two-color LED for display that is easy-to-read in a small DIN48x48 body. Dual output of predicted output and preset output can be set with settings for predicted output.

CE Mark

Merits

●Large, easy-to-see display

A large LED for display with character height of 12 mm (4 digits) and 10 mm (6 digits) is used in a small DIN48x48 body.



●Easy operation

Setting and changing of preset values with individual setting keys has the feel of digital switches.

●User configurabe digit number

User can configure the no. of digit.

●Battery-less memory retention

EEPROM is used to retain values in memory, so there is no need for battery maintenance.

●Removable terminals

Maintenance has been reduced via terminals that can be removed. After wiring, the terminal cover provides a safe surface for worry-free use.

●Tamper proof

Key protection can be set for individual keys to prevent tampering.

●Power source for a large-capacity sensor (AC P/S type only)

You can source the power for sensor from the built-in P/S 24VDC, 60mA.

●Free power supply for the AC type

The operating AC voltage is wide as 85VAC～264VAC.

●Various types of counts

[Prescaling]

・The input pulse can be converted to any values and displayed.

[Dual phase addition/subtraction by individual input]

・The counting range can be from positive to negative. However, settings are in the positive range.

[Addition-Subtraction]

・Counts can be selected for positive or negative display.

●Dual output with alarm output

Dual setting is possible with alarm output.
Alarm values are values prior to reaching preset values.

●High-speed response with 10 kcps

The input response frequency for this class is a maximum of 10 kHz. Input operational speed can be adjusted to switch to 30, 200, 1 k, or 10 kHz.

●IP65

Membrane is used to protect from operation with wet or dirty hands, A special cover is also provided as an option to enhance the protective structure.

●Designed in compliance with CE and UL

List of Models

Category	Model Number	Number of Digits	Source Voltage	Sensor Source Voltage DC24 V 60 mA
Preset counter	**KCV-4S**	4	AC	●
	KCV-4S-C		DC	
	KCV-6S	6	AC	●
	KCV-6S-C		DC	
Total counter	**KCV-4T**	4	AC	●
	KCV-4T-C		DC	
	KCV-6T	6	AC	●
	KCV-6T-C		DC	

AC:AC100～240V
DC:DC12～24V

Model number system

KCV-□□-□

- **C:** DC power
  Blank: AC power
- **S** : Output
  T : Total
- **4** : 4-digit
  6 : 6-digit
- Series Name

Accessories: Installation Frame

4-digit

6-digit

General Specifications

Item		Specification	
		AC power	DC power
Source voltage		AC100～240V	DC12～24V
Permitted power fluctuation		AC85～264V	DC10～26.4V
Power consumption		approx. 11 VA	approx. 4 W
Sensor power		DC24 V (20-28V) 60 mA (Max. 10%p-p ripple)	———
Memory Backup upon Power Failure		EEPROM (Writing Up to 100,000 times) Memory Duration 10 years	
Ambient temperature		−10～50℃	
Storage temperature		-20-70℃ (with no freezing)	
Ambient humidity		35-85%RH (with no dewing)	
Withstand voltage		AC 2kV for one minute (for AC input, 0 V, and relay interconnection) (for DC input, 0 V, and relay interconnection)	
Vibration resistance	Durable	Displacement amplitude 0.5 mm Frequency 10-55 Hz along three axes	
	No malfunction	Displacement amplitude 0.35 mm Frequency 10-55 Hz along three axes	
Impact resistance	Durable	490 m/s² 11 ms along three axes	
	No malfunction	98 m/s² 11 ms along three axes	
Noise resistance		AC power ±1.5 kV between terminals (pulse width 1 of μs and rise time 1 of ns)	DC power ±1.0 kV between terminals (pulse width 1 of μs and rise time 1 of ns)
Protective structure		IP65 (front panel only)	
Weight		Approx. 150 g	Approx. 110 g
Terminals	Conforming wiring	0.25～1.65mm²	
	Conforming crimped contact	R1.25-3	
	Permitted torque	0.5Nm	

Performance Specifications

Item	Preset Counter	Total Counter
Category	Addition and Subtraction Preset Counter	Addition and Subtraction Total Counter
Setting	Single with alarm output	———
Number of digits	4 or 6 digits	4 or 6 digits
Display (LED character height)	4-digit: 12 mm (count)/7 mm (preset) 6-digit: 10 mm (count)/7 mm (preset)	
Counting range	4-digit : -999-9999 6-digit:-99999-999999	
Setting range	4-digit : 0-9999 6-digit: 0-999999	———
Input	Operational speed: 30/200/1 k/10 kHz switching	
	Input resistance: positive logic 15 kΩ Negative logic 3.3 kΩ (AC power)/1.8 kΩ (DC power)	
	Inpult voltage: "L" 0-3 V "H" 7-30 V	
Disabled count input	Responded in less than 100 μs	
External reset	Max. signal amplitude 5 ms	
Automatic reset	Responded in less than 100 μs	
Manual reset	Responded in less than 0.1 s	
Input gate duration during power failure	20～500ms	
Input gate duration during power recovery	50～500ms	
Output	DC output: NPN open collector output 24 V 100 mA Withstand pressure 35 V residual voltage less than 1.5 V	———
	Relay output: 1 transformer relay AC220V 2A (resistance load)	———
Output mode	One-shot/ Hold/Match	———
Output duration	10-9990 ms every 10 ms	———
Prescaling	0.001-99.999 (6-digit)/0.001-9.999 (4-digit)	
Decimal point	Lamp for arbitrary places available	
Key protection	Setting of arbitrary keys possible	Setting of reset keys possible
Installation	Exclusively for embedding (terminal block connection)	

●Prescaling is for 1x values.

I/O Specifications

Count input	Input speed	30Hz／200Hz／1kHz／10kHz		
	Input resistance	Positive logic 15 kΩ Negative logic 3.3 kΩ (AC power)/1.8 kΩ (DC power)		
	Input voltage	L：0～3V H：7～30V		
Disabled count input	Input response	On delay: 0.1 ms Off delay: 0.1 ms		
	Input resistance	Positive logic 15 kΩ Negative logic 3.3 kΩ (AC power)/1.8 kΩ (DC power)		
	Input voltage	L：0～3V H：7～30V		
External reset input	Input response	On delay: 0.1 ms Off delay: 0.1 ms		
	Input resistance	Positive logic 15 kΩ Negative logic 3.3 kΩ (AC power)/1.8 kΩ (DC power)		
	Input voltage	L：0～3V H：7～30V		
Transistor output	Withstand voltage	Less than 35 V		
	Current	Less than 100 mA		
	Residual voltage	Less than 2 V		
Relay output	Capacity	AC220V 2A (resistance load)	AC220V 0.5A (cos φ =0.4)	DC30V 0.5A (L／R=7ms)
	Lifetime	more than 100,000 uses	more than 200,000 uses	more than 200,000 uses

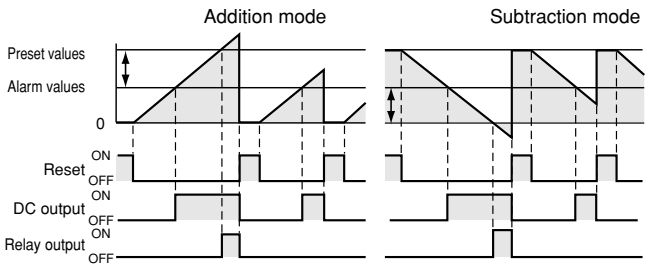
Output modes

Mode	Count	Output
Hold	Continuous	Hold
One-shot	Reset	One -shot＊ 10-9990 ms
Match	Continuous	Match

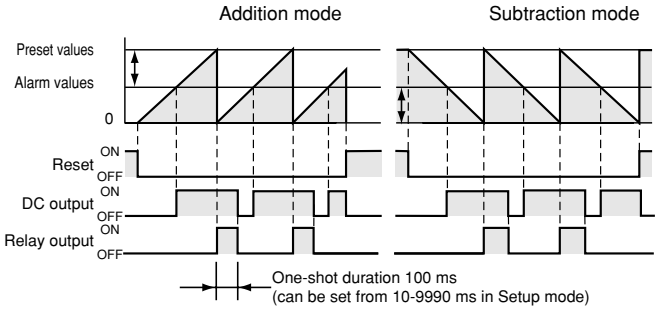
＊Can be set in milliseconds from 10 to 9990 ms (in Setup mode).

Output mode diagrams

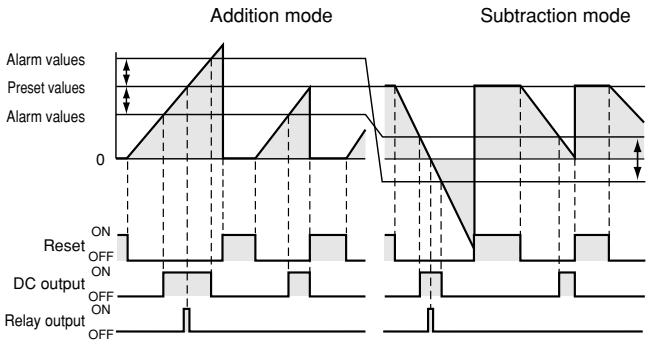
Hold output (continuous count)



One-shot output (reset count)



Matching mode (continuous count)



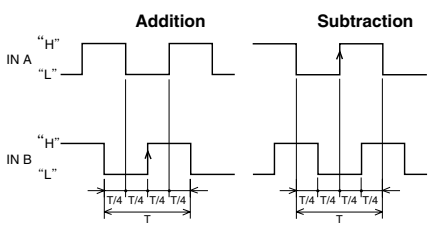
: Alarm value setting

When alarm values are set to 0, output operations for DC output will be the same as for relay output.

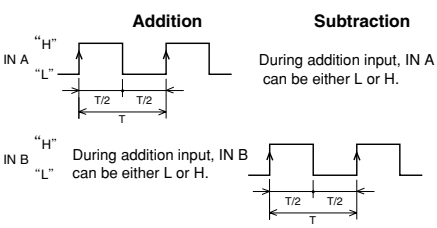
※When displaying alarm output (DC output), the output LED will blink on and off.

Counting timing

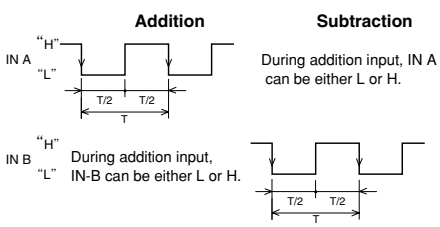
Dual input mode



Input mode for addition or subtraction (during input of positive logic)



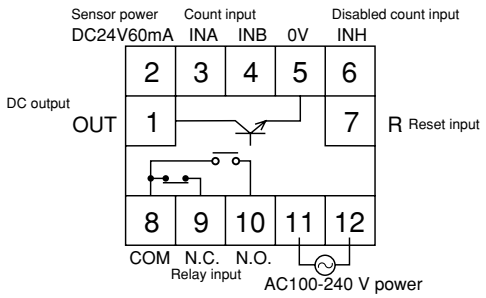
Input mode for addition or subtraction (during input of negative logic)



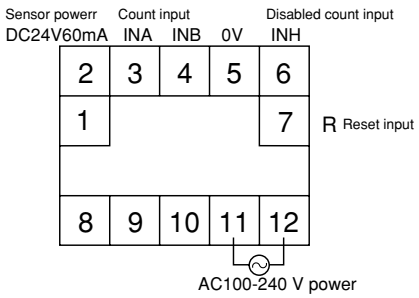
(Note)
With ↑ or ↓ the required counting speed is (CPS)= $\frac{1}{T\ \text{sec}}$

Wiring Diagrams

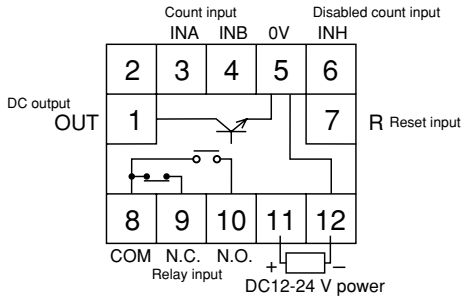
KCV-4S／6S



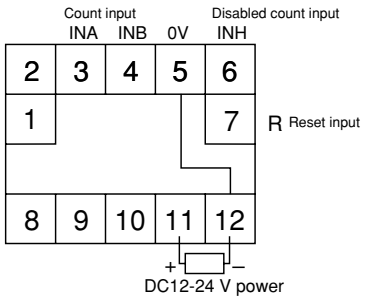
KCV-4T／6T



KCV-4S-C／6S-C



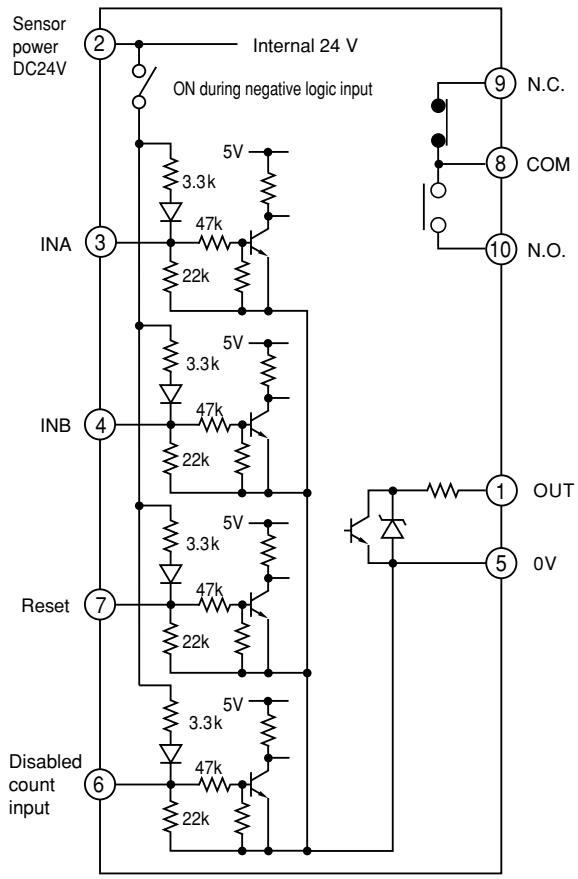
KCV-4T-C／6T-C



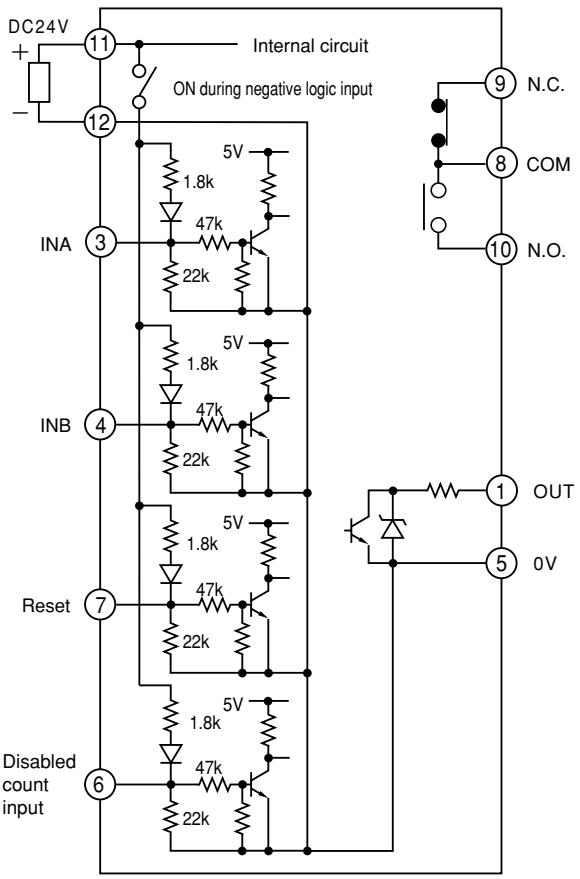
※Alarm output is used in combination with DC output (OUT terminal).

I/O Circuit Diagrams

AC power



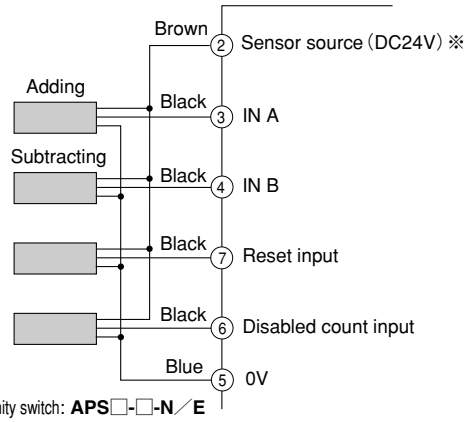
DC power



Input Wiring Examples

Proximity switch with NPN open collector output

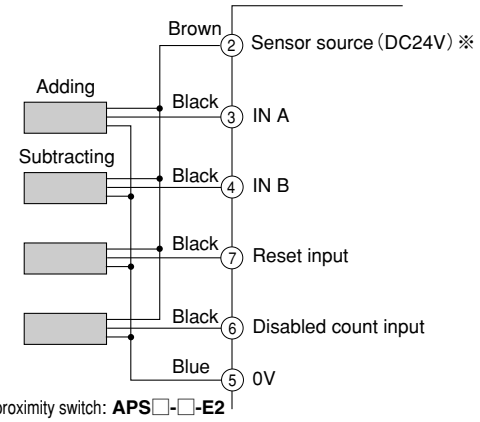
●Input logic: Negative logic: (no-volt input)(nEG)
●Input mode: Input for addition or subtraction (Dip switch 2 ON)



Recommended proximity switch: **APS□-□-N／E**

Proximity switch with voltage output or PNP open collector output

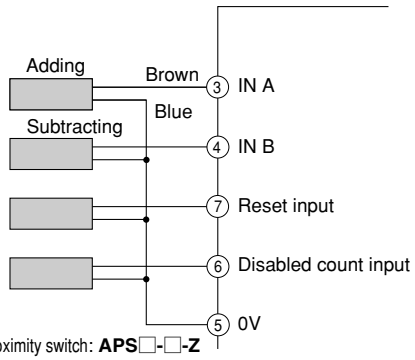
●Input logic: Positive logic: (voltage input)(Po5)
●Input mode: Input for addition or subtraction (Dip switch 2 ON)



Recommended proximity switch: **APS□-□-E2**

DC 2-wire proximity switch

●Input logic: Negative logic (no-volt input)(nEG)
●Input mode: Input for addition or subtraction (Dip switch 2 ON)

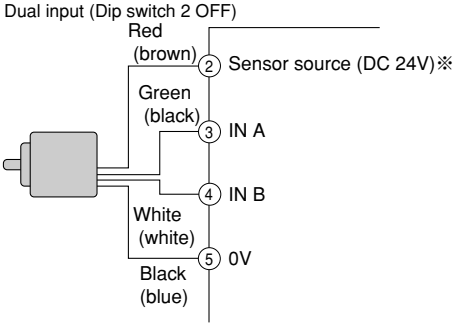


Recommended proximity switch: **APS□-□-Z**

•With the DC type, please supply source voltage above 20 V.

Rotary encoder

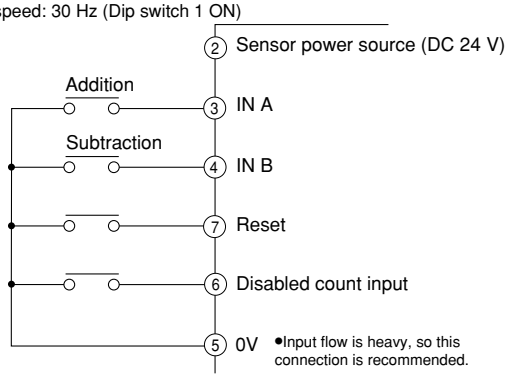
●Input logic: Arranged with encoder output and set as positive or negative logic
●Input mode: Dual input (Dip switch 2 OFF)



Recommended rotary encoder: **TRD-J□-RZ／S**
TRD-N□-RZ／S

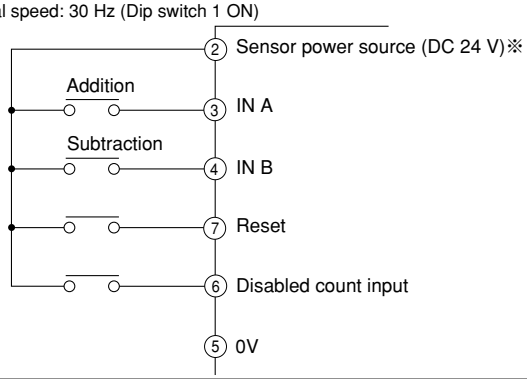
Switch or relay

●Input logic: Negative logic (no voltage input)(nEG)
●Input mode: Input for addition or subtraction (Dip switch 2 OFF)
●Operational speed: 30 Hz (Dip switch 1 ON)



•Input flow is heavy, so this connection is recommended.

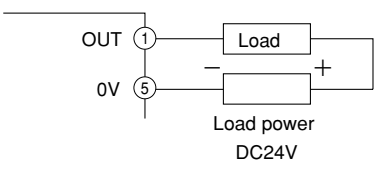
●Input logic: Positive logic (voltage input)(Po5)
●Input mode: Input for addition or subtraction (Dip switch 2 ON)
●Operational speed: 30 Hz (Dip switch 1 ON)



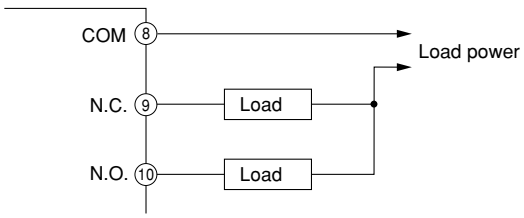
※There is no DC power source. Use a separate external power source.

Output Wiring Examples

NPN open collector output



Relay output



Front Panel Layout and Description

■Panel guide

①Output (red)
- •Operating mode
  Lit when output is ON.
  Blinks when alarm output is ON.

②Key protection (red)
- •Operating mode
  Blinks when key protection is ON (only when the key is ON).
- •Setup Mode
  Displays key protection settings.

⑥RST key
- •Operating mode
  Allows count values to be reset (0 for Addition and preset values for Subtraction).
- •Setup mode
  Allows selection of set items.

③Count value (red)
- •Operating mode
  Displays count values.
- •Setup mode
  Displays setting contents.

④Preset values (green)
- •Operating mode
  Displays preset values.
- •Setup mode
  Displays set items.

⑤Digit keys
- •Operating mode
  Allows changes in preset values
  ※After changing preset values, total key input is ineffective for about one second. Preset values then take effect.
- •Setup mode
  Allows to configure the setups.

●The Total Counter has several lamps that differ with respect to the Preset Counter:

①Output	: None
②Key protection	: None other than for display in compliance with (RST) key.
④Preset values	: Not displayed in Operating mode.
⑤Digit keys	: Not effective in Operating mode.

■Key strokes

1.Changing preset values

Press a digit key once to increase the corresponding digit by one:

→0→1→2→3→4→5→6→7→8→9

After removing your finder from the key, the settings will be verified after about one second.

2. Resetting the count

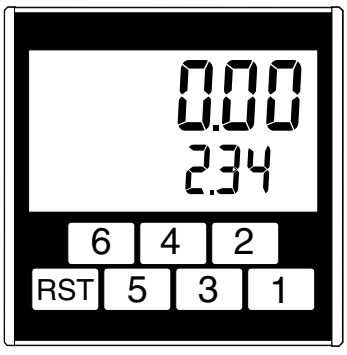
Press the (RST) key to reset the currently displayed count. The count is reset within 0.1 second after the key is pressed. For example, the current count 0010 is reset to 0 for Addition. It is reset to the preset value for Subtraction.

3. Protecting the keys

Turning the Dip switch ON disables the reset and digit keys. If disabled keys are pressed, the LED for the corresponding key will blink. If Key protection is selected to disable keys in Setup mode, Dip switch 6 will come ON. At factory setup, Key protection in Setup mode is completely disabled, so just turning Dip switch 6 ON will disable all keys.

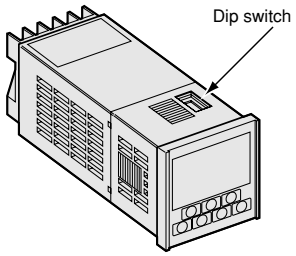
Example: When the counter is preset to "123"

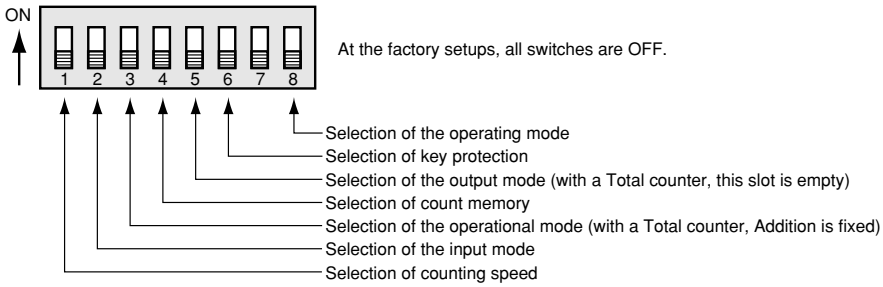
- [1] Press the 1 key and the display changes to 124
- [2] Press the 2 key and the display changes to 134
- [3] Press the 3 key and the display changes to 234



■Configure dip switches

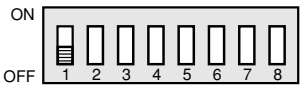
- ●Use the dip switch on the top of the counter to configure varions parameters and operation mode.
- ●Configure dip switches with power off. Operation with power up will have no effect.
- ●When dip switches are re-configured, you must press the Reset key in operating mode to reset the count values.





Counting speed

The counting speed is selected with Dip switch 1.

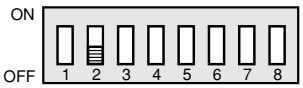


Counting speed	SW1
30Hz	ON
10kHz	OFF

※Factory setup

Input mode

The input mode is selected with Dip switch 2.

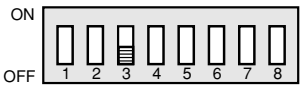


Input mode	SW2
Input for Addition or Subtraction	ON
Dual input	OFF

※Factory setup

Operational mode

The operational mode is selected with Dip switch 3.

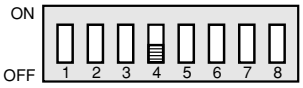


Operational mode	SW3
Addition	ON
Subtraction	OFF

※Factory setup

Counting memory

The counting memory is selected with Dip switch 4.

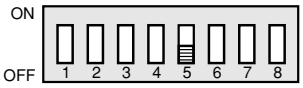


Counting memory	SW4
Memory upon power failure	ON
Power source reset	OFF

※Factory setup

Output mode

The output mode is selected with Dip switch 5. Match output can be selected in Setup mode.

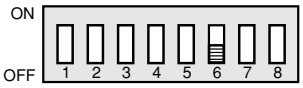


Output mode	SW5
Hold output	ON
One-shot output	OFF

※Factory setup

Key protection

With Dip switch 6, [Do not protect keys] can be selected to take effect for keys set in Setup mode using [Protect keys]. Setting for keys to protect can performed in Setup mode. At the factory setup, [Do not protect keys] is set.

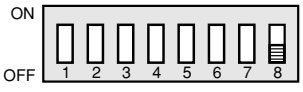


Key protection	SW6
Settings in Setup mode take effect	ON
Do not	OFF

※Factory setup

Operating mode

The operating mode is selected with Dip switch 8.



Operating mode	SW8
Setup mode	ON
Run mode	OFF

※Factory setup

※Dip switch 7 is not used.

■Setup mode

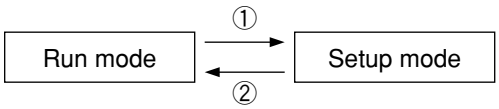
Settings that cannot be selected with dip switches can be set in Setup mode.

Items that can be configured in Setup Mode

(1) Counting speed—200/ 1 kHz, Dip switch 1
(2) Input logic ——— Positive or negative logic
(3) Output mode —— Match output, Dip switch 5
(4) Output duration—Duration of One-shot output can be set from 10-9990 ms (in 10-ms increments)
(5) Prescaling ——— 4-digit: 0.001-9.999
6-digit: 0.001-99.999
(6) Prescaling factor —— The scaling factor can be set for values used in prescaling.
1x
10x
100x
1000x
(7) Number of digits —— The number of counter digits for display can be set.
4-digit: 1-4 digits
6-digit: 1-6 digits
(8) Decimal place ——— An arbitrary digit can be set for display of the decimal point.
(9) Predicted output —— Offset values can be set with respect to preset values.
4-digit: 0-9999
6-digit: 0-999999
(10) Resetting key protection —— Setting to disable the reset key can be performed.
(11) Protecting digit keys ——— Setting to disable an arbitrary digit key can be performed.

※With a Total Counter, items 3, 4, 7, 9, 10, and 11 are skipped.

1. Switching Between Setup mode and Run mode

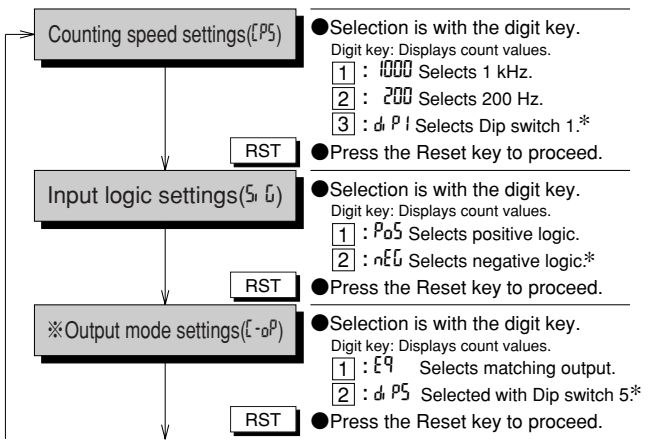


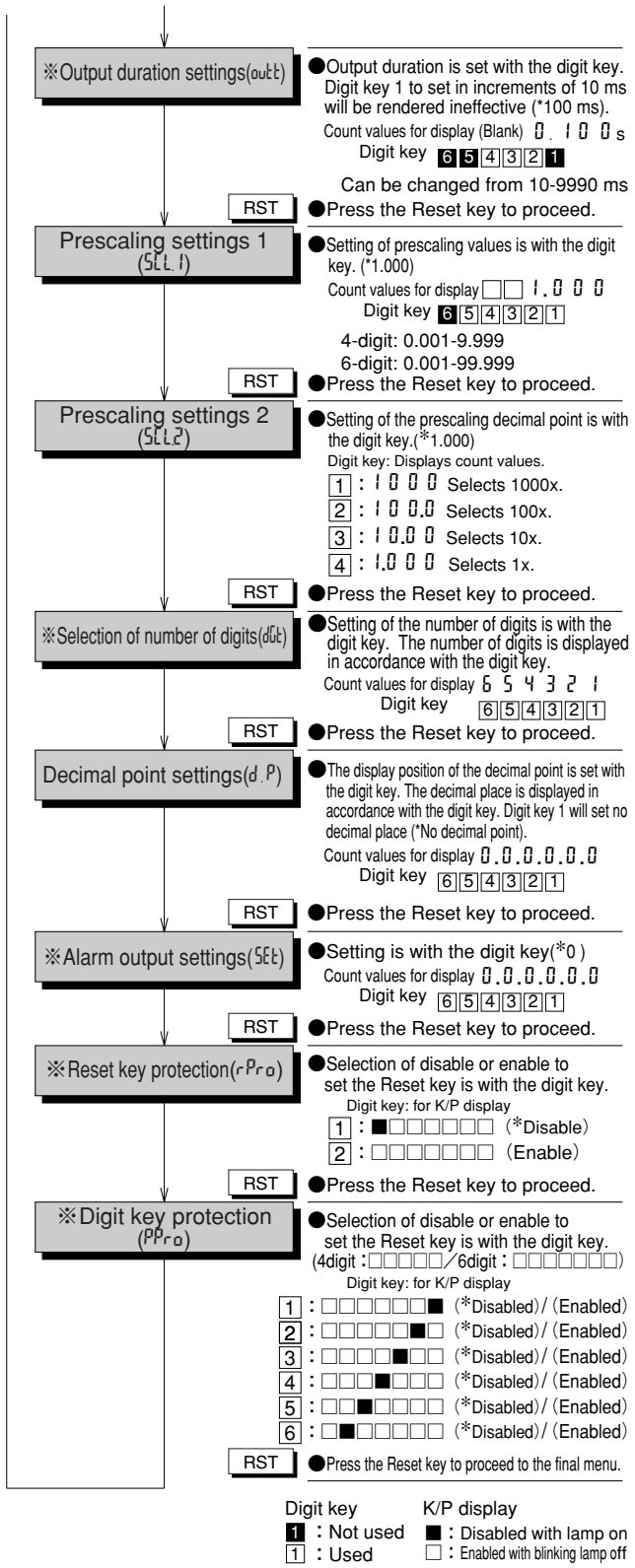
①Setting Dip switch 8 to ON and turning on the power will start the Setup mode.
②Setting Dip switch 8 to OFF and turning on the power will start the Run mode.

2. Operations in Setup mode

In Setup mode, the count can be initialized using the menu as follows:

＊Represents factory setup.





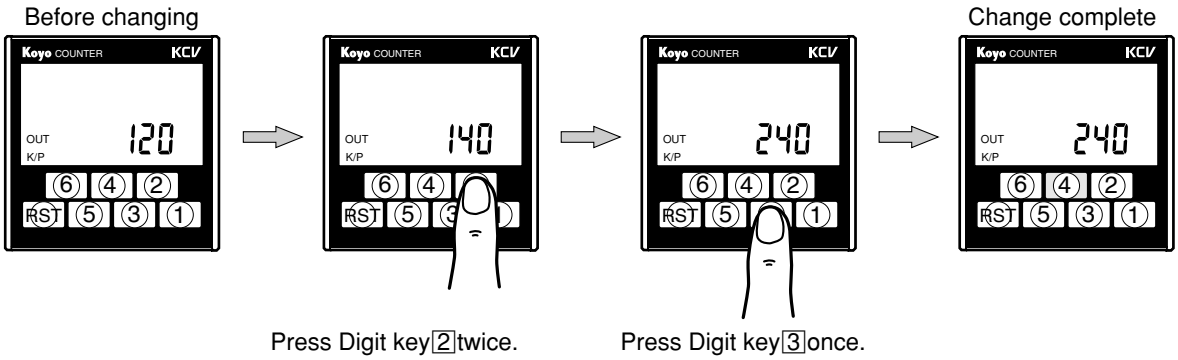
- The number of digits selected for setting of digits will render effective the settings for the decimal place, alarm output, and key protection that follow. Only the selected number of digits is set.
- With the Total Counter, items marked with an * are skipped.
- When changing the setting of the number of digits selected, the decimal point will be removed, the alarm output will be set to 0, and preset values will automatically be changed to 5.
- After changing the default settings in Setup mode, press the Reset key in Run mode and reset count values.

Operational Example (for KCV-6S)

■Run mode

Changing preset values

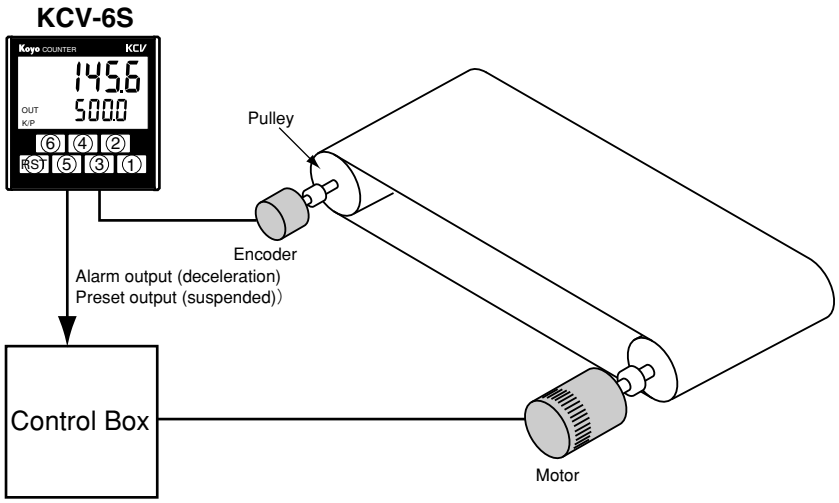
1. Change the preset value from 120 to 240



2. The preset value will be 240, and operations will continue with the altered value. Preset values will take effect about 1 second after being changed.

■Positioning application example with encoder

Positioning of a conveyor can be done in increments of 0.1 mm. It sets the Alarm in 20mm prior to the preset value to stop the conveyor in accurate position.



●Pulley diameter ：15 dia
●Encoder pulse count：1000P/R

Set item	Set item
Counting speed	10kHz※
Input logic	Negative logic※
Output logic	One-shot※
Output duration	100ms※
Prescaling	0.047
Scale factor	10
No. of digits	6※
Decimal point	Between 1st and 2nd digit
Alarm output	20.0

※Represents factory setup.

1. Prescale calculation

$$\text{Prescale} = \frac{\pi \times \text{pulley diameter (mm)}}{\text{encoder pulse count}}$$

$$= \frac{3.1416 \times 15}{1000}$$

$$= 0.047\text{-mm pulse}$$

2. Switching to Setup mode

Turn Dip switch 8 ON and then turn power ON (Dip switches 1-7 are OFF).

3. Changing setting contents

① The setting screen for Counting speed is first displayed.

These values are initial values.

Press the (RST) key to proceed.

② The setting screen for Input logic is displayed.

These values are initial values.

Press the (RST) key to proceed.

③ The setting screen for Output mode is displayed.

These values are initial values.

Press the (RST) key to proceed.

④ The setting screen for Output duration is displayed.

These values are initial values.

Press the (RST) key to proceed.

⑤ The setting screen for Prescaling settings 1 is displayed.

Set prescaling to 0.047.
Press the 4 key 9 times.
Press the 2 key 4 times.
Press the 1 key 7 times, and 0.047 will appear.

Press the (RST) key to proceed.

⑥ The setting screen for Prescaling settings 2 is displayed.

Set the scaling factor to 10.

Press the (3) key 1 time ans 10 will appear.

Press the (RST) key to proceed.

⑦ The setting screen for the Number of digits is displayed.

These values are initial values.

Press the (RST) key to proceed.

⑧ The setting screen for the Decimal point is displayed.

Display the decimal point between the first and second digit.

Press the 2 key and the decimal point will be displayed between the first and second digit.

Press the (RST) key to proceed.

⑨ The setting screen for Alarm output is displayed.

Set the alarm output to 20.

Press the (3) key twice and 20.0 will appear.

Press the (RST) key to proceed.

Setting is complete after this step.

4. Switching to Run mode

Turn the power OFF after completing setting in Setup mode and turn Dip switch 8 OFF (Run mode) (When power is OFF, all the setups in Setup mode are saved in the memory).

5. Starting Run mode

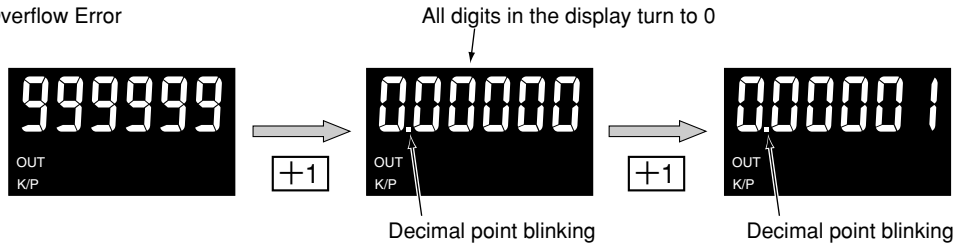
Be sure to turn power ON after changing the setups in Setup mode and press the (RST) key to reset the count values.

Error Codes

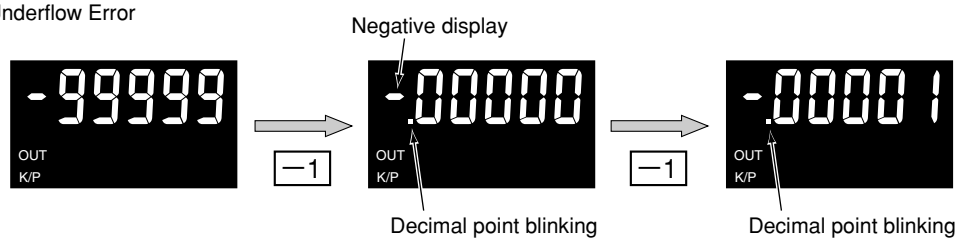
Common Errors

Error	Error type	Error details	Corrective Action
E21	Memory data error	Preset values and Setup mode items have changed.	Press the (RST) key to eliminate the error display. The count value will be set to 5000, and the Setup mode contents will be set to settings used at factory setup.
Decimal point blinking	Counter Overflow Error	Count values have exceeded the display range.	Error display will be cleared by the " (RST) " key or when the count valup return to the count range. In the counter, correct calculation is in a range from - 2147483.648 to 2147483.647.
Decimal point blinking Negative display	Counter Underflow Error	Count values are below the display range.	

●Counter Overflow Error



●Counter Underflow Error



Option

Option	Model Number	Details
Rubber packing	**KC-48P**	Prevents water from entering the control panel by installing this between the installation panel and KCV.
Front cover	**KC-48C**	Protects the front panel from dirt and the like. Material: Soft silicone rubber Key operation can be performed with the front cover as-is.

Precautions

●Precautions for Use

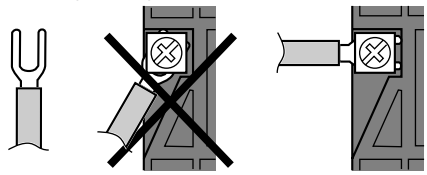
(1) With the DC power source, the 0-V terminal ⑫ and the input common 0-V terminal ⑤ are internally short-circuited.
(2) Apply the rated voltage in one instant, not by gradually raising the voltage.
(3) Always use negative input logic to set the DC 2-wire proximity switch.
(4) During counting, changes to preset values will take effect about one second after key input of the change. In subtraction mode, key input takes effect when the count is reset valid preset value will be saved in the memory at loss of power.
(5)It is recommended to use a sheet included in the package to keep the setups for the future maintenance.
(6) Use in the following environments should be avoided:
- ●A location where the ambient temperature is above 50℃ or below 10℃.
- ●A location where the ambient humidity is above 85% or abrupt temperature changes may cause condensation.
- ●A location with dust, iron fillings, corrosive gasses, or the like.
- ●A location exposed to direct sunlight.
- ●A location with significant vibrations or impact.

(7) When conducting testing of insulation withstand voltage, insulation resistance, or the like, remove the KCV counter from control box.

●Precautions for Wiring

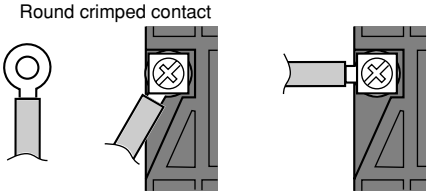
- ●Keep the wires away from power line.
- ●With regard to use in locations where extensive noise is generated, keep the KCV counter and wires away from the noise source to the extent possible.
- ●Empty terminals are not to be used as relay terminals.
- ●For connection, use of crimped contacts is recommended.
  When wiring the 1 and 7 terminals, do not install fork-shaped crimped contacts at an angle. Use a round crimped contact for angled installation.

Fork-shaped crimped contacts



For angled installation, connection with the contact is insufficient. Like in the illustration above, install the contact perpendicular to the horizontal.

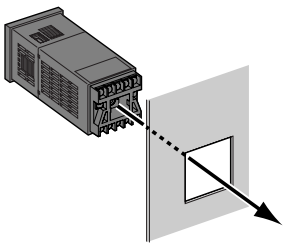
Round crimped contact



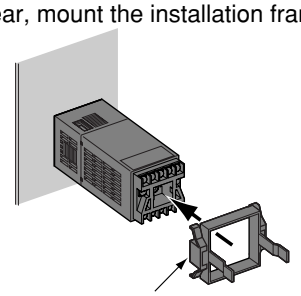
Installation and Removal of the Main Body

●Installation

①Insert the main body through the panel installation port.

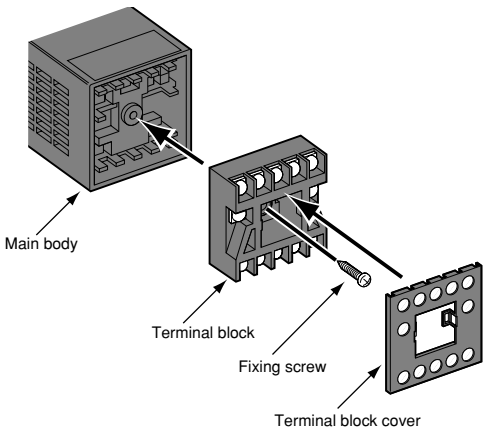


②From the rear, mount the installation frame.



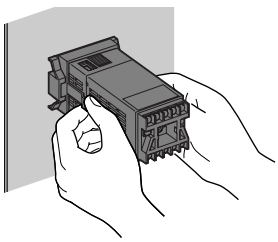
Installation frame: Can be installed vertically or horizontally.

●Installation of the Terminal Block and Terminal Cover



- ●Do not use a screw other than the one used to fix the terminal block during shipping.
- ●Maintain a permitted torque of 0.3 Nm.
- ●Install the terminal block after wiring is complete.

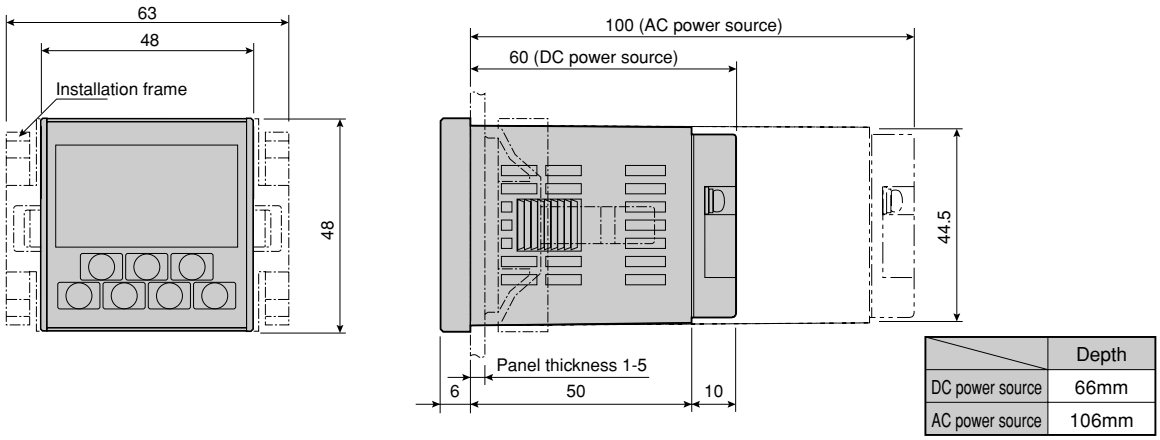
●Removal



①Holding the tabs, spread them 2-3 mm.
②While keeping the tabs spread, pull the device towards you.

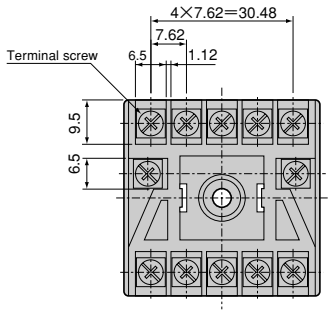
External Dimensions

(in mm)



	Depth
DC power source	66mm
AC power source	106mm

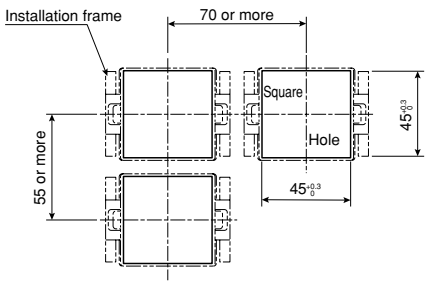
Detailed Diagram of the Terminal Block



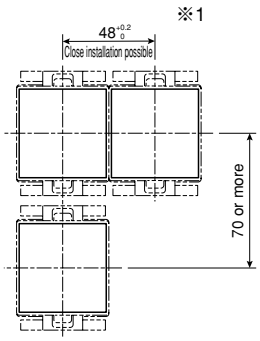
Complying wiring : 0.25～1.65mm^2
Complying crimped contact: R1.25-3
Permitted torque : 0.5Nm

Boring Dimensions for Installation

1.When the installation handle is horizontal



2.When the installation handle is vertical



※When aligning the front cover (KC48C and KC48P), line dimensions should be more than 55 mm.

KCN-A Single Preset Counters for Addition or Subtraction

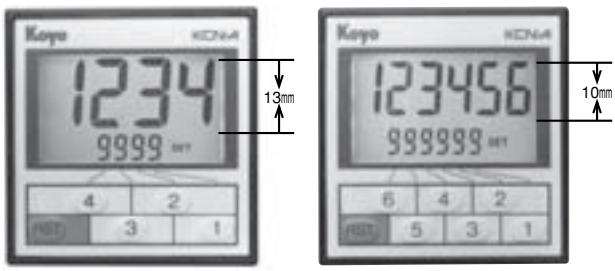
Maximum counting speed:
30cps/5kcps(selected by dip switch)
200cps/1kcps(selected in Setup mode)

With the DIN standard of only 48 mm by 48 mm, the full featured preset counter incorporates an easy to read LCD display.
Just press keys to set values by digit, or change operation between addition and subtraction.

Merits

●Small body and easy to read display

With its body of only 48 mm by 48 mm, the counter provides full screen display of either 4-digit or 6-digit numbers with the height of 13 mm or 10 mm.



●Backlit LCD integrated in all models

Displayed values are backlit to facilitate reading in darkness.

●Key Protection to lock keys individually

On the front panel, each digit key and the Reset key can be locked to protect against erroneous operation. The digit keys can be also used to increment the corresponding digit values.

●Keypad protection cover

A keypad cover is also attached to provide additional protection.

●EEPROM to eliminate cell replacement

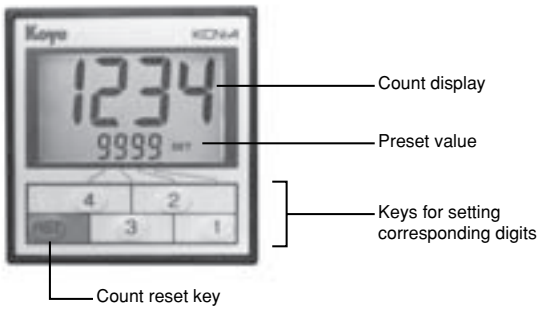
The counter uses an EEPROM to eliminate the use of cells. The memory can store all counts, preset values and mode settings.

●Water proofed front panel

The keypad on the front panel is completely coated (IP64) for insulation from dust and water.

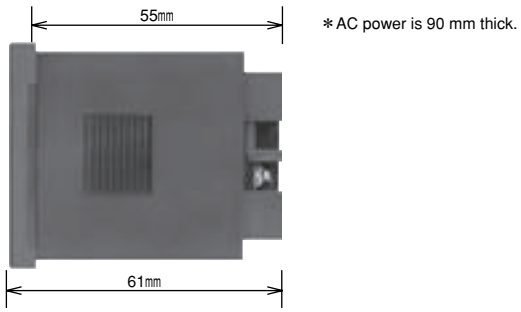
●Easy operation.

Values can be set and changed digit by digit simply by pressing the corresponding keys.



●DC power as thin as 55 mm

With minimum space requirement, the control board can be installed anywhere.



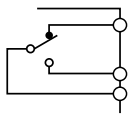
∗AC power is 90 mm thick.

●A series of models to meet all your needs

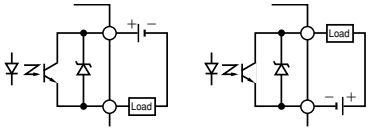
All eight models include advanced functions such as prescaling and decimal display. These models can be combined appropriately to satisfy your requirements.

●Output options

1c relay output



Either a sink or source can be used for DC output.



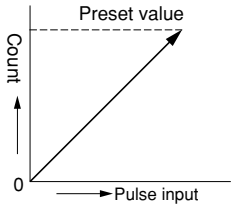
Isolated from internal circuit by photocoupler

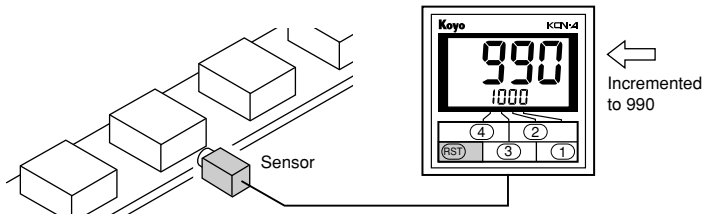
●Switching between addition and subtraction

Addition mode and Subtraction mode

Addition mode

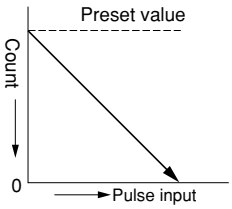
In the Addition mode, the count increments by one for each pulse input. When the value has reached a preset value, the counter generates a signal.

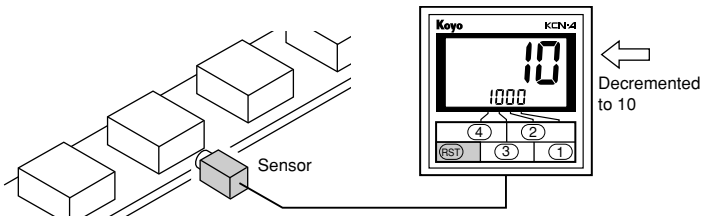




Subtraction mode

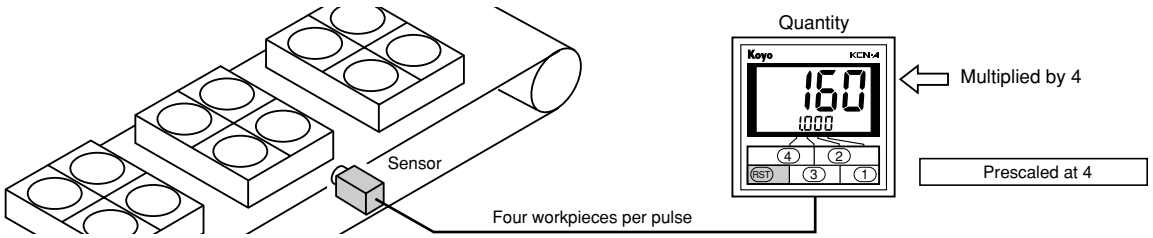
In the Subtraction mode, the count decrements by one for each pulse input. When the value has reached zero, the counter generates a signal.

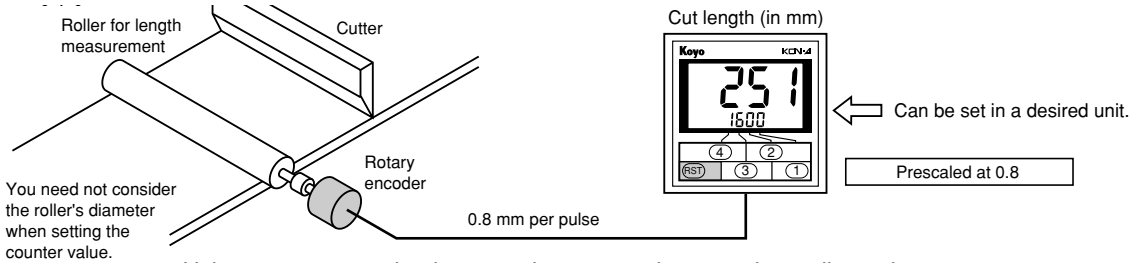




●Prescaling

Converting the number of pulses to quantity or dimension

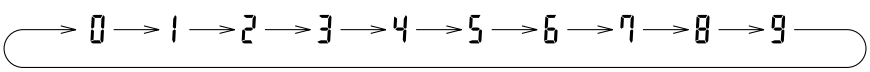


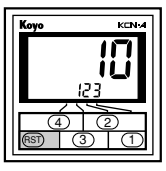


Using a present scale, the count is converted to quantity or dimension.

●Easy operation

Changing a preset value: On the front panel, press a digit key once to increment the corresponding digit by one.





Example: When the counter is preset to 123

Pressing (1) key increments the first digit by one to 124

Pressing (2) key increments the second digit by one to 134

Pressing (3) key increments the third digit by one to 234

Each digit is preset upon change.

●Key Protection against erroneous operation

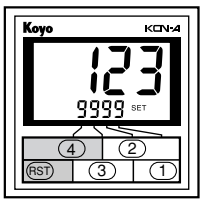
All keys on the front panel can be locked to secure current settings.

These keys can be protected individually.

The digit keys can be also used to increment the corresponding digit.

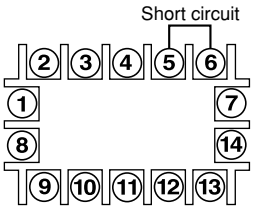
Example: Protecting the fourth digit of KCN-A4SR Counter

(1)In the Setup mode, select the key to be protected. In this case, choose the digit 4.



Protectable keys

(2)Short circuit the Key Protection input ⑥ and the 0V pin ⑤.



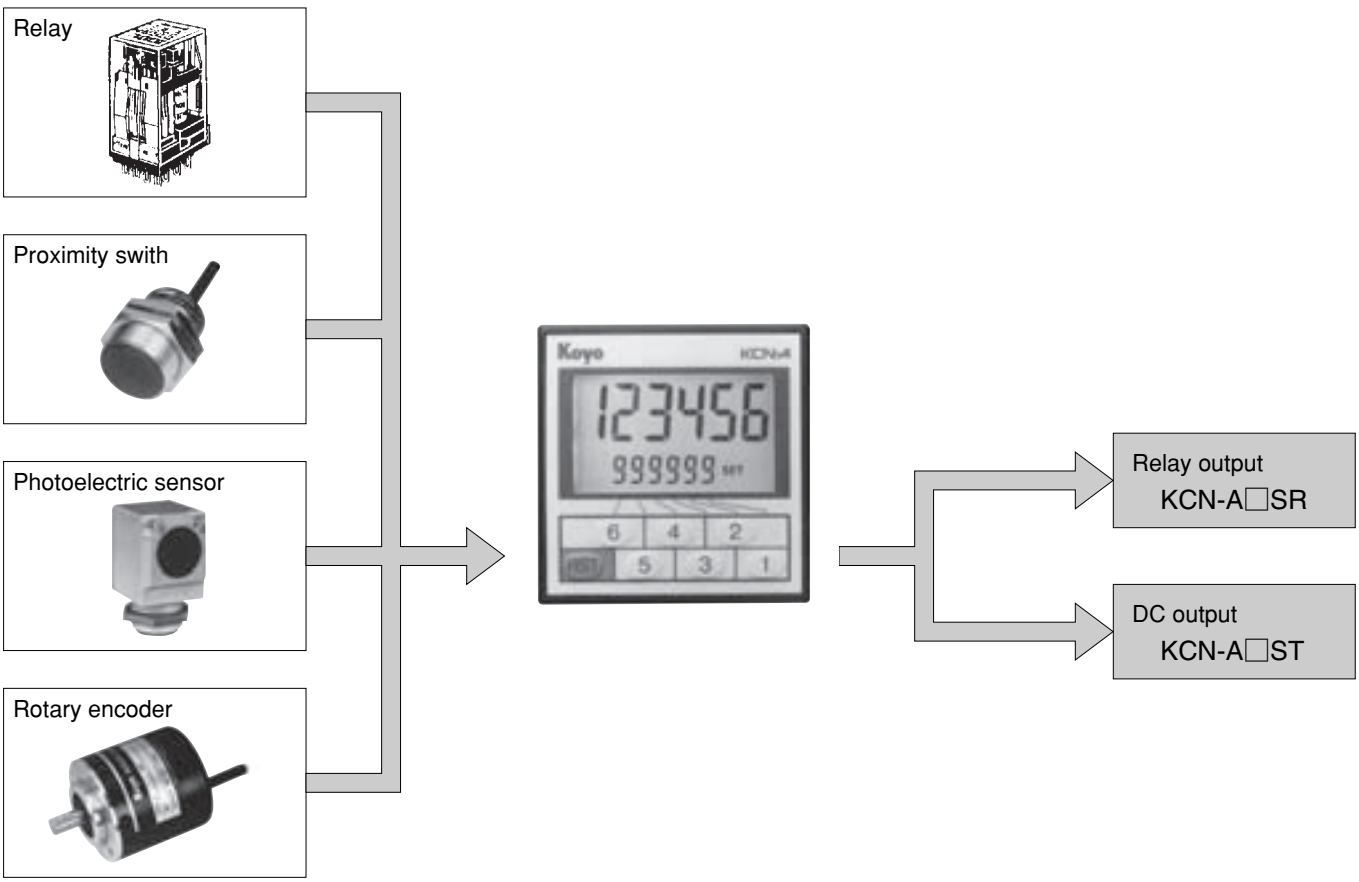
●Displaying a decimal point

A decimal point can be displayed at a desired location.

Decimal point

●Switching the input logic between positive and negative

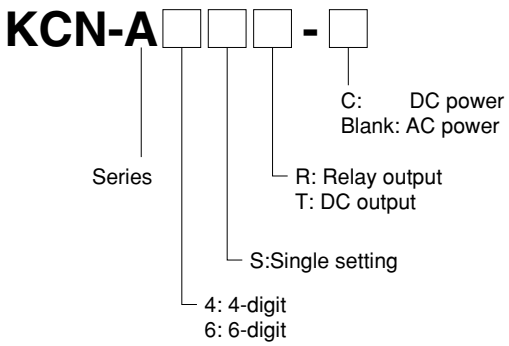
Device choices are expanded by two input logics available for positive (voltage) input and negative (no voltage) input.



List of models

Source voltage	Output	Sensor power	4-digit counters	6-digit counters
DC24V only	Relay output	None	**KCN-A4SR-C**	**KCN-A6SR-C**
	DC output		**KCN-A4ST-C**	**KCN-A6ST-C**
AC110V or AC200V	Relay output	DC24V 15mA	**KCN-A4SR**	**KCN-A6SR**

Model number system



General Specifications

Item		Specification
Source voltage	AC	AC 85～115V, or AC 180～240V
	DC	DC 20～28V (Max. 10%p-p ripple)
Power consumption	AC	Approx. 5VA
	DC	Approx. 2W
Sensor power	AC	DC 24V (20～28V) 15mA (Max. 10%p-p ripple)
	DC	None
Memory backup at power failure		EEPROM (Up to 100,000 writes) Either power-on reset or memory backup can be selected in Setup mode.
Ambient temperature		−10～+50℃
Storage temperature		−20～+70℃ (with no freezing)
Ambient/Storage humidity		35～85%RH (with no dewing)
Withstand voltage	AC	AC 2kV for one minute (For each of AC input, OV and relay output interconnection)
	DC	AC 2kV for one monute (between 0V and relay output)
Insulation resistance	AC	Min. 20MΩ at DC 500V (between AC input/0V/relay output)
	DC	Min. 20MΩ at DC 500V (between 0V and relay output)
Vibration resistance		Durable for one hour along three axes at 10～55Hz with 0.5mm amplitude No error for one hour along three axes at 10～55Hz with 0.35mm amplitude
Shock resistance		Durable for 11 ms along three axes at 490 m/s² (50G) No error for 11 ms along three axes at 98 m/s² (10G) (Shock applied three times in each case)
Noise resistance	AC	±1.5kV between power terminals (square wave pulse with 1 μs width and 1 ns rise time)
	DC	±1kV between power terminals (square wave pulse with 1 μs width and 1 ns rise time)
Coating		IP64 for the keypad on the front panel against dust and splash.
Installation		Flush mounting
Connection		Terminal block
Mass (weight)	AC	Approx. 220g
	DC	Approx. 110g

Performance Specification

Item	Specification				
Operation	Addition or subtration (selectable)				
Setting	Single				
Number of digits	4 or 6 digits				
Setting range	4 digits: 0～＋9999　6 digits: 0～＋999999				
Counting rage	4 igits: －999～＋9999　6 digits: －99999～＋999999				
Counting speed	30 cps or 5kcps (selected by Dip Switch 1) 200cps or 1kcps (selected in Setup mode)				
Input mode	Addition or subtration (selected by Dip Switch 2)				
Input logic	Negative (no voltage) or positive (selected in Setup mode)				
Count disable input	Responded within 0.2ms				
External reset input	Minimum pulse width: 6ms				
Auto reset	Responded within 0.2ms (14ms at 30cps)				
Manual reset	Responded within 0.1 s				
Power reset	Power shutdown: 1 s or more　Reset duration: 1 s or less (until restart)				
Output	NPN open collector or relay contact 1c (depending on models)				
Output mode	One Shot (momentary output) or Hold (selected by Dip Switch 3), or Countup (selected in Setup mode)				
Output duration in One Shot mode	100ms, or 10～9990ms (selected in Setup mode)				
Key protection	Both the Reset key and digit set keys, or individual key protection (selected in Setup mode)				
Zero setting	Enabled or disabled (selected in Setup mode)				
I/O response	Maximum counting speed	Open collector output		Relay output	
		On delay	Off delay*	On delay	Off delay
	30cps	14ms or less	15ms or less	24ms or less	24ms or less
	200cps	2.5m or less	3.5ms or less	13ms or less	13ms or less
	1kcps	1ms or less	2.5ms or less	11ms or less	11ms or less
	5kcps	0.5ms or less	2ms or less	11ms or less	11ms or less
Decimal point display	Any location (selected in Setup mode)				
Prescaling	4 digits: 0.001～9.999　6 digits: 0.001～99.999 (selected in Setup mode)				

＊Off delay time applies only to the Countup mode.

I/O Specifications

Count input	Input speed	30cps／200cps／1kcps／5kcps		
	Input resistance	Positive: 15kΩ Negative: 3.3kΩ		
	Input voltage	L：0～3V H：7～30V		
Count disable input	Input response	On delay: 0.2ms Off delay: 0.2ms		
	Input resistance	Positive: 15kΩ Negative: 3.3kΩ		
	Input voltage	L：0～3V H：7～30V		
External reset input	Input response	On delay: 6ms or less Off delay: 6ms or less		
	Input resistance	Positive: 15kΩ Negative: 3.3kΩ		
	Input voltage	L：0～3V H：7～30V		
DC output (Type T)	Withstand voltage	Max. 35 V		
	Current	Max. 100 mA		
	Residual voltage	Max. 2 V		
Relay output (Type R)	Capacity	AC220V 2A (resistance load)	AC220V 0.5A (cos ϕ =0.4)	DC30V 0.5A (L／R=7ms)
	Durability	Min. 100,000 contacts	Min. 200,000 contacts	Min. 200,000 contacts

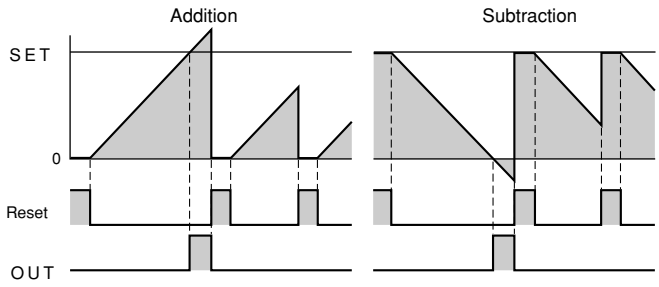
Output modes

Mode	Count	Signal output
Hold	Continued	Held
One Shot	Reset	Momentary (for 10 to 9990 ms*)
Equal	Continued	Only when the count equals the preset value

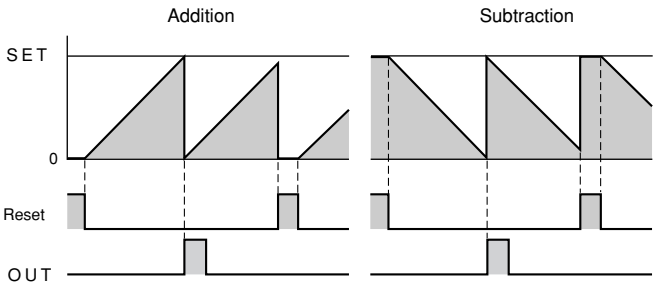
*Can be set in 10 miliseconds from 10 to 9990 ms (in Setup mode).

Output mode diagrams

Hold mode OUT: Held Count: Continued

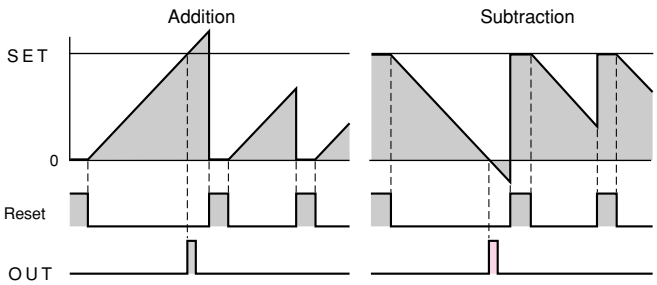


One Shot mode OUT: One Shot Count: Reset



● 100 ms in One Shot mode, or 10 to 9990 ms (can be set in Setup mode)

Equal mode OUT: Equal Count: Continued

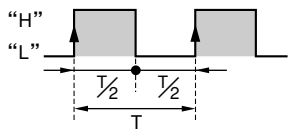


● Only when the count equals the preset value

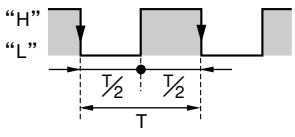
●Output duration depends on the counting speed. There is no DC output at 2kcps or relay output at 100cps or more.

Counting timing

●Positive (voltage) input



●Negative (no voltage) input

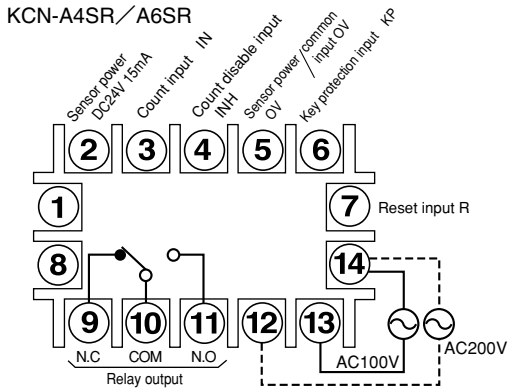


《Note》 or Counted at rising or falling edge.

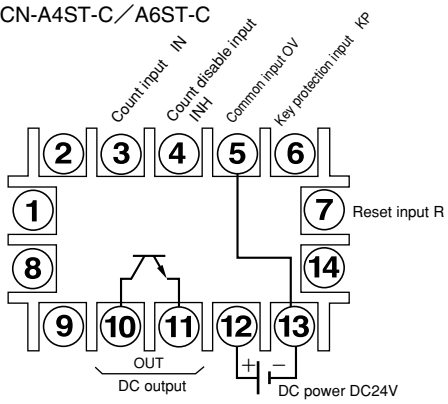
Minimum speed required (cps) = $\frac{1}{\text{Tsec}}$

Wiring Diagrams

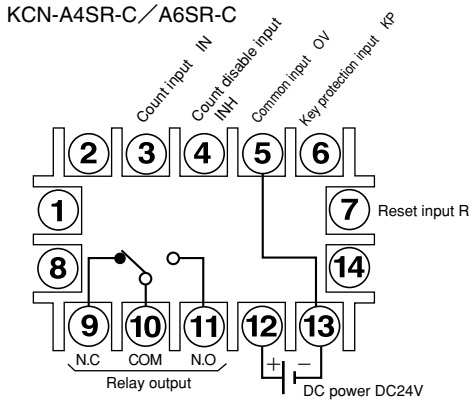
KCN-A4SR／A6SR



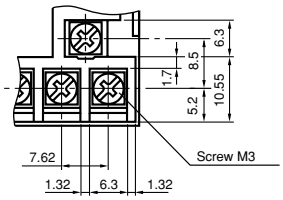
KCN-A4ST-C／A6ST-C



KCN-A4SR-C／A6SR-C



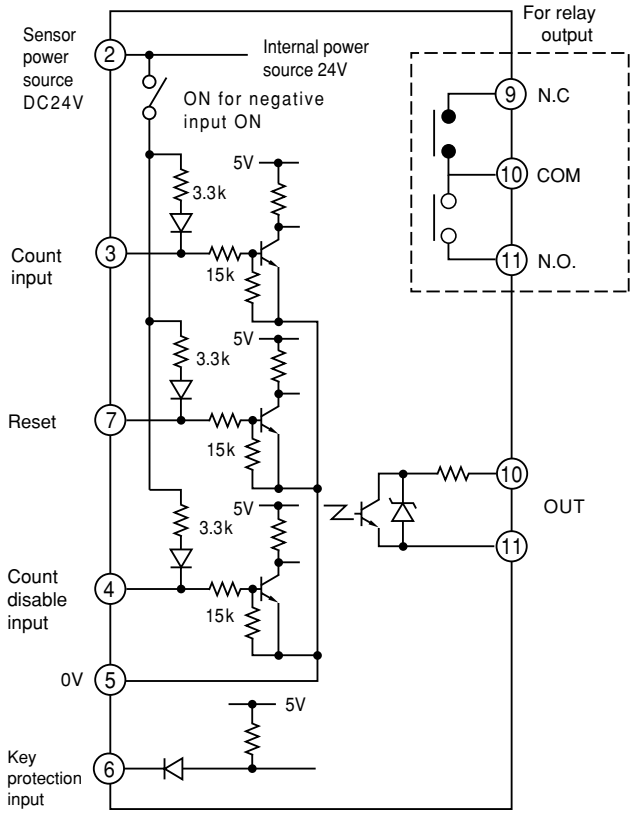
Dimensions of Terminal block



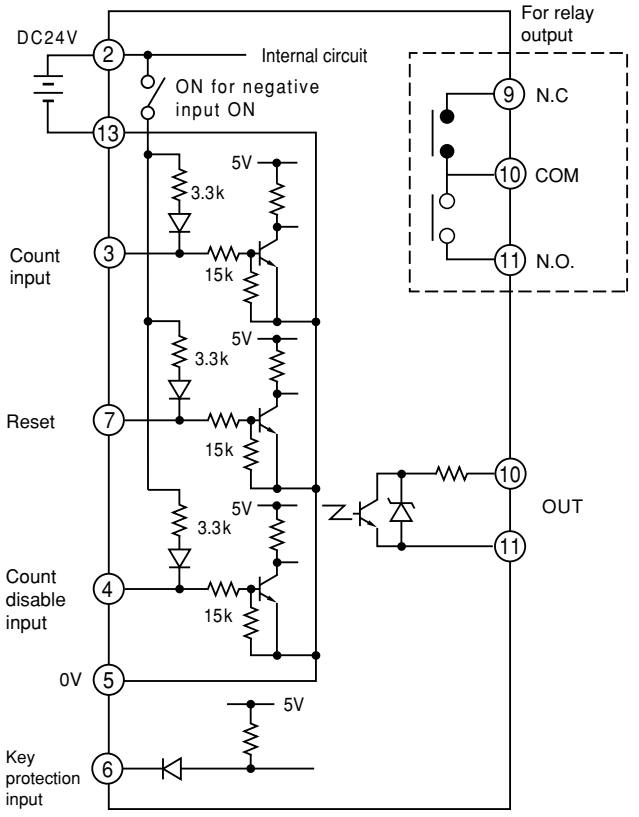
Wire section: 0.25～1.65mm²
Conforming criped contact: 1.25-3

I/O Circuit Diagrams

AC Power



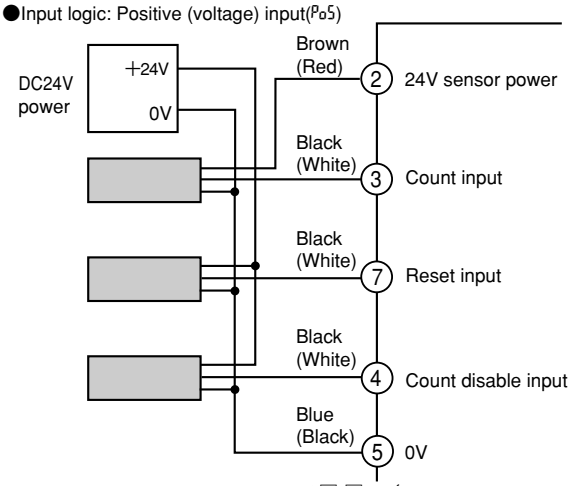
DC Power



Input Wiring Examples (count, reset and count disable)

Proximity switch with voltage output or PNP open collector output

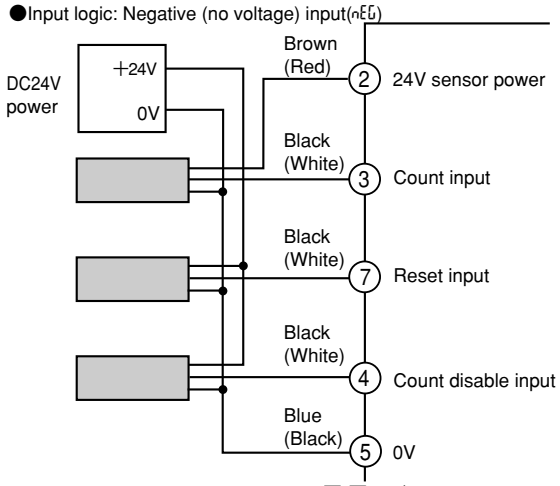
●Input logic: Positive (voltage) input(Pos)



Recommended proximity switch: APS□-□-T／E2

Proximity switch with NPN open collector output

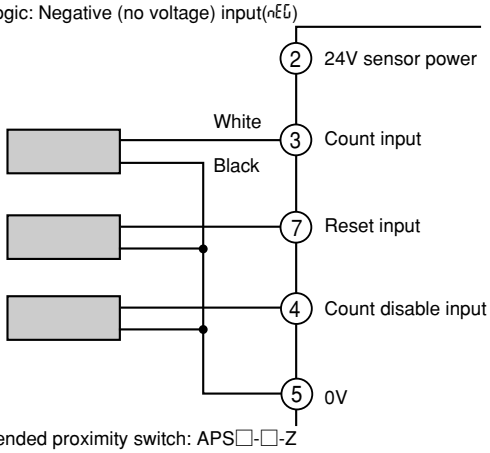
●Input logic: Negative (no voltage) input(neg)



Recommended proximity switch: APS□-□-N／E

DC 2-wire proximity switch

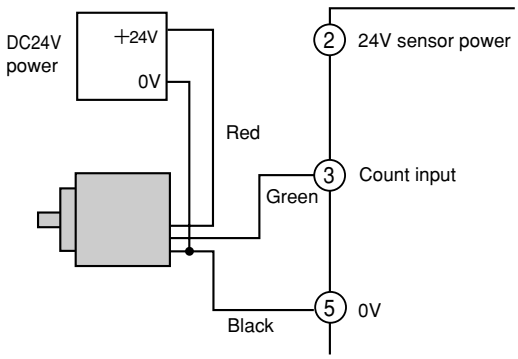
●Input logic: Negative (no voltage) input(neg)



Recommended proximity switch: APS□-□-Z

Rotary encoder

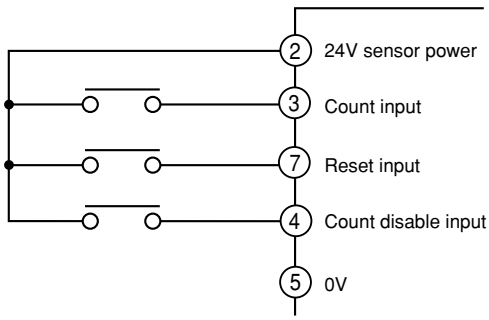
●Input logic: Positive or negative to be set according to the encoder output



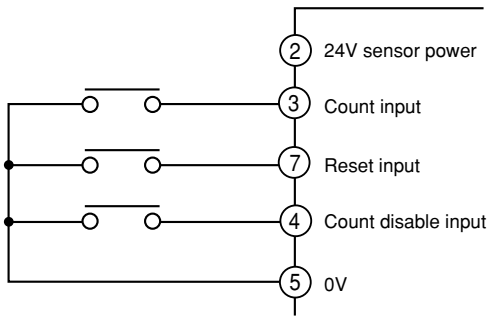
Recommended rotary encoder: TRD-J□-S(one-phase output)

Switch or relay

●Input logic: Positive (voltage) input(Pos)



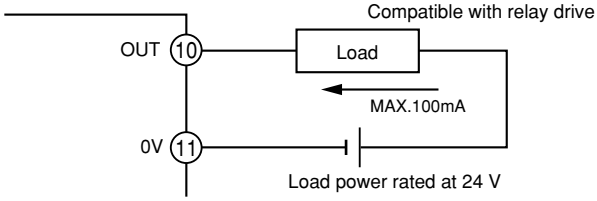
●Input logic: Negative (no voltage) input(neg)



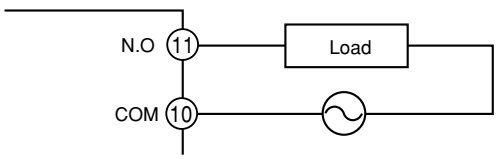
This connection is preferable to accommodate high input current.

Output Wiring Examples

NPN open collector output

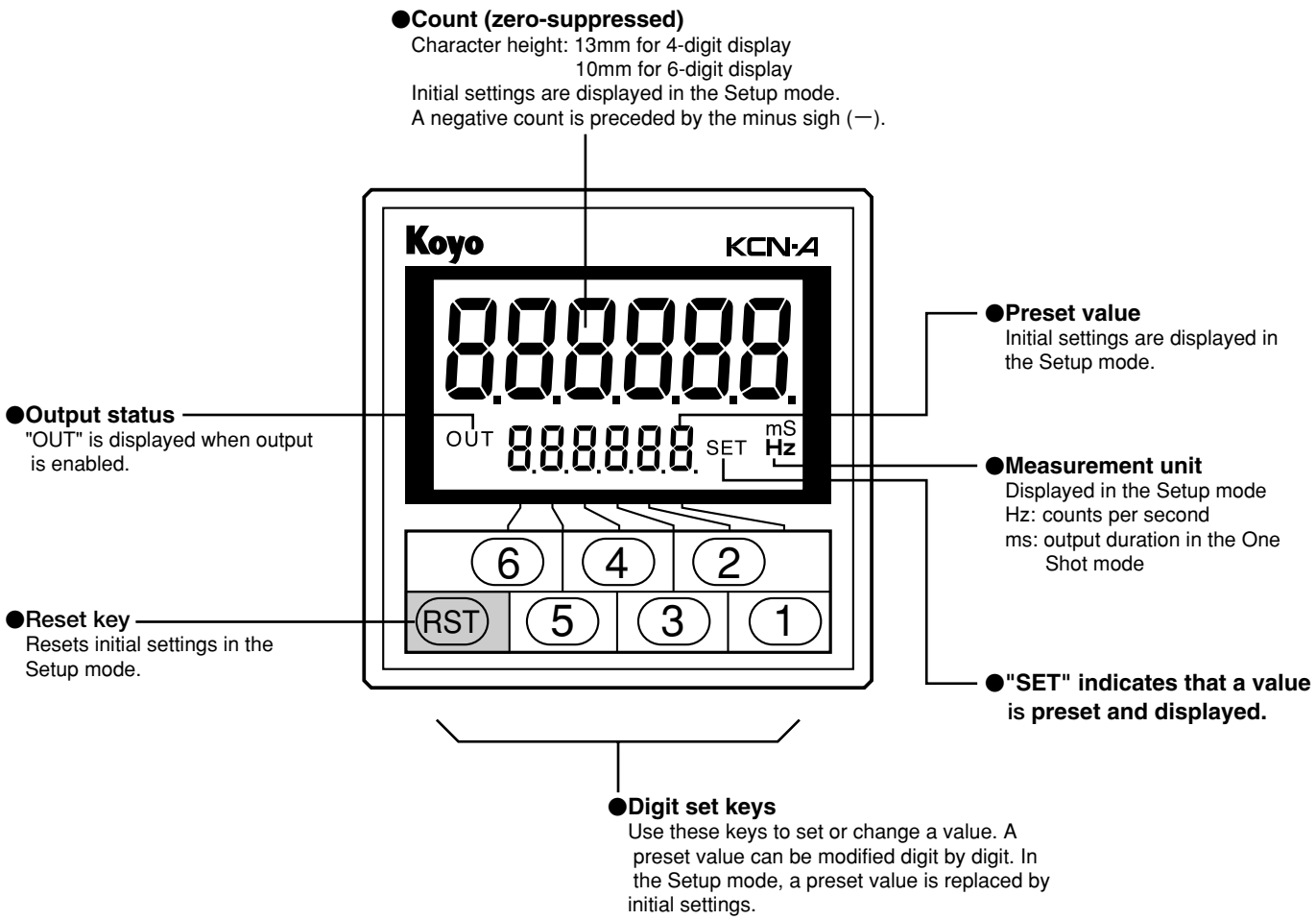


Relay output

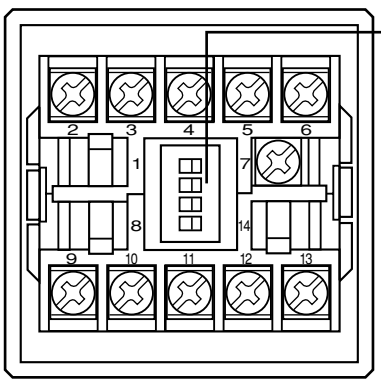


Front Panel Layout and Description

■Front panel



[Rear side]



■Using the keys

1. Changing a preset value

On the front panel, press a set key once to increment the corresponding digit by one.

→0→1→2→3→4→5→6→7→8→9

Example: When the counter is preset to 123

Pressing (1) key·····124

Pressing (2) key·····134

Pressing (3) key·····234

Each digit is preset upon change.

2. Resetting the count

Press the (RST) key to reset the currently displayed count. The count is reset within 0.1 second after the key is pressed.

For example, the current count "0010" is reset to "0" in the Addition mode, and to the preset value in the Subtraction mode.

3. Protecting the keys

You can lock the (RST) key and the set keys by short circuiting the Key Protection input pin ⑥ and the 0V pin ⑤. The keys to be protected can be selected in the Setup mode.

■Standard initialization using the dip switches

Use the dip switches on the rear panel to initialize the counter speed and modes. This initialization should be performed before you turn the power on.

Dip switches

1 2 3 4

ON

OFF

*All switches are set to OFF at delivery.

No.	Item	ON/OFF	indicated by	Mode selected
1	Counting speed	ON	30	30cps
		OFF	5K	5Kcps
2	Input mode	ON	DWN	Subtraction
		OFF	UP	Addition
3	Output mode	ON	⎍	One Shot (100 ms)
		OFF	⎍	Hold
4	Operation mode	ON	SET	Setup
		OFF	RUN	Run

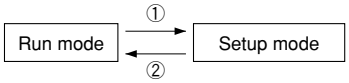
Set Dip switch 4 to the OFF position to start operation.

■Custom initialization in the setup mode

In the Setup mode, you can initialize the counter to non-standard values.

1)Counting speed: 200cps or 1kcps
2)Count memory: Off (power-on reset)
3)Input logic: Positive (voltage) input
4)Output mode: Countup
5)Output duration: Output duration in the One Shot mode can be set to 10 to 9990 ms in 10 ms increments.
6)Prescale: Four digits: 0.001 to 9.999
Six digits: 0.001 to 99.999
7)Decimal point: Can be displayed at any digit location.
8)Key protection: Reset key and/or any set keys can be selected for protection.

1. Switching between Setup mode and Run mode



1. Set Dip switch 4 to ON then turn the power on to enter into the Setup mode.
2. Set Dip switch 4 to OFF then turn the power on to enter into the Run mode.

*Initial values set in the Setup mode are written to the memory when the power is off.

2. Operation in Setup mode

In the Setup mode, the counter can be initialized using the menu as follows:

Count speed(SPEEd)
- ●Use the set key to select a value.
  Set key: Display
  1 : 200 200cps.
  2 : 1000 1kcps.
  3 : diP1 Follows the setting of DIP switch 1*.

RST ●Press the Reset key to proceed.

Count memory(Count)
- ●Use the set keys to select a value.
  Set key: Display
  1 : CLEr Power on reset.
  2 : rEtn Backup for power failure*

RST ●Press the Reset key to proceed.

Input logic(S inL)
- ●Use the keys to select a value.
  Set key: Display
  1 : PoS Positive logic
  2 : nEG Negative logic*

RST ●Press the Reset key to proceed.

Output mode(C-oP)
- ●Use the set keys to select a value.
  Set key: Display
  1 : Eq Coincidence output
  2 : diP3 Follows the setting DIP switch 3.*

RST ●Press the Reset key to proceed.

Output duration(out-t)
- ●Use the set keys to set the output duration. The 1 key is invalid because the duration must be set in 10ms unites.(100ms*)
  Display Blank 1 0 0 ms
  Set Keys 6 5 4 3 2 1

RST ●Press the Reset key to proceed.

Prescale(SCALE)
- ●Use the set keys to set the prescale. (1.000*)
  Display 1.000
  Set Keys 6 5 4 . 3 2 1

RST ●Press the Reset key to proceed.

Decimal point(Point)
- ●Use the set keys to set the decimal point place. The decimal point is displayed in the digit place for the specified set key. (Without decimal point*)
  Display 0.0.0.0.0.0
  Set Keys 6 5 4 3 2 1

RST ●Press the Reset key to proceed.

Rest key protection (r-Pro)
- ●Use the set keys to select a value
  Set key: Display
  1 : EnAb Enables the reset key.
  2 : diSA Disables the reset key*

RST ●Press the Reset key to proceed.

Set key protection (P-Pro)
- ●Use the set keys to set each set key to be enabled(o)or disabled(-). (*4-digit type:----/6-digit type:------)
  Set key: Display
  1 : - (Disabled)/o(Enabled) : Digit 1
  2 : - (Disabled)/o(Enabled) : Digit 2
  3 : - (Disabled)/o(Enabled) : Digit 3
  4 : - (Disabled)/o(Enabled) : Digit 4
  5 : - (Disabled)/o(Enabled) : Digit 5
  6 : - (Disabled)/o(Enabled) : Digit 6

RST ●Press the Reset key to proceed.

Output when the set value is 0(POout)
- ●Use the set keys to select a value.
  Set key: Display
  1 : diSA Output disabled*
  2 : EnAb Output enabled

RST ●Press the reset key to return to the count speed menu.

*Indicates a value set at delivery

Important: Always press the Reset key in the Run mode after changing initial settings.

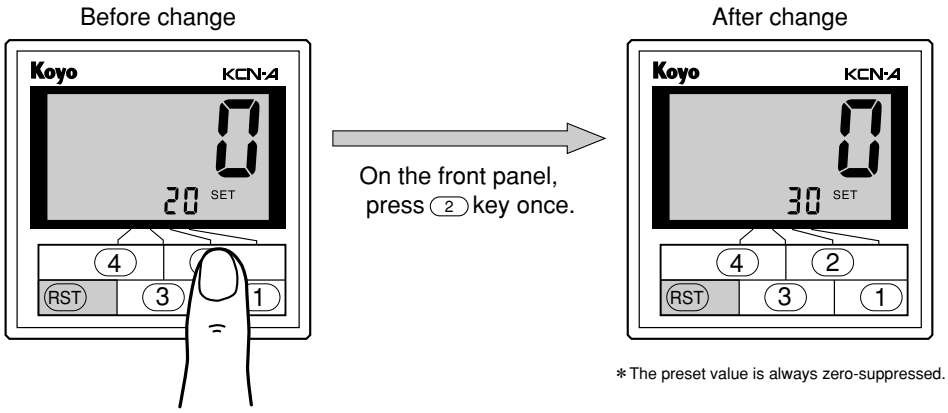
Notes
- When you enable key protection, short circuit the Key Protection input pin 6 and the 0V pin 5.
- Keys not available for specific operation are inversely highlighted.

Operation Example (for KCN-A4S)

■ Run mode

Changing the preset value

1. Change 20 to 30 as follows:

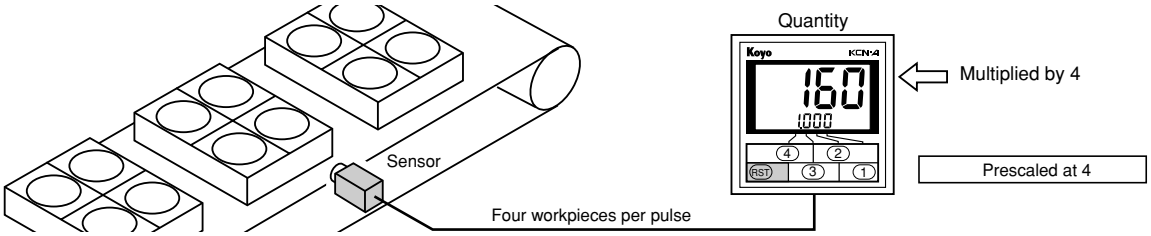


∗ The preset value is always zero-suppressed.

2. The new preset value 30 will be used for the subsequent operation.

■Setup mode

Set the prescale to 4 to count the number of workpieces processed as follows:



1. Switch to Setup mode.

Set Dip switch 4 to ON then turn the power on to enter into the Setup mode.

2. Set or change the initial settings.

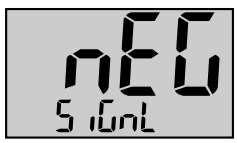
❶ On the counting speed screen, press Dip switch 1 to select the initial speed.

Press the (RST) key to proceed.

❷ On the Count memory screen, press "2" key to select memory backup at power failure.

Press the (RST) key to proceed.

❸ On the Input logic screen, press "2" key to select negative logic.



Press the (RST) key to proceed.

❹ On the Output mode screen, press "2" key to select the mode selected by dip switch 3.

Press the (RST) key to proceed.

❺ On the Output duration screen, leave the initial setting (100 ms) unchanged.

Press the (RST) key to proceed.

❻ On the Prescale screen, press the 4 key three times to change the current setting to 4.000.

All necessary settings are now completed.

3. Switch to Run mode.

Set Dip switch 4 to OFF, and turn the power off then turn it on again to enter into the Run mode. (Initial values set in the Setup mode are written to the memory when the power is off.)

4. Start up Run mode

Turn the power on after changing initial setups, and then press the (RST) key in the Run mode.

List of Error Codes

●In Run mode

	Error code		Description	Possible cause
	Count display	Preset display		
①	F F F F F F	Preset	Counter overflow	Count has exceeded upper limit.
	- F F F F F	Preset	Counter underflow	Count has decreased below lower limit.
②	Err (ERR)	PSEt (PRESET)	Preset memory data error	Preset value divided by prescale exceeds count range.
③	Err (ERR)	SEt (SET)	Initial setting memory data error	

Solving errors

①For an overflow or underflow, press the (RST) key to reset the counter and clear the error code.

②For a preset memory error, press the (RST) key. The preset display returns to the initial value (5000). Change this value as necessary.

③When an initial setting error has occurred, switch to the Setup mode then restart the counter. One of the error codes listed below will be displayed, Initialize or change the corresponding item(s), and return to the Run mode then press the (RST) key.
Simply press the (RST) key if no change is required. All items are reset to the initial values set at delivery.

●Initial setting memory data errors

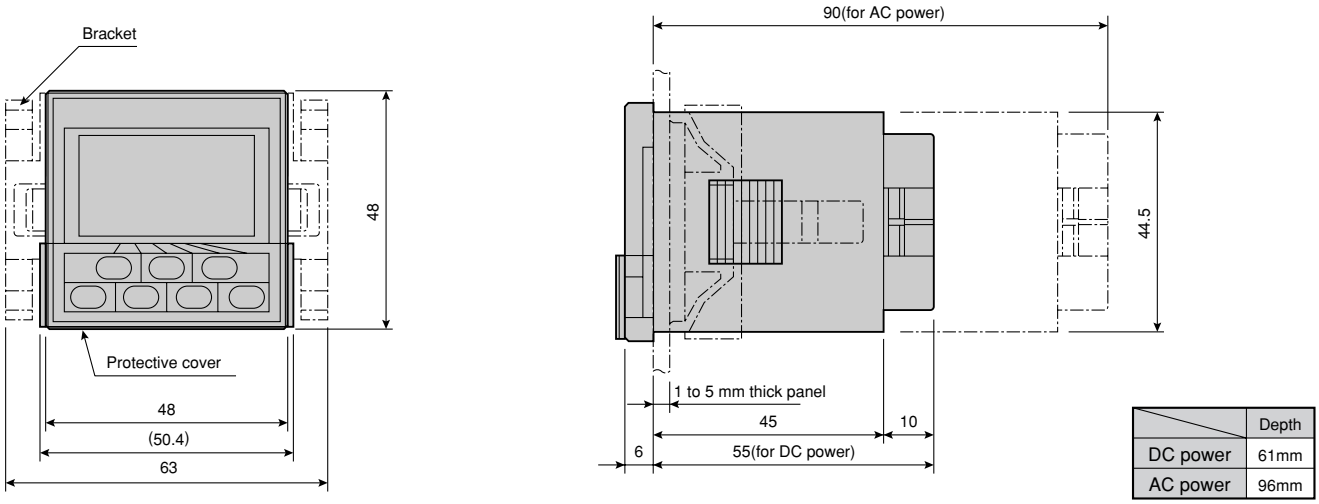
Error code		Description
Count display	Preset display	
Err (ERR)	SPEEd (SPEED)	Counting speed memory data error
Err (ERR)	Count (COUNT)	Count memory/reset data error
Err (ERR)	SiGnL (SIGNL)	Input logic memory data error
Err (ERR)	C-oP (C-OP)	Output mode memory data error
Err (ERR)	out-t (OUT-T)	Output duration memory data error
Err (ERR)	SCALE (SCALE)	Prescale memory data error
Err (ERR)	Point (POINT)	Decimal point memory data error
Err (ERR)	Pro (PRO)	Key protection memory data error
Err (ERR)	P0out (P0OUT)	Zero output memory data error

Note:
The counter is automatically checked for errors when its power is turned on. If an error occurs, counting and display are disabled except for overflow and underflow.

Important

●For DC power source, the 0V power terminal ⑬ and the 0V common input terminal ⑤ are internally short-circuited.
●Always use negative input logic for DC 2-wire proximity switch.
●After changing initial settings, always press the (RST) key to activate the new values.
●During counting, any change to a preset value becomes effective when each digit key is pressed.
●For maintenance purposes, keep records of initial settings and preset values.
●Avoid using the counter in the environments where:
(1) Ambient temperature is above 50℃ or below −10℃.
(2) Ambient humidity exceeds 85%, or abrupt temperature changes may cause dewing.
(3) The operation may by affected by dust, metal chips, corrosive gases or other harmful objects.
(4) The machine is exposed to direct sunlight.
(5) You anticipate vibration or shock.
●Keep the following in mind when wiring:
(1) The wiring of the counter should be separated from power line.
(2) Keep the counter body and wiring away from noise source.
(3) Never use a free terminal as a relay.
●Isolate the counter from the control circuit before testing insulation voltage and resistance.

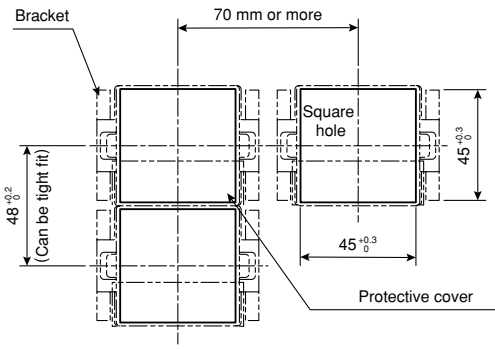
External Dimensions (in mm)



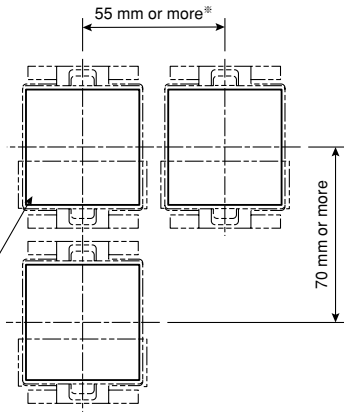
	Depth
DC power	61mm
AC power	96mm

●Boring dimensions for Installation

1. Horizontally aligned handles

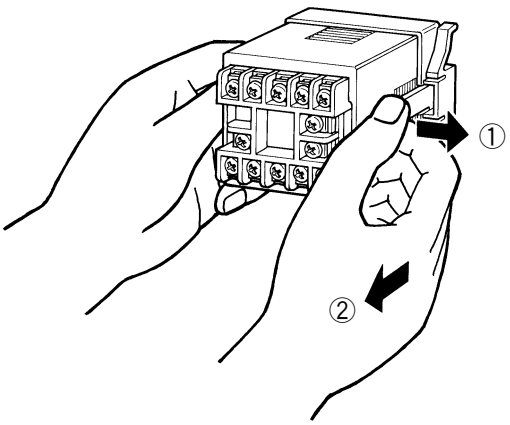


2. Vertically aligned handles



※48 mm for tight alignment without the protective cover.

●How to remove the counter



①Hold the lever then pull it 2 to 3 mm in the direction shown.
②Pull the lever to your side.

KCX series

Category			Model number	Number of digits	Memry backup at power failure	Operation speed	Sensor power	Source voltage
Preset Counter	Single preset	Addition with I/O indicators	**KCX-1**	1		10cps/ 200cps	DC12V 50mA	AC90～132V AC180 ～264V 50/60Hz
			KCX-2	2				
			KCX-3	3		10cps/ 1kcps		
			KCX-4	4				
		Addition with numerical display	**KCX-1D**	1		10cps/ 200cps		
			KCX-2D	2				
			KCX-2DM	2	●			
			KCX-3D	3		10cps/ 1kcps		
			KCX-3DM	3	●			
			KCX-4D	4				
			KCX-4DM	4	●			
			KCX-5D	5		10cps/ 5kcps		
			KCX-5DM	5	●			
			KCX-6D	6				
			KCX-6DM	6	●			
		Addition and Subtraction	**KCX-B4**	4		10cps/ 20kcps	DC24V 80mA	AC90～132V AC180～264V 50/60Hz
			KCX-B4M	4	●			
			KCX-B6	6				
			KCX-B6M	6	●			
	Dual preset (with numerical display)	Addition	**KCX-3W**	3		10cps/ 2kcps	DC12V 50mA	AC90～132V AC180～264V 50/60Hz
			KCX-4W	4				
			KCX-4WM	4	●			
			KCX-5W	5		10cps/ 5kcps		
			KCX-6W	6				
			KCX-6WM	6	●			
		Addition and Subtraction	**KCX-B4W**	4		10cps/ 20kcps	DC24V 80mA	AC90～132V AC180～264V 50/60Hz
			KCX-B4WM	4	●			
			KCX-B6W	6				
			KCX-B6WM	6	●			
Total counter	—	Addition	**KCX-4T**	4	●	10cps/ 1Kcps	DC12V 50mA	AC90～132V AC180～264V 50/60Hz
			KCX-6T	6	●	10cps/ 5Kcps		
			KCX-8T	8	●	10cps/ 10Kcps		
		Addition and Subtraction	**KCX-B6T**	6	●	10cps/ 20kcps	DC24V 80mA	

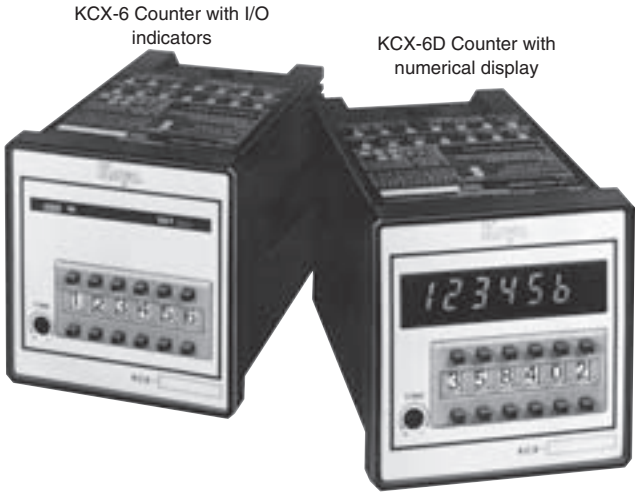
Accessory: Metal fitting(bracket)

KCX-□,□M,□D,□DM

Single Preset Green Counters for Addition

Maximum Counting speed	**1- or 2-digit: 10cps or 200cps** **3- or 4-digit: 10cps or 1Kcps** **5- or 6-digit: 10cps or 5Kcps**

These counters feature an easy to read green LED screen to display one- to six-digit values, and operation modes and status. Advanced functions are also integrated, including dust insulation and power backup.



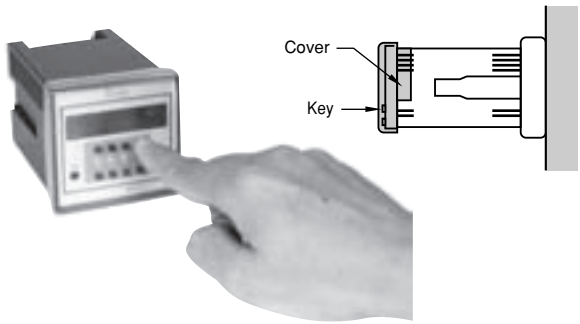
Merits

●Green LED for easy reading

Each model features a green LED display to facilitate reading. Numerical values are displayed with the height of 8 mm.

●Dust prevention cover

On all models, a protective cover is attached to the front panel. The keys and buttons can be operated through this cover.



●Minimum space requirement

In compliance with the DIN standard, all models are sized 72 mm (height)～72 mm (width)～103.5 mm (depth).

●Memory backup at power shutdown

Nickel cadmium battery is supported for minimum maintenance work. During power shutdown, current consumption is kept as low as several microamperes allowing memory backup for up to 2,000 hours. Power failure is detected by an integrated circuit to activate emergency I/O gates. Input status before shutdown is stored so the counter can resume operation upon recovery. Any pulse input is ignored during power shutdown.

●Built-in sensor power

A DC12V, 50 mA power source is included in all counters to allow direct connection to a proximity switch, photoelectric sensor or rotary encoder.

●Variable output duration

On the front panel, you can control the duration of One shot (Type A) output. Using a dial, the output time can be adjusted between 50 ms and 1,000 ms. You can extend it to 10 seconds by adding a capacitor.

●Type A and Type B output options

With a small change to the connection, the output mode can be switched between One shot and Hold.

●Six counter modes

Any of the six combinations can be selected as described on page 78.

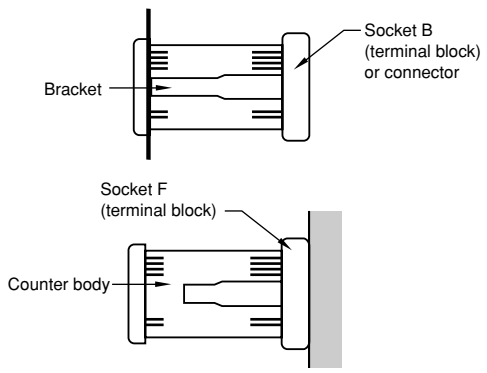
●Wide range of source voltage

You can choose source voltage of either AC90 to 132V, or AC180 to 264V.

●Option to disable count input

●Mounting

The counter can be mounted onto the wall surface in either way, wall surface mounting or flush mounting. Use mounting bracket for the flush mounting and use terminal block (socket F) for wall surface mounting.



Specifications

Model number	I/O indicators	Standard	KCX-1	KCX-2	KCX-3	KCX-4	—	—
	Numerical display	Standard	KCX-1D	KCX-2D	KCX-3D	KCX-4D	KCX-5D	KCX-6D
		backup memory	—	KCX-2DM	KCX-3DM	KCX-4DM	KCX-5DM	KCX-6DM
Number of digits			1-digit	2-digit	3-digit	4-digit	5-digit	6-digit
Operation	Type A: One shop output with auto reset Type B: Hold output							
Count input			Contact input	Static input	Contact input	Static input	Contact input	Static input
	Maximum count speed		10cps	200cps	10cps	1kcps	10cps	5kcps
	Minimum pulse width		50ms	2.5ms	50ms	0.5ms	50ms	0.1ms
	Input resistance		6kΩ	12kΩ	6kΩ	12kΩ	6kΩ	12kΩ
	Input voltage		"L"0～2V／"H"6～30V					
External reset	Response time		On delay: 20ms Off delay: 4ms		On delay: 10ms Off delay: 2ms		On delay: 5ms Off delay: 1ms	
	Input resistance		6kΩ					
	Input voltage		"L"0～2V／"H"6～30V					
Auto reset	Response time		Max. 5ms		Max. 1ms		Max. 0.2ms	
Power-on reset*1	Power shutdown		Min. 0.2s					
	Reset duration		Min. 0.2s					
DC output*2	Output resistance		1.2kΩ (at no load voltage of 12V)					
	Output current		Source: 2.5mA Sink:8.0mA					
	Withstand voltage		45V					
	Output duration		Type A: Variable Type B: Held					
Relay output	Capacity		AC250V 2A					
	Circuit		One transfer circuit					
	Output duration		Type A: Variable Type B: Held					
	Electrical durability		Min. 1,000,000 contacts at AC250V resistance load)					
	Mechanical durability		Min. 10,000,000 contacts					
I/O response*3			10cps	200cps	10cps	1kcps	10cps	5kcps
	Voltage output		Approx. 10ms	Approx. 4ms	Approx. 10ms	Approx. 0.8ms	Approx. 10ms	Approx. 0.15ms
	Contact output		Approx. 20ms	Approx. 14ms	Approx. 20ms	Approx. 10ms	Approx. 20ms	Approx. 10ms
Memory backup at power shutdown (Only models with battery)	Time for charging*4		50hours					
	Backup duration		Approx. 2,000 hours at 25℃ or 800 hours at 45℃					
	Response of emergency input gate*5		20～200ms (70ms typ)					
	Response of input gete upon recovery*6		50～500ms (120ms typ)					
Sensor power	DC＋12V±2V 50mA Max. 10% (rms) ripple							
Withstand voltage	AC 2kV for one minute (For each of AC power, pin E and relay contact interconnections)							
Insulation resistance	DC 500V Min. 20MΩ							
Vibration resistance	(In compliance with JIC C0911)		Durable for one hour along three axes at 10 to 55 Hz with 0.5mm amplitude No error for one hour along three axes at 10 to 55 Hz with 0.35mm amplitude					
Source voltage	AC 90～132V, or AC 180～264V (50/60Hz)							
Power consumption	With numerical display: Approx. 5VA With I/O indicators: Approx. 3VA							
Ambient temperature (during operation)	During power supply: 0～＋40℃ (－10～＋50℃ with no risk of destroyed battery) During memory backup: －10～＋50℃							

Storage temperature	With memory backup (included battery): −20～+50℃(−20～+70℃ during transportation of less than one week) Without memory backup: −20～+55℃
Ambient/Storage humidity	35～85%RH (with no dewing)
Noise resistance*7	1kV (square wave pulse with 1 μs width)
Weight	Approx. 0.5kg

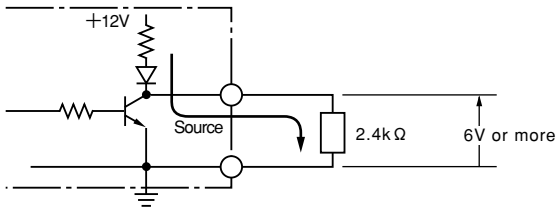
Notes:

*1. Power-on reset is available on the KCX-1 to 6 and KCX-1D to 6D, the models without the memory backup option (battery). "Reset time" is the time required for the counter to restart counting after the power is turned on.

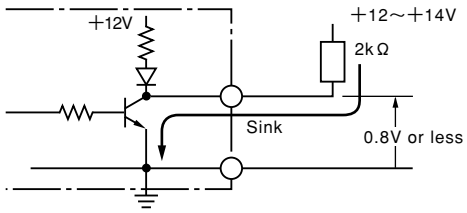
*2. DC output

When connected to 12V

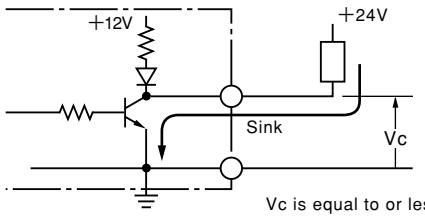
●Positive load



●Negative load

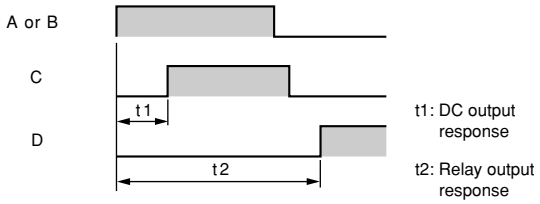


When connected to 24V



Vc is equal to or less than 3V at sink current of 20 mA.

*3. Time required for the counter to generate signal after the last pulse is counted at the rising edge.



*4. Time required for the included battery to be fully charged.

*5. Time for an internal circuit to disable pulse input and reset input after it detects power failure. Until this time, these signal inputs remain active.

*6. Time for an internal circuit to enable pulse input and reset input after it detects power recovery.

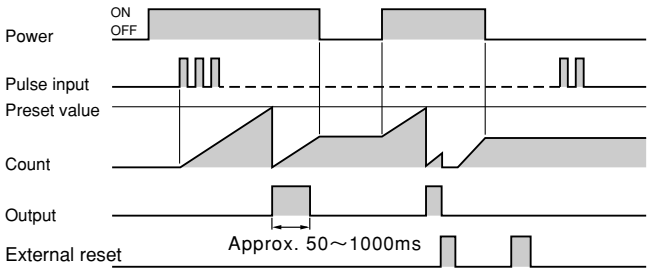
*7. Noise tests also include static discharge, induced load switching, electromagnetic switch oscillation and other tests defined by KOYO.

Output modes

Type A (One shot) output

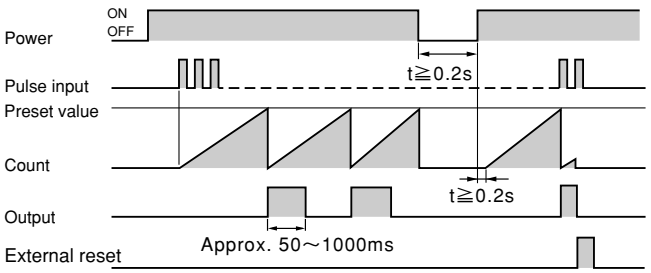
●The counter generates a signal upon countup, or when the number of input pulses has reached the preset value.
●Using a dial, the output duration can be adjusted between 50ms and 1,000ms.
●Upon countup, both the count and signal output are automatically reset.
●Count is reset to zero when the external reset terminal is activated.

With memory backup



●Count is reset by external reset.

Standard models

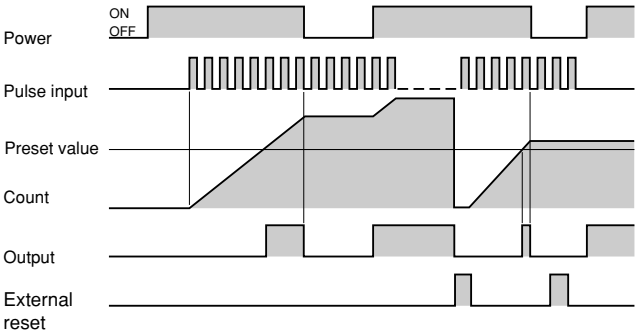


●Count is reset by external reset, or power shoutdown for 0.2 second or more.

Type B (Hold) output

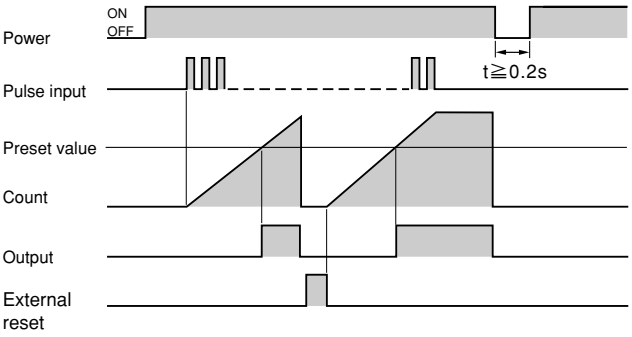
●The counter generates and holds a signal upon countup, or when the number of input pulses has reached the preset value.
●On the counters with numerical displays, the terminals ④, ⑤ and ⑥ can be connected. In this case, the count is not reset upon countup, but continues to be incremented for each pulse input.
When the terminal ④ and ⑤ are connected, the count is upon countup. (See "Switching between Type A and Type B" below.)

With memory backup



●Count is reset by external reset.

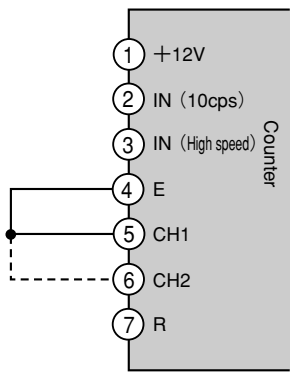
Standard models



●Count is reset by external reset, or power shoutdown for 0.2 second or more.

■Switching between Type A and Type B

Connect terminals ④ and ⑤ to select the Type B operation. The count is reset upon countup.
If the terminals ④, ⑤ and ⑥ are connected, the count is not reset upon countup. It continues to be incremented for each pulse input.



Type B operation

Terminal Assignment

●With I/O indicators

Teminal number	Name	Description
1	+12V	Sensor power output
2	IN(10cps)	Count input
3	IN	High speed count input*1
4	E	Grounding *2(capacitor ⊖)
5	CH	One shot output/Hold switch (capacitor ⊕)
6	—	Not connected
7	R	External reset input
8	OUT	DC output
9	COM.	Relay output
10	N.O.	
11	N.C.	
12	AC180～264V	AC power input
13	AC90～132V	
14	AC0V	

●With numerical display

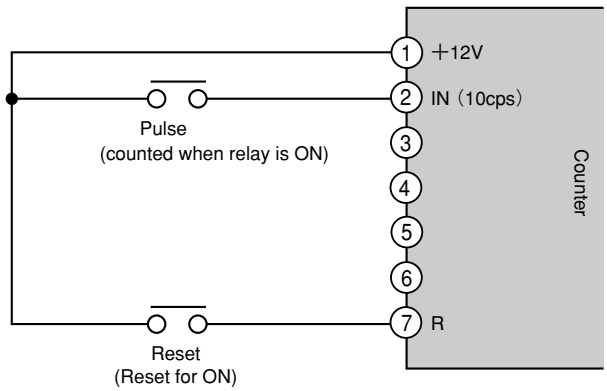
Teminal number	Name	Description
1	+12V	Sensor power output
2	IN(10cps)	Count input
3	IN	High speed count input＊1
4	E	Grounding ＊2(capacitor ⊖)
5	CH1	One shot output/Hold switch (capacitor ⊕)
6	CH2	Auto reset/Not auto reset switch
7	R	External reset input
8	OUT	DC output
9	COM.	Relay output
10	N.O.	
11	N.C.	
12	AC180～264V	AC power input
13	AC90～132V	
14	AC0V	

*1. See Specifications.
*2. Capacitor for output time extension

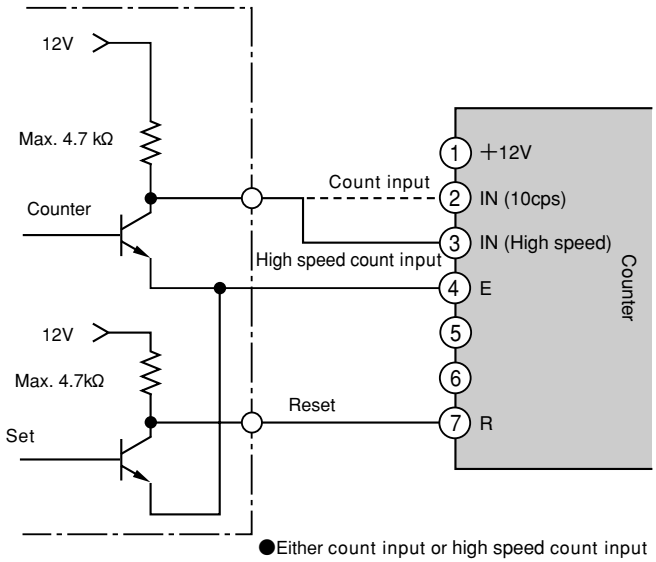
Wiring Diagrams

■Pulse input

1. Relay input

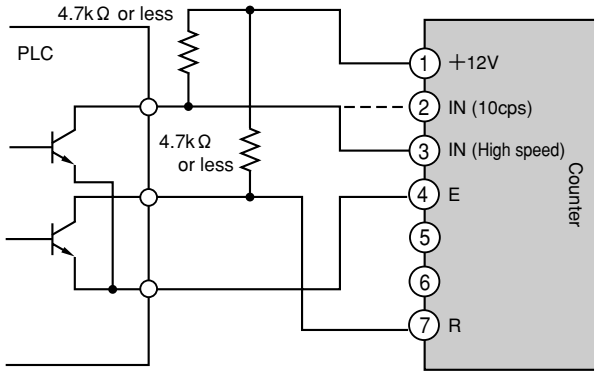


2. DC input



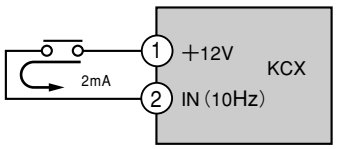
●Either count input or high speed count input can be selected as count rate.

3. Connection to open collector output

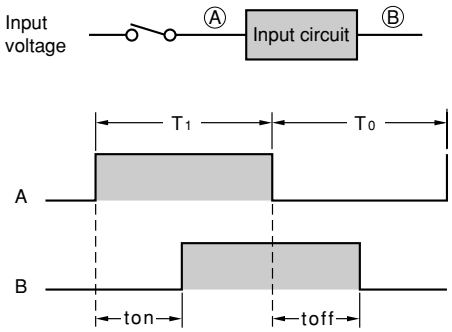


Notes on relay input

(1)On the circuit shown on the right, the input current to the relay is less than 2mA. Use a reliable relay that responds to such small current. Do not use an electromagnetic switch contact designed for large current and voltage.



(2)The following table lists the standard responses of Terminal ② at the pulse rate of 10 cps:

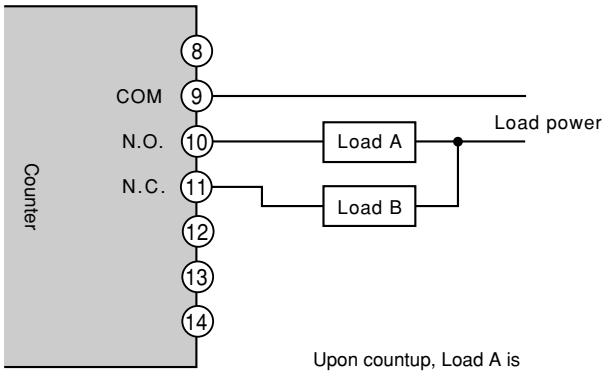


Input voltage	On delay (ton)	Off delay (toff)
6V	16ms	4ms
12V	8ms	8ms
30V	3ms	23ms

These are the standard values. T1 and T0 should be at least three times longer than ton and toff. For example, when using the DC12V sensor power, T1 and T0 should be 24ms or more.

■Output Connection

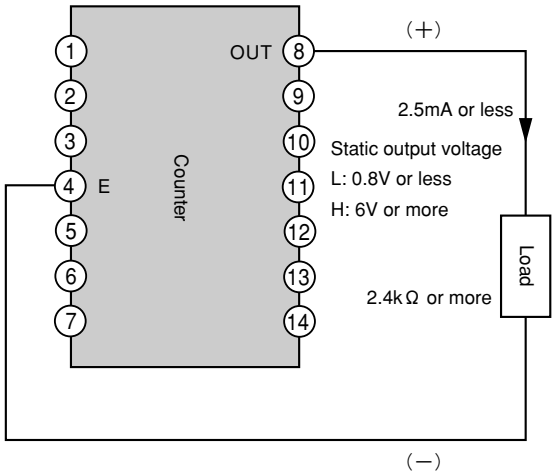
1. Relay output



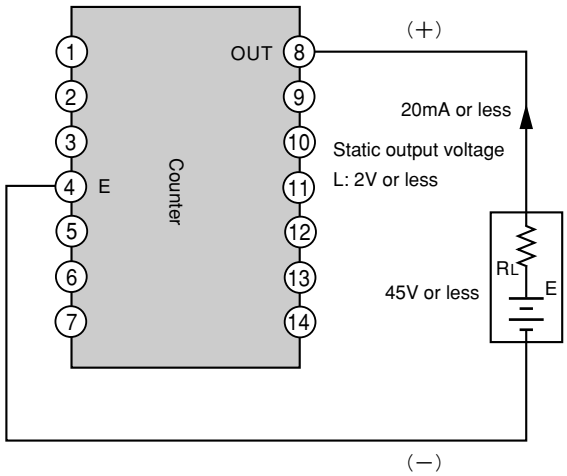
Upon countup, Load A is activated and Load B is deactivated.

2. DC output

●Source load



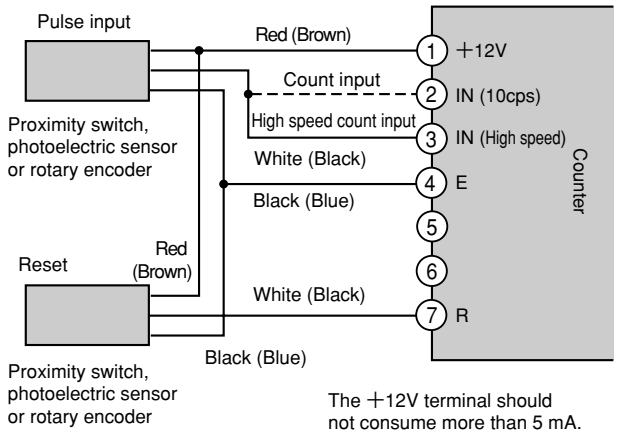
●Sink load



Electric current flows into the circuit when the output voltage falls to "L" level. Contrary to the open collector, the output rises to "H" level upon countup.

Connection Examples

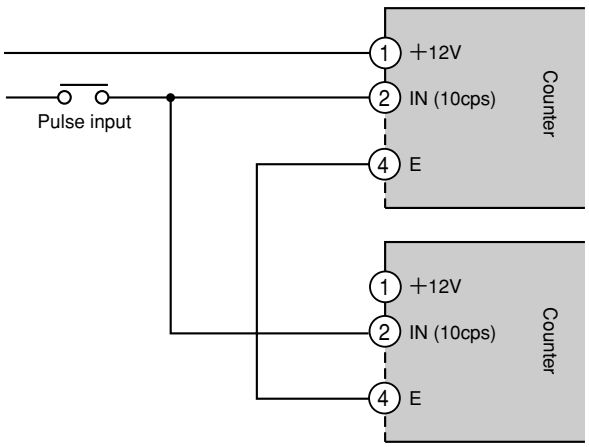
■Direct connection to a sensor



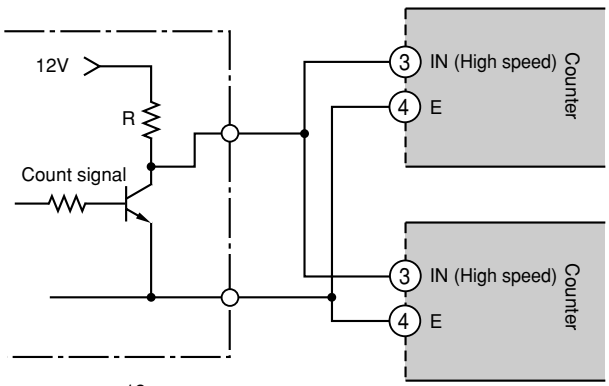
The +12V terminal should not consume more than 5 mA.

■Parallel Counters

1. Relay input

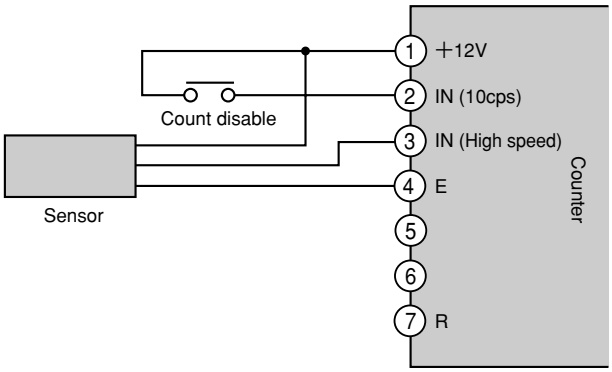


2. DC input



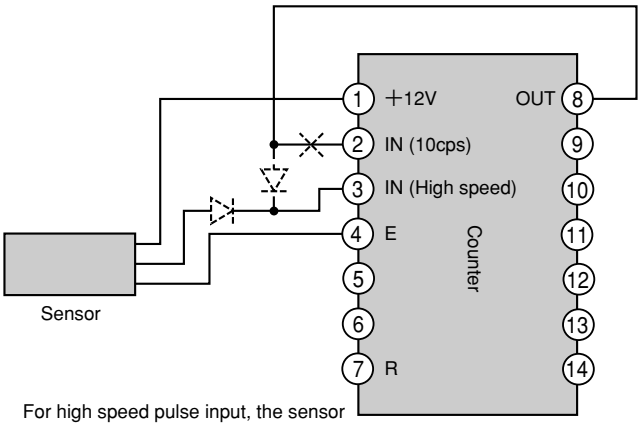
$R \leqq \frac{12}{N}(k\Omega)$ N: Numbers of counter that can be connected in parallel.

■Count disable using a free terminal



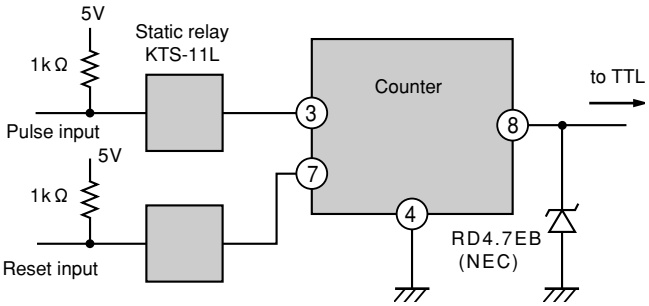
Pulse count is disabled when the contact is closed to force input to the terminal ②. However, the count increments by 1 when the contact is closed while the sensor (terminal ③) output is at "L" level.

■Count disable during signal output



For high speed pulse input, the sensor should be connected as shown by the dashed lines. Use Hitachi diodes IS2076 or equivalent.

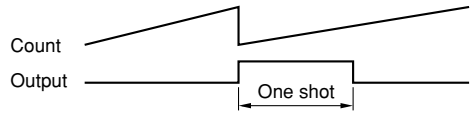
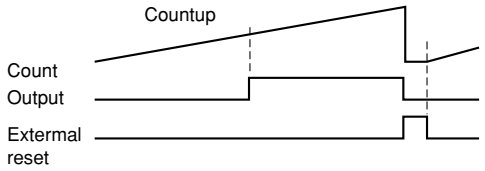
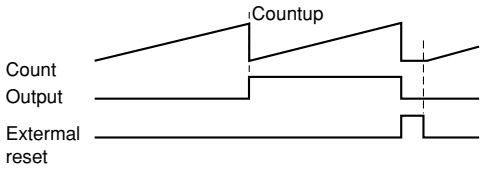
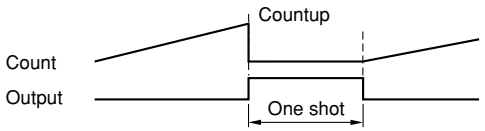
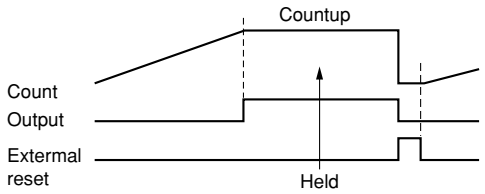
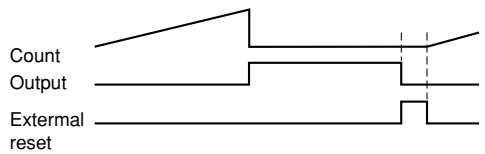
■Connection to TTL logic gate



Pull-in current is 4mA on the KCX counter side (0.4V residual voltage).

List of Counter Modes

One of the following six combinations can be selected for the numerical display counters.

Output		Upon countup		Count disable	Timing chart	Connection
Held	One shot	Reset	Not reset			
	●	●			Type A operation 	
●			●		Type B Operation 	④-⑤-⑥
●		●				④-⑤
	●	●		●		②-⑧* or ③-⑧
●			●	●		②-⑧* or ③-⑧ ④-⑤-⑥
●		●		●		②-⑧* or ③-⑧ ④-⑤

*When Terminal ⑧ is connected to Terminal ②, the time for the count disable to be activated is the same as the response time of Terminal ②.

KCX-□W,□WM

Dual Preset Green Counters for Addition

Maximum count speed 3- or 4-digit: 10cps or 2kcps
5- or 6-digit: 10cps or 5kcps

These counters feature an easy to see green LED screen to display three to six digit counts and dual preset values. Other features include dust insulation and power backup.

Merits

●Green LED for easy reading

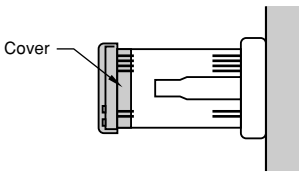
Each model features a green LED display to facilitate reading. Numerical values are displayed with the height of 8mm.

●Minimum space requirement

In compliance with the DIN standard, all models are sized 72mm (height)〜72mm (width)〜103.5mm (depth).

●Dust prevention cover

On all models, a protective cover is attached to the front panel. The keys and buttons can be operated through this cover.



●Option to disable count input

Pulse input and count can be disabled by signal input to the count disable terminal.

●Memory backup at power shutdown

The integrated nickel cadmium battery allows memory backup for up to 5,000 hours.

●Wide range of source voltage

The counter accepts voltage of DC 4.5V to 30V from a source ranging from 5V to 24V. You can choose source of either AC 90 to 132V, or AC 180 to 264V.

●Variable output duration

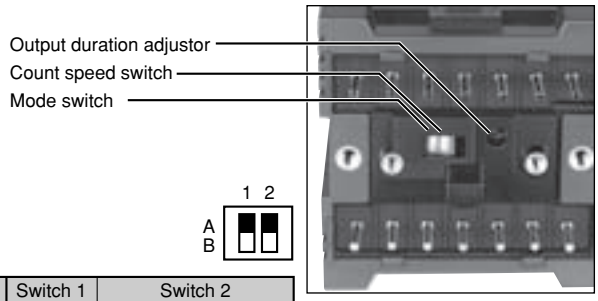
On the rear panel, you can control the duration of One shot (Type A) output. Using a dial, the output time can be adjusted between 50 ms and 1,000ms.

●One shot output and Hold output options

Using the selector on the rear panel, output type can be selected between One shot (Type A) output and hold (Type B) output.

●Slow Count and Fast Count options

Using the selector on the rear panel, count speed can be switched between 10cps and 2kcps (5kcps for 5- or 6-digit counter).



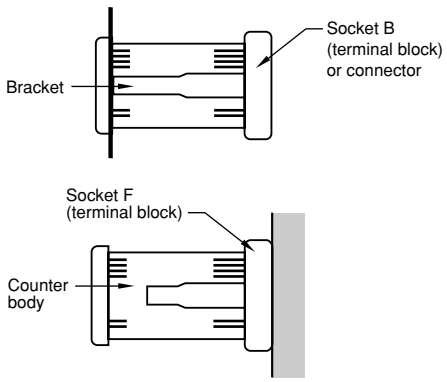
	Switch 1	Switch 2	
	Mode	Count speed	
A	Type A operation	2kcps (3・4W / 4WM)	5kcps (5・6W / 6WM)
B	Type B operation	10cps	

●Integrated sensor power

DC12V, 50 mA power source is included in all counters to allow direct connection to a proximity switch, photoelectric sensor or rotary encoder.

●Mounting

The counter can be mounted onto the wall surface in either way, wall surface mounting or flush mounting. Use mounting bracket for the flush mounting and use terminal block (socket F) for wall surface mounting.



Specifications

Model number	Standard models	KCX-3W	KCX-4W	KCX-5W	KCX-6W
	With backup memory	—	KCX-4WM	—	KCX-6WM
Number of digits		3 digits	4 digits	5 digits	6 digits
Operation	First preset: Type B (Hold output) only Second preset: Type A (One shot output) or Type B (Hold output) selected by switch on rear panel				
Count input	Maximum count speed	10cps 2kcps (selected by switch)		10cps 5kcps (selected by switch)	
	Minimum pulse width	10cps：50ms 2kcps：0.25ms		10cps：50ms 5kcps：0.1ms	
	Input resistance	6kΩ			
	Input voltage	"L"0～2V、"H"4.5～30V			
Count disable input	Response time	On delay ： Max. 0.25ms Off delay ： Max. 0.25ms		On delay ： Max. 0.1ms Off delay ： Max. 0.1ms	
	Input resistance	6kΩ			
	Input voltage	"L"0～2V、"H"4.5～30V			
External reset	Response time	On delay ： Max. 10ms Off delay ： Max. 2ms		On delay ： Max. 4ms Off delay ： Max. 0.8ms	
	Input resistance	6kΩ			
	Input voltage	"L"0～2V、"H"4.5～30V			
Auto reset	Response time	Max. 0.5ms		Max. 0.2ms	
Power-on reset (KCX-3～6W)	Power shutdown	Min. 200ms			
	Reset duration	Max. 200ms			
DC output	Output resistance	1.2kΩ (at no load voltage of 12V)			
	Output current	Source: 2.5mA Sink: 8mA			
	Withstand voltage	45V			
	Output duration	50ms～1s			
Relay output	Capacity	AC250V 2A			
	Circuit	One make contact			
	Output duration	50ms～1s			
	Electrical durability	Min. 10,000,000 contacts			
	Mechanical durability	Min. 1,000,000 contacts (resistance load)			
I/O response	Voltage output	10cps：10ms 2kcps：0.4ms		10cps：10ms 5kcps：0.15ms	
	Contact output	10cps：20ms 2kcps：10ms		10cps：20ms 5kcps：10ms	
Memory backup at power shutdown (KCX-3～6WM)	Time for charging	50h			
	Backup duration	5000h(25℃)、2000h(40℃)			
	Response of emergency input gate	Max. 200ms			
	Response of input gate upon recovery	Max. 200ms			
Sensor power	DC+12V 50mA				
Source voltage	AC 90～132V, or AC 180～264V (50/60Hz) approx. 5.5VA				
Ambient temperature	During power supply: 0～+40℃ (−10～+50℃ with no risk of destroyed battery) During memory backup: −10～+50℃				
Storage temperature	KCX-3～6W: −20～+55℃ KCX-3～6WM: −20～+50℃ (−20～+70℃ during transportation of less than one week)				
Ambient/Storage humidity	35～85%RH (with no dewing)				
Weight	0.5kg				

Note:
See pages B-34 and B-35 for withstand voltage, insulation resistance, vibration resistance, noise resistance and other related specifications.

Operation

■Type A (One shot) output
Type B (Hold) output

Selecting A or B

Only Type B output is available for the first preset value.

For the second preset value, either Type A or B can be selected by the switch on the rear panel.

■Variable Type A output

For the second preset value, the duration of Type A output can be changed. Use the dial on the rear panel to select the desired time from 50ms to 1,000ms.

■Changing count speed

The input speed of Terminal ② can be changed. Use the selector on the rear panel to select 10cps or 2kcps (or 5kcps for 5- or 6-digit counter).

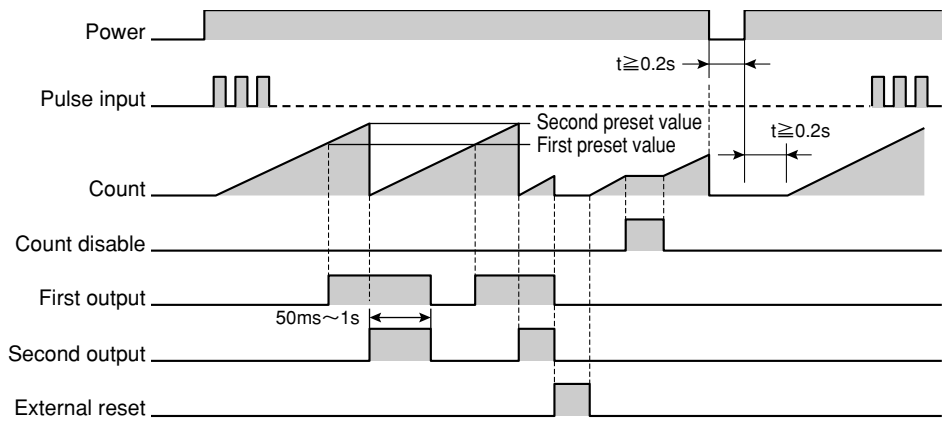
■Terminal Assignment

Terminal number	Name	Description
1	+12V	Sensor power output
2	IN	Count input
3	INH	Count disable input
4	E	Grounding
5	OUT1	DC output
6	OUT2	DC output
7	R	External reset input
8	OUT1	Relay output (1a contact)
9		
10	OUT2	Relay output (1a contact)
11		
12	AC180～264V	AC power input
13	AC90～132V	
14	AC0V	

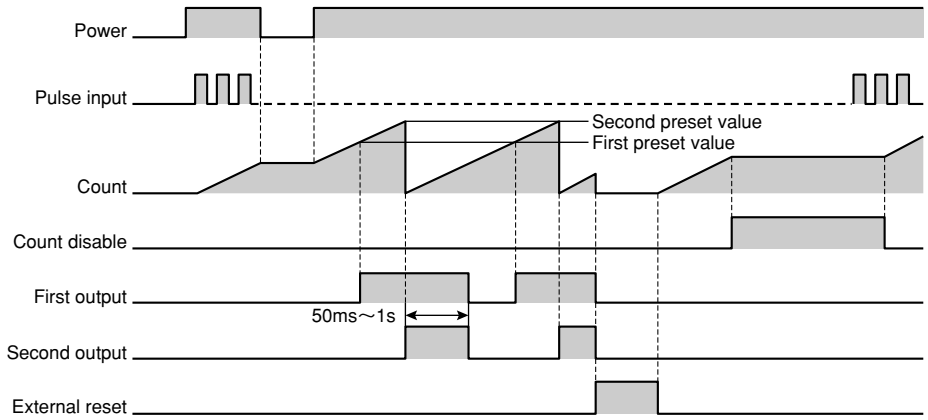
Type A (One shot) output

(1) Count starts 0.2 second after the power is on.
(2) Count is interrupted when the count disable terminal ③ is activated by additional voltage of 4.5V to 30V. Count is restarted when the terminal is deactivated.
(3) The counter generates a signal upon countup, or when the number of input pulses has reached the first preset value. For the first preset, signal output is held (Type B output).
(4) The counter generates another signal when the pulse count has reached the second preset value. Upon countup, both the count and signal output are automatically reset.
(5) The first signal drops to zero at the same time as the second signal.
(6) Count is reset to zero when the external reset terminal ⑦ is activated by additional voltage of 4.5V to 30V. Signal output is also reset if the count has previously reached the first and/or second value.
(7) The KCX-3 to 6WM models integrates a backup memory for power shutdown. When the power is shut down, both the count and the output status are stored in this memory.
(8) These models also have a power-on reset function. Count and signal output are reset when the power is off for 0.2 second then turned on.

Standard models: KCX-3 to 6W



With memory backup: KCX-3 to 6WM



Type B (Hold) output

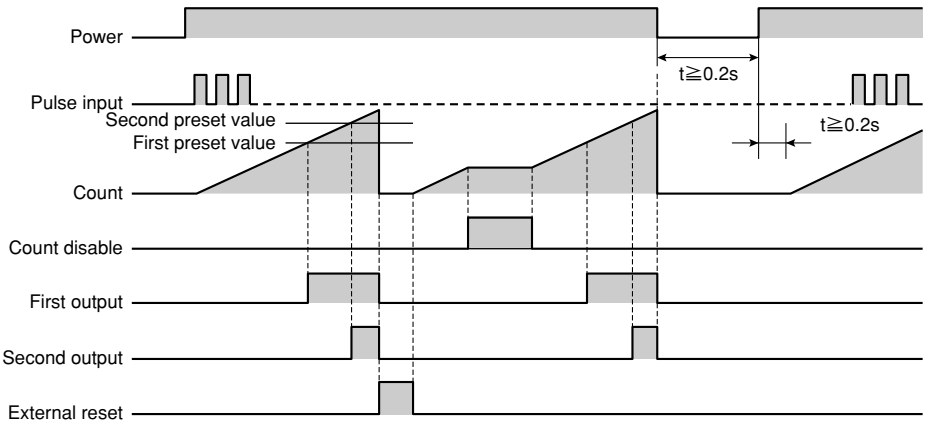
(1)
(2) } Same as the Type A output.
(3)

(4)The counter generates and holds a signal when the pulse count has reached the second preset value.

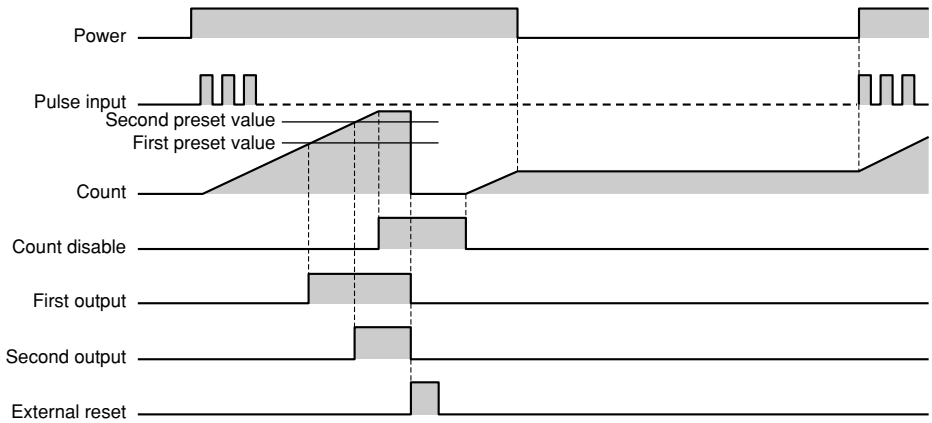
(5)Count and signal output are reset when the external reset terminal ⑦ is activated by additional voltage of 4.5V to 30V.

(6)
(7) } Same as the steps 7 and 8 of the Type A output

Standard models: KCX-3 to 6W



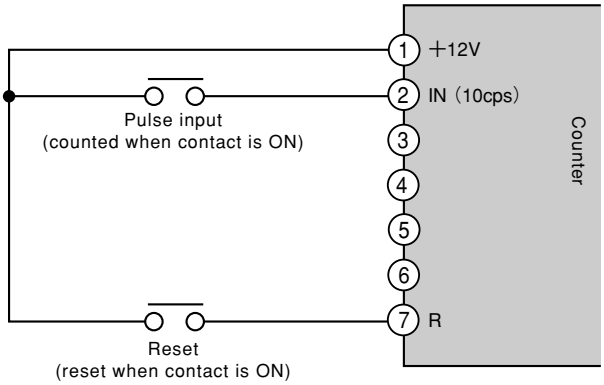
With memory backup: KCX-3 to 6WM



Wiring Diagrams

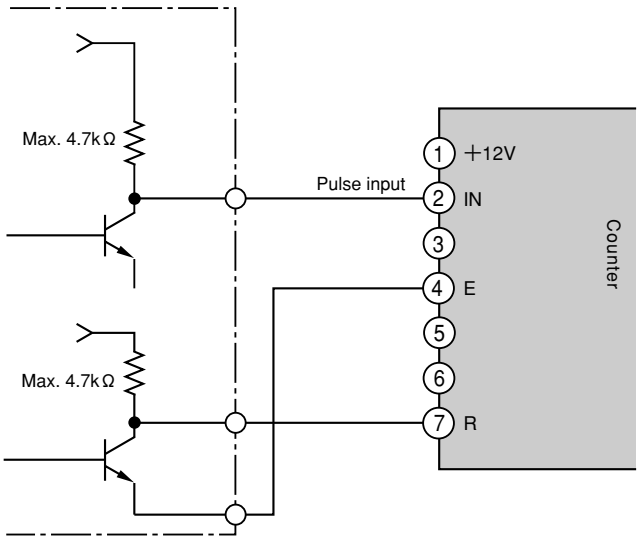
■Pulse input

1. Relay input



On the rear panel, set the speed switch to Low (10 cps).

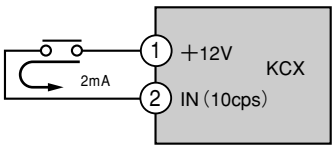
2. DC input



Either pulse input or high speed pulse input can be selected as count rate.

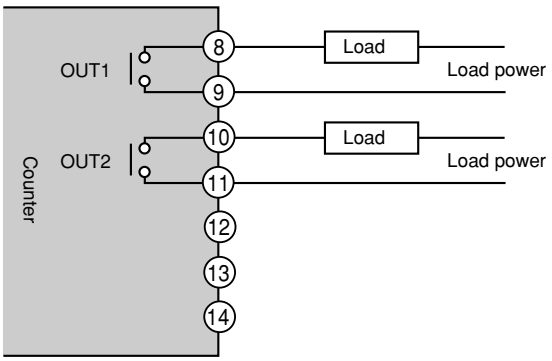
Note on relay input

On the circuit shown on the right, the input current to the relay is less than 2mA. Use a reliable relay that responds to such small current. Do not use an electromagnetic switch contact designed for large current and voltage.



■Output Connection

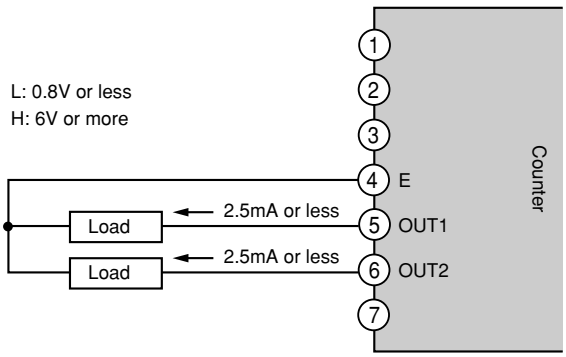
1. Relay output



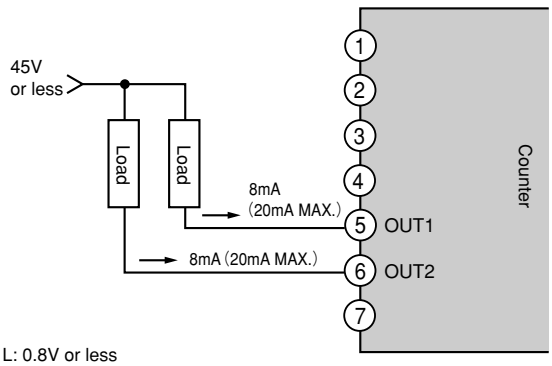
Only the relay contact a is used for the first and second outputs.

2. DC output

●Source load



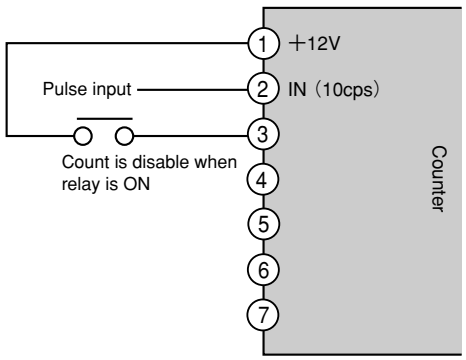
●Sink load



L: 0.8V or less
3V or less at sink current of 20mA.

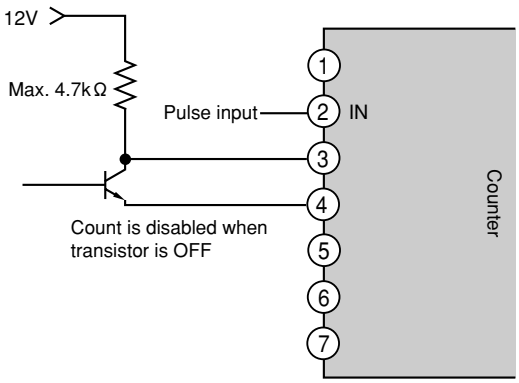
■Count Disable Input Connections

1. Relay input



When count is disabled, only slow input is available.

2. DC input



KCX-□T

Total Counters with Green LED

Maximum counting speed
KCX-4T: 10cps or 1kcps
KCX-6T: 10cps or 5kcps
KCX-8T: 10cps or 10kcps

The counters feature an easy to see green LED screen. Other features include variable voltage and power backup of 5,000 hours.

Merits

●Green LED for easy reading

Each model features a green LED display to facilitate reading. Numerical values are displayed with the height of 8 mm.

●Option to disable count input

Pulse input and count can be disable by voltage input to the disable terminal.

●Memory backup at power shutdown

The integrated nickel cadmium battery allows memory backup for up to 5,000 hours.

●Wide range of source voltage

The counter accepts voltage of DC 4.5V to 30V from a source ranging from TTL level to 24V. You can choose source of either AC 90 to 132V, or AC 180 to 264V.

●Latch option

Count can be latched and displayed by signal input to the latch terminal. When the terminal is deactivated, the counter restarts from the current count.

●Option to disable manual reset

You can disable the Reset key on the front panel to prevent accidental reset.

●Zero suppression

The counter suppresses non-significant zeroes on the left to the count value.

●Built-in sensor power

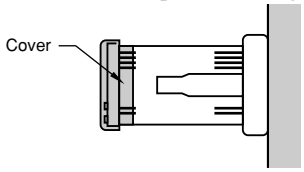
A DC 12V, 50mA power source is included in all counters to allow direct connection to a proximity sensor, photoelectric sensor or rotary encoder.

●Minimum space requirement

In compliance with the DIN standard, all models are sized 72mm (height)〜72mm (width).

●Dust prevention cover

On all models, a protective cover is attached to the front panel. The keys and buttons can be operated through this cover.



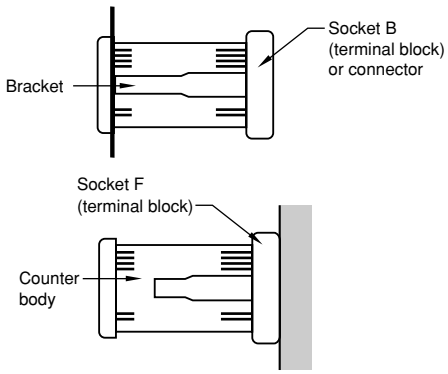
KCX-4T

KCX-6T

KCX-8T

●Mounting

The counter can be mounted onto the wall surface in either way, wall surface mounting or flush mounting. Use mounting bracket for the flush mounting and use terminal block (socket F) for wall surface mounting.



Specifications

Model number		KCX-4T	KCX-6T	KCX-8T
Number of digits		4 digits	6 digits	8 digits
Count input	Maximum count speed	10cps or 1kcps	10cps or 5kcps	10cps or 10kcps
	Minimum pulse width	10cps：50ms 1kcps：0.5ms	10cps：50ms 5kcps：0.1ms	10cps：50ms 10kcps：50 μs
	Input resistance	10cps：6kΩ 1kcps：12kΩ	10cps：6kΩ 5kcps：12kΩ	10cps：6kΩ 10kcps：12kΩ
	Input voltage	"L"0～2V、"H"4.5～30V		
Count disable input	Response time	On delay：Max. 1ms Off delay：Max. 1ms	On delay：Max. 0.2ms Off delay：Max. 0.2ms	On delay：Max. 0.1ms Off delay：Max. 0.1ms
	Input resistance	6kΩ		
	Input voltage	"L"0～2V、"H"4.5～30V		
Manual reset	Disabled by switch on the front panel (by short circuiting Terminals ④ and ⑥)			
External reset	Response time	On delay：Max. 0.5ms Off delay：Max. 0.5ms	On delay：Max. 0.1ms Off delay：Max. 0.1ms	On delay：Max. 50 μs Off delay：Max. 50 μs
	Input resistance	6kΩ		
	Input voltage	"L"0～2V、"H"4.5～30V		
Memory backup at power shutdown	Time for charging	50h		
	Backup duration	5000h(25℃)、2000h(40℃)		
	Response of emergency input gate	Max. 200ms		
	Response of input gate upon recovery	Max. 200ms		
Latch input	Response time	Max. 0.5ms	Max.0.1ms	Max.0.1ms
	Input resistance	6kΩ		
	Input voltage	"L"0～2V、"H"4.5～30V		
Sensor power	DC＋12V±2V 50mA (Max. 5% rms ripple)			
Source voltage	AC 90～132V, or AC 180～264V (50/60Hz, 5.5VA)			
Ambient temperature	During power supply: 0～＋40℃ (－10～＋50℃ with no risk of destroyed battery) During memory backup: －10～＋50℃			
Storage temperature	－20～＋50℃ (－20～＋70℃ during transportation of less than one week)			
Ambient/Storage humidity	35～85%RH (with no dewing)			
Weight	Approx. 0.5kg			

Note:

See pages B-34 and B-35 for withstand voltage, insulation resistance, vibration resistance, noise resistance and other related specifications.

■Terminal Assignment

Terminal number	Name	Description	Terminal number	Name	Description
1	＋12V	Sensor power output	8	—	Not connected
2	IN (10cps)	Count input	9	—	Not connected
3	IN(1kcps/5kcps/10kcps)	High speed count input	10	L	Latch input
4	E	Grounding	11	—	Not connected
5	INH	Count disable	12	AC180～264V	AC power input
6	RD	Manual reset prevention	13	AC90～132V	
7	R	External reset input	14	AC0V	

Operation

(1)Count starts 0.2 second after the power is on.

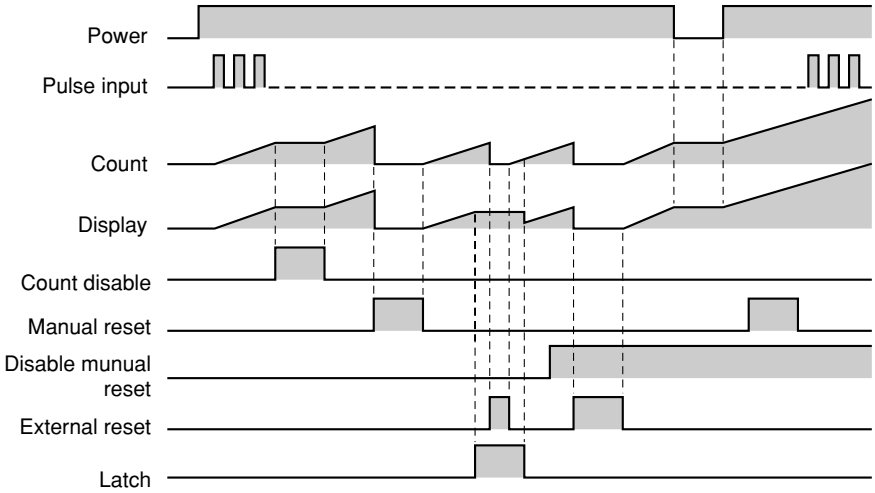
(2)Count is reset to zero when the Reset key is pressed, or when the external reset terminal ⑦ is activated by additional voltage of 4.5V to 30V. Only one zero is displayed on the first digit.

(3)The minimum pulse width should be as follows:
50ms for all counters operating at 10cps
0.5ms for KCX-4T at 1k cps
0.1ms for KCX-6T at 5k cps
50 μ s for KCX-8T at 10k cps
The counter total individual counts and displays the current total.
The terminal ② should be used for 10 cps, and the terminal ③ for 1k cps, 5k cps and 10k cps.

(4)Count is interrupted when the count disable terminal ⑤ is activated by additional voltage of 4.5V to 30V. Count is restarted when the terminal is deactivated.

(5)Count is latched when the terminal ⑩ is activated by input voltage of 4.5V to 30V. When the terminal is deactivated, the counter restarts from the current count.

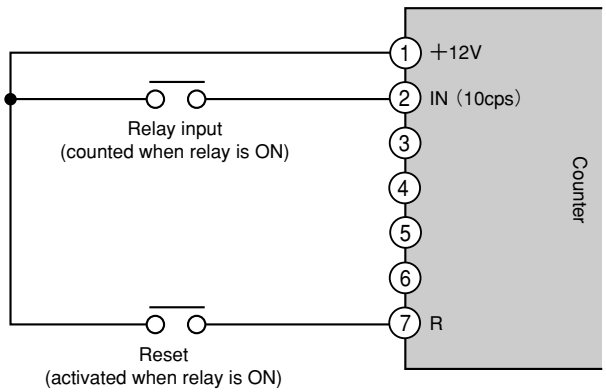
Timing Charts



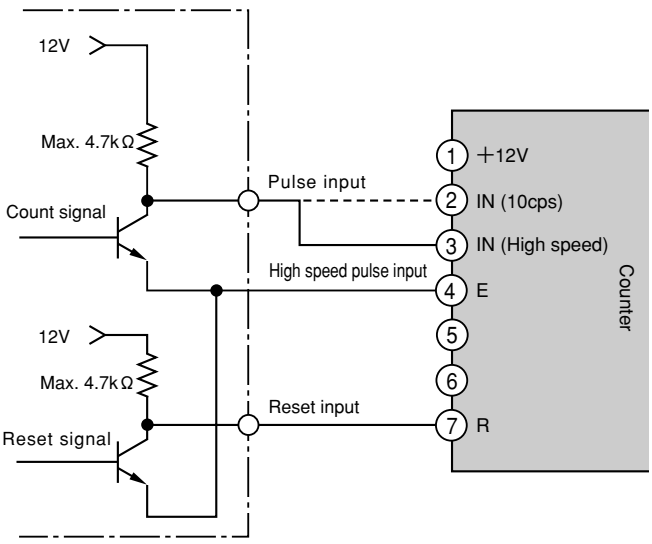
Wiring Diagrams

■Pulse input

1. Relay input



2. DC input

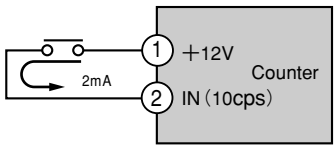


Either pulse input or high speed pulse input can be selected as count rate.

Note on relay input

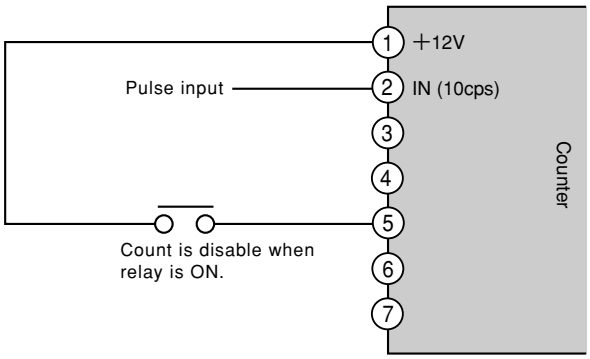
On the circuit shown on the right, the input current to the relay is less than 2mA.

Use a reliable relay that responds to such small current. Do not use an electromagnetic switch contact designed for large current and voltage.

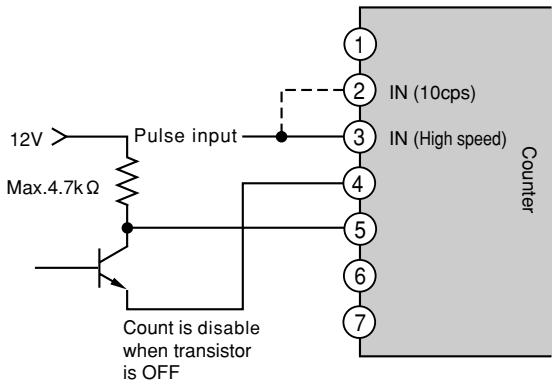


■Count Disable Input Connections

1. Relay input



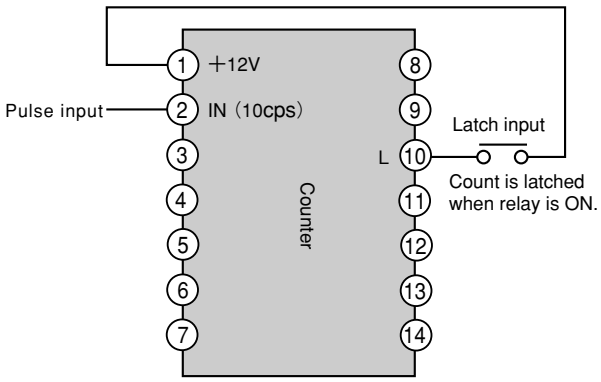
2. DC input



Either pulse input or high speed pulse input can be selected as count rate.

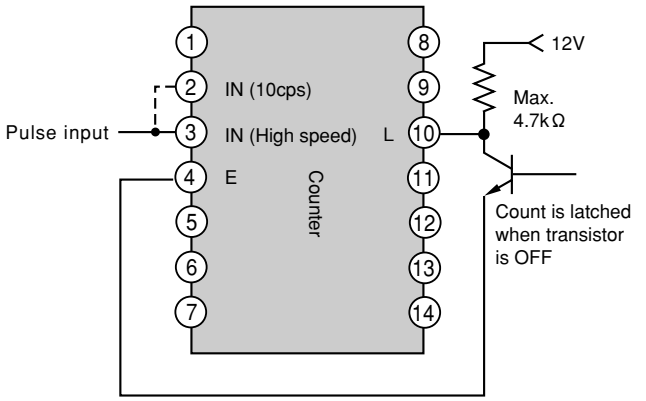
■Latch Input Connections

1 Relay input



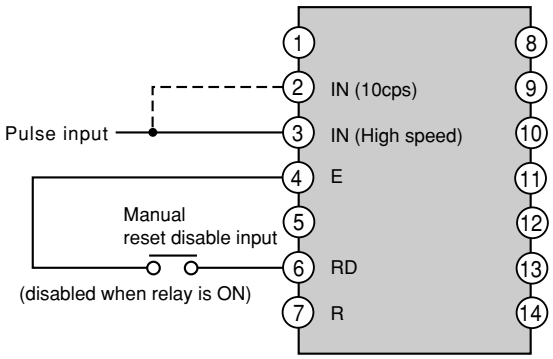
For relay input, only the pulse input can be used.

2. DC input



Either pulse input or high speed pulse input can be selected as count rate.

■Disabling manual reset



KCX-B

Single or Dual Preset Counters for Fast Addition and Subtraction

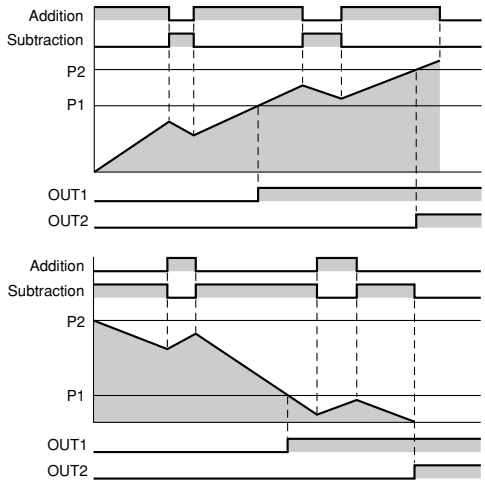
Maximum counting speed: 10cps or 20kcps

The counter integrates 6-digit green LED display, and provides Add, Subtract and Compare options. I/O logic can be switched between positive logic and negative. The counter can be connected to either a source or sink I/O device.

Merits

●Addition and Subtraction

With the ability to count in the two directions, the counter can be used for precise control of a cutter or winder.



●Fast count at 20kcps

The 72mm high and 72mm wide the counter operates as fast as at 20kcps. The speed can be switched to 10cps for slower relay input.

●Two-phase input and separate input

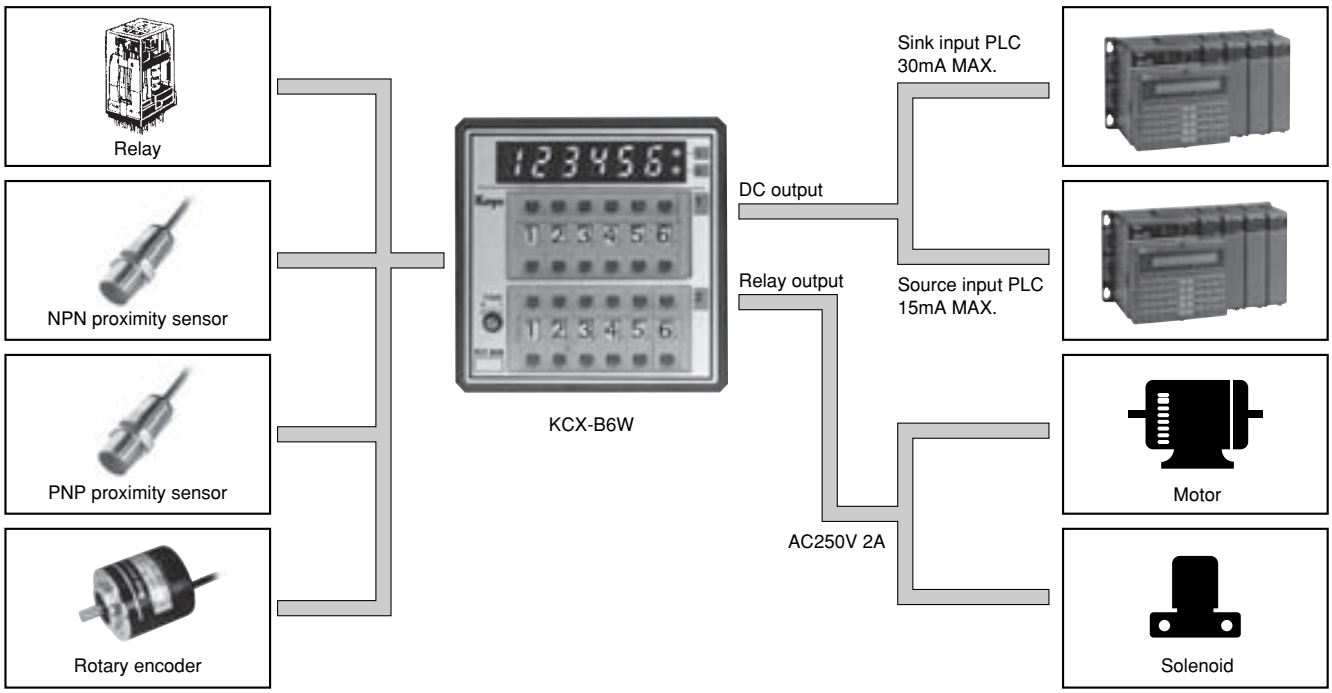
With these options, the counter widens choices of input devices to rotary encoders, proximity sensors and relay contacts. It accepts simultaneous inputs for addition and subtraction. This is ideal for keeping track of variable quantities such as workpieces on a conveyor and cars in a parking lot.

●Output options

Different modes are available including Countup and Compare. Using the switch on the rear panel, you can select any of the six modes for single preset counters, and ten modes for dual preset counters.

●Positive and negative I/O logics

Choices of I/O devices are also expanded. The counter supports both positive and negative I/O logics.



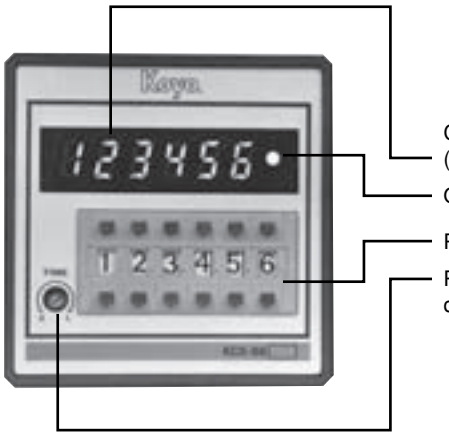
Specifications

Model number	Standard	KCX-B6	KCX-B6W
	With backup memory	KCX-B6M	KCX-B6WM
Setting	—	Single preset	Dual preset
Number of digits	—	6 digits	
Pulse input	Maximum count speed	10cps 20kcps (selected by switch)	
	Input resistance	Positive: 2.2kΩ Negative: 4.7kΩ	
	Input voltage	"L"0～6V、"H"12～30V	
Count disable input	Response time	On delay: Max. 25 μs Off delay: Max. 25 μs	
	Input resistance	Positive: 2.2kΩ Negative: 4.7kΩ	
	Input voltage	"L"0～6V、"H"12～30V	
External reset input	Response time	On delay: Max. 5ms Off delay: Max. 5ms	
	Input resistance	Positive: 2.2kΩ Negative: 4.7kΩ	
	Input voltage	"L"0～6V、"H"12～30V	
Auto reset	Reset time	Max. 50 μs	
DC output	Number of circuits	1 circuit	2 circuits
	Positive output	Voltage: 16～28V (at no load vltage of 28V) Current: Max. 15mA	
	Negative output	Load voltage: Max. 35V Load current: Max. 30mA Residual voltage: Max. 1.5V	
Relay output	Number of circuits	One transfer circuit	Two N.O. contacts
	Capacity	AC220V 2A (resistance load)	
	Electrical durability	Min. 200,000 contacts (resistance load)	
	Mechanical durability	Min. 20,000,000 contacts	
I/O response	DC output	10cps: Approx. 30ms 20kcps: Approx. 30 μs	
	Relay output	10cps: Approx. 40ms 20kcps: Approx. 10ms	
Power-on reset (KCX-B4、6 KCX-B4W、6W)	Power shutdown	Max. 500ms	
	Reset time*	Max. 500ms	
Memory backup at power shutdown (KCX-B4M、6M KCX-B4WM、6WM)	Time for charging	50h	
	Backup duration	2000h(25℃)	
	Response of emergency input gate	20～500ms	
	Response of input gate upon recovery	50～500ms	
Sensor power	DC＋24V (20～28V) 80mA		
Withstand voltage	AC 2kV for one minute (For each of AC power, Terminal E and relay contact interconnections)		
Vibration resistance	(In compliance with JIS C 0911)	Durable for one hour along three axes at 10 to 55Hz with 0.5mm amplitude No error for one hour along three axes at 10 to 55Hz with 0.35mm amplitude	
Noise resistance	1kV (square wave pulse with 1 μs width)		
Source voltage	AC90～132V,or AC180～264V 14VA		
Ambient temperature	－10～＋50℃		
Storage temperature	－20～＋50℃ (－20～＋70℃ during transportation of less than one week)		
Ambient/Storage humidity	35～85%RH (with no dewing)		
Weight	Approx. 0.5kg		

*Time required for the counter to restart counting after the power is turned on.

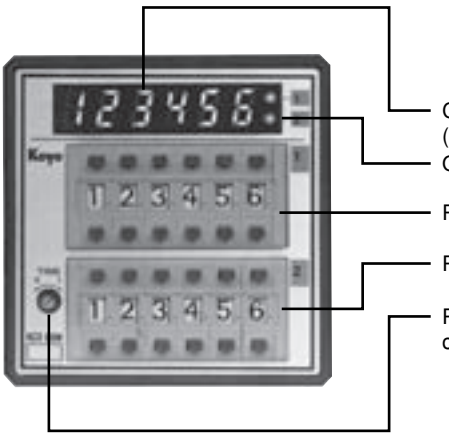
Front Panel and Terminal Assignment

KCX-B6(M)

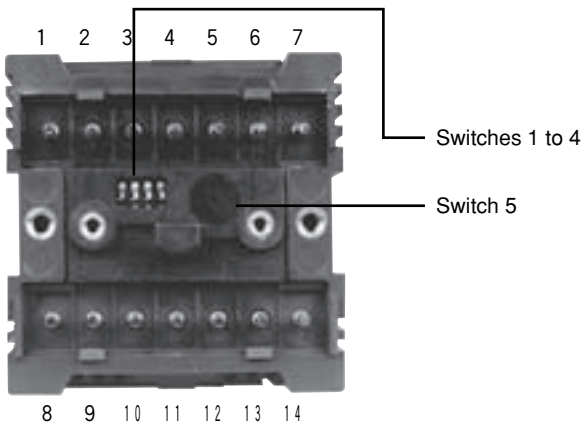


T/N	Name	Description
1	+24V 80mA	Sensor power
2	IN A	Pulse count input A
3	IN B	Pulse count input B
4	E	Negative common I/O
5	IN H	Count disable
6	—	Not connected
7	R	External reset input
8	OUT	DC output
9	COM	Common Relay output
10	N.O.	N.O. Relay output
11	N.C.	N.C. Relay output
12	AC180～264V	Power input
13	AC90～132V	
14	AC0V	

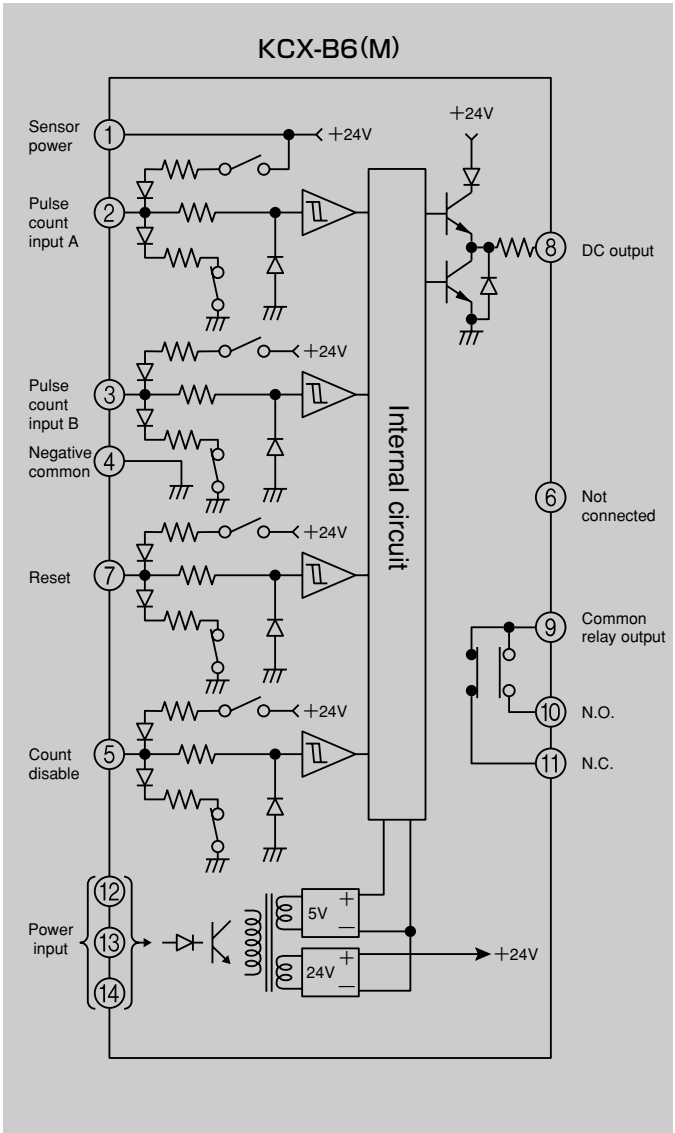
KCX-B6W(M)

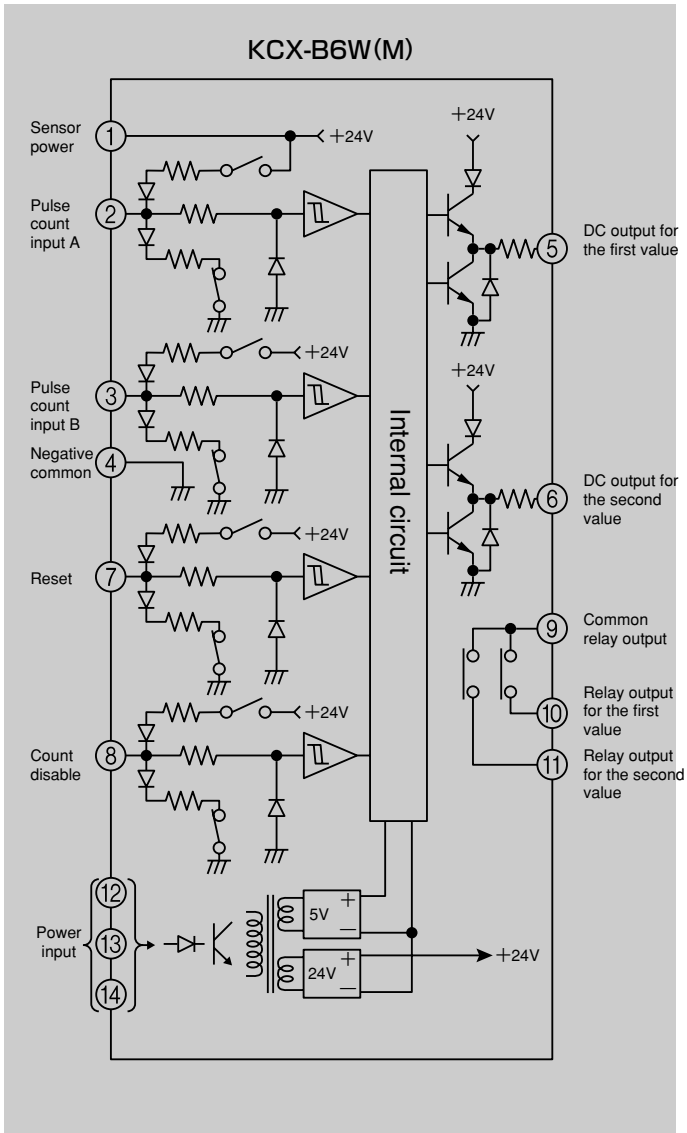


T/N	Name	Description
1	+24V 80mA	Sensor power
2	IN A	Pulse count input A
3	IN B	Pulse count input B
4	E	Negative common I/O
5	OUT 1	DC output for the first value
6	OUT 2	DC output for the second value
7	R	External reset input
8	IN H	Count disable
9	COM	Connected relay output
10	N.O.1	Relay output for the first value
11	N.O.2	Relay output for the second value
12	AC180～264V	Power input
13	AC90～132V	
14	AC0V	



I/O Circuits

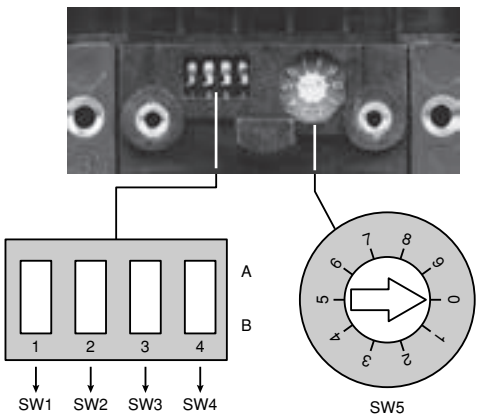




Operating procedures

1. Mode selection

To select the counter modes, use the four switches located on the rear side of the counter, and ten positions of the rotary switch.



Switch	Mode selected	Position	Value selected
1	Count speed	A	10cps
		B	20kcps
2	Pulse count	A	Separate
		B	Two-phase
3	Direction	A	Subtraction
		B	Addition
4	I/O logic	A	Negative
		B	Positive
5	Signal output	—	

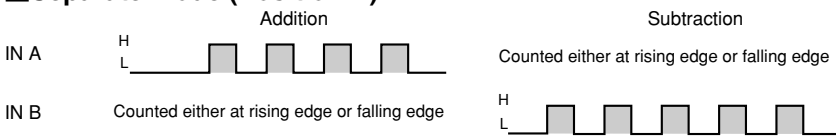
Switch 1 Count speed

This switch used to set or change the maximum count rate. Turn the switch to Position A to select 10cps, and Position B to select 20kcps. Position A is used for relay input such as a switch or relay. Use Position B for DC input such s a rotary encoder or proximity switch.

Switch 2 Count mode

This switch selects the Two-Phase or Separate count mode. For a proximity switch or relay, set the switch to Position A to select the Separate mode. For a rotary encoder, set it to Position B to select the Two-Phase mode.

■Separate mode (Position A)



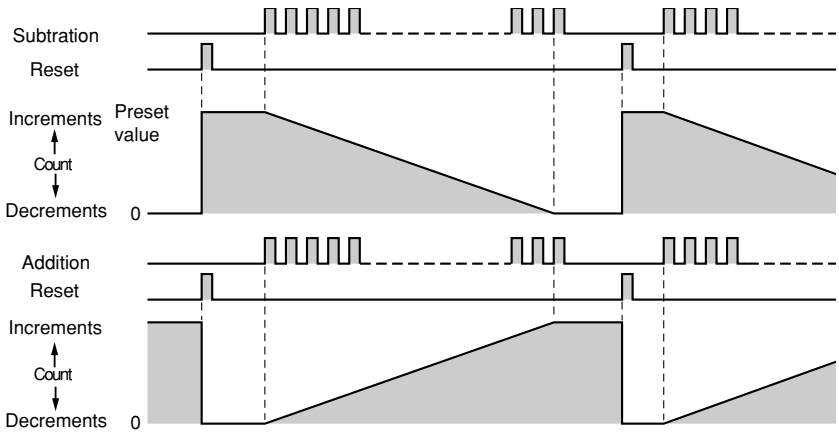
■Two-Phase mode (Position B)

Switch 3 Direction

This switch changes the count direction to Addition or Subtraction. Set the switch to Position A to select Subtraction, and set it to Position B to select Addition. When a reset signal is entered, the counter is reset as follows:

In the Subtraction mode, the single preset counter is reset to the first preset value, and the dual preset counter is reset to the second preset value.

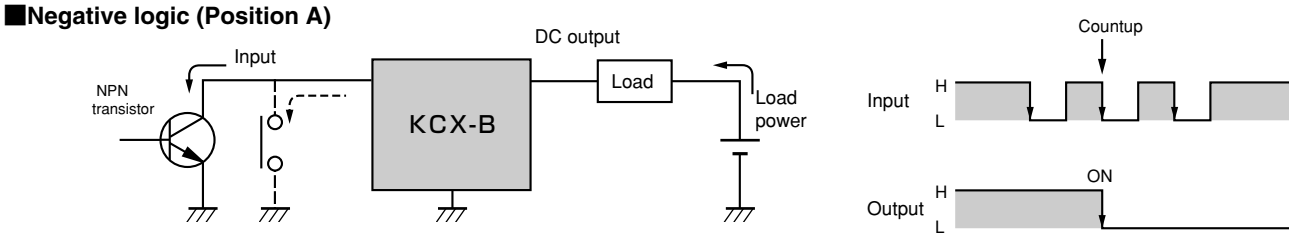
In the Addition mode, both counters are reset to zero.



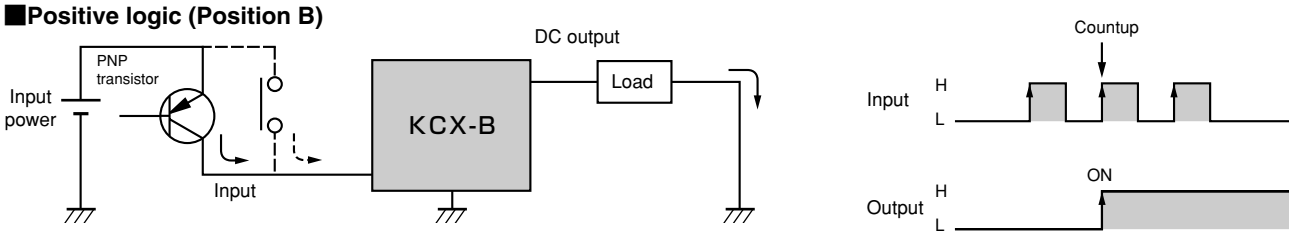
Switch 4 I/O logic

Use this switch to select either positive or negative I/O logic. To select the negative logic (active at "L" level), set the switch to Position A. To select the positive logic (active at "H"), set it to Position B.

■Negative logic (Position A)



■Positive logic (Position B)



Switch 5 Signal output

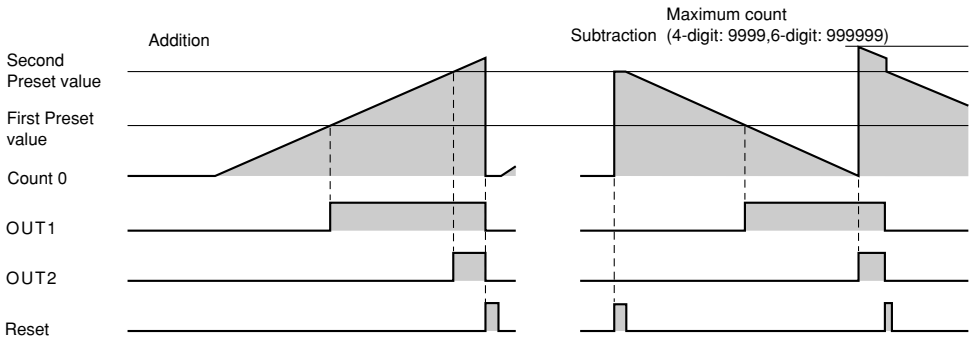
Use this rotary switch to select the output mode of the counter. Six modes are available for single preset counters, and ten modes for dual preset counters.

- "OUT 2" applies to single preset counters. P2 is reset to the preset value, and P1 is reset to zero.
- Positions 0 to 5 are used to select the Countup mode. Positions 6 to 9 select the Compare mode.

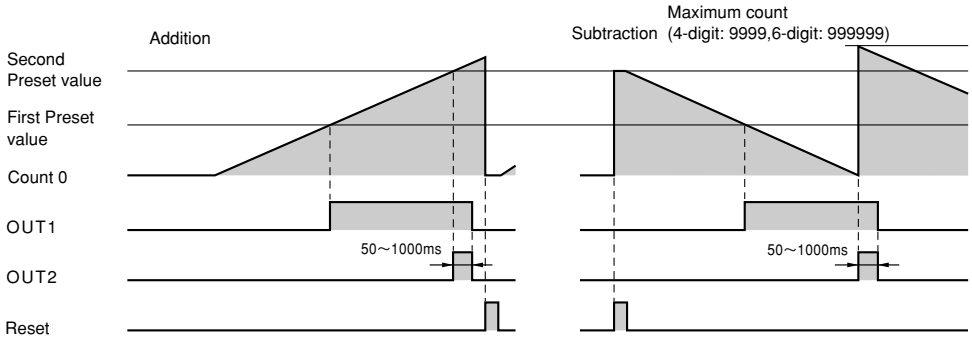
C: Count
P1: First preset value
P2: Second preset value

Position	OUT 1		OUT 2	
	Count	Signal output	Count	Signal output
0	Continued	Held	Continued	Held
1				50～1000ms
2			Reset	
3		100ms	Continued	Held
4				50～1000ms
5			Reset	
6	C≦P1		C≧P2	
7			P1≦C≦P2	
8	C≧P2		C＜0	
9	P1≦C≦P2		C≧P2	

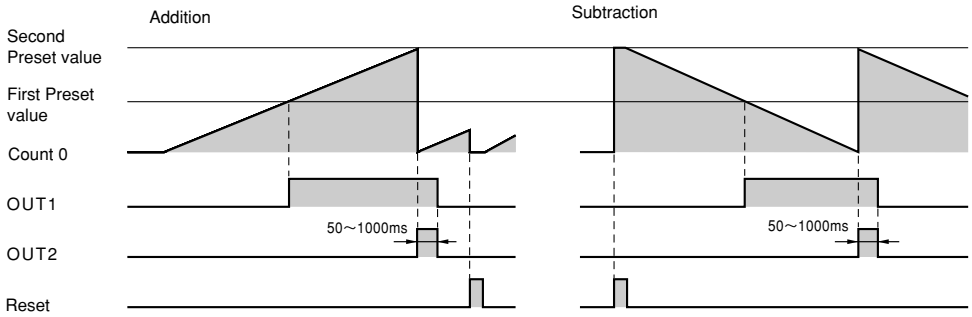
■Position 0



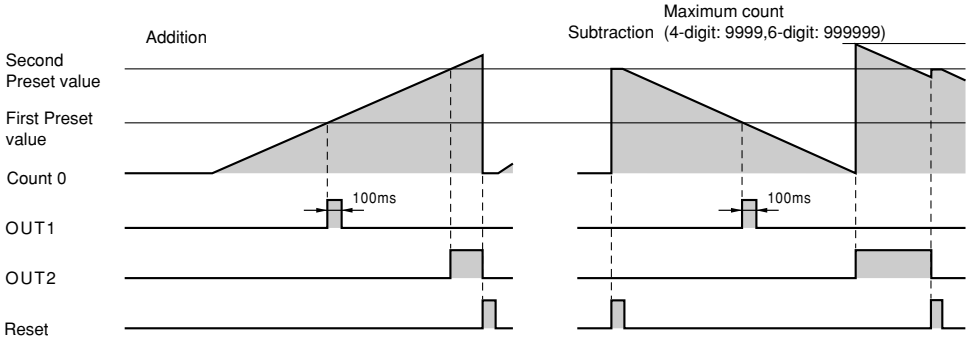
■Position 1



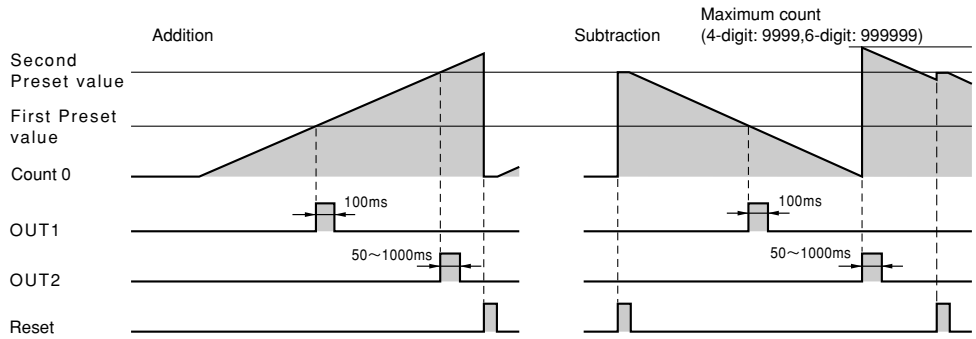
■Position 2



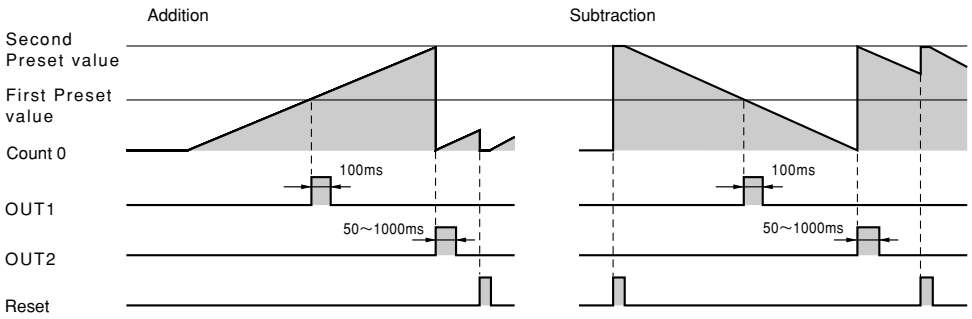
■Position 3



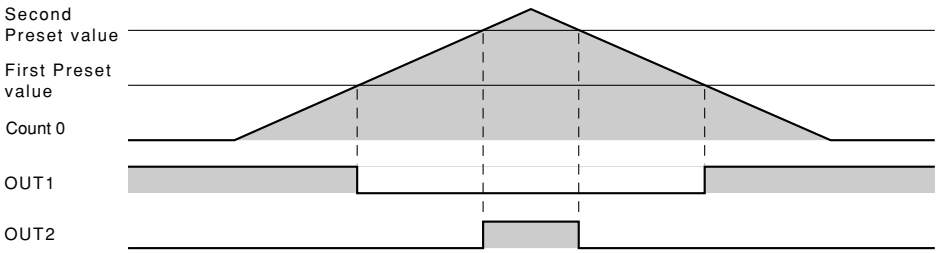
■Position 4



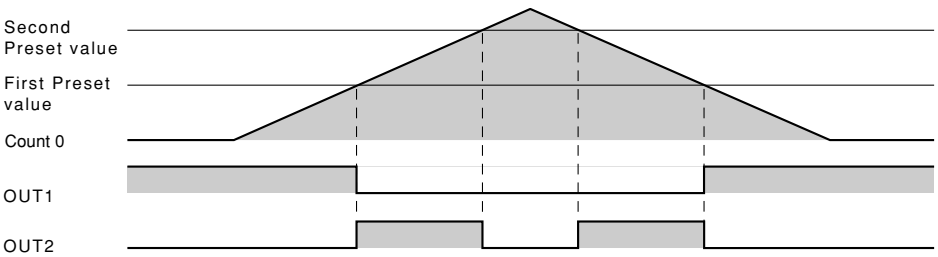
■Position 5



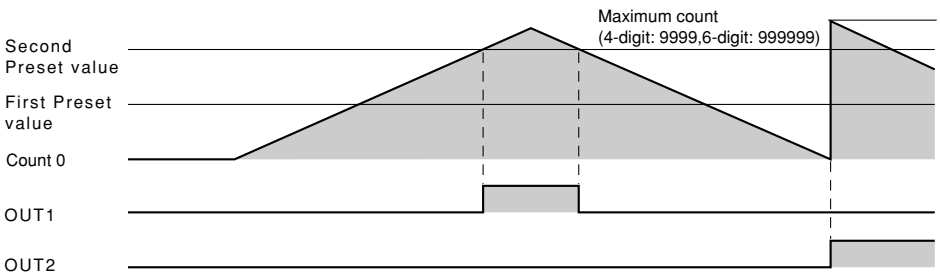
■Position 6



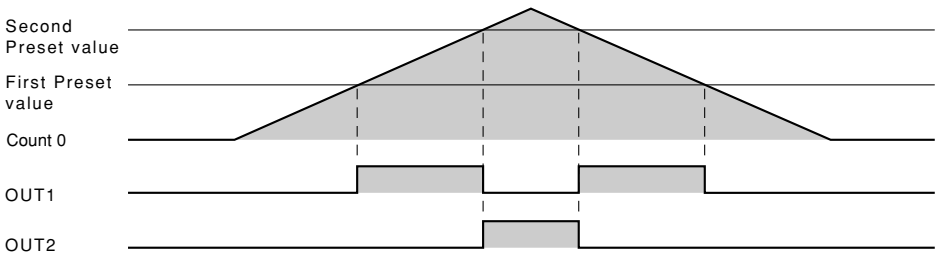
■Position 7



■Position 8

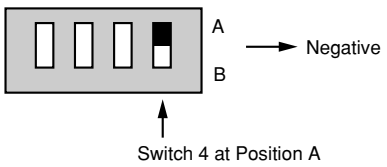


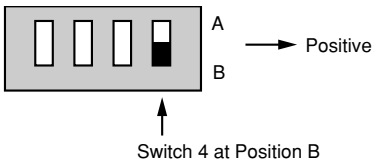
■Position 9



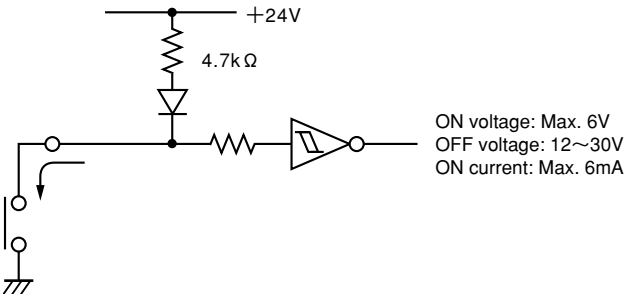
2. Input Circuit

The KCX-B Series counters can use either positive or negative input.
To change the input mode, use Dip switch 4 on the rear panel.

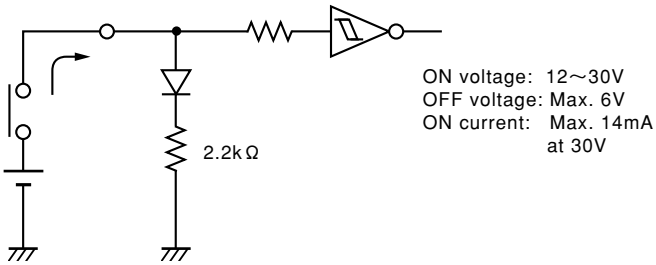




Negative input equivalent circuit



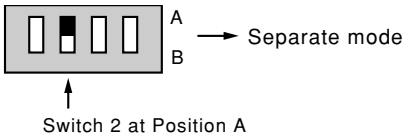
Positive input equivalent circuit



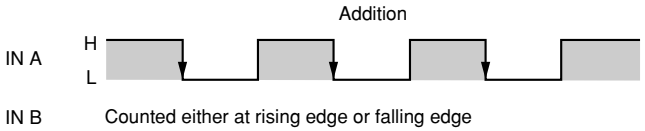
(1) Pulse count mode

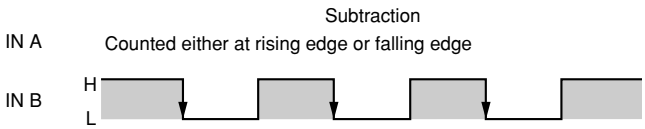
Use Dip switch 4 to change the pulse count mode between Two-Phase (90˚ dephased) or Separate.

■Input waveforms

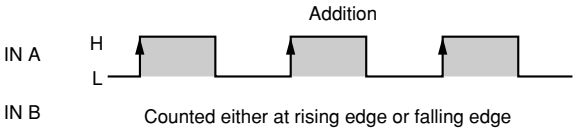


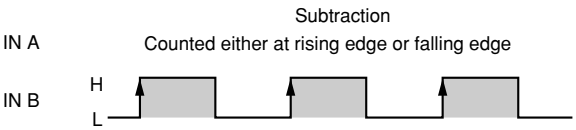
■Negative mode

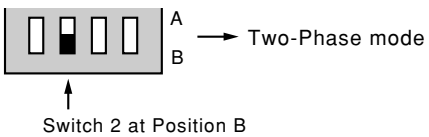




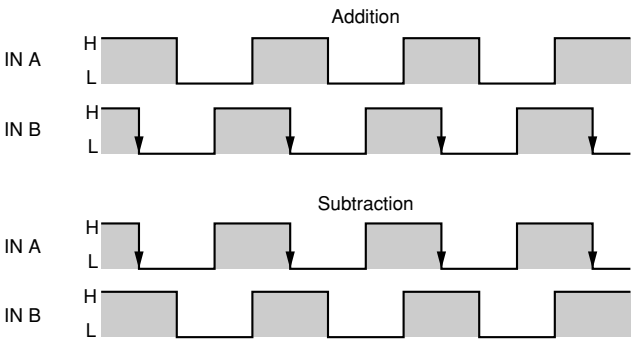
■Positive mode



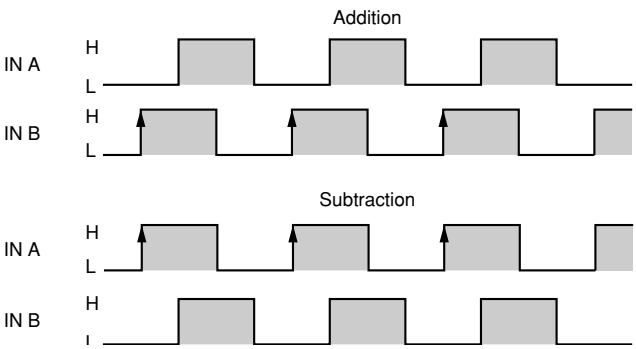




■Negative mode

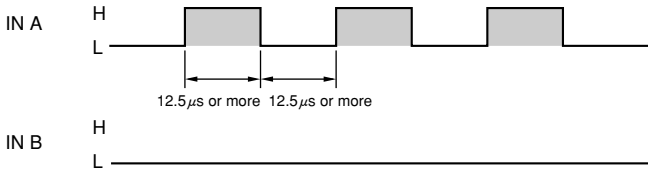


■Positive mode

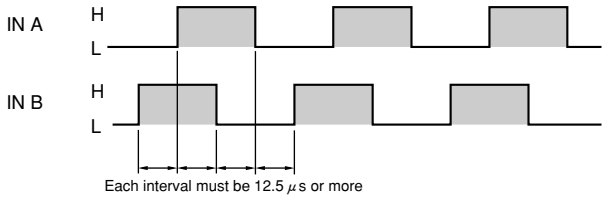


■Pulse count requirements

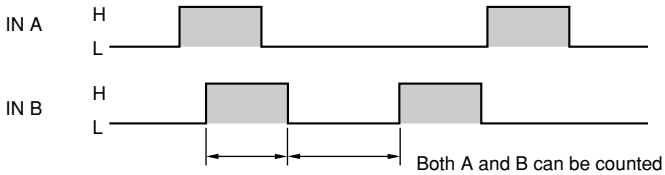
■Separate mode



■Two-Phase mode



■Repeated additions or subtractions



Both A and B can be counted at the same time if the pulse width and interval are equal to or longer than 12.5μs.

(2) External reset

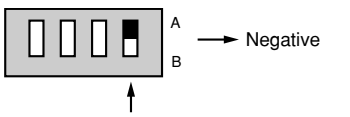
In the addition mode, this signal resets the count to zero. In the subtraction mode, the count is reset to the first preset value on the single preset counters, and to the second value on the dual preset models. The reset input overrides the pulse input and the count disable input.

(3) Count disable

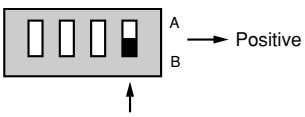
The disable signal suspends the pulse count. When it turns off, count restarts from the value at the time of suspension.

3. Output Circuit

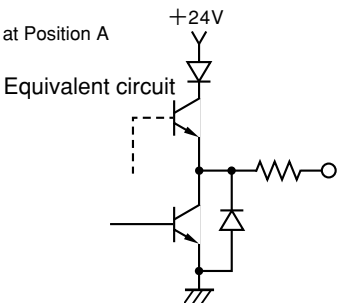
The KCX-B Series counters can use DC output or relay output. Either positive or negative logic can be selected. The 1c relay contact is used for the single preset models, and 2a relay contact for the dual preset models.



Switch 4 at Position A



Switch 4 at Position B



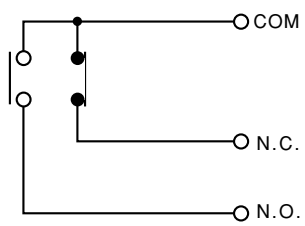
Negative Switching current:	Max. 30mA
Negative Applied voltage:	Max. 35V
Negative Residual voltage:	Max. 1.5V
Positive Output voltage:	16~28V
Positive Output current:	Max. 15mA

※In the negative mode, the output terminal generates a voltage of 20V to 28V when signal output turns off. For the load input terminal, use a reverse current blocking diode that withstands 40V backward voltage and 40mA forward current.

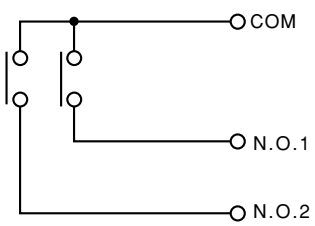
※Use a totem-pole structure for the DC output. Do not connect the circuit in parallel with other DC output.

Relay output AC220V 2A (resistance load)

Single preset



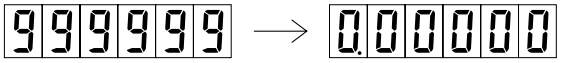
Dual preset



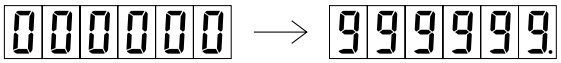
4. Count overrange

The KCX-B models can count from 0 to 999999 (6 digits).

When Switch 5 is between Position 0 to Position 5, the counter is set to the Hold mode or One shot mode. In the Hold mode, signal output is retained after countup. In the One shot mode, signal is generated for a short period upon countup.
When Switch 5 is anywhere between Position 6 to Position 9, the counter operates in the Compare mode. When the count exceeds the above range, the counter retains the lower or upper limit.
In the Addition mode, the count changes as follows when it has reached the upper limit:



In the Subtraction mode, the count changes as follows when it has reached the lower limit:

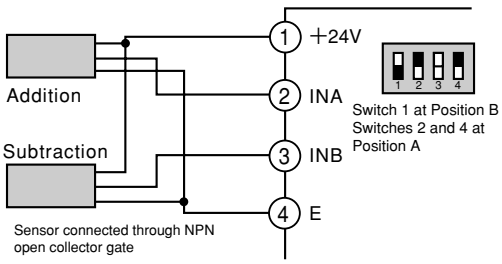


Wiring Examples

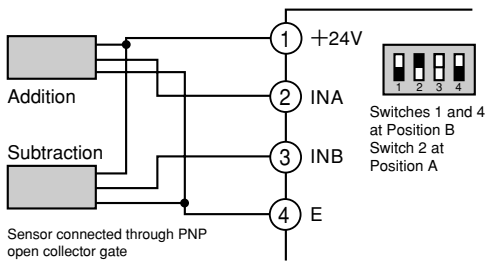
Pulse input

Proximity switch or Photoelectric sensor

■Negative logic

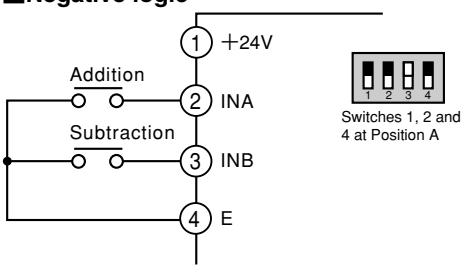


■Positive logic

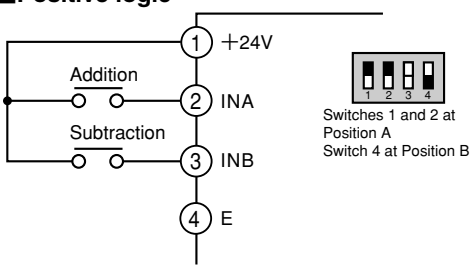


Switch or relay

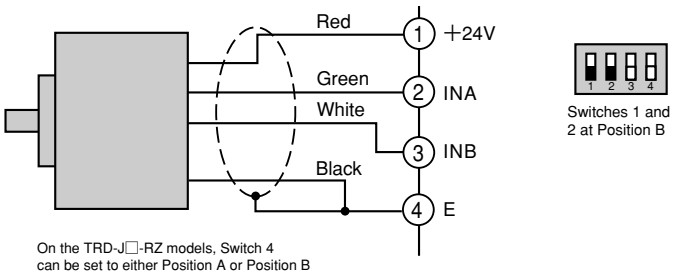
■Negative logic



■Positive logic

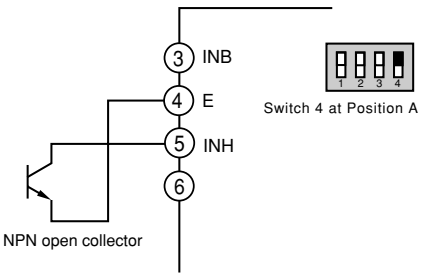


Rotary encoder

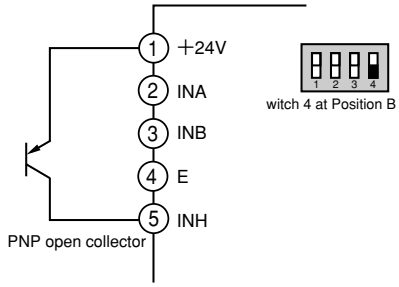


Count disable input

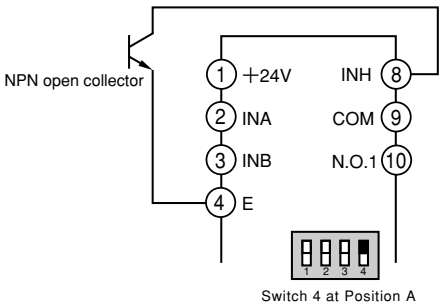
■Single preset in negative logic



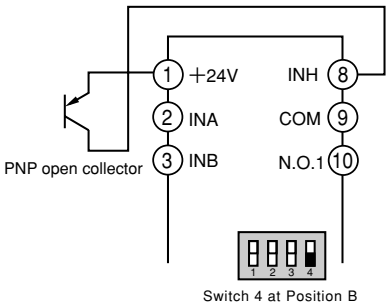
■Single preset in positive logic



■Dual preset in negative logic

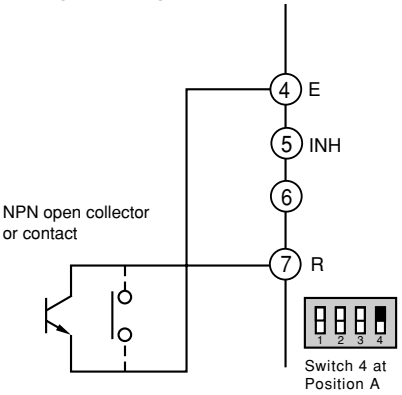


■Dual preset in positive logic

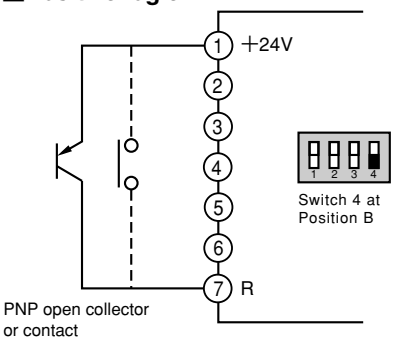


Reset input

■Negative logic

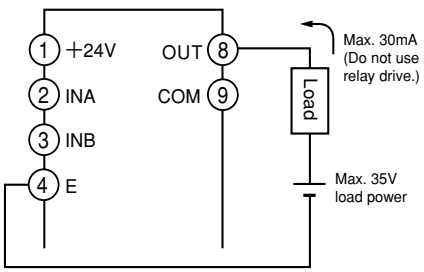


■Positive logic

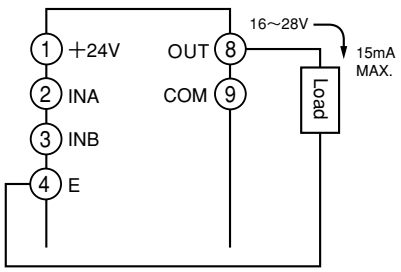


DC output

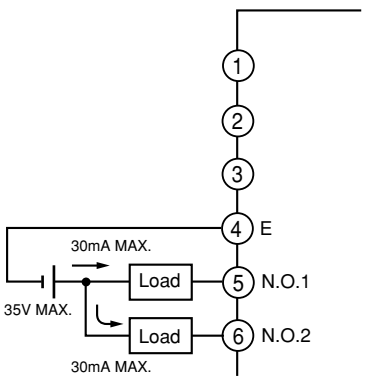
■Single preset in negative logic



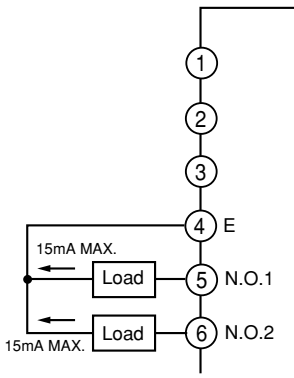
■Single preset in positive logic



■Dual preset in negative logic

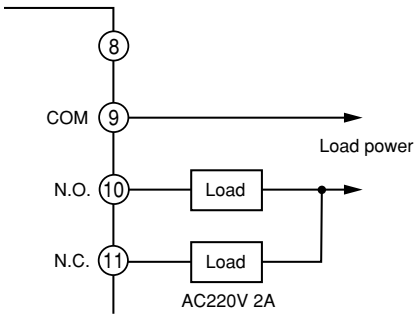


■Dual preset in positive logic

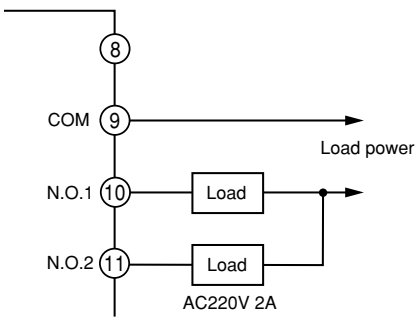


Relay output

■Single preset

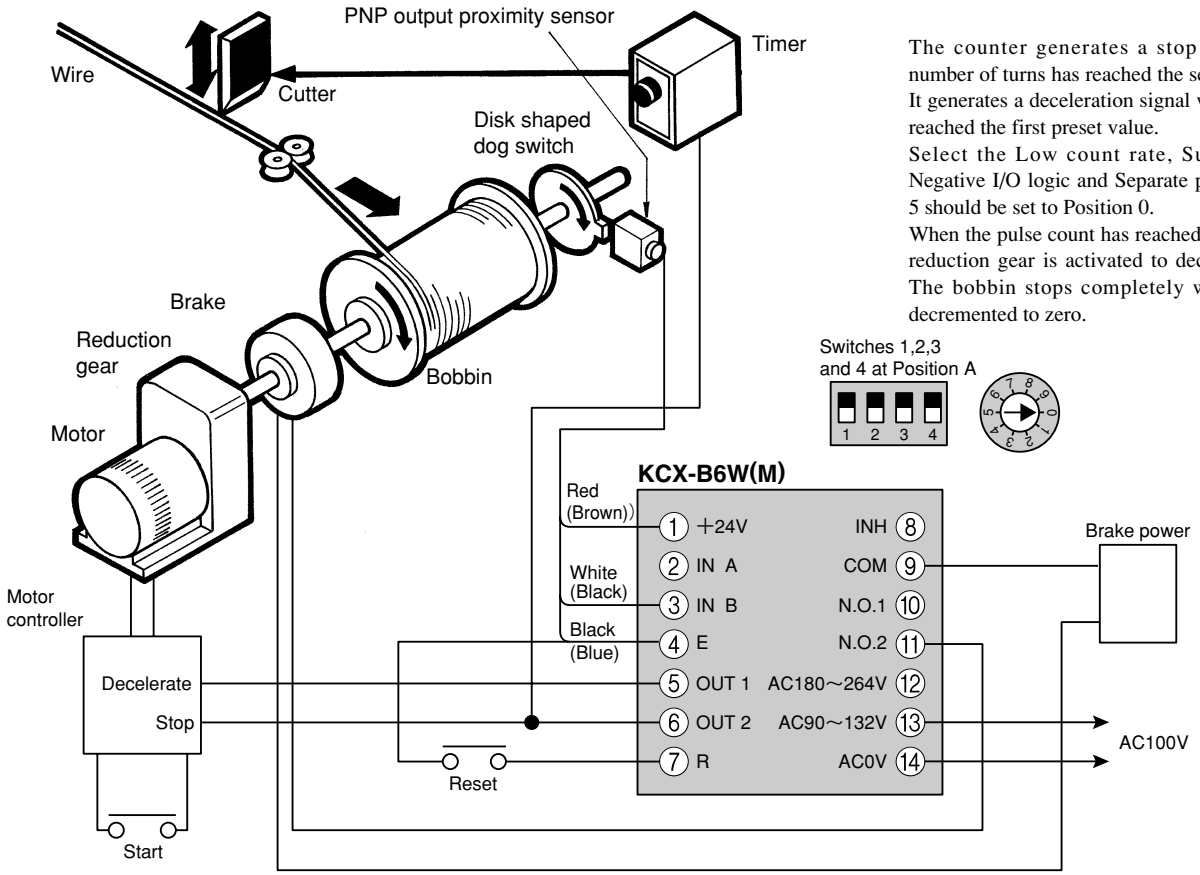


■Dual preset



Recommended applications

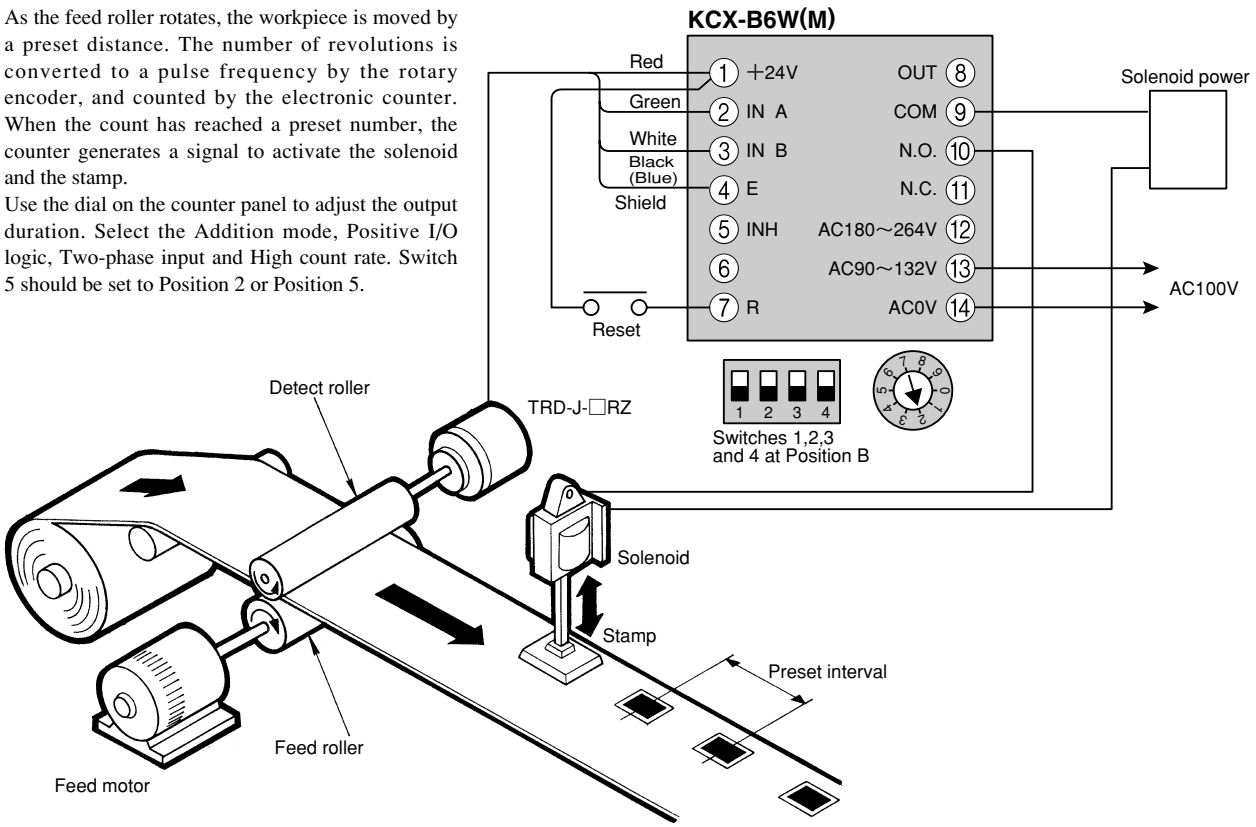
Winder with one-step reduction gear



The counter generates a stop signal when the number of turns has reached the second preset value. It generates a deceleration signal when the count has reached the first preset value.
Select the Low count rate, Subtraction mode, Negative I/O logic and Separate pulse input. Switch 5 should be set to Position 0.
When the pulse count has reached the first value, the reduction gear is activated to decelerate the motor. The bobbin stops completely when the count is decremented to zero.

Stamper

As the feed roller rotates, the workpiece is moved by a preset distance. The number of revolutions is converted to a pulse frequency by the rotary encoder, and counted by the electronic counter. When the count has reached a preset number, the counter generates a signal to activate the solenoid and the stamp.
Use the dial on the counter panel to adjust the output duration. Select the Addition mode, Positive I/O logic, Two-phase input and High count rate. Switch 5 should be set to Position 2 or Position 5.



KCX-B6T

Fast Total Counters for Addition and Subtraction

Maximum count speed: 10cps or 20kcps

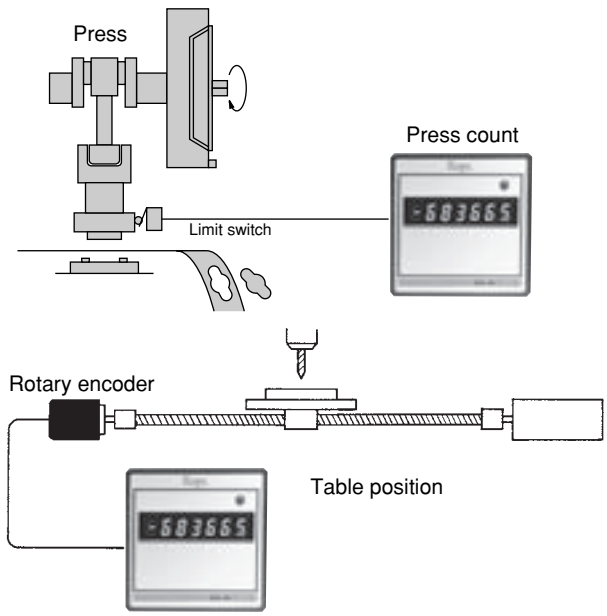
In addition to counting in two directions, these counters can use negative values. They are displayed on the easy to see green LED screen. Available options include count disable, reset prevention and negative or positive input logic. The counter can be used for positioning a moving object as shown below.

KCX-B6T

Merits

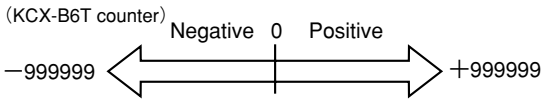
●Total counter as fast as 20kcps

Using both addition and subtraction, the counter totals individual counts much more quickly than other similar products. With the option of 10cps, the counter can be used for many purposes.



●Ability to count negative numbers

The count range is doubled by the ability to operate both in positive and negative numbers.

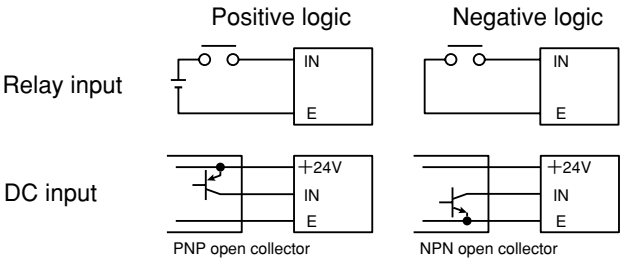


●Two-phase input and separate input

With these options, the counter widens choices of input devices to rotary encoder, proximity sensors and relay contacts. It accepts simultaneous inputs for addition and subtraction. This is ideal for keeping track of variable quantities such as workpieces on a conveyor and cars in a parking lot.

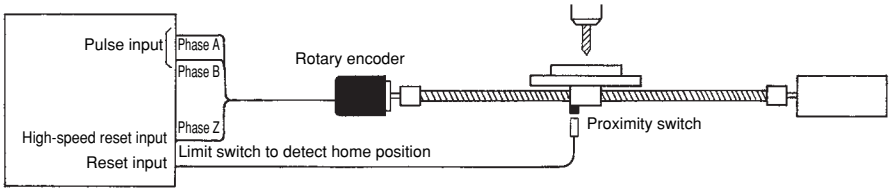
●Positive and negative input logics

The choices of input devices are also expanded. Except for slow reset, positive or negative can be selected to allow the use of PNP or NPN open collector.



●Fast reset and slow reset

The two reset signals work as AND elements. They can be used to combine two different operations. For example, the counter can be reset only when the rotary encoder and the drilling machine are at their respective home positions. No additional circuit is required.



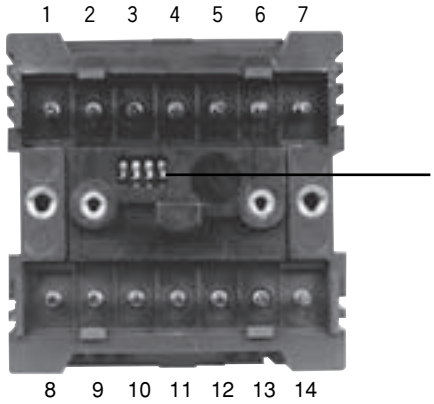
Specifications

Model number	KCX-B6T	
Number of digits	6 digits	
Count range	−999999～+999999	
Pulse input	Maximum count speed	10cps 20kcps or (selected by switch)
	Input resistance	Positive: 2.2kΩ Negative: 3.3kΩ
	Input voltage	"L"0～6V、"H"16～30V
Count disable input	Response time	On delay: Max. 25μs Off delay: Max. 25μs
	Input resistance	Positive: 2.2kΩ Negative: 3.3kΩ
	Input voltage	"L"0～6V、"H"16～30V
High speed reset input	Response time	On delay: Max. 25μs Off delay: Max. 25μs
	Input resistance	Positive: 2.2kΩ Negative: 3.3kΩ
	Input voltage	"L"0～6V、"H"16～30V
Reset input	Response time	On delay: Max. 50ms Off delay: Max. 50ms
	Input resistance	Positive: 3.3kΩ
	Input voltage	"L"0～6V、"H"16～30V
Manual reset	Manual reset is disabled by switch on front panel (by short circuiting terminals ④ and ⑥)	
Memory backup at power shutdown	Time for charging	50h
	Backup duration	2000h(25℃)
	Response of emergency input gate	20～500ms
	Response of input gate upon recovery	50～500ms
Sensor power	DC+24V(20～28V) 80mA	
Withstand voltage	AC 2kV for one minute (between AC power and Terminal E)	
Vibration resistance	(In compliance to JIS C 0911)	Durable for one hour along three axes at 10 to 55Hz with 0.5mm amplitude No error for one hour along three axes at 10 to 55Hz with 0.35mm amplitude
Noise resistance	1kV (square wave pulse with 1μs width)	
Source voltage	AC90～132V, or AC180～264V 14VA	
Ambient temperature	−10～+50℃	
Storage temperature	−20～+50℃ (−20～+70℃ during transportation of less than one week)	
Ambient/Storage humidity	35～85%RH (with no dewing)	
Weight	Approx. 350g	

Character height on display: 8mm

Terminal Assignment

T/N	Name	Description
1	+24V 80mA	Sensor power
2	IN A	Pulse count input A
3	IN B	Pulse count input B
4	E	Common input
5	IN H	Count disable
6	RD	Manual reset prevention
7	RH	High speed reset input
8	RL	Reset input
9	—	Not connected
10	—	Not connected
11	—	Not connected
12	AC180～264V	Power input
13	AC90～132V	
14	AC0V	

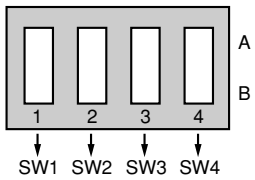


Operating procedures

1. Mode selection

To select the counter modes, use the four switches located on the rear side of the counter.

Switch	Mode selected	Position	Value selected
1	IN A Count speed	A	10cps
		B	20kcps
2	IN B Count speed	A	10cps
		B	20kcps
3	Pulse count	A	Separate
		B	Two-phase
4	Input logic	A	Negative
		B	Positive



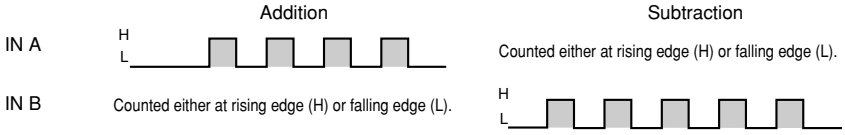
Switches 1 and 2 **Count speed**

These switches are used to set or change the maximum count speed. Turn the either switch to Position A to select 10cps, and Position B to select 20kcps. Position A is used for relay input such as a switch or relay. Use Position B for DC input such s a rotary encoder or proximity switch.

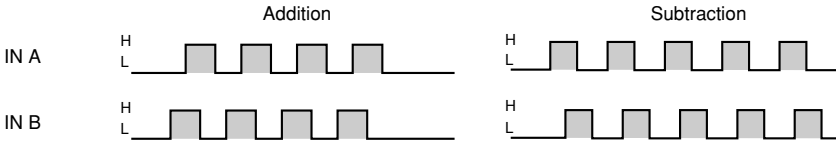
Switch 3 **Pulse speed**

This switch changes the pulse count mode between Two-Phase and Separate. For a Proximity switch or relay, set the switch to Position A to select the Separate mode. For a rotary encoder, set it to Position B to select the Two-Phase mode.

■Separate mode (Position A)



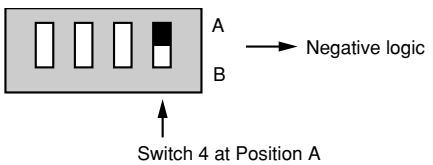
■Two-Phase mode (Position B)

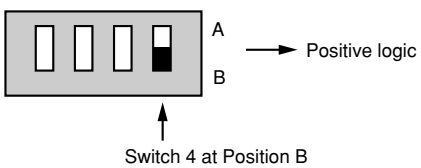


Switch 4 **Input logic**

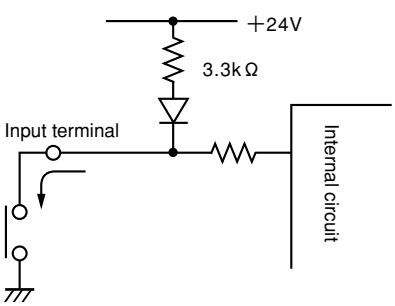
Use this switch to select the input logic either Positive or Negative. To select the negative logic (active at "L" level), set the switch to Position A. To select the positive logic (active at "H"), set it to Position B.

2. Input logic selection



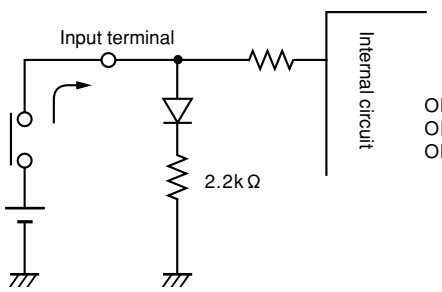


Negative logic input equivalent circuit



ON voltage: Max. 6V
OFF voltage: 16 to 30V
ON current: Max. 9mA

Positive input equivalent circuit

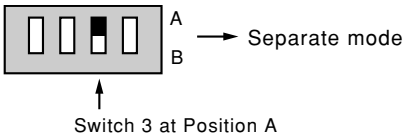


ON voltage: 16 to 30V
OFF voltage: Max. 6V
ON current: Max. 14mA
at 30V

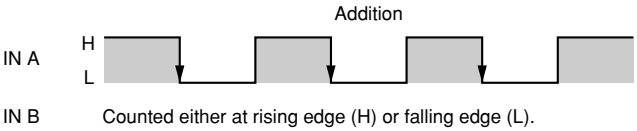
3. Pulse count input

Use Dip switch 3 to change the pulse count mode between Two-Phase (90° dephased) or Separate.

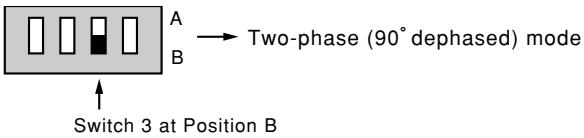
■Input waveforms



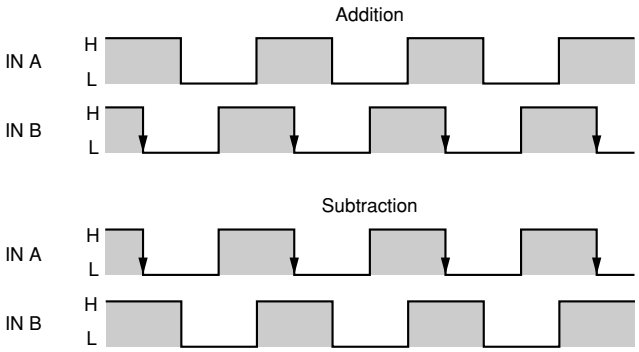
■Negative mode



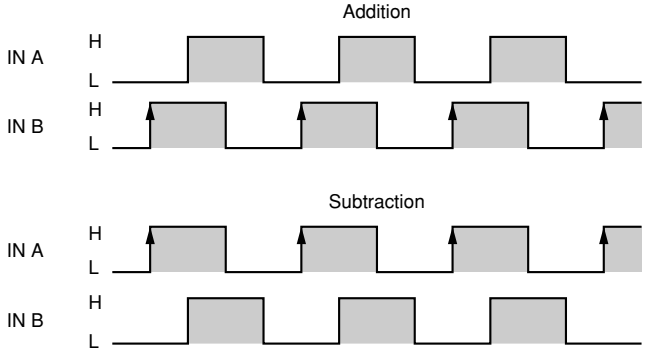
■Positive mode



■Negative mode

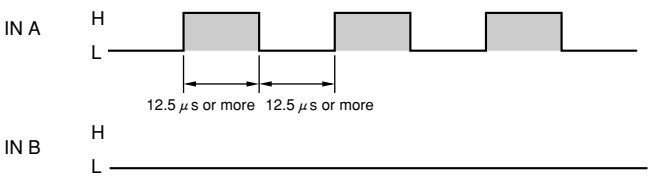


■Positive mode

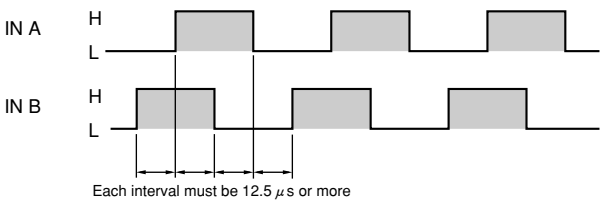


■Pulse count requirements

■Separate mode

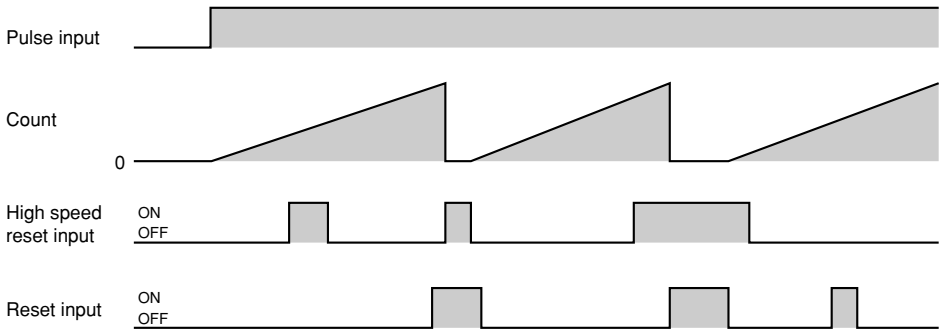


■Two-Phase mode



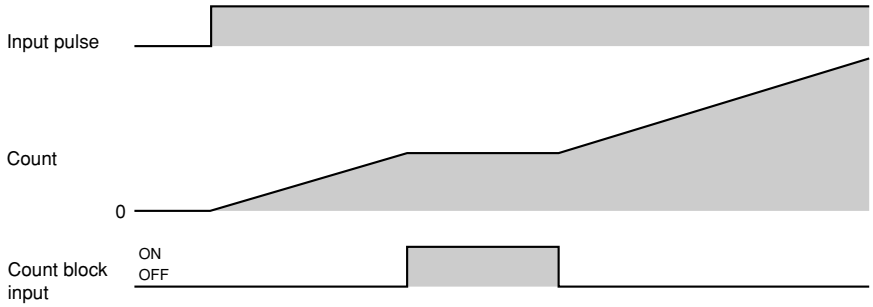
4. External reset input

On the KCX-B6T Series counters, reset and high speed reset are used as an AND gate.
If you do not use both of them, keep the unused input at ON level.



5. Count disable input

The disable signal halts the pulse count. When it turns off, count restarts from the value at the time of halt.



Count overrange

The KCX-B6T models can count from-999999 to 999999.

In the Addition mode, the count is reset to 000000 when it has reached 999999.

In the Subtraction mode, the count is reset to 000000 when it has reached -999999.

Disabling manual reset

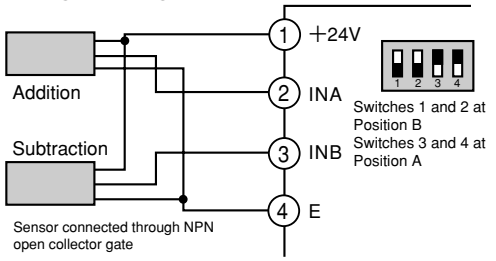
Connect Terminals 6 and 4 if you wish to disable the Reset button on the front panel.
It allows you to prevent erroneous preset.

Wiring Examples

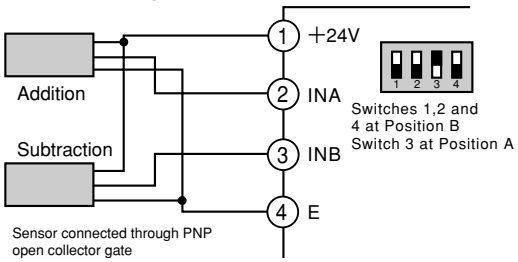
Pulse input

Proximity switch or photoelectric sensor

■Negative logic

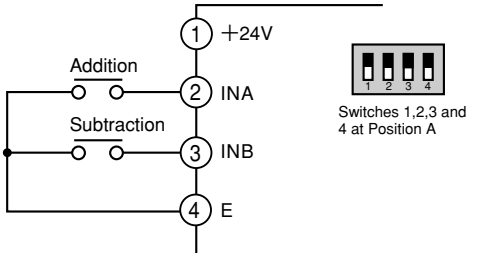


■Positive logic

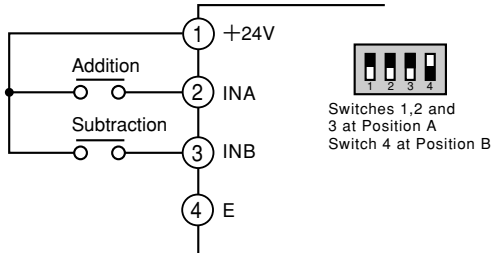


Switch or relay

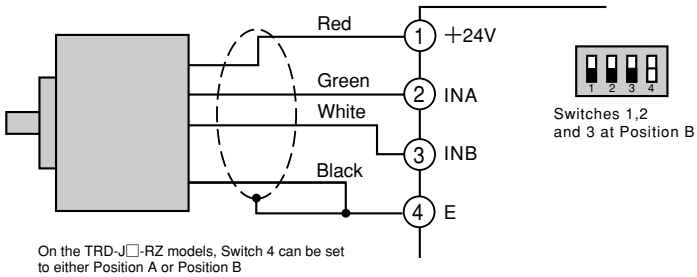
■Negative logic



■Positive logic

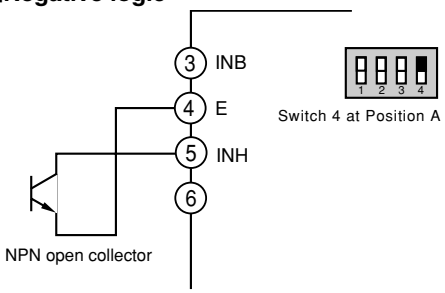


Rotary encoder

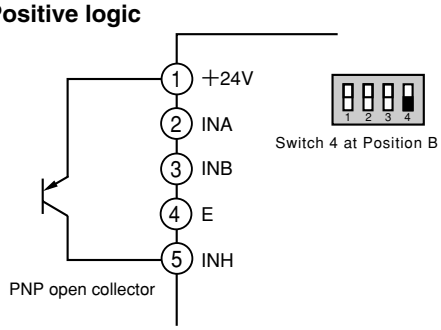


Count disable input

■Negative logic

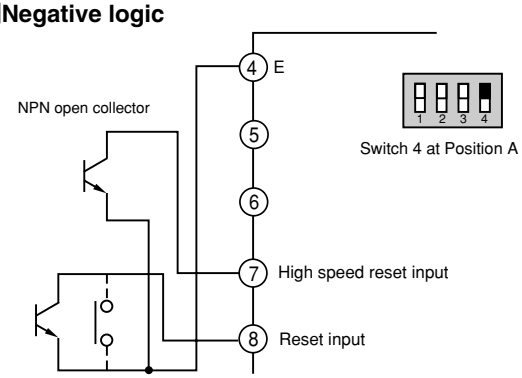


■Positive logic

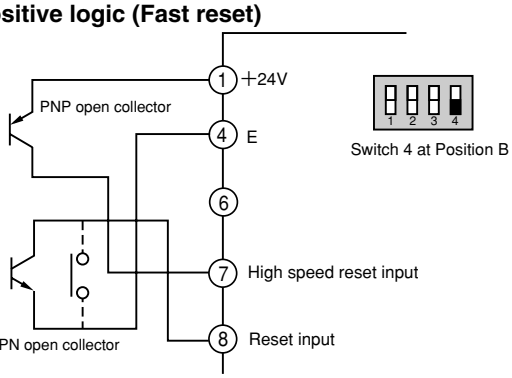


Reset input

■Negative logic



■Positive logic (Fast reset)

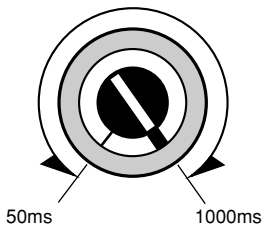


For optimum performance(KCX-□,□M,□D,□DM/□W,□WM/□T/B/B6T)

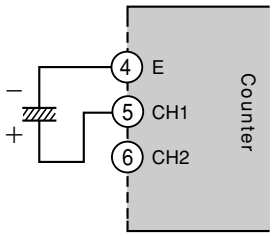
■Changing the duration of Type A output

In the One shot mode, output duration can be changed from 50ms to 1,000ms. For adjustment, use the dial on the front panel.
(On the KCX-□W and KCX-□WM counters, the dial is located on the rear panel.)

Turn the dial counterclockwise or clockwise to decrease or increase the duration. Turn it fully to either direction to select the minimum or maximum time.



On the KCX single preset counters, you can extend the output time by adding a capacitor between the terminals ④ and ⑤.



Electrolytic capacitor	Output duration		
	Minimum		Maximum
None	50ms	～	1s
2.2 μF 16V	100ms	～	2s
4.7 μF 16V	150ms	～	3s
10 μF 16V	250ms	～	5s
22 μF 16V	500ms	～	10s

■Memory backup at power shutdown

In some counters, a second battery is integrated to backup the count memory upon power shutdown. The battery can be fully charged in 50 hours. With only one hour charging, it can supply power for 40 hours, or 100 hours on the KCX-□WM and KCX-□T models.

Notes on memory backup

1. When power is shut down, the count display is cleared, and the sensor power drops to 0 V.

2. During Type B (Hold mode) operation, DC output also drops to 0V resulting in random signal. Upon the recovery of power, the signal output returns to the status before the power shutdown.

3. If the power is turned off during pulse input, the counter uses the battery to continue correct count.

4. You cannot reset the count by shutting power down.

5. During power shutdown, the count is not reset by any external reset signal.

6. In the following cases, 100 hours are required for charging the battery:

●When the counter is used for the first time

●When the battery is unused for a long time

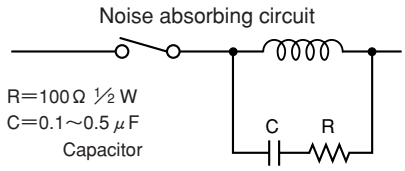
7. Service life of battery

When fully charged, the battery should be able to support memory for 2,000 hours (5,000 hours on the KCX-□WM and KCX-□T models). It should be replaced when this period is reduced to 50%. Normally, the battery can be used for five years. It can serve longer if the ambient temperature is kept at 5 to 30℃.

■Protection against noise

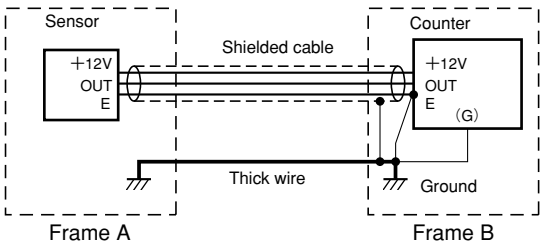
All of the KOYO electronic counters are tested for noise resistance. In addition to the standard tests, we perform special inspections to assure reliable performance. Use the following procedures for additional enhancement:

1. When you use a solenoid valve, clutch or brake near the counter, connect a surge absorbing circuit in parallel with its drive coil. This circuit should consist of a capacitor serially connected with a resistance of 100Ω (1/2W). Use an oil-impregnated capacitor or an MP capacitor of 0.1 to 0.5 μF.



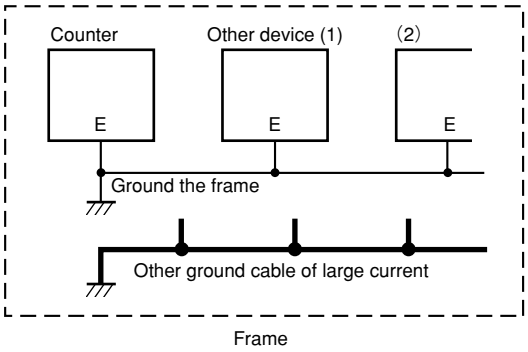
2. In a noisy area, do not share the power line with a device that uses large electric current. Always shield the I/O signal cables, and connect the shielded cables between the sensor and the counter.

   If they are installed on separate frames, use a thick wire of at least 0.5mm² to connect the frames.

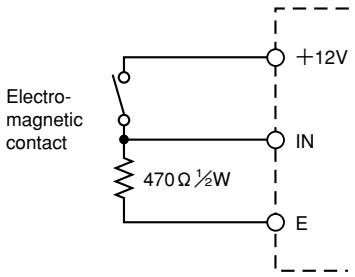


3. Keep the minimum distance between Terminal E and the frames.

   If you use a common ground for the counter and other devices, connect the ground cable to the counter frame. Use a thick and short ground cable, and isolate it from any other cable that grounds a large current.



4. Use a resistor of 470Ω (1/2W) if you add an electromagnetic relay to the slow pulse count terminal. Insert the resistor between the input terminal and the ground cable. This prevents incomplete contact, and helps improve reliability.



■Changing the preset value

During operation, a change to the preset value may cause the counter to generate a false signal. Before you make a change, always turn the power off, or reset the counter. Otherwise, the counter generates no signal upon countup, or erroneously generates a signal before or after the count has reached the new value.

Presetting to zero

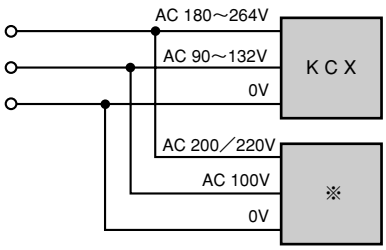
The counter may be preset to zero (for example, to "000" on a 3-digit counter). This may cause the counter to act as follows:

- It may generate a signal unless the input pulse is at "L" level and the reset signal is at "H" level.
- In the Type B mode, the counter may display 0,1,2,3 if a sequence of pulse signals are entered while the reset signal is at "L" level.

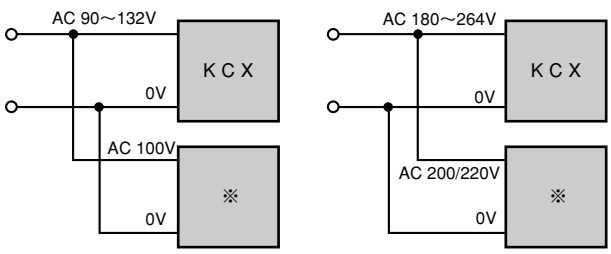
■Connecting the power

On the KCX Series counters, the power transformer is set to 110V or 220V. Avoid the following connection:

Wrong



Correct



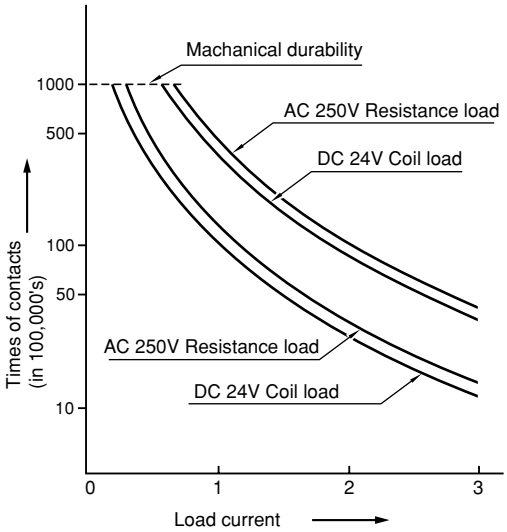
※Other counters

Cautions

●Output relay contact

The counter can be connected to an induced load. It may be an electromagnetic switch, control relay, AC solenoid or electromagnetic valve. The counter contains an output relay contact. Its service life is reduced if higher current or voltage flows to the contact. The following graph shows the relation between the durability of the contact and the magnitude of load:

Relay durability curve

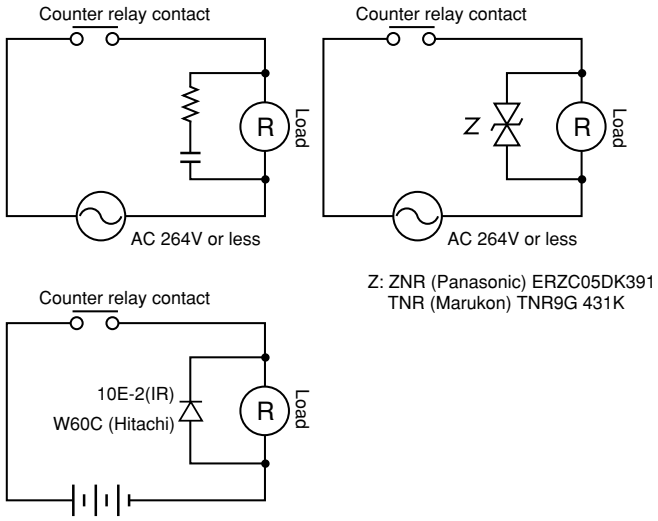


Under load conditions specified in JEM 1230 (1976)

On the contact surface, carbide is produced by glow discharge of induced load being switched. This increases the contact resistance. The carbide produced can be eliminated by arc discharge that occurs at higher current. It keeps the contact surface clean with minimum resistance. At lower current or voltage, the contact cannot be switched properly because of the carbide. It becomes unserviceable before the number of contacts reaches the normal limit. Its life can be reduced to as short as one tenth or one hundredth of the time estimated from the above curve. If you use small voltage or current, action should be taken to prevent glow discharge.

An effective means is to use a CR surge absorber or varistor. Connect such element in parallel with the load as shown below.

Surge absorbing circuit



●The induced load of the relay contact is 10% to 20% of the resistance load. The smaller the load is, the longer the contact can serve.

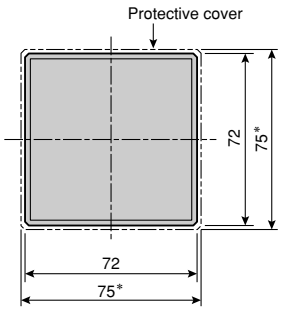
●With or without the memory backup, the status of DC output during power shutdown is undefined. That is, the output can randomly change between “1" and “0".

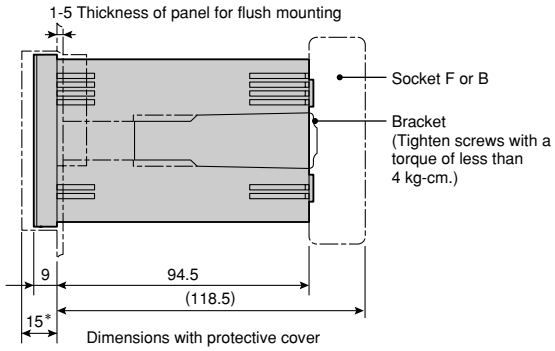
●On some models, certain numbers are displayed in different shapes as shown below. This is normal for such models.

KCX-1D/2D/3D/4D KCX-B/KCX-B6T	Other models
6	b
9	q

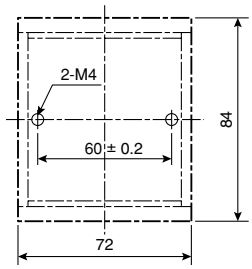
External Dimensions

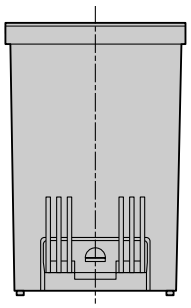
(in mm)



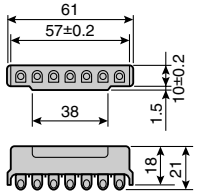


●Boring dimensions for wall surface mounting using Socket F

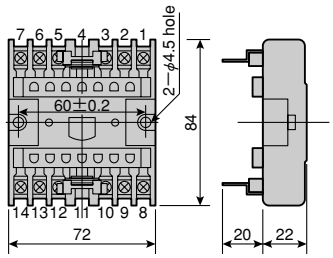




●Specified connector: KA-01



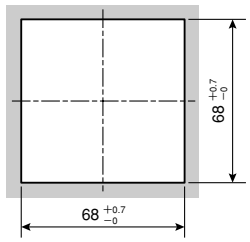
●Socket F (KF-03) for wall surface mounting



●External dimensions of Socket B (KB-03): Same as Socket F.

●KA-01, KF-03 and KB-03 are options.

●Boring dimensions for flush mounting

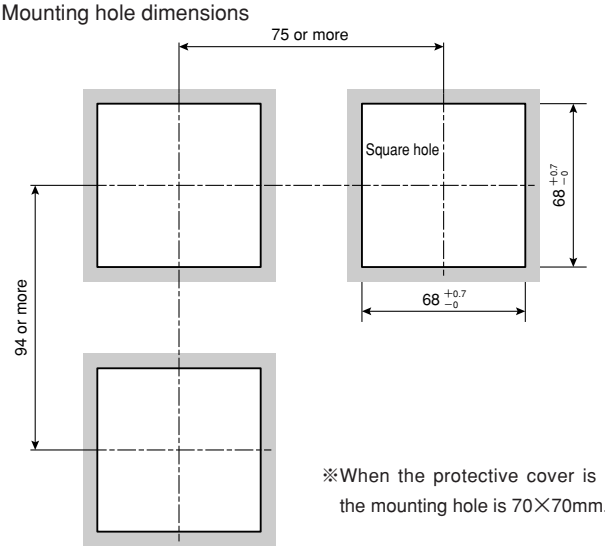


Notes:

- Use the screws provided to install the counter on Socket F (KF-03) or Socket B (KB-03).
- For the connector kit KA-01 and Socket B (KB-03), use screws sized as follows:
  For the connector kit (KA-01): 12mm or less
  For Socket B (KB-03): 30mm or less

Do not use longer screws, as they may break the internal elements.

Mounting hole dimensions

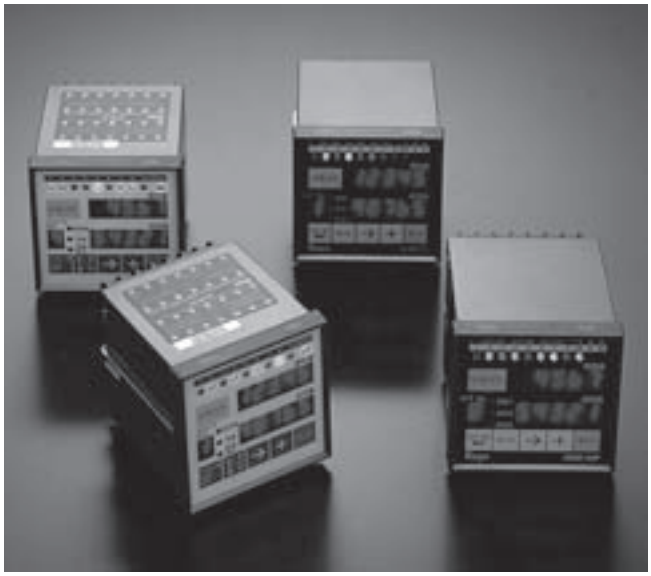


※When the protective cover is used, the mounting hole is 70×70mm.

KCM-50-1/51-1 Multi-counter (Maintenance Counters)

The KCM-50 series has 9 counters aggregated into one unit, while the KCM-51 series has 8 counters (timers) aggregated into one unit).
These devices can indicate tool replacement for machining centers, NC industrial machinery, and the like as well as maintainance periods for multiple tools.

- Tool management: Replacement notification/warning
- Whetstones for grinding: Maintenance notification
- Quantity management: Total counters/preset counters
- Time management: Integration timers



KCM-50 series

KCM-50/KCM-50-1
KCM-50P/KCM-50P-1

This counter is equipped with 9 units for count input/presetting/independent alarm output (increased count output). The counter produces output when an individual unit reaches set values for equipment halt.

- Open collector output: **KCM-50 (Surface sheet in Japanese)**
  KCM-50-1 (Surface sheet in English)
- Voltage output: **KCM-50P (Surface sheet in Japanese)**
  KCM-50P-1 (Surface sheet in English)

KCM-51 series

KCM-51/KCM-51-1
KCM-51P/KCM-51P-1

This counter is equipped with 8 units for count input/presetting/independent alarm output (increased count output). The counter produces output when an individual unit (timer) reaches set values for equipment halt.

- Open collector output: **KCM-51 (Surface sheet in Japanese)**
  KCM-51-1 (Surface sheet in English)
- Voltage output: **KCM-51P (Surface sheet in Japanese)**
  KCM-51P-1 (Surface sheet in English)

KCM-50 series

Merits

●Nine 5-digit preset counters are aggregated into one unit

●Battery-less

Retention of set values and count values is maintenance-free thanks to use of EEPROM.

●Independent alarm (preset) output from 9 circuits

●Color-differentiated display pre-alarm (green)-alarm (orange)-equipment halt (red)

The pre-alarm is provided to indicate when alarm values are being approached.

●Equipment halt output

Over-values are set with respect to set alarm values for individual counters. Equipment halt (displayed in red) is output whenever a counter reaches over-values.

●These 9 preset counters can also be used as a total counter

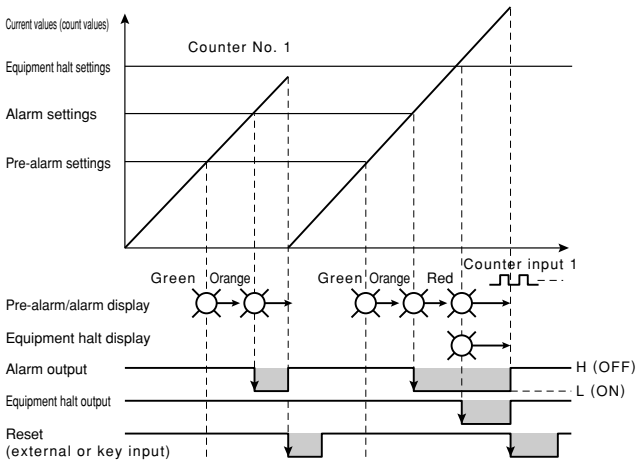
The counters can be preset (alarm setting) independently to output preset values (displayed in orange) when counts are input.

●Oil-resistant front operation panel

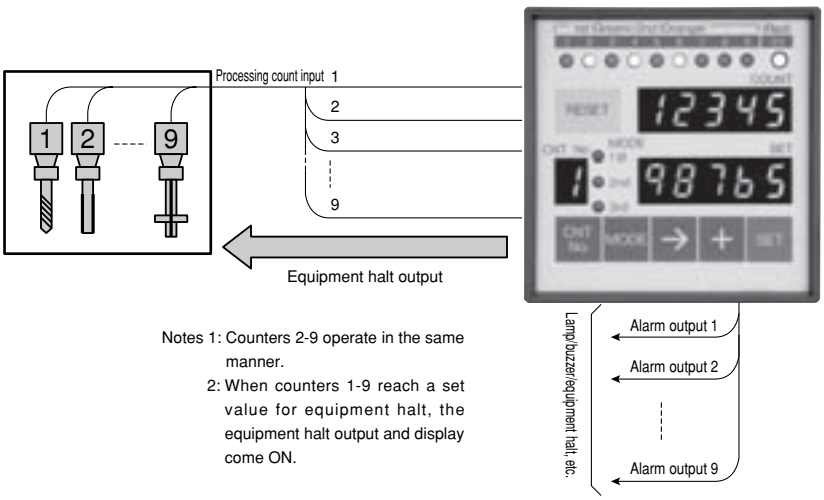
●Small (DIN 72 x 72mm)

The counter's depth is 82 mm, which makes it thin enough for a control panel.

Basic operations Timing chart (KCM-50/50-1)



Application example: Tool maintenance for multiaxial industrial machinery



Notes 1: Counters 2-9 operate in the same manner.
2: When counters 1-9 reach a set value for equipment halt, the equipment halt output and display come ON.

KCM-51 series

Merits

●Eight 5-digit preset counters (timers) are aggregated into one unit

●Battery-less

Retention of set values and count values is maintenance-free thanks to use of EEPROM.

●Independent alarm (preset) output from 8 circuits

●Color-differentiated display for counters (timers) upon reaching set values

Setting 1 (green)-Setting 2 (orange)- Setting 3 (red)

●OR output

Output is produced by any of the counters (timers) upon reaching Setting 1 values or Setting 3 values.

●These 8 preset counters can also be used as a total counter or integrated timer

Use of counter and timer functions can be mixed.

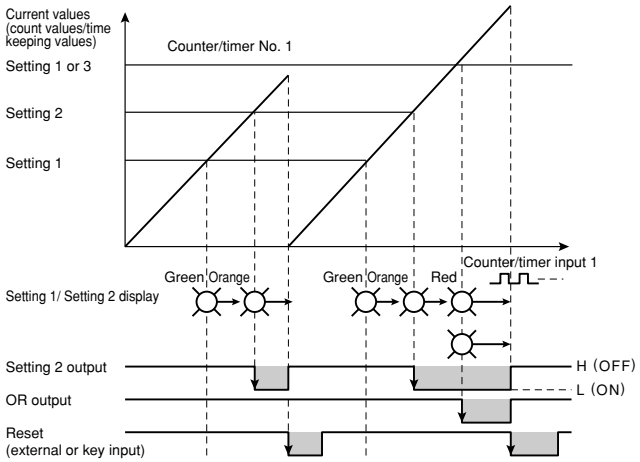
●Any counter /timer can be reset with an external signal.

●Oil-resistant front operations panel

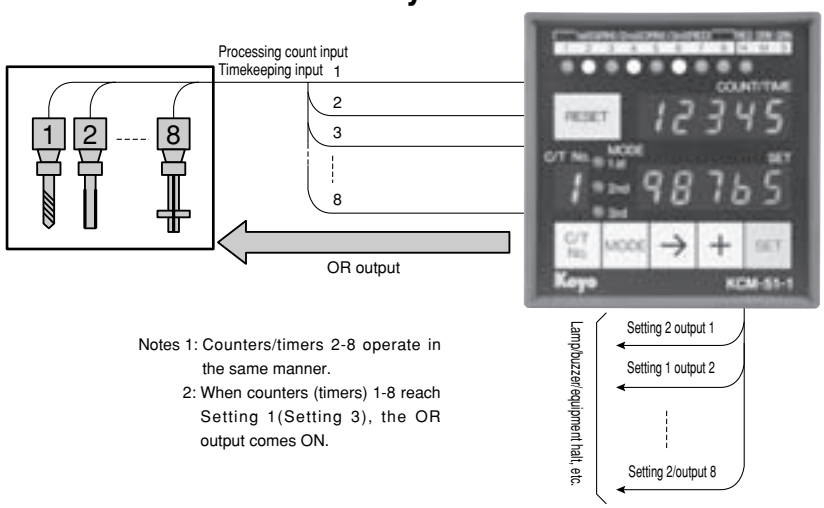
●Small (DIN 72 x 72)

The counter's depth is 82 mm, which makes it thin enough for a control panel.

Basic operations Timing chart (KCM-51-1/51-1)



Application example: Tool maintenance for multiaxial industrial machinery



Notes 1: Counters/timers 2-8 operate in the same manner.
2: When counters (timers) 1-8 reach Setting 1(Setting 3), the OR output comes ON.

KCM-50-1

Front Panel Layout and Description

Count-up display (green-orange-red)

- Green: Represents reaching prealarm set values.
- Orange: Represents reaching alarm set values.
- Red: Represents reaching equipment halt settings.

Reset Key

- Resets values currently displayed.
  When multiple counters are counting up, operating Reset switches to the next counter display.

Equipment halt display (red)

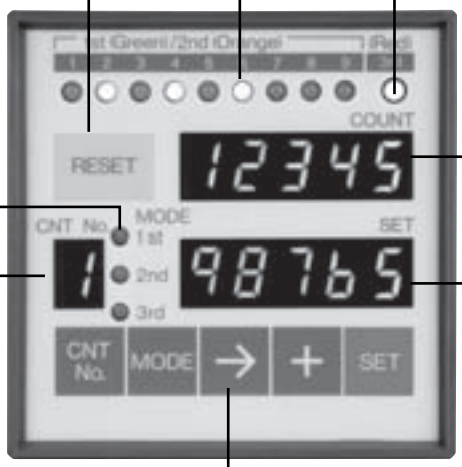
- Displays counters that have reached equipment halt settings.

Mode display

- Displays pre-alarm/alarm equipment halt if present in Setup mode. When no displays are lit, the counter is in Run mode.

Current value display

- Displays the current value of the counter displayed by Counter No. In Run mode, zeroes for higher digits are not lit.



Counter No. display

- Displays the selected Counter No.
- When counters are counting up (set alarm values), this display switches to the Counter No. with an increased count.

Set value display

- Displays the set value (alarm, pre-alarm, or equipment halt) of the counter displayed by Counter No.
  In Run mode, zeroes for higher digits are not lit.

CNT No. Key

- Switches the counter's Current value display and Set value display.

  → 1 → 2 → 3 ---------- 8 → 9 →

- In Run mode, unused counters are not displayed.
- Continue to push this key for more than 1 second and the display will automatically advance.

MODE Key

- Switches between Run mode and Setting modes.

  Setting modes

  → Run → Alarm → Pre-alarm → Equipment halt →

  When no key input continues for longer than 1 minute, the display automatically switches to Run mode.

→ Key (Digit Selection Key)

- Used for selection of digits during set value input.

  → 5th digit → 4th digit ---------- 1st digit →

- The selected digit flickers.
- Continue to push this key for more than 1 second and the display will automatically advance.

+ Key (Value Advancement Key)

→ The number of the digit selected is advanced with this key.

→ 0 → 1 → 2 ---------- 8 → 9 →

- Continue to push this key for more than 1 second and the display will automatically advance.

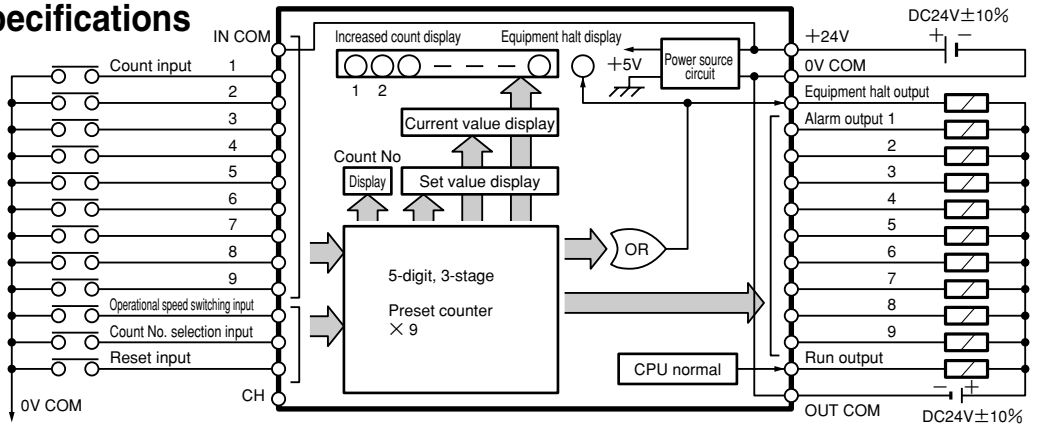
SET Key

- This key sets values as set in memory in Setting mode. Once set, a portion of the Set value display will blink 3 times, which represents input.

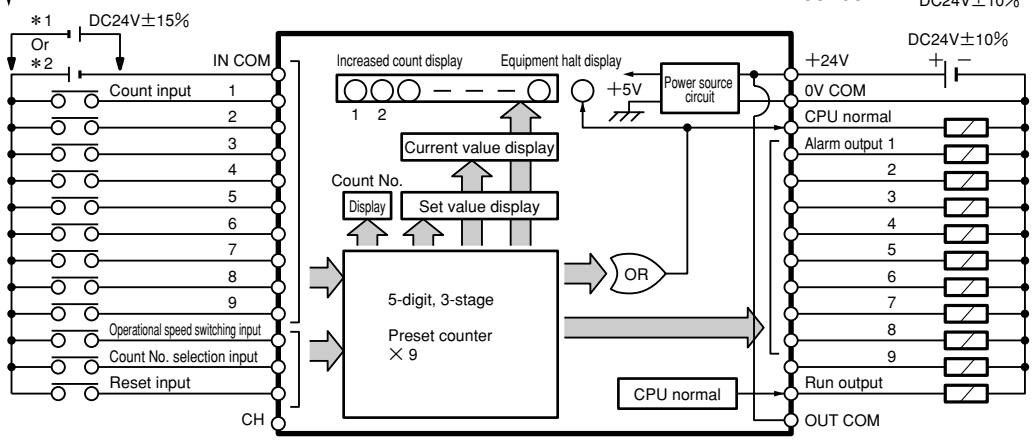
Input and Output/Specifications

●Block Diagram

KCM-50



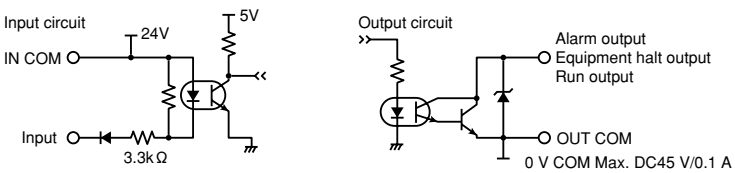
KCM-50P



*1 Positive logic
*2 Negative logic

Terminal number	I/O	Explanation of functions	Specifications	
5, 6, 7, 12, 13, 14, 19, 20, 21	Count input 1～9	Regardless of Run mode/Setting mode, the current values of the counter are added (+1). Current values proceed from H→L, L→H, and L→H (positive logic).	Operational speed 30/500Hz	KCM-50 Input voltage ON: 0-3 V OFF: more than 16 V Input resistance: 3.3 kΩ KCM-50P Input voltage (Positive logic) ON: 0-6 V OFF: Input open (Negative logic) ON: 16-27.6 V OFF: 0-6 V Input resistance: 2.2 kΩ
18	Operational speed switching input	OFF：30Hz ON ：500Hz	Switching with source ON edge	
26	Count No. selection input	Counter selection input →1→2→3→4→5→6→7→8→9→ Counter No. advances with H→L and L→H (positive logic). In Run mode, unused counters are not selected.	Ondelay: 30ms Offdelay: 30ms	
25	Reset input	Current values of the counter specified by Counter No. are reset. When input for Counter No. selection and reset are input together within approx. a 5-seoncd interval, all counters are reset.	Ondelay: 0.1s Offdelay: 0.1s	
1, 2, 3, 8, 9, 10, 15, 16, 17	Alarm output 1～9	Output when set alarm values are reached with independent output for counter Nos. 1-9.	Duration of input response: 30ms (30Hz) 10ms (500Hz)	
4	Equipment halt output	Output when equipment halt settings are reached with output for any counter from Nos. 1-9.		
11	Run output	ON for CPU normal/OFF for CPU abnormal	Response duration ON : After power supply less than 1.5 s OFF: After abnormality sensing less than 10 ms	
—	Count No. display	Displays the Counter No. selected via the Counter No. selection key or external counter no. selection input. Switches to the Counter No. (in order of preference) with an increased count when counters are counting up. Order of preference: Equipment halt＞alarm＞pre-alarm		

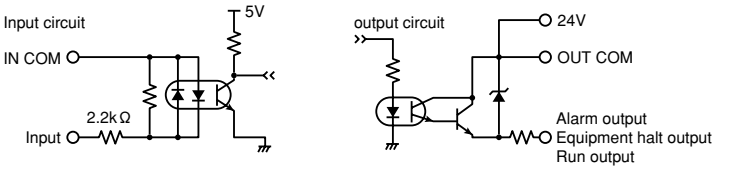
KCM-50



Notes 1: IN COM and 24 V are connected internally to the counter.

2: OUT COM and 0 V COM are connected internally to the counter.

KCM-50P



Note: OUT COM and 24 V are connected internally to the counter.

KCM-51-1

Front Panel Layout and Description

Count-up display (green-orange-red)

- Green: Represents reaching Setting 1 values.
- Orange: Represents reaching Setting 2 values.
- Red: Represents reaching Setting 3.

Reset Key

- Resets values currently displayed.
  When multiple counters are counting up, operating Reset switches to the next counter display.

Timekeeping unit display (red)

Differentiates timekeeping units by color for display during timer operation.

- Green: Seconds
- Orange: Minutes
- Red: Hours

Mode display

- Displays Setting 1/Setting 2/Setting 3 if present in Setup mode. When no displays are lit, the counter is in Run mode.

Current value display

- Displays the current value of the counter/timer displayed by Counter /timer No. In Run mode, zeroes for higher digits are not lit.

C/T No. display

- Displays the selected Counter/ timer No.
- When counters/timers are counting up (Setting 2), this display switches to the Counter/Timer No. with an increased count.

Set value display

- Displays the set value (Setting 1, Setting 2, or Setting 3) of the counter/timer displayed by Counter /timer No. In Run mode, zeroes for higher digits are not lit.

C/T No. Key

- Switches the counter's Current value display and Set value display.
  1 → 2 → 3 ---------- 8
- In Run mode, unused counters/timers are not displayed.
- Continue to push this key for more than 1 second and the display will automatically advance.

MODE Key

- Switches between Run mode and Setting modes.

Setting modes

Run → Setting 1 → Setting 2 → Setting 3

When no key input continues for longer than 1 minute, the display automatically switches to Run mode.

→ Key (Digit Selection Key)

- Used for selection of digits during set value input.
  5th digit → 4th digit ---------- 1st digit
- The selected digit blinks.
- Continue to push this key for more than 1 second and the display will automatically advance.

+ Key (Value Advancement Key)

→ The number of the digit selected is advanced with this key.

0 → 1 → 2 ---------- 8

- Continue to push this key for more than 1 second and the display will automatically advance.

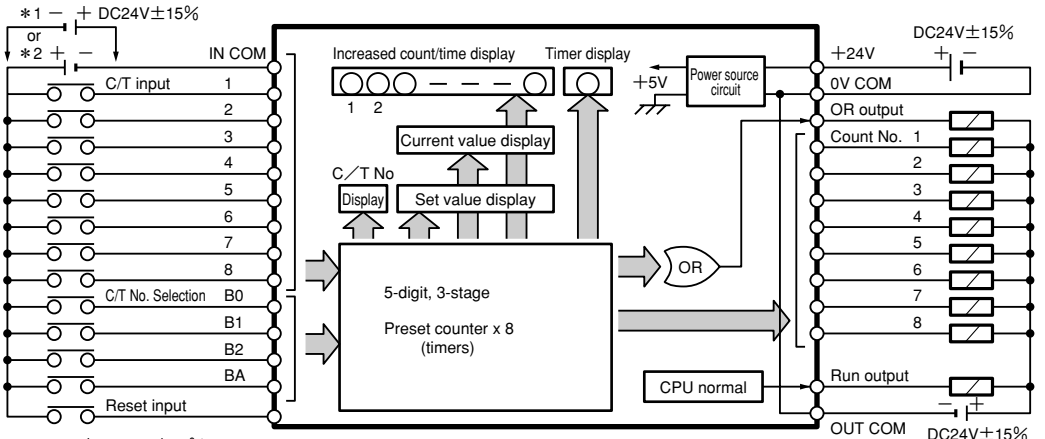
SET Key

- This key sets values as set in memory in Setting mode. Once set, a portion of the Set value display will blink 3 times, which represents input.

Input and Output Functions/ Specifications

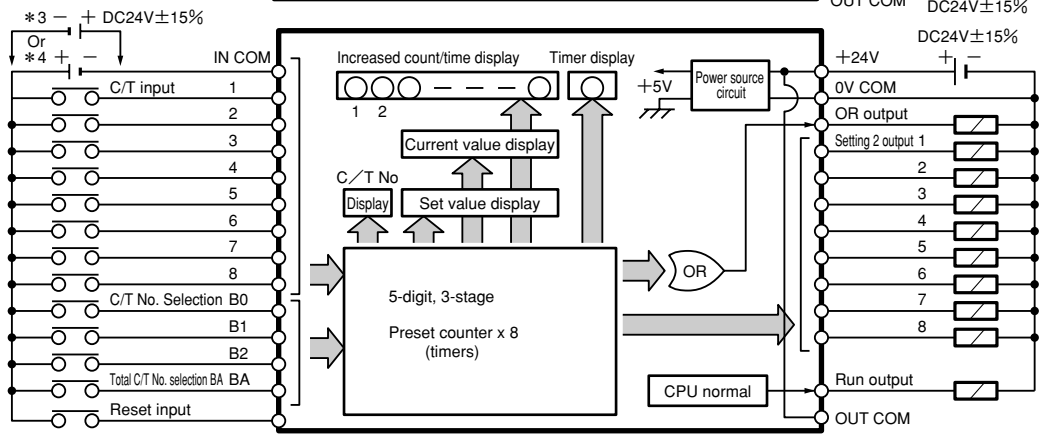
●Block Diagram

KCM-51-1



＊1 Positive logic input
＊2 Negative logic input

KCM-51P-1

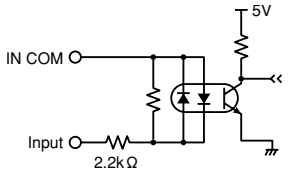


＊3 Positive logic input
＊4 Negative logic input

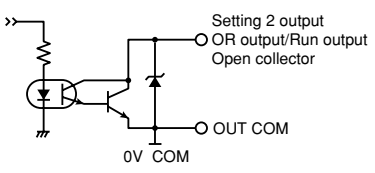
Terminal number	I/O	Explanation of functions	Specifications	
5 6 7 12 13 14 19 20	C/T input 1～8	Regardless of Run mode/Setting mode, the count (timekeeping) of the counter (timer) is performed. ●When used as a counter, current values proceed from OFF→ON	Operational speed 30 cps/500 cps Min. pulse amplitude 16.6 ms/1 ms	Input voltage (Negative logic) ON: 0-6 V OFF: Input open (Positive logic) ON: 16-27.6 V OFF: 0-6 V Input resistance: 2.2 kΩ
		●When used as a timer, timing starts OFF→ON. Timekeeping is continuous when ON. Timing is halted with ON→OFF.	Timekeeping range Hours 1-99999 hrs Minutes 1-99999 mins Seconds 1-99999 s	
21, 26, 27	C/T No. Selection input	Specifies 3 inputs (B0, B1, and B2) for the counter/timer No. that is to be reset.		
18	C/T No. Selection input	Input is ON when during reset input for all timers and counters to be selected.		
25	Reset	Current values of the selected Counter/timer No. become 0.	Ondelay: 30 ms Offdelay: 30 ms	
1, 2, 3, 8, 9, 10, 15, 16	Setting 2 output 1～8	Output when Setting 2 values are reached with output for any counter/timer from Nos. 1-8.	Duration of input response: 30 ms (30-Hz timer) 10 ms(500 Hz)	
4	OR output	Output when Setting 1 (Setting 3) values are reached with output for any counter/timer from Nos. 1-8		
11	Run output	ON for CPU normal/OFF for CPU abnormal.	Response duration ON: After power supply less than 1.5 s OFF: After abnormality sensing less than 10 ms	
—	Counter/timer No. display	Displays the Counter/timer No. selected via the Counter/timer No. selection key or external C/T No. selection input.		

●Default settings: Pressing the Mode key and + key at the same time has the counter enter Default Setting Mode, and default setting of the following data is performed.1)Counter/timer selection 2)Setting of operational speed/timekeeping units 3)Selection of Reset key disable or enable 4)Set value selection with respect to OR output (Setting 1 or Setting 3)

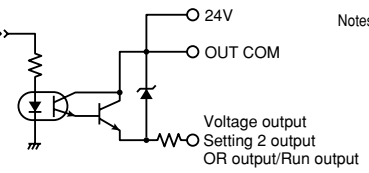
KCM-51-1/51P-1: Input circuit



KCM-51-1: Output circuit



KCM-51P-1: Output circuit



Notes 1: Input common 0 V: Positive logic
24 V: Negative logic
2: Output common
KCM-51-1: 0 V and internally short-circuited
KCM-51P-1: 24 V and internally short-circuited

General Specifications (Common to KCM-50-1/51-1 Series)

Item	Specification
Source voltage	DC 24 V±15% (20.4-27.6 V) KCM-50-1: DC 24 V±10% (21.6-26.4 V)
Power consumption	5W
Ambient temperature	−10～+55℃
Storage temperature	−20～+70℃(with no freezing)
Ambient humidity/ storage humidity	45～85%RH(with no dewing)
Insulation resistance	more than 100 MΩ DC500 V 1 minute between power source and input terminals
Withstand voltage	AC500V 50/60 Hz 1 minute (uncharged metallic portion exposed to charged portion and external portion)
Noise resistance	Between power source terminals: ±1 kV (pulse amplitude 1 μs rise 1 ns) Between input terminals: ±500 kV (pulse amplitude 1 μs rise 1 ns)
Vibration resistance	No malfunction: displacement amplitude 0.5 mm 10-55 Hz along three axes Durability: displacement amplitude 0.75 mm 10-55 Hz along three axes
Impact resistance	98m/s² along three axes
Case packing	Munsell N-4 (dark gray) ABS material
Weight	350g

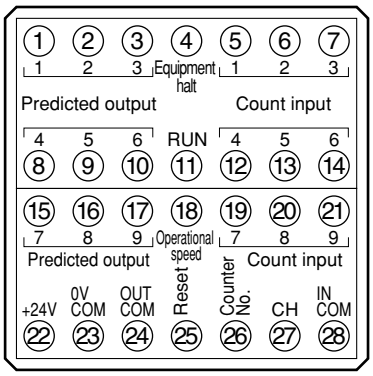
Model numbers

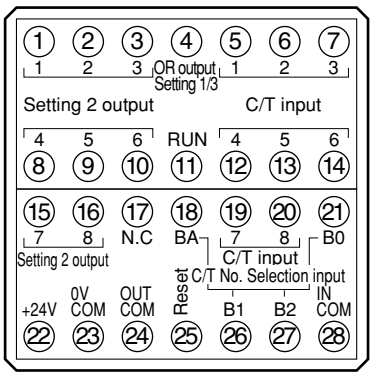
Model number
KCM-50
KCM-50-1
KCM-50P
KCM-50P-1
KCM-51
KCM-51-1
KCM-51P
KCM-51P-1

(Accessories)
Metal fittings for installation

Terminal arrangement (names and functions)

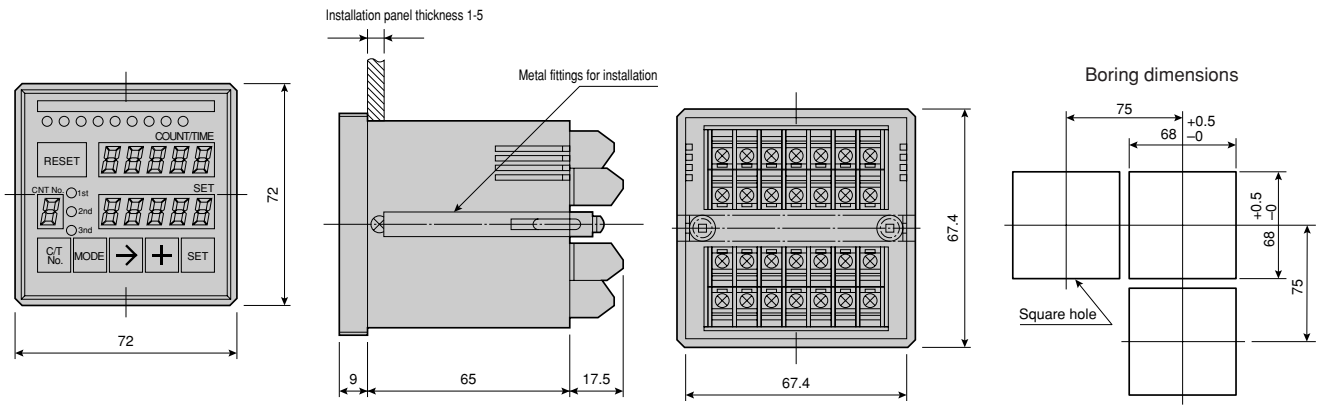
●KCM-50 Series



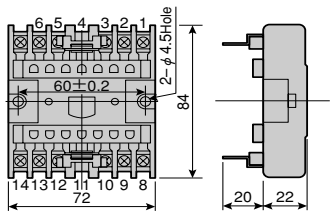
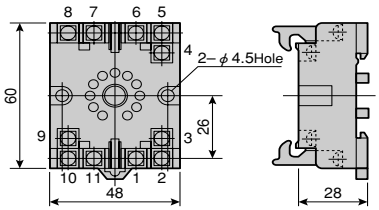
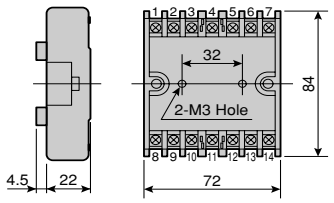
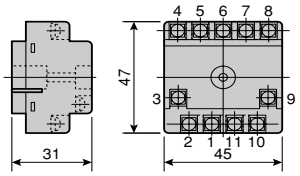


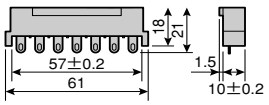
External Dimensions

(in mm)



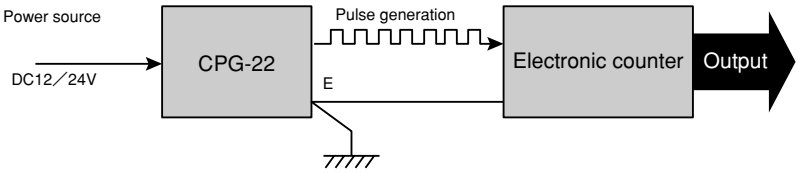
Products Related to Electronic Counters

	Model number	Appearance	Applicable countents	External dimensions
Sockets for wall surface mounting	KF-03		KCX KCX-B ※Except KCX-RN	
	KF-04		TC-4L	
Sockets for flush mounting	KB-03		KCX KCX-B ※Except KCX-RN	
	KB-04		TC-4L	

	Kit model number	Contents	Applicable counters	External dimensions
Connectors for flush mounting	KA-01	●Connector ●Support metals ●Screws	KCX KCX-B ※Except KCX-RN	

Clock-pulse generator CPG-22

The clock-pulse-generator provides the pulse which you can use for application requiring high-precision timer for a long period.

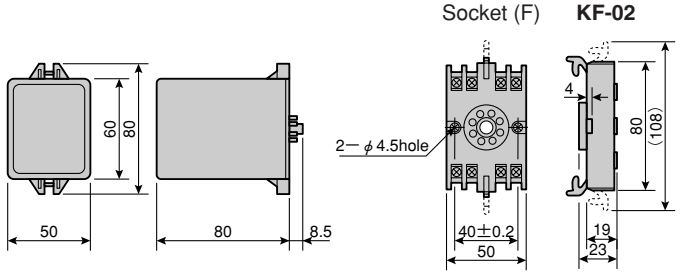


Specifications

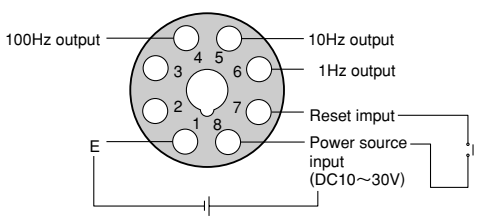
Model number			CPG-22
Operation			The clock-pulse generator (1 Hz, 10 Hz, and 100 Hz) provides high-precision digital control using a liquid crystal oscillator. It can be used as a high-precision timer in combination with preset counters like KCX series.
Output	1Hz	Output resistance	Approx. 1.5 Ω (6-9 V)
		Output duration	Approx. 50 ms
	10Hz	Output resistance	Approx. 1.5 Ω (6-9 V)
		Output duration	Approx. 50 ms
	100Hz	Output resistance	Approx. 1.5 Ω (6-9 V)
		Output duration	Approx. 5 ms
Reset input		Input resistance	Approx. 24 Ω
		IRespon-siveness	Less than 1 ms min. pulse amplitude of 5 ms
Power source			DC 12/24 V common (DC 10-30 V)
Consumption current			30mA
Ambient temperature			−10～+50℃
Storage temperature			−20～+70℃ (with no freezing)
Ambient humidity/ storage humidity			35～85%RH (with no dewing)
Accessories			None

External Dimensions (in mm)

Socket (F) **KF-02**



Terminal arrangement

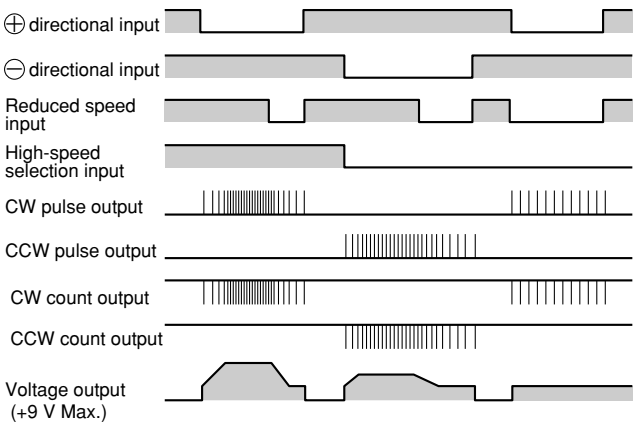


Pulse Generator FG-01

- The pulse generator converts the ON/OFF output of D3-HSC (PLC, Add/sub. counter module) to a pulse train for pulse-motor application.
- The Generator has voltage output to allow high-speed control of DC sensor motors and inverter motors.
- Settings like low speeds, high speeds, timing related to addition and subtraction, and DC voltage output can be set in a broad range via volume on the front panel.
- Count output can be switched between positive and negative logic to allow connection to different types of counters.

Specifications

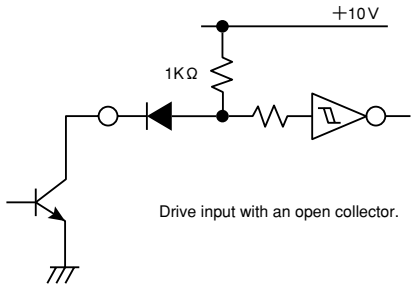
Item	Specification
Source voltage	AC90～132V／180～264V 50/60Hz 5VA
High-speed 1	50～3500Hz (Changed via volume)
High-speed 2	100～9000Hz
Low-speed	15～2000Hz
Timing related to addition and subtraction	30～300ms／1000Hz
⊕⊖ directional input	Negative logic input ON voltage less than 1.5 V OFF voltage more than 8 V ON current 10 mA
Reduced speed output	
High-speed selection input	
Count mode selection input	
CW/CCW pulse output	+5 V positive logic/output current 30 mA/pulse amplitude 50 μs
CW/CCW count output	Open collector output current 30 mA Pulse amplitude 50 μs (possible to switch between positive and negative logic)
DC output	+9 V 10 mA Max. (can be changed with volume)
Ambient temperature	0～+50℃
Storage temperature	−20～+70℃ (with no freezing)
Ambient humidity/ storage humidity	35～85%RH(with no dewing)
Accessories	Metal fittings for installation



∗Voltage output is for positive output only; negative voltage is not output.
∗CW/CCW count output can be switched between positive logic and negative logic.
∗When direction input is entered, switching to high-speed selection input is not possible.

Input circuit

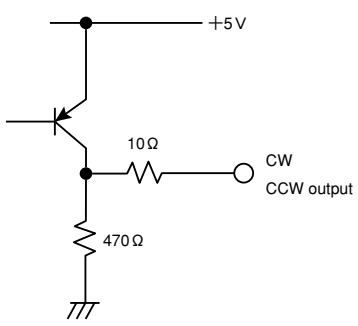
⊕,⊖ directional input
Reduced speed input
High-speed selection input
Count mode selection input



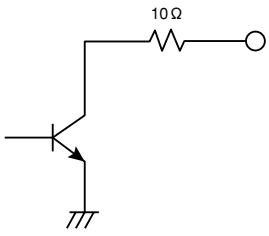
Drive input with an open collector.

Output circuit

CW／CCW pulse output
(Output for a pulse motor driver)



CW／CCW count output
(Output for a counter)



When using positive logic,
pull up with resistance.

Terminal arrangement

Terminal number	Explanation	
①	＋ (Directional input)	With this input, CW/CCW pulse outputs and count outputs are produced.
②	－ (Directional input)	
③	Reduced speed input	With this input, high-speed changes to low-speed.
④	0V	Input common terminal
⑤	Count mode selection input	Allows switching of positive logic of count output. H: negative logic/L: positive logic
⑥	High-speed selection input	Allows selection of high speed 1 and high speed 2. H: high speed 1/L: high speed 2
⑦	Voltage output	Voltage output corresponding to the pulse frequency.
⑧	CW (Pulse output)	Output to a pulse motor driver.
⑨	CCW (Pulse output)	
⑩	CW (Count output)	Output to a counter for pulse setting.
⑪	CCW (Count output)	
⑫	AC180～264V	AC source input
⑬	AC90～132V	
⑭	AC0V	

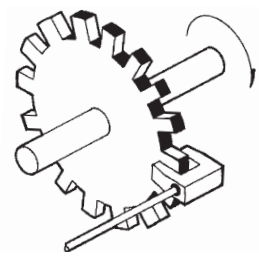
※The FG-01's external dimensions and exclusive socket are the same as those of the KCX Series counters.
Refer to page B-72.

DIGITAL TACHOMETERS

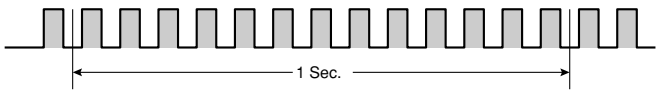
How the tachometers work

There are two operation principles for measuring revolutional movement.
The KOYO tachometers use the cycle period.

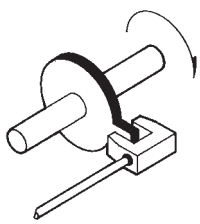
Pulse count



Based on the pulse input from the detector, the tachometer calculates and displays the number of revolutions per minute (rpm). Using the prescale, it converts the number of revolutions to a speed then displays the value.
To ensure precision, measurement time or input pulse should be increased.



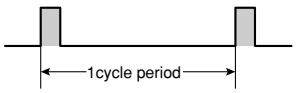
Cycle period



The tachometer calculates the number of revolutions (rpm) by multiplying the inverse of the cycle period (in seconds) by 60 as follows:

$$\text{Number of revolutions (rpm)} = \frac{1}{\text{cycle period (in seconds)}} \times 60 \text{ (rpm)}$$

The lower the speed is, the more precisely it is measured.



Measurement range: 1 to 9999 pulse cycles/revolution
(On TC-4L model, only 1 or 10 cycles/revolution can be selected.)

TC-V Series

Digital Tachometers

This tachometer is provided with a large display that is easy to read in a small DIN 48 body.
Bright character display is with a large red LED and a character height of 10 mm, which makes it easy to read from a distance and at an angle.
In addition, a green LED is used for preset values to differentiate from measurement values.
Setting of preset values to 0 settings with individual setting keys for digits has the feel of digital switches, and operation is simple.
Basic function settings are made with digital switches; detailed settings are selected with digit keys, so operation is easy.

CE Marking complied

Merits

●Key protection to lock keys individually

Key protection can be set for individual keys to prevent a malfunction or tampering.

●Battery-less memory retention

EEPROM is used to retain values in memory, so there is no need for battery maintenance.

●Removable terminals

Maintenance has been reduced via terminals that can be removed. After wiring, the terminal cover provides a safe surface for worry-free use.

●Free power source for the AC type

The source voltage for the AC type covers from AC85-264 V; the power source cannot be selected.

●IP65 Protective structure

The front cover panel uses sheet keys, so operation with wet or dirty hands can be done worry-free. A front cover is also provided as an option to enhance the protective structure.

●Designed in compliance with CE and UL

●Prescaling

Prescaling that can convert the speed and flow for the speed of revolution into units of time for the workload is provided.

●Stable display

Time settings can be made during measurement to stabilize the display when high speeds are used.You can choose 0.2/0.5/1.0/2.0s

●High-speed response

The measurement input for this class complies with high speeds at 20 kcps.

●High precision

Cycle measurement is used in measurement format to obtain a high degree of precision at low speeds.

●Revolution halt is already at 0

Halt determination times that are already displayed as 0 after revolution halt can be selected from 0.2/0.5/1.0/2.0/6.0 s.

●Equipped with output

A single preset type is also offered. It complies with revolution control.

●With zero halt

Unneeded 0s for higher digits are not displayed.

List of Models

Category	Model Number	Number of Digits	Source Voltage	Sensor Source Voltage DC24V 60mA	Price
Digital tachometer with single preset	**TC-V6S**	6	AC	●	
	TC-V6S-C		DC		
Digital tachometer for dedicated display	**TC-V6**		AC	●	
	TC-V6-C		DC		

Accessories: Installation Frame

Model number system

TC-V6□-□

- **C** : DC power / Blank: AC power
- **S** : Single preset / Blank: Dedicated display
- **6** : 6-digit
- Series Name

General Specifications

Item	Specification		
	AC power		DC power
Source voltage	AC100～240V		DC12～24V
Permitted power fluctuation	AC85～264V		DC10～26.4V
Power consumption	Approx. 11 VA		Approx. 4 W
Sensor power	DC24V (20～28V) 60mA (less than 10%p-p ripple)		————
Memory Backup upon Power Failure	EEPROM Writing Up to 100,000 times Memory Duration 10 years		
Ambient temperature	－10～50℃		
Storage temperature	－20～70℃ (with no freezing)		
Ambient humidity	35～85%RH (with no dewing)		
Withstand voltage	AC 2kV for one minute (for AC input, 0 V, and relay interconnection) (for the DC type, 0 V, and relay interconnection only)		
Vibration resistance	Durable	Displacement amplitude 0.5 mm Frequency 10-55 Hz along three axes	
	No malfunction	Displacement amplitude 0.35 mm Frequency 10-55 Hz along three axes	
Impact resistance	Durable	490 m/s^2 11 ms along three axes	
	No malfunction	98 m/s^2 11 ms along three axes	
Noise resistance	AC power ±1.5 kV between terminals (pulse width 1 of μs and rise time 1 of ns)		DC power ±1.0 kV between terminals (pulse width 1 of μs and rise time 1 of ns)
Protective structure	IP65 (front panel only)		
Weight	Approx. 150g		Approx. 110g
Terminals	Conforming wiring	0.25～1.65mm^2	
	Conforming crimped contact	R1.25-3	
	Permitted torque	0.5Nm	

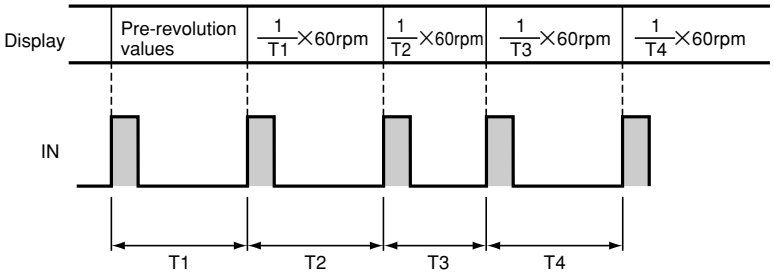
Performance Specifications

Item	Specification
Category	Tachometer
Setting	Single with alarm output/without (separate model number)
Number of digits	6 digits
Display	Display of settings: red LED Character height 10 mm preset settings: green LED character height 7 mm
Operational format	Cycle measurement
Set items	Speed of revolution only
Basic setting range	10～999999 rpm (when prescaling is 1)
Prescaling	M×10^{-n}=10^{-9}～999999 1≦M≦999999、0≦n≦9
Measurement precision	±0.013% excluding selection of low-speed input (10 Hz) (±0.1% during low-speed input)
Setting duration	0.2／0.5／1.0／2.0s
Input	Input logic: Negative logic (no-load input) / Positive logic (load input)
	Input resistance: Positive logic 15 kΩ Negative logic 3.3 kΩ (AC power)/1.8 kΩ (DC power)
	Inpult voltage: “L” 0～3 V “H” 7～30 V
Setting input response	Max. signal amplitude 5 ms
External reset	No-volt output: NPN open collector output
*Output	24 V 100 mA Withstand pressure 35 V Residual voltage less than 1.5 V
	Relay output: 1 transformer relay AC220V 2A (resistance load)
*Output mode	Compared output / Retained output
Key protection	Setting of arbitrary keys possible
Installation	Exclusively for embedding (terminal block connection)

*means that items do not apply to devices for designated display.

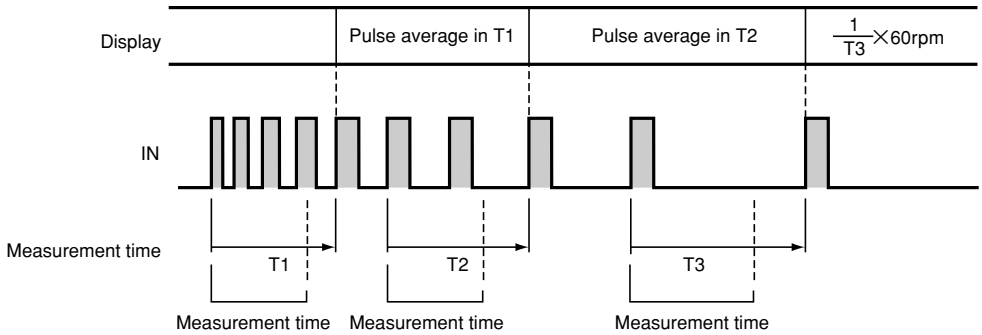
Measurement operations

1) Display of the speed of revolution for one revolution/pulse
The reciprocal ($\frac{1}{T}$) of the IN input cycle (T sec) is multiplied by 60 and displayed as the speed of revolution.

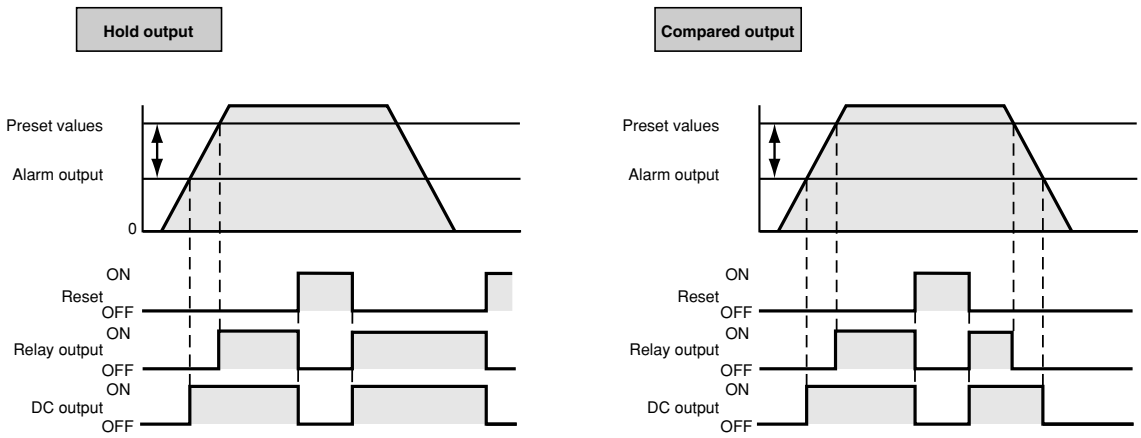


The range for count input 1 P/R is 10～999999 rpm during prescaling.

2) Measurement time
This item is used for revolution at high speeds and to stabilize display. Displays the average of a pulse as entered in the measurement time; when outside the measurement time, the display is updated with each input pulse.



Output operations chart (only for devices with output)

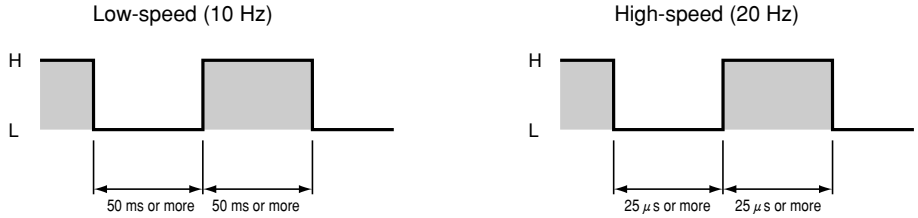


: Alarm settings

When alarm settings are 0, DC output is the same as in output operations for relay output.

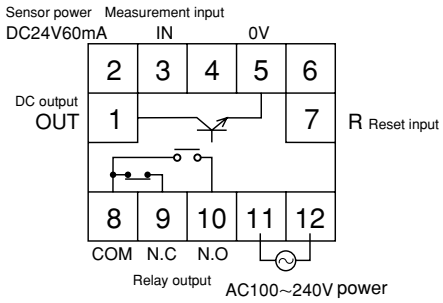
●Alarm settings should be smaller values than preset values. Performing alarm setting with values that exceed preset values will result in measurement values of 0; alarm output (DC output) will come ON.

Input single pulse width

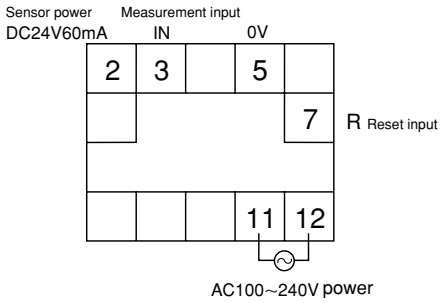


Wiring Diagrams

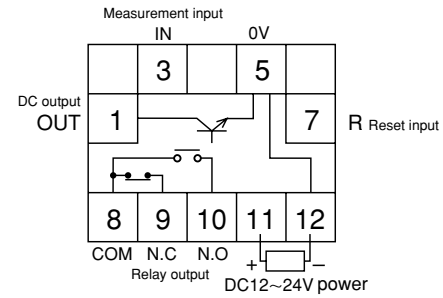
TC-V6S



TC-V6

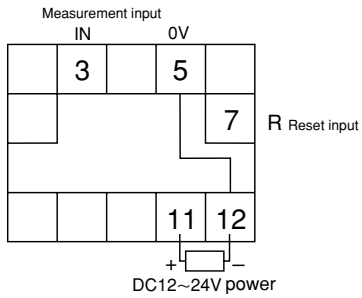


TC-V6S-C



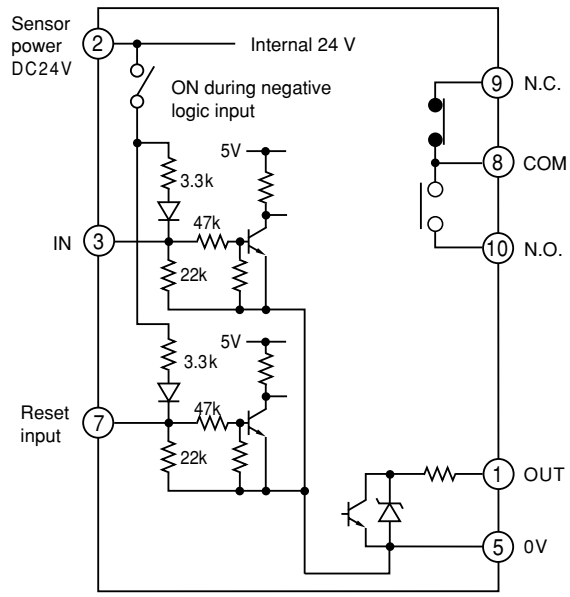
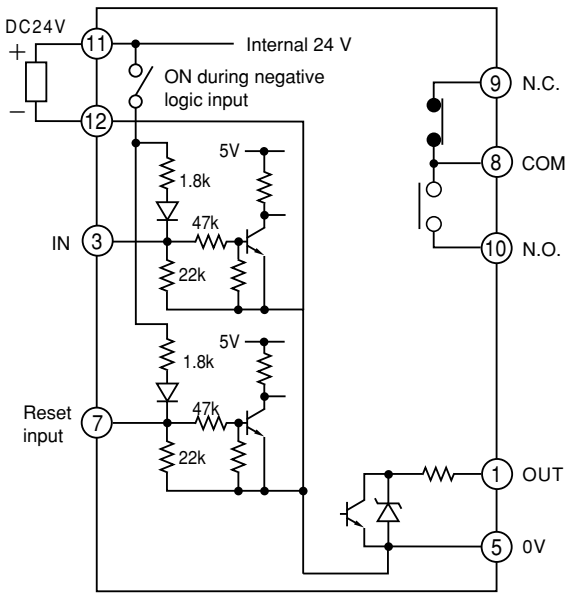
※Alarm output is used in combination with DC output (OUT terminal).

TC-V6-C



Do not connect any of the terminals for the DC input.

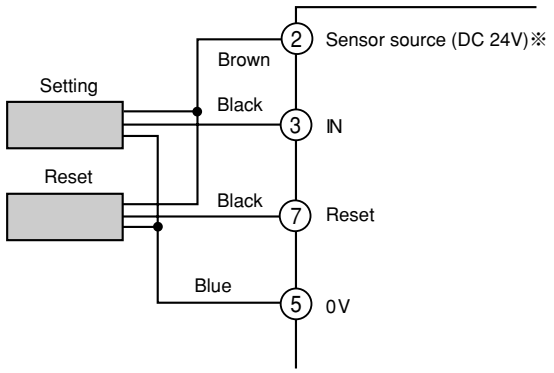
I/O Circuit Diagrams

AC power	DC power
	

Input Wiring Examples (Measurement input/Reset input)

Proximity switch with NPN open collector output

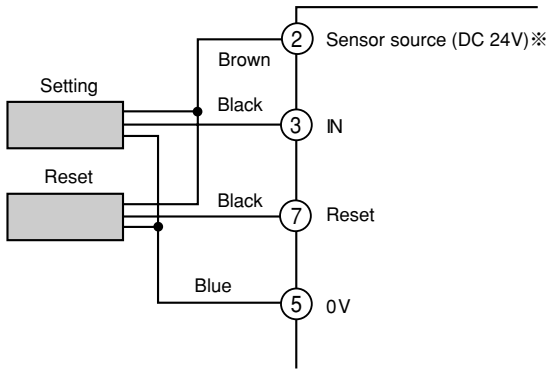
●Input logic: Negative logic: (no-volt input) (nEG)



Recommended proximity switch: APS□-□-N／E

Proximity switch with voltage output or PNP open collector output

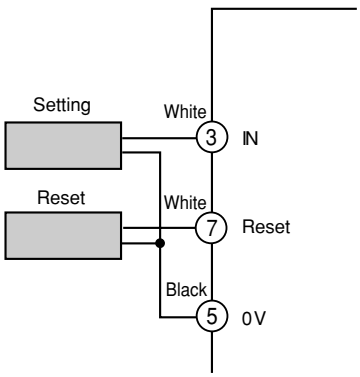
●Input logic: Negative logic: (voltage input) (Pos)



Recommended proximity switch: APS□-□-E2

DC 2-wire proximity switch

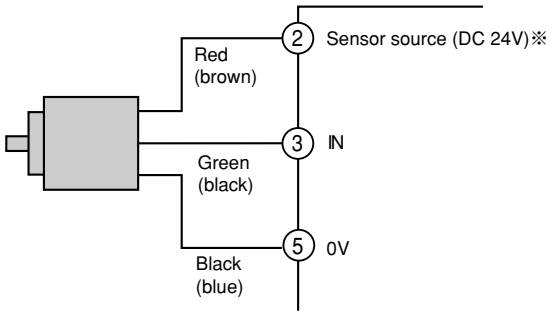
●Input logic: Negative logic (no-volt input) (nEG)



Recommended proximity switch: APS□-□-Z
※With the DC type, please supply source voltage above 20 V.

Rotary encoder

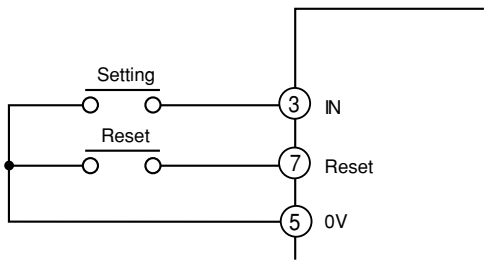
●Input logic: Arranged with encoder output and set as positive or negative logic



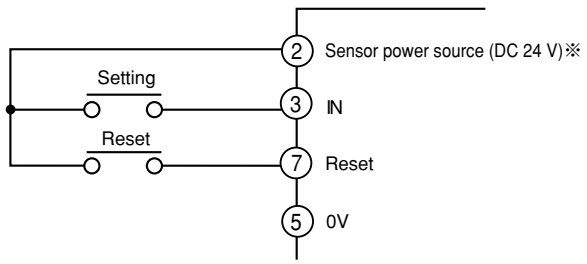
Recommended proximity switch: TRD-J□-S
TRD-N□-S

Switch or relay

●Input logic: Negative logic (no-volt input) (nEG)
●Measurement input response: 10 Hz (Dip switch 1 ON)



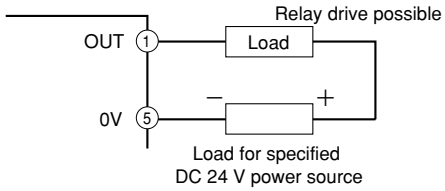
●Input logic: Positive logic (voltage input) (Pos)
●Measurement input response: 10 Hz (Dip switch 1 ON)



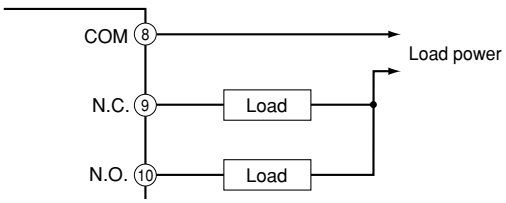
※There is no DC power source. Use a separate external power source.

Output Wiring Examples

NPN open collector output



Relay output



Front Panel Layout and Description

①Output (red)
- Operating mode
  Lit when output is ON.
  Blinks when alarm output is ON.

②Key protection (red)
- Operating mode
  Blinks when key protection is ON (only when the key is ON).
- Setup Mode
  Displays key protection settings.

⑥RST key
- Operating mode
  Turns output OFF.
- Setup mode
  Allows selection of set items.

③Measurement value (red)
- Operating mode
  Displays measurement values.
- Setup mode
  Displays setting parameters.

④Preset values (green)
- Operating mode
  Displays preset values.
- Setup mode
  Displays set items.

⑤Digit keys
- Operating mode
  Allows changes in preset values for the operating mode.
- Setup mode
  Allows selection of setting parameters.

●The Designated Display panel has several lamps that differ with respect to the Single Preset Counter:

①Output display／②Protection Display
- None

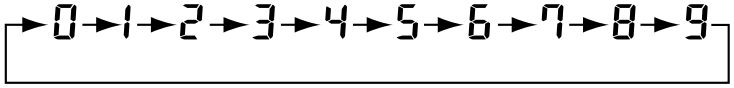
④Preset values
- Not displayed in Operating mode.

⑤Digit keys ／⑥RST keys
- Disabled in Operating mode.

■Key Operation

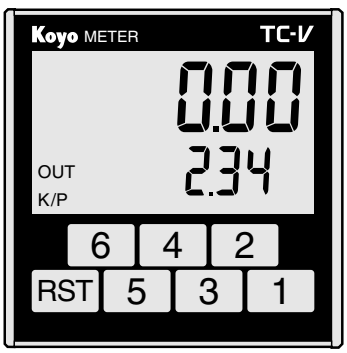
1. Changing preset values (Single preset only)

Press a digit key once to increase the corresponding digit by one:



After removing your finder from the key, the settings will be verified after about one second.

Example:
When the counter is preset to "123"
Press the [1] key and the display changes to 124
Press the [2] key and the display changes to 134
Press the [3] key and the display changes to 234



2. Output OFF (Single preset only)

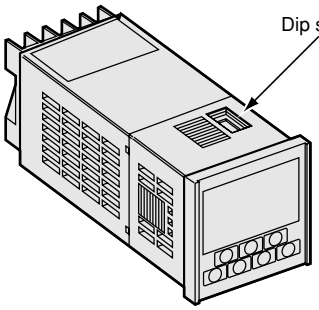
Press the [RST] key to reset to turn output OFF (Response time 0.1s). When output is ON, pressing the [RST] key will turn output OFF.

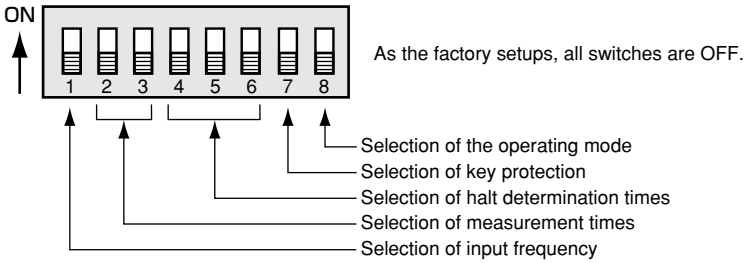
3. Protecting the keys (Single preset only)

Protection of individual keys can be set with operating keys. When Key protection is set in Operating mode, pressing a set key will cause the corresponding LED for the key pushed to blink in order to indicate that operation has been disabled. As the facfory setup, Key protection in Setup mode is completely disabled, so just turning Dip switch 7 ON with power supplied will disable all keys.

■Configure dip switches

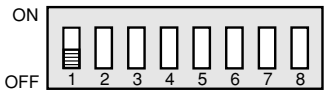
- ●Use the dip switch on the top of the counter to configure varions parameters and operation mode.
- ●Configure dip switches with power off. Operation with power up will have no effect.
- ●When dip switches are re-configured, you must press the Reset key in operating mode to reset the count values.





Input frequency

The input frequency is selected with Dip switch 1.

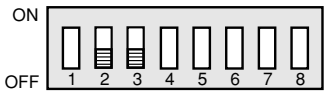


Input frequency	SW1
10Hz	ON
20kHz	OFF

※Factory setup

Measurement times

The measurement times are selected with Dip switches 2 and 3.



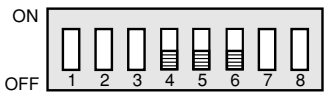
Measurement times	SW2	SW3
0.2s	OFF	OFF
0.5s	OFF	ON
1.0s	ON	OFF
2.0s	ON	ON

※Factory setup

With the cycle measurement format, the display will change as pulses are input, and the display may vary during high revolutions.
The average of the pulse input in the measurement time can be displayed with setting of the measurement time to stabilize the display during high revolutions.

Halt determination times

The halt determination times are selected with Dip switches 4, 5, and 6.



Suspension determination times	SW4	SW5	SW6
6.0s(10)	OFF	OFF	OFF
2.0s(30)	OFF	OFF	ON
1.0s(60)	OFF	ON	OFF
0.5s(120)	OFF	ON	ON
0.2s(300)	ON	OFF	OFF

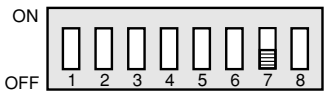
※Factory setup

Items in parentheses are maximum revolutions for 1 P/R.

After the halt determination time is set once measurement input is OFF, the function will display 0.
When setting the halt determination time at 1 P/R to 0.2 s, be aware that the maximum revolutions will be 300 rpm.

Key protection

With Dip switch 7, [Do not protect keys] can be selected to take effect for keys set in Setup mode using [Protect keys]. Setting for keys to protect can performed in Setup mode. As the factory setups, [Do not protect keys] is set.



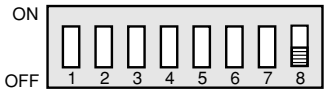
Key protection	SW7
Settings in Setup mode take effect	ON
Do not	OFF

※Factory setup

With the Designated display type, this should be OFF.

Operating mode

The operating mode is selected with Dip switch 8.



Operating mode	SW8
Setup mode	ON
Run mode	OFF

※Factory setup

■Setup Mode

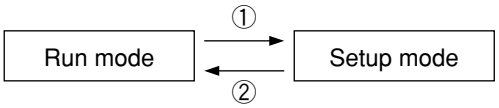
Settings that cannot be selected with dip switches can be set in Setup mode.

Items that can be configured in Setup Mode

1) Prescaling——Prescaling values (10^{-9}～999999) are set.
2) Input logic——Positive or negative logic
3) Output mode——Compared/Retained
4) Decimal place——Any digit can be set for display of the decimal point.
5) Alarm output —Offset values can be set with respect to preset values.
0～999999
6) Resetting key protection—Setting to disable the reset key can be performed.
7) Protecting digit keys——Setting to disable any digit key can be performed.

※With a Dedicated Display Tachometer, items 3), 5), 6), and 7) are skipped.

1. Switching Between Setup mode and Run mode



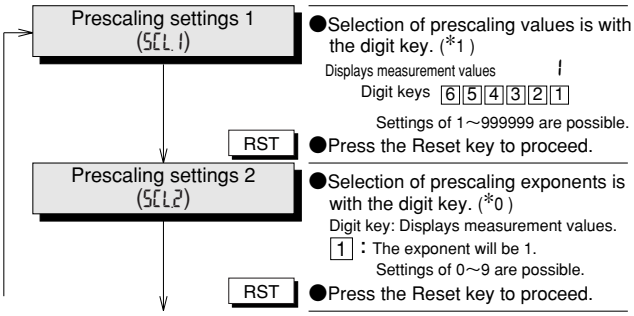
①Setting Dip switch 8 to ON and turning on the power will start the Setup mode.

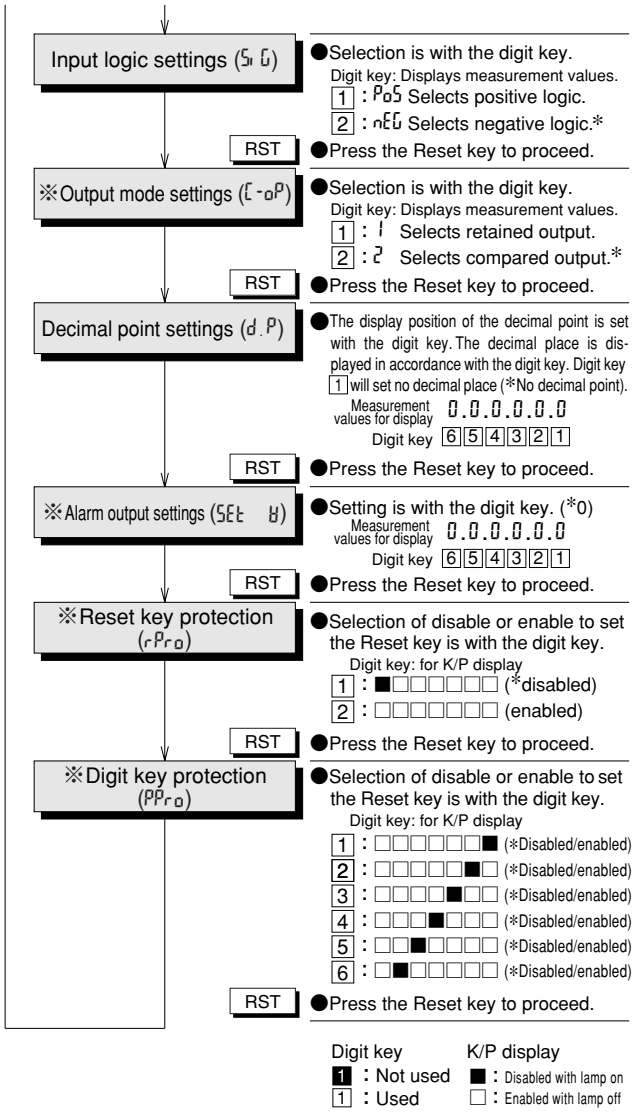
②Setting Dip switch 8 to OFF and turning on the power will start the Run mode.

2. Operations in Setup mode

In Setup mode, the settings can be initialized using the menu as follows:

*Represents the factory setup.





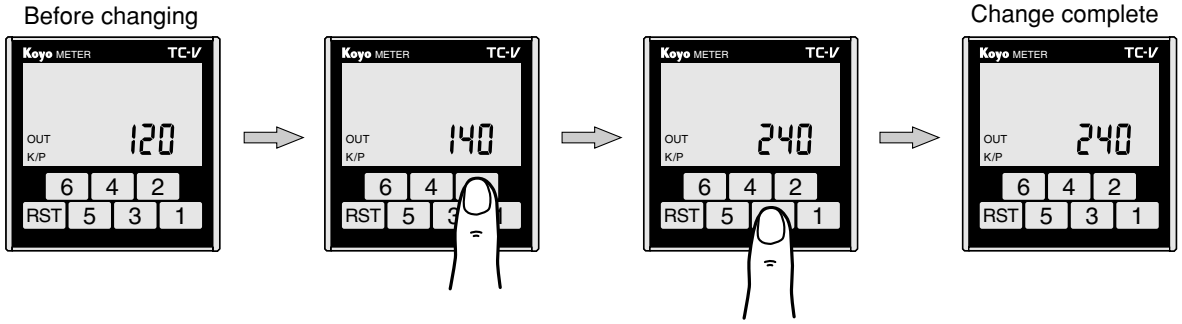
- With the Designated display tachometer, items marked with an ※ are skipped.
- Setting parameters are rendered effective by pressing the Reset key and proceeding to the next step.
- Key protection settings are rendered effective with Dip switch 7 as well as an AND condition. To begin protection, turn Dip switch 7 ON.

Operational Example

■Run mode

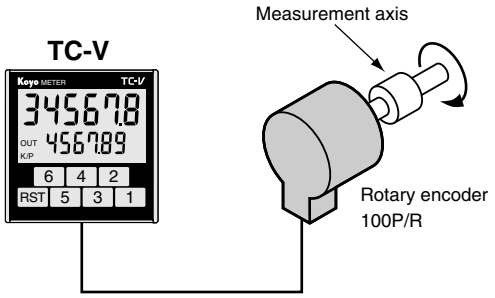
Changing preset values

1. Change the preset value from 120 to 240.



■Setting Example for Display of the Speed of Revolution

When using a rotary encoder for 100 pulses/revolution, the speed of revolution can be displayed.
A measurement time of 1.0 s will be used to stabilize the display during high revolutions. In addition, the decimal place will be after the first digit with the half determination time of 1.0 s.



•Calculation of prescaling values

With the tachometer, prescaling is 1 for 1 pulse/revolution.
Accordingly, prescaling for 100P/R is

$$\frac{1}{100}=0.01$$

Prescaling setting is done with the exponent and mantissa such that

$$0.01=1\times10^{-2}$$

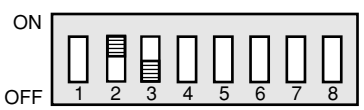
•Set items

Set items	Contents
Measurement time	1.0s
Halt measurement time	1.0s
Prescaling exponent	1
Prescaling mantissa	−2

1. Setting the dip switch

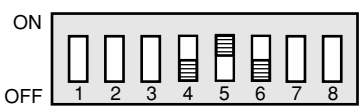
Turn OFF the power, then operate the dip switch.

①Select the Measurement time of 1.0 s.



●Turn Dip switch 2 ON
●Turn Dip switch 3 OFF

②Select the half measurement time of 1.0 s.



●Turn Dip switch 4 OFF
●Turn Dip switch 5 ON
●Turn Dip switch 6 OFF

2. Switching to Setup mode

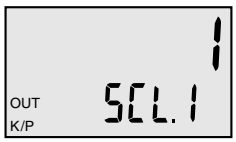
Turn Dip switch 8 ON and then turn power ON.

3. Changing setting contents

①The setting screen for the Prescaling mantissa is displayed.

These values are initial values.

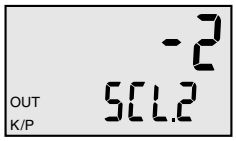
Press the (RST) key to proceed.



②The setting screen for the Prescaling exponent is displayed.

Press the (1) key twice and "−2" is set.

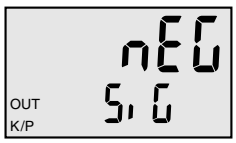
Press the (RST) key to proceed.



③The setting screen for Input logic is displayed.

These values are initial values.

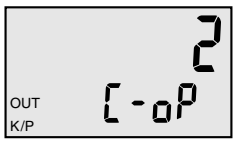
Press the (RST) key to proceed.



④The setting screen for Output mode is displayed.

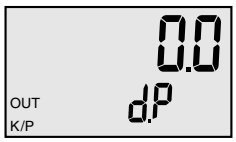
These values are initial values.

Press the (RST) key to proceed.



⑤The setting screen for the Decimal point is displayed.

Press the (2) key and the decimal point will be displayed between the first and second digit.



Press the (RST) key and the setting parameters will be written.

Setting is complete after this step.

4. Switching to Run mode

Turn the power OFF after completing setting in Setup mode and turn Dip switch 8 OFF (Run mode) (When power is OFF, setting contents from Setup mode are written).

5. Starting Run mode

Be sure to turn power ON after changing settings in Setup mode and press the (RST) key to reset count values.

Error Codes

Common Errors

Error	Error Type	Error Details	Corrective Action
E01	Overflow Error	Data to display exceeds the display range.	Enter measurement values in normal ranges and the device will automatically recover (review settings for prescaling and the decimal point).
E02	Underflow Error	The position of data to display drops below the display range.	
E04	Over Input Frequency	The input frequency exceeds 20 kHz.	Lower the input frequency.
E21	Memory Data Error	Preset/set values and Setup mode items have changed.	Press the Reset key to eliminate the error display. Measurement values and timekeeping values will be set to 0, preset and set values will be 5000, and Setup mode parameters will be set to factory setups.

Option

Option	Model Number	Details
Rubber Packing	**KC-48P**	Prevents water from entering the control panel with installation between the installation panel and TC-V.
Front Cover	**KC-48C**	Protects the front panel from dirt and the like. Material: Soft silicone rubber Key operation can be performed with the front cover as-is.

Precautions

●Precautions for Use

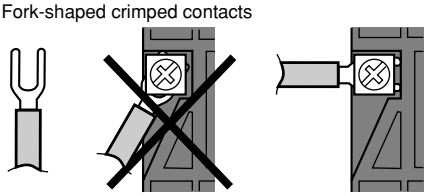
(1) With the DC power source, the 0-V terminal ⑫ and the input common 0-V terminal ⑤ are internally short-circuited.
(2) Apply the rated voltage in one instant, not by gradually raising the voltage.
(3) Always use negative input logic to set the DC 2-wire proximity switch.
(4) During counting, changes to preset values will take effect about one second after key input of the change. In subtraction mode, key input takes effect when the count is reset Valid preset valve will be saved in the memory of loss of power.
(5)It is recommended to use a sheet included in the package to keep the setups for the future maintenance.
(6) Use in the following environments should be avoided:
- ●A location where the ambient temperature is above 50℃ or below 10℃.
- ●A location where the ambient humidity is above 85% or abrupt temperature changes may cause condensation.
- ●A location with dust, iron fillings, corrosive gasses, or the like.
- ●A location exposed to direct sunlight.
- ●A location with significant vibrations or impact.

(7) When conducting testing of insulation withstand voltage, insulation resistance, or the like, detach the control circuit from the main body.
(8) When power is interrupted, writing to the internal EEPROM will take place. The number of times EEPORM writing can be performed is less than 100,000, so avoid use with frequent power source operation.

●Precautions for Wiring

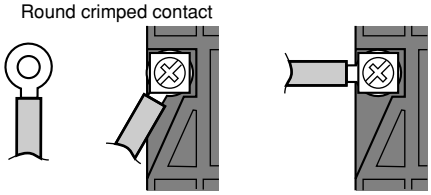
●Keep the wires away from power line.
●With regard to use in locations where extensive noise is generated, keep the TC-V tachometer and wires away from the noise source to the extent possible.
●Empty terminals are not to be used as relay terminals.
●For connection, use of crimped contacts is recommended.
When wiring the 1 and 7 terminals, do not install fork-shaped crimped contacts at an angle. Use a round crimped contact for angled installation.

Fork-shaped crimped contacts



For angled installation, connection with the contact is insufficient. Like in the illustration above, install the contact perpendicular to the horizontal.

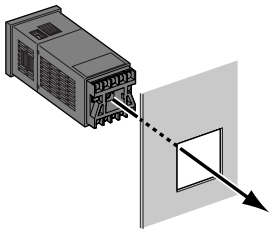
Round crimped contact



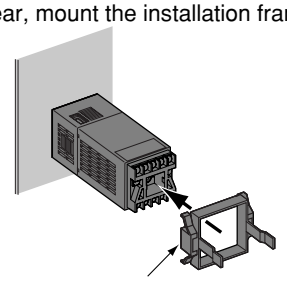
Installation and Removal of the Main Body

●Installation

①Insert the main body through the panel installation port.

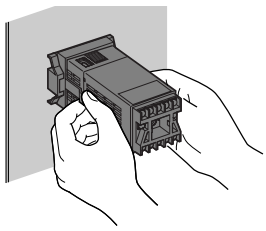


②From the rear, mount the installation frame.



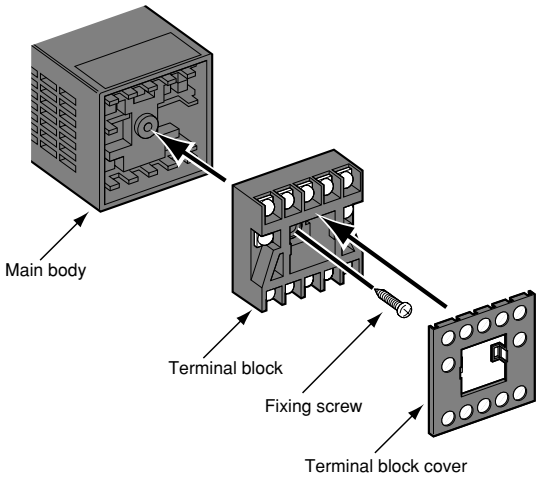
Installation frame: Can be installed vertically or horizontally.

●Removal



①Holding the tabs, spread them 2～3 mm.
②While keeping the tabs spread, pull the device towards you.

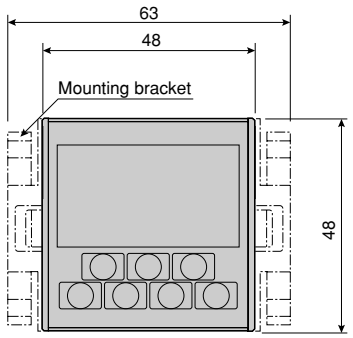
●Installation of the Terminal Block and Terminal Cover

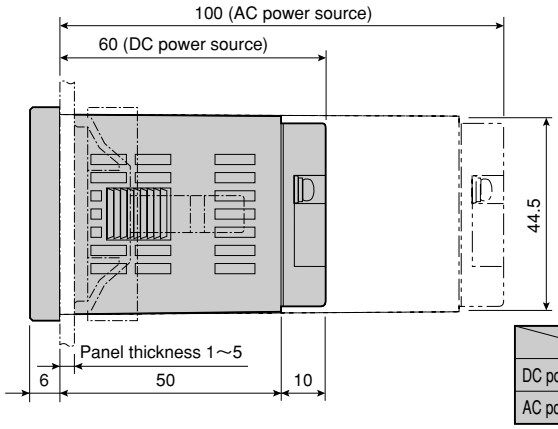


●Do not use a screw other than the one used to fix the terminal block during shipping.
●Maintain a permitted torque of 0.3 Nm.
●Install the terminal block after wiring is complete.

External Dimensions

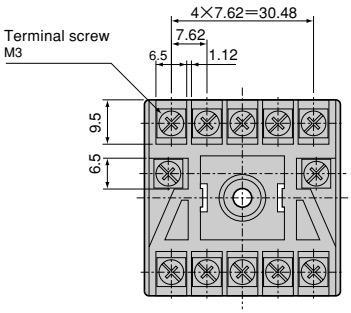
(in mm)





	Depth
DC power source	66mm
AC power source	106mm

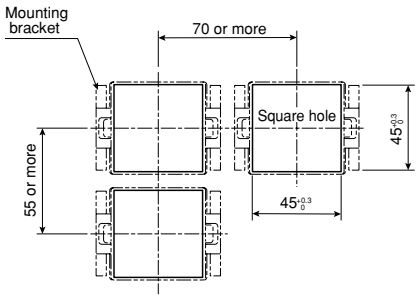
Detailed Diagram of the Terminal Block



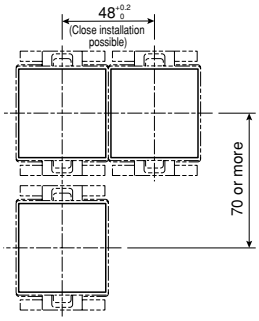
Complying wiring: 0.25-1.65 mm^2
Complying crimped contact: R1.25-3
Permitted torque: 0.5 Nm

Boring Dimensions for Installation

1. When the installation handle is horizontal



2. When the installation handle is vertical



TC Series Digital Tachometers

Merits

●Prescaling

Based on a preset scale, the tachometer converts the number of revolutions to a distance, volume or production per unit time. The prescale function is not included in the TC-4L model.

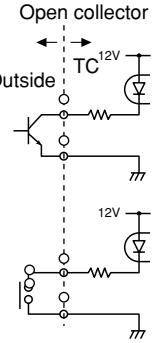
●Precision

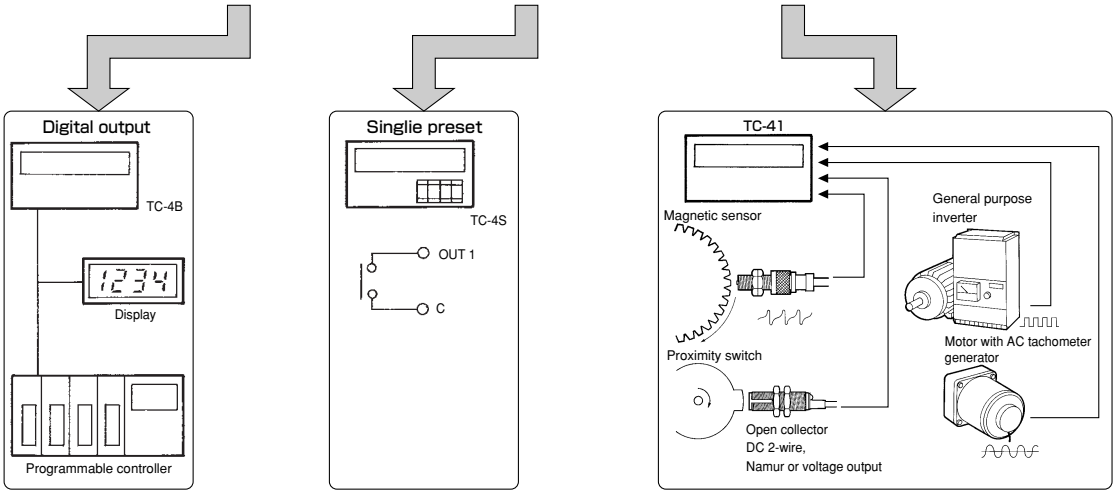
Using a sampling technique, the tachometer precisely measures various speeds and cycles of repeated movements

●Quick reset (TC-41)

On the TC-41 model, the displayed value is reset to zero if no pulse is entered for one second. The counter displays the previous value if it receives no pulse for six seconds.

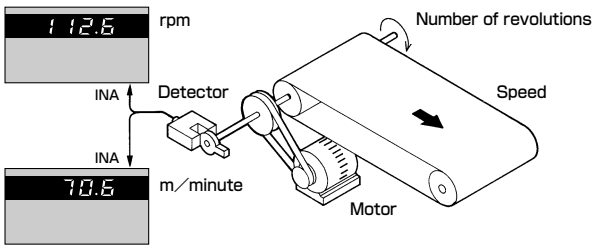
List of Digital Tachometers

Signal output			Signal input	Functions				
None (Display only)	Digital	Single preset		Mode	Pre-scalling	Sam-pling	Decimal point	Error report
TC-4L 	—	—	Open collector Outside TC 12V 	Mode 1 only	—	—	●	●
TC-4 	**TC-4B** 	**TC-4S** 	12V	8 modes	●	●	●	●
TC-41 	—	—	Any types of sensors	Mode 1 only * 4 modes	●	●	●	●



Measurement examples
Eight measurement modes and examples

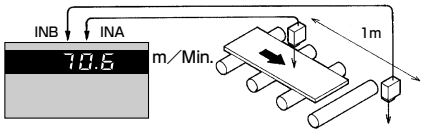
Revolutions (rpm) (Mode 1)
Speed (Mode 1)



Based on the pulse input from the detector, the tachometer calculates and displays the number of revolutions per minute (rpm).

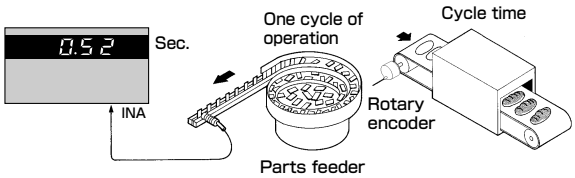
Using the prescale, it converts the number of revolutions to a speed then displays the value. Speed=number of revolutions×2πr (r is the radius of the roller in meters.)

Passing speed (Mode 2)



Using two detectors, the tachometer measures the speed of an object passing through a certain point. The prescale can be adjusted to suit the measurement unit.

Cycle time (Mode 3)

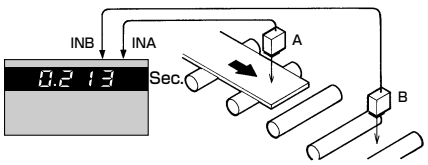


The tachometer measures the time for an object to pass through a certain distance.

Cycle measurement range 10ms～140s

Time elapsed: Infinite

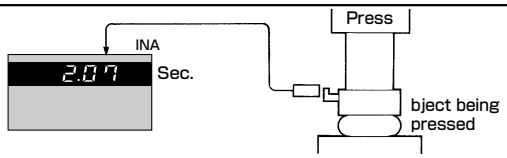
Time lag (Mode 4)



The tachometer measures the time for an object to move from the detector A to the detector B. Its speed can be calculated from the "time lag" between the two sensors and their distance.

Cycle measurement range 10ms～140s

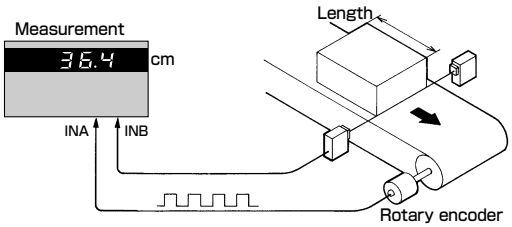
Process time (Mode 5)



The tachometer displays the time elapsed after an action is started. For example, it measures the time after a press is started or a valve is opened.

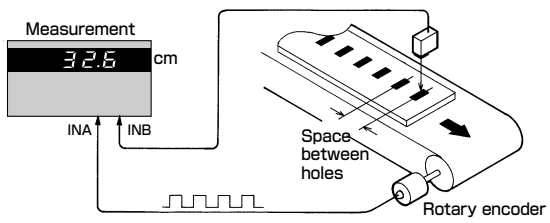
Cycle measurement range 10ms～140s

Length (Mode 6)



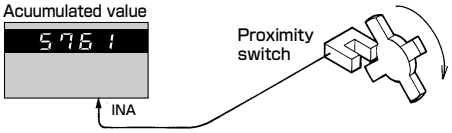
The photoelectric sensor generates pulse when it detects a moving object. The pulse count is converted to the length by the rotary encoder, and displayed on the tachometer. With the prescalling function, the measurement can be converted at a preset scale.

Spacing (Mode 7)



The tachometer measures and displays the space between two adjacent objects (in this case holes). With the prescaling function, the measurement can be converted at a preset scale.

Accumulate (Mode 8)



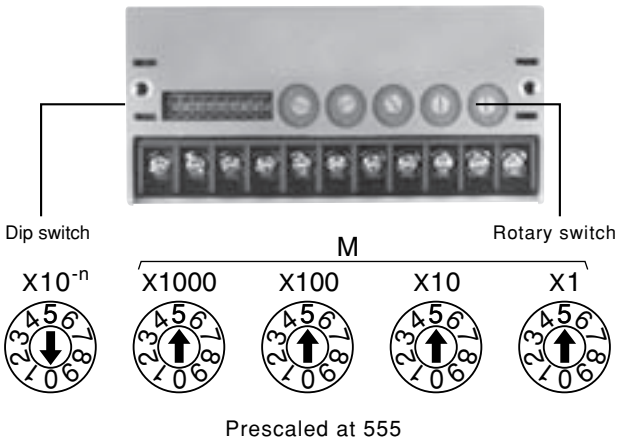
The tachometer totals individual pulse counts. It can be used also as a preset counter. With the prescaling function, the measurement can be converted at a preset scale.

Merits

Prescaling

Preset a 4-digit value to determine the scale used to calculate values for display.
To preset a scale, use the five small rotary switches on the rear panel.

Measurement×Prescale=Value to be displayed
Set the scale in the form of "M×10-n" where M is a 4-digit integer and n is a number from 0 to 9. Use the leftmost switch to set the exponent n, and the other four switches to set the value of M. The prescale can range from 1×10^{-9} to 9999×10^{-0}=9999.
Prescaling is not available on the TC-4L model.

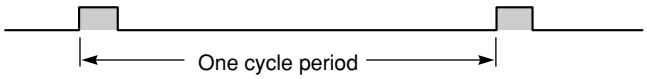


Sampling

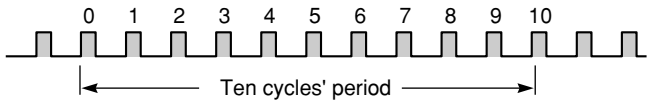
This function is available only in Mode 1.

The tachometer counts the cycle time of a rotating object. Using this value, it calculates the number of revolutions per minute. When an object rotates fast, one cycle period becomes too short to allow precise measurement. The tachometer samples a specified number of cycles and totals all cycle periods. From this total, it then calculates one cycle period. This averaging technique minimizes errors at high speeds. The times of sampling can be set to 1, 10 or 100. (Only 1 can be selected on the TC-4L model.)

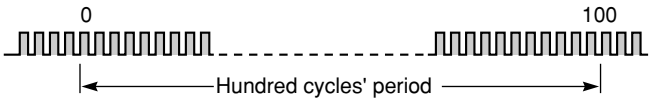
●Times of sampling: 1



●Times of sampling: 10

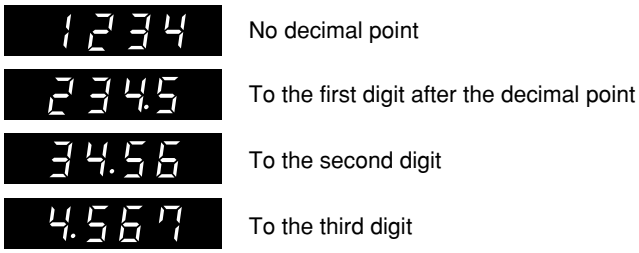


●Times of sampling : 100



Decimal point Selection

For the 4-digit display, you can select the location of the decimal point. Measurements are displayed to a precision specified by the decimal point.



List of Error Codes

An error code is displayed to indicate an overflow, prescale error, or other error as shown on the right.

Error code	Name	Description
E01	Overflow	Measurement has exceeded upper limit.
E02	Underflow	Measurement is smaller than the value representable by the lowest digit.
E03	Prescale error	The integer part (M) is set to zero.
E04	Overfrequency	Input frequency has exceeded 10 kHz in Mode 1.

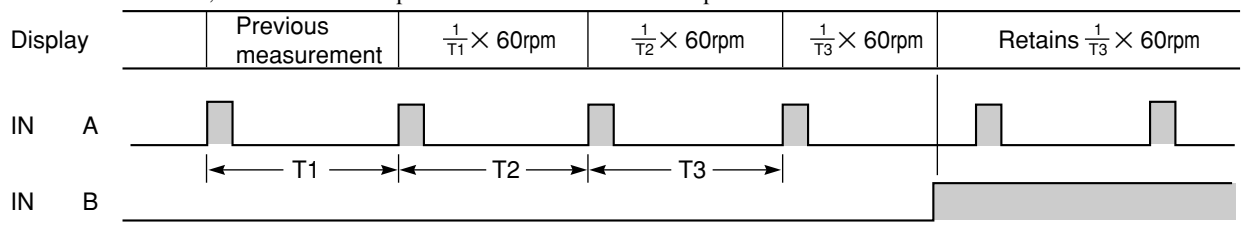
Note: The errors E01, E02 and E04 are automatically cleared when the value returns to the allowable range.

Measurement modes

Mode 1: Number of revolutions(rpm)

The following description does not apply to TC-61 and TC-41.
The TC-4L model does not have the input terminal IN B.

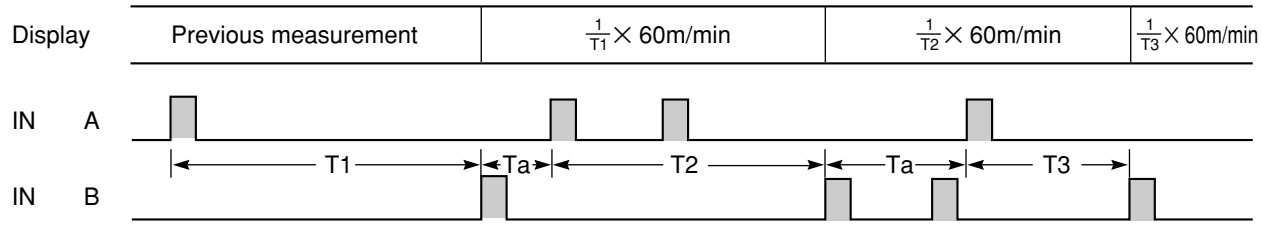
The tachometer calculates the number of revolutions(rpm)by multiplying the inverse of the cycle period(T)of IN A by 60, and displays the result.
When IN B turns ON, the tachometer stops measurement and retains the previous value.



Measurement range: 10 to 9999 rpm(at input rate=1 pulse/revolution, times of sampling=1, and prescale=1)
Measurement is made for each cycle only if the cycle period is 300 ms or more. If not, the counter waits for at least one cycle before it restarts measurement. It displays the previous value if no pulse is entered for six seconds.

Mode 2: Passing speed (m/min.)

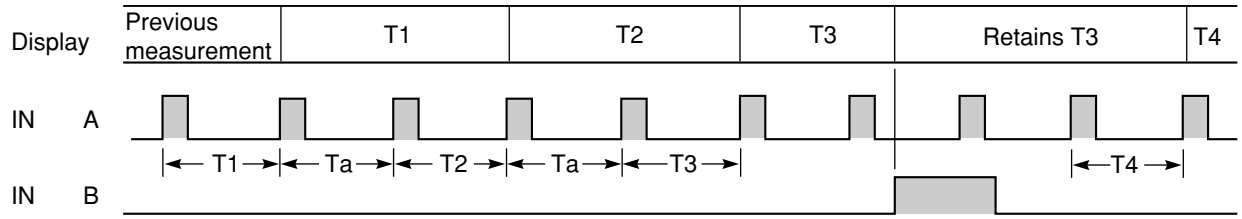
The tachometer calculates the speed of an object by multiplying the inverse of the value T by 60. T is time elapsed after the sensor IN A turns ON until the sensor IN B turns ON. The speed is displayed in meters per minute if the distance between the two sensors is 1 m.



T: 10 ms～6 seconds. Ta: 30 ms interval between measurements

Mode 3: Cycle time (10 ms to 140 s)

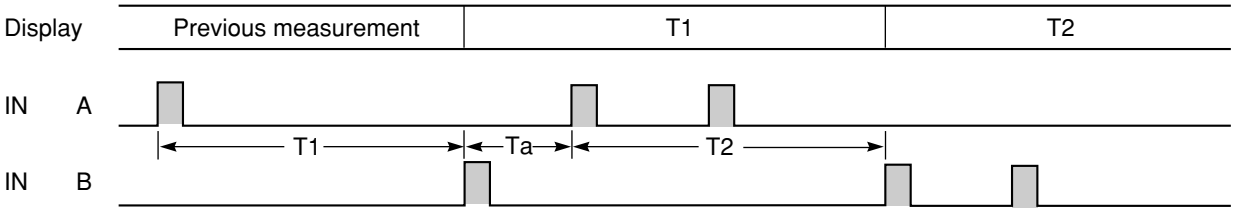
The tachometer calculates the cycle period (T) of IN A.
It measures every other cycles ranging from 10 ms to 140 seconds.
When IN B turns ON, the tachometer stops measurement and retains the current value.



Ta: 30 ms interval between measurements

Mode 4: Time lag (10 ms to 140 s)

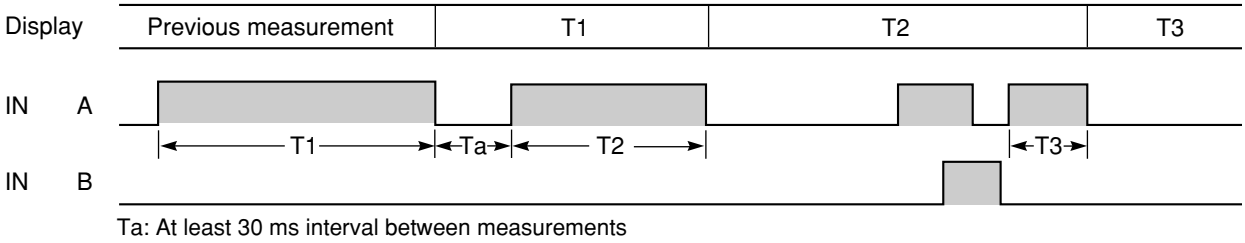
The tachometer measures the time elapsed after the sensor IN A turns ON until the sensor IN B turns ON.
Allowable measurements range from 10 ms to 140 seconds.



Ta: At least 30 ms interval between measurements

Mode 5: Process time (10 ms to 140 s)

The tachometer displays the time elapsed after the sensor IN A is activated.
Allowable measurements range from 10 ms to 140 seconds.
When IN B turns ON, the tachometer stops measurement and retains the current value.

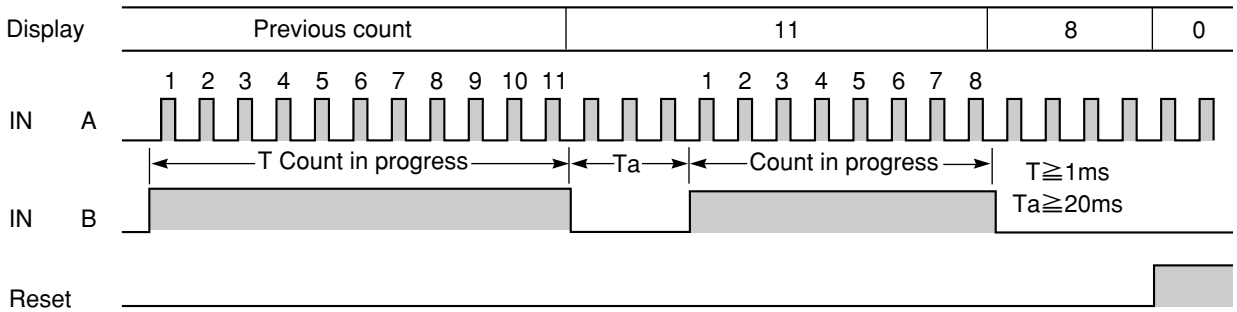


Ta: At least 30 ms interval between measurements

Mode 6: Length

Response of IN A: 10k cps

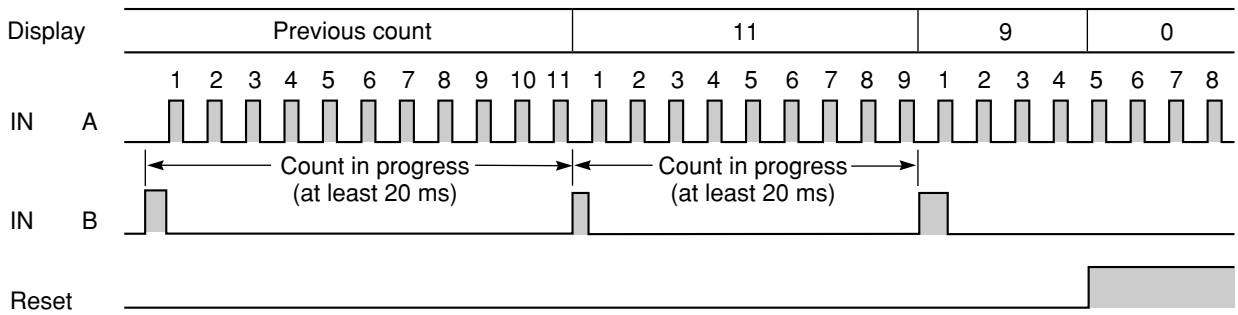
While IN B is ON, the tachometer counts the frequency of pulse pulse entered to IN A.
The value is displayed when IN B turns off. It is reset to zero when a reset signal is entered.



Mode 7: Spacing

Response of IN A: 10k cps

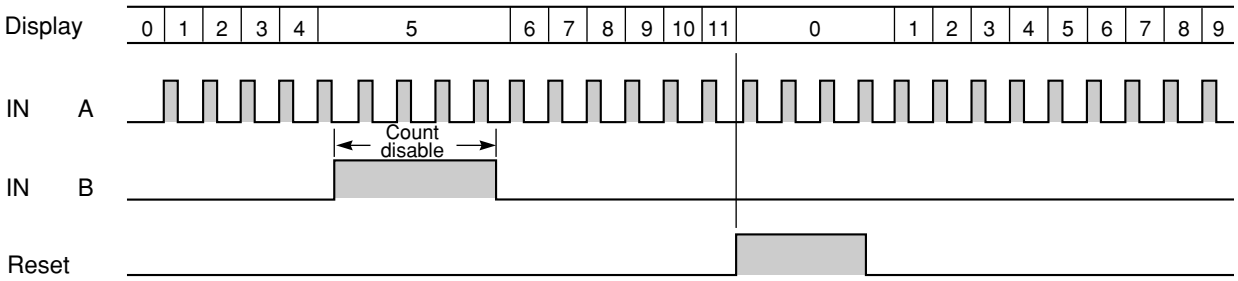
When IN B turns ON, the tachometer counts the frequency of pulse entered to IN A since the last time IN B turned ON.
The value is reset to zero when a reset signal is entered.



Mode 8: Accumulate

Response of IN A: 10k cps
(150 cps on TC-4S and 4W in One Shot mode)

The tachometer totals and displays pulse counts entered to IN A.
The count is suspended when IN B turns ON.
The displayed value is reset to zero when a reset signal is entered.



TC-4L-G/H

Power-Saving Small Tachometers for Display Only

On the 48 mm square panel, the tachometers displays revolution speeds. The input rate can be set to either one pulse or ten pulses per revolution.

●TC-4L-G : AC110V(AC85～115V 50/60Hz)
●TC-4L-H : AC220V(AC180～240V 50/60Hz)

General Specifications

●Electrical specifications

Item	Specification
Rated voltage	TC-4L-G : AC85～115V TC-4L-H : AC180～240V
Rated frequency	50/60Hz
Power consumption	6VA
Withstand voltage	AC2000V 1 Min. (between power and external terminal)
Insulaion resistance	Min. 20MΩ DC500V (between power and external terminal)

●Environment

Item	Specification
Ambient temperature	−10～+50℃
Storage temperature	−25～+70℃(with no freezing)
Ambient/Storage humidity	35～90%RH(with no dewing)
Vibration resistance	Durable along three axes at 10 to 55 Hz with 0.5 mm amplitude No error along three axes at 10 to 55 Hz with 0.35 mm amplitude
Shock resistance	Durable for 11 ms along three axes at 490 m/s2 (50 G) No error for 11 ms along three axes at 98 m/s2 (10 G)
Noise resistance	1 kV 1 μs between power terminals

Mechanical and Performance Specifications

Item	Specification
Measurement method	Cycle period measurement
Function	Display only
Display interval	Every 0.4 second if input pulse cycle is 0.4 second or less. Otherwise, 0.4 second plus cycle period. Previous value is displayed for six seconds after the object stops revolution.
Screen	7-segment red LED for 4-digit display(Character height: 8 mm)
Measurement range*1	10～9999rpm
Precision	±1 digit
Available measurement	Number of revolutions per minute (Mode 1 only)
Prescaling	1 or 10 pulses/revolution*2
Times of sampling	1
Installation	Socket B or F using optional
Sensor power	DC12V 30mA
Power-on reset	Shutdown period: 0.5 second Reset period: 0.5 second
External dimensions	48W×48H×95D
Weight	Approx. 200 g
Accessory	Metal fitting

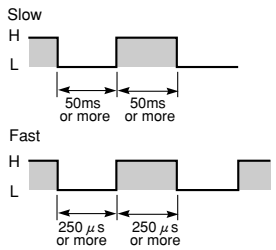
*1 When prescale is 1.
*2 The pulse rate per revolution can be set to either 1 or 10.

	Input pulse rate	Switch 4 at Position A	Position B
Measurement range	1 pulse/revolution	10～999 rpm	one tenth
	10 pulse/revolution	ten fold	1～9999rpm

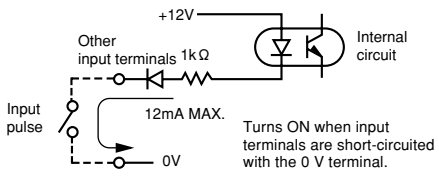
Input

Terminal number	Signal	Name	Specification			
			Response	Resistance	Voltage	
					ON	OFF
6	IN	Input	10 cps or 2k cps	1kΩ	0～4V	10～30V

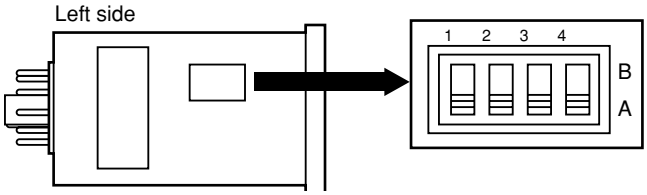
Input pulse width



Input circuit



Switches

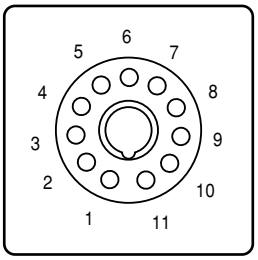


Switch	Used to select	at Position A	at Position B
1	Count speed	2kcps	10cps
2	Decimal point location	See the table below for the locations selected by different combinations of the swithes.	
3	Decimal point location		
4	Input pulse rate	1 pulse/revolution	10 pulses/revolution

Decimal point location

Switch	9999	999.9	99.99	9.999
2	A	B	A	B
3	A	A	B	B

Terminal Assignment

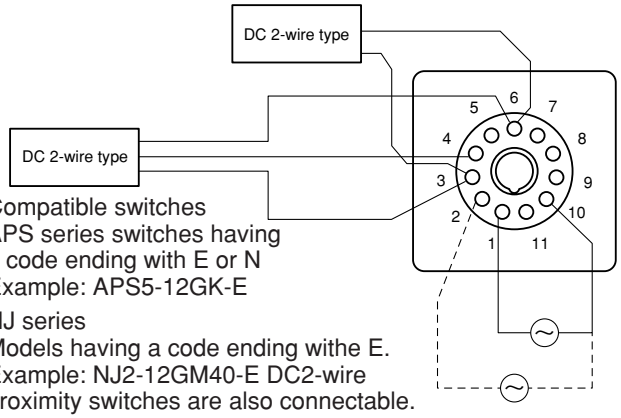


View for Rear side

T/N	Description	T/N	Description
3	0V	9	Not connected
4	+12V(Sensor power)	10	※110 V or 220 V depending on models
5	Not connected	11	AC220V / AC110V
6	Input	—	
7	Not connected	1	※Not connected for teminal No.11
8		2	

■Wiring examples

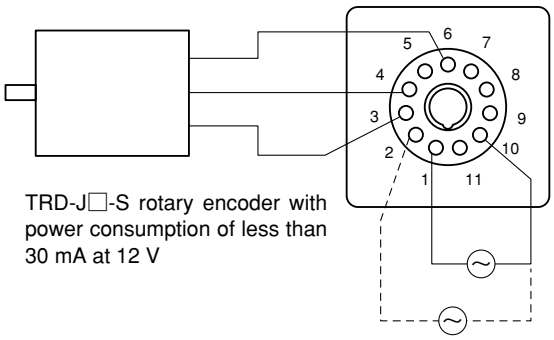
●Proximity switch



Compatible switches
APS series switches having a code ending with E or N
Example: APS5-12GK-E

NJ series
Models having a code ending withe E.
Example: NJ2-12GM40-E DC2-wire proximity switches are also connectable.

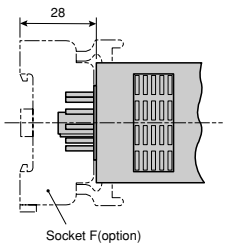
●Rotary encoder

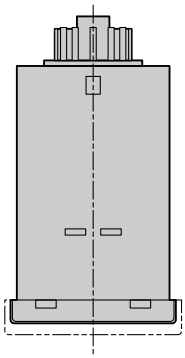


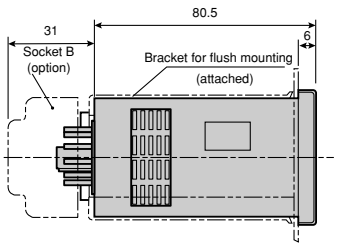
TRD-J□-S rotary encoder with power consumption of less than 30 mA at 12 V

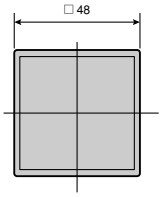
External Dimensions

(in mm)

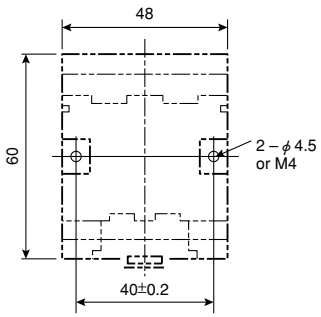




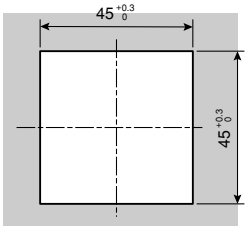




Boring dimensions for wall surface mounting

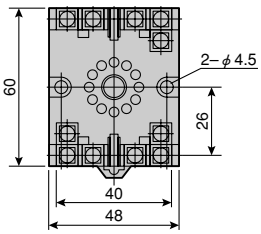


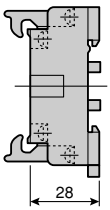
Boring dimensions for flush mounting

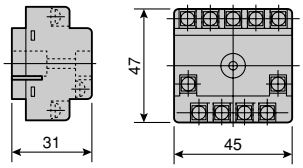


Specified sockets

(options) For wall surface mounting using Socket F or DIN rails: KF-04 For flush mounting: KB-04





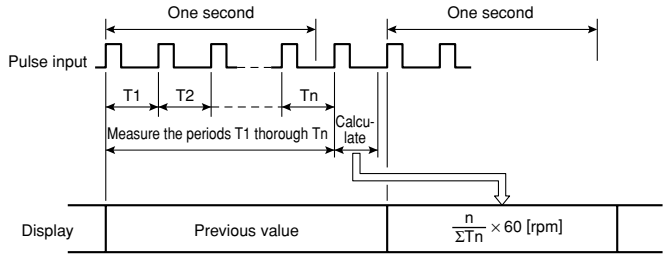


TC-41

Display Only Tachometers with Flexible Input Circuit

The display only tachometer features a special circuit to allow connection to any input device.
Displayed value is reset to zero if no pulse is entered for one second. Revolution speed is calculated from the average cycle period of pulse entered during one second. This minimizes the effect of speed variations. Available options include prescaling, sampling and decimal point display.

Operation



- When pulse rate per revolution=1, times of sampling=1, and prescale=1.
- When times of sampling=10 or 100, and 10 or 100 pulse period is shorter than one second.
- The above averaging is not performed if one cycle period exceeds one second, or if 10 or 100 pulse period is longer than one second.
- The displayed value can be reset to zero by input of an external signal.

General Specifications

●Electrical Specification

Item	Specification
Reted voltage	AC90～132V／180～264V
Rated frequency	50／60Hz
Power consumption	14VA
Withstand voltage	AC 2000 V for one minute between power and external terminal
Insulation resistance	Min. 20MΩ DC500V (between power and external terminal)

●Environment

Item	Specification
Ambient temp.	−10～+50℃
Storage temp.	−25～+70℃(with no freezing)
Ambient/Storage humidity	35～90%RH(with no dewing)
Vibration resistance	Durable along three axes at 10 to 55 Hz with 0.5 mm amplitude No error along three axes at 10 to 55 Hz with 0.35 mm amplitude
Shock resistance	Durable for 11 ms along three axes at 490 ms^2(50 G) No error for 11 ms along three axes at 98 ms^2(10 G)
Noise resistance	1 kV 1 μs between power terminals

Mechanical and Performance Specifications

Item	Specification
Measurement method	Cycle period measurement
Function	Display only, compatible to various inputs
Screen	7-segment red LED for 4-digit display(Character height: 14.2 mm)
Measurement range	10～9999 rpm／60～9999 rpm
Precision	±1 digit
Available measurement	Number of revolutions per minute(Mode 1 only)
Prescaling	$M\times10^{-n}=10^{-9}$～9999 1≦M≦9999、0≦n≦9 (where M and n are integers)
Times of sampling	1,10 or 100 (Mode 1 only)
Installation	Use screws and the terminal block on rear panel
Sensor power	DC12V 50mA
Power-on reset	Shutdown period: 0.5 second Reset period: 0.5 second
Output dimensions	96W×48H×105D (mm)
Weight	Approx. 450 g
Accsessary	Metal fiting

Note: Averaging the pulse cycles per second minimizes variations of displayed value.

Compatible sensors and switches

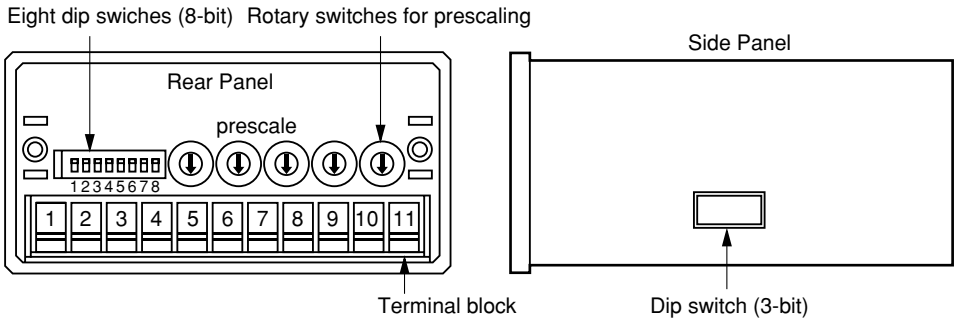
12 to 24V DC output sensor ····· Voltage input 1
5V general purpose inverter※ TTL(5V totem-pole output) ····· Voltage input 2 → IN 1 (changed by dip switch)
DC 2-wire proximity switch ····· DC2W input
Gear sensor AC tachometer generator ····· Electromagnetic sensor → IN 2

IN 1 and IN 2 cannot be used at the same time.

※To digitally display the speed of inverter motor, connect its pulse output to the TC-41 tachometer. Analog (voltage or current) signals cannot be used. The TC-41 circuit should be configured so as to accept the pulse to be counted.

Switches

The terminals and switches are located on the rear and the side of the tachometer.

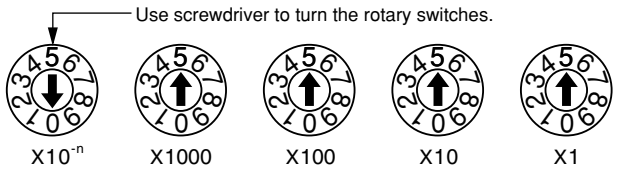


■ Prescaling

This function allow you to multiply the measured value by any value within the range shown below.

Measurement×Prescale=Value to be displayed

Set the scale in the form of "M ×10^{-n}" where M is a 4-digit integer and n is a number from 0 to 9. Use the leftmost switch to set the exponent n, and the other four switches to set the value of M. The prescale can range from 1x10^{-9} to 9999x10^{-0}=9999.



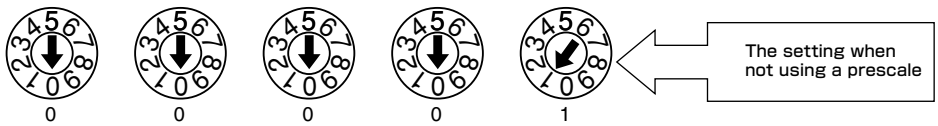
Notes:

1.The exponent (10^{-n}) can be set in a range of to 9.

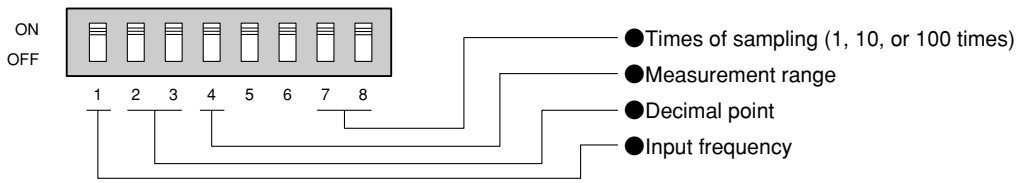
2.If you do not use a prescale, set the value to 1 (1×10^{-0})＝1 as follows:

Prescaled at 1

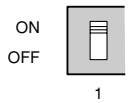
∗ All the settings are 0 by the default.



■Eight dip switches on the rear panel

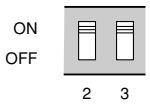


Switch 1: Input frequency (Count speed)



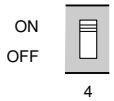
ON	10 cps (Low speed) for both IN A and IN B
OFF	10k cps (High speed) for both IN A and IN B

Switches 2 and 3: Decimal Point



Switch	9999	999.9	99.99	9.999
2	OFF	ON	OFF	ON
3	OFF	OFF	ON	ON

Switch 4: Measurement range



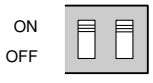
ON	60 to 9999rpm* Reset to zero when pulse input is suspended for 1 second.
OFF	10 to 9999rpm* Reset to zero when pulse input is suspended for 6 seconds.

*When pulse rate per revolution=1, and prescale=1

Switches 5 and 6:

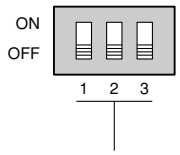
Unassigned

Switches 7 and 8: Time of Sampling



Switch	1 time	10 times	100 times	
7	OFF	ON	OFF	ON
8	OFF	OFF	ON	ON

■Dip switches on the side panel



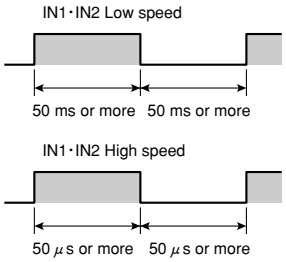
●Dip switch for selecting IN1 input mode

Switch 1	OFF	ON	OFF	OFF
Switch 2	OFF	OFF	ON	OFF
Switch 3	OFF	OFF	OFF	ON
Input mode	Voltage 1 (12～24V)	Voltage 2 (5V)	Current 1 (Namur)	Current 2

Input Specifications

Terminal number	Name	Function	Specifications			
			Response	Resistance	Voltage ON	Voltage OFF
2	IN 1 Selected by dip switches	Voltage input 1 (12～24V)	10cps or 10kcps	15kΩ	0～4V	6～30V
		Voltage input 2 (5V)		15kΩ	0～1.5V	2.5～30V
		Current input 1		3.5kΩ *1	0～4V	6～30V
		Current input 2		1kΩ *1	0～4V	6～30V
3	IN 2	Electromagnetic detector pulse input	10cps *2 or 10kcps	10kΩ	10cps: 0.3Vp-p or more 100cps: 0.3Vp-p or more 1kcps: 2Vp-p or more 10kcps: 20Vp-p or more	
4	RESET	Reset input (open collector)	30ms	1kΩ *1	0～4V	10～30V

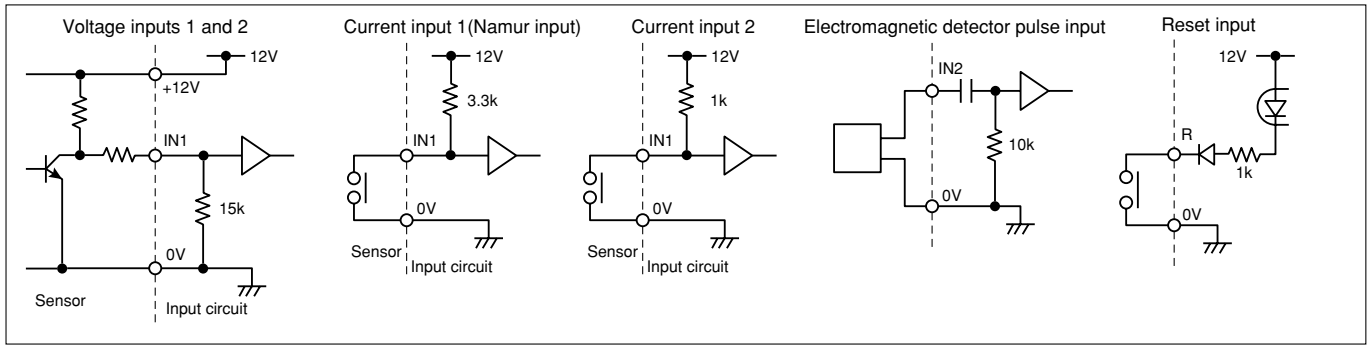
Input pulse width



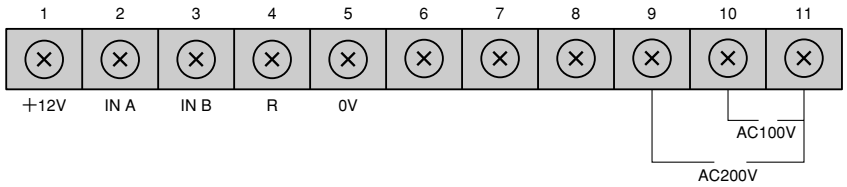
*1.Pulled up to 12 V by internal circuit.

*2.Use the dip switch 1 on the rear panel. Turn it to OFF to select 10kcps. IN 1 and IN2 cannot be used at the same time.

Circuit configuration

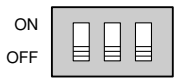
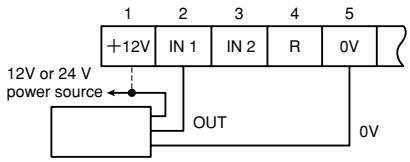
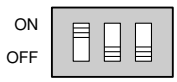
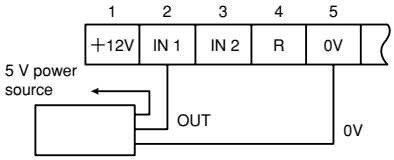
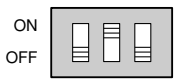
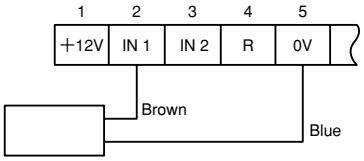
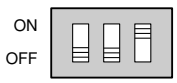
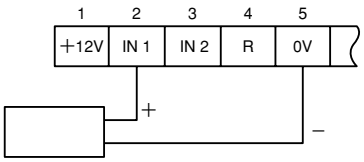
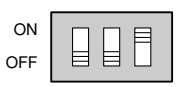
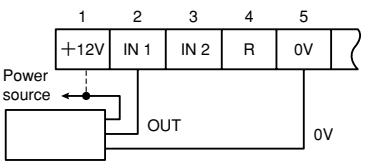


Terminal Assignment



Terminal number	Name	Description
1	+12V	DC sensor power
2	IN 1	Input
3	IN 2	Input
4	R	Reset input
5	0V	Common input: voltage and power
6	Not used	Not connected
7	Not used	Not connected
8	Not used	Not connected
9	AC200V	ACpower
10	AC100V	
11	AC0V	

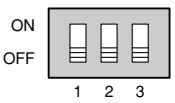
Wiring Examples

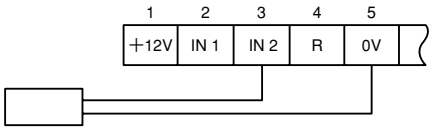
Sensor	Input	Dip switches	Connection
Proximity switch for voltage output (12 V to 24 V) Models: APS-80A-2T APS-30-2T	Voltage input 1		
General inverter for voltage output(5V) TTL for totem-pole output	Voltage input 2		
Proximity switch for Namur output The NJ type is turned OFF at detection time.	Current input 1 (Namur input)		
Sensor for current output Open collector and DC 2-wire proximity switch Models: APS3-12GMC-Z APS5-12GK-Z	Current input 2		
Sensor for NPN open collector output Can be connected to Namur or current input Models:APS5-12GK-E/APS3-16F-E TRD-J ☐-S/RZ	Namur input or Current input		

Notes:

- When using the +12 V sensor power, confirm that the sensor consumes less than 50 mA. This power is applicable to all the models listed above.
- To use IN 2 for electromagnetic detector, turn all the three switches on the side panel to the OFF positions.

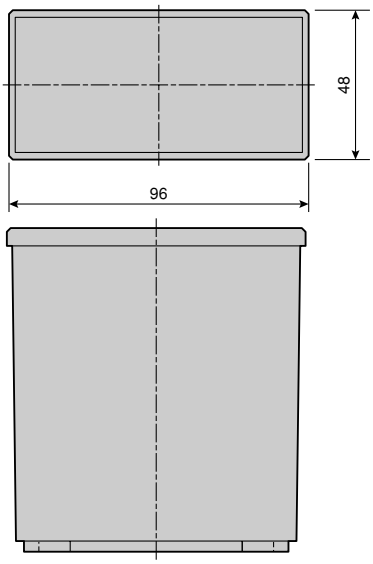
〈Example〉 Gear sensor, AC tachometer generator, etc.

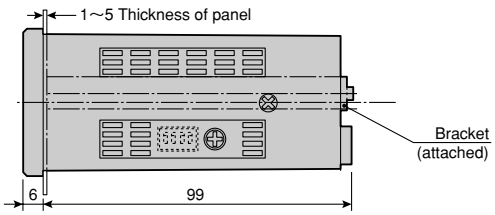




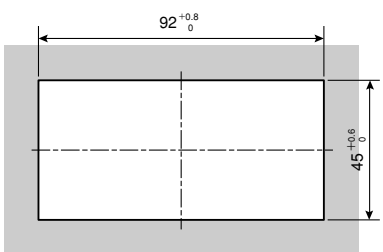
External Dimensions

(in mm)

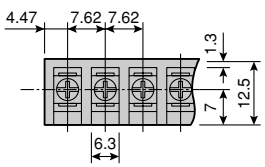




Boring dimensions



External dimensions of terminals block



TC-4 Display Only Tachometer

The red LED screen clearly displays character of 14.2 mm in height. Eight modes are available for the following measurements: number of revolutions, speed, cycle time, time lag, process time, length, spacing, and total.
Options include prescaling, sampling and decimal point display.

Displayed value is updated every 0.4 second when input cycle period is 0.4 second or less.

General Specifications

●Electrical specifications

Item	Specification
Rated voltage	AC90～132V/180～264V
Rated frequency	50/60Hz
Power consumption	14VA
Withstand voltage	AC 2000 V for one minute between power and external terminal
Insulation resistance	Min.20MΩ DC500V (between power and external terminal)

●Environmental specifications

Item	Specification
Ambient temperature	−10～+50℃
Storage temperature	−25～+70℃(with no feezing)
Ambient/Storage humidity	35～90%RH(with no dewing)
Vibration resistance	Durable along three axes at 10 to 55 Hz with 0.5 mm amplitude No error along three axes at 10 to 55 Hz with 0.35 mm amplitude
Shock resistance	Durable for 11 ms along three axes at 490 m/s²(50 G) No error for 11 ms along three axes at 98 m/s²(10 G)
Noise resistance	1 kV 1 μs between power terminals

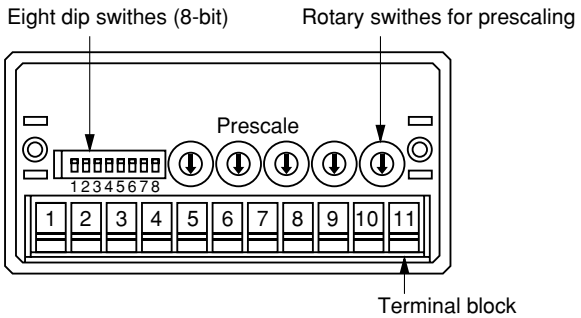
Mechanical and Performance Specifications

Item	Specification
Measurement method	Cycle period based measurement
Function	Display only
Screen	7-segment red LED for 4-digit display (Character height: 14.2mm)
Measurement range	10～9999 rpm, 10ms～140s, 1～9999 counts
Precision	±1 digit(Mode 1) or ±0.1ms (Modes 2 to 5)
Available measurements	8 modes*
Prescaling	$M\times10^{-n}=10^{-9}$～9999 1≦M≦9999、0≦n≦9 (M and n are integers)
Times of sampling	1, 10 or 100 (Available only in Mode 1)
Installation	Use screws and the terminal block on rear panel
Sensor power	DC12V 50mA
Power-on reset	Shutdown period: 0.5 second/Reset period: 0.5 second
External dimensions	96W×48H×105D (mm)
Weight	Approx. 450 g
Accessary	Metal fitting

* The following eight modes are available:
Mode 1: Number of revolutions(rpm)
Mode 2: Speed(meters/minute)
Mode 3: Cycle time(seconds)
Mode 4: Time lag(seconds)
Mode 5: Process time(seconds)
Mode 6: Length
Mode 7: Spacing
Mode 8: Prescale counter

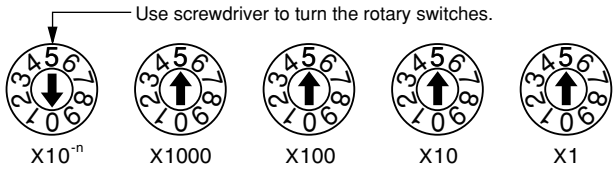
Switches (rear panel)

The terminals and switches are located on the rear of the tacometer.



■Prescaling

Preset a 4-digit value to determine the scale used to calculate values for display.



Measurement×Prescale=Value to be displayed

Set the scale in the form "M × 10^{-n}" where M is a 4-digit integer and n is a number from 0 to 9.

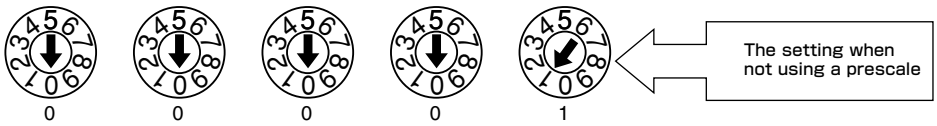
Use the leftmost switch to set the exponent n, and the other four switches to set the value of M.

The prescale can range from 1 × 10^{-9} to 9999×10^{-0}=9999.

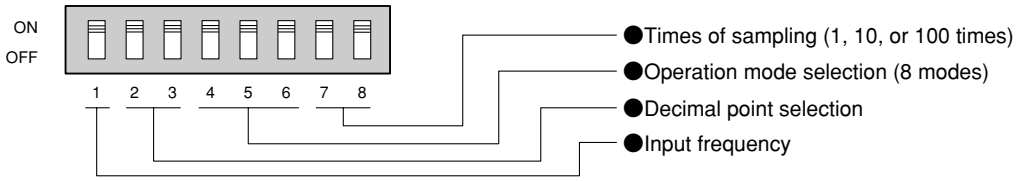
Notes:

1.The exponent (10^{-n}) can be set in a range of 0 to 9.

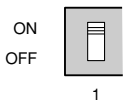
2.If you do not use a prescale, set the value to 1×10^{-0}= as follows.



■Eight dip switches on the rear panel

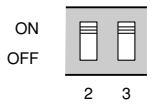


Switch 1: Input frequency (Count speed)



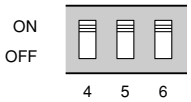
ON	10cps for both IN A and IN B (Low speed)
OFF	10kcps for both IN A and IN B (High speed)

Switches 2 and 3: Decimal Point



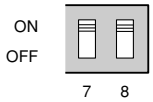
Switch	9999	999.9	99.99	9.999
2	OFF	ON	OFF	ON
3	OFF	OFF	ON	ON

Switches 4, 5 and 6: Measurement range



Switch	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	Mode 8
4	OFF	ON	OFF	ON	OFF	ON	OFF	ON
5	OFF	OFF	ON	ON	OFF	OFF	ON	ON
6	OFF	OFF	OFF	OFF	ON	ON	ON	ON

Switches 7 and 8: Times of Sampling



Switch	1 time	10 times	100 times	
7	OFF	ON	OFF	ON
8	OFF	OFF	ON	ON

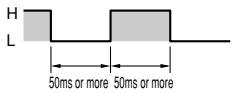
Input specifications

Terminal number	Name	Function	Specifications			
			Response	Resistance	Voltage	
					ON	OFF
2	IN A	Input	10Hz/10kHz selection	1kΩ	0～4V	10～30V
3	IN B	Input				
4	R	Reset input*	30ms			

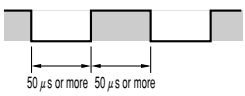
Not available in Modes 1 to 5

Input pulse width

INA・INB low speed

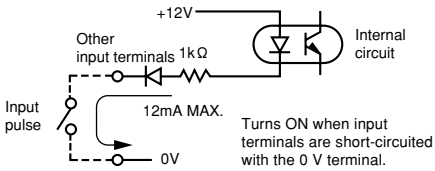


INA・INB high speed

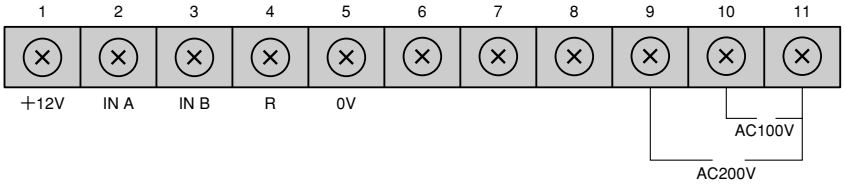


Circuit configuration

INA・INB・reset



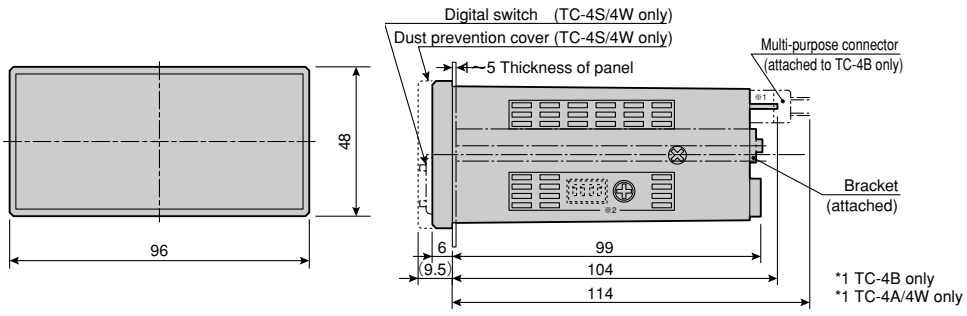
Terminal Assignment

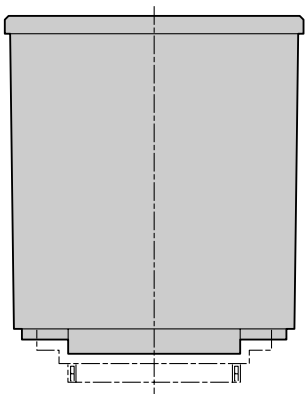


Terminal number	Name	Description
1	+12V	DC sensor power
2	IN A	Input
3	IN B	Input
4	R	Reset input
5	0V	Common input: voltage and power
6	Not used	Not connected
7	Not used	Not connected
8	Not used	Not connected
9	AC200V	AC power
10	AC100V	
11	AC0V	

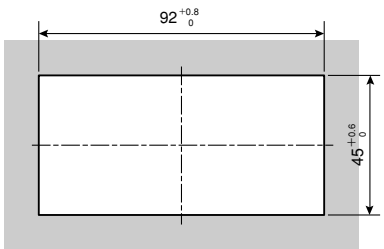
External Dimensions

(in mm)



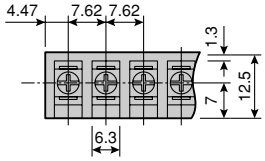


Boring dimensions



47×94 when the attached dust cover is used

External dimensions of terminal block



TC-4B Tachometer with Digital Output

TC-4B provides features of digital output (BCD) on the base unit of TC-4.

The TC-4B gives the BCD output faster than displaying the value if input cycle period is 0.4 second or less.

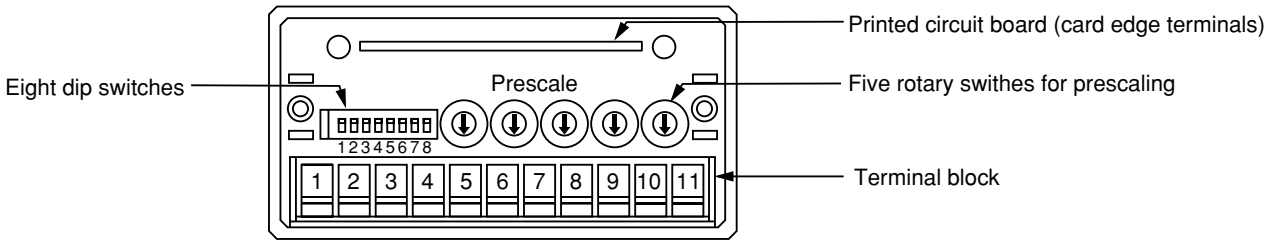
Mechanical and Performance Specifications

Item	Specification
Measurement method	Cycle period based measurement
Function	Digital output(BCD 4 digits)
Screen	7-segment red LED for 4-digit display(Character height: 14.2mm)
Measurement range	10～9999rpm, 10ms～140s, 1～9999 count
Precision	±1 degit(Mode 1)or ±0.1ms(Modes 2 to 5)
Available measurements	8 modes*
Prescaling	$M \times 10^{-n}=10^{-9}$～9999 1≦M≦9999、0≦n≦9 (M and n are integrers)
Times of sampling	1, 10 or 100 (Available only in Mode 1)
Installation	Use screws and the terminal block on rear panel
Sensor power	DC12V 50mA
Power-on reset	Shutdown period: 0.5 second/Reset period: 0.5 second
External dimensions	96W×48H×110D
Weight	Approx. 450 g
Accessary	Metal fitting (card edge connection)

For the General Specifications, see page C-33.

*8 Modes
- Mode 1 : Number of revolutions (rpm)
- Mode 2 : Speed (meters/minute)
- Mode 3 : Cycle time (seconds)
- Mode 4 : Time lag (seconds)
- Mode 5 : Process time (seconds)
- Mode 6 : Length
- Mode 7 : Spacing
- Mode 8 : Prescale counter

Switches (rear panel)



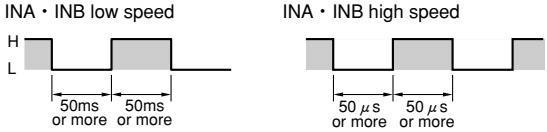
See page C-34 for how to operate these switches.

Input terminals

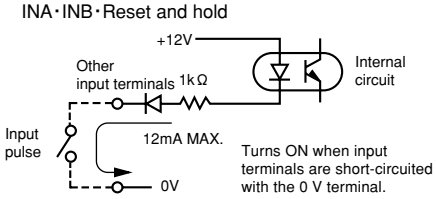
Terminal number	Name	Function	Specifications			
			Response	Resistance	Voltage	
					ON	OFF
2	INA	Input	10Hz/10kHz selection	1kΩ	0～4V	10～30V
3	INB	Input				
4 *	R HOLD	Reset input Hold input	30ms			

*Card edge terminal 10

Input pulse width



Input circuit configuration

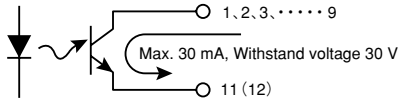


Output specifications

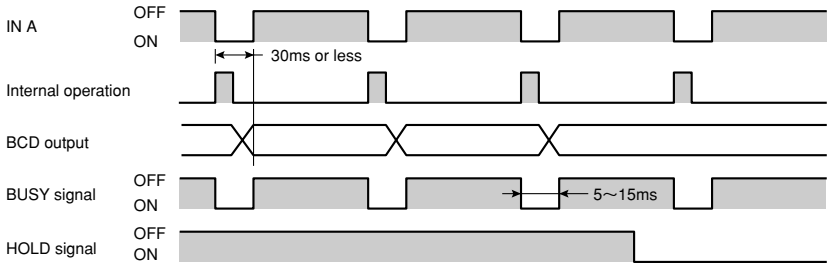
■Output specifications

Output type	Open collector
Operation	Turns on when resultant value is "1"
Voltage	Max. 24V
Current	Max. 30mA
Residual voltage	Max. 2V

■BCD and BUSY signals



■ Timing chart for BCD output with BUSY and HOLD signal. (example for Model 1)

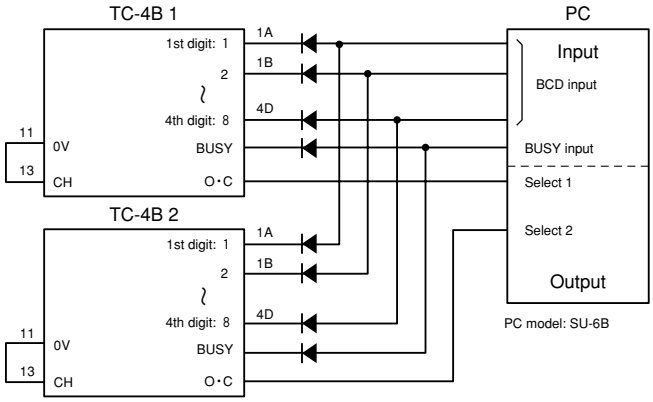


BCD value is not updated when HOLD signal is ON and BUSY signal is OFF. Data can be updated as long as BUSY signal is ON.

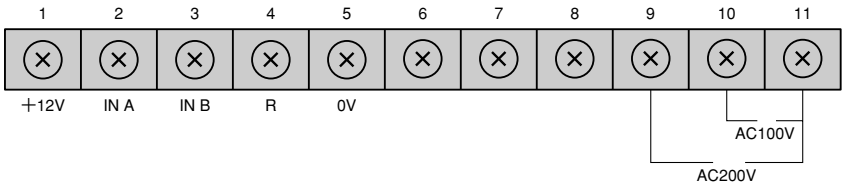
■BCD output connection

Shunt the common input terminal 11 with the CH terminal 13 to separate the terminal 11 from the common output terminal 12.

More than one TC-4B tachometer can be connected to a programmable controller(PC). They can share BCD and BUSY terminals so the PC can be configured with 17 input terminals. A diode is required for each of BCD outputs and BUSY outputs.

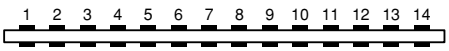


Terminal Assignment



Terminal number	Name	Description
1	+12V	DC sensor power
2	IN A	Input
3	IN B	Input
4	R	Reset input
5	0V	Common input: voltage and power
6	Not used	Not connected
7	Not used	Not connected
8	Not used	Not connected
9	AC200V	ACpower
10	AC100V	
11	AC0V	

Card edge terminals



4-digit BCD values are generated through the card edge terminals as follows:

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Terminal name	B	1A	1B	2A	2B	3A	3B	4A	4B	BUSY	HOLD	0V	O・C	CH	
	A	1C	1D	2C	2D	3C	3D	4C	4D	BUSY	HOLD	0V	O・C	CH	

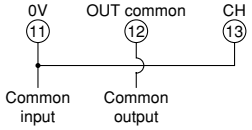
Signal	Upper edge(B)	1	2	1	2	1	2	1	2	BUSY	HOLD	0V	O・C	CH	Unused
	Lower edge(A)	4	8	4	8	4	8	4	8	BUSY	HOLD	0V	O・C	CH	Unused
	Destination/function	1 digit		2 digit		3 digit		4 digit		Output	Input	Common	OUT Common	O・C swiching	

Card edge terminal 11 is internally connected with Terminal 5 on the internal board.

For the External Dimensions, see page C-27.

Separating Terminal 11 and OUT Terminal 12

These terminals are internally connected. Short circuit the common input terminal 11 with the CH terminal 13 to separate the common input and common output.



TC-4S Single Preset Tachometer

The TC-4S has a comparator function on the basic unit of TC-4.
TC-4S is presettable and give output when the current value reaches the preset.

TC-4S

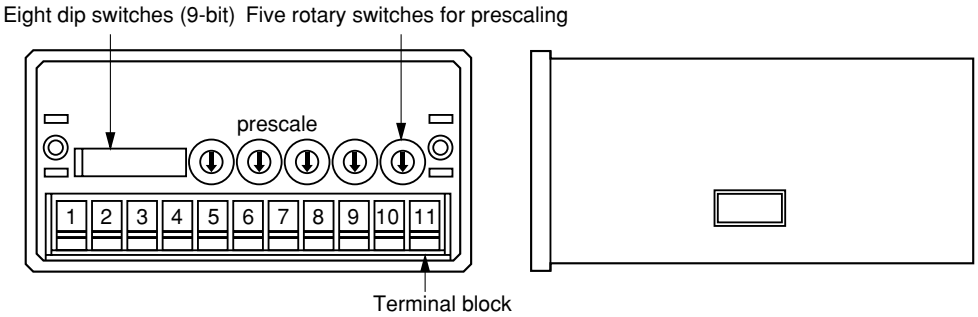
Mechanical and Performance Specifications

Item	Specification
Measurement method	Cycle period based measurement
Function	TC-4S: Single preset
Screen	7-segment red LED for 4-digit display (Character height: 14.2mm)
Measurement range	10～9999rpm, 10ms～140s, 1～9999 count
Precision	±1 degit(Mode 1) or ±0.1ms(Modes 2 to 5)
Available measurements	8 modes*
Prescaling	$M \times 10^{-n}=10^{-9}$～9999 1≦M≦9999、0≦n≦9 (M and n are integers)
Times of sampling	1, 10 or 100(Available only in Mode 1)
Installation	Use screws and the terminal board on rear panel
Sensor power	DC12V 50mA
Power-on reset	Shutdown period: 0.5 second/Reset period: 0.5 second
External dimensions	96W×48H×105D
Weight	Approx. 450 g
Accessary	Metal fitting, dustproof cover

For the General Specifications, see page C-25.

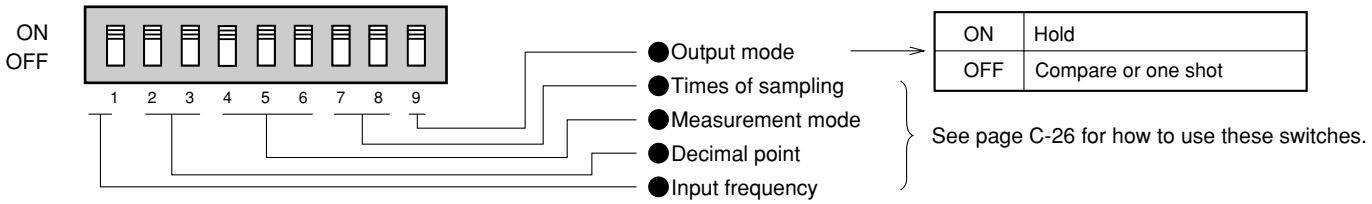
*8 Modes
- Mode 1 : Number of revolutions (rpm)
- Mode 2 : Speed (meters/minute)
- Mode 3 : Cycle time (seconds)
- Mode 4 : Time lag (seconds)
- Mode 5 : Process time (seconds)
- Mode 6 : Length
- Mode 7 : Spacing
- Mode 8 : Prescale counter

Rear panel and Side panel



See page C-26 for how to operate these switches.

■Dip switches on the rear panel



ON	Hold
OFF	Compare or one shot

See page C-26 for how to use these switches.

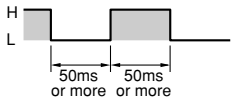
Input Specifications

Terminal number	Name	Function	Specifications			
			Response	Resistance	Voltage	
					ON	OFF
2	IN A	Input	10cps or 10kcps	1kΩ	0～4V	10～30V
3	IN B	Input				
4	R	Reset input*	30ms			

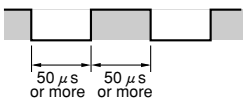
*Not available in Modes 1 to 5.

Input pulse width

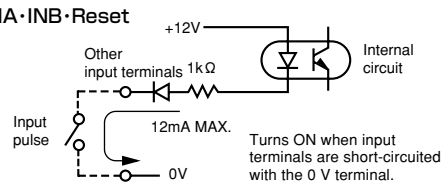
INA・INB low speed



INA・INB high speed



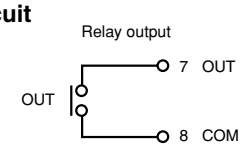
Input circuit configuration



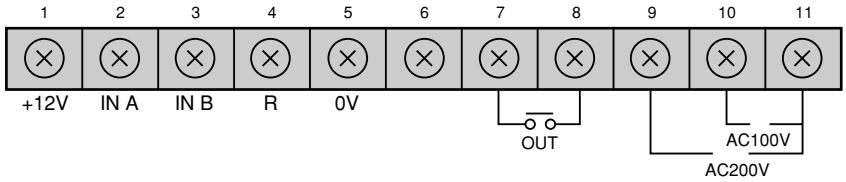
Output specifications

Terminal number	Name	Function	Specifications	
			Response	Contact capacity
7	OUT	Contact output	Max. 50ms	200,000 contacts at 220V 2 A(resistance load)

Output circuit

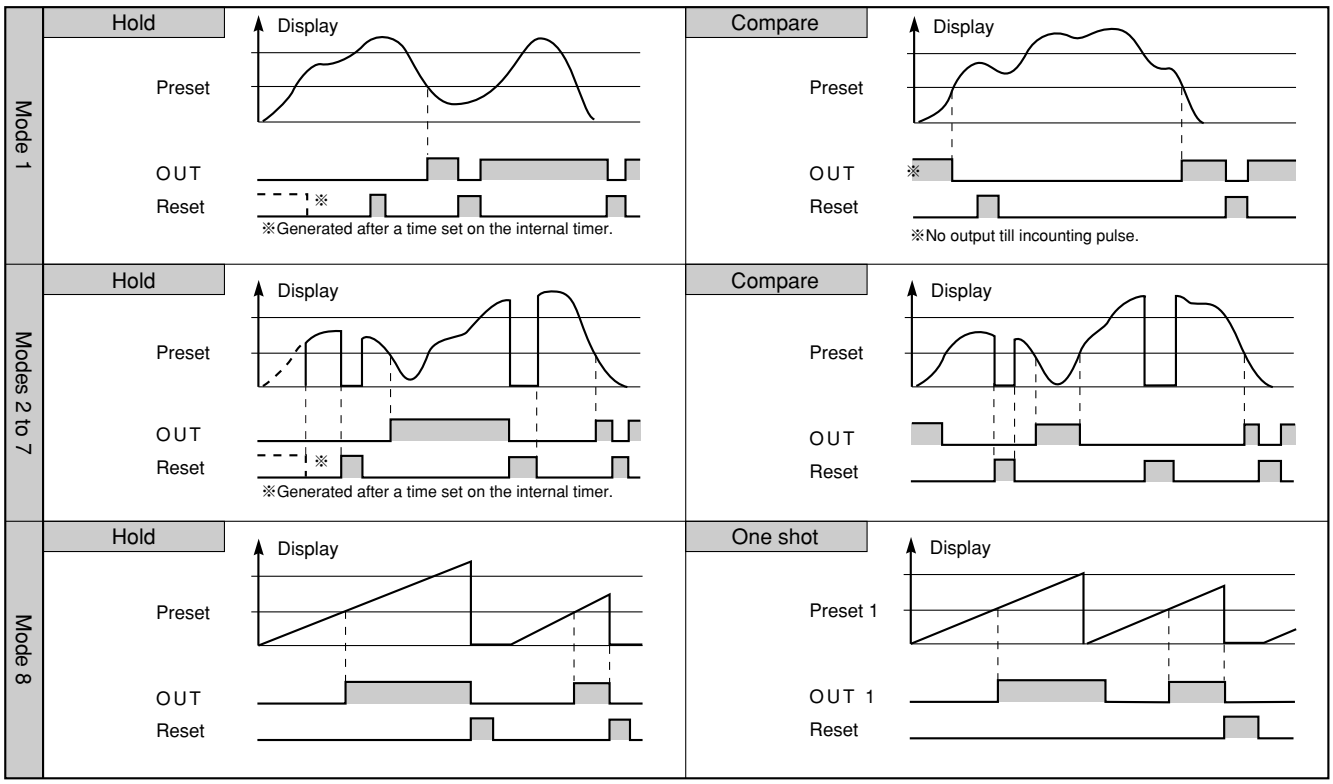


Terminal Assignment



Terminal number	Name	Description
1	+12V	sensor power
2	IN A	Input
3	IN B	Input
4	R	Reset input
5	0V	Common for input and sensor power
6	NC	–
7	OUT	Output
8	Common output	
9	AC200V	AC power
10	AC100V	
11	AC0V	

Timing charts

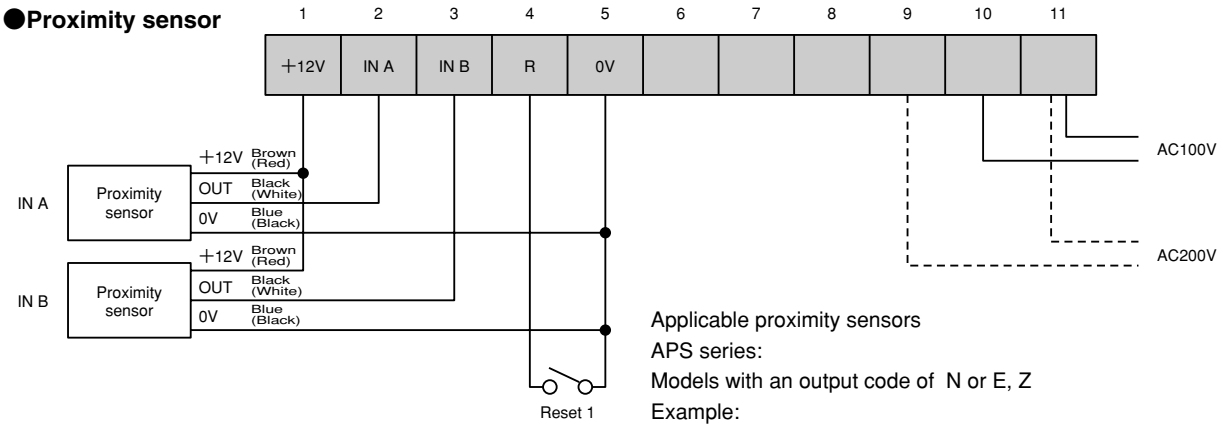


See page C-27 for the external dimension of the counter.

In the Compare mode, OUT is generated when the display value has reached the preset value .

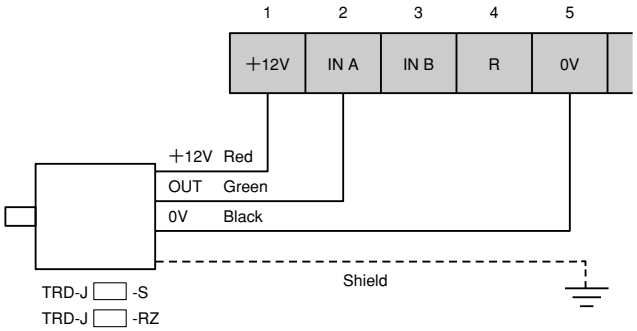
Wiring

●Proximity sensor



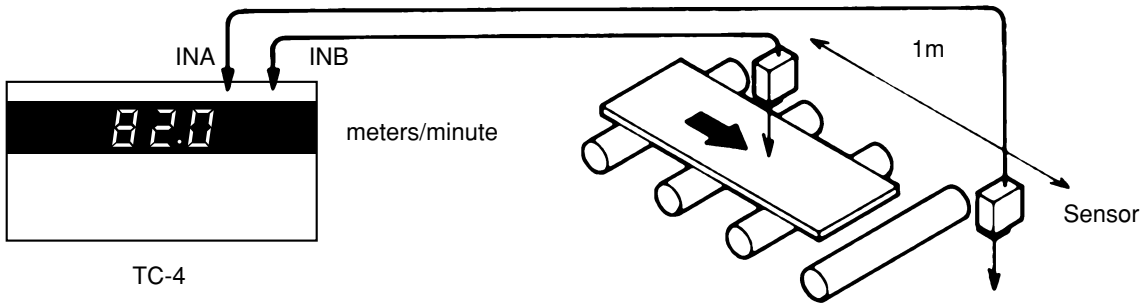
Applicable proximity sensors
APS series:
Models with an output code of N or E, Z
Example:
APS3-16F-E

●Rotary encoder



Recommended application Measuring speed between two points

The tachometer can measure the speed of an moving object detected by two sensors. With the sensors positioned as shown below, the speed in meters per minute is calculated from their pulse counts and distance.



Step 1 Select the model.

Use TC-4 that displays speeds.

Step 2 Install sensors.

Use photoelectric sensors for inputs to INA and INA.

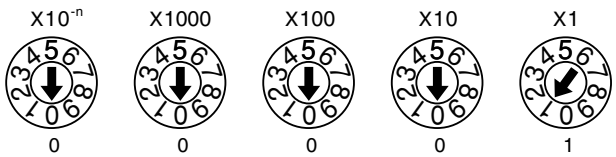
Step 3 Set the dip switches.

On the rear panel, set the dip switches as follows:

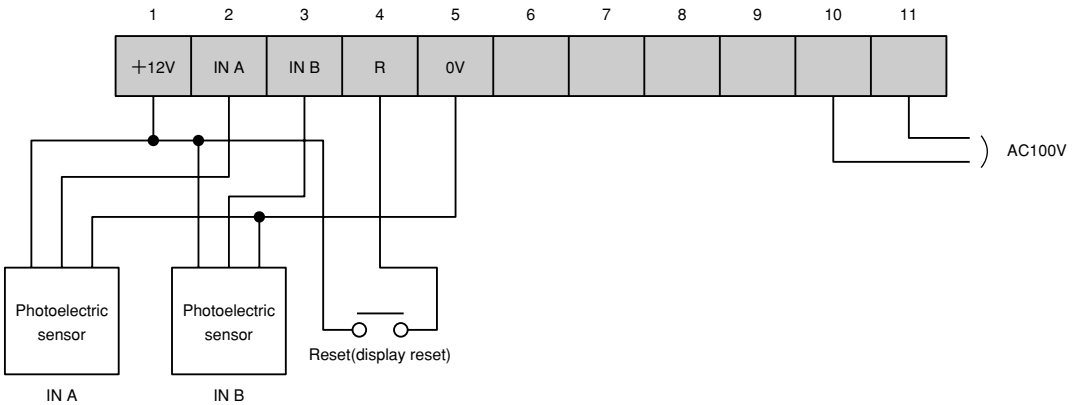
Switch	Set to	To select	Set
1	Input frequency	Fast Input frequency	OFF
2	Decimal point	One digit after decimal point (000.0)	ON
3			OFF
4	Operation mode	Mode 2	ON
5			OFF
6			OFF
7	Number of sampling	Times of sampling: 1	OFF
8			OFF

Step 4 Select a prescale

Select "1" by setting the rotary switches as follows (if the prescale has been changed from the initial value):



Step 5 Configure the circuit.



DIGITAL TIMERS

KT-V Series

Digital Timers

A large display that is easy to read has been provided in a small DIN48 size.
The large red LED is bright with a character height for display of 12 mm, which allows it to be seen easily from a distance and at an angle. In addition, set values use a green LED to differentiate from timekeeping values. Setting of set values with individual setting keys has the feel of digital switches. Basic function settings are made with digital switches; detailed settings are selected with digit keys, so operation is easy.

CE Mark

Merits

●Tamper proof
Key protection can be set for individual keys to prevent a malfunction or tampering.

●Battery-less memory retention
EEPROM is used to retain values in memory, so there is no need for battery maintenance.

●Removable terminals
Maintenance has been reduced via terminals that can be removed. After wiring, the terminal cover provides a safe surface for worry-free use.

●Power source for a large-capacity sensor
You can source the power for sensor from the built-in P/S 24VDC, 60mA.

●Free power supply for the AC type
The operating AC voltage is wide as 85VAC～264VAC.

●Various types of time ranges
The device covers 10 types of time ranges with times of 0.001 s to 9999 hours.

●Various uses with 5 types of operating modes
Settings can be made for ondelay, offdelay, one-shot, integration, and flicker.

●Display of Elapsed time/Remaining time
The time display can be selected to display elapsed time and remaining time.

●IP65 Protective structure
The front cover panel uses sheet keys, so operation with wet or dirty hands can be done worry-free. A front cover is also provided as an option to enhance the protective structure.

●Designed in compliance with CE and UL

List of Models

Model Number	Number of digits	Source Voltage	Sensor Source Voltage DC24 V 60 mA
KT-V4S	4	AC	●
KT-V4S-C		DC	

(Accessories) Installation Frame

Model number system

KT-V4S-□

- **C** : DC power
  Blank : AC power
- **S** : with output
- **4** : 4 digits
- Series Name

General Specifications

Item	Specification		
	AC power		DC power
Source voltage	AC100～240 V		DC12～24 V
Permitted power fluctuation	AC85～264 V		DC10～26.4 V
Power consumption	Approx. 11 VA		Approx. 4 W
Sensor power	DC24 V (20-28 V) 60 mA (less than 10%p-p ripple noise)		———
Memory Backup upon Power Failure	EEPROM Writing Up to 100,000 times Memory Duration 10 years		
Ambient temperature	−10～50℃		
Storage temperature	−20～70℃ (with no freezing)		
Ambient humidity	35～85%RH (with no dewing)		
Withstand voltage	AC 2kV 1 minute AC 2kV for one minute (for AC input, 0 V, and relay interconnection) (for the DC type, 0 V and relay interconnection only)		
Vibration resistance	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	
Impact resistance	Durability	490 m/s^2 along three axes	
	No malfunction	98 m/s^2 along three axes	
Noise resistance	AC power between terminals ±1.5 kV (pulse width 1 of μs and rise time 1 of ns)		DC power between terminals ±1.0 kV (pulse width 1 of μs and rise time 1 of ns)
Protective structure	IP65 (front panel only)		
Weight	Approx. 150 g		Approx. 110 g
Terminals	Conforming wiring	0.25～1.65 mm^2	
	Conforming crimped contact	R1.25-3	
	Permitted torque	0.5 Nm	

Performance Specifications

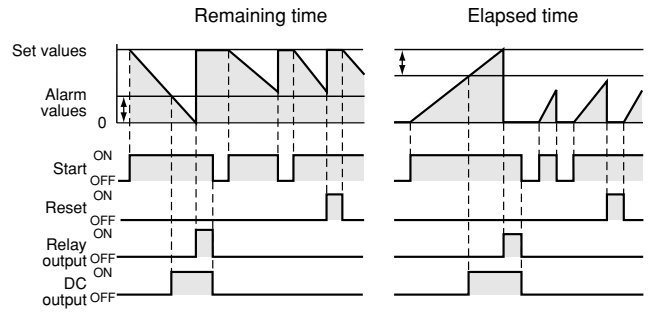
Item	Specification
Category	Timer
Operational format	Ondelay, offdelay, one-shot, accumulation, and flicker (with alarm output)
Number of digits	4 digits
Display	Display of timekeeping values: red LED, Character height 12 mm, Set display: green LED, Character height: 7 mm
Time range	0.001 s～9.999 s/0.01 s～99.99 s/0.1 s～999.9 s/1 s～9999 s/1 s～99 min 59 s/1 min～9999 min /1 h～9999 h/1 min～99 h 59 min/0.1 min ～999.9 min/0.1 h～999.9 h
Display	Elapsed time/Remaining time
Timer precision	0.013% or ±15 ms (using large values)
Input	Input logic: negative logic (no-load input)/ positive logic (voltage input)
	Input resistance: positive logic 15 kΩ Negative logic 3.3 kΩ (AC power)/1.8 kΩ (DC power)
	Inpult voltage: “L” 0-3 V “H” 7-30 V
Start input response	Less than 15 ms/5 ms/1 ms
External reset	Min. signal amplitude 5 ms
Output	DC output: NPN open collector output / 24 V 100 mA Withstand pressure 35 V Residual voltage less than 1.5 V
	Relay output: 1 transformer relay AC220V 2A (resistance load)
Output duration (flicker)	10-9999 ms variable every 10 ms
Key protection	Setting of arbitrary keys possible
Installation	Exclusively for embedding (terminal block connection)

Output Operation Chart

Ondelay

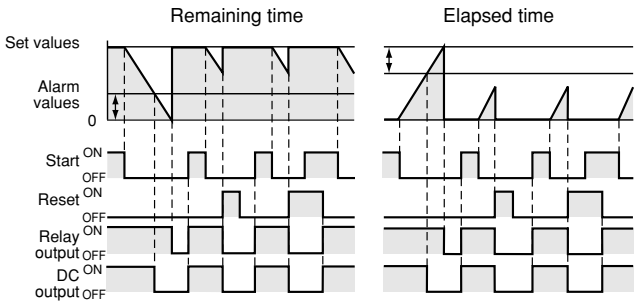
: Alarm setting

SW 1 2
OFF OFF



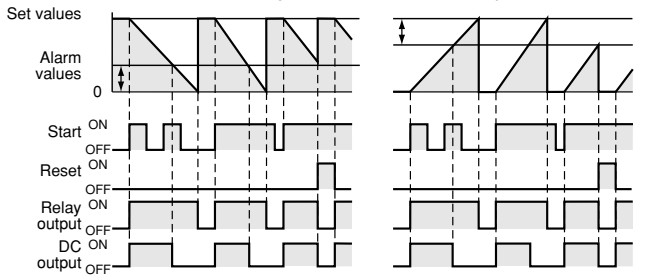
Offdelay

SW 1 2
OFF ON



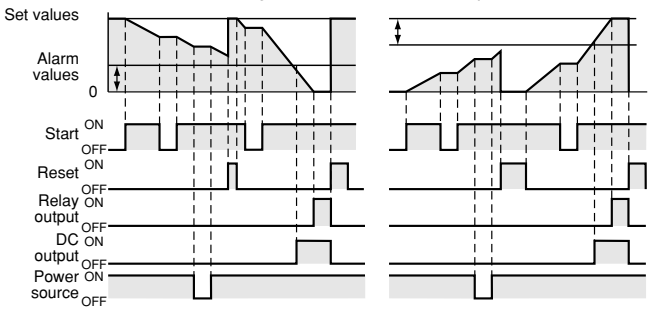
One-shot

SW 1 2
ON OFF



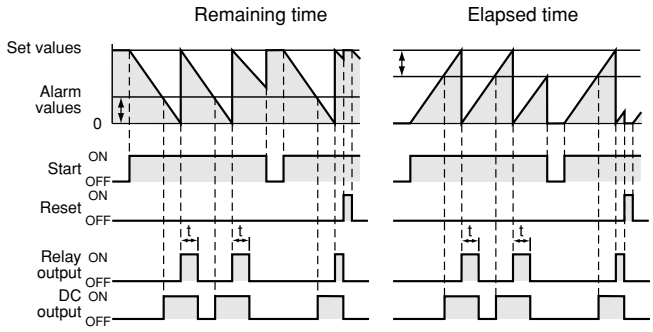
Accumulation

SW 1 2
ON ON



Flicker

(in Setup mode)



Output time of t is 10～9990 ms variable (100 ms at shipping time)

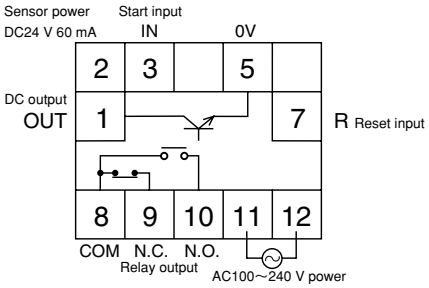
: Alarm settings

When alarm settings are 0, DC output is the same as in output operations for relay output.

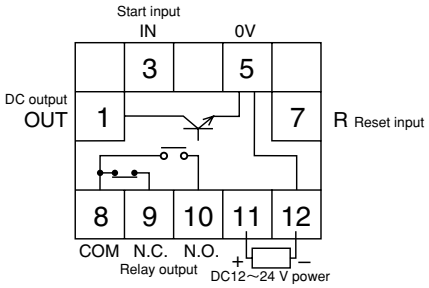
- Alarm settings should be smaller values than preset values. Performing alarm setting with values that exceed preset values will result in measurement values of 0; alarm output (DC output) will come ON.

Terminal Wiring Diagrams

KT-V4S



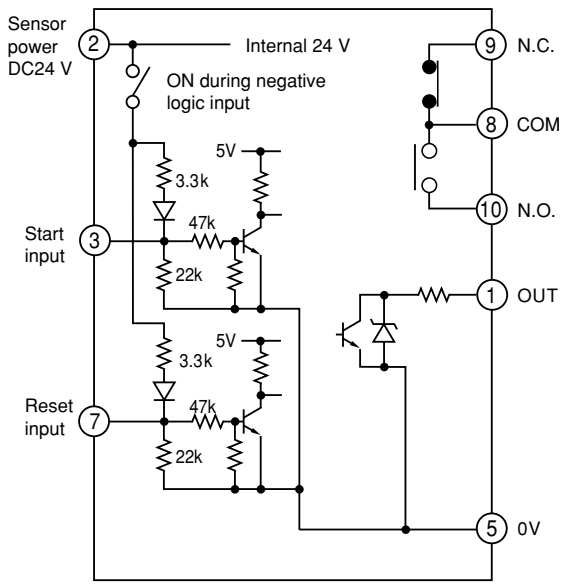
KT-V4S-C



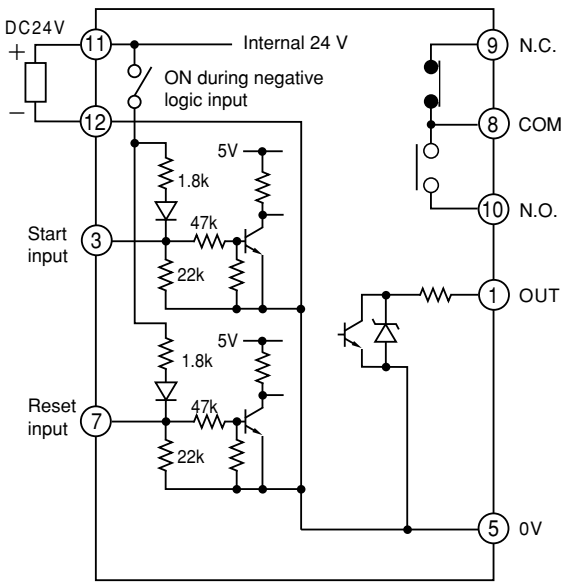
※Alarm output is used in combination with DC output (OUT terminal).

I/O Circuit Diagrams

AC power



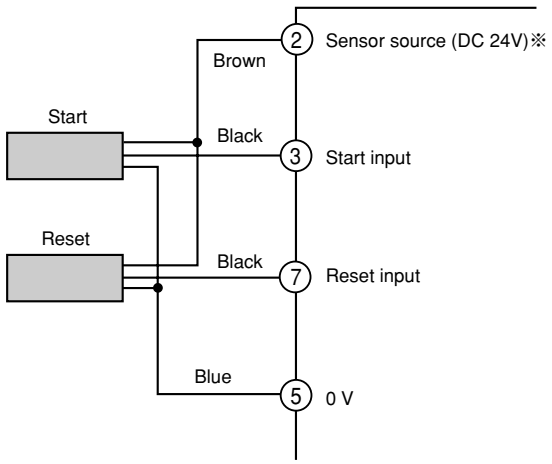
DC power



Input Wiring Examples (Start input/Reset input)

Proximity switch with NPN open collector output

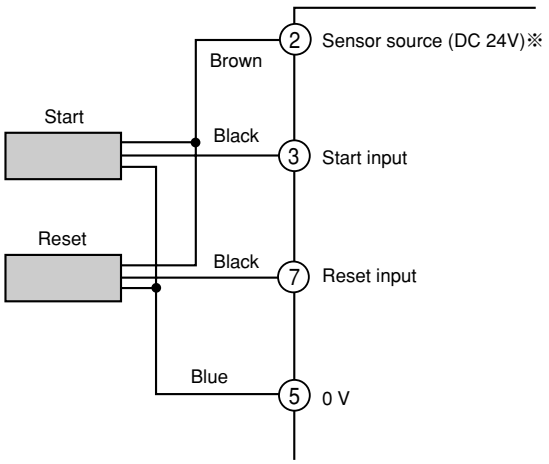
●Input logic: Negative logic: (no-volt input) (nEG)



Recommended proximity switch: APS□-□-N／E

Proximity switch with voltage output or PNP open collector output

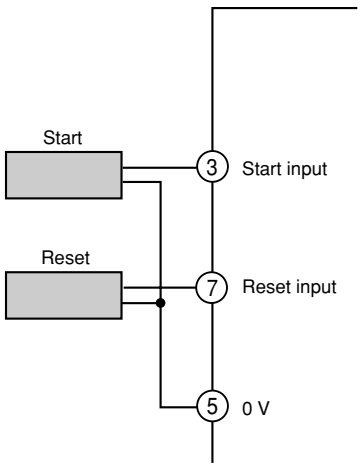
●Input logic: Negative logic (voltage input) (PoS)



Recommended proximity switch: APS□-□-E2

DC 2-wire proximity switch

●Input logic: Negative logic (no-volt input) (nEG)

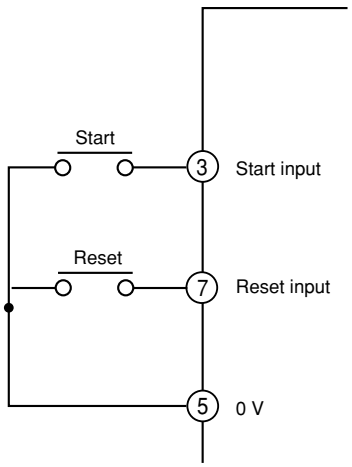


Recommended proximity switch: APS□-□-Z

※With the DC type, please supply source voltage above 20 V.

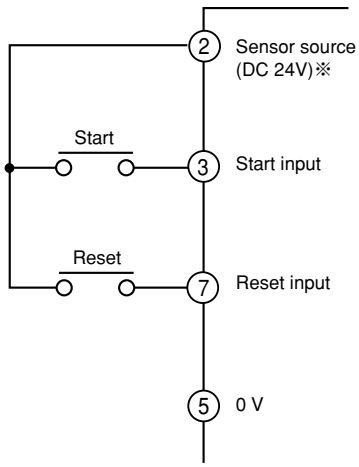
Switch or relay

●Input logic: Negative logic (no-volt input) (nEG)
●Start input response: 15 ms



●Input current is heavy, so this connection is recommended.

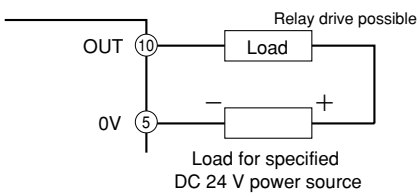
●Input logic: Positive logic (voltage input) (PoS)
●Start input response: 15 ms



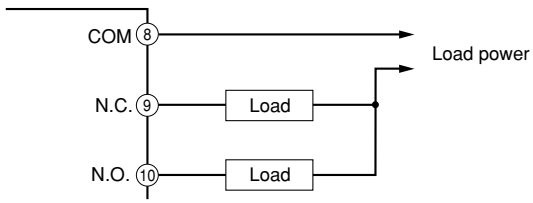
※There is no DC power source. Use a separate external power source.

Output Wiring Examples

NPN open collector output



Relay output



Front Panel Layout and Description

①Output (red)
- Operating mode
  Lit when output is ON.
  Blinks when alarm output is ON.

②Key protection (red)
- Operating mode
  Blinks when key protection is ON (only when the key is ON).
- Setup Mode
  Displays key protection settings.

⑦RST key
- Operating mode
  Allows timekeeping values to be reset (0 for Elapsed time and set values for Remaining time).
- Setup mode
  Allows selection of set items.

③Timekeeping values (red)
- Operating mode
  Displays timekeeping values.
- Setup mode
  Displays setting parameters.

④Units
- Operating mode
  Displays units for timekeeping values.
  H: hours/m: minutes/ s: seconds

⑤Set values (green)
- Operating mode
  Displays set values.
- Setup mode
  Displays set items.

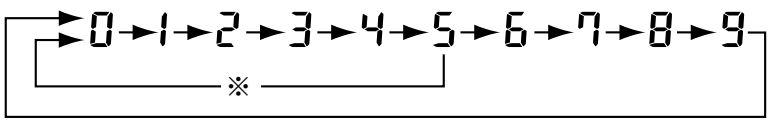
⑥Digit keys
- Operating mode
  Allows changes in set values.
  ※After changing set values, total key input is ineffective for about one second. Set values then take effect.
- Setup mode
  Allows selection of setting parameters.

Time range	Time/Set values	Units
□□□□ s	0~9999	s
□□□□ min	0~9999	m
□□□□ hour	0~9999	h
□□ min □□ s	0:00~99:59	m:s
□□ hour □□ min	0:00~99:59	h:m

■Key Operation

1. Changing set values

Press a digit key once to increase the corresponding digit by one:



After removing your finder from the key, the settings will be verified after about one second.

※When the digit of the display is advanced to 60 □□ : ■□
(minutes) (seconds)
(hours) (minutes)

Example: When the current settings are "123"

Press the [1] key and the display changes to 124
Press the [2] key and the display changes to 134
Press the [3] key and the display changes to 234

2. Resetting the timekeeping values

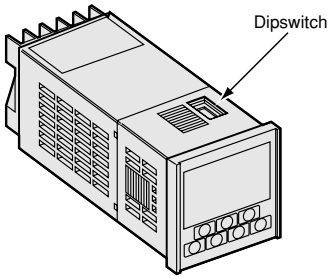
Press the [RST] key to reset the timekeeping values. The count is reset within 0.1 second after the key is pressed. When the Reset key is pressed in the display mode for remaining time, values become set values. In the display mode for elapsed time, they become 0.

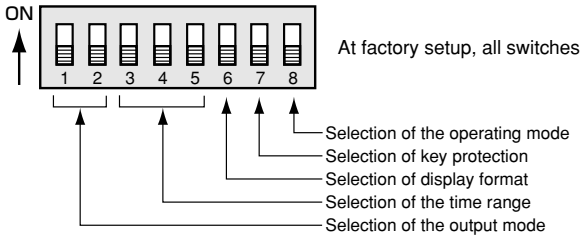
3. Protecting the keys

Turning the Dip switch ON disable the reset and digit keys. If disabled keys are pressed, the LED for the corresponding key will blink. If Key protection is selected to disable keys in Setup mode, Dip switch 6 will come ON. As the factory setup, Key protection in Setup mode is completely disabled, so just turning Dip switch 6 ON will disable all keys.

■Configure Dip switches

- ●Use the dip switch on the top of the counter to configure varions parameters and operation mode.
- ●Configure dip switches with power off. Operation with power up will have no effect.
- ●When dip switches are re-configured, you must press the Reset key in operating mode to reset the count values.

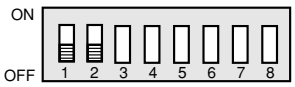




At factory setup, all switches are OFF.

Output mode

The output mode is selected with Dip switches 1 and 2. Blink mode for items not present can be selected in Setup mode.



Operation	SW1	SW2
Ondelay	OFF	OFF
Offdelay	OFF	ON
One-shot	ON	OFF
Accumulation	ON	ON

※Factory setup

Time range

The time range is selected with Dip switches 3, 4, and 5. The time range for items not present can be selected in Setup mode.

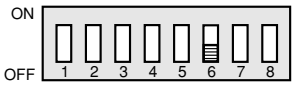
Time range	SW3	SW4	SW5
□.□□□s	OFF	OFF	OFF
□□.□□s	OFF	OFF	ON
□□□.□s	OFF	ON	OFF
□□□□s	OFF	ON	ON
□□m□□s	ON	OFF	OFF
□□□□m	ON	OFF	ON
□□□□h	ON	ON	OFF
□□h□□m	ON	ON	ON

※Factory setup

h: hours m: minutes s: seconds

Display format

The display format is selected with Dip switch 6.

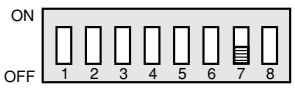


Input mode	SW6
Input for Addition or Subtraction	OFF
Dual input	ON

※Factory setup

Key protection

With Dips witch 7, [Do not protect keys] can be selected to take effect for keys set in Setup mode using [Protect keys]. Setting for keys to protect can be performed in Setup mode. When this switch is ON, re-supplying power will cause protection to take effect. As the factory setup, [Do not protect keys] is set.

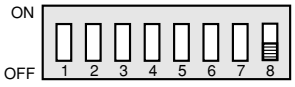


Key protection	SW7
Settings in Setup mode do not take effect	OFF
Do	ON

※Factory setup

Operating mode

The operating mode is selected with Dip switch 8.



Operating mode	
Run mode	OFF
Setup mode	ON

※Factory setup

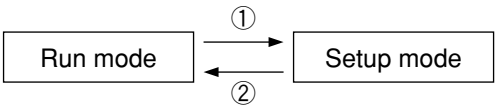
Setup Mode

Settings that cannot be selected with dip switches can be set in Setup mode.

Items that can be contiguned in Setup Mode

(1) Start input response —1/5/15 ms
(2) Input logic ——— Positive or negative logic
(3) Output mode ——— Flicker mode, dip switch
(4) Time range ——— 0.0 m/0.0 h, dip switch
(5) Output duration ——— Duration of output in Blink mode can be set from 10～9990 ms (in 10-ms increments)
(6) Alarm output ——— Offset values can be set with respect to preset values.
(7) Resetting key protection – Setting to disable the reset key can be performed.
(8) Protecting digit keys ——— Setting to disable the arbitrary digit key can be performed.

1. Switching Between Setup mode and Run mode

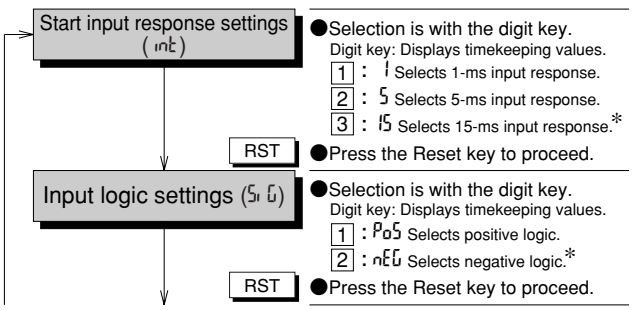


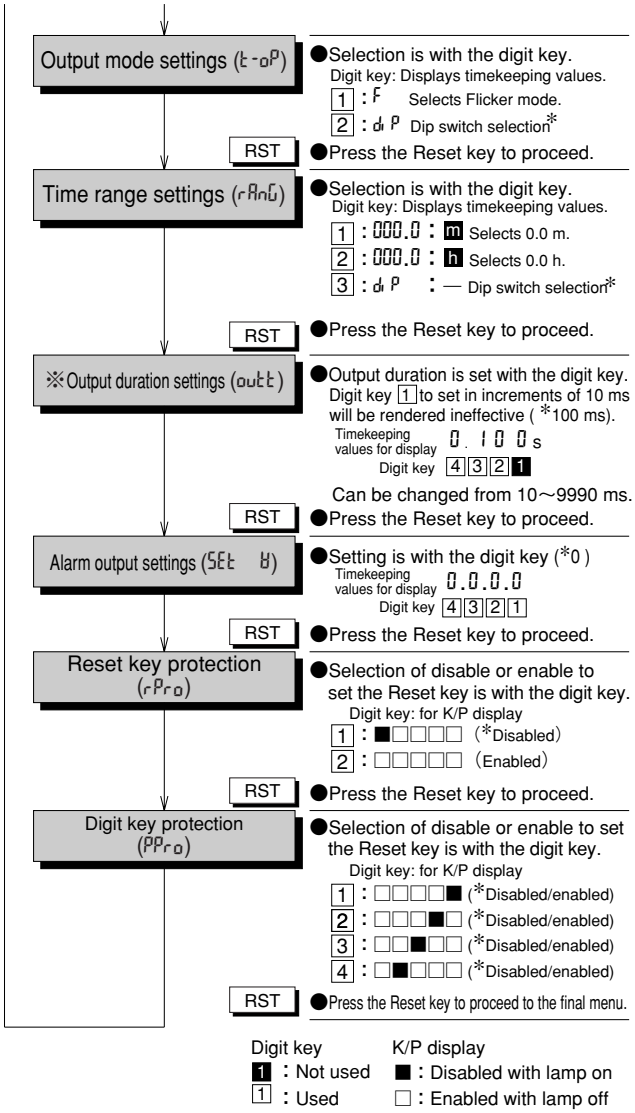
① Setting Dip switch 8 to ON and turning on the power will start the Setup mode.
② Setting Dip switch 8 to OFF and turning on the power will start the Run mode.

2. Operations in Setup mode

In Setup mode, the count can be initialized using the menu as follows:

＊Represents factory setups.





Digit key
■ : Not used
□ : Used

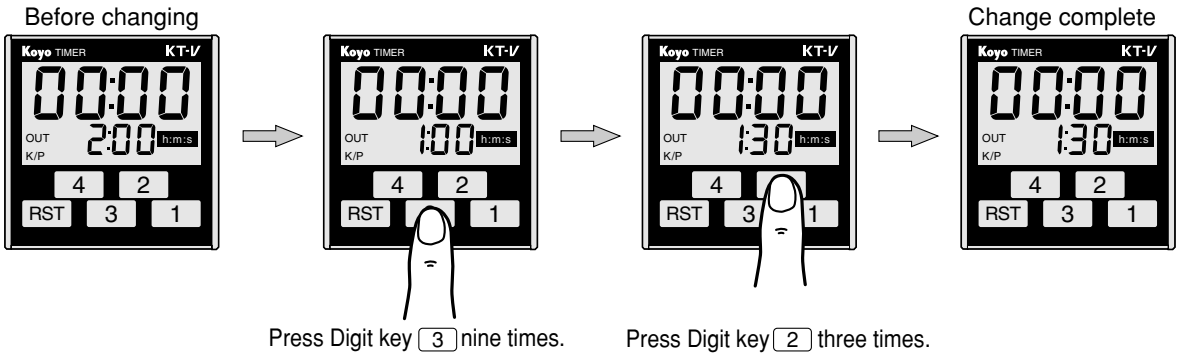
K/P display
■ : Disabled with lamp on
□ : Enabled with lamp off

- In Flicker mode, items marked with an ※ are skipped.
- After changing the default settings in Setup mode, press the RST key in Run mode and reset timekeeping values.
- Setting parameters are rendered effective by pressing the RST key and proceeding to the next step.
- Key protection settings are rendered effective with Dip switch 7 as well as an AND condition. To begin protection, turn Dip switch 7 ON.

Operational Example

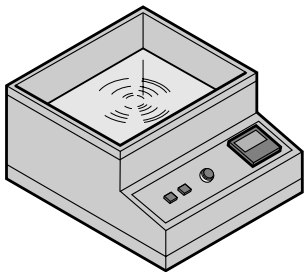
■Changing preset values

1. Change the preset value from 2:00 to 1:30



■Washing Time Control

After pressing the start switch, washing will be performed for the set time.

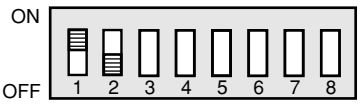


Set item	Details
Output mode	One-shot
Time range	□□m□□s
Display format	Remaining time
Key protection	Reset key, s key: Disabled

1. Setting Dip switches

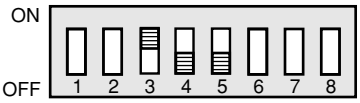
Operate Dip switches with the power off.

①Select Output mode and One-shot.



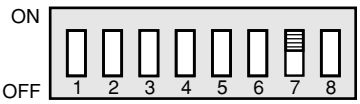
- Dip switch 1 ON
- Dip switch 2 OFF

②Select the time range in □□ m □□ s.



- Dip switch 3 ON
- Dip switches 4 and 5 OFF

③Select Key protection.



- Dip switch 7 ON

2. Switching to Setup mode

Turn Dip switch 8 ON and then turn power ON.

3. Changing setting contents

① The setting screen for [Start input response] is displayed.

These values are initial values.

Press the (RST) key to proceed.

② The setting screen for [Input logic] is displayed.

These values are initial values.

Press the (RST) key to proceed.

③ The setting screen for [Output mode] is displayed.

These values are initial values.

Press the [RST] key to proceed.

④ The setting screen for [Time range] is displayed.

These values are initial values.

Press the (RST) key to proceed.

⑤ The setting screen for [Alarm output] is displayed.

These values are initial values.

Press the (RST) key to proceed.

⑥ The setting screen for [Reset key protection] is displayed.

These values are initial values.

Press the (RST) key to proceed.

⑦ The setting screen for [Digit key protection] is displayed.

Press the (4) key and (3) key to permit key protection.

Press the (RST) key and the setting parameters will be written.

4. Switching to Run mode

Turn the power OFF after completing setting in Setup mode and turn Dip switch 8 OFF (Run mode); then turn power ON.

5. Starting Run mode

Be sure to turn power ON after changing settings in Setup mode and press the (RST) key to reset count values.

Precautions

●Precautions for Use

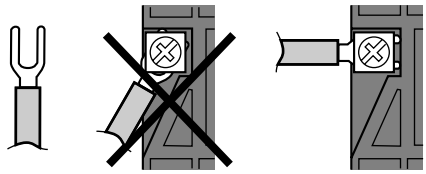
(1) With the DC power source, the 0-V terminal ⑫ and the input common 0-V terminal ⑤ are internally short-circuited.
(2) Apply the rated voltage in one instant, not by gradually raising the voltage.
(3) Always use negative input logic to set the DC 2-wire proximity switch.
(4) During counting, changes to preset values will take effect about one second after key input of the change. In subtraction mode, key input takes effect when the count is reset valid preset value will be saved in the memory at loss of power.
(5) It is recommended to use a sheet included in the package to keep the setups for the future maintenance.
(6) Use in the following environments should be avoided:
- ●A location where the ambient temperature is above 50℃ or below 10℃.
- ●A location where the ambient humidity is above 85% or abrupt temperature changes may cause condensation.
- ●A location with dust, iron fillings, corrosive gasses, or the like.
- ●A location exposed to direct sunlight.
- ●A location with significant vibrations or impact.

(7) When conducting testing of insulation withstand voltage, insulation resistance, or the like, detach the control circuit from the main body.
(8) When power is interrupted, writing to the internal EEPROM will take place. The number of times EEPROM writing can be performed is less than 10000, so avoid use with frequent power source operation.

●Precautions for Wiring

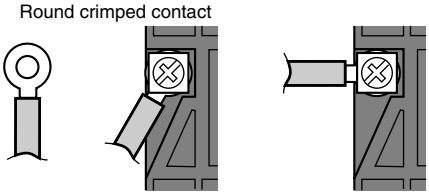
●Keep the wires away from power line.
●With regard to use in locations where extensive noise is generated, keep the KT-V timer and wires away from the noise source to the extent possible.
●Empty terminals are not to be used as relay terminals.
●For connection, use of crimped contacts is recommended.
When wiring the 1 and 7 terminals, do not install fork-shaped crimped contacts at an angle. Use a round crimped contact for angled installation.

Fork-shaped crimped contacts



For angled installation, connection with the contact is insufficient. Like in the illustration above, install the contact perpendicular to the horizontal.

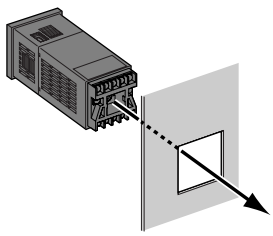
Round crimped contact



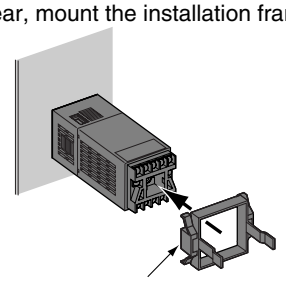
Installation and Removal of the Main Body

●Installation

①Insert the main body through the panel installation port.

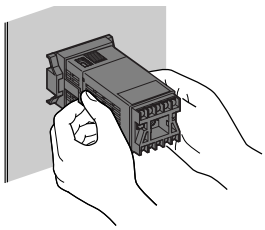


②From the rear, mount the installation frame.



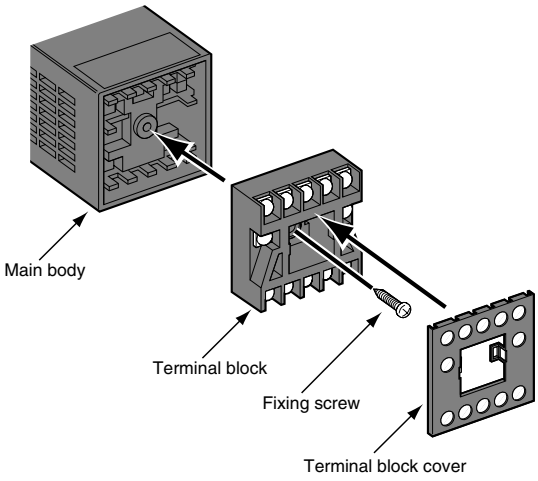
Installation frame: Can be installed vertically or horizontally.

●Removal



①Holding the tabs, spread them 2～3 mm.
②While keeping the tabs spread, pull the device towards you.

●Installation of the Terminal Block and Terminal Cover



- Do not use a screw other than the one used to fix the terminal block during shipping.
- Maintain a permitted torque of 0.3 Nm.
- Install the terminal block after wiring is complete.

Error Codes

Common Errors

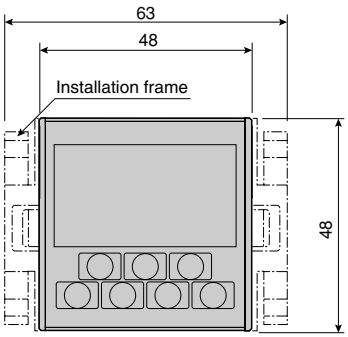
Error	Error type	Error details	Corrective Action
E21	Memory data error	Preset/set values and Setup mode items have changed.	Press the Reset key to eliminate the error display. Measurement values and timekeeping values will be set to 0, preset and set values will be 5000, and Setup mode contents will be set to the factory setups.

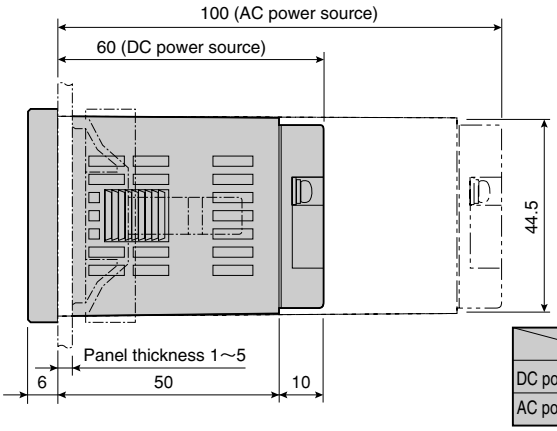
Options

Option	Model Number	Details
Rubber packing	**KC-48P**	Prevents water from entering the control panel with installation between the installation panel and TC-V or KT-V.
Front cover	**KC-48C**	Protects the front panel from dirt and the like. Material: Soft silicone rubber Key operation can be performed with the front cover as-is.

External Dimensions

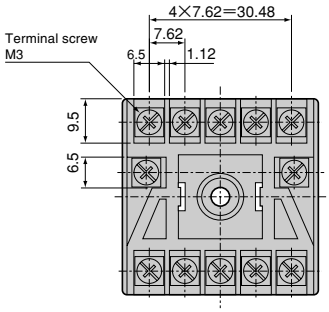
(in mm)





	Depth
DC power source	66 mm
AC power source	106 mm

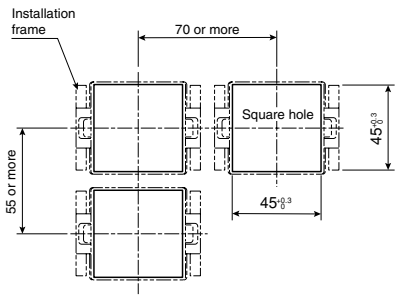
Detailed Diagram of the Terminal Block



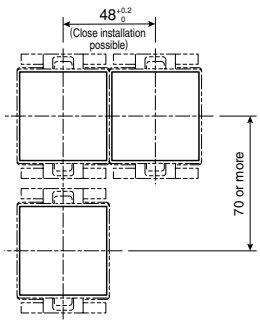
Complying wiring: 0.25-1.65 mm²
Complying crimped contact: R1.25-3
Permitted torque: 0.5 Nm

Boring Dimensions for Installation

1. When the installation handle is horizontal



2. When the installation handle is vertical



PROGRAMMABLE CAM

Programmable Cam

List of KOYO Programmable Cam

Model number	Appearance	Encoder	Resolution (number of digits)	Number of output points	Response time	Source voltage	Sensor power	Reference page
FC-81F-C	 95W×80H×60.5D	Absolute	360/720	8	300rpm/360 resolution 150rpm/720 resolution	DC12/24V	———	E-3
FC-161F-C	 140W×90H×60.5D	Absolute	360/720	16	1600rpm/360 resolution 800rpm/720 resolution (No dynamic CAM setting available)	AC12/24V	———	E-3
FC-321F-C	 140W×90H×60.5D	Absolute	360/720	32	1600rpm/360 resolution 800rpm/720 resolution (No dynamic CAM setting available)	DC12/24V	———	E-3
FC-80-C	 105W×100H×66D	Absolute	360/720	8	300rpm/360 resolution 150rpm/720 resolution	DC12/24V	———	E-12
FC-160	 140W×100H×66D	Absolute	360/720	16	1600rpm/360 resolution 800rpm/720 resolution	AC85～264V	Encoder power source +12V 70mA	E-12
FC-320	 195W×100H×66D	Absolute	360/720	32	1600rpm/360 resolution 800rpm/720 resolution (No dynamic CAM setting available)	AC85～264V	Encoder power source +12V 70mA	E-12
FC-21	 210W×162H×80D	Absolute	360/515/720/1024	24	3600rpm/360 resolution	AC100/200V	Encoder power source +12V 70mA	E-24

FC-81F-C/FC-161F-C/FC-321F-C

An embedded installation type, so confirmation can be done in a normal operating state with the control panel screen.
Various functions are provided such as timing, irregularity detection, and a multi-purpose communication port.

Surface sheet in Japanese:
FC-81F-C
FC-161F-C
FC-321F-C
Surface sheet in English:
FC-81F-C-1
FC-161F-C-1
FC-321F-C-1

Merits

●Easy operation
Simple key operations with the operating panel installed.

●Setting changes are possible in Run mode
Fine adjustment of the ON/OFF position of output can be performed via adjustment mode without stopping the device.

●Independent setup
The FC-161F-C can register 8 types of programs and the FC-321F-C can register 10. Any programs can be selected via switching bank input during setup.

●Multi-purpose communication port
With use of the PLC and a PC, allows reading of operating commands from the PLC, changes in setting values, angles for the PLC, output state, and the like.

●Quick change to a tachometer after completion of adjustment
Switching of the display for the angle/number of revolutions can be easily performed with the sheet key switches on the front panel.

●Home position adjustment
Any angle can be the home position (0) via 2 methods, applying external home position input or key operation.
This eliminates the troublesome adjustment of the home position.

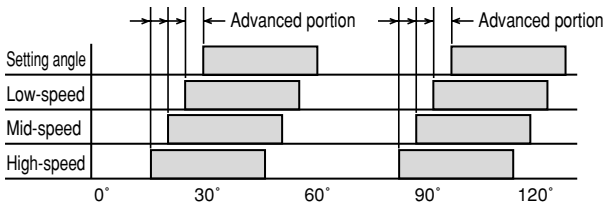
●Angle setting is easy with the teaching function
Cam output of On and Off angle settings is performed while the machine is operating.
Users that found program settings for key operation to be a hassle will be able to enjoy setting with the teaching function.

●Pulse output setting function
This determines the number of pulse per revolution. (divided output).

●Applicable in a broad variety of industries
This series is best suited for timing control of individual types of injectors, packaging machines, applicators, bottling, etc., in the food product, packaging, and printing fields.

●Also provided as an wall-mounting type
Wall-mounting types of the FC-80-C/FC-320 cam switches are also provided.

●Automatic timing function (FC-161F-C/FC-321F-C)
When controlling timing with a cam switch for a machine so as to change the speed of revolution, the lag in work timing due to a delay in actuator operation becomes a problem.
This function, an automatic timing function, corrects the lag in timing. This is done with quick output of only the angle portion calculated from the speed of revolution at the point when the angle corresponds to the lag time for actuator operation.



Uses
- ●Speed changes during start-stop
- ●A device with a speed that changes
- ●A device where speed adjustment is needed

General Specifications

Item	FC-81F-C	FC-161F-C	FC-321F-C
Source voltage	DC12／24V		
Permitted power fluctuation	DC10.8～26.4V		
Power consumption	5W	8W	
Ambient temperature	－10～+50℃		
Storage temperature	－20～+70℃ (with no freezing)		
Ambient/Storage humidity	35～85%RH(with no dewing)		
Ambient environment	No corrosive gas or the like		
Vibration resistance	Durability: displacement amplitude 0.5 mm 10-55 Hz 3 directions		
Impact resistance	Impact resistance Durability: 500 m/s 3 directions		
Noise resistance	1.0 kV between power terminals	1.5 kV between power terminals	
	Pulse width 1 μs/rise 1 μs/ square wave pulse		
Protective structure	IP54: Rear panel sheet only		
Dimensions (W/H/D)	95×80×60.5（mm）	140×90×60.5（mm）	40×90×60.5（mm）
Weight	300g	420g	420g

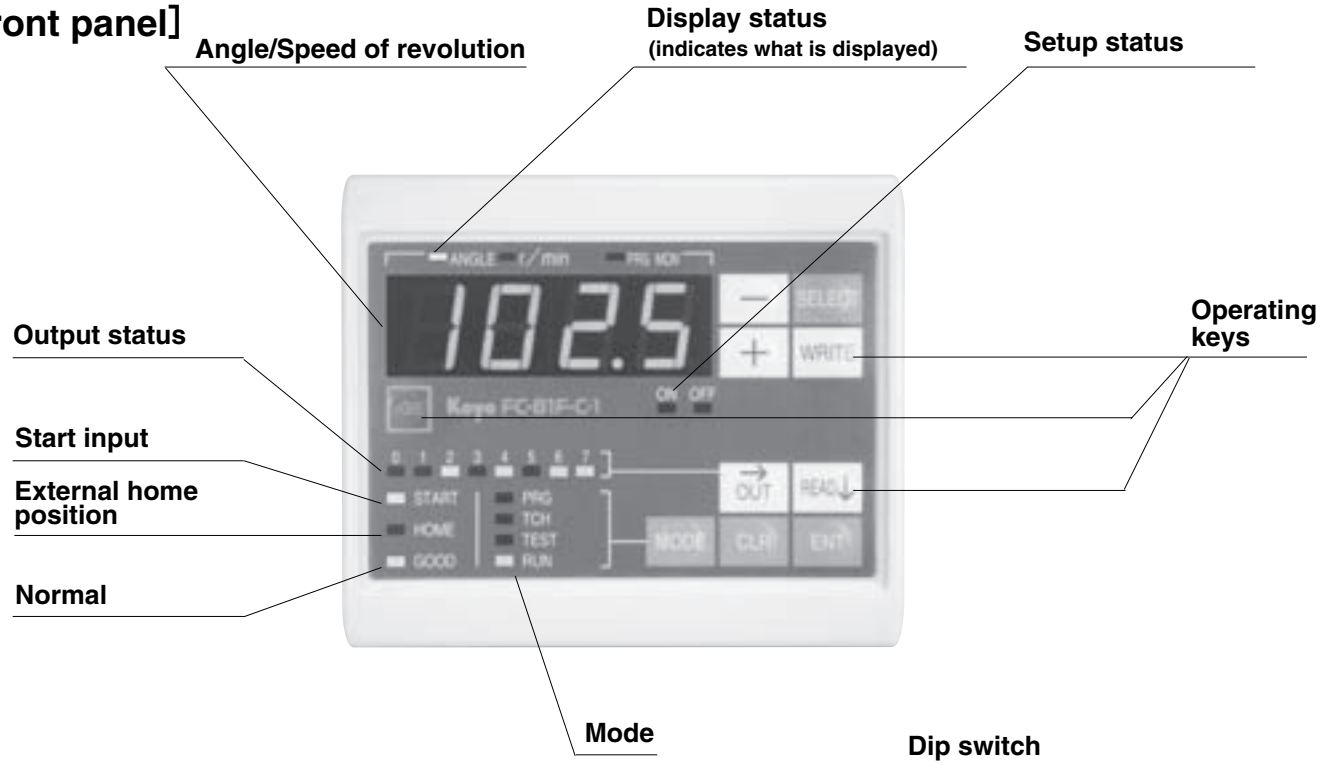
Mechanical and Performance Specifications

Item	FC-81F-C	FC-161F-C	FC-321F-C
Number of input points	Start:1 Protect: 1 Home position: 1	Start:1 Bank entry: 3 Protect: 1 Home position: 1	Start:1 Bank entry: 4 Protect: 1 Home position: 1
Encoder input	H：7.5V（OFF）／L：0～2V（ON）	H：7.5～30V（OFF）／L：0～2V（ON）	
	Resolution: 360 or 720 per revolution (output code: gray binary)		
Control input	H：7.5～30V（OFF）／L：0～2V（ON）		
Output points	8	16	32
Output specifications	NPN open collector Withstand voltage: Less than 35 V/current less than 0.1 A		
Total number of output areas	16	64	128
Number of revolutions for response r/min(rpm)	300 at resolution of 360 150 at resolution of 720	1600 at resolution of 360 800 at resolution of 720	1600 at resolution of 360 800 at resolution of 720
	Max. 550 μs	Max. 250 μs	Max. 250 μs
Output response time	Max. 2 s		
Source start time		8 (Banks 0～7)	10 (Banks 0～9)
Number of banks	—		
Memory	EEPROM		
Resolution	360 or 720 per revolution (selected with a dip switch)		
CW/CCW directional switching	Switching with a dip switch		
RUN output	Normally on in Run/Adjustment mode (switched with a dip switch)		
Display	Angle or rotation speed(selected with a dip switch)		
Home position adjustment	Home position as arbitrary position	Protect, copy, pulse output, and communication	
Special functions	Protect	RS-232C FC designated protocol	
Communication	—		
Timing function	None	Present	Present
Accessories	Metal fittings for installation		

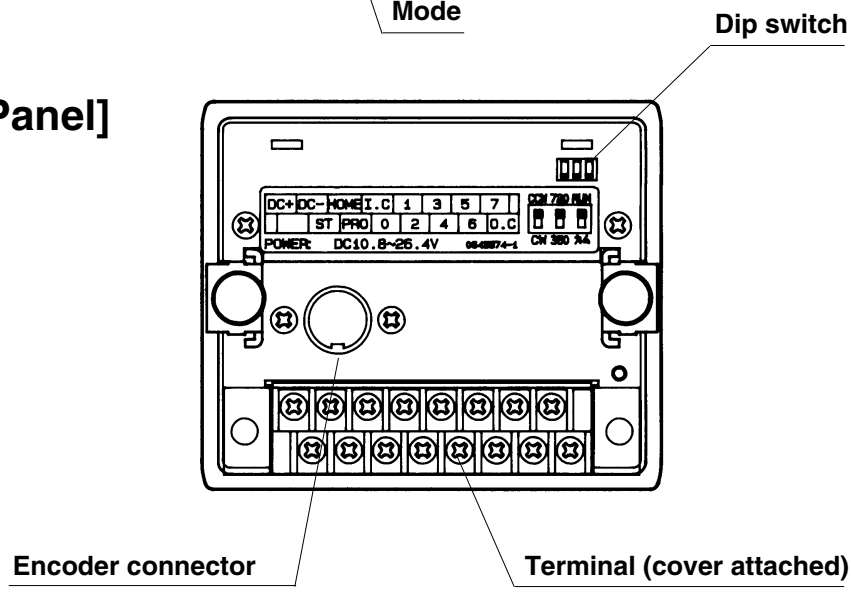
FC-81F-C

Panel Layout and Description

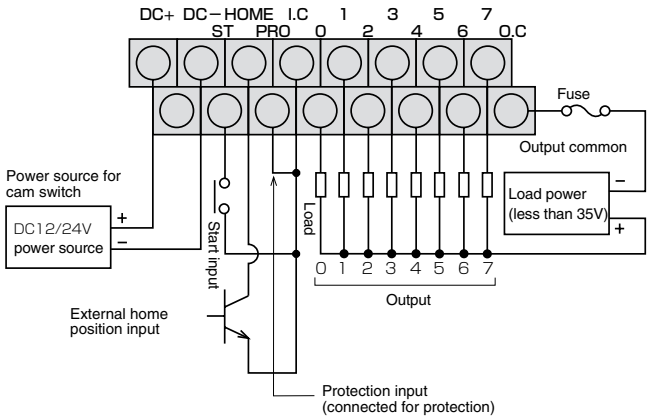
[Front panel]



[Rear Panel]



Wiring

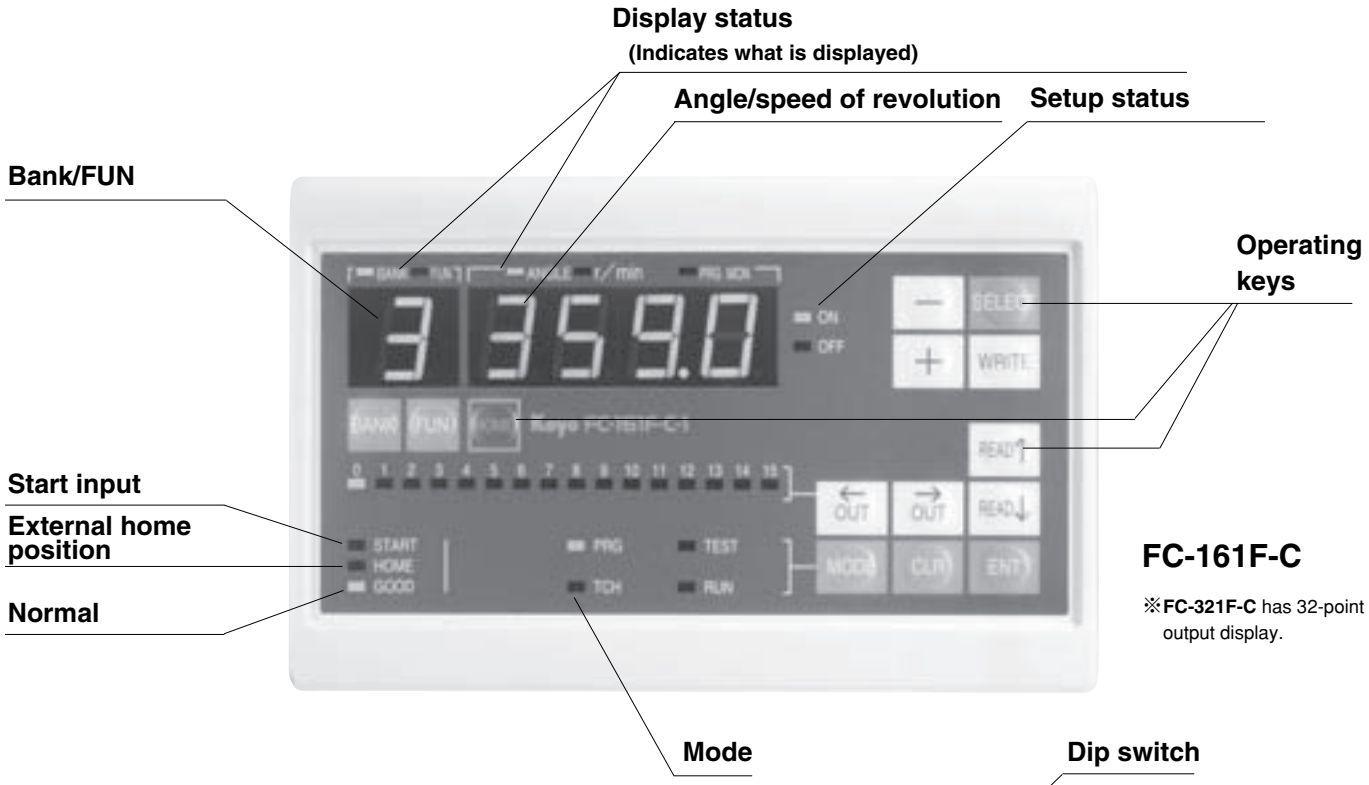


1. The external starting point input is connected for DC output with no chattering.
2. Output common (0.C), input common (1.C), and power source-(DC-) terminals are short-circuited internally.

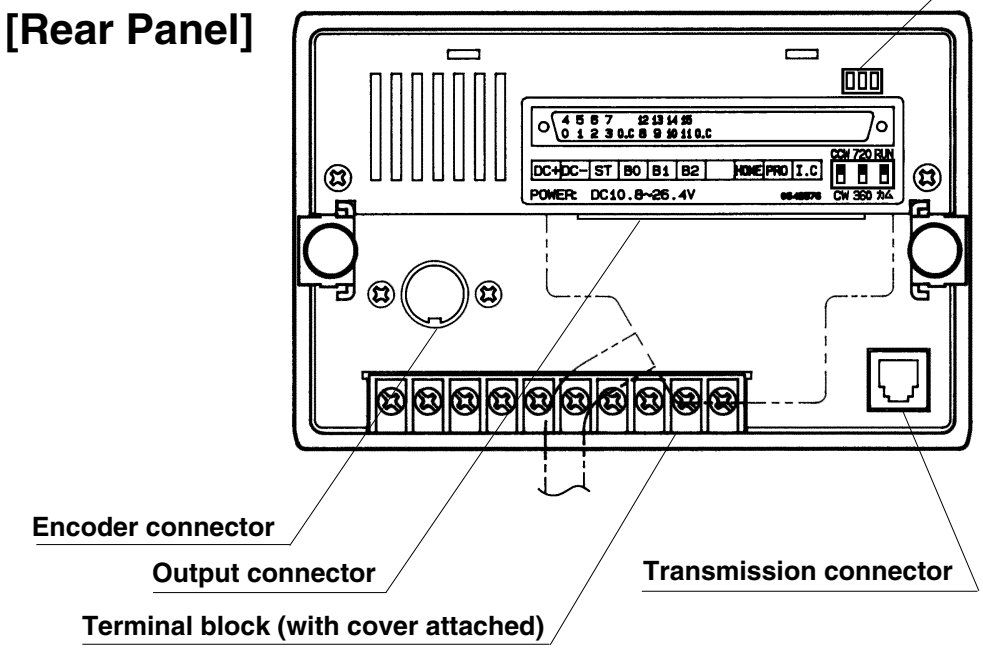
FC-161F-C/FC-321F-C

Panel Layout and Description

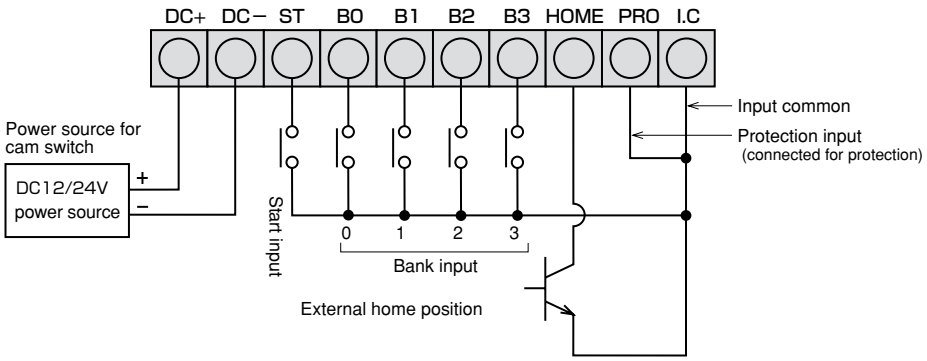
[Front panel]



[Rear Panel]

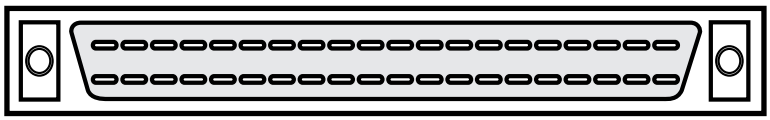


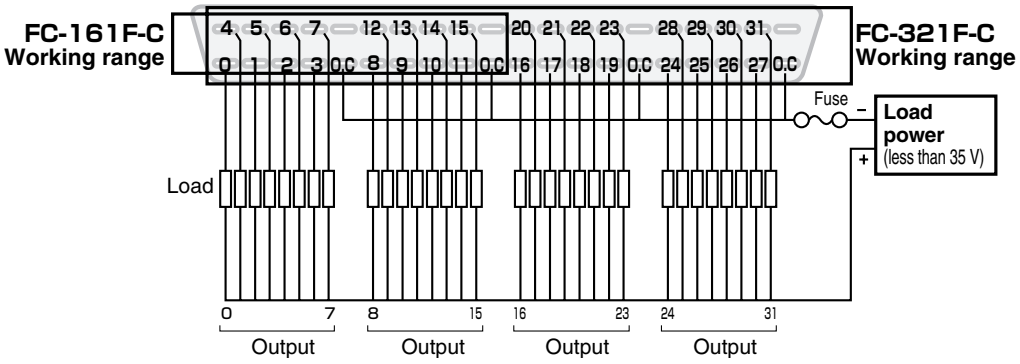
Wiring



1. Bank input 3 is for FC-321F-C only.
2. The external starting point input is connected for DC output with no chattering.
3. Output common (0.C), input common (1.C), and power source-(DC-) terminals are short-circuited internally.

Connector Pin-out

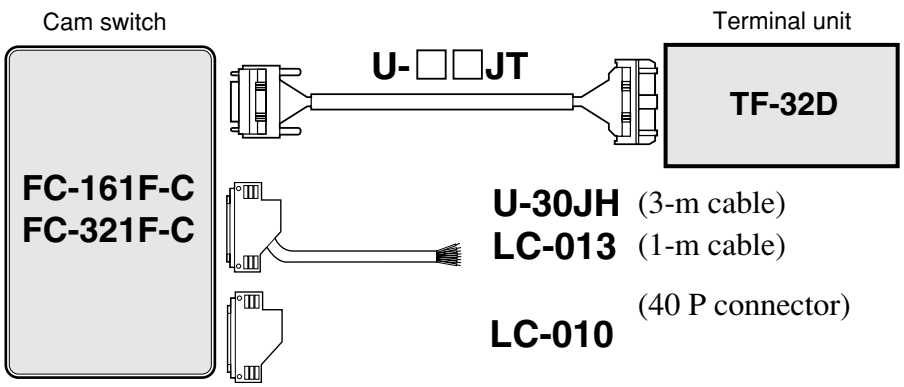




※Switching cam switch output/RUN output is possible only for 31.
Only pin-31 can be selected for either CAM output or RUN output.

Connector for Connection (optional)

Acceptable for use in rose-wire types and terminal unit types to effectively reduce wiring.



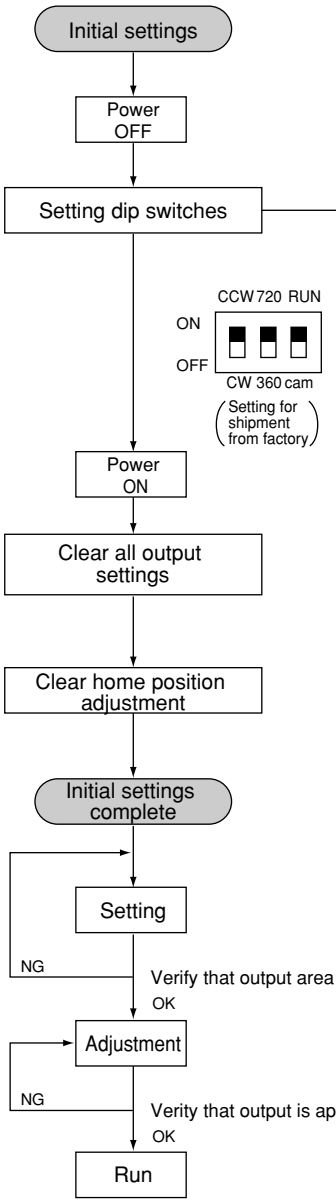
Cable connecting the cam switch and terminal unit TF-32D

U-30JH (3-m cable)
LC-013 (1-m cable)

LC-010 (40 P connector)

Fujitsu Ltd.
Connector : **FCN-361J040-AU**
Cover : **FCN-360C040-J1**

Initial Settings



Switch 1: Select the direction of rotation.
CW: Angle increase when encoder shaft is rotated in CW direction.
CCW: Angle increase when encoder shaft is rotated in CCW direction.

*Determine CW or CCW by facing the encoder shaft.

Switch 2: Select encoder resolution.
360: When using resolution of 360/revolution for the encoder
720: When using resolution of 720/revolution for the encoder

Switch 3: Select when using RUN output.
Cam: When using all output as cam output
RUN: When using specified output as RUN output*
※Possible output for RUN output
FC-81F-C: Output 7
FC-161F-C: Output 15
FC-321F-C: Output 31
RUN output is ON during normal operation when in Run/Adjustment mode; when an error occurs, it goes OFF.

●Clear all output settings in setup or teaching mode.

CLR | ON/OFF | ENT

●Clear home position adjustment in teaching mode.
(FC-161F-C: Banks 0-7
FC-321F-C: Banks 0-9)

CLR | HOME | ENT

Note) Each bank must be cleared.

●Setups for output and setups, changes and clearance for teaching mode can be done.

●Adjustment mode
Performs fine adjustment of output area settings in trial operation (When not needed, Run in Run mode).

●Run mode
Runs the device.

List of Operations

	Function	Operating procedures	Operating mode: Setting	Teaching	Adjustment	Run
1	Selecting operating mode.	MODE key selects the Mode. Selection is in sequence from the current mode →Setting →Teaching →Adjustment →Run → ENT key enters into the selected mode.	●	●	●	●
2	Selecting display	SELECT key alternates the angle and rotational speed in the display.	×	×	●	●
3	Selecting bank number	BANK （＊）The bank number. Note	●	●	×	×
4	Selecting output number	Select the output number with the push of the ←OUT key or the →OUT key. （＊）The lamp position for output display changes with each push of the key.	●	●	●	●
5	Read-out of output area settings	After specifying the bank number（※） and output number, the READ↑ key （※）or READ↓ key is pushed. Alternates ON and OFF angle.	●	●	●	●
6	Clear 1 output area settings	Clear an output area setting that has been read-out with operation of the CLR ENT keys when output area to be erased has been read-out.	●	●	×	×
7	Clear all output area settings	After selecting the bank number（※）and output number, clear output area settings with operation of the CLR →OUT (or ←OUT (※)) ENT keys.	●	●	×	×
8	Clear all output area settings within the specified bank	After selecting the bank number（※）, clear settings with operation of the CLR BANK ENT keys. However, home position adjustment settings are not cleared. Note	●	●	×	×
9	Clear all output area settings	Clears settings with operation of the CLR ON/OFF ENT keys. However, home position adjustment settings are not cleared.	●	●	×	×
10	Writing output area settings	Select the bank number* and output number. After displaying the angle to set with the ＋ or － keys, written with the ON/OFF key (ON angle and OFF angle are set in sequence).	●	×	×	×
11	Wrting output area Settings (teaching)	Select the bank number（※） and output number. After turning the encoder, the position to set is halted and written with the ON/OFF key (ON angle and OFF angle are set in sequence).	×	●	×	×
12	Setting of home position adjustment	Set the bank number（※） and stop rotating the encoder at the machinery starting point. The home position angle is selected with the HOME key. The home position becomes the written zero angle with the ON/OFF key.	×	●	×	×
13	Clear home position adjustment	Set the bank number（※）. Home position adjustment is erased with operation of the CLR HOME ENT keys and the encoder output angle is displayed as-is.	×	●	×	×
14	Change output area settings	Read-out values for the ON angle or OFF angle to set. Push the ＋ key or － key and values to change will be displayed. Then, press the ON/OFF key to write values that changed.	●	×	×	×
15	Fine adjustment of the output area settings during operation (only effective when Start input is ON)）	Read-out values for the ON angle or OFF angle to set. The angle is increased via the ＋ key and decreased via the － key. Changes are complete (fine adjustment) and output operations change at the same time.	×	×	●	×

Note) Corresponds only to FC-161F-C/FC-321F-C.

An（※）means that the FC-81F-C does not have BANK , ←OUT , or READ↑ keys.

For setting operation of special functions, refer to the Operations Manual.

Error Codes

Error code	Details	Explanation	Cause/Corrective Action
E18	Rotary encoder connection error	Rotary encoder resolution and cam switch resolution specifiecations do not match.	●Dip switch settings are incorrect. ●Verify rotary endocer resolution. ●Rotary enocder malfunction.
E19	Rotary encoder code error	Output of a rotary encoder that is not present is detected.	●Rotary enocder malfunction (not connected). ●Cut or short of the connection cable for the rotary encoder. ●Affected by external noise.
E20		Rotary encoder code not continous.	
E21	Memory change error	Contents of setting values (output, home position adjustment, or timing) have changed	●Affected by excessive noise. ●All clear and then re-input all settings.
E30	Rotational speed error	Programmable cam cannot repsond to the rotary encoder rotational speed.	●Verfity rotational speed for the rotary encoder. ●Verfity rotary encoder resolution.
Setting LED blinking	Setting value error	Output area settings overlap.	●Erase overlapping setting values or reset after changing.
		Ouput area settings are protected.	●Verify protection input.
Bank Display A ～F	Bank error	Bank input for a bank thta is not present is specified.	●Verify bank input.

Timing function for the FC-161F-C/FC-321F-C

●This function adnavces via setting of the output ON/OFF angle in proportion with the encoder's rotational speed. Effective for correction of machinery system delays.

（1） Settings/Operation

① Enter setting mode.

② Push the FUN key and specify 0.

③ Set the output number with OUT or OUT keys.

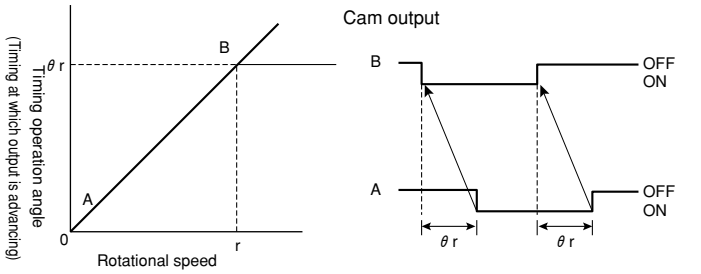
④ Set the timing rotational speed with + or − keys. Write with the ON/OFF key.

⑤ Set the timing rotational angle with + or − keys. Write with the ON/OFF key.

⑥ Push the BANK key and return to setting mode.

(2) Timing operation

$$\theta r = \frac{\text{Timing angle}}{\text{Timing rotational speed}} \times r \text{ (rotational speed that the endoder is actiually turning at)}$$



Notes:

●OFF angle should set to at 2 degrees or more. With a short delay, any change in revolution speed is reflected to the angle for the selected output.

●Revolution speed is reset to zero if angle is not incremented for 170 ms.

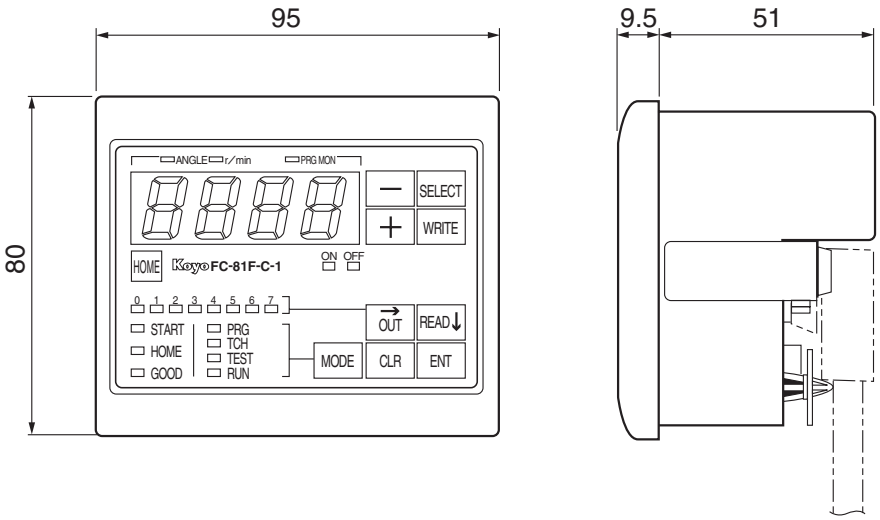
●As shown in the following table, response speed and time depend on how many dynamic angle are set. Up to eight angles can be set for the outputs 0 to 7.

Timing setting points		1	2	3	4	5	6	7	8
Output response time (ouptuptu 0-) μs		305	315	330	350	370	385	415	420
Responserotational speed (revoltons/min.)	360 resolution	1000	900	800	700	600	500	500	400
	720 resoltion	500	450	400	350	300	250	250	200

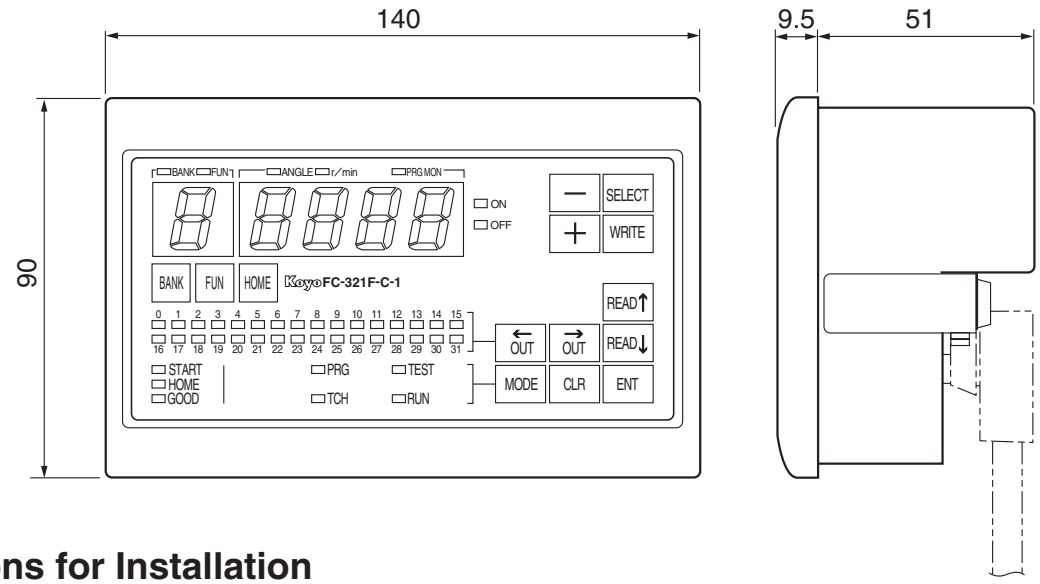
External Dimensions

(in mm)

FC-81F-C



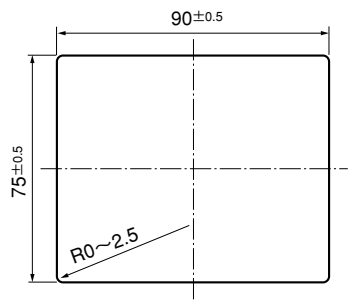
FC-161F-C
FC-321F-C



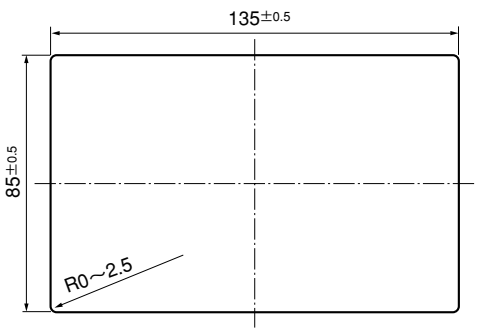
Boring Dimensions for Installation

Panel thickness
0.5-4 mm

FC-81F-C



FC-161F-C / FC-321F-C



FC-80-C/FC-160/FC-320

With their convenience and efficiency, the cam-operated switches improve your productivity. The small body allows easy installation and movement.

Surface sheet in Japanese:
FC-80-C
FC-160
FC-320
Surface sheet in English:
FC-80-C-1
FC-160-1
FC-320-1

Merits

●Easy operation
With simple key operation, you can set or check values on the digital display.

●RUN time change
You can reposition the switches during runtime.

●Easy setup
All you need for setup is simply choose programmed procedures. Ten program banks are included in the FC-320, and eight banks in the FC-160 models.

●Dynamic CAM
The FC-320 models provides eight dynamic CAM switch automatically tune the ON/OFF timing of the CAM switch. Switching timing is automatically controlled according to the actuator response and the cam rotation.

●Multi-purpose communication port
Except FC-80-C, all models integrate a port for connection to a PC. Programs and data can be transferred to and from your desktop. On the FC-160 and 320 models, programs can be copied between two corresponding banks.

●The absolute encoders for sensor
Three models of rotary encoders are available: TRD-NA, TRD-KL and TRD-K. The TRD-NA encoder is 35 mm thick, with external diameter of 50 mm. Also available are TRD-K reinforced series and TRD-KL adaptive series.

●Precise positioning
The absolute encoders provides higher precision and linearity than resolvers. They are fully compatible to one another to allow easy replacement.

●Quick response
The switches respond to cam revolving as fast as 1,600 rpm, or 800 rpm at 720 resolution.

●Protection against errors
You can prevent potential errors by short circuiting the protect terminal.

●Revolution status at a glance
The circular window displays both the direction and the position of the revolving axis.

●Home position calibration
The position and angle of the encoder is automatically adjusted.

●Applicable to DIN rails
The switch can be installed on DIN standard rails, or fixed with screws.

●Battery-less
The counter uses an EEPROM to eliminate the use of cells.

General Specifications

Item	FC-80-C	FC-160	FC-320
Source voltage	DC10.8～26.4V	AC85～264V	
Power consumption	5W	20VA	
Ambient temperature	－10～+50℃		
Storage temperature	－20～+70℃ (with no freezing)		
Ambient/Storage humidity	35～85%RH(with no dewing)		
Withstand voltage	N/A because no insulation is provided between DC power and I/O terminals.	AC 2kV for one minute for each of AC input, I/O and frame interconnections	
Insulation resistance		20MΩ for one minute for each of AC input, I/O and frame interconnections	
Vibration resistance	Durable for along three axes at 10 to 55 Hz with 0.5 mm amplitued No error along three axes at 10 to 55 Hz with 0.35 mm amplitude		
Shock resistance	Durable along three axes at 490 m/s2(50 G) No error along three axes at 98 m/s2 (10 G)		
Noise resistance*	1.0kV between power terminals (square wave pulse with 1 μs width and 1 ns rise time)	1.5kV between power terminals	
Dimensions	105×100×66（mm）	140×100×66（mm）	195×100×66（mm）
Weight	300g	450g	550g
Accessary	None		

Mechanical and Performance Specifications

Item	FC-80-C	FC-160	FC-320
Number of input points	Start: 1 Protect: 1	Start: 1 Bank entry: 3 Protect: 1	Start: 1 Bank entry: 4 Protect: 1
Resolution	360 or 720 per revolution(selected by dip switch)		
Encoder voltage	H: 7.5V(OFF)／L: 0～2V(ON)(open collector withstand voltage: Min. 14V)		
Control voltage	H: 7.5～30V(OFF)／L: 0～2V(ON)		
Output type	8	16	32 (8 points for Dynamic CAM)
Withstand voltage	NPN open collector Withstand voltage: Max. 35V／Current: Max. 0.1A／Residual voltage: Max. 1.5V		
Total number of output areas	Total 16 CAMS for 8 outputs (If could be 16 CAMS for 1 output)	Total 32 CAMS for 16 outputs (32 times per Bank)	Total 64 CAMS for 32 outputs (64 times per Bank)
Number of revolutions for responser/min(rpm)	300 at 360 resolution 150 at 720 resolution	1600 at 360 resolution 800 at 720 resolution	1600 at 360 resolution (without Dyna- 800 at 720 resolution mic CAM)
Output reseponse	Max. 550 μs	Max. 250 μs	Max. 250 μs (without Dynamic CAM)
Response to power input	Max. 2s		
Number of banks	1	8 (banks 0 to 7)	10 (banks 0 to 9)
Display	Angle or rotation speed (selected by dip switch)		
Direction	CW/CCW (selected by dip switch)		
RUN output	—	Normally ON(selected by dip switch): TEST mode※	
Home position calibration	Any position can be selected as home.		
Memory	EEPROM		
Program storage	—		SRAM memory card
Dynamic CAM	—		Outputs 0 to 7 only
Output pulse frequency	—	Any value allowable for currently selected resolution(one value for each output)	

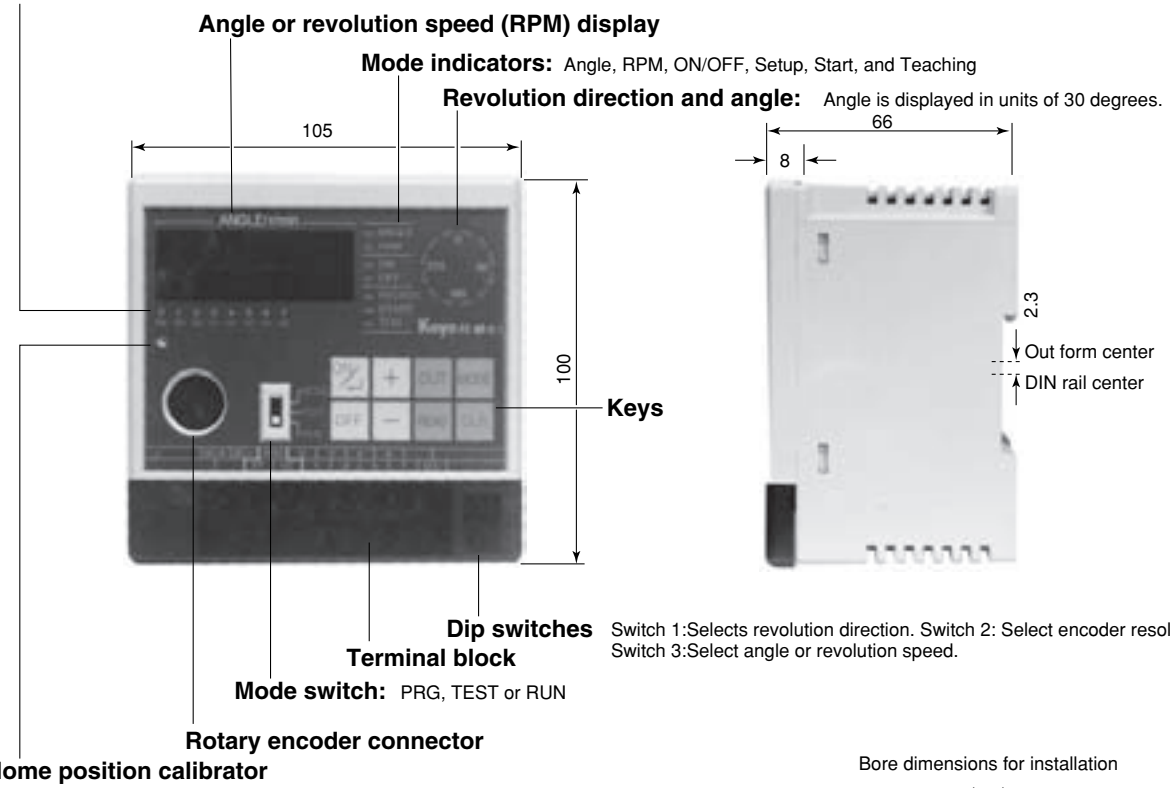
※Use dip swich to select CAM or RUN as current output.
※Memory card for FC-320, M-01F has discontinued its production.

FC-80-C

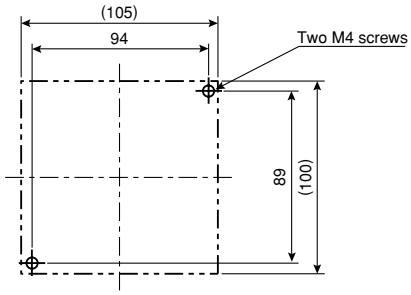
Front Panel Description and External Dimensions

(Unit: mm)

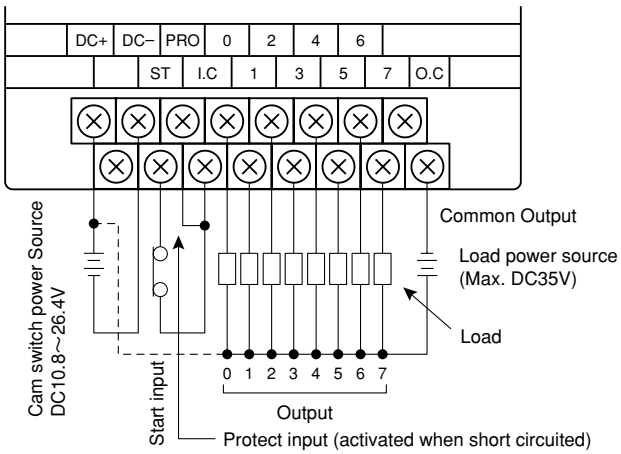
Output indicators: Indicate the currently selected output. Press the OUTPUT key to select the output number.



Bore dimensions for installation



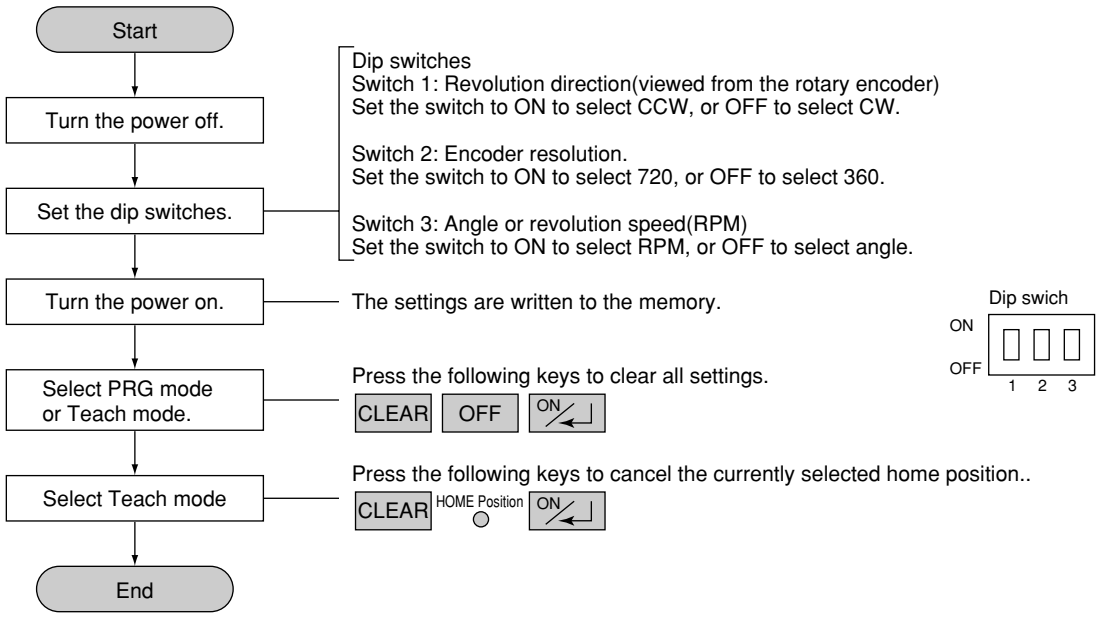
Wiring Diagram



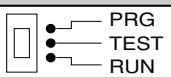
List of Error Codes

Error code	Description/Possible cause(s)	Cause/Corrective Acfion
E18	Rotary encoder connector error ● Resolution is different between the rotary encoder and the cam switch.	● Change the resolution of the rotary encoder or the cam switch. ● Check Dip switch 2 to confirm the encoder resolution. ● Repair the rotary encoder.
E19	Rotary encoder error or code discontinuity ● The rotary encoder has counted a false signal. ● The cam switch does not respond to the rotary encoder. ● The rotary encoder has generated non-sequential codes.	● Eliminate the sources of noise. ● Check Dip switch 2 to confirm the encoder resolution. ● Repair or re-connect the rotary encoder. ● Repair or re-connect the rotary encoder cables.
E21	Memory error ● Home position or other setting has been changes.	● Eliminate the sources of noise. ● Clear all settings then re-enter the correct values.
Value of LED blinking	The value is out of allowable range ● Same output has been selected more than once.	● Re-enter the correct value. ● Cancel the selection then re-select the output number.

Initializing



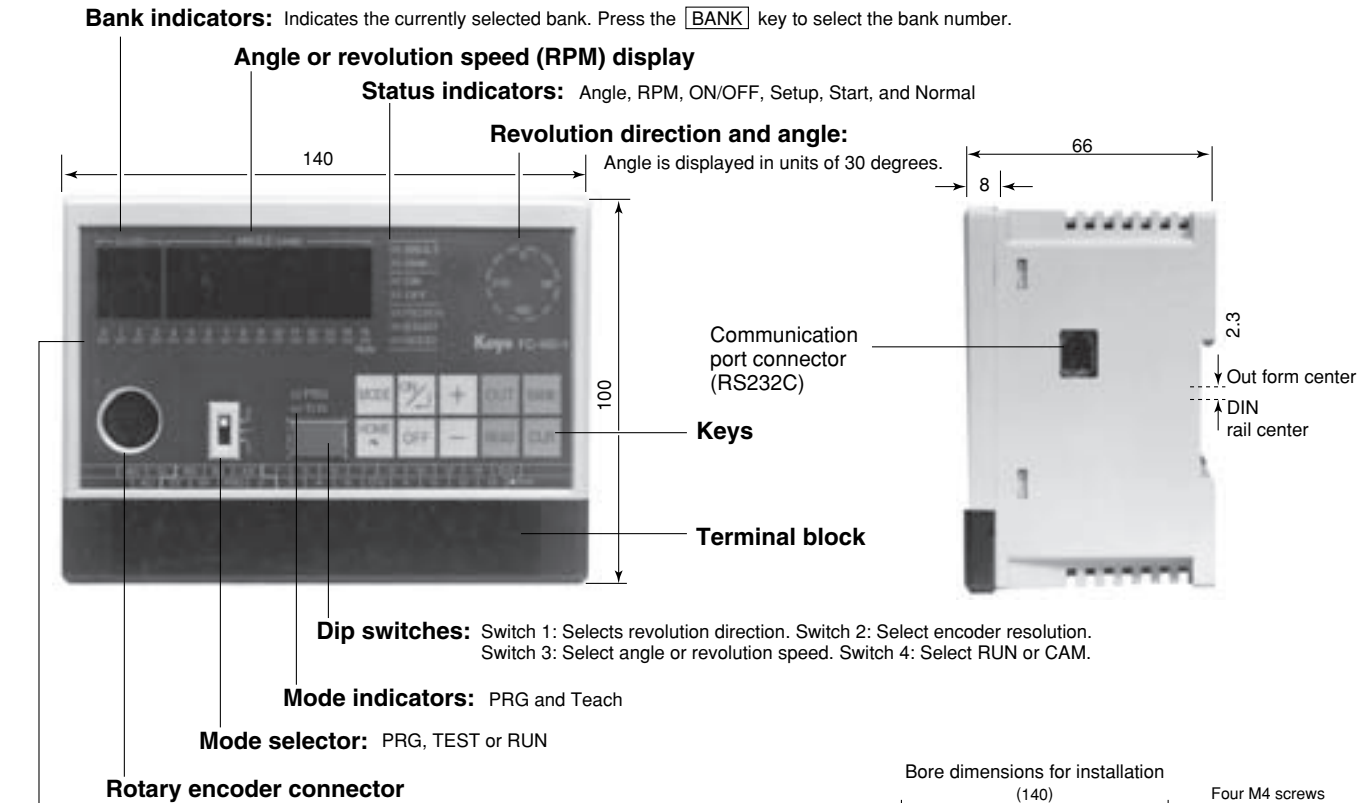
Operating procedures

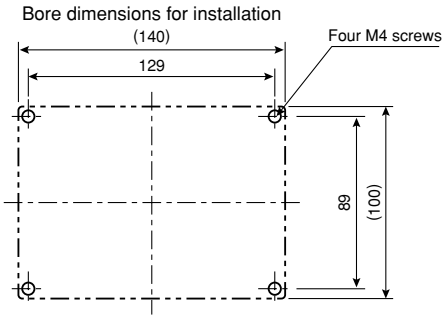
Step		Procedure	Available modes			
			PROG	Teach	TEST	RUN
1	Selecting mode	Using the Mode switch, select PRG, TEST or RUN. 	●	●	●	●
2	Selecting PRG or Teach	Press the MODE key to switch the mode between PRG and Teach.	●	●	×	×
3	Selecting output	Press the OUTPUT key to select the output number. Pressing the key once moves to the next output.	●	●	●	●
4	Reading angle	Select the output number then press the READ key. ON angle and OFF angle are read out alternately.	●	●	●	●
5	Clearing individual settings	Select the output number for the settings to be cleard, and press the CLEAR key then the ON key.	●	●	×	×
6	Clearing all output selections	Press the following keys in the order listed: CLEAR OFF ON	●	●	×	×
7	Clearing all settings (except the home position)	Press the following keys in the order listed: CLEAR OFF ON This does not delete the home positioning set up.	●	●	×	×
8	Writing settings	Select the output number for settings to be written. Using the + − keys, select the ON angle and the OFF angle. Press the ON key to write the ON angle, then press the OFF key to write the OFF angle. Writing all possible ON angles Select the "0" (or "0.0") degree, and press the ON key then the OFF key.	●	×	×	×
9	Teaching the current settings	Select the output number for settings to be written. Start the rotary encoder then stop it at the desired position. Press the ON key to write the ON angle, then press the OFF key to write the OFF angle.	●	×	×	×
10	Setting the home position	Stop the rorary encoder at the desired home position, then press the ○ key.	×	●	×	×
11	Clearing the home position	Press the CLEAR ○ key then the ON key to clear the home position. Current angle displayed.	×	●	×	×
12	Changing settings	Select the ON angle or OFF angle to be changed. Using the + − keys, change the angle selected. Press the ON key to write the new ON angle, or press the OFF key to write the new OFF angle. The ON/OFF indicator turns on then turns off.	●	×	×	×
13	Adjusting settings during operation	Select the ON angle or OFF angle to be adjusted. Using the + − keys, adjust the angle selected. The new value becomes effective upon adjustment, and is reflected to the current operation. The ON/OFF indicator flashes during adjustment.	×	×	●	×

FC-160

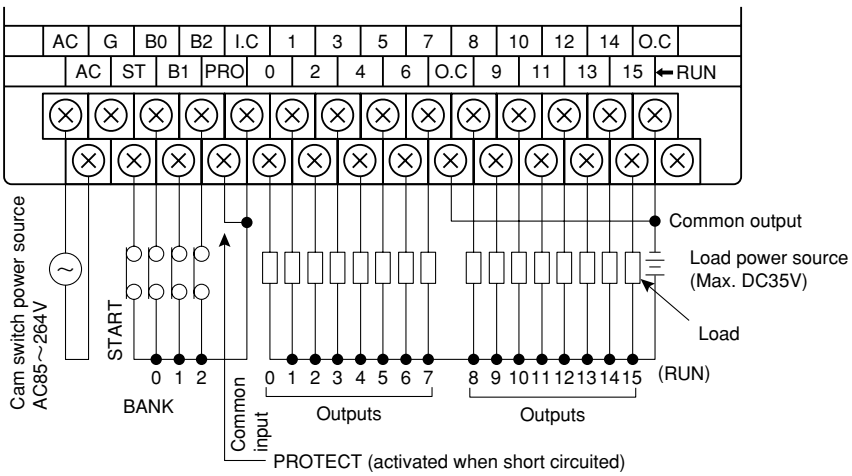
Front Panel Description and External Dimensions

(in mm)





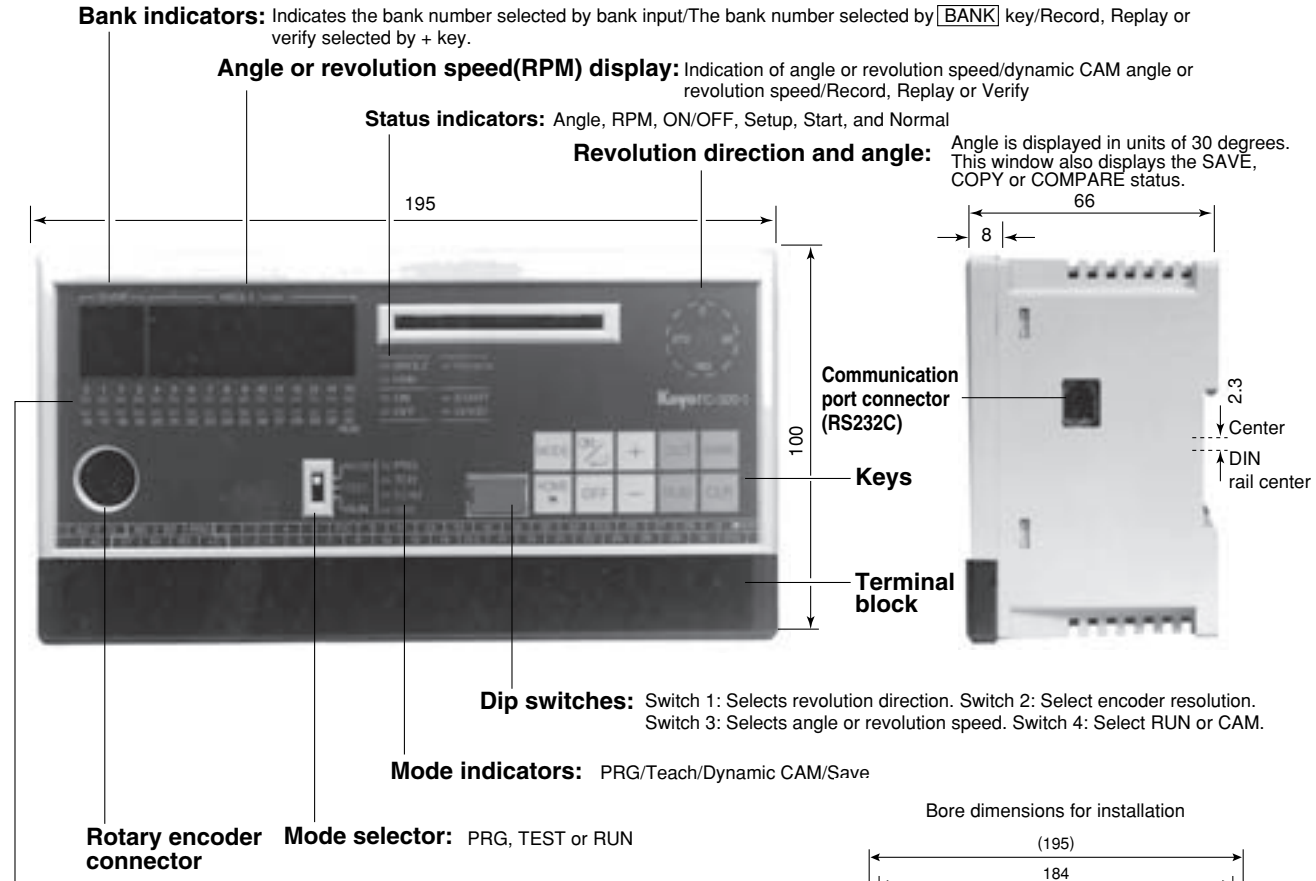
Wiring Diagram



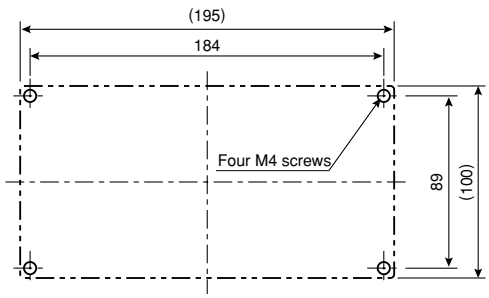
FC-320

Front Panel Description and External Dimensions

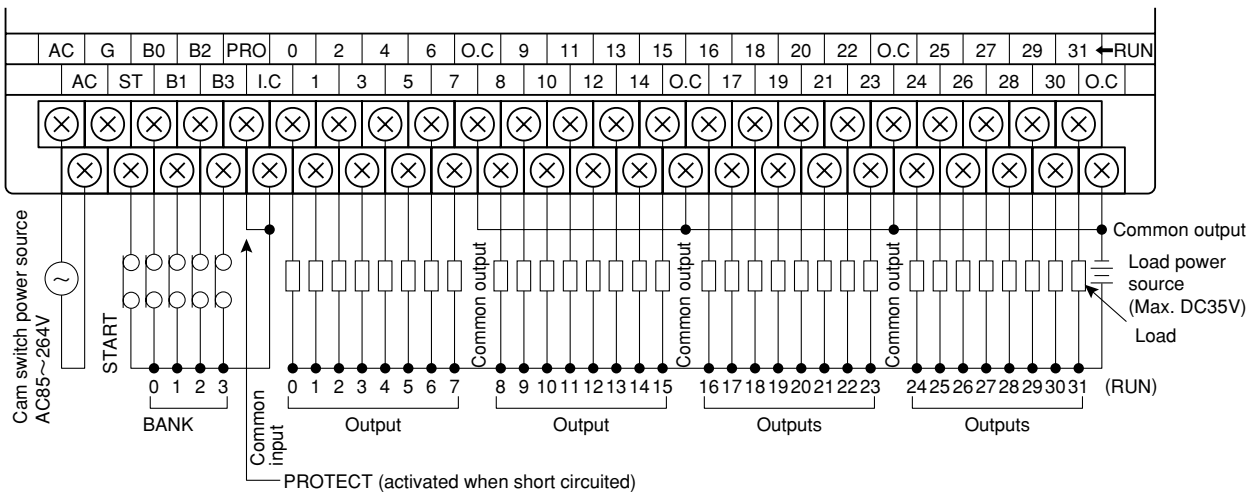
(in mm)



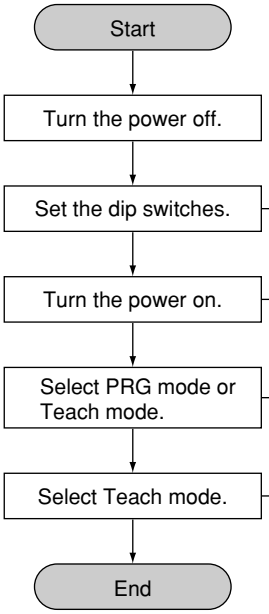
Bore dimensions for installation



Wiring Diagram



Initializing



Switch 1: Revolution direction(viewed from the rotary encoder)
Set the switch to ON to select CCW, or OFF to select CW.

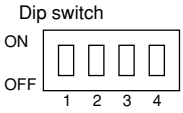
Switch 2: Encoder resolution.
Set the switch to ON to select 720, or OFF to select 360.

Switch 3: Angle or revolution speed(RPM)
Set the switch to ON to select RPM, or OFF to select angle.

Switch 4: RUN or CAM
Set the switch to ON to select RUN, or OFF to select CAM.

The settings are written to the memory.

Dip switch



Press the following keys to clear all settings.

CLEAR OFF ON

Press the following keys to cancel the home position for the currently selected bank. (FC-160: Banks 0 to 7 FC-320: Banks 0 to 9)

CLEAR Home position ON

Operating procedures

Step		Procedure	Model	Available modes PRG	TEACH	ANGLE	SAVE	TEST	RUN
1	Selecting mode	Using the Mode switch, select MODE, TEST or RUN (MODE / TEST / RUN)	FC-160	●	●	—	—	●	●
			FC-320			●	●		
2	Selecting PRG or Teach	Press the MODE key to switch the mode in the following sequence: → PRG → TEACH → D.CAM (FC-320 ONLY) → SAVE (FC-320 ONLY)	FC-160	●	●	—	—	×	×
			FC-320			●	●		
3	Selecting bank	Press the BANK key to select the bank number.	FC-160	●	●	—	—	×	×
			FC-320			●	×		
4	Reading angle	Press the OUTPUT key to select the output number. Pressing the key once moves to the next output.	FC-160	●	●	—	—	●	●
			FC-320			●	×		
5	Clearing individual settings	Select the output number then press the READ key. ON angle and frequency are read out alternately.	FC-160	●	●	—	—	●	●
		Select the output number for the settings to be cleared, and press the CLEAR key then the ON key.	FC-320			×	×		
6	Clearing all output selections	Press the following keys in the order listed: CLEAR ON	FC-160	●	●	—	—	×	×
			FC-320			×	×		
7	Clearing individual bank setting	Select the bank number and output number, then preess the following keys in the order listed: CLEAR OUTPUT ON	FC-160	●	●	—	—	×	×
			FC-320			×	×		
8	Clearing all settings for selected bank	Preess the following keys in the order listed: CLEAR OUTPUT ON	FC-160	●	●	—	—	×	×
			FC-320			×	×		
9	Clearing all settings (except the home position)	Preess the following keys in the order listed: CLEAR OUTPUT ON	FC-160	●	●	—	—	×	×
			FC-320			×	×		
10	Writing settings	Select the bank number and the output number. Using the + − keys, select the ON angle and the OFF angle. Press the ON key to write the ON angle, then press the OFF key to write the OFF angle.	FC-160	●	×	—	—	×	×
		Writing ON angle and pulse frequency Select the bank number and the output number. Using the + − keys, select the ON angle. Press the ON key to write the angle. Using the + − keys, select the pulse frequency. Press the ON key to write the frequency.	FC-320			×	×		

Step		Procedure	Model	Available modes PRG	TEACH	ANGLE	SAVE	TEST	RUN
11	Teaching the current settings	Select the bank number and input number. Start the rotary encoder then stop it at the desired position. Press the [ON] key to write the ON angle, then press the [OFF] key to write the OFF angle.	FC-160	×	●	—	—	×	×
			FC-320			×	×		
12	Setting the home position	Stop the rotary encoder at the desired home position, then press the [HOME] key.	FC-160	×	●	—	—	×	×
			FC-320			×	×		
13	Clearing the home position	Select the bank number then preess the following keys in the order listed: [CLEAR] [HOME] [ON] Current angle is displayed.	FC-160	×	●	—	—	×	×
			FC-320			×	×		
14	Changing settings	Select the ON angle or OFF angle to be changed. Using the [+] [−] key, chang the angle selected. Press the [ON] key to write the new ON angle, or press the [OFF] key to write the new OFF angle. The ON/OFF indicator turns on then turns off.	FC-160	●	×	—	—	×	×
			FC-320			×	×		
15	Adjusting settings during operation	Select ON angle OFF angle to be adjusted. Using [+] [−] keys, adjust the angle selected. The new value becomes effective upon adjustment, and is reflected the current operation.	FC-160	×	×	—	—	●	×
			FC-320			×	×		
16	Reading dynamic CAM	Select the bank number and the output number then press the [READ] key. Dynamic CAM angle and revolution speed are read out altemately.	FC-320	×	×	●	×	×	×
17	Writing dynamic CAM angle	Select the bank number and the output number. Using the [+] [−] keys, select the control angle and revolution speed. Press the [ON] key to write the settings.	FC-320	×	×	●	×	×	×
18	Clearing dynamic CAM angle	Select the bank number and the output number, and prees the [CLEAR] key then the [ON] key. Both the dynamic CAM angle and the revolution speed are set to zero. Dynamic CAM angle is cleared also by the CLEAR procedures 6,8 and 9.	FC-320	×	×	●	×	×	×
19									
20									
21									
22	Transferring data between memories	Using the communication port, connect two FC-160(or FC-320) units.	FC-160	●	×	×	×	×	×
	Select the COPY mode.	Press the CLEAR key then the MODE key."COPY" is diplayed on the circular window. Press the [ON] key again to proceed.							
	Select SAVE, LOAD or COPY.	Using the [+] [−] key, select one of the following operations.							

Operation	Bank indicator	Circular window
F	FC - E	SAVE: Saving data from the current unit.
L	E - FC	LOAD: Restoring data to the current unit.
c	- FC -	COPY: Copying data between two banks of the current unit.

Press the [ON] key again to proceed.

Select source and destination banks.

Press the [BANK] key to display all banks. Using the [ON] key, select the source and the destination. "1" or "2" flashes on the circular window to indicate source or destination as follows:

Angle/revolution speed display
① — ②

	SAVE	LOAD	COPY
①	Source	Destination	Source
②	Destination	Source	Destination

Press the [ON] key again to execute the selected operation.

FC-320

List of Error Codes

Error code	Description	Description/Possible cause(s)	Cause/Corrective Action	Note
E18	Rotary encoder connector error	Resolution is different between the rotary encoder and the cam switch	● Change the resolution of the rotary encoder or the cam switch. ● Verify the dip switch 2 to confirm the encoder resolution. ● Repair the rotary encoder.	
E19	Rotary encode error Code discontinuity	The rotary encoder has counted a false signal.	● Repair or re-connect the rotary encoder. ● Repair or re-connect the rotary encoder cables. ● Eliminate source of noise	
E20		The rotary encoder has generated nonsequential codes.		
E21	Memory error	Home position or other setting has been changed.	● Eliminate sources of noise. ● Clear all settings then re-enter the correct values.	
E30	Revolution speed error	The programmable cam does not respond to the rotary encoder.		
E70 E90～99	Communication error	Communication failed.	● Verify the mode and data for errors. ● Verify that the PROTECT terminal is connected. ● Check the communication cable, and repair if necessary. ● Eliminate sources of noise.	
E80～89		COPY operation failed.		
Value of LED flashing	Value error	The flashing values is out of allowable range	● Re-enter the correct value.	
One of the bank codes A to flashing	Bank error	Same bank has been selected more than once. Selected bank does not exist.	● Cancel the selection then re-select the bank number.	

Dynamic CAM Angle and Speed (specific to FC-320)

(1) Setting the dynamic CAM angle

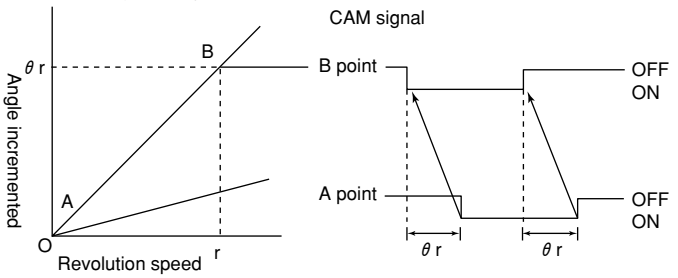
Follow the procedure "17. Writing dynamic CAM angle" described earlier.

Dynamic CAM angle determines the ON and OFF angles in relation to current revolution speed.

Dynamic CAM speed is used for setting the dynamic CAM angle, and specified in 10 rpm.

(2) Relation of Dynamic Angle and Speed

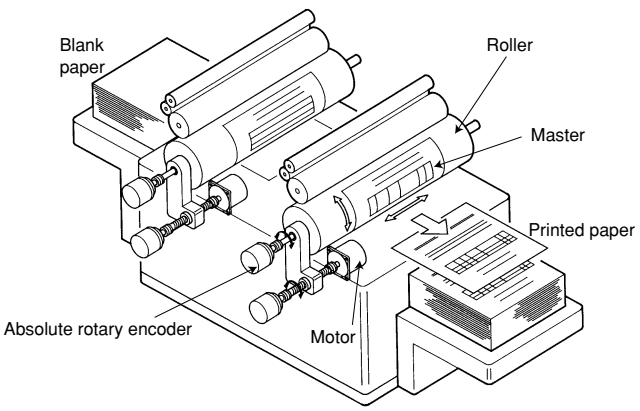
$\theta r = \frac{\text{Dynamic speed}}{\text{Dynamic angle}} \times r$ (where r is the current revolution speed.)



Notes:

- **OFF angle should be set to at least 2 degrees. With a short delay, any change in revolution speed is reflected to the angle for the selected output.**
- **Revolution speed is reset to zero if angle is not incremented for 170 ms.**
- **As shown in the following table, response speed and time depend on how many dynamic angles are set. Up to eight angles can be set for the outputs 0 to 7.**

Number of settings		1	2	3	4	5	6	7	8
Response time (μs)		345	365	380	400	420	435	465	470
Response speed (rpm)	At 360 resolution	1100	1000	900	800	700	600	500	500
	At 720 resolution	550	500	450	400	350	300	250	250



Recommended application

1. An FC series programmable cam is used to control the OFF angle of the rotary press. When mounting the master, use the clamp as the reference position.
2. A rotary encoder is used to control color densities and to position the the drive shaft of the rotary press. It can be positioned to the precision of ±1.00 mm in horizontal direction.

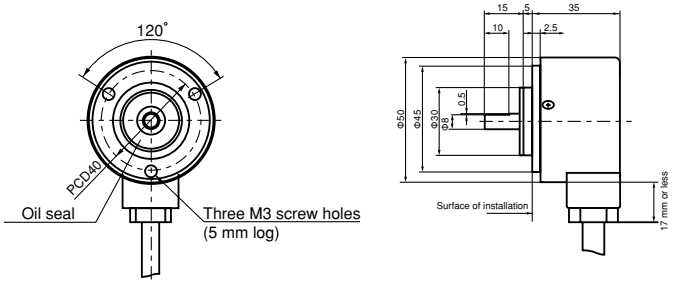
・The system helps minimize adjustments.

・Other applications include control and management of conveyors, multilayered parking lots, and manufacturing processes.

These absolute encoders are ideal for angle control. Combined with the FC series programmable cam, they improve precision and efficiency.

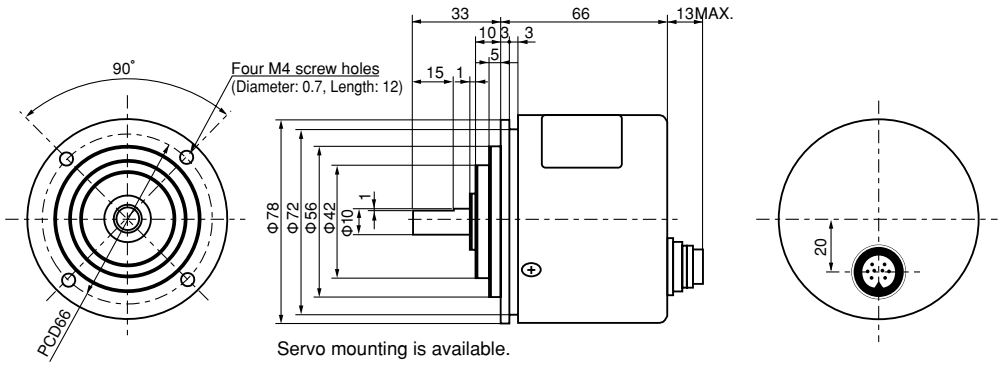
TRD-NA360NWF
TRD-NA720NWF

Small encoders with diameter of 50 mm



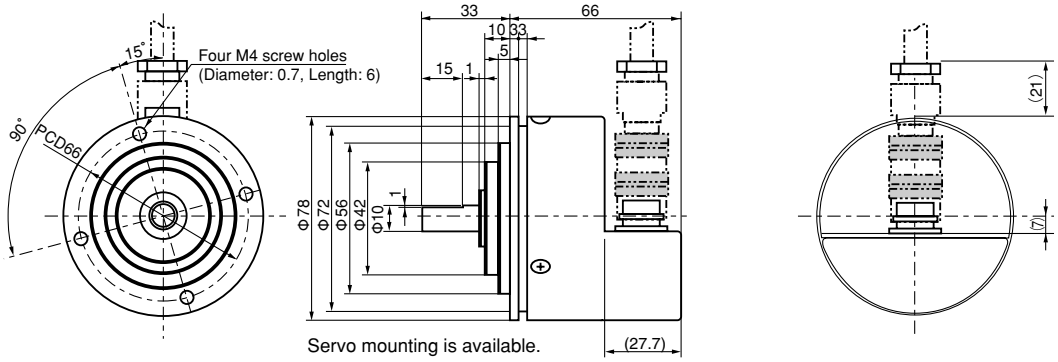
TRD-K360-YC2
TRD-K720-YC2

Robust encoders



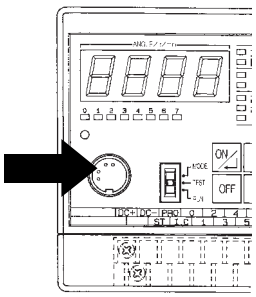
TRD-KL360-YC2
TRD-KL720-YC2

Adaptive to all environments

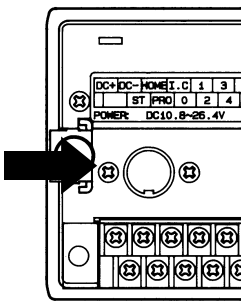


Terminal connection

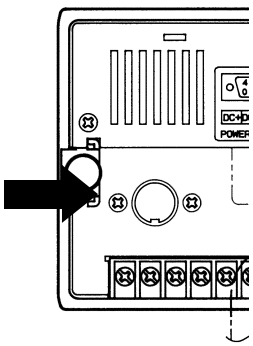
FC-80-C/FC-160/FC-320

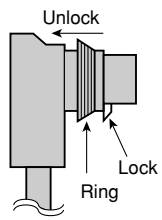


FC-81F-C (Rear face)

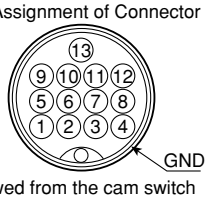


FC-161F-C/FC-321F-C (Rear face)





Pin Assignment of Connector

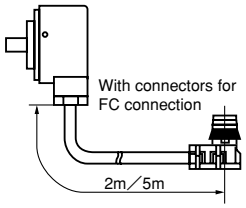
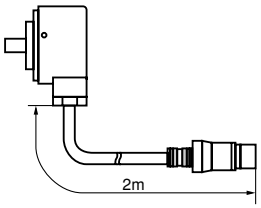
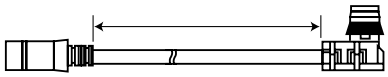
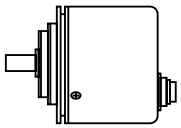
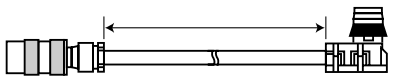
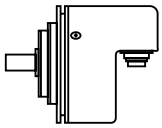
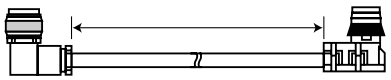


Viewed from the cam switch

Pin No.	Bit location and value 720	360	Pin No.	Bit location and value 720	360
1	0V	←	8	bit6(2^6)	bit5(2^4)
2	12V	←	9	bit7(2^6)	bit6(2^5)
3	bit1(2^0)	Not connected	10	bit8(2^7)	bit7(2^6)
4	bit2(2^1)	bit1(2^0)	11	bit9(2^8)	bit8(2^7)
5	bit3(2^2)	bit2(2^1)	12	bit10(2^9)	bit9(2^8)
6	bit4(2^3)	bit3(2^2)	13	Not connected	←
7	bit5(2^4)	bit4(2^3)			

Note: 720 and 360 indicate resolution.

Connectors for the rotary encoders

Absolute rotary encoder		Connector and cable			
Model	Appearance	Appearance	Cable length	Model	Note
Models with standard connectors TRD-NA□NWF TRD-NA□NWF5M		—	—	—	—
Models with relays and connectors TRD-NA□NWE (NPN)			3m	F-30GF	360/720 resolution
			5m	F-50GF	
			10m	F-100GF	
Models with built-in connectors TRD-K□-YC2			2m	F-20ANC2	360 resolution
			5m	F-50ANC2	
			2m	F-20BNC2	720 resolution
			5m	F-50BNC2	
Models with built-in connectors TRD-KL□-YC2			2m	F-20ANC2A	360 resolution
			5m	F-50ANC2A	
			2m	F-20BNC2A	720 resolution
			5m	F-50BNC2A	

FC-21

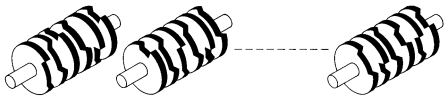
Using an absolute encoder, these switches can turn twenty four devices on and off at specified angles.

Merits

●Easy to operate programmer

Using the E-15PJ cable, the FC-20P programming unit allows both local and remote operations.

●Up to ten banks for program storage



Bank 0 for program 0 **Bank 1 for program 1** **Bank 9 for program 9**

Resolution	Times of programmed switching
360	180/device
512	256/device
720	360/device
1024	512/device

- Angles can be controlled to a precision of one degree.
- Resolution can be set to 360, 512, 720 or 1,024.

●Battery-less

The switches use an EEPROM to eliminate the use of cells.

●Dynamic programming

You can re-program procedures during runtime.

●Tape storage

The FC-models support tapes for storage of programs.

●Home position calibration

The position and angle of the encoder is automatically adjusted.

●Write-protected programs

You can protect your programs from writing, modification and removal.

●Teach option

During setup, you can customize your programs according to your needs.

●Self diagnosis

During operation, any errors are reported with displayed codes.

Front Panel Layout and Description

Position display
- ON or OFF angle, home position, selected key or mode (PRG, TEST or RUN mode)
- Angle after home position calibration(TEST or RUN mode)
- Revolution speed (TEST or RUN mode)

Output status display
- Cam numbers and status (PRG, TEST or RUN mode)
- Output status after angle input (TEST or RUN mode)

Use SHF key to switch cams between 1 to 16 and 17 to 24.

Bank display
- Bank selected by BANK key(PRG or RUN mode)
- Bank selected by BANK SELECT signal(TEST or RUN mode)
- 4th digit of position value

FC-20P Programmer

ON/OFF	: Lights when ON angle is displayed. Flashes when OFF angle is displayed.
RUN	: Lights in TEST or RUN mode.
(SHF)	: Flashes when SHF key is pressed.
POWER	: Lights when power is on.
CPU	: Lights when an error occurred on CPU.

Decimal point key

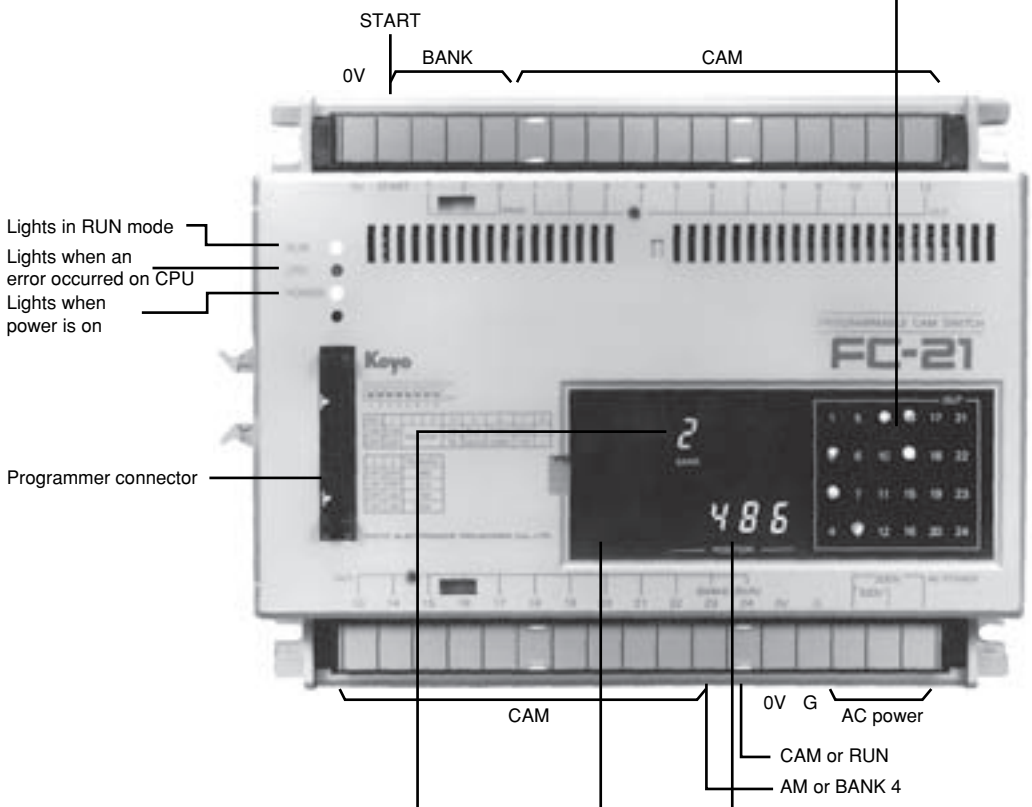
Ten keys

BNK key:	Selects a bank in PRG or run mode.
OUT key:	Selects a cam in PRG, TEST or RUN mode.
REF key:	Reads angle in PRG, TEST or RUN mode.
TCH key:	Reads home position in PRG, TEST or RUN mode. Select Teach option in PRG mode.
SHF key:	Selects a cam range, or selects a specific operation in combination with another key.
F key:	Selects a function specific to FC-21.

+ key:	Increments angle by one degree in TEST mode. Increments angle by one degree during output status display in all modes.
− key:	Decrements angle by one degree in TEST mode. Decrements angle by one degree during output status display in all modes.
↓ key:	Displays ON/OFF angle in PRG, TEST or RUN mode.
↵ key:	Executes a program.
C key:	Clears a setting, error, cam selection, or previous operation in PRG mode, or clears readout value in TEST or RUN mode.
SHF + (SAVE)	: Saves program in PRG mode.
SHF − (LOAD)	: Restores program in PRG mode.
SHF ↓ (VERIFY)	: Checks program with tape.

Output status display

- Cam numbers and status (PRG, TEST or RUN mode)
- Output status after angle input(TEST or RUN mode)



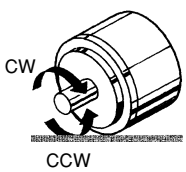
Bank display

- Bank selected by BANK key (PRG mode)
- Bank selected by BANK SELECT signal (TEST or RUN mode)

Position or revolution speed display

- ON/OFF angle, home position or key status (PRG mode)
- Angle after home position calibration (TEST or RUN mode)
- Revolution speed (TEST or RUN mode)

Dip switches



FC-21

Switch number		1	2	3	4	5	6	7	8
Select		Direction	Resolution	Resolution	Number of output points	CAM 24	Write protect	Allowable range at 720 resolution	Reserved
Position	ON	CCW*	512･1024/revolution	720･1024/revolution	24	RUN	Enable	0～359.5	—
	OFF	CW*	360･720/revolution	360･512/revolution	16	CAM	Diable	0～719	—

*CW means the current value increases when the switch turns clockwise, viewed from the encoder axis and CCW means the current value increases when the switch turns counter clockwise, viewed from the encoder axis.

General Specifications

Items	Specification
Source voltage	FC-21 : AC90～120V／180～240V 50/60Hz
	FC-21-1: AC93～126V／195～264V 50/60Hz
Power consumption	30VA
Ambient temperature	0～＋50℃
Storage temperature	－20～＋70℃ (with no freezing)
Ambient/Storage humidity	35～85％RH (with no dewing)
Withstand voltage	AC 2kV 1min. (Each of AC input, I/O and frame interconnections)
Insulation resistance	Min. 20MΩ DC500V (Each of AC input, I/O and frame interconnections)
Vibration resistance	Durable for along three axes at 10 to 55 Hz with 0.5 mm amplitude No error along three axes at 10 to 55 Hz with 0.35 mm amplitude
Shock resistance	Durable along three axes at 98 m/s² (10 G)
Noise resistance	1kV between power terminals(square wave pulsa with 1 μs width, 1 ns rise time, positive/negative polarity, source synchronization and 0 to 360° phase)
Weight	2kg

●Storage tape interface

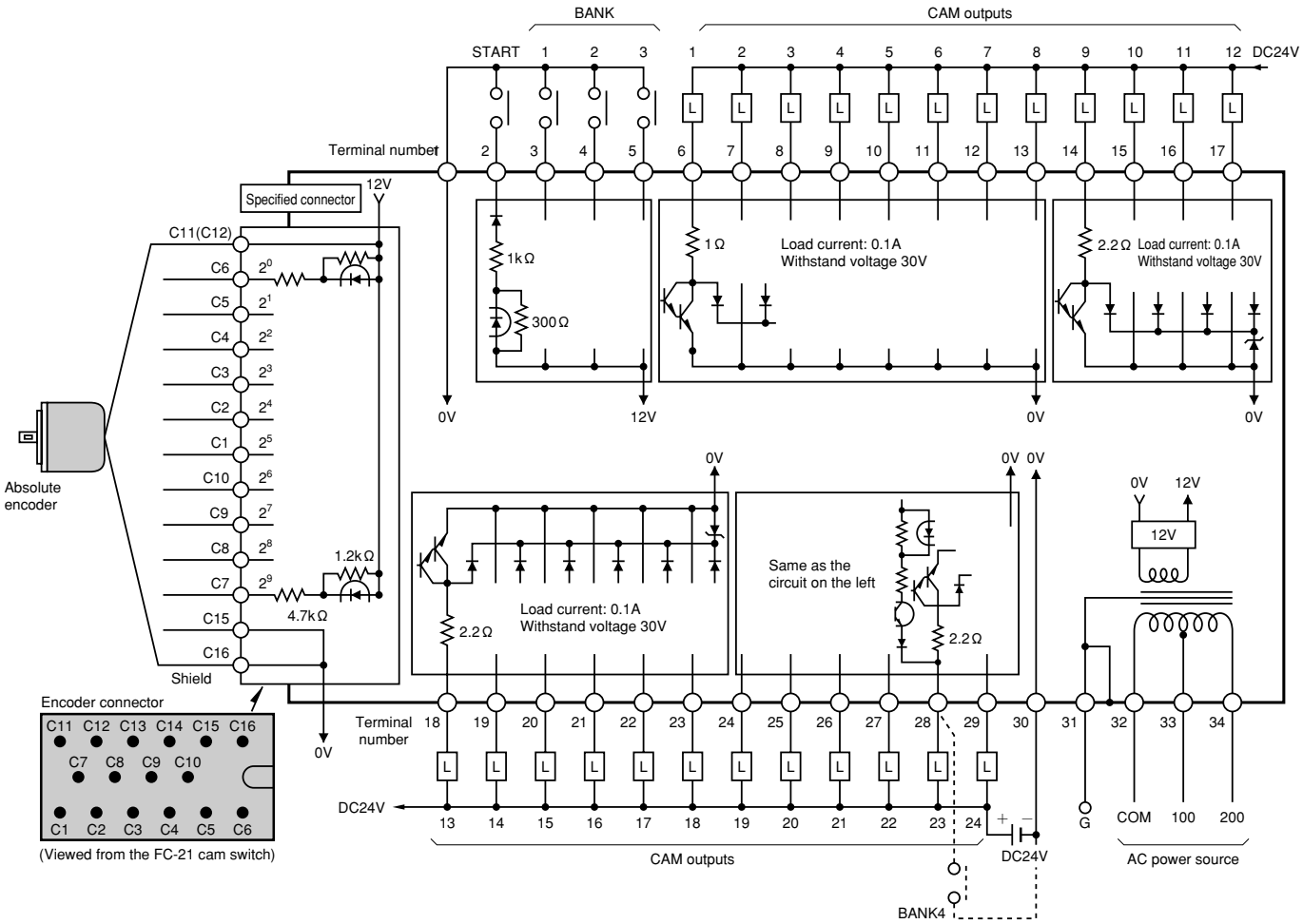
Item	Specification
Baud rate	830
Modulation	FSK "1" : 2kHz ／ "0" : 1kHz
Head/ End Mark	2kHz
File numbers	0 to 999 arbitrarily

Note: Use data recorder designed for personal computers.
Music tape recorder are not recommended.

Mechanical and Performance Specifications

<table>
<tr><td rowspan="2">Item</td><td colspan="5">Specification</td></tr>
<tr><td colspan="5">FC-21</td></tr>
<tr><td>Number of input points</td><td colspan="5">RUN: 1
BANK: 4</td></tr>
<tr><td>Encoder inut</td><td colspan="5">10-bit Gray binary codes
Use connector specific to the encoder.</td></tr>
<tr><td>Resolution</td><td colspan="5">360, 512, 720 or 1,024 per revolution (selected by dip switch)</td></tr>
<tr><td>Number of output points</td><td colspan="5">24 or 16 (selected by dip switch)</td></tr>
<tr><td>Output type</td><td colspan="5">Photo-isolated transistor open collector
Voltage: 30V 0.1A (outputs 1～24)</td></tr>
<tr><td>RUN</td><td colspan="5">Normally ON in TEST or RUN mode
May be switched to CAM 24 by dip switch.</td></tr>
<tr><td>Times of ON/ OFF switching</td><td colspan="5">Max. 180 at 360 resolution
256 at 512 resolution
360 at 720 resolution
512 at 1,024 resolution</td></tr>
<tr><td rowspan="5">Response revolution speed</td><td>ON-OFF interval</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>resolution 360</td><td>3600rpm</td><td>2400rpm</td><td>1200rpm</td></tr>
<tr><td>resolution 512</td><td>2520rpm</td><td>1680rpm</td><td>840rpm</td></tr>
<tr><td>resolution 720</td><td>1800rpm</td><td>1200rpm</td><td>600rpm</td></tr>
<tr><td>resolution 1024</td><td>1260rpm</td><td>840rpm</td><td>420rpm</td></tr>
<tr><td rowspan="10">Number of banks/programs</td><td>Number of banks</td><td colspan="2">Resolution</td><td>Number of outputs</td></tr>
<tr><td>10</td><td colspan="2" rowspan="2">360</td><td>16</td></tr>
<tr><td>7</td><td>24</td></tr>
<tr><td>7</td><td colspan="2" rowspan="2">512</td><td>16</td></tr>
<tr><td>4</td><td>24</td></tr>
<tr><td>5</td><td colspan="2" rowspan="2">720</td><td>16</td></tr>
<tr><td>3</td><td>24</td></tr>
<tr><td>3</td><td colspan="2" rowspan="2">1024</td><td>16</td></tr>
<tr><td>2</td><td>24</td></tr>
<tr><td>Direction</td><td colspan="5">CW or CCW(viewed from encoder)(selected by dip switch)</td></tr>
<tr><td>Write-protect</td><td colspan="5">ON or OFF (selected by dip switch)
Select ON to disable write, modification and removal.</td></tr>
<tr><td>Home position</td><td colspan="5">0～359 at 360 resolution
0～511 at 512 resolution
0～719 at 720 resolution
0～1023 at 1024 resolution</td></tr>
<tr><td>Program memory</td><td colspan="5">EEPROM</td></tr>
<tr><td>Output status display</td><td colspan="5">Programmer panel: Red LED for 16 outputs from 1 to 16 or 17 to 24
Main panel: Red LED for 24 outputs）</td></tr>
<tr><td>Bank status display</td><td colspan="5">Programmer panel: Red LED for 1-digit numbers with height of 8 mm
Main panel: Red LED for 1-digit numbers with height of 8 mm</td></tr>
<tr><td>Position display</td><td colspan="5">Programmer panel: Red LED for 3- or 4-digit numbers with height of 8 mm
Main panel: Red LED for 4-digit numbers with height of 8 mm</td></tr>
</table>

FC-21
I/O Circuits



Terminal Assignment

No.	Name	Function	Description
1	0V	Negative common	Terminal common to negative I/O
2	START	START input	Disables all CAM outputs when turned off (except in RUN mode)
3	BANK1	BANK SELECT input	Selects a bank.
4	BANK2		
5	BANK3		
6 ⟆ 27	OUT1 ⟆ OUT22	CAM outputs	Turn corresponding outputs on or off according to current settings. NPN open collector output: DC24V 0.1A Withstand voltage: Max. 30V
28	OUT23 BANK4	CAM/BANK switch	Selects BANK 4 when resolution is 360 and number of outputs is 16. Otherwise, selects CAM 23.
29	OUT24 RUN	CAM/RUN switch	OUT 24 can be switched to CAM or RUN
30	0V	Negative common	Terminal common to negative I/O
31	G	GND	Grounds chassis or transformer shielded cable.
32	COM	100V 200V	AC power source
33	100		
34	200		

Input Specification

No.	Name	Function	START input		Input voltage	
			ON	OFF	ON	OFF
C1 ⟆ C10	2^0～2^8	Encoder input	3mA	Max. 0.2mA	Max. 2V	Min. 10V
2	START	START input	12mA	Max. 2mA	Max. 4V	Min. 8V
3	BANK1	BANK input	12mA	Max. 2mA	Max. 4V	Min. 8V
4	BANK2					
5	BANK3					
23	BANK4					

●Encoder power source

No.	Name	Function	Output voltage tolerance	Output capacity
C11 (C12)	+12V	Encoder power source	DC10.8～13.2V	Max. 70mA

I/O signals

ENCODER "L" active

ENCODER signal is used to control the absolute encoder and the cam switch. To enter this signal, connect the encoder connector to the cam switch connector. Using Dip switches 2 and 3, set the resolution to 360, 512, 720 or 1,024. This resolution determines the number of banks. For details, refer to the description of the BANK SELECT signal.

FC-21

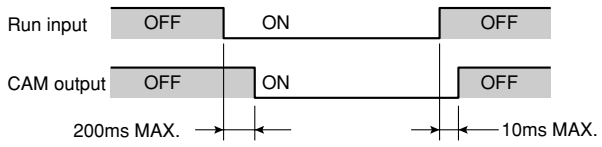
Resolution	360	512	720	1024
Dip switch 2	OFF	ON	OFF	ON
Dip switch 3	OFF	OFF	ON	ON

●Applicable models of absolute encoders

TRD-K□-YCS (Resolution: 360, 512, 720 or 1,024)
TRD-K□-YPS (Resolution: 360, 512, 720 or 1,024)
TRD-K□-YC2 (Resolution: 360, 512, 720 or 1,024)
TRD-KL□-YC2 (Resolution: 360, 512, 720 or 1,024)
TRD-NA□NW□ (Resolution: 360, 512, 720 or 1,024)

START "L" active

The START signal controls the CAM output signals according to programmed instructions. All CAM outputs are turned off when the START signal turns to the HIGH level.



BANK SELECT "L" active

BANK SELECT signals are used to select a bank (i.e. program). Banks are selected as shown in Tables A below. Tables B show the number of available banks in relation to resolution and the number of outputs.

FC-21

BANK SELECT signal		1	2	3	4*
BANK SELECT	0	OFF	OFF	OFF	OFF
	1	ON	OFF	OFF	OFF
	2	OFF	ON	OFF	OFF
	3	ON	ON	OFF	OFF
	4	OFF	OFF	ON	OFF
	5	ON	OFF	ON	OFF
	6	OFF	ON	ON	OFF
	7	ON	ON	ON	OFF
	8	OFF	OFF	OFF	ON
	9	ON	OFF	OFF	ON

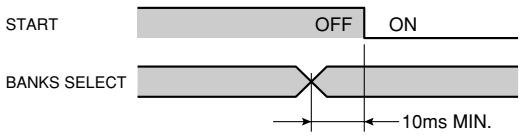
Table A

Number of banks	Resolution	Number of banks
10	360	16
7	360	24
7	512	16
4	512	24
5	720	16
3	720	24
3	1024	16
2	1024	24

Table B

*BANK 4 is used as an output terminal when the number of outputs is 24.

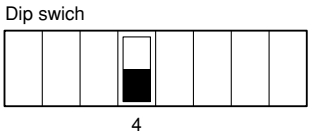
As shown below, a bank should be selected before the START signal is turned on.



CAM "L" active

CAM signal turns on or off according to programmed angle. Using Dip switch 3 or 4, set the number of outputs to 16 or 24.

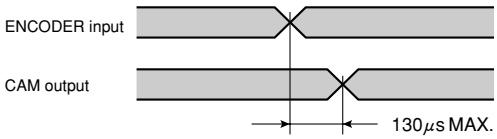
FC-21



The following table shows the output numbers selected:

	Number of outputs	Output numbers	Terminal numbers
OFF	16	1～16	6～21
ON	24	1～24	6～29

In response to ENCODER signal, CAM signal delays as follows:



RUN "L" active

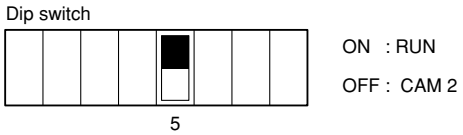
RUN signal turns on or off to indicate the status in different modes as follows:

Status	Mode		
	PRG	TEST	RUN
CPU error	OFF	OFF	OFF
Memory error	OFF	OFF	OFF
Low voltage	OFF	OFF	OFF
Other errors*	OFF	OFF	OFF
Normal	OFF	ON	ON

***Depending on the error, RUN may not turn off.**

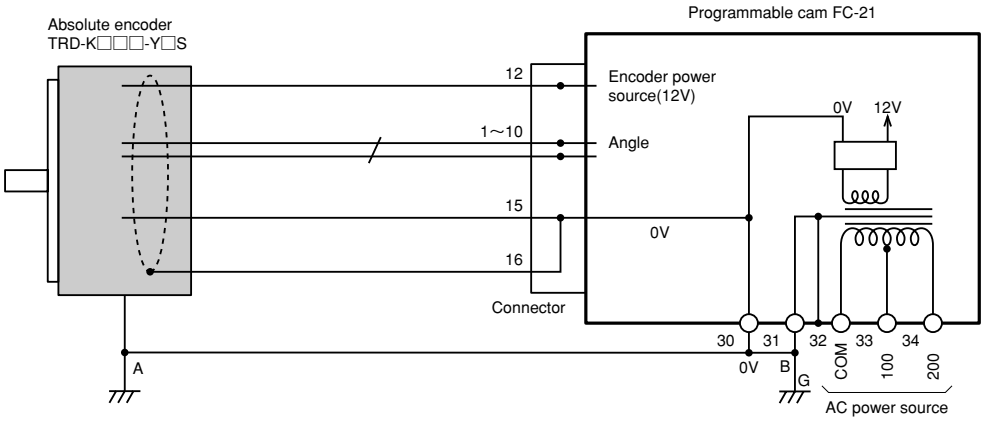
CAM 24 can be switched to RUN by the dip switch 4 or 5. In this case, the number of outputs is reduced to 23.

FC-21



RUN turns on within 35 seconds after PRG mode is switched to RUN mode or TEST mode.

Connecting the encoder and the programmable cam



- Keep the encoder cable away from power lines of motors and clutches.
- The shielded cable of the encoder is not connected to its ground cable or the frame. Using the specified connector, connect it to the 0 V terminal.
- Connect the 0 V terminal 30 to the ground terminal 31.
- Using a cable with a section area of 3 to 5.5 mm^2 connect the points A and B as shown.

Initializing the programmable cam

1	Turn the power off. Connect the FC-20P programmer and the encoder to the cam switch. Set the dip switches to the desired positions. Write protect should be set to OFF.
2	Select the PRG mode, then turn the power off.
3	According to the dip swich setting, memory allocation. ●For the code output setting end origirl calibration valve vary. Perform Step 20.

Programming procedures

Step		Procedure	Available modes			FC-21
			PRG	TEST	RUN	
1	Selecting PRG mode	Using the Mode switch, select the PRG mode.	●			●
2	Selecting TEST mode	Using the Mode switch, select the TEST mode.		●		●
3	Selecting RUN mode	Using the Mode switch, select the RUN mode.			●	●
4	Selecting bank	BNK [ ] [↵] Press the BANK key to select the bank number.	●		●	●
5	Clearing all settings for selected bank	Press the following keys in the order listed: [C] [3] [4] [8] [↵] Except the home position, all settings for the specified bank are cleared.	●			●
6	Intializing the home position	Press the following keys in the order listed: [REF] [↓] [0] [↵]	●			—
7	Writing cam settings	OUT [ ][ ] [↵] [↓] [ ][ ][ ] [↵] [ ][ ][ ] [↵] Cam number / Output number — ON angle — OFF angle Omit the cam number if it is already selected.	●			●
8	Teaching the cam settings	OUT [ ][ ] [↵] [↓] TCH [Run the machine being controlled] [↵] TCH [Run the machine being controlled] [↵] Cam number — Current ON angle — Current OFF angle Omit the cam number if it is already selected.	●			●
9	Reading ON angle	OUT [ ][ ] [↵] [ ][ ][ ] [↓] Cam number — ON angle(may be omitted) ON angle closest to the entered value is read out. If the value is omitted, positive ON angle closest to zero is read out. Using the [↓] [↓] keys, specify other ON angles to be read.	●	●	●	●
10	Reading cam status Cam number Cam status	OUT [↵] [ ][ ][ ] [↓] Angle (may be omitted) Cam status at the entered angle is read out. If the angle is omitted, status at the angle zero is read out. Use the [+] [−] [+] [−] keys to increment or decrement angles.	●	●	●	●

Step		Procedure	Available mode			FC-21
			PRG	TEST	RUN	
11	Clearing angle settings	Follow the step 9 above to read ON angle or OFF angle to be cleared. Press the following keys: [C] [↵] The specified ON or OFF angle is cleared, together with the corresponding OFF angle or ON angle.	●			●
12	Adjusting settings during operation	Follow the step 9 above to read ON angle or OFF angle to be adjusted. Using the [+] [−] keys, adjust the angle selected. Using the [+] [−] keys to increment or decrement the angle by one degree.		●		●
13	Reading current angle	Press the [REF] key to read the current angle of the cam.	●	●	●	●
14	Programming the home position	Stop the machine at its home position. Press the following keys in the order listed: [REF] [TCH] [ ] [ ] [ ] [↵] Angle(may be omitted) The entered angle is programmed as the home position of the machine. If the angle is omitted, current angle is programmed as home position.	●			●
15	Changing settings	Follow the step 9 above to read ON angle or OFF angle to be changed. Press the following keys in the order listed: [SHF] [OUT] [ ] [ ] [ ] [↵] New ON/OFF angle	●			●
16	Saving data to tape	Press the following keys in the order listed: [SHF] [+] [ ] [ ] [ ] [↵] SAVE Program number All settings and home position are saved.	●			●
17	Restoring data from tape	Press the following keys in the order listed: [SHF] [+] [ ] [ ] [ ] [↵] LOAD Program number Data for the specified program is restored.	●			●
18	Checking data with tape	Press the following keys in the order listed: [SHF] [↓] [ ] [ ] [ ] [↵] VERIFY Program number Data for the specified program is checked.	●			●
19	Saving, restoring or checking data for a selected bank.	Follow the step 16, 17 or 18 above. Press the following keys in the order listed: [BNK] [ ] [↵] Bank number Data for the specified bank is saved, restored or checked.	●			●
20	Clearing all setting and the home position	Press the following keys in the order listed: [F] [9] [4] [2] [↵] All settings for all banks are cleared, and the home position is reset to zero.	●			●

Step		Procedure	Available modes			FC-21
			PRG	TEST	RUN	
21	Displaying position or revolution speed	Press the following keys to display current position: F 1 ↵ Press the following keys to display current revolution speed: F 2 ↵	●	●	●	●
22	Displaying bank number	F BNK Press the following keys to display current bank number Press C key and F key at the same to display the previously selected bank.	●	●	●	●
23	Transferring data between banks	Press the following keys to specify the source and destination banks: BNK ☐ ↵ Source bank number F 3 ☐ ↵ Destination bank number	●			●
24	Setting the frequency (60 pulses) per revolutin	Press the following keys: OUT ☐ ↵ ↓ Output number F 4 ↵ This operation is unavailable for the resolution 512 and 1,024.	●			●

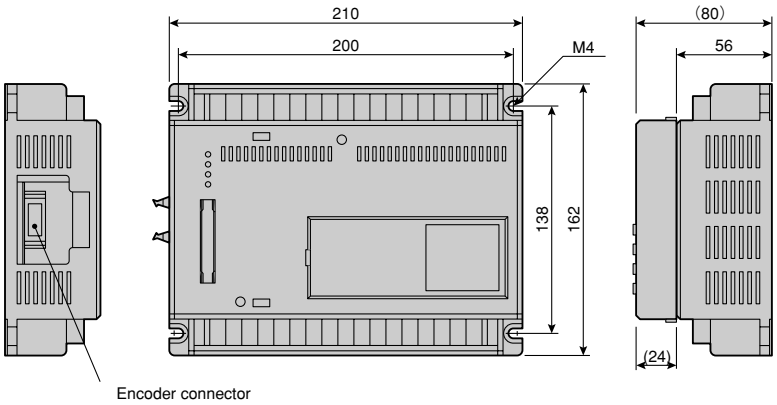
List of Error Codes

Error code	Name	Possible cause	Corrective Action
E01	Key entry error	Keys were not pressed as required.	Check the operating procedures.
E11	Bank number error	The entered bank number does not exist.	Check the dip switches 2 and 3 to confirm the correct number.
E12	Cam number error	The entered cam number does not exist.	Check the dip switch 3 to confirm the correct number.
E13	Angle error	The entered angle does not exist.	Check the dip switch 2 to confirm the correct angle.
E14	Write protect error	Write was attempted in write-protected mode.	Turn the power off, then turn the dip switch 5 off to enable writing.
E15	Duplicate angle	Same angle has been set more than once.	Follow the step 9, 11 or 7 to clear the setting, then re-enter the value.
E16	Dip switch error	A dip switch has been repositioned.	Turn the power, then set the dip switch to the correct position. Select the
E17	BNK SELECT error	The selected BANK SELECT number does not exist.	PRG mode then turn the power on.
E18	ENCODER error	The selected ENCODER number does not exist.	Check the dip switch 2 to confirm the current resolution, and check the ENCODER connection.
E21	Data memory error	Data has been changed.	Turn the power off, then check the dip switches. Select the PRG mode, then turn the power on.
E22	Program memory error	Program has been changed.	Turn the power off, then check the program. Select the PRG mode, then turn the power on
E25	Unmatched data	Data in memory does not match data in tape.	Clear wrong data, and save or restore correct data to memory or tape.
E26	Unmatched data and dip switch setting	Data in tape does not match the setting of a dip switch.	Turn the power off, then set the dip switch to the correct position. Select the PRG mode, then turn the power on.

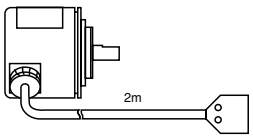
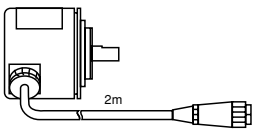
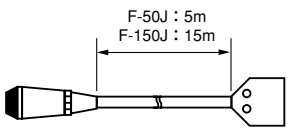
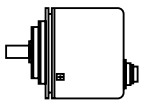
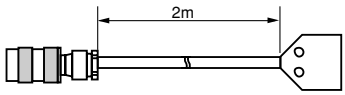
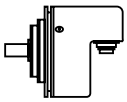
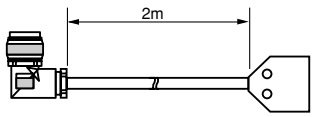
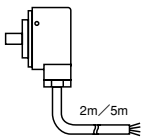
Note: No error is displayed when the AC power lowers or shuts down.
Use the C key to clear error codes.

External Dimensions

(in mm)

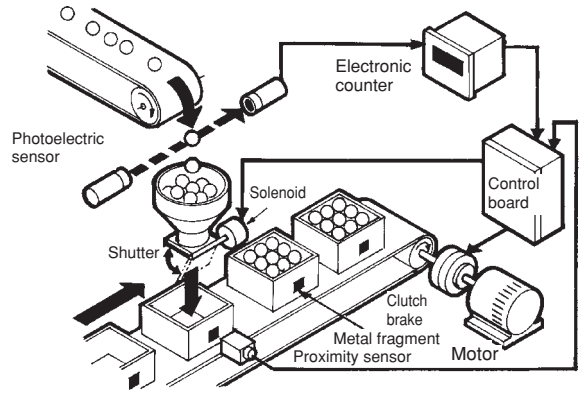


Applicable models of rotary encoders and cables with connectors

Absolute rotary encoder		Connector and cable	
Model	Appearance	Appearance	Model
Models with standard connectors TRD-K□-YCS		—	—
Models with cables and connectors TRD-K□-YPS			**F-50J** **F-150J**
Models with built-in connectors TRD-K□-YC2			**F-20C2**
Models with built-in connectors TRD-KL□-YC2			**F-20C2A**
Models with built-in cables TRD-NA□NW□			—

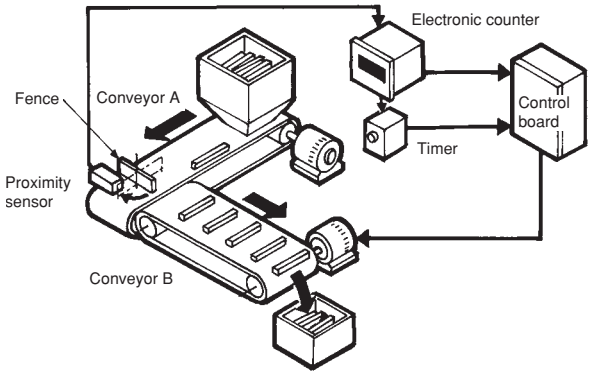
Application Examples

Packaging uniform quantities



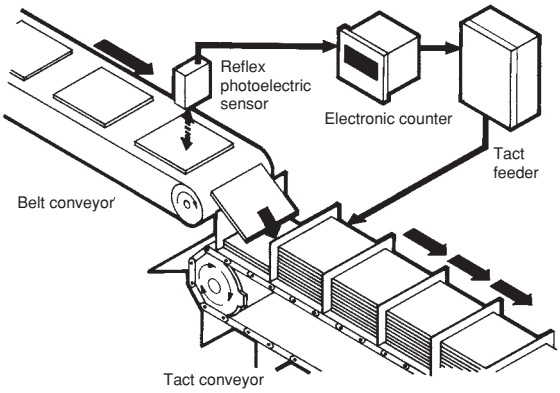
The photoelectric sensor generates a pulse signal as it detects each product falling from the conveyor. The electronic counter counts the number or pulses generated. When the count has reached a preset number, the counter generates a signal to open the hopper's shutter. The products are ejected into a box then the next vacant box is conveyed to the same position as the previous one.

Grouping bars into same quantities



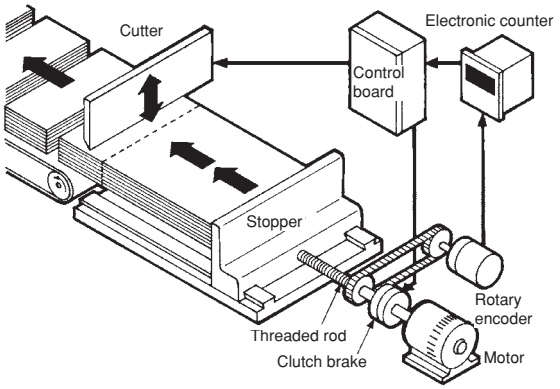
Each bar is brought by the conveyor A to the fence. This make the fence swing toward the proximity sensor and activates the sensor to feed the bar onto the conveyor B. The electronic counter counts pulses generated by the proximity sensor. When the count has reached a preset number, the counter generates a signal to stop the conveyor A. The conveyor B also stops after a time set by the timer.

Partitioning products into same quantities



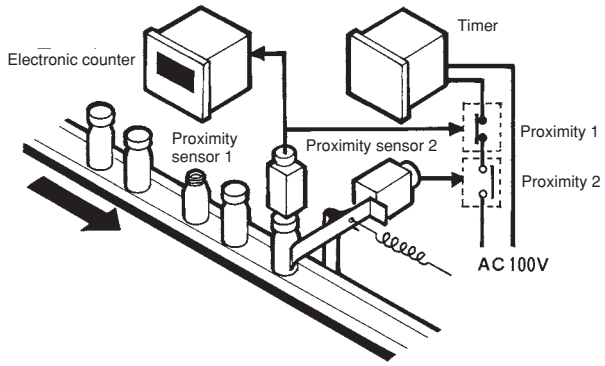
The electronic counter counts the products fed by the conveyor and detected by the reflex photoelectric sensor. When the count has reached a preset number, the counter activates the tact feeder to advance the conveyor by one step for the next counting cycle.

Cutting materials to uniform length



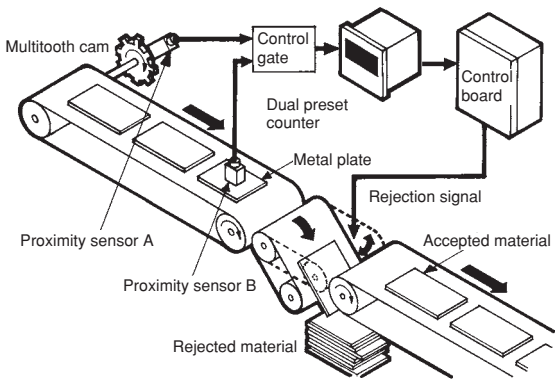
As the threaded rod rotates, the stopper is moved by a preset distance. The number of rotations is converted to the number of pulses by the rotary encoder, and counted by the electronic counter. When the count has reached a preset number, the cutter is activated to cut the material to a fixed length.

Counting bottles and checking for caps



The proximity sensor check each bottle for a cap. At the same time, it activates the counter to count the bottles and display the count. When no cap is detected within a specified time, the internal timer generates an alarm.

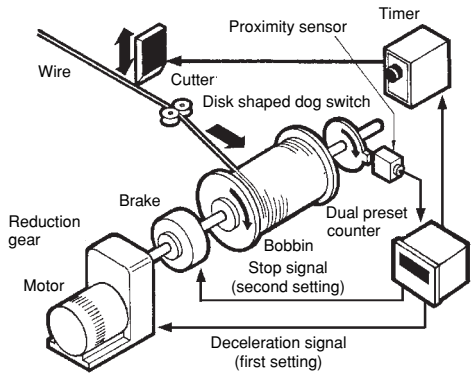
Sorting materials by length



The proximity sensor A generates pulse signals when it detects the rotation of the multitooth cam. The electronic counter counts the number of pulses while a metal plate is being detected by the proximity sensor B. This count is compared with the upper and lower limits that specify acceptable size of plates. Any plate outside the tolerance is rejected.

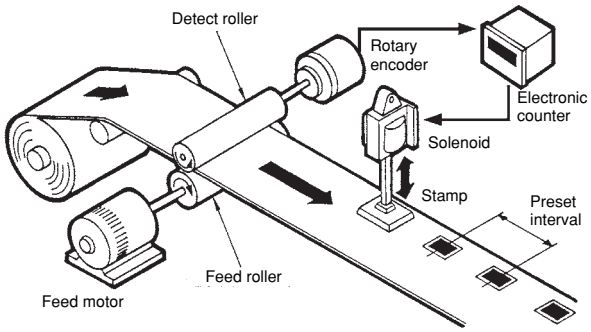
Application Examples

Winding wire for constant turns



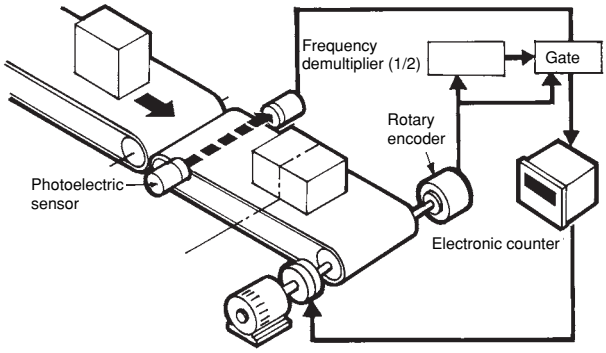
The proximity sensor A generates plus signals when it detects the rotation of the bobbin. The pulse count is entered to the counter, and compared with dual preset values: the expected total number of turns of wire, and the total number minus one. When the pulse count has reached the second setting, the reduction gear is activated. The bobbin stops completely when the count equals the first setting. At the same time, the timer activates the cutter to cut the wire.

Marking at same intervals



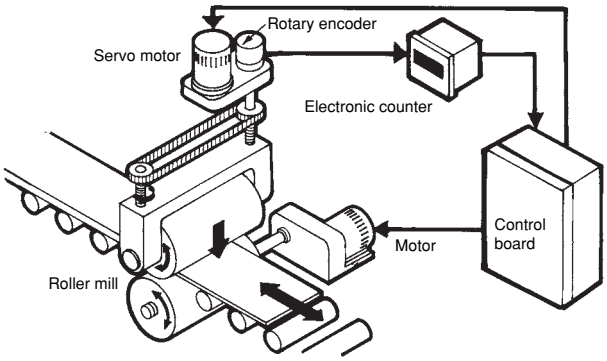
As the feed roller rotates, the workpiece is moved to a preset distance. The number of rotations is converted to the number of pulses by the rotary encoder, and counted by the electronic counter. When the count has reached a preset number, the counter generates a signal to activate the stamp.

Detecting the center of workpieces



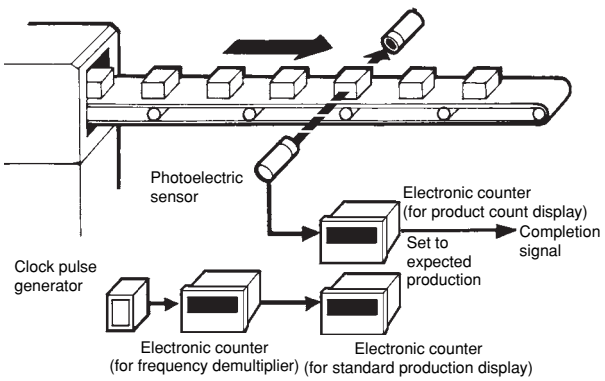
The photoelectric sensor generates pulse signals when a workpiece starts to cover its light. The pulse frequency is halved by the frequency demultiplier then processed by the rotary encoder for counting. The workpiece is centered when the count has reached a preset number.

Spacing rolled materials



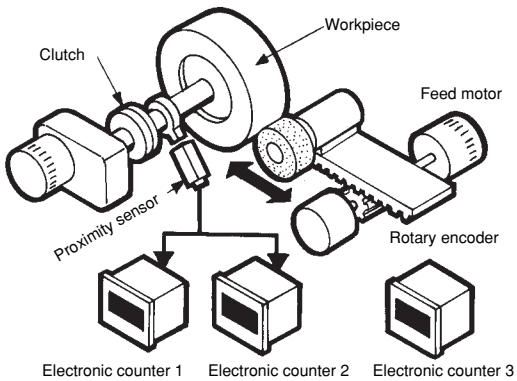
As the threaded rod rotates, the material is fed by a preset length. The number of rotations is converted to the number of pulses by the rotary encoder then counted by the electronic counter. When the count has reached a preset number, it stops the motor that controls the spacing.

Production management



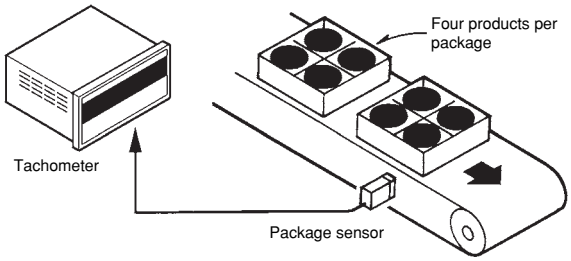
The first counter is set to the expected number of products, and the second counter is set to the standard number of products. The third counter works with the frequency demultiplier and the clock pulse generator. The clock controls output rate at ten pulses/second to provide the time required for one product. The third counter counts the time elapsed for the current production. It warns an overtime when this value exceeds the standard production time.

Positioning a grinder



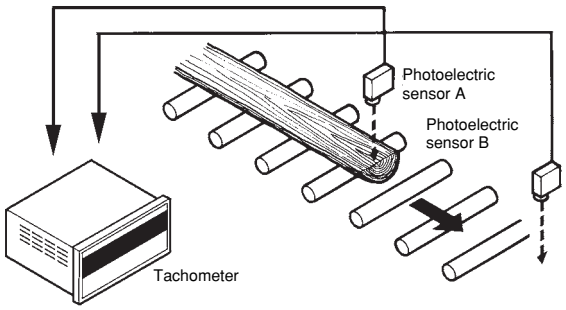
When the proximity sensors detects a workpiece fed in position, it activates the motor to rotate the workpiece and accelerate the grinder. The electronic counters are used to change the speeds of the motor and the grinder.

Displaying the total number of packaged products



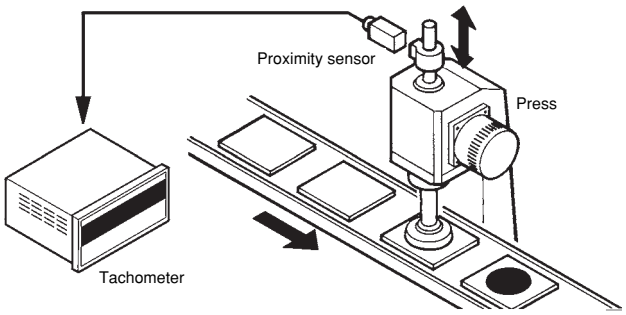
The tachometer counts packages containing a fixed number of products. It is to display the total number of products. For example, it should be set to "4" for packages each containing four products.

Displaying the speeds of moving objects



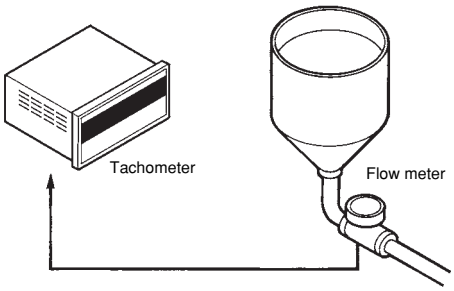
The tachometer measures the speed of an object moving from the photoelectric sensor A to the sensor B. Using the preset scale, the speed is calculated from the "time lag" between the two sensors and their distance.

Displaying press process time



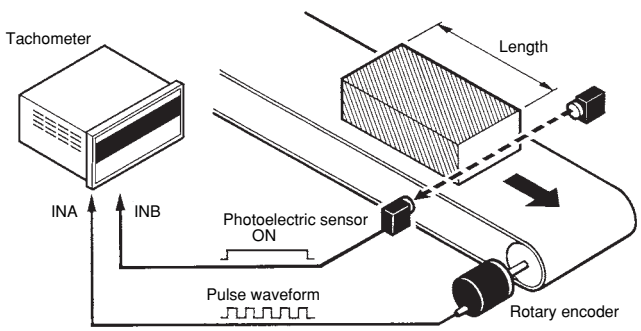
A dog switch is installed so it activates the proximity sensor when it detects the bottom of the press. The tachometer displays the time elapsed after the proximity seneor is activated.

Displaying flow rates



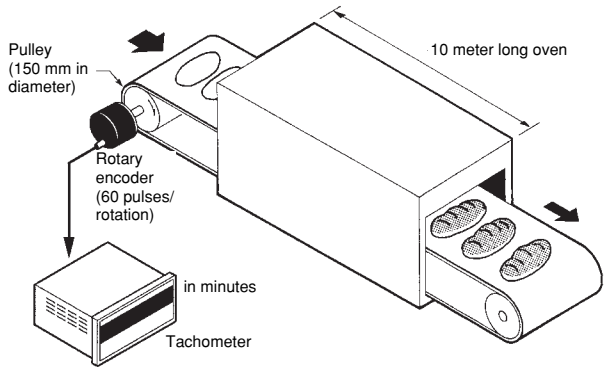
The tachometer counts and displays the number or pulses generated by the flow meter. This number is multiplied by a preset value to display a flow rate in liters or cubic meters.

Displaying length



When the photoelectric sensor is activated by an object, the tachometer counts the number of pulses generated by the rotary encoder. This number is converted to the length.

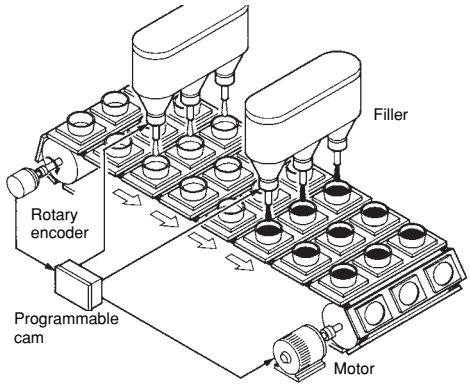
Displaying time for passing through an oven



The tachometer displays the time elapsed after each piece of bread enters into the oven. The time is calculated from the diameter of the pulley, the number of pulses generated by rotary encoder and the length of the oven.

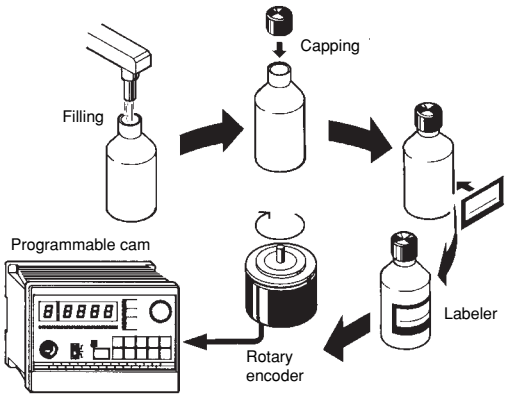
Application Examples

Controlling filling timing



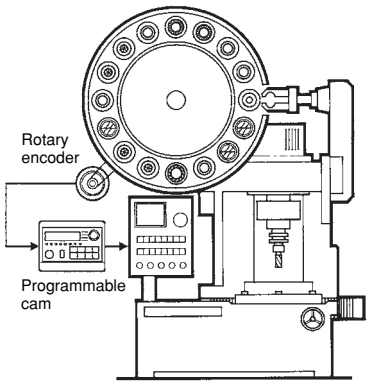
Along with the programmable cam, the rotary encoder controls the timing of filling containers, their positions and the timing of transferring filled containers. The use of the programmable cam and the encoder allows easy positioning and quick adjustment of machines.

Controlling a bottling machine



The programmable cam and the rotary encoder provide overall control of the entire bottling processes. Filling bottles, capping and labeling can be controlled from a single turn table. The table can be also controlled to avoid angular deviations.

Positioning a numerically controlled machine



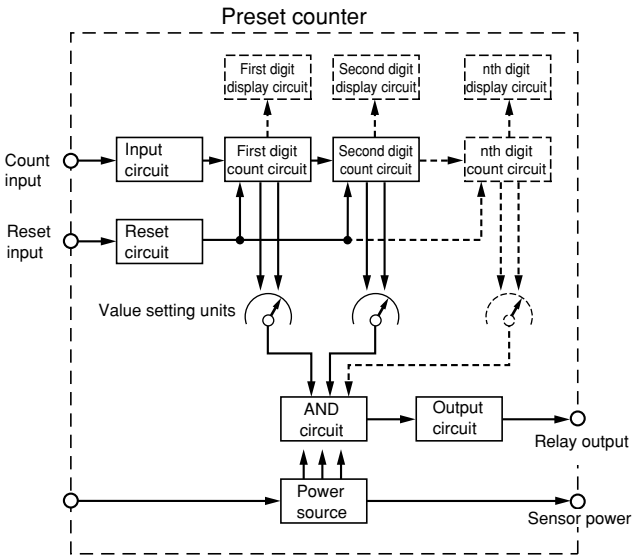
The programmable cam and the rotary encoder can be used to control the position of a numerically controlled machine. Modifying the cam switch configuration allows you to use different types of workpieces.

Glossary

Preset counter

Counts input pulses, and generates a signal when the count has reached a preset value. The following diagram shows its circuit configuration:

Block Diagram (KCX series)



Dual preset counter

Using pairs of preset values and output circuits, the counter generates a signal when the count has reached lower or upper value.

Total counter

Only displays counts, and generates no control signal.

Batch counter

It contains two preset counters: one counts the number of batches, and the other generates a signal according to the setting.

External counter

The counter do not have a setting unit at the main body and allows external connection of a digital switch, rotary switch, card reader, etc.

All-output counter (Read-out counter)

This counter outputs the count value as a signal to an external source at any time.

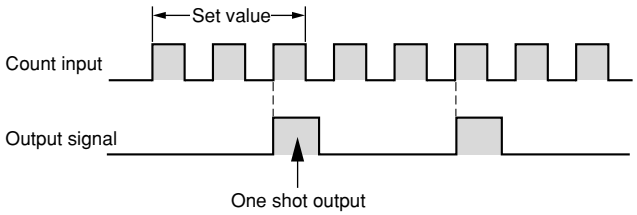
Multi-counter

Multiple counter functions are built in this counter. It outputs the count when either of the counter has attained to the preset value. It is best-suited for maintaining and controlling multiple tools at a machining center or NC machine tool during tool change.

Type A operation (One Shot output)

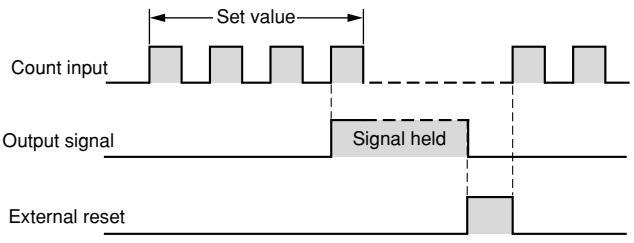
Auto reset for repeated operations

- Generates a signal during a specified time when the number of input pulses has reached a preset value.
- The internal count circuit is automatically reset upon countup to allow both the next counting cycle and signal output.
- Current count can be reset either by activating the reset terminal (external reset) or by temporarily shutting the power down (power reset).



Type B operation (Hold output signal)

- Generates and hold a signal when the number of input pulses has reached a preset value.
- The internal count circuit and the hold circuit can be reset either by activating the reset terminal (external reset) or by temporarily shutting the power down (power reset).

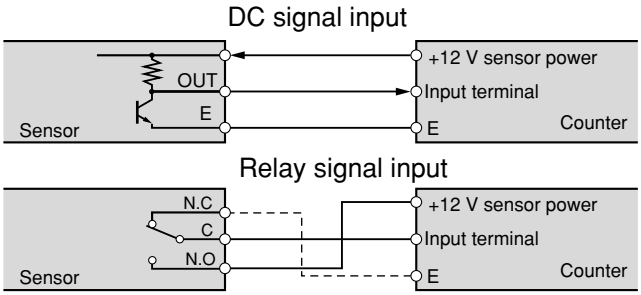


Glossary

DC and relay signal inputs

DC signal input is invoked by output from a proximity sensor, photoelectric sensor, rotary encoder, or other transistor or semiconductor circuit.

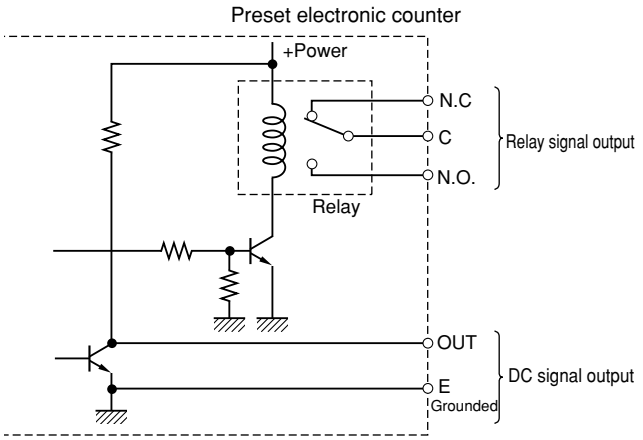
Relay signal input is controlled by a microswitch, limit switch, push button switch, or relay.



DC and Relay signal outputs

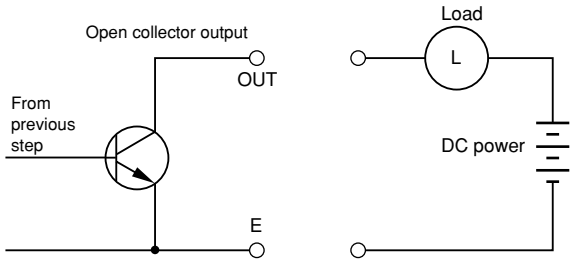
DC signal output means the signal generated by a semiconductor circuit.

Relay signal output is the signal generated by an internal relay contact.



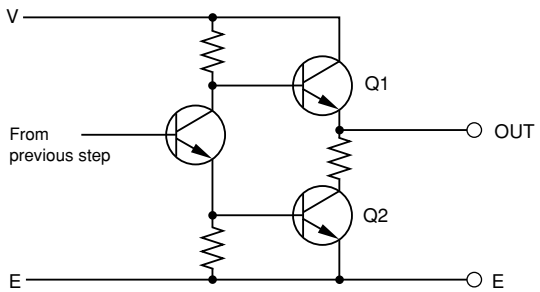
Open collector output

An open collector gate is not connected with the internal power source. Therefore, it should be connected with an external power and load. You can choose any voltage or current(negative load) levels within the counter specification.



Totem-pole output

A DC output circuit configured like a totem-pole. As shown below, an output line is located between the serially connected output transistors Q1 and Q2. It provides higher current than conventional DC output, using the same positive and negative loads. The circuit can directly drive a relay.



Maximum counting speed

Expressed in counts per second (cps), the maximum counting speed indicates how many pulses the unit can count at the make-break ratio of 1 to 1(Ta=Tb).

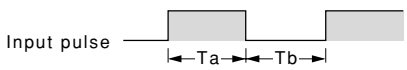
If the ratio is not 1:1, counting is restricted by the pulse width in relation to the minimum Ta or Tb as shown in Paragraphs (2) and (3) below.

$$\text{Ta MIN.} = \text{Tb MIN.} = \frac{1}{\text{maximum counting speed}} \times \frac{1}{2} \text{ (s)}$$

(Each model has specific values for these items)

(1) When Ta=Tb

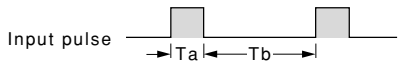
Ta or Tb must be longer than Ta MIN or Tb MIN for the counter to count pulse.



Ta=Tb≧Ta MIN.=Tb MIN.

(2)When Ta＜Tb

Ta must be longer than Ta MIN. for the counter to count pulses.



Ta≧Ta MIN.

(3)When Ta＞Tb

Tb must be longer than Tb MIN. for for the counter to count pulses.

Tb≧Tb MIN.

If you wish to add static signal input, select appropriate input terminal for desired counting speed or frequency. You should choose a terminal with the lowest maximum counting speed.

Resets

●**Power-on reset:** Resets the count when power is turned on. To reset the count, turn the power off then turn it on at any time.

●**Auto reset:** Resets the A type operation upon countup. The reset duration is shorter than the counter's input cycle at maximum counting speed. This enables the unit to restart counting from zero during cycle.

●**External reset:** The count is reset when specific voltage is applied to the reset input terminal. Some models reset to the Low level.

●**Manual reset:** The count is reset when you press the button on the front panel.

Sensor power source

It supplies power to an external device such as a proximity sensor, photoelectric sensor or rotary encoder. All KOYO counters include a sensor power source. (DC type is not included.)

Bank

Number of programs.

Programs (operation) can be set for each bank.

Glossary for specifications

Count input disable gate (response)

ON DELAY time: The time until input is disabled after turning ON the disable gate.

OFF DELAY time: The time until input is enabled after turning OFF the disable gate.

External set input (response)

ON DELAY time: Time for the set gate to be activated.

OFF DELAY time: Time for the set gate to be deactivated.

External reset (response)

ON DELAY time: Time for the counter to be reset.

OFF DELAY time: Time for the counter to be restarted.

Power reset (time)

Time for the counter to be restarted by power input.

Auto reset (time)

Time for the counter to be restarted by countup.

DC output (response)

Time for the DC output terminal to be activated by input of a preset number of pulses.

Relay output (response)

Time for the output relay's N.O. contact to be closed by input of a preset number of pulses.

Output disable gate (response)

ON DELAY time: The time until output is disabled after turning ON the disable gate.

OFF DELAY time: The time until output is enabled after turning OFF the disable gate.

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Providing our customers with
the best in value and technology

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