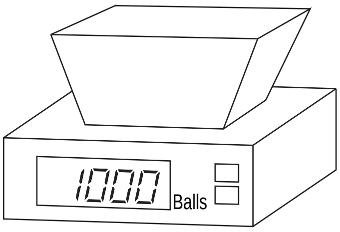
Overview of Counters

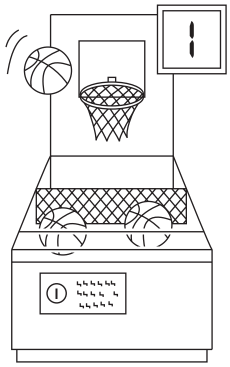
■ What is a Counter?

The term counter is derived from the word count. It is fairly simple for people to count ten or twenty objects, but larger numbers make counting increasingly difficult. Counters outperform people when it comes to counting accurately.

For example, the devices that are used by people on street corners to count pedestrians in traffic surveys are one type of counter. They are a good replacement for people because they accurately count pedestrians and remember the count even with very large numbers.



Some game machines accurately and automatically calculate the number of items you have won. It would be a significant problem for amusement businesses if they did not count accurately.

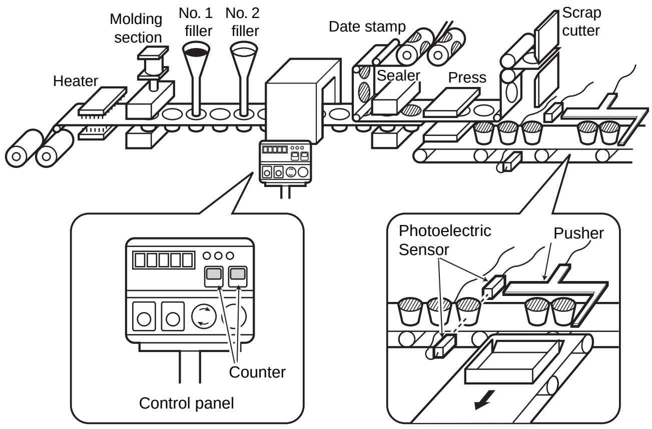


The basketball gaming machines at amusement parks count the number of baskets made within a certain amount of time.

Even here, Counters count with high accuracy to enable the machines to display the correct number of baskets.

The following example shows the use of Counters in automated machinery.

Pudding Production Line

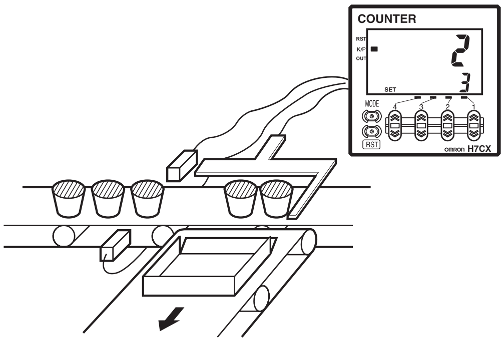


On a pudding production line, a Photoelectric Sensor detects the finished products. If the number three is preset in the Counter and it receives a Photoelectric Sensor signal three times, the Pusher (see note) pushes the three pudding containers into a box.

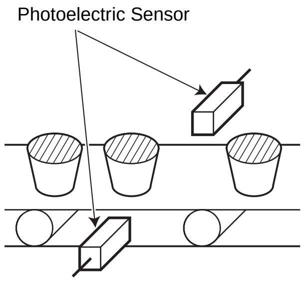
Note: Pusher: Pushing device

■ Preset Counter

The following section describes the input, control, and output signal sequence in a boxing process.

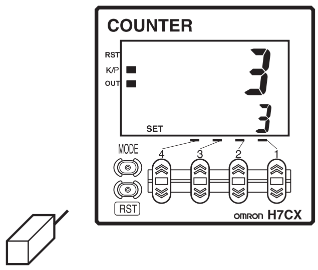


1. Input



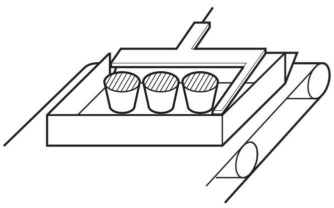
A Photoelectric Sensor is an input device that detects an object when that object blocks light. Each time the light is blocked, the Photoelectric Sensor sends a signal to the Counter.

2. Control



Preset the number three in the Counter. The Counter will then count the number of signals from the Photoelectric Sensor and sends a signal to the Pusher (i.e., the output device) after the Counter receives a signal for the third time.

3. Output



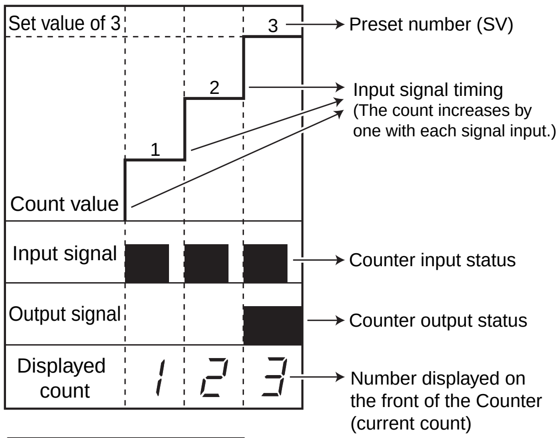
When the Pusher receives the output signal from the Counter, it pushes the three pudding containers into a box.

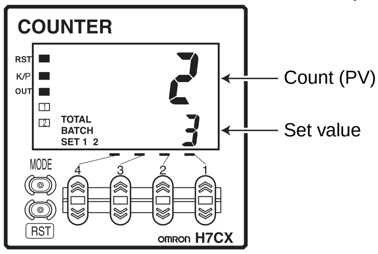
As you can see, the Counter is involved in every step of the input, control, and output signal sequence.

What is a Preset Counter?

A Preset Counter is a control device that counts the number of input signals until a preset value is reached. It then outputs a signal to activate the next output device.

See the following timing chart for the input and output signal timing in the boxing process for pudding.





Description of the Timing Chart

1. When the first pudding container passes by the Photoelectric Sensor, the Sensor sends a signal to the Counter and 1 will be displayed.

↓

2. When the next pudding container passes by the Photoelectric Sensor, 2 will be displayed.

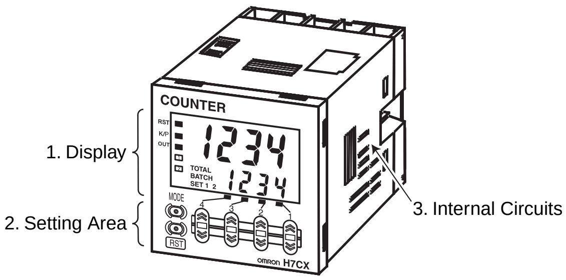
↓

3. When the third pudding container passes by the Photoelectric Sensor, 3 will be displayed. Because this number matches the set value, the Counter will output a signal.

The preset number is called the set value (or preset value). When that number is reached, a signal is output. This is often referred to counting up, but it means the same as timer setting or time up.

■ Basic System Configuration

H7CX Digital Counter

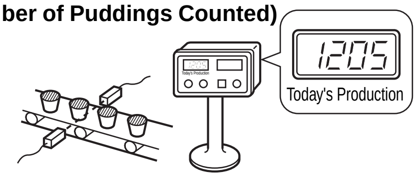


1. Display	Displays the Counter value.
2. Setting Area	Enters settings from the keys on the front panel.
3. Internal Circuits	The internal circuits count the number of input signals, compare the count to the set value, and then output a signal when the two values match.

■ Types of Counters

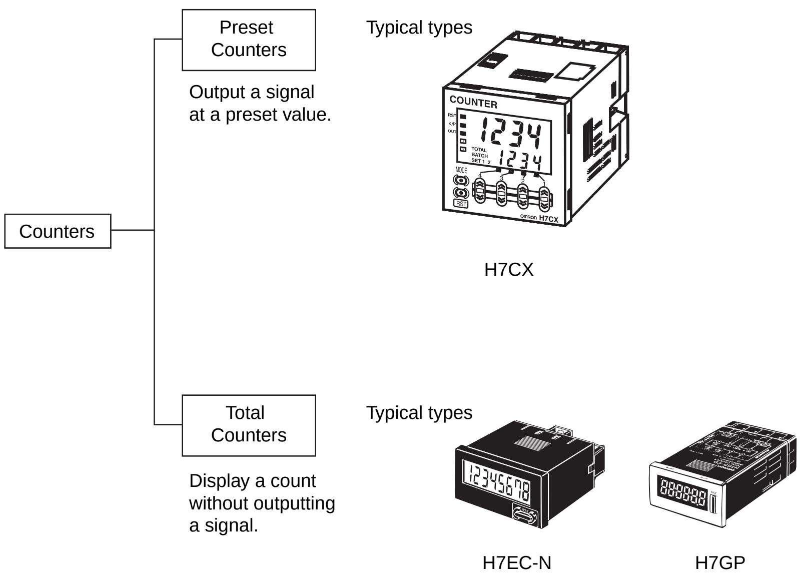
The term preset in Preset Counter means that you can set a value in advance. A Preset Counter may be one that counts up and outputs a signal at a predetermined point or it may be a Total Counter that strictly counts without outputting a signal. The Total Counter is often used when you only have to display a production count for example.

(Number of Puddings Counted)



The Counter uses a Photoelectric Sensor to count the number of puddings produced and then displays the number that it counted.

Counters are classified into two groups according whether they produce an output or not.

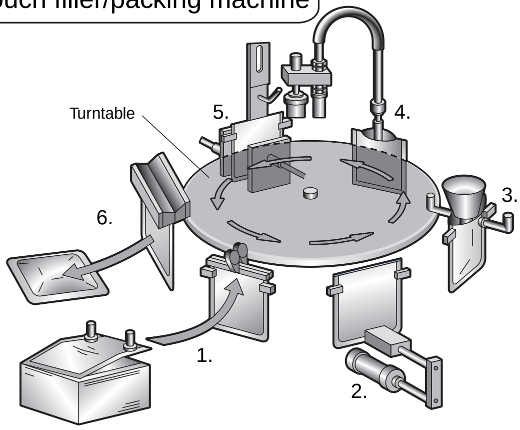


Overview of Cam Positioners

■ What is a Cam Positioner?

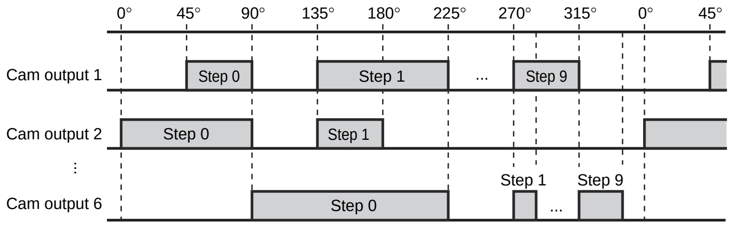
A Cam Positioner obtains angle data from an input device (e.g., an Encoder or Resolver) and uses preset ON/OFF angle settings to turn outputs ON and OFF. In food packing machines, for example, the Cam Positioner uses angle position data to control the timing of various mechanisms. The purpose of Cam Positioners is generally this type of timing control.

Pouch filler/packing machine



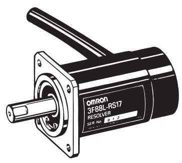
1. Control of the arm that supplies bags from the magazine
2. Control of the pump-driven cylinder
3. Control of filling a solid object with a specific amount of liquid
4. Control of the plunger and pump used to fill a body with a specific amount of liquid
5. Control of pouch sealing and air removal
6. Control of the metal seal pressing time and discharge arm

Cam outputs	Step 0		Step 1		...	Step 9	
	ON angle	OFF angle	ON angle	OFF angle		ON angle	OFF angle
1.	45°	90°	135°	225°		270°	315°
2.	0°	90°	135°	180°		---	---
...							
6.	90°	225°	270°	285°		315°	345°



■ Resolver

Unlike Encoders, Resolvers are simply structured and have no electronic components so their performance is virtually unaffected by dust or vibration. This makes them highly reliable and environmentally resistant. Because they are brushless as well, they are maintenance free and their service life depends solely on the ball bearings.



Features

Excellent Environmental Resistance

Resolvers boast excellent environmental resistance, particularly against oil, dust, temperature, and shock. They also have an ambient operating temperature range of –10 to 80°C.

Absolute Angle Detection

Resolvers can detect absolute angles and only one Resolver is needed for high-precision at 360 and 720 resolutions.

Shaft-load Tolerance: 196 N, Shaft Diameter: 10 mm (3F88L-RS17/RS17T).

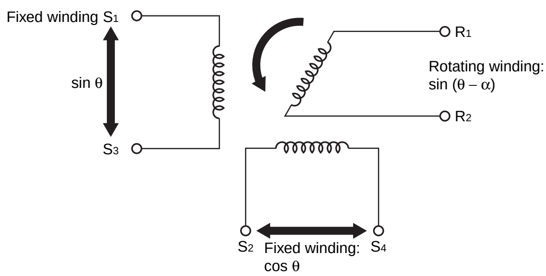
With a radial and thrust shaft-load tolerance of 196 N, Resolvers outclass all other detectors, such as Encoders.

Maximum Cable Length Up to 100 m

Resolver cables can be extended up to 100 m to enable remote operation and control from a location well away from the Resolver.

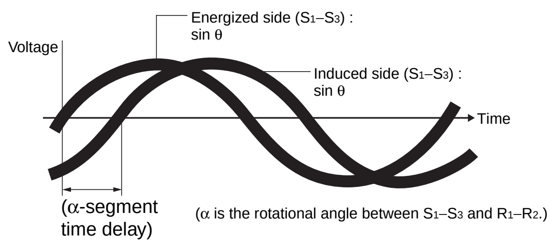
Operating Principle

As shown in the following diagram, sin θ and cos θ voltage is applied to the two sets of fixed windings, S_1–S_3 and S_2–S_4, respectively, that are mechanically 90° out of phase. Observing the sin (θ – α) voltage induced in the rotating winding R_1–R_2 makes the Resolver a kind of rotating transformer that detects angles.



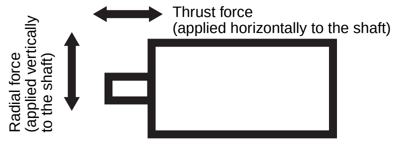
If the fixed winding is locked in position completely in phase with fixed winding S_1–S_3 (energized by sin θ voltage) for example, then sin θ voltage will be induced in R_1–R_2. When the rotating winding starts rotating, sin (θ – α) voltage will be induced in R_1–R_2 because of the cos θ voltage of the S_2–S_4 winding that is 90° out of phase with the S_1–S_3 winding. (See the figure below.)

A delay or advance of α is detected and measured to determine absolute angles.



Allowable Thrust and Radial Forces

Thrust and radial forces represent the maximum vertical and horizontal forces applied to a shaft. The magnitude of these forces is proportionally related to the service life of the product (i.e., the mechanical service life of the bearings).



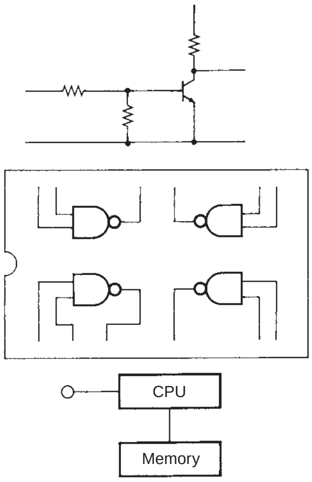
Origin Compensation

When a Resolver is linked to a mechanical system, the Resolver origin can be easily adjusted to match the machine origin if they are not the same. The process of aligning the two origins is called origin compensation.

Counter Glossary

Electronic Counter

A counter which mainly consists of transistors, ICs, micro-computers, etc.

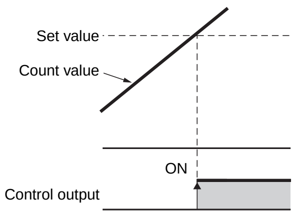


Electromagnetic Counter

A counter which performs counting by energizing or de-energizing the built-in electromagnet.

Preset Counter

A counter whose control output operates when it counts up to a set value.

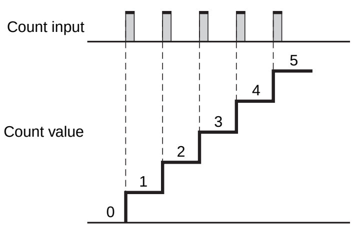


Totalizing Counter

A counter which indicates the total value of the counting inputs and is not provided with a control output.

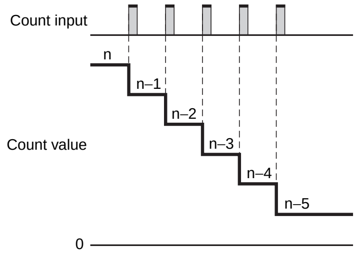
Addition (Up/Incrementing) Counter

A counter having an add input and thus capable of counting in an ascending order.



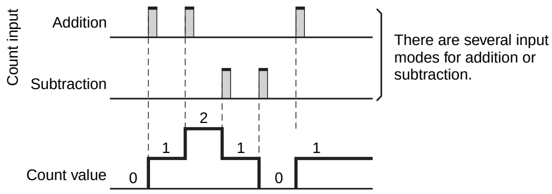
Subtraction (Down/Decrementing) Counter

A counter with a subtract input and thus capable of counting in descending order.



Up/Down Counter

A counter with the capability of counting in an ascending or descending order, depending on the up-down inputs. Also called a reversible counter.

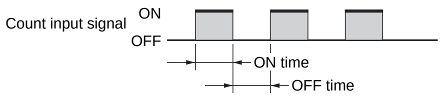


Maximum Counting Speed

The maximum counting speed at which the display or output section of the counter operates accurately without miscounting. The maximum counting speed is expressed in units of counts per second (cps).

ON/OFF Ratio

The ratio of the ON signal time of a given input signal to the OFF signal time of the same input signal. The maximum counting speed of each counter is determined by a counting input signal with an ON-OFF ratio of 1:1.

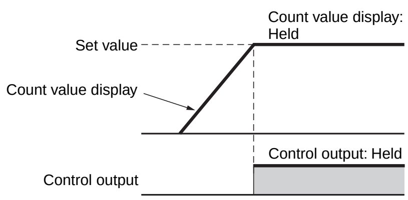


Operating Mode

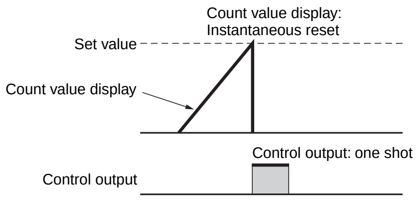
Control output patterns or display patterns that appear when counted up to the value set by the preset counter.

Examples:

N Mode



C Mode

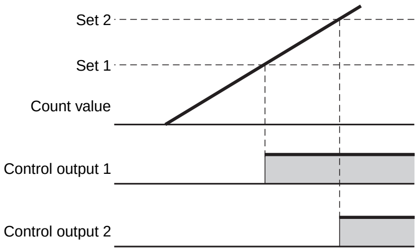


Note: Refer to the description of each product for information on operation in other modes.

Stage

Number of preset values that correspond with the number of control outputs.

Example: Two-stage Counter



Number of Digits

The maximum number of countable digits.

Display Method

The type of element used to display the counting results.

LED: Light emitting diode

LCD: Liquid crystal display

Note: Electromagnetic counters display results using a revolving mechanism with printed characters.

Externally Supplied Power

Power supplied from the counter to sensors that are used for counting or resetting. (Also called sensor power.)

Reset

To restore the counting, display and output sections of the counter, to their initial states.

Power Reset

To reset the counter by cutting off the operating supply voltage.

External Reset

To reset the counter by applying a specific signal to the reset input signal terminal.

Auto Reset

To reset the counter automatically with a signal generated from inside the counter.

Self-reset

To reset the counter by a signal generated by internal circuitry.

Manual Reset

To mechanically reset the counter by manual means.

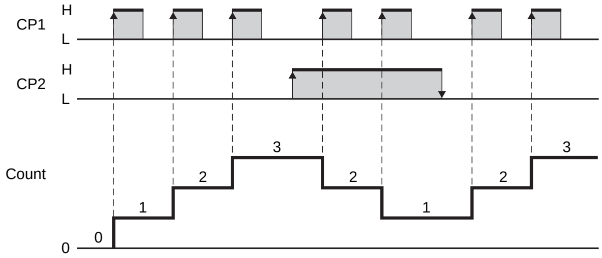
Electromagnetic Reset

To electromagnetically reset the counter by applying a reset signal.

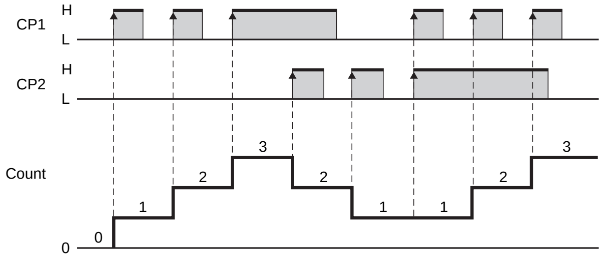
Counting Function

Refer to the following timing charts for the input modes of incremental, decrementing, and up/down (or reversible) Counters. (These charts focus on the up/down input mode.).

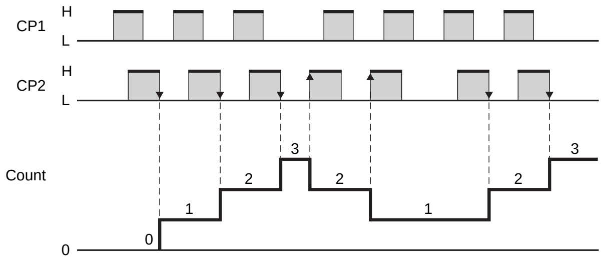
Up/Down A Command Input



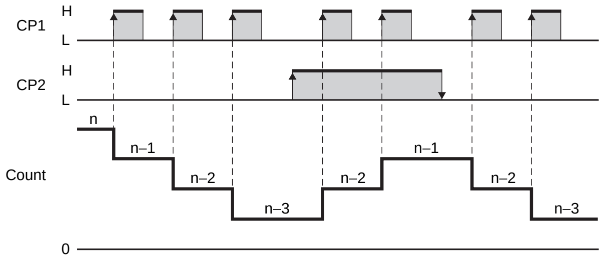
Up/Down B Command Input



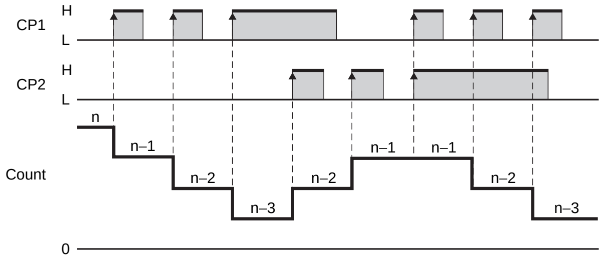
Up/Down C Quadrature Input



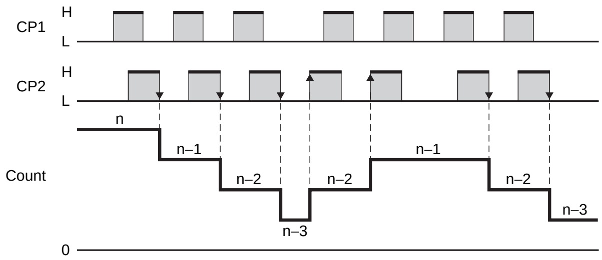
Up/Down D Command Input



Up/Down E Individual Input



Up/Down F Quadrature Input

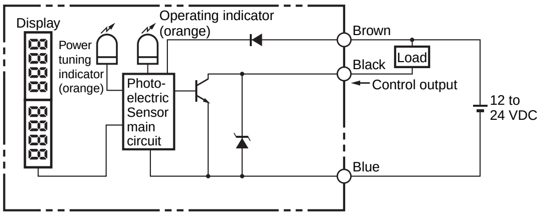


Precautions for Correct Use of Counters

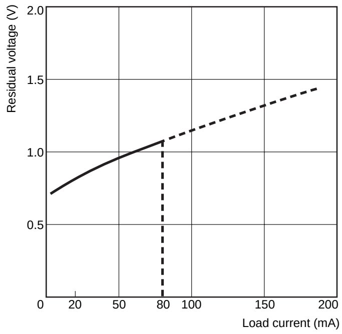
Input Connection

Consider the residual voltage of the input sensor and make sure that the input conditions of the Counter conform with the rated conditions.

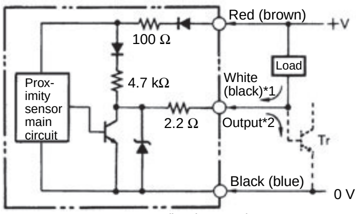
Connection Example with Photoelectric Sensor: E3X-DA11



Note: The residual voltage is the voltage between the output and 0-V lines when the transistor is ON (i.e., the total voltage between both edges of the transistor and diode bridge).

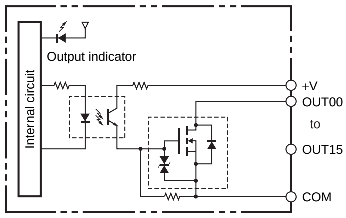


Connection Example with Proximity Sensor: E2E-X☐E



*1 200 mA max. (load current)
*2 Output with Tr connected.

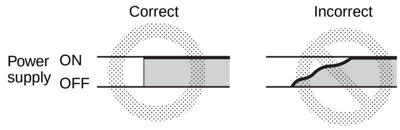
Connection Example with Programmable Controller: CJ1W-OD211



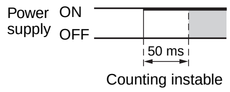
- The Counter may not receive count inputs correctly when using an input waveform for with an inverter current.

Power Supply

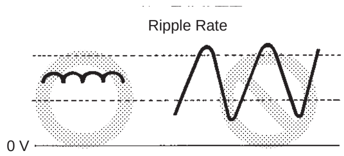
- Impose supply voltage on the Timer through a switch or relay contact at one time. Do not impose supply voltage gradually, otherwise the Timer may go into time-up condition or may not be reset.



- The Counter requires 50 ms for stable operation after power is turned ON. Input signals only after this 50-ms period has lapsed. For details, refer to the section on each product.



- AC power can be applied to the Counter regardless of the polarity of the power supply terminals. When supplying DC power, be careful enough not to make a mistake in polarity.
- Be sure that the ripple rate of DC power supplied to the Counter is within the rated range.



- The Counter can withstand an external impulse voltage with a ±(1.2 × 50)-µs standard waveform, which conforms to the Japanese JEC-210 standards, imposed between the power supply terminals. If an impulse voltage exceeding this should exist, use an appropriate surge absorber.
- Make sure that no residual voltage or inductive voltage exists when the power is turned OFF.
- Be sure that the capacity of the power supply is large enough, otherwise the Counter may not start due to inrush current that may flow for an instant when the Counter is turned ON. (Refer to *Reference Material for Counters: Inrush Current* on page 14.)

Control Outputs

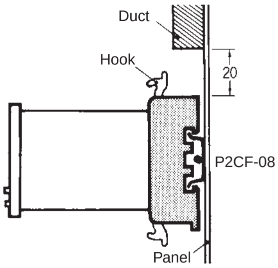
- Use a load current for the control output relay contacts that is below the rated applicable load. Otherwise the life of the relay contacts will be significantly shortened, or if transistors are used, the transistors may be damaged.
- The life of control output relay contacts depends greatly on switching conditions. Be sure to test the contacts in actual operating conditions prior to using them, then use them within a range of switching cycles that will not cause any problems. If a contacts are used after their performance has degraded, it may eventually cause insufficient insulation between circuits or burning damage to the relay itself.
- For micro-load switching, check the minimum applicable load that is given for each product.

Mounting

- There is no particular restriction on surface mounting directions, but be sure that the Counter is securely mounted horizontally.

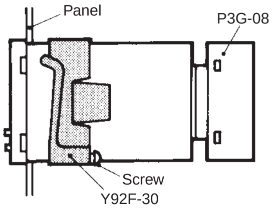
Surface Mounting

- When mounting the Counter vertically with the P2CF Socket, consider the movable hooks and be sure that there is a 20-mm space on each of the upper and lower parts of the Socket.

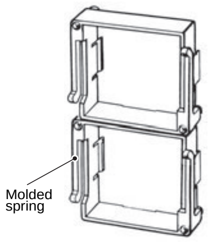


Flush Mounting

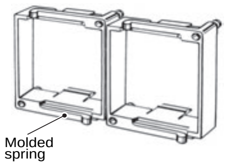
- When the Y92F-30 Flush Mounting Adapter is used, insert the Counter into the square hole from the front side of the panel and put on the Flush Mounting Adapter from the rear side of the Counter. Press the Flush Mounting Adapter so that the space between the Flush Mounting Adapter and the panel is reduced as much as possible, and secure the Flush Mounting Adapter with screws.



- When multiple Counters are closely mounted vertically, be sure that the molded springs of each Y92F-30 Flush Mounting Adapter are located on the left and right sides.

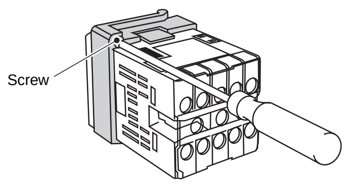


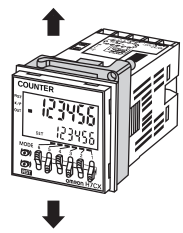
- When multiple Counters are closely mounted horizontally, be sure that the molded springs of each Y92F-30 Flush Mounting Adapter are located on the top and bottom sides.



Dismounting

To dismount the Y92F-30 Flush-mounting Adaptor from the Counter, loosen the screw of the Y92F-30 and move both hooks upwards and downwards respectively.





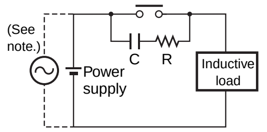
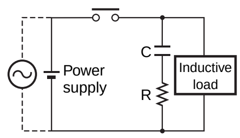
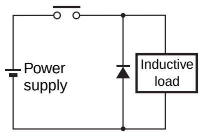
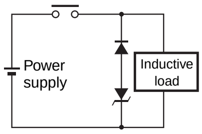
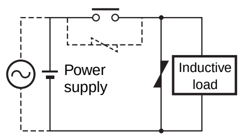
Setting

When using a key switch for setting, do not use your fingernail or an instrument with a sharp point, otherwise the key may be damaged.

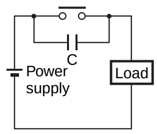
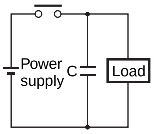
Others

- When conducting a dielectric test, impulse voltage test, or insulation resistance test between an electric circuit and non-current-carrying metal parts of the Counter mounted to a control panel, be sure to take the following steps.
  1. Separate the Counter from the circuitry of the control panel by disconnecting the socket from the Counter or wires.
  2. Short-circuit all terminals of the Counter.
     (These steps will prevent the circuits in the Counter from damage that may be caused if a machine on the control panel has an improper dielectric strength or insulation resistance.)
- The Counter constantly reads changes to the preset value. (The H7AN-R□ Counter can also be set so that it will read preset value changes when it is reset.) The Counter will produce an output signal if the data input change coincides with the Counter input. Refer to the section on the relevant product for information on reading the operating mode and other function settings.
- Do not tighten any terminal screw excessively.
- Counter-electromotive voltage is generated by any inductive load that is turned on or off. For the purpose of surge absorption, when using the Counter to switch an electromagnetic device, such as a solenoid valve, apply a diode if the electromagnetic device is in DC circuitry and a surge absorber if the electromagnetic device is in AC circuitry, otherwise Counter damage or malfunctioning may result.

Examples of Surge Suppressor

Circuit example		Applicability		Features and remarks	Element selection
		AC	DC		
CR		(See remarks.) (OK)	OK	Load impedance must be much smaller than the CR impedance when the Relay operates on an AC voltage. When the contact is open, the current flows through C and R to the inductive load.	Use the following as guides for C and R values: C: 0.5 to 1 μF for a 1-A contact current R: 0.5 to 1 Ω for 1-V contact voltage However, these values may depend on numerous factors, including the type of load and variations in characteristics. Confirm optimum values experimentally. Capacitor C suppresses the discharge when the contacts are opened, while the resistor R limits the current applied when the contacts are closed the next time. Generally, use a capacitor with a dielectric strength of 200 to 300 V. When it is to be used in an AC circuit, use an AC capacitor (with no polarity). When it is to be used with high DC voltage, if there is any question about the ability to short the arcing of the contacts, it may be more effective to connect the capacitor and resistor across the contacts, rather than across the load. Perform testing with the actual equipment to determine this.
		OK	OK	The release time of the contacts will be delayed when a Relay or solenoid is used as the load.	
Diode		NG	OK	The energy stored in a coil (inductive load) reaches the coil as current via the diode connected in parallel with the coil, and is dissipated as Joule heat by the resistance of the inductive load. This type of circuit delays the release time more than the CR type.	Use a diode having a reverse breakdown voltage of more than 10 times the circuit voltage, and a forward current rating greater than the load current. A diode having a reverse breakdown voltage two or three times that of the supply voltage can be used in an electronic circuit where the circuit voltage is not particularly high.
Diode + Zener diode		NG	OK	This circuit effectively shortens release time in applications where the release time of a diode protection circuit is too slow.	The breakdown voltage to the Zener diode should be about the same as the supply voltage.
Varistor		OK	OK	This circuit prevents a high voltage from being applied across the contacts by using the constant-voltage characteristic of a varistor. This circuit also somewhat delays the release time. This circuit is effective if connected across the load when the supply voltage is 24 to 48 V. If the supply voltage is 100 to 240 V, connect the circuit across the contacts.	The cutoff voltage Vc must satisfy the following conditions. For AC, it must be multiplied by $\sqrt{2}$. Vc > (Supply voltage × 1.5) However, if Vc is set too high, its effectiveness will be reduced because it will fail to cut off high voltages.

Do not use the following types of contact protection circuit.

	This circuit arrangement is very effective for diminishing sparking (arcing) at the contacts when breaking the circuit. However, since electrical energy is stored in C (capacitor) when the contacts are open, the current from C flows into the contacts when they close. This may lead to contact welding.		This circuit arrangement is very useful for diminishing sparking (arcing) at the contacts when breaking the circuit. However, since the charging current to C flows into the contacts when they are closed, contact welding may occur.

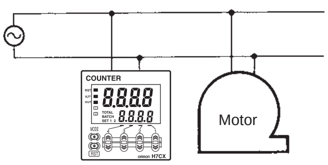
Note: Although it is considered that switching a DC inductive load is more difficult than a resistive load, an appropriate surge suppressor can achieve almost the same characteristics.

- Inrush current depends on the type of load, and may affect the contact switching frequency, number of usable switching operations, etc. It is recommended that you check the rated current and the inrush current, and design the circuit with a sufficient margin for variation in these current values.
- Disconnect the wiring before replacing the battery. Touching parts to which a high voltage is applied may result in electric shock.

Troubleshooting

Refer to the following for the troubleshooting of the Counter if the Counter malfunctions or has errors.

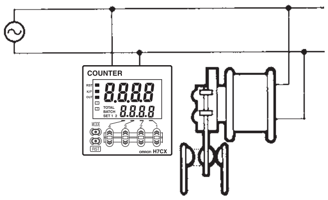
1. The following may result if a heavy inductive load, such as a high-capacity motor or solenoid, shares the power line connected to the Counter or is present near the Counter.



The Counter may count up or down without any input signal.

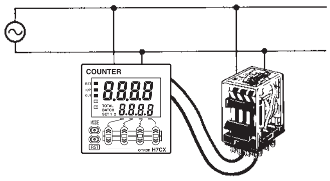
The power supply circuit of the Counter may be damaged.
To prevent this, keep the motor or solenoid away from the Counter or connect a noise filter to the power supply circuit.

2. The following may result if a device with contacts generating arcs shares the power line connected to the Counter or is present near the Counter.



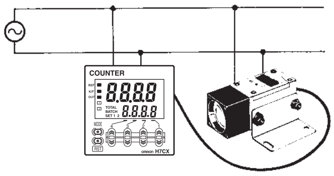
The Counter may count up or down without any input signal.
To prevent this, connect an arc suppressor to the device.

3. The following may result if the input device has a relay without highly reliable contacts.



The Counter may not count up or down when the contacts are activated.
To prevent this, replace the relay with one that has highly reliable contacts.

4. The following may result if the input signal line is excessively long.

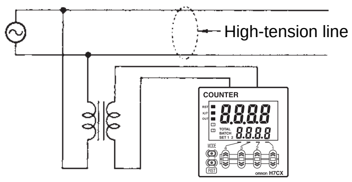


The power line connected to the Counter may cause the Counter to count up or down.
To prevent this, refer to *Safety Precautions for All Counters*.

The residual voltage may make it impossible for the Counter to check the interval between input signals, thus obstructing the counting operation of the Counter.

To prevent this, make the input signal line as short as possible and insert a 0.01- to 0.1-µF capacitor into the signal line close to the signal input terminal of the Counter.

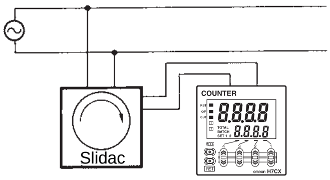
5. The following may result if the power line is close to a high-tension line.



The high-tension line may cause the Counter to count up or down.

To prevent this, refer to *Safety Precautions for All Counters*.

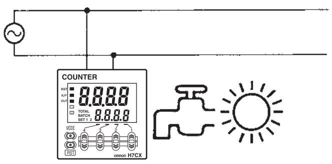
6. The following may result if the supply voltage is imposed gradually.



The Counter may not operate normally or the Counter displays an inaccurate value.

To prevent this, supply all power instantly to the Counter through a switch or relay.

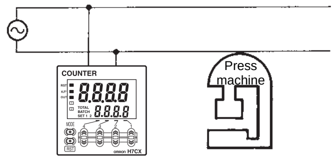
7. The following may result if the Counter is used for a long time in a place with excessive dust, direct sunlight, or sprayed water or oil that affects the Counter.



The Counter may not count up properly or operate normally and the coverings of the Counter is deformed.

To prevent this, protect the Counter from water, oil, dust, and sunlight. A hard front cover will protect the Counter from dust and drops of water.

8. The following may result if the Counter is used in a place with excessive or continuous vibration or shock.

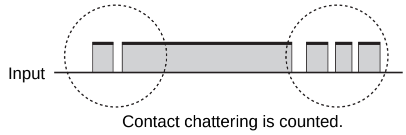


Contact chattering may cause sequencing errors.

The built-in parts of the Counter may malfunction due to the stress imposed on the built-in parts.

To prevent this, reduce the vibration by putting a rubber cushion under the vibration source. Do not mount the Counter directly to the vibration source.

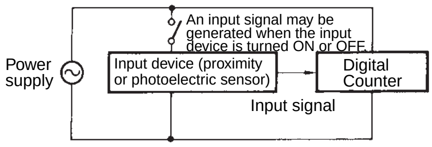
9. The following may result if the Counter is in high-speed counting operation with relay input signals.



The Counter may count more than the actual number of input signals.

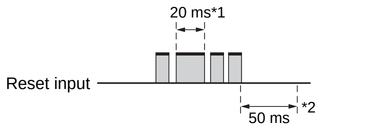
To prevent this, set the counting speed to 30 Hz (cps).¶

10. If the proximity or photoelectric sensor used as the input device is turned on or off while supply voltage is imposed on the Counter, excessive pulses may be generated from the input device and input to the Counter.



11. If the count input is a transistor input at a speed of 30 Hz (cps) maximum, setting the maximum counting speed to 30 Hz (cps) will improve the noise immunity of the Counter.

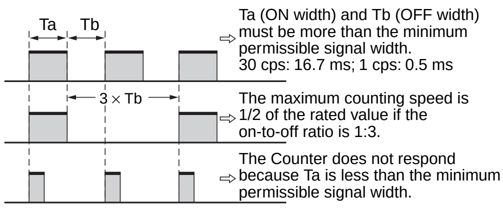
12. The Counter can be reset with a reset signal, which must be 20 ms long minimum, from the relay or transistor regardless of the maximum counting speed or input method of the Counter.



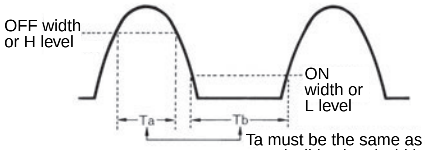
*1 The reset signal with distorted waves or chattering waves is acceptable as long as the reset signal is stable for 20 ms minimum.

*2 The CP1 and CP2 can be input if it passes 50 ms after the reset signal input is completed.

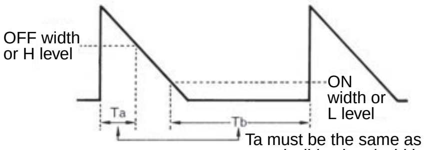
13. The maximum counting speed is the response speed of the Counter when signals with the minimum permissible signal width are input at an ON-to-OFF ratio of 1:1.
If the ratio is not 1:1, the minimum signal width must be higher than the combined specified value for the ON width and OFF width. The response speed will thus be lower.
If the width of each signal or interval between adjacent signals is less than the minimum permissible signal width, the Counter will not respond even for an input signal that is less than the maximum counting speed.



14. If transistor input signals are other than square-wave signals, such as sine-wave, triangular-pulse, or saw-tooth-pulse signals, all the ON and OFF widths or H- and L-level periods must be more than the minimum permissible signal width.



Ta must be the same as or more than the minimum permissible signal width and so must Tb.



Ta must be the same as or more than the minimum permissible signal width and so must Tb.

Q&A for Counters

Q1 **Are there Counters that can output a zero setting (with the current count reset to zero)?**

A1 See the zero-setting timing chart for the following Counters.

Model	Remarks
H8GN H7AN H7CN	Instantaneous output when power is turned ON. Output OFF during reset input.
H7BX H7CX	Instantaneous output in output mode N or F and output OFF with reset input when power is turned ON. Instantaneous output and output OFF after the one-shot time has elapsed with all other modes. Output OFF for K-1 mode even if OUT 1 is set to be self-holding after the one-shot time for OUT 2 has elapsed.

Q2 **What kind of counter is a Preset Counter?**

A2 Preset Counters output a control signal when the current value reaches the value preset in the Counter.

Q3 **What kind of counter is a Total Counter?**

A3 Total Counters do not output a control signal. They only display the current value.

Q4 **What functions are available with a Time Counter?**

A4 Time Counters count time and display the amount of time counted. They are also called total time meters or hour meters. Hours is not the only unit available, however, and time can displayed in minutes, seconds, or in some cases even days.

A Time Counter is not a Timer. You set a specific time with a Timer and an electrical signal is output when that time has elapsed. With a Time Counter on the other hand, you do not set a time. It simply totals the time and displays that total. If you were to define the two in terms of timers, then a Timer would be a Preset Timer and a Timer Counter would be a Total Timer. The Time Counter, however, has historically been classified as a counter.

Refer to the FAQs for Counters on the web site. Contact: **www.fa.omron.co.jp/**

Reference Material for Counters: Inrush Current

"---" indicates a constant current and therefore the corresponding values are omitted from the table. All the values are approximate values and should therefore only be used as a guide.

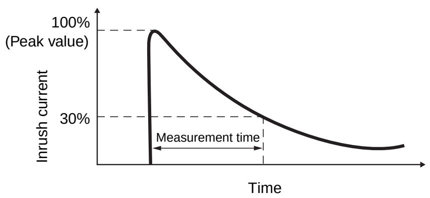
■ Counters

Model	Voltage	Applied voltage	Inrush current (peak value)	Time (see note)
H7AN series	100 to 240 VAC	264 VAC	23 A	1 ms
	12 to 24 VDC	26.4 VDC	15 A	4 ms
H7BX series	100 to 240 VAC	264 VAC	7.6 A	2 ms
	24 VAC/12 to 24 VDC	26.4 VAC	13.5 A	2 ms
H7CN series	100 to 240 VAC	264 VAC	800m A	1 ms
	12 to 48 VDC	52.8 VDC	400m A	1 ms
H7E series	---	---	---	---
H7CX-A□-N series	100 to 240 VAC	264 VAC	4.9 A	0.9 ms
	24AC/12 to 24 VDC	26.4 VAC	9.3 A	1.4 ms
		26.4 VDC	6.2 A	1.7 ms
H7CX-A□D-N series	24AC/12 to 24 VDC	26.4 VAC	9.2 A	1 ms
		26.4 VDC	6.3 A	1 ms
H7CX-A series (previous models)	100 to 240 VAC	264 VAC	5.8 A	0.7 ms
	24 VAC/12 to 24 VDC	26.4 VAC	10.4 A	1.2 ms
	12 to 24 VDC	26.4 VDC	6:00 AM	1.2 ms
H7CX-R series (previous models)	100 to 240 VAC	264 VAC	5.8 A	0.7 ms
	24 VAC/12 to 24 VDC	26.4 VAC	10.4 A	1.2 ms
H7CZ series	100 to 240 VAC	264 VAC	4.6 A	0.4 ms
	AC24/12 to 24 VDC	26.4 VAC	9.2 A	1 ms
		26.4 VDC	6.3 A	1 ms
H8BM-R series	24 VDC	26.4 VDC	1.6 A	12 ms

■ Cam Positioner

Model	Voltage	Applied voltage	Inrush current (peak value)	Time (see note)
H8PS-8 Series	24 VDC	26.4 VDC	1.9 A	23 ms
H8PS-16, -32 Series	24 VDC	26.4 VDC	3.1 A	12 ms

Note: The time of the inrush current is measured as shown in the following figure.



In the interest of product improvement, specifications are subject to change without notice.