

# PRECAUTIONS IN USING THE COUNTER

## Cautions for circuits

### 1. Protective circuit for counter contact

In the circuit that switches an inductive load, a contact failure may occur at a contact point due to surge or inrush current resulting from that switching. Therefore, it is recommended that the following protective circuit be used to protect the contact point.

| Circuit          |    | CR circuit (r: resistor c: capacitor)  |           | Diode circuit   | Varistor circuit   |
|------------------|----|--|-----------|---|--|
|                  |    |  |           |   |  |
| Application      | AC | (see note.)  | Available | Not available   | Available  |
|                  | DC | Available  | Available | Available   | Available  |
| Features/Others  |    | If the load is a relay or solenoid, the release time lengthens. Effective when connected to both contacts if the power supply voltage is 24 or 48 V and the voltage across the load is 100 to 200 V.   |           | The diode connected in parallel causes the energy stored in the coil to flow to the coil in the form of current and dissipates it as joule heat at the resistance component of the inductive load. This circuit further delays the release time compared to the CR circuit. (2 to 5 times the release time listed in the catalog) | Using the rated voltage characteristics of the varistor, this circuit prevents excessively high voltages from being applied across the contacts. This circuit also slightly delays the release time. |
|                  |    | If the load is a timer, leakage current flows through the CR circuit causing faulty operation. Note: If used with AC voltage, be sure the impedance of the load is sufficiently smaller than that of the CR circuit.   |           |   |  |
| Device Selection |    | As a guide in selecting r and c,<br>c: 0.5 to 1 μF per 1 A contact current<br>r: 0.5 to 1 Ω per 1 V contact voltage<br>Values vary depending on the properties of the load and variations in counter characteristics.<br>Capacitor c acts to suppress the discharge the moment the contacts open. Resistor r acts to limit the current when the power is turned on the next time. Test to confirm. Use a capacitor with a breakdown voltage of 200 to 300 V. Use AC type capacitors (non-polarized) for AC circuits. |           | Use a diode with a reverse breakdown voltage at least 10 times the circuit voltage and a forward current at least as large as the load current.<br>In electronic circuits where the circuit voltages reverse breakdown voltage of about 2 to 3 times the power supply voltage.  | —  |

### 2. Type of Load and Inrush Current

The type of load and its inrush current characteristics, together with the switching frequency, are important factors which cause contact welding. Particularly for loads with inrush currents, measure the steady state current and inrush current and use a relay or magnet switch which provides an ample margin of safety. The table below shows the relationship between typical loads and their inrush currents.

| Type of load           | Inrush current                          |
|------------------------|---|
| Resistive load         | Steady state current                    |
| Solenoid load          | 10 to 20 times the steady state current |
| Motor load             | 5 to 10 times the steady state current  |
| Incandescent lamp load | 10 to 15 times the steady state current |
| Mercury lamp load      | 1 to 3 times the steady state current   |
| Sodium vapor lamp load | 1 to 3 times the steady state current   |
| Capacitive load        | 20 to 40 times the steady state current |
| Transformer load       | 5 to 15 times the steady state current  |

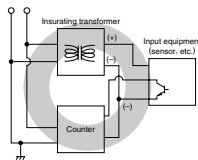
When you want large load and long life of the counter, do not control the load direct with a counter. When the counter is designed to use a relay or a magnet switch, you can acquire the longer life of the counter.

### 3. Connection of input (Except for LC4H-S/AC type)

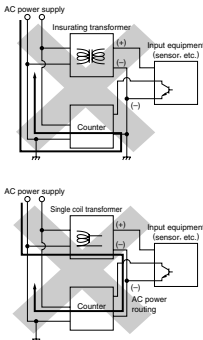
The LC4H series use power supply without a transformer (power and input terminals are not insulated). In connecting

various kinds of input signals, therefore, use a power transformer in which the primary side is separated from the ungrounded secondary side as shown in Fig. A, for the power supply for a sensor and other input devices so that short-circuiting can be prevented.

(Fig. A) Good



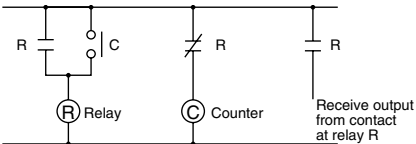
(Fig. B) No good



Do not use a single coil transformer (e.g., Sly-Duck). Otherwise, the internal circuit of the counter will be short-circuited as shown in Fig. B resulting in breakdown.

### 4. Long Continuous Current Flow

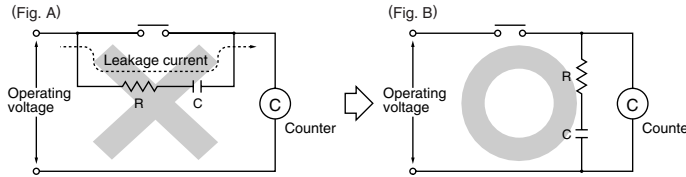
Avoid keeping the counter on for a long period of time (over one month). Otherwise heat is generated and accumulated inside the counter, which may deteriorate its electronic parts. If the counter must be kept on for a long period of time, a relay is added. See the circuit diagram below.



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## 5. Leakage current

1) For connecting operating voltage to the counter, a circuit should be used, which will prevent the flow of leakage current. For example, a circuit for contact protection as shown in Fig A. will permit leakage current flow through R and C, causing erroneous operation of the counter. Instead, the circuit shown in Fig. B should be used.



2) If the counter is directly switched with a non-contact element, leak current may flow into the counter and cause it to malfunction.

## Cautions for use (common for all models)

### 1. Terminal connections

Correctly connect the pins while seeing the terminal layout/wiring diagram. In particular, the DC type, which has polarities, does not operate with the polarities connected reverse. Any incorrect connection can cause abnormal heating or ignition.

### 2. Connection to operating voltage

1) Apply the entire supply voltage through a switch, relay or other contact.  
2) The operating voltage for the DC type must be at the specified ripple percentage or less. The average voltage must fall within the allowable operating voltage range.

| Rectification type      | Ripple percentage |
|-------------------------|-------------------|
| Single-phase, full-wave | Approx. 48%       |
| Three-phase, full-wave  | Approx. 4%        |
| Three-phase, half-wave  | Approx. 17%       |

3) Make sure that no induced voltage and residual voltage are applied between the power terminals on the counter after the power switch is turned OFF.  
(If the power line is wired in parallel with the high-voltage and motor lines, induced voltage may be produced between the power pins.)

### 3. Control output

1) Keep the load capacity below the counter's rated control capacity. If used above the rating, the counter's service life may shorten. With the transistor output type counters, transistors may be damaged.

### 4. Installing the counter

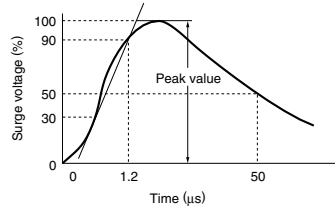
1) To install the counter, use the dedicated pin bracket or socket (cap). Avoid connecting the pins on the counter by directly soldering them.  
2) In order to maintain the characteristics, do not remove the counter cover (case).

## 5. Superimposed surge of power supply

For the superimposed surge of power supply, the standard waveform ( $\pm 1.2 \times 50\mu\text{s}$  or  $\pm 1 \times 40\mu\text{s}$ ) is taken as the standard value for surge-proof voltage. (The positive and negative voltages are applied each three or five times between the power pins.)

For the standard values for the LC4H type counters, see the respective items in "Cautions for use."

### • Single-pole, full-wave voltage for surge waveform [ $\pm(1.2 \times 50) \mu\text{s}$ ]



If external surge occurs exceeding the specified value, the internal circuit may break down. In this case, use a surge absorption element. The typical surge absorption elements include a varistor, a capacitor, and a diode. If a surge absorption element is used, use an oscilloscope to see whether or not the foreign surge exceeding the specified value appears.

### 6. Signal input

The counter's signal input comes in two ways. One is by opening and closing the input terminal. The other is by applying a specified H-level or L-level voltage to the input terminal.

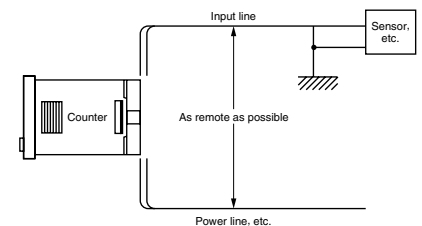
For an input sensor's residual voltage, input impedance, input voltage level and other signal input conditions, see the ratings for each type of product.

### 7. Operating environment

1) For the ambient operating temperature and humidity, see the ratings for each type of product.  
2) Avoid using the counter in a location where inflammable or corrosive gas is generated, the counter is exposed to much dust and other foreign matter; water or oil is splashed on the counter; or vibrations or shocks are given to the counter.

3) The counter cover (case), the knobs, and the dials are made of polycarbonated resin. Therefore, prevent the counter from being exposed to organic solvents such as methyl alcohol, benzene, and thinner, strong acid substances such as caustic soda, and ammonia and avoid using the counter in atmosphere containing any of those substances.

4) If the counter is used where noises are emitted frequently, separate the input signal elements (such as a sensor), the wiring for the input signal line, and the counter as far as possible from the noise source and the high power line containing noises.



## 8. Checking the actual load

In order to increase the reliability in the actual use, check the quality of the counter in the actual usage.

## 9. Others

1) If the counter is used exceeding the ratings (operating voltage and control capacity), the contact life, or any other specified limit, abnormal heat, smoke, or ignition may occur.  
2) The LC2H series counter, incorporates a lithium battery. Never disassemble the lithium battery or throw it into fire because this may affect humans and facilities. The lithium battery must be disposed of as an inflammable like other used batteries.  
3) If any malfunction of the counter is likely to affect human life and properties, give allowance to the rated values and performance values. In addition, take appropriate safety measures such as a duplex circuit from the viewpoint of product liabilities.