OMRON

# Self-powered Tachometer

# H7ER

## Subminiature Tachometer Requires No External Power Supply

- Subminiature (DIN-sized, 48 × 24 mm).
- Wire-wrap and screw terminal types available.
- DC-powered model can display the number of revolutions of an encoder in user-selectable units of measure.
- No-voltage, DC voltage input types available.
- Panel adapters for existing cutouts available; see Accessories section.
- Conforms to EMC standards.
- Approved by UL.


# Ordering Information

## ■ Tachometer

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Operating mode** | | Up type | | | | | | |
| **Display** | | LCD digital (character height: 6.7 mm) | | | | | | |
| **Reset system** | | Not provided | | | | | | |
| **Number of digits (see note 1)** | | 4 | | | 5 | | | |
| **Count input** | | No-voltage input | | DC voltage input | | | | |
| **Max. counting speed** | | 1 kcps | | | 10 kcps | | | |
| **Max. revolutions displayed (see note 2)** | | 1,000 rps | 1,000 rpm | 1,000 rps | 1,000 rps | 10,000 rpm | 1,000 rpm | Selectable (see note 3) |
| **Applicable encoder resolution** | | 1 pulse/rev. | 60 pulse/rev. | 1 pulse/rev. | 10 pulses/rev. | 60 pulses/rev. | 600 pulses/rev. | selectable (see note 3) |
| **Terminals** | **Wire-wrap** | H7ER | --- | H7ER-V | H7ER-V1 | H7ER-V2 | H7ER-V3 | --- |
| | **Screw** | H7ER-B | H7ER-B2 | H7ER-BV | H7ER-BV1 | H7ER-BV2 | H7ER-BV3 | H7ER-SBV |
| **Approved standards** | | UL | | | | | | |

**Note:** 1. When there is no input, 0.0 or 0 is displayed.

2. The maximum number or revolution which may be displayed depends on the output specifications of the encoder to be used.

3. Many kinds of encoders can be used with the H7ER-SBV. Confirm pulse compatibility by referring to specific values listed in “Setting the RPM Display of the H7ER-SBV,” in the Operation (H7ER-SBV) section.

# Specifications

## ■ Ratings

| | | |
|---|---|---|
| **External supply voltage** | | H7ER-SBV: 5 to 24 VDC ±10%, Contains 5% ripple (p-p) max.<br>DC voltage & No-voltage input types: Not required (powered by built-in battery) |
| **Power consumption** | | H7ER-SBV: Approx. 800 mW (at 24 VDC) |
| **Current consumption** | | H7ER-SBV: 30 mA (at 24 VDC), 15 mA (at 12VDC), 8 mA (at 5 VDC) |
| **Count input** | **DC voltage input** | High (logic) level: 4.5 to 30 VDC<br>Low (logic) level: 0 to 2 VDC |
| | **No-voltage input** | Maximum short-circuit impedance: 10 kΩ max.<br>Short-circuit residual voltage: 0.5 V max.<br>Minimum open impedance: 500 kΩ min. |
| **Max. counting speed** | | 1 kcps (gate time: 1 second) with the 4-digit version.<br>10 kcps (gate time: 1 second) with the 5-digit version. |
| **Reset system** | | Automatic (no external or manual reset) |

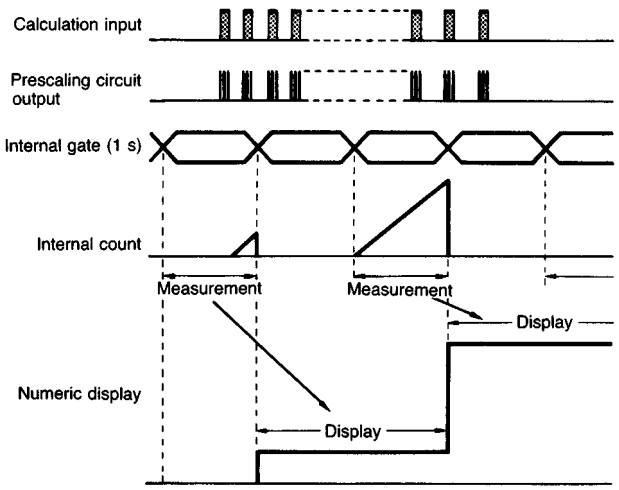
## ■ Characteristics

| | |
|---|---|
| **Insulation resistance** | 100 MΩ min. (at 500 VDC) |
| **Dielectric strength** | 1,000 VAC 50/60 Hz for 1 minute between current-carrying terminals and exposed non-current-carrying metal parts |
| **Impulse withstand voltage** | 4.5 kV for 1 minute between current-carrying terminal and exposed non-current-carrying metal parts |
| **Noise immunity** | 4-digit type: Input terminal ±500V<br>5-digit type: Input terminal ±300V |
| **Vibration resistance** | Mechanical: 10 to 55 Hz; 0.75 mm double amplitude<br>Malfunction: 10 to 55 Hz; 0.3 mm double amplitude |
| **Shock resistance** | Mechanical: 294 $m/s^2$ (approx. 30 G)<br>Malfunction: 98 $m/s^2$ (approx. 10 G) |
| **Ambient temperature** | Operating: –10C° to 55°C<br>Storage: –25C° to 65°C |
| **Ambient humidity** | Operating: 35% to 85% |
| **EMC** | Emission Enclosure: EN55011 Group 1 class A<br>Emission AC Mains: EN55011 Group 1 class A<br>Immunity ESD: EN61000-4-2: 4 kV contact discharge<br>8 kV air discharge<br>Immunity RF-interference: ENV50140: 10 V/m (10 k to 1 GHz)<br>Immunity Conducted Disturbance: ENV50141: 10 V (0.15 to 80 MHz)<br>Immunity Burst: EN61000-4-4: 2 kV power-line<br>2 kV I/O signal-line |
| **Battery life** | 7 years min. of continuous operation |
| **Case color** | Light gray (Munsell 5Y7/1) |
| **Weight** | H7ER-SBV: approx. 80 g (including mounting bracket)<br>DC voltage & No-voltage input types: approx. 60 g<br>(including mounting bracket) |

# Operation

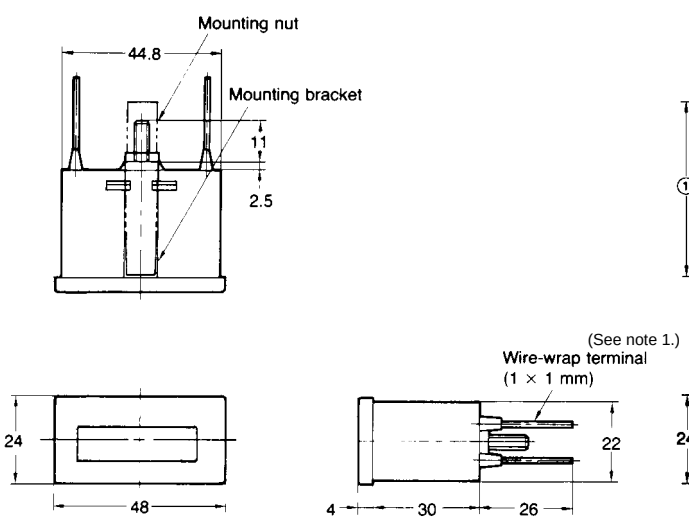
## ■ Operating Mode

**Calculation**
H7ER Digital Tachometer
Additions per Second

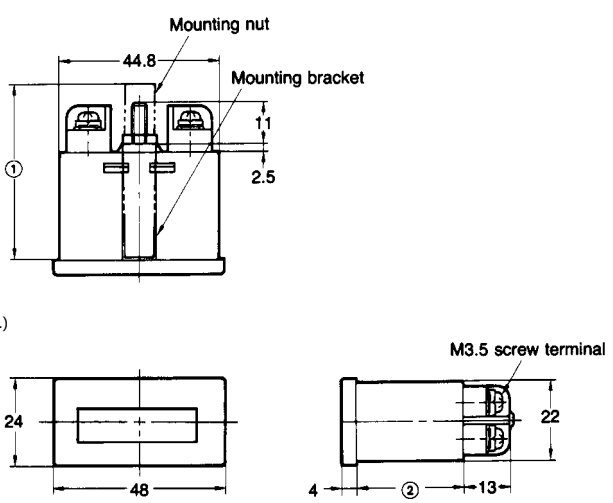



# Dimensions

**Wire-wrap Terminal Type (see note 1)**




**Screw Terminal Type (see note 2)**

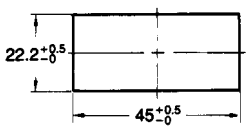



**Note:** 1. The wire-wrap terminal type can also be surface mounted.

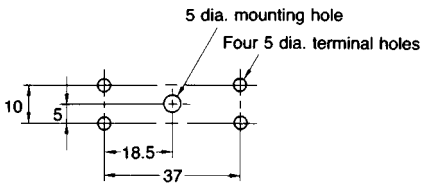
2. As shown in the chart below, two dimensions of the H7ER-SBV differ from other screw-terminal types.

| Dimension | H7ER-SBV | DC voltage input types<br>No-voltage input types |
|---|---|---|
| ① | 78.9 | 48.9 |
| ② | 60 | 30 |

**Panel Cutout**



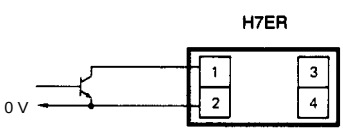

**Mounting Holes**




# Installation

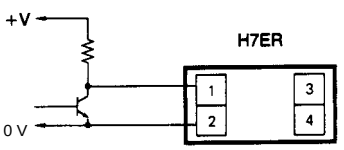
## ■ Connections

**No-voltage Input Type**
Solid-state Input (Open Collector of an NPN Transistor)



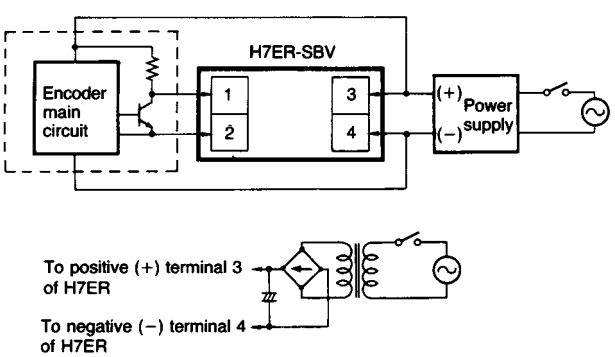

**Note:** Do not connect or use terminals 3 and 4 for any reason.

**DC Voltage Input Type**
Solid-state Input (Open Collector Input of an NPN Transistor)




**Note:** 1. Do not connect or use terminals 3 and 4 for any reason.
2. Select input transistors according to the following:
Dielectric strength of the collector ≧ 50 V
Leakage current < 1 μA

**H7ER-SBV**

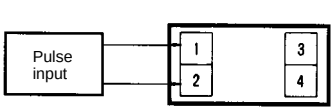



**Note:** Keep the effective DC voltage value to within 7 to 19 V when a smoothing capacitor is not used.

## ■ Terminal Arrangement

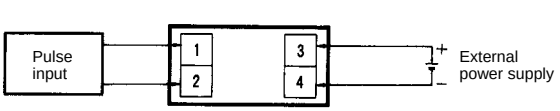
Bottom View: View of the Tachometer rotated horizontally 180°

**H7ER**




**Note:** Do not use terminals 3 and 4 as interrupts.

**H7ER-SBV**

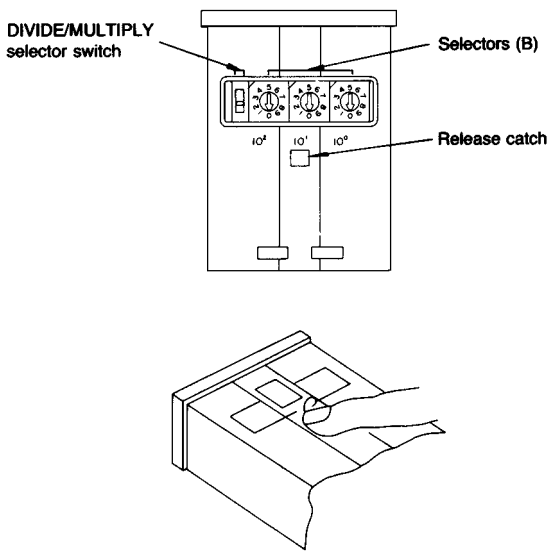



**Note:** There is a short circuit between terminal 2 and terminal 4.

# Operation (H7ER-SBV)

## Setting the RPM Display of the H7ER-SBV

The H7ER-SBV Tachometer is able to display the rotating speed (in either revolutions per second, or per minute) of different encoders. The Tachometer is set by using a sliding selector switch and three selectors, located under flip-up cover on the Tachometer.
Settings and accurately-displayed values depend upon the revolutions output of encoder.
Gain access to the switches by pressing the Tachometer cover, near the hinged cover.




## Setting Procedure

The H7ER-SBV Tachometer has a prescale function that converts input pulses. Set to an appropriate prescale value depending on the output pulse specifications of the encoder. (Refer to the following table.)

| Unit to be displayed | Number of pulses per one encoder rotation | Prescale setting | Applicable revolution | |
|---|---|---|---|---|
| | | | Upper limit | Lower limit |
| rpm (number of revolutions per minute) | 1 | x 60 | 60 rpm | 10,000 rpm |
| | 2 | x 30 | 30 rpm | |
| | 3 | x 20 | 20 rpm | |
| | 4 | x 15 | 15 rpm | |
| | 5 | x 12 | 12 rpm | |
| | 6 | x 10 | 10 rpm | |
| | 10 | x 6 | 6 rpm | |
| | 12 | x 5 | 5 rpm | |
| | 15 | x 4 | 4 rpm | |
| | 20 | x 3 | 3 rpm | |
| | 30 | x 2 | 2 rpm | |
| | 60 | ÷ 1 | 1 rpm | |
| | 120 | ÷ 2 | | 5,000 rpm |
| | 180 | ÷ 3 | | 3,333 rpm |
| | 240 | ÷ 4 | | 2,500 rpm |
| | 300 | ÷ 5 | | 2,000 rpm |
| | 360 | ÷ 6 | | 1,666 rpm |
| | 420 | ÷ 7 | | 1,428 rpm |
| | 480 | ÷ 8 | | 1,250 rpm |
| | 540 | ÷ 9 | | 1,111 rpm |
| | 600 | ÷ 10 | | 1,000 rpm |
| rps (number of revolutions per second) | 1 | ÷ 1 | 1 rps | 10,000 rps |
| | 2 | ÷ 2 | | 5,000 rps |
| | 3 | ÷ 3 | | 3,333 rps |
| | 4 | ÷ 4 | | 2,500 rps |
| | 5 | ÷ 5 | | 2,000 rps |
| | 6 | ÷ 6 | | 1,666 rps |
| | 7 | ÷ 7 | | 1,428 rps |
| | 8 | ÷ 8 | | 1,250 rps |
| | 9 | ÷ 9 | | 1,111 rps |
| | 10 | ÷ 10 | | 1,000 rps |

For example, if the encoder you plan to use has a resolution of 180, and you desire the tachometer to display revolutions per minute, set the tachometer switches as follows:

DIVIDE/MULTIPLY switch: DIVIDE
Left selector ($10^2$): 0
Center selector ($10^1$): 0
Right selector ($10^0$): 3

In this example, the tachometer display will read accurately from 1 to 3,333 rpm. Should the encoder input be outside this range, the tachometer readout will be inaccurate.

## Calculating Tachometer Settings

If the encoder you plan to use has a resolution which is not listed in the table, it will be necessary to calculate the tachometer switch settings.

### rps Settings

If the tachometer is to display rps, set the DIVIDE/MULTIPLY switch to DIVIDE. The selector settings correspond exactly to the resolution value of the encoder.

For example, if the encoder you plan to use has a resolution of 287, and you desire the tachometer to display in units of revolutions per second, set the tachometer switches as follows:

DIVIDE/MULTIPLY switch: DIVIDE
Left selector ($10^2$): 2
Center selector ($10^1$): 8
Right selector ($10^0$): 7

### rpm Settings

If the tachometer is to display rpm, the settings may be easily calculated. However, the encoder resolution value must be a factor of 60, or divisible evenly into 60, and equal to or greater than 60.

When set to □ MULTIPLY using the prescale setting, the rpm is displayed in the unit of □ (preset value).

When the resolution of the encoder is less than 60, set the DIVIDE/MULTIPLY switch to MULTIPLY.

Calculate the selector settings with the following formula:

$B = 60 \div A$

Where: B = value to be set on the selector switches
A = resolution of the encoder

For example, if the encoder has a resolution of 5, the calculation would be:

$60 \div 5 = 12$

thus, the tachometer settings would be:

DIVIDE/MULTIPLY switch: MULTIPLY
Left selector ($10^2$): 0
Center selector ($10^1$): 1
Right selector ($10^0$): 2

When the resolution of the encoder is equal to, or greater than 60, set the DIVIDE/MULTIPLY switch to DIVIDE.

Calculate the DIP switch settings with the following formula:

$B = A \div 60$

For example, if the encoder has a resolution of 720, the calculation would be:

$720 \div 60 = 12$

thus, the tachometer settings would be:

DIVIDE/MULTIPLY switch: DIVIDE
Left selector ($10^2$): 0
Center selector ($10^1$): 1
Right selector ($10^0$): 2

### Calculating Minimum (Rmin) and Maximum (Rmax) Revolutions

In all of the above cases, the number of revolutions the encoder transmits must fall within a calculated minimum and maximum range. If the encoder's output exceeds or falls below this range, the number of revolutions will not be displayed accurately. Also, be aware that the tachometer is not capable of representing values greater than 10,000 even if the calculated value indicates otherwise.

Calculating the maximum number of revolutions (Rmax)
When displaying in rpm
Rmax = 10,000 × 60/A (rpm) or 10,000 (rpm), whichever is smaller

When displaying in rps
Rmax = 10,000/A (rps)

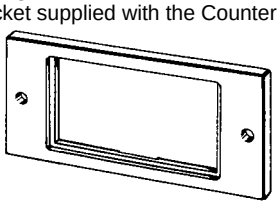
Calculating the minimum number of revolutions (Rmim)
With selector switch set to DIVIDE
Rmin = 1 (rpm or rps)

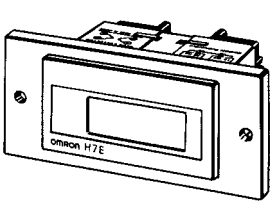
With selector switch set to MULTIPLY
Rmin = 60/A (rpm)

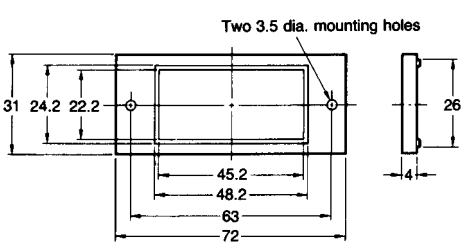
# Accessories (Order Separately)

The H7ER are supplied with the mounting bracket and nut. Additionally, the panel adapters shown here allow the H7ER models to be fitted to existing panel cutouts.

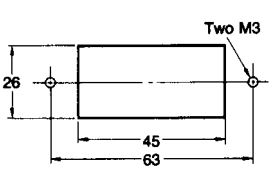
**Flush Mounting Adapter Y92F-75**
**for 26 × 45 Rectangular Cutout**
Use mounting bracket supplied with the Counter



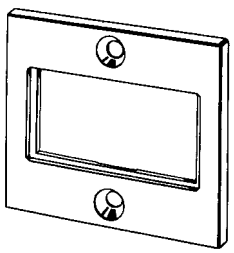


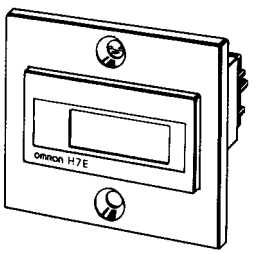



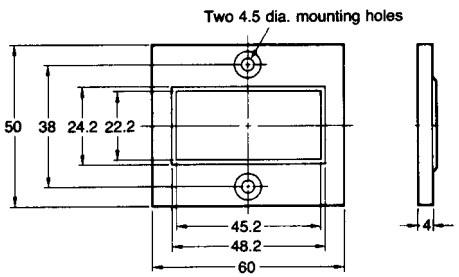

**Panel Cutout**



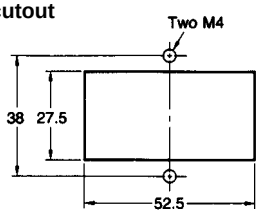
**Flush Mounting Adapter Y92F-76**
**for 27.5 × 52.5 Rectangular Cutout**
Use mounting bracket supplied with the Counter





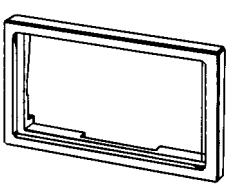



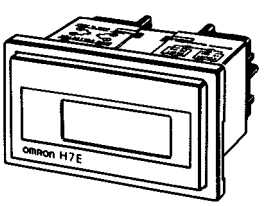

**Panel cutout**

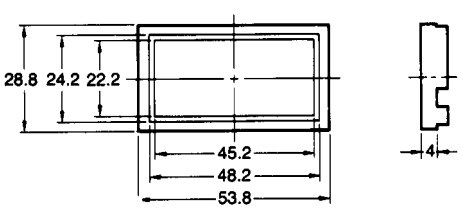



**Flush Mounting Adapter Y92F-77**
**for 24.8 × 48.8 Rectangular Cutout**

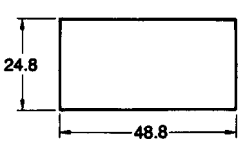
**Note:** Use the Y92F-77 Adapter with the attached No.2 Mounting Bracket. The -SBV models cannot be used.





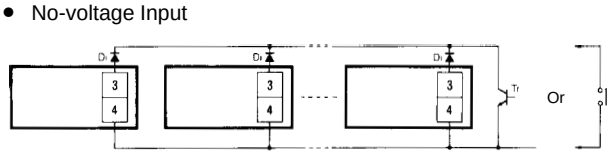

**Panel Cutout**




# Precautions

## Reset Input or Count Input to More than One H7E Counter at a Time

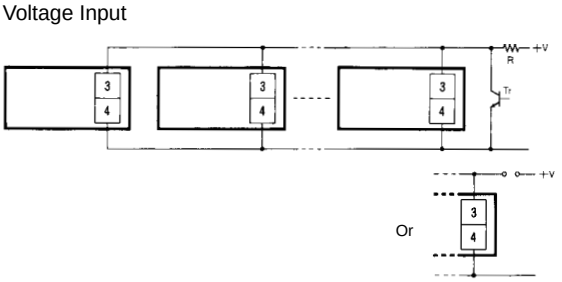
- No-voltage Input




**Note:** 1. The leakage current of the transistor used for input must be less than 1 μA.

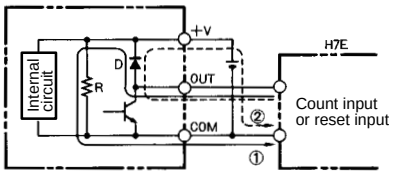
2. The forward voltage of the $D_1$ must be as low as possible (i.e., 0.1 V maximum with an IF of 20 μA) so that the voltage between terminals 3 and 4 will be 0.5 V when reset input is ON.

- Voltage Input



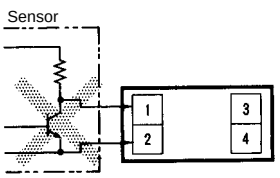

**Note:** H (Reset ON) level must be 4.5 V minimum.

## Reset Input and Count Input

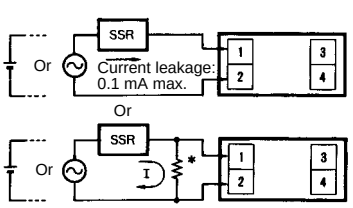



## Input and Power Supply

- Do not impose voltage on the Counter if the Counter is a model that operates with no-voltage input, otherwise the internal circuit of the Counter may be damaged.
  Do not connect any single input signal in parallel to Counter models operating with non-voltage input and those operating with voltage input, otherwise the Counters may malfunction.
- When connecting a sensor to the Counter that operates with no-voltage input, make sure that the sensor has open collector output.




- When using shielded wire, stray capacitance may occur. The operation of the Counter might be affected when using wires which have a capacitance exceeding 500 pF (about 10 m, with parallel wires of 2 $mm^2$). Keep all wires as short as possible.
- When connecting an open collector input from a transistor to the Counter that operates with no-voltage input, make sure that the leakage current of the transistor is 5 μA maximum.
- When connecting count input from an SSR to the Counter that operates with free-voltage input, use OMRON's G3TA-IA or G3TA-ID SSR, otherwise make sure that the leakage current of the SSR is 0.1 mA maximum or connect a bleeder resistor in parallel to the input circuit of the Counter.




*Bleeder resistor
The voltage between terminals 1 and 2 must be 1.5 V maximum when the SSR is OFF.

- Apply DC voltage (including full-wave rectification) to the H7ER-SBV as its source power. Applying voltage of half-wave rectification or phase control will cause display errors.

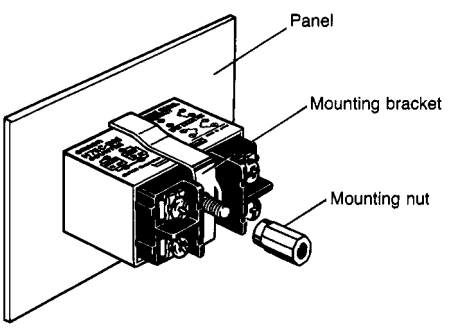
## Wire-wrap Terminals

The dimensions of the terminals used on H7E wire-wrap models measure 1 × 1 mm. When wiring a Counter with wire-wrap terminals, select one of the three gauges of wire from the table below. Also listed in the table are the appropriate wiring hardware.

| Wire gauge | Bit | Sleeve | Method |
|---|---|---|---|
| AWG22 | 2-A | 2-B | Normal wire-wrap |
| AWG24 | 1-A | 1-B | Normal wire-wrap |
| AWG26 | 3-A | 3-B | Normal wire-wrap |

## How to Mount the Counter

Insert the H7E Counter from the front of the mounting panel. Slide the mounting bracket into place from the rear of the panel, and tighten the knurled nut by hand. Do not use tools (such as pliers) to tighten the nut. Excessive tightening may damage the Counter.




**⚠ Caution**

The H7ER has a built-in lithium battery. Be sure to dispose of the old H7ER properly, as lithium batteries are likely to explode if incinerated.

**ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.**
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. M062-E1-1 **In the interest of product improvement, specifications are subject to change without notice.**

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