

Solid-state Timer H3BA-N

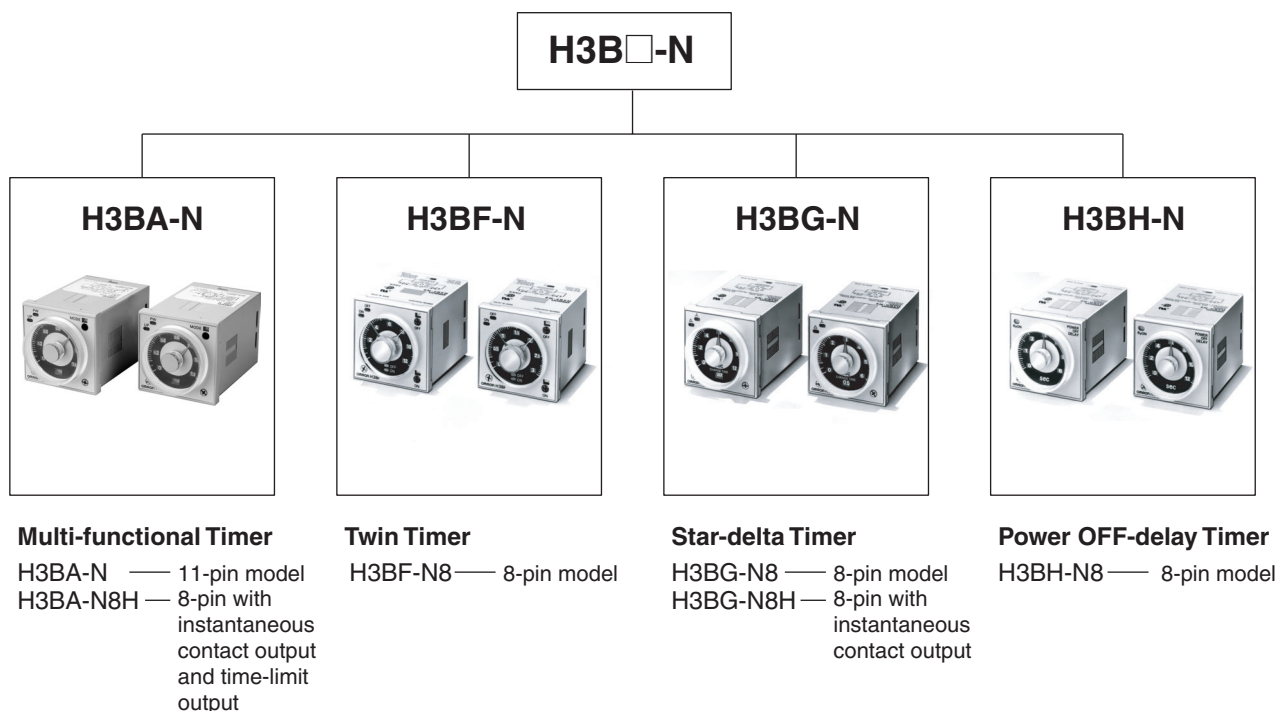
Please read and understand this catalog before purchasing the products. Please consult your OMRON representative if you have any questions or comments. Refer to *Warranty and Application Considerations* (page 20), and *Safety Precautions* (page 16).

Solid-state Timer with Valuable Multiple-time Ranges and Multiple-operating Modes

- Handles a wide range of applications through six operating modes.
- With H3BA-N8H models, the output type can be switched between time-limit DPDT and time-limit SPDT + instantaneous SPDT using a selector.
- Setting rings (order separately) to enable consistent settings and to limit the setting range.
- Panel Covers (order separately) to enable various panel designs.
- Conforms to LR and approved by UL and CSA.



■ Broad Line-up of H3B□-N Series



Note: Refer to the *H3BF-N/BG-N/BH-N Datasheet (Cat. No. L094-E1-1)* for details.

Model Number Structure

Model Number Legend

H3BA-N□

1

1. Number of Pins/Output

None: 11-pin models/Time-limit DPDT

8H: 8-pin models/Time-limit SPDT and switchable SPDT (time-limit ↔ instantaneous)

Ordering Information

List of Models

Control output	Supply voltage	11-pin models	8-pin models
Contact output: DPDT (time-limit output)	110 VAC (50/60 Hz)	H3BA-N 110 VAC	---
	220 VAC (50/60 Hz)	H3BA-N 220 VAC	
	24 VDC	H3BA-N 24 VDC	
Contact output: Time-limit SPDT and switchable SPDT (time-limit ↔ instantaneous)	110 VAC (50/60 Hz)	---	H3BA-N8H 110 VAC
	220 VAC (50/60 Hz)		H3BA-N8H 220 VAC
	24 VDC		H3BA-N8H 24 VDC

Accessories (Order Separately)

Name/specifications		Models
Flush Mounting Adapters		Y92F-30 Y92F-70 Y92F-71
Mounting Tracks	50 cm (l) × 7.3 mm (t)	PPF-50N
	1 m (l) × 7.3 mm (t)	PPF-100N
	1 m (l) × 16 mm (t)	PPF-100N2
End Plate		PPF-M
Spacer		PPF-S
Protective Cover		Y92A-48B
Track Mounting/ Front Connecting Sockets	8-pin	P2CF-08
	11-pin	P2CF-11
Back Connecting Sockets	8-pin	P3G-08
	11-pin	P3GA-11
Time Setting Ranges	Setting a specific time	Y92S-27
	Limiting the setting range	Y92S-28
Panel Covers (See note 1.)	Light gray (5Y7/1)	Y92P-48GL
	Black (N1.5)	Y92P-48GB
	Medium gray (5Y5/1)	Y92P-48GM
Hold-down Clips (See note 2.)	For PL08 Socket	Y92H-1
	For PF085A Socket	Y92H-2

Note: 1. The Time Setting Ring and Panel Cover are sold together.

2. Hold-down Clips are sold in sets of two.

Specifications

■ General

Item	H3BA-N	H3BA-N8H
Operating mode	A: ON-delay B: Flicker OFF start B2: Flicker ON start C: Signal ON/OFF-delay D: Signal OFF-delay E: Interval	A: ON-delay H: ON-delay with instantaneous output contact
Pin type	11-pin	8-pin
Input type	No-voltage input	---
Output type	DPDT (time-limit)	SPDT (time-limit) and switchable SPDT (time-limit <---> instantaneous)
Mounting method	DIN track mounting, surface mounting, and flush mounting	
Approved standards	UL508, CSA C22.2 No.14, Conforms to LR (currently under application and approval is expected by the end of Feb. 2006)	

■ Time Ranges

Time unit	s (sec)	min	h (hrs)	× 10 h (10 h)
Setting	1.2	0.05 to 1.2	0.12 to 1.2	1.2 to 12
	3	0.3 to 3		3 to 30
	12	1.2 to 12		12 to 120
	30	3 to 30		30 to 300

■ Ratings

Item	H3BA-N	H3BA-N8H
Rated supply voltage (See notes 1 and 2)	110 VAC (50/60 Hz), 220 VAC (50/60 Hz), 24 VDC	
Operating voltage range (See note 3)	85% to 110% of rated supply voltage	
Power reset	Minimum power-opening time: 0.1 s	
No-voltage input	ON impedance: 1 kΩ max. ON residual voltage: 1 V max. OFF impedance: 200 kΩ min.	
Power consumption	110 VAC: Approx. 4.6 VA (1.5 W) 220 VAC: Approx. 7.9 VA (1.3 W) 24 VDC: Approx. 0.6 W	110 VAC: Approx. 3.6 VA (1.6 W) 220 VAC: Approx. 5.4 VA (1.4 W) 24 VDC: Approx. 0.9 W
Control outputs	Contact: 5 A at 250 VAC, resistance load (cosφ = 1)	

- Note:**
1. DC ripple rate: 20% max.
 2. Models other than 24-VDC H3BA-N models cause an inrush current. Pay careful attention when attempting to turn on power to such models with non-contact output from a device such as a sensor.
 3. 90% or higher if the Timer is used continuously at a high ambient temperature.

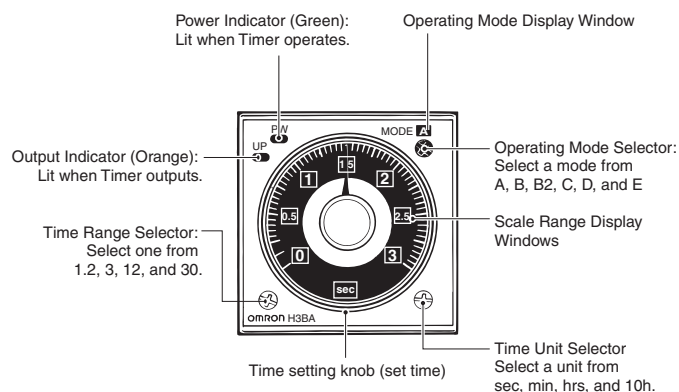
■ Characteristics

Item	H3BA-N	H3BA-N8H
Accuracy of operating time	±0.3% FS max. (±0.3%±10 ms in a range of 1.2 s)	
Setting error	±5% FS ±0.05 s max.	
Reset time	Min. power-opening time: 0.1 s max. Min. pulse-input time: 50 ms	
Influence of voltage	±0.5% FS max. (±0.5%±10 ms in a range of 1.2 s)	
Influence of temperature	±2% FS max. (±2%±10 ms in a range of 1.2 s)	
Insulation resistance	100 MΩ min. (at 500 VDC)	
Dielectric strength	2,000 VAC, 50/60 Hz for 1 min between current-carrying metal parts and exposed non-current-carrying metal parts 2,000 VAC, 50/60 Hz for 1 min between control output terminals and operating circuit 1,000 VAC, 50/60 Hz for 1 min between contacts not located next to each other (750 VAC for H3BA-N8H)	
Impulse withstand voltage	1 kV (between power terminals) 2 kV (between current-carrying terminal and exposed non-current-carrying metal parts, 1.5 kV for 24-VDC models)	
Noise immunity	AC models: ±1.5 kV (between power terminals), and ±600 V (between input terminals), square-wave noise by noise simulator (pulse width: 100 ns/1 μs, 1-ns rise) DC models: ±480 V (between power terminals), and ±600 V (between input terminals), square-wave noise by noise simulator (pulse width: 100 ns/1 μs, 1-ns rise)	
Static immunity	Malfunction: 4 kV Destruction: 8 kV	
Vibration resistance	Destruction: 10 to 55 Hz with 0.75-mm single amplitude each in three directions Malfunction: 10 to 55 Hz with 0.5-mm single amplitude each in three directions	
Shock resistance	Destruction: 1,000 m/s ² (approx. 100G) each in three directions Malfunction: 100 m/s ² (approx. 10G) each in three directions	
Ambient temperature	Operating: -10°C to 55°C (with no icing) Storage: -25°C to 65°C (with no icing)	
Ambient humidity	Operating: 35% to 85%	
Life expectancy	Mechanical: 20 million operations min. (under no load at 1,800 operations/h) Electrical: 100,000 operations min. (5 A at 250 VAC, resistive load at 1,800 operations/h)	Mechanical: 10 million operations min. (under no load at 1,800 operations/h) Electrical: 100,000 operations min. (5 A at 250 VAC, resistive load at 360 operations/h)
Case color	Light gray (Munsell 5Y7/1)	
Enclosure ratings	IEC: IP40 (panel surface)	
Weight	Approx. 95 g	

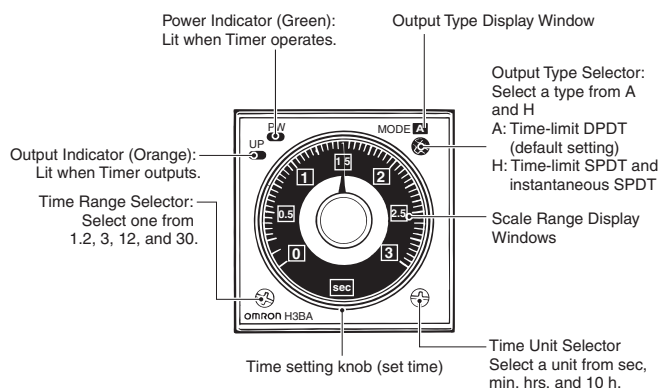
Note: For setting the time-limit of the Timer to a cycle of less than 3 seconds or applying the forced reset, use the H3BA-N in mode D (signal OFF-delay).

Nomenclature

H3BA-N



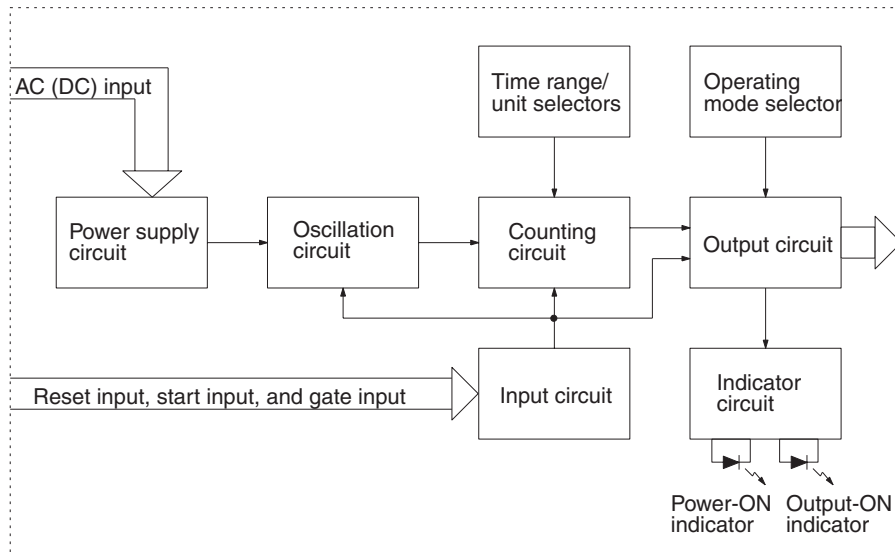
H3BA-N8H



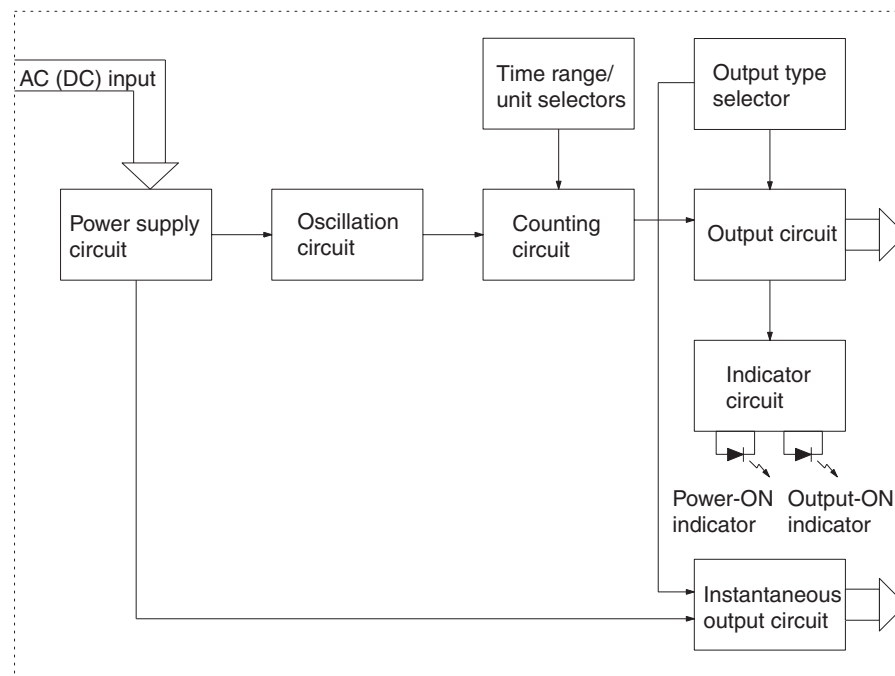
Operation

■ Block Diagrams

H3BA-N



H3BA-N8H



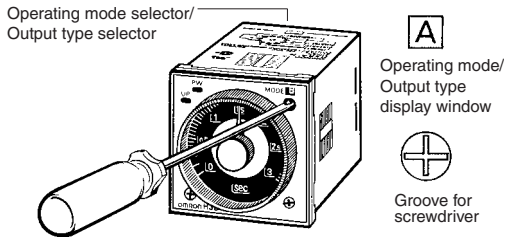
■ I/O Functions

Inputs	Start	Starts time-measurement.
	Reset	Interrupts time-measurement and resets time-measurement value. No time-measurement is made and control output is OFF while the reset input is ON.
	Gate	Prohibits time-measurement.
Outputs	Control output	Outputs are turned ON according to designated output mode when preset value is reached.

Basic Setting

Setting of Selector

The selectors can be turned clockwise and counterclockwise to select the desired time unit, time range, output type (only for H3BA-N8H) or operating mode. Each selector has a snap mechanism that secures the selector at a given position. Set the selector at a position at which it is secured. Do not set it midway between two securing positions or a malfunction could result from improper setting.



Selection of Operating Mode with H3BA-N

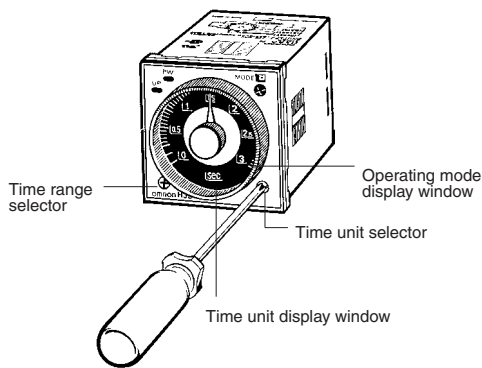
Turn the operating mode selector with a screwdriver until the desired operating mode (A, B, B2, C, D, or E) appears in the display window located above the selector.

Selection of Output Type with H3BA-N8H

Turn the output type selector with a screwdriver until the desired output type (A or H) appears in the display window located above the selector.

Selection of Time Unit and Time Range

The desired time unit (sec, min, hrs, or 10h) is displayed in the window below the time setting knob by turning the time unit selector located at the lower right corner of the front panel. A time range (1, 2, 3, 12, or 30) is selected with the time range selector at the lower left corner of the front panel, and the selected time range appears (in the window at the lower right part) within the plastic frame of the time setting knob.



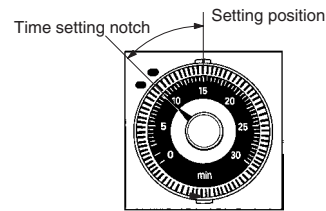
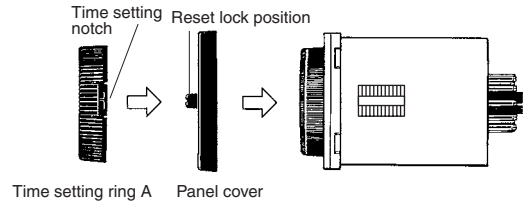
Setting of Time

Use the time setting knob to set the desired time.

Using the Setting Ring

Setting a Specific Time

Mount the Panel Cover on the Timer, set the desired time with the time setting knob, and place Time Setting Ring A onto the time setting knob so that the time setting notch of Time Setting Ring A is in the center of the reset lock position of the Panel Cover.

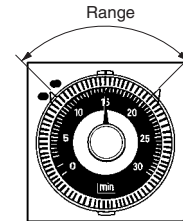
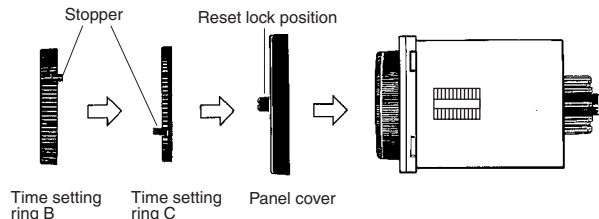


Example: To set the time to 10 s.

Limiting the Setting Range

Example: To set a range of 10 and 20 s.

Mount the Panel Cover on the Timer, set the time setting knob to 10 s (the lower limit of the setting range), and place Time Setting Ring C onto the time setting knob so that the stopper of Time Setting Ring C is on the right edge of the reset lock position of the Panel cover. Next, set the time setting knob to 20 s (the upper limit of the setting range), place Time Setting Ring B onto the time setting knob so that the stopper of Time Setting Ring B is on the left edge of the reset lock position of the Panel Cover.

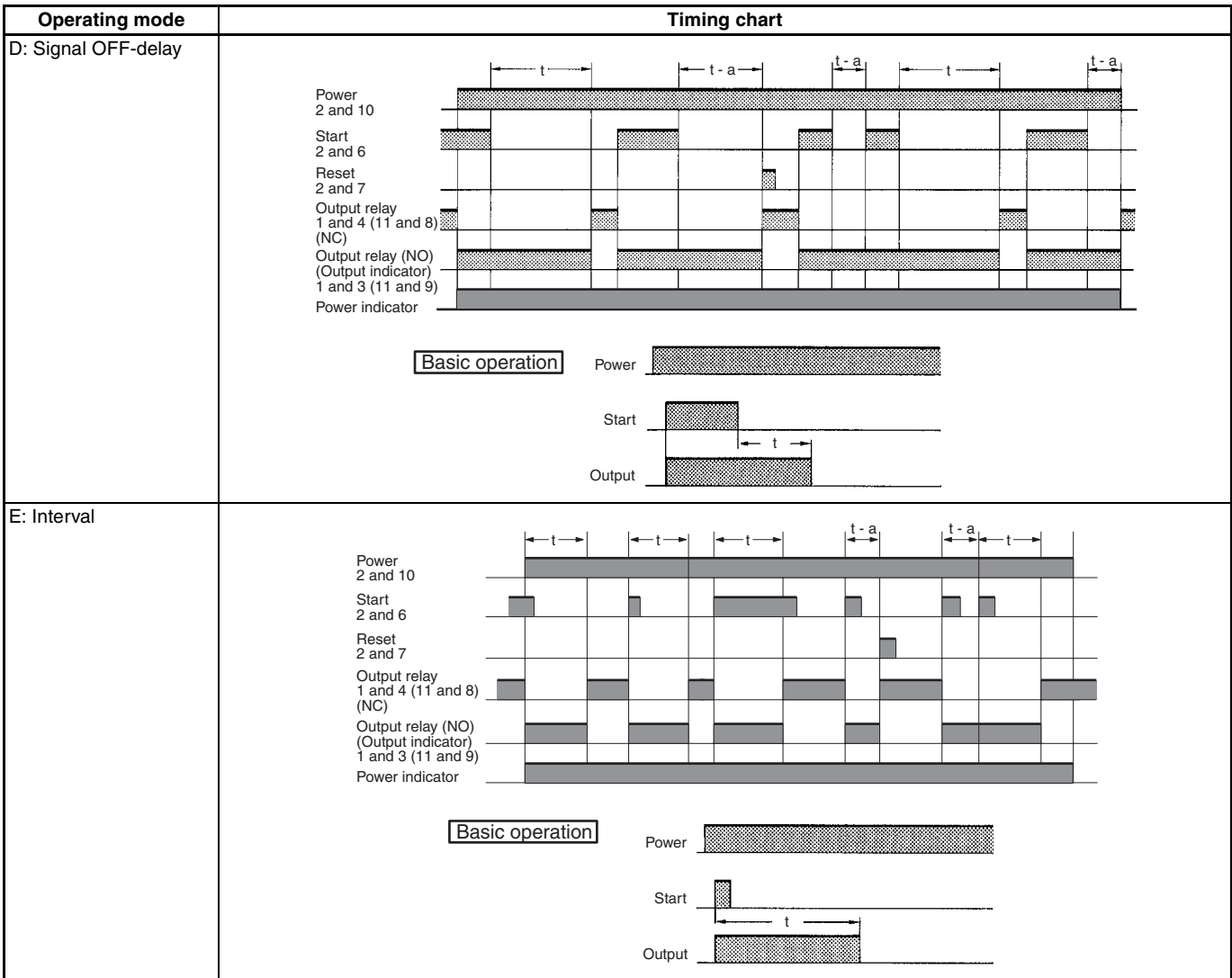


Timing Chart

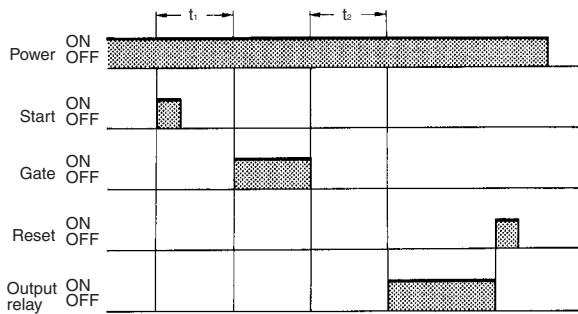
- Note:** 1. The minimum power-opening time ("Rt") is 0.1 s and the minimum pulse width is 0.05 s.
 2. The letter "t" in the timing charts stands for the set time and "t-a" means that the period is less than the time set.

H3BA-N

Operating mode	Timing chart	
A: ON-delay Power 2 and 10 Start 2 and 6 Reset 2 and 7 Output relay (NC) 1 and 4 (11 and 8) Output relay (NO) 1 and 3 (11 and 9) and output indicator Power indicator		<p>Basic operation</p>
B: Flicker OFF start Power 2 and 10 Start 2 and 6 Reset 2 and 7 Output relay (NC) 1 and 4 (11 and 8) Output relay (NO) 1 and 3 (11 and 9) and output indicator Power indicator		<p>Basic operation</p>
B2: Flicker ON start Power 2 and 10 Start 2 and 6 Reset 2 and 7 Output relay 1 and 4 (11 and 8) (NC) Output relay (NO) (Output indicator) 1 and 3 (11 and 9) Power indicator		<p>Basic operation</p>
C: Signal ON/OFF-delay Power 2 and 10 Start 2 and 6 Reset 2 and 7 Output relay 1 and 4 (11 and 8) (NC) Output relay (NO) (Output indicator) 1 and 3 (11 and 9) Power indicator		<p>Basic operation</p>

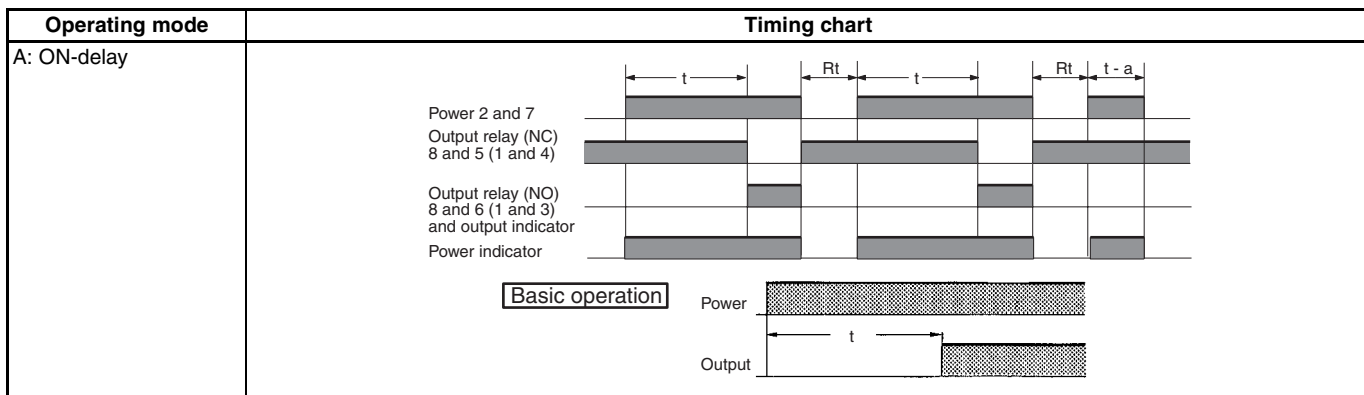


Gate Signal Input in Operating Mode A (ON-delay Operation)

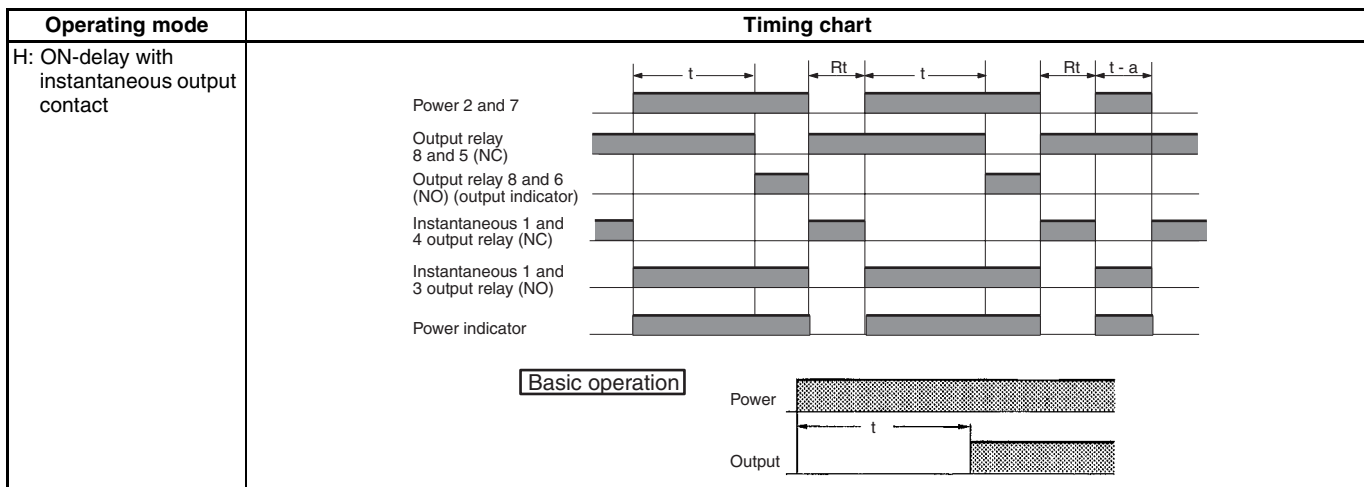


Note: The set time is the sum of t_1 and t_2 .

H3BA-N8H, Output Type: A Type



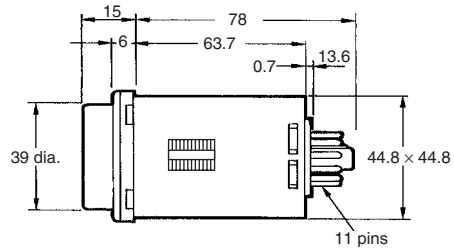
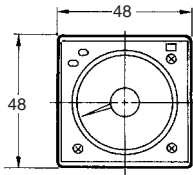
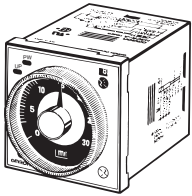
H3BA-N8H, Output Type: H Type



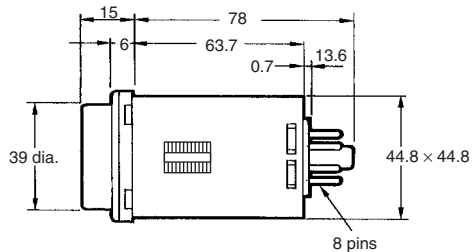
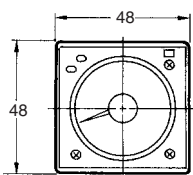
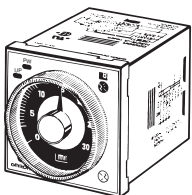
Dimensions

Note: All units are in millimeters unless otherwise indicated.

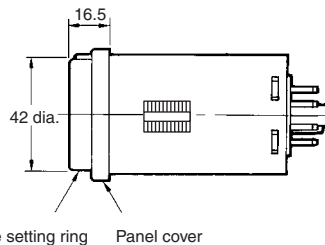
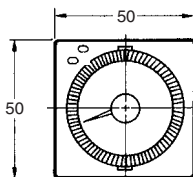
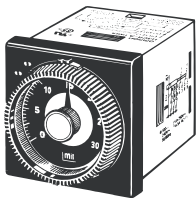
H3BA-N



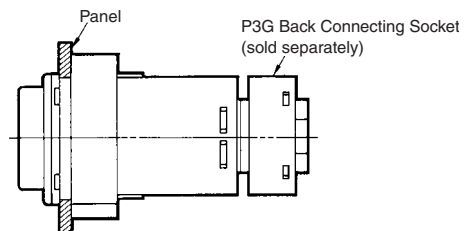
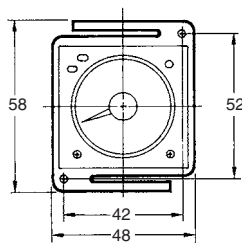
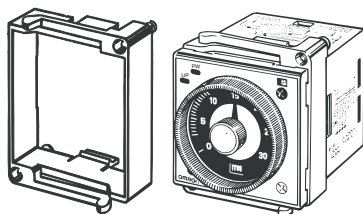
H3BA-N8H



Dimensions with Set Ring

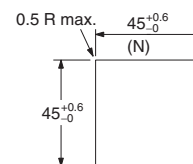


Dimensions with Y92F-30 Flush Mounting Adapter

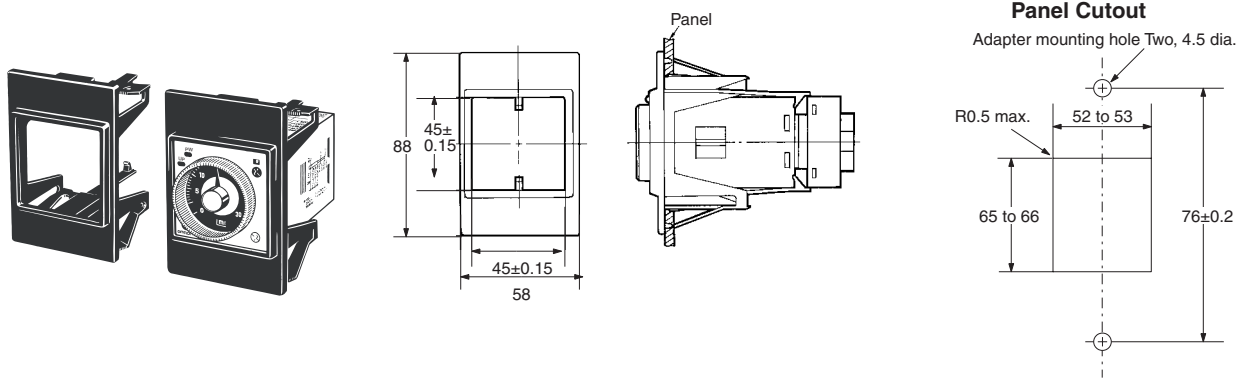


Note: The mounting panel thickness should be 1 to 5 mm.

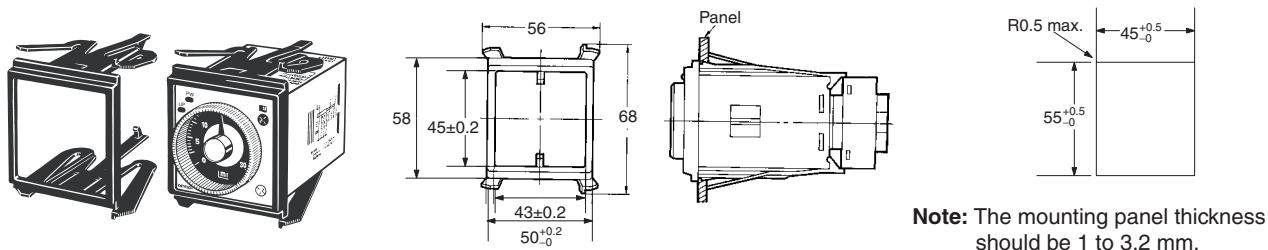
Panel Cutout



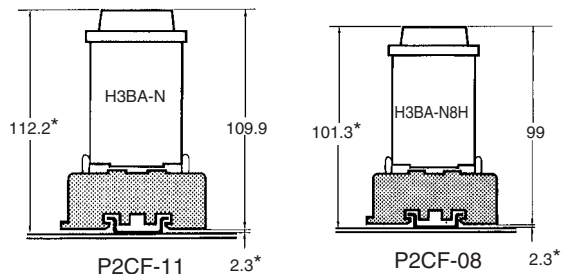
Dimensions with Y92F-70 Flush Mounting Adapter



Dimensions with Y92F-71 Flush Mounting Adapter

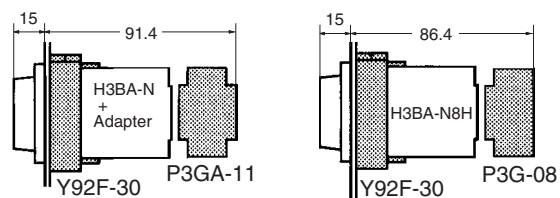


Track Mounting



Note: These dimensions vary with the kind of DIN track (reference value).

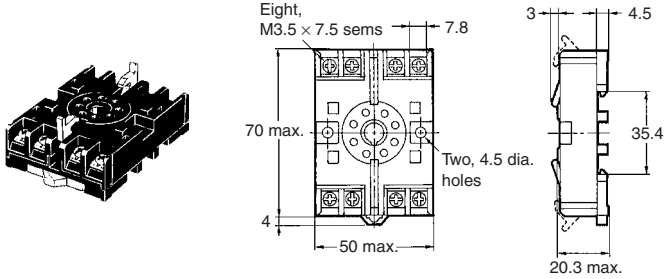
Flush Mounting



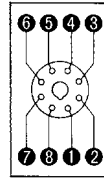
■ Accessories (Order Separately)

Track Mounting/Front Connecting Socket

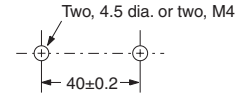
P2CF-08



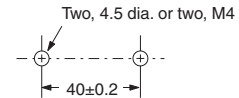
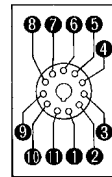
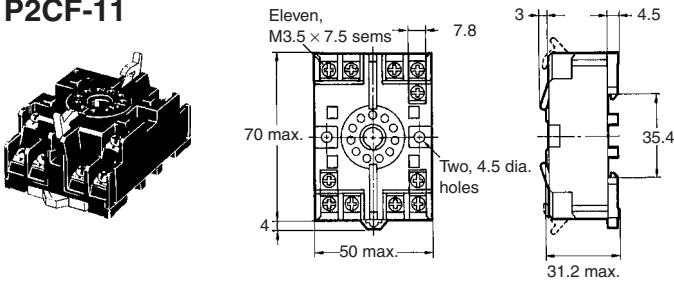
Terminal Arrangement/
Internal Connections
(Top View)



Surface Mounting Holes

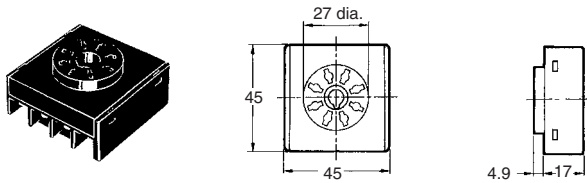


P2CF-11

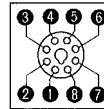


Back Connecting Socket

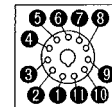
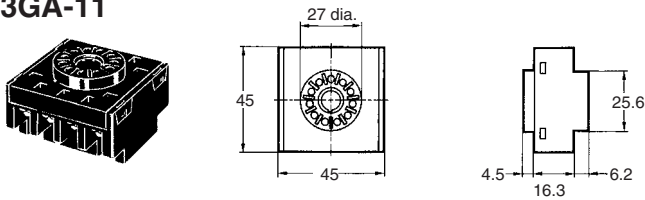
P3G-08



Terminal Arrangement/
Internal Connections
(Bottom View)

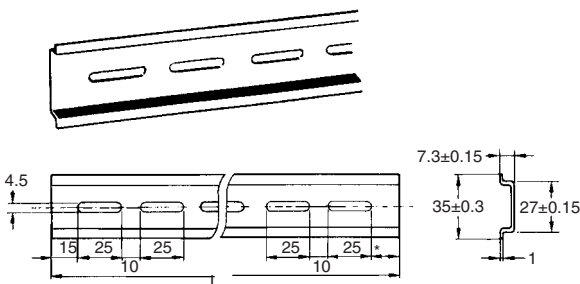


P3GA-11

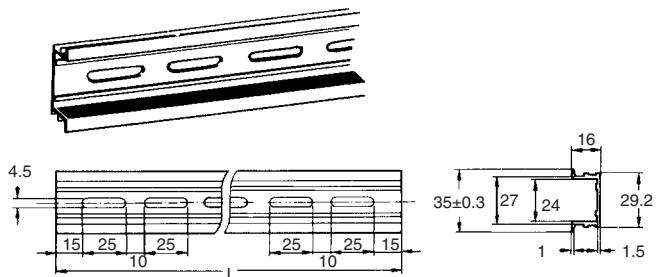


Mounting Track

PFP-100N, PFP-50N



PFP-100N2

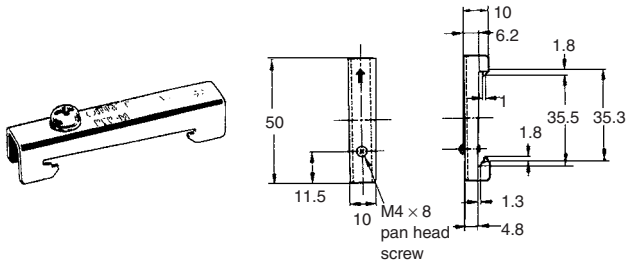


L: Length

1 m	PFP-100N
50 cm	PFP-50N
1 m	PFP-100N2

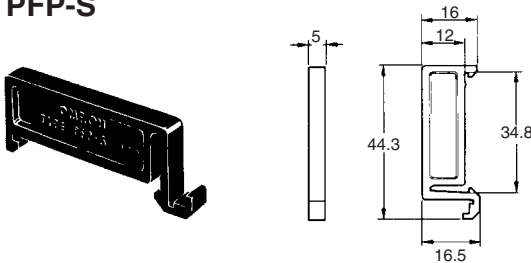
End Plate

PFP-M



Spacer

PFP-S



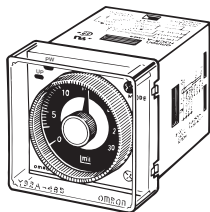
Protective Cover

Y92A-48B

The protective cover protects the front panel, particularly the time setting section, against dust, dirt, and water. It also prevents the set value from being altered due to accidental contact with the time setting knob.

- Note:**
1. The Y92A-48B Protective Cover is made of a hard plastic and therefore it must be removed to change the timer set value.
 2. The Protective Cover cannot be mounted if the Panel Cover (sold separately) is used on the Timer.

Y92A-48B



Time Setting Ring/Panel Cover

There are three types of Panel Covers (Y92P-48GL, Y92P-48GB, and Y92P-48GM), all of which are available in three colors. Use the most suitable type of Panel Cover with the design of the scaling plate according to the application.

When setting a given time for the Timer, use of the Y92S-27 or Y92S-28 Time Setting Ring facilitates the time setting operation and minimizes possible setting errors by operators.

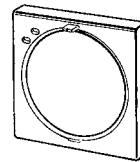
The Time Setting Ring and Panel Cover should be used as a pair.

Setting a specific time	Time Setting Ring A (Y92S-27) and Panel Cover (Y92P-48GL, -48GB, or -48GM)
Limiting the setting range	Time Setting Ring B or C (Y92S-28), and Panel Cover (Y92P-48GL, -48GB, or -48GA)

Y92S-27 Time Setting A



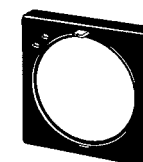
Y92P-48GL Light Gray



Y92S-28 Time Setting B



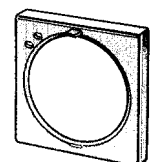
Y92P-48GB Black



Y92S-28 Time Setting C

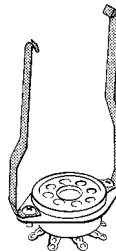


Y92P-48GM Medium Gray

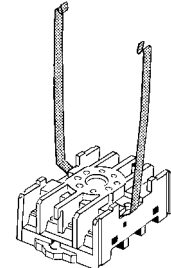


Hold-down Clip

Y92H-1 For PL08 Socket



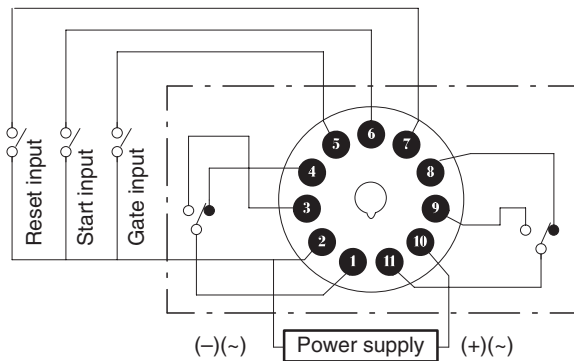
Y92H-2 For PF085A Socket



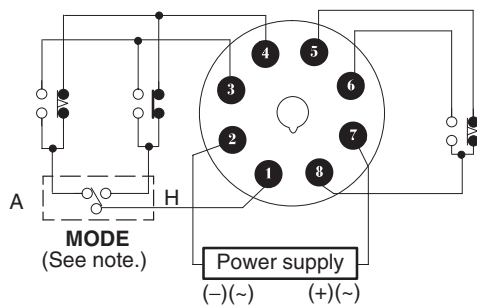
Installation

■ Terminal Arrangement

H3BA-N (Contact Output)



H3BA-N8H (Contact Output)



Note: The output contact can be set to either instantaneous or time-limit contact using the output type selector located at the upper right corner of the front panel.

Note: The delayed contacts of conventional timers are shown as follows:



The contact symbol of the H3BA-N is expressed as follows because of its multiple operating modes:



The instantaneous contacts of conventional timers are shown as follows:

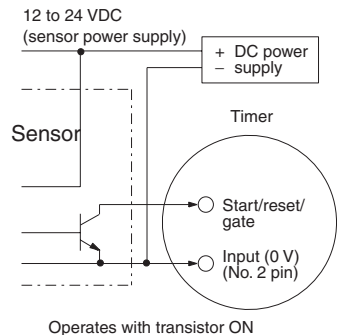


Input Connections

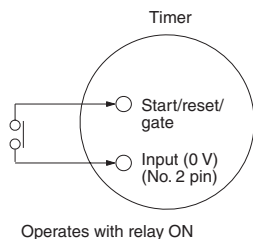
The inputs of the H3BA-N are no-voltage (short circuit or open) inputs.

No-voltage Inputs

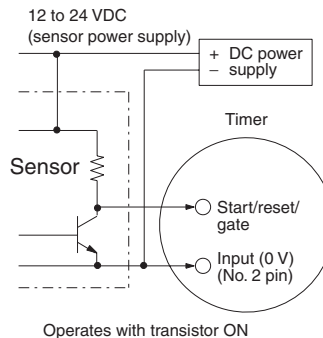
No-contact Input
(Connection to NPN open collector output sensor.)



Contact Input



No-contact Input
(Connection to a voltage output sensor.)



No-voltage Input Signal Levels

No-contact input	1. Short-circuit level Transistor ON Residual voltage: 1 V max. Impedance when ON: 1 kΩ max.
	2. Open level Transistor OFF Impedance when OFF: 200 kΩ min.
Contact input	Use contacts which can adequately switch 0.1 mA at 5 V

Safety Precautions

CAUTION

Minor electric shock may occasionally occur. Do not disassemble the product or touch the interior of the Timer.



Minor burns may occasionally occur. Do not touch the product while power is being supplied or immediately after power is turned OFF.



Minor fires may occasionally occur. Tighten terminal screws to a torque of 1.08 N·m so that they do not become loose.



Minor electric shock may occasionally occur during operation. Install the terminal cover.



Minor electric shock, fire, or malfunction may occasionally occur.



Do not allow metal fragments, lead wire scraps, or chips from processing during installation to fall inside the Timer.

Precautions for Safe Use

Please observe the following precautions for safe use of this product.

Environmental Precautions

Store the Timer within specified ratings. If the Timer has been stored at -10°C or lower, let it stand for 3 hours or longer at room temperature before turning ON the power supply.

Use the Timer within the specified ratings for operating temperature and humidity.

Do not operate the Timer in locations subject to sudden or extreme changes in temperature, or locations where high humidity may result in condensation.

Do not use the Timer in locations subject to excessive dust, corrosive gas, or direct sunlight.

Do not use the Timer in locations subject to vibration or shock. Extended use in such locations may result in damage due to stress.

Install the Timer well away from any sources of static electricity, such as pipes transporting molding materials, powders, or liquids.

Usage Precautions

Install a switch or circuit breaker that allows the operator to immediately turn OFF the power, and label it to clearly indicate its function.

Pay careful attention to polarity to prevent wrong connections when wiring terminals.

Internal elements may be destroyed if a voltage outside the rated voltage is applied.

Maintain voltage fluctuations in the power supply within the specified range.

The Timer uses a transformerless power supply. Do not touch the input terminals while the supply voltage is being applied, otherwise an electric shock may occur.

Precautions for Correct Use

Changing the Setting

Do not change the time unit, time range, or operation mode while the Timer is in operation, otherwise the Timer may malfunction.

Connecting the Operating Power Supply

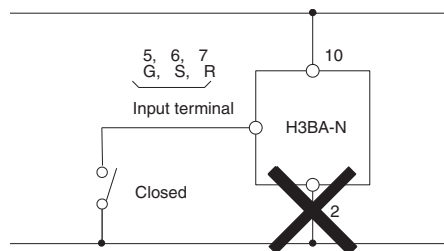
The H3BA-N□ contains a capacitor-drop power circuit. Use a sinusoidal power supply with a commercial frequency. Do not use power supplies with a high frequency component (such as inverter power supplies) for Timers with 110 or 220-VAC specifications. Using these power supplies can damage internal circuits.

If voltages other than the rated voltage is applied, the internal components may be damaged. The internal element (varistor) will be damaged if a voltage of higher than 100 VAC is applied to the 24-VDC line.

Connect the power supply voltage through a relay or switch in such a way that the voltage reaches a fixed value immediately or the Timer may not be reset or a timer error could result.

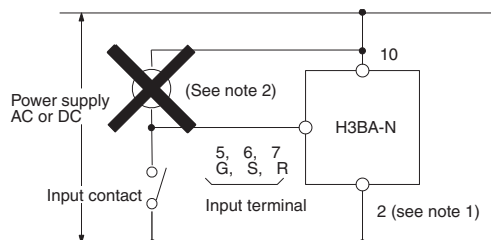
A DC power supply can be connected if its ripple factor is 20% or less and the mean voltage is within the rated operating voltage range of the Timer.

If the wiring to the terminal 2 (common terminal for both the power supply and input signals) is broken, the internal circuit will be destroyed.



Input/Output

An appropriate input will be applied to the input signal terminals of the Timer when one of the input terminals (terminals 5, 6, and 7) and the common terminal (terminal 2) for the input signals are short-circuited. Do not attempt to connect any input terminal to any terminal other than the common terminal or to apply voltage across other than the specified input and common terminals or the internal circuits of the Timer may be damaged.



Note: 1. Power supply terminal 2 is a common terminal for the input signals (G, S, R) to the Timer. Never use terminal 10 as the common terminal for this purpose, otherwise the internal circuit of the Timer may be damaged.

2. Do not connect a relay or any other load between these two points, otherwise the internal circuit of the Timer may be damaged due to the high-tension voltage applied to the input terminals.

Operating Time Setting

When setting the operating time, do not turn the setting knob beyond its scale range. For precise time setting, conduct operation tests by adjusting the setting knob.

The accuracy of the operating time of the Analog Timer is indicated by the percentage value on the basis of the full-scale time. The absolute fluctuation value will not be improved by changing the time setting. Therefore, when selecting the model, be sure that the application will be able to use a time setting as close as the full-scale time setting of the Timer.

Others

When conducting a dielectric test, impulse voltage test, or insulation resistance test between the electric circuit and non-current-carrying metal parts of the Timer mounted to a control panel, be sure to take the following steps. These steps will prevent the internal circuitry of the Timer from damage that may be caused if a machine on the control panel has an improper dielectric strength or insulation resistance.

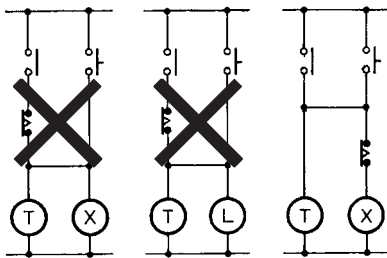
1. Separate the Timer from the circuitry of the control panel by disconnecting the socket from the Timer or wires.
2. Short-circuit all terminals of the Timer.
If any device with no-contact output, such as a proximity sensor, photoelectric sensor, or SSR, is directly connected to the Timer, current leakage from the device may cause Timer malfunction. Be sure to test the device with the Timer before using the device for actual applications.

Before using the Timer to switch inductive loads, be sure to connect a surge absorbing element to the Timer in order to prevent the Timer from malfunction and damage. A diode is an example of a surge absorbing element for DC circuits and a surge absorber is an example of a surge absorbing element for AC circuits.

Do not leave the Timer in time-up condition for a month or longer in places with high temperatures, otherwise the internal parts, such as an electrolytic capacitor, of the Timer may be damaged. Use the Timer with an appropriate relay so that the Timer will not be left in time-up condition for a long time.

If the Timer is mounted in contact with a mounting surface, the service life of internal parts may be shortened. Provide at least 10 mm between the Timer and the mounting surface to prolong the service life of the Timer.

When the Timer is reset right after the Timer goes into time-up condition, be sure to provide the Timer with an appropriate circuit configuration considering the resetting time of the Timer so that a sequential error will not result.



The Timer uses the constant value read method. Be careful when changing the set value because the output of the Timer will be ON when the set value coincides with the count value.

Be sure that the casing of the Timer is free from organic solvents, such as paint thinner and benzene, strong acid, and alkali solvents, which will damage the casing.

Note: It is impossible to connect more than two Timers in parallel.

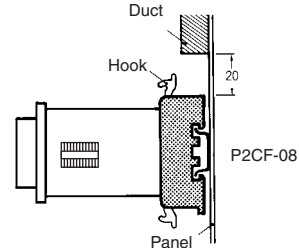
Mounting

Surface Mounting

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

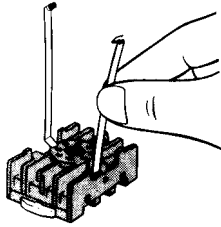
P2CF Socket

When mounting the Timer 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.

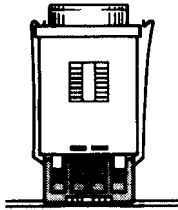


PL Socket

1. Secure the Socket to the panel surface with screws and insert the F-shaped hook into the sockets.

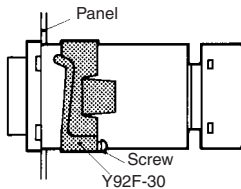


2. Connect the Timer to the Socket and press the tip of each hook by hand.



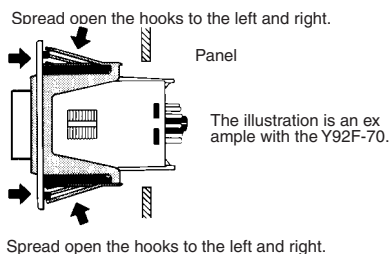
Panel Mounting

When the Y92F-30 Flush Mounting Adapter is used, insert the Timer into the square hole from the front side of the panel and put on the Flush Mounting Adapter from the rear side of the Timer. 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.



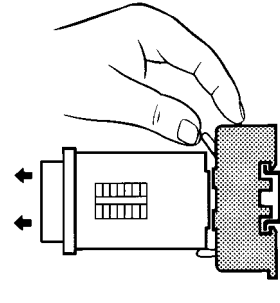
When using the US08, be sure to use 10.5-dia. max. multi-conductor cable or 3-dia. max. insulated stranded wire for wiring.

When the Y92F-40, Y92F-70 or Y92F-71 Flush Mounting Adapter is used, just insert the Timer into the square panel hole. If the panel coating is too thick and the hooks do not click, spread open the hooks appropriately to the left and right after inserting the Timer to the hole.



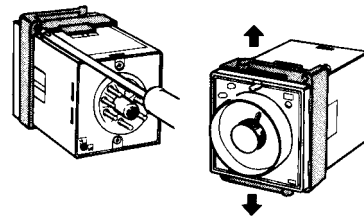
■ Dismounting

Surface Mounting with P2CF

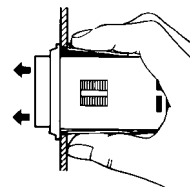


Panel Mounting

Loosen the screws of the Flush Mounting Adapter, spread open the hooks, and remove the Mounting Adapter.



When the Y92F-40, Y92F-70, Y92F-71 Mounting Adapter is used, press the hook inwards with the thumb and index finger of both hands, and press the Timer towards the front side.



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Note: This datasheet is provided as a guideline for selecting products. Do not use this document to operate the Unit.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

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- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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Email: org@lifeelectronics.ru