Timer Glossary

■ Term Definitions

ON Time

The period of time during which a required voltage is being applied to the operating circuit.

OFF Time

The period of time between the moment that resetting begins and the moment that the operating voltage is applied to the operating circuit. Therefore, the OFF time of the Timer is larger than the resetting time.

Operating Time

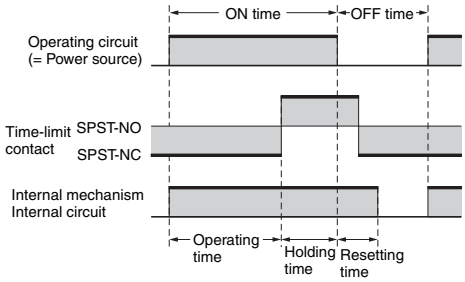
The period of time from the application of a required voltage to the operating circuit until the completion of the time-limit contact operation.

Holding Time

The period of time from the completion of the time-limit operation to the start of the reset operation.

Resetting Time

The period of time from the interruption of the voltage supplied to the operating circuit during or after the time-limit operation until the return of the Timer to its initial state.



The resetting time of the Timer is the period of time during which all the internal components including the contacts, pointer, and the circuit components, such as the capacitor, of the Timer are reset.

If the Timer is in operation with an insufficient OFF time (i.e., the OFF time is less than the rated resetting time), the normal operation of the Timer cannot be expected. In such cases, the Timer may operate with insufficient operating time, operate instantaneously, or not operate at all. Be sure that the OFF time of the Timer is the same as or more than the rated resetting time.

Self-reset

To automatically reset the Timer by interrupting the voltage being supplied to the operating circuit.

Electrical Reset

To reset Timer by applying a required voltage to the reset circuit.

Manual Reset

To mechanically reset the Timer by manual operation.

Synchronous Motor (Time Switch)

A motor that operates in synchronization with the power frequency (50/60 Hz). Because of the simplicity of a structure using this type of motor, it is reasonably priced.

The motor stops when there is a power interruption, so the time must be reset after the power is restored.

Quartz Motor (Time Switch)

The motor is operated by quartz oscillation. The quartz motor is equipped with a corrective function for power interruptions, so it can be used immediately after the power is restored.

Accuracy of Operating Time

Differences of operating times measured when the Timer repeats operation under the same condition with a given setting time.

Formula for calculation (with operating time measured more than 5 times):

Accuracy of operating time

$$= \pm \frac{1}{2} \times \frac{\text{T max.} - \text{T min.}}{\text{TMs}} \times 100\ (\%)$$

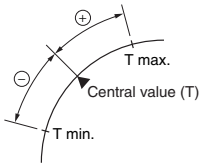
where,

T max.: Maximum value of operating times measured at the same set time

T min.: Minimum value of operating times measured at the same set time

TMs: Maximum scale time (TMs is a set value in the case of a Digital Timer)

Differences in the operating time appear as a shift from the central value of the operation, so the maximum or minimum value is divided by 2 and expressed as a plus (+) or minus (–) indication.



If there are setting changes in the H3CA or other types of Analog Timer while they are in time-limit operation, the following operation will result.

$$T = T_1 + T_2 \times \frac{T_3 - T_1}{T_3}$$

T: Final time-up time
T_1: Time elapsed
T_2: New setting
T_3: Previous setting

Setting Error

A difference between the actual operating time and scale time. Formula for calculation (measurement position can be any scale position as long as it is set to 1/3 min. of the maximum scale time):

Setting error

$$= \frac{\text{TM} - \text{Ts}}{\text{TMs}} \times 100\ (\%)$$

where,

TM: Average value of measured operating times

Ts: Set time

TMs: Maximum scale time (TMs is a set value in the case of the Digital Timer)

Influence of Voltage

A change in operating time when the voltage of the control power source changes within the permissible fluctuation range.

Formula for calculation:

Variation due to voltage change

$$= \pm \frac{TMx_1 - TM_1}{TMs} \times 100\ (\%)$$

where,

TM_1: Average value of operating times measured at rated voltage

TMx_2: Average value of operating times measured at a voltage which causes the maximum deviation from TM_1 within the permissible fluctuation range.

TMs: Maximum scale time (TMs is a set value in the case of the Digital Timer.)

Influence of Temperature

A change in operating time when the ambient temperature changes within a permissible range.

Formula for calculation:

Variation due to temperature change

$$= \pm \frac{TMx_2 - TM_2}{TMs} \times 100\ (\%)$$

where,

TM_2: Average value of operating times measured at 20°C.

TMx_2: Average value of operating times measured at a temperature which causes the maximum deviation from TM_2 within the specified ambient temperature range.

TMs: Maximum scale time (TMs is a set value in the case of the Digital Timer.)

OFF Time Characteristics

A change in operating time when the operating time in a given OFF time and the OFF time are changed.

Formula for calculation:

OFF time characteristic

$$= \pm \frac{TMx_3 - TM_3}{TMs} \times 100\ (\%)$$

TM_3: Average value of operating times measured with a 1-second OFF time.

TMx_3: Average value of operating times measured with an OFF time that causes the maximum deviation from TMx_3 within the specified OFF-time range of one hour from the specified resetting time.

TMs: Maximum scale time (TMs is a set value in the case of the Digital Timer.)

OFF-time characteristics are determined by the charging and discharging of a capacitor and resistor used in combination as an Electronic Timer. The characteristics vary by ±1.5% to ±5%.

Operating time accuracy, setting error, influence of voltage, influence of temperature, and OFF-time characteristics are items used to express the precision of the Timer. Any of these items may be ignored depending on the particular specifications of the model.

The Motor Timer and Electronic Timer indicate these items by percentage values. The Count Timer indicates these items by differential time values because the differential range of the Timer's operating time is almost definite due to the operating principle of the Timer. Furthermore, the Count Timer total setting error can be indicated to express all these items in the case of the Count Timer.

Vibration Resistance (Malfunction)

The range of vibration during operation in which contacts that are closed will not open by vibration for a period exceeding the specified time (1 ms).

Vibration Resistance (Destruction)

The range of vibration in which there is no damage to parts during transport or use, and the operating characteristics are still satisfied.

Shock Resistance (Malfunction)

The range of shock during operation in which contacts that are closed will not open by shock for a period exceeding the specified time (1 ms).

Shock Resistance (Destruction)

The range of shock in which there is no damage to parts during transport or use, and the operating characteristics are still satisfied.

Insulation Resistance

The resistance offered by an insulating material to the flow of current resulting from an impressed DC voltage.

Dielectric Strength

The voltage level that will not cause insulation breakdown when applied for 1 minute to the same location as in the insulation resistance measurement.

Impulse Withstand Voltage (AC)

A voltage imposed between the operating power supply terminals or between a charged terminal and non-charged metal part to check the withstand surge voltage of the Timer. The impulse withstand voltage imposed between the operating power supply terminals is 3 kV and that imposed between a charged terminal and non-charged metal part is 4.5 kV with both using a ±1.2 × 50-μs standard waveform.

Noise Immunity

The mechanical and physical resistance of the Timer against external noise.
The noise resistance of the Timer is checked with a noise simulator, a coil load, an oscillating relay, and static electric noise.

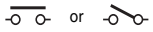
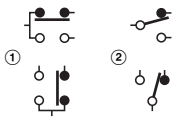
Mechanical Life Expectancy

The life expectancy of a Timer when the control output of the Timer is operated under no load condition.

Electrical Life Expectancy

The life expectancy of a Timer when the control output of the Timer is operated to switch the specified voltage/current load connected to the control output.
The electrical or mechanical life of the Timer is generally indicated by the operating times of control output. The electrical life is indicated by the operating time of the control output connected to a load and the mechanical life is indicated by the operating time of the control output with no load. The electrical life is shorter than the mechanical life. The lighter the load is, the longer the electrical life will be. Therefore, to prolong the electrical life of the Timer, use the Timer to switch heavy loads via relays instead of directly switching them with the control output.

■ Symbols Used in Internal Connection Diagram of Timers

Name	Symbol	Description
NO contacts		Normally open contacts (A pair of contacts which are normally open when no relay input is applied.)
NC contacts		Normally closed contacts (A pair of contacts which are normally closed when no relay input is applied.)
Transfer contacts		Transfer contacts (NO and NC contacts which have a common contact terminal are collectively called “transfer contacts.”) A variety of contacts shown in ① and ② are all transfer contacts with NC contact arranged either on the right side or on the upper side.
Time-limit operating contacts		① NO contacts ② NC contacts
Time-limit resetting contacts		① NO contacts ② NC contacts

Name	Symbol	Description
Time-limit operation, time- limit resetting contacts		① NO contacts ② NC contacts
Manually operated, automatic resetting contact		Contacts that reset upon release of the hand, and used as the contacts to operate a pushbutton switch. (Same for pushbutton, pull, and rotating switches.) ① NO contacts ② NC contacts
Synchronous motor		A miniature motor which operates in synchronization with power frequency.
Relay		An electromagnetic relay
LED		Used to indicate the operating state of the Timer.

Reference Material for Timers: Inrush Current

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

■ Timers

Model		Voltage	Applied voltage	Inrush current (peak value)	Time (see note)
H3AM-NS/-NSR		100 to 240 VAC	264 VAC	2.74 A	1.7 ms
H3CA-A series		24 to 240 VAC/ 12 to 240 VDC	264 VAC	1.6 A	0.6 ms
H3CA-8/-8-306		200/220/240 VAC	264 VAC	1.5 A	0.6 ms
		100/110/120 VAC	132 VAC	780 mA	5 ms
		24 VDC	---	---	---
H3CA-8H/-8H-306		200/220/240 VAC	264 VAC	1.6 A	0.6 ms
		100/110/120 VAC	132 VAC	1.5 A	5 ms
		24 VDC	26.4 VDC	1.2 A	2 ms
H3CR-A/-A8/-AP		100 to 240 VAC/ 100 to 125 VDC	264 VAC	780 mA	1.8 ms
			137.5 VDC	310 mA	3.2 ms
		24 to 48 VAC/ 12 to 48 VDC	26.4 VAC	830 mA	2.4 ms
			26.4 VDC	570 mA	6.3 ms
H3CR-A8E		100 to 240 VAC/ 100 to 125 VDC	264 VAC	1.76A	0.1ms
			137.5 VDC	550 mA	0.2 ms
		24 to 48 VAC/VDC	26.4 VAC	270 mA	35 ms
			26.4 VDC	270 mA	31 ms
H3CR-AS/-A8S		24 to 48 VAC/ 12 to 48 VDC	26.4 VAC	370 mA	2.2 ms
			26.4 VDC	250 mA	3.2 ms
H3CR-F		100 to 240 VAC/ 100 to 125 VDC	264 VAC	750 mA	1 ms
			137.5 VDC	0.5 A	9.1 ms
		24 to 48 VAC/ 12 to 48 VDC	26.4 VAC	0.83 A	10 ms
			26.4 VDC	0.57 A	9.4 ms
H3CR-H	S series	100/110/120 VAC	132 VAC	1.05 A	111 ms
		200/220/240 VAC	264 VAC	1.07 A	119 ms
		24 VAC/VDC	26.4 VAC	1.26 A	133 ms
			26.4 VDC	0.85 A	137 ms
		48 VDC	52.8 VDC	0.73 A	112 ms
		100 to 125 VDC	137.5 VDC	0.62 A	109 ms
	M series	100/110/120 VAC	132 VAC	1.02 A	364 ms
		200/220/240 VAC	264 VAC	1.03 A	323 ms
		24 VAC /VDC	26.4 VAC	1.21 A	478 ms
			26.4 VDC	0.87A	560 ms
		48 VDC	52.8 VDC	0.71 A	384 ms
		DC100 to 125 VDC	137.5 VDC	0.62 A	380 ms
H3DE-MS/F/G		24 to 230 VAC/VDC	253 VAC	4.4 A	0.03 ms
			253 VDC	2.68 A	0.03 ms
			26.4 VDC	203 mA	11 ms
H3DE-H		200 to 230 VAC	200 VAC	0.8 A	130 ms
		100 to 120 VAC	100 VAC	0 .93 A	130 ms
		48 VAC/VDC	48 VAC	0.95 A	130 ms
			48 VDC	0.68 A	70 ms
		24 VAC/VDC	24 VAC	1.25 A	140 ms
			24 VDC	0.89 A	40 ms
H3DK-M/S/F/G		24 to 240 VAC/VDC	264 VAC	4.69 A	46.27 ms
			24 VDC	0.168 A	134 ms
			264 VDC	3.64 A	46 ms
		12 VDC	13.2 VDC	2.62 A	418.67 ms
H3DK-H		100 to 120 VAC	132 VAC	2.06 A	1320 ms
		200 to 240 VAC	264 VAC	2.38 A	677.33 us
		24 to 48 VAC/VDC	52.8 VAC	1.81 A	1810 us
			24 VAC	1.68 A	19.8 us
			24 VDC	1.16 A	35.2 ms
			52.8 VDC	2.44 A	8.84 ms

Model	Voltage	Applied voltage	Inrush current (peak value)	Time (see note)
H3DS	24 to 230 VAC/ 24 to 48 VDC	253 VAC	3 A	1 ms
		26.4 VDC	0.5 A	4 ms
H3FA-A	24 VDC	26.4 VDC	1.8 A	0.01 ms
	12 VDC	13.2 VDC	1.5 A	0.01 ms
	6 VDC	6.6 VDC	1.1 A	0.05 ms
	5 VDC	5.5 VDC	1.1 A	0.05 ms
H3FA-SA	24 VDC	26.2 VDC	1.8 A	0.01 ms
	12 VDC	13.2 VDC	1.5 A	0.01 ms
	6 VDC	6.6 VDC	1.1 A	0.05 ms
	5 VDC	5.5 VDC	1.1 A	0.05 ms
H3M series	200/220/240 VAC	264 VAC	1.2 A	0.5 ms
	100/110/120 VAC	132 VAC	620 mA	0.4 ms
	110 VDC	---	---	---
	100 VDC	---	---	---
	48 VDC	52.8 VDC	5 A	1 ms
	24 VDC	26.4 VDC	2.6A	1 ms
	12 VDC	13.2 VDC	1.3A	1 ms
H3RN series	All specifications except for 24 VAC	---	---	---
	24 VAC	26.4 VAC	200 mA	3 ms
H3Y series	All specifications except for 12 VDC	---	---	---
	12 VDC	13.2 VDC	350 mA	0.4 ms
H3YN series	All specifications except for 12 VDC	---	---	---
	12 VDC	13.2 VDC	600 mA	1 ms
H5AN series	100 to 240 VAC	264 VAC	23 A	1 ms
	100 VDC	110 VDC	8 A	2 ms
	12 to 24 VDC	26.4 VDC	15 A	6.5 ms
H5CN series	100 to 240 VAC	264 VAC	800 mA	1 ms
	12 to 48 VDC	52.8 VDC	400 mA	1 ms
H5CX-A□-N series	100 to 240 VAC	264 VAC	4.8 A	0.5 ms
H5CX-A□D-N series	24 VAC/12 to 24 VDC	26.4 VAC	9.5 A	1 ms
		26.4 VDC	6.6 A	1 ms
H5CX-L□-N series	100-240 VAC	264 VAC	5.3 A	0.4 ms
	24 VAC/12 to 25 VDC	26.4 VAC	6.4 A	1.4 ms
		26.4 VDC	4.4 A	1.7 ms
H5CX-B□-N series	12 to 24 VDC	26.4 VDC	4.4 A	1.7 ms
H5CX-A/-L series (previous models)	100 to 240 VAC	264 VAC	5.3 A	0.4 ms
	24 VAC/12-24 VDC	26.4 VAC	6.4 A	1.4 ms
		26.4 VDC	4.4 A	1.7 ms
H5CX-B series (previous models)	12 to 24 VDC	26.4 VDC	6 A	1.2 ms
H5CZ series	100-240 VAC	264 VAC	4.6 A	0.4 ms
	24 VAC/12-24 VDC	26.4 VAC	9.5 A	1 ms
		26.4 VDC	6.6 A	1 ms

■ Time Switches

Model	Voltage	Applied voltage	Inrush current (peak value)	Time (see note)
H4KV-DSA-R	100 to 200 VAC	240 VAC	4.8 A	1.1 ms
H4KV-DSA (previous models)	100 to 200 VAC	240 VAC	0.7 A	0.5 ms
H5L-A	All specifications	---	---	---
H5S-W series	100 to 240 VAC	264 VAC	3.1 A	0.2 ms
	24 VDC	26.4 VDC	1.3 A	2.7 ms
H5S-Y series	100 to 240 VAC	264 VAC	3.1 A	0.2 ms
	24 VDC	26.4 VDC	1.4 A	2.7 ms
H5S series (previous models)	100 to 240 VAC	264 VAC	2.5 A	0.3 ms
	24 VDC	26.4 VDC	1.1 A	3 ms
H5F series	100 to 240 VAC	264 VAC	2 A	0.3 ms

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