OMRON

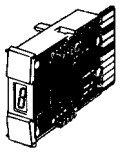
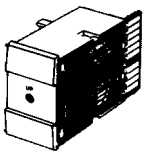
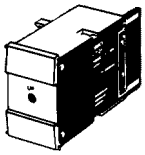
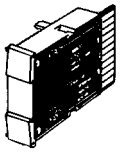
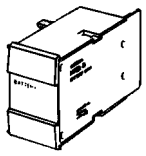
Solid-state Counter

H7S

Choice of Functional Modules for an Arbitrary Counter System Configuration

- Compact (same size as thumbwheel switch modules)
- Capability to both read in and read out BCD data
- Building-block type modules permit easy assembly of a counter system with up to eight digits plus inputs and outputs
- Simple multi-stage preset/totalizing counter configuration up to eight stages
- Number system selectable (6, 24, 60, any other base may be used)
- Initial set mode to allow counting from an arbitrary value

Ordering Information

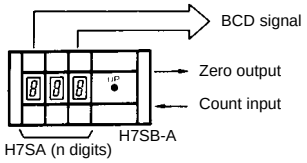
Model	Function
Counter Unit **H7SA** 	• Serves as a single-digit element of a multi-digit Counter. • Reads in and out BCD data. • Displays a digit by backlighted LCD. • May be combined with up to seven other Counter elements to form an 8-digit Counter (maximum). • Specifies a selectable number system.
Input-Output Unit **H7SB-A** 	• Specifies the input-output mode of the Counter. • Specifies the counting speed of the Counter. • Selects either Initial Set or Preset mode. • Communicates with up to eight H7SA Counters. • Generates output when the count value of the Counter coincides with the preset value. • Provides open collector output for loads.
Preset Output Unit **H7SB-B** 	• Generates coincidence output in multistage Counter system configuration. • Communicates with up to eight decimal-coded thumbwheel switch modules. • Provides open collector output for loads.
Fan-out Unit **H7SB-C** 	• Amplifies signals from the H7SA Counters. • Converts BCD signals into decimal or BCD/BCD (Signal Distributor) (real/complementary code) data. • Distributes signals to respective stages in multistage Counter system configuration.
Battery Unit **H7SB-D** 	• Serves for battery backup to retain the contents of memory (i.e. count data) in the event of a power failure. • The life expectancy of the battery is five years at 20°C with the 8-digit model of model H7SA.

■ Accessories (Order Separately)

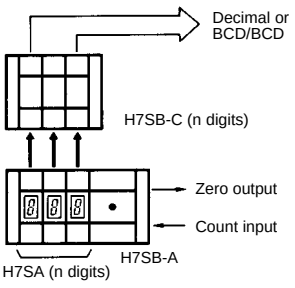
Card-edge Connector	P7S-22P
End Caps (pair)	A7P-M

■ Combination Examples

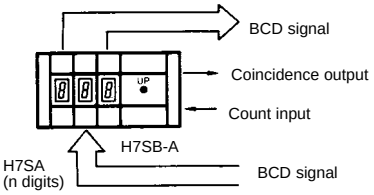
Read-out Counter (A)



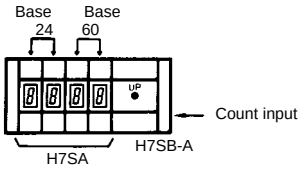
Read-out Counter (B)



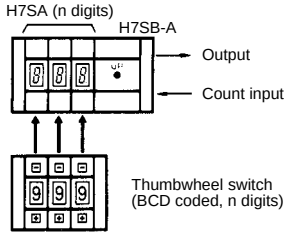
Read-in/Read-out Counter



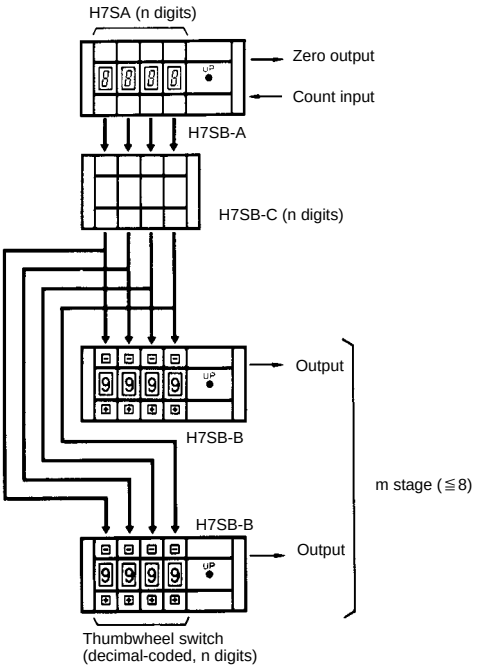
Counter with Selectable Number System



Preset Counter



Multistage Counter



Specifications

■ Ratings

Supply voltage	5 VDC ±10% (contains 10% ripple)
Power consumption	H7SA: 75 mW per Unit H7SB-A: 75 mW per Unit H7SB-B: 75 mW per Unit H7SB-C: 50 mW per Unit
Max. counting speed	30 cps/1,000 cps (wire-selectable)
Count input	No voltage input Short-circuit impedance: 1 kΩ max. Short-circuit residual voltage: 1.0 V max. (current flow through count input terminal when shorted: 0.5 mA) Open-circuit impedance: 100 kΩ min. Voltage input: HIGH level: 4 to 30 V LOW level: 0 to 2 V (Input resistance: 27 kΩ)
Reset system	External reset (reset signal time: 0.02 s)
Control output	Open collector: 30 VDC max., 100 mA max., ON residual voltage: 0.5 V max.
BCD input (to H7SA)	Short-circuit impedance: 1 kΩ max. Short-circuit residual voltage: 1.0 V max. (breakdown voltage: 5 V) Open-circuit impedance: 100 kΩ min.
BCD output (from H7SA)	Open drain: 5 V 1 mA (breakdown voltage: 5 V)
Decimal or BCD/BCD output (from H7SB-C) (see note)	Open collector: 30 VDC 20 mA, ON residual voltage: 0.5 V max.

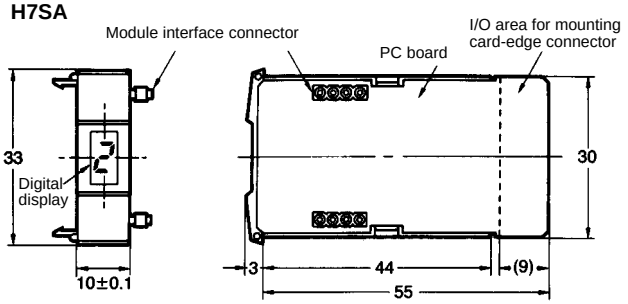
Note: BCD: BCD complementary code

■ Characteristics

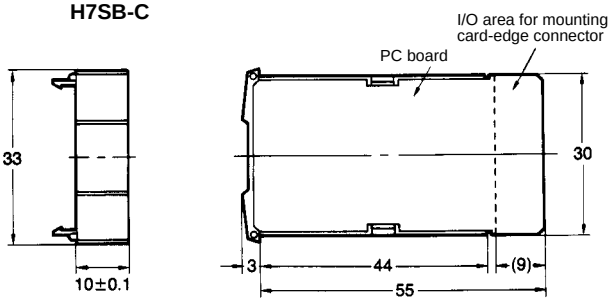
Insulation resistance	100 MΩ min. (at 500 VDC)
Dielectric strength	1,000 VAC 50/60 Hz for 1 minute
Vibration resistance	Destruction: 10 to 55 Hz; 0.75 mm double amplitude Malfunction: 10 to 55 Hz; 0.3 mm double amplitude
Shock resistance	Destruction: 300 m/s^2 (approx. 30 G) Malfunction: 100 m/s^2 (approx. 10 G)
Ambient temperature	Operating: –10°C to 55°C (with no icing) Storage: –25°C to 65°C (with no icing)
Ambient humidity	35% to 85%

Dimensions

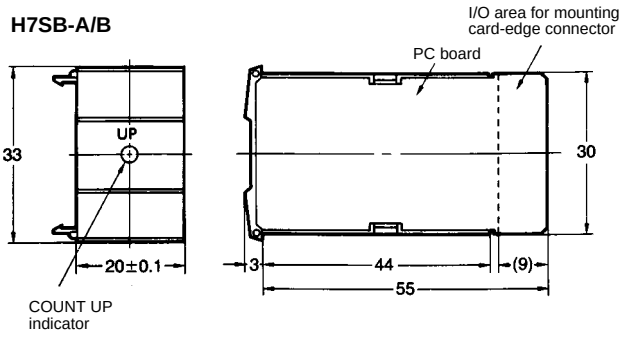
H7SA



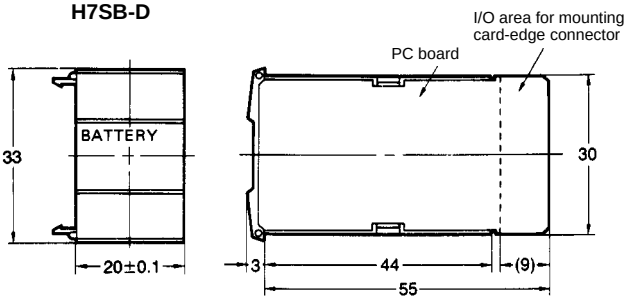
H7SB-C



H7SB-A/B

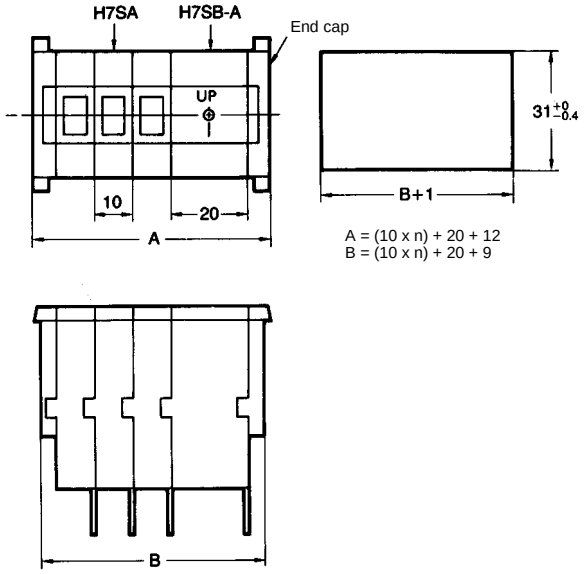


H7SB-D



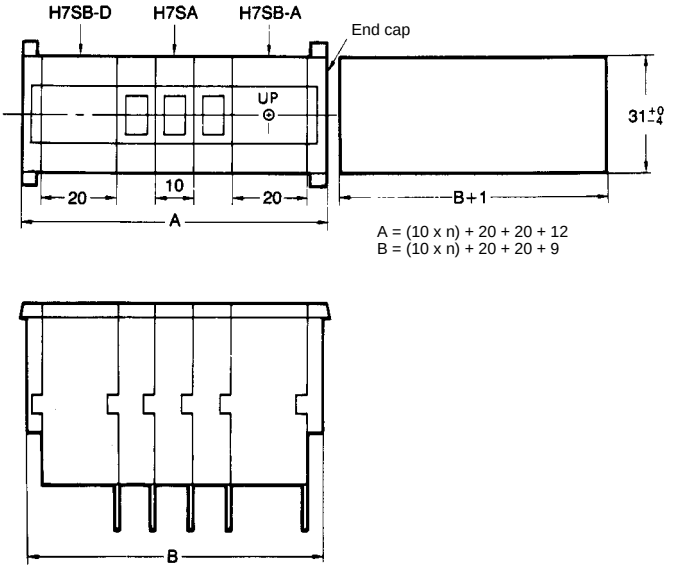
Panel Cutouts for Flush Mounting

When Multiple H7SAs (n Digits) are Combined with One H7SB-A



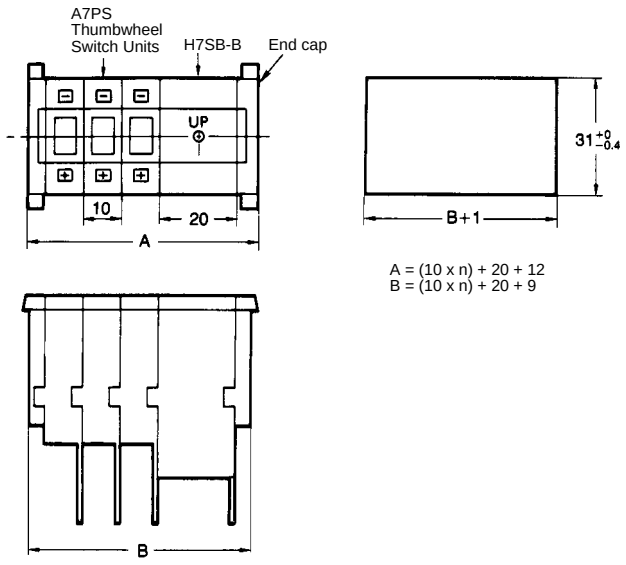
A = (10 x n) + 20 + 12
B = (10 x n) + 20 + 9

When Multiple H7SAs (n Digits) are Combined with One H7SB-A and One H7SB-D



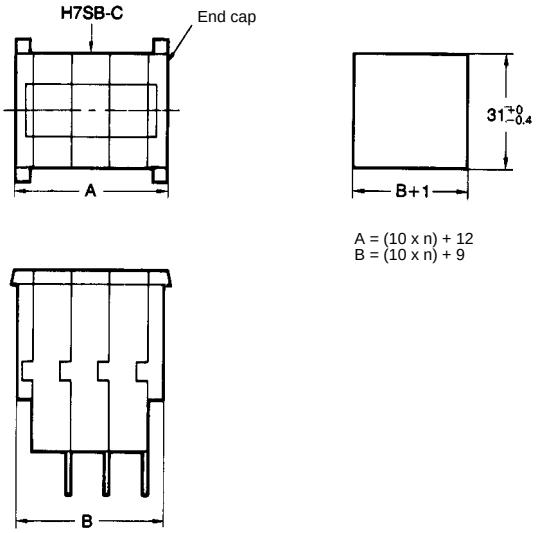
A = (10 x n) + 20 + 20 + 12
B = (10 x n) + 20 + 20 + 9

When Multiple A7PSs (n Digits) are Combined with One H7SB-B in Multistage Counter Configuration



A = (10 x n) + 20 + 12
B = (10 x n) + 20 + 9

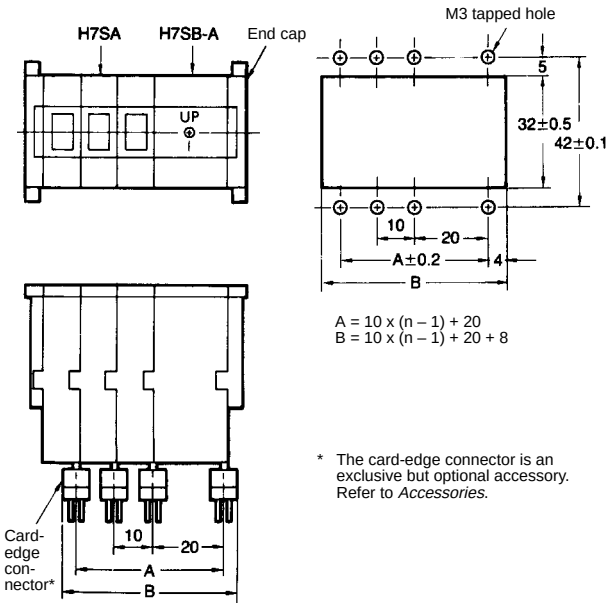
When Multiple H7SB-Cs (n Digits) are Used



A = (10 x n) + 12
B = (10 x n) + 9

Connector Mounting Holes for Front Mounting

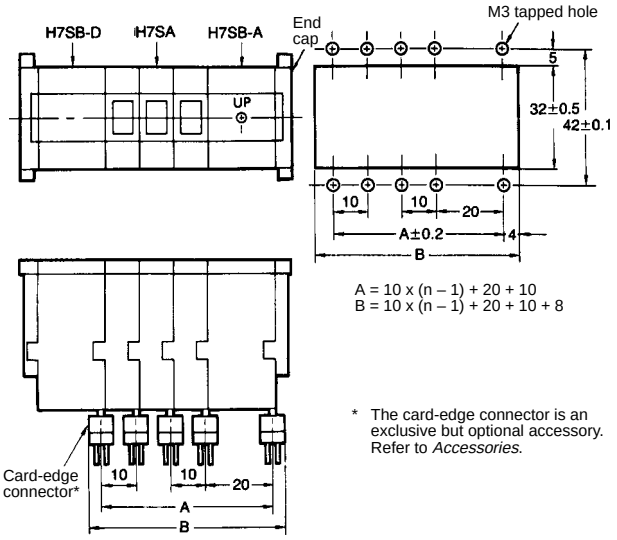
When Multiple H7SAs (n Digits) are Combined with One H7SB-A



A = 10 x (n – 1) + 20
B = 10 x (n – 1) + 20 + 8

* The card-edge connector is an exclusive but optional accessory. Refer to *Accessories*.

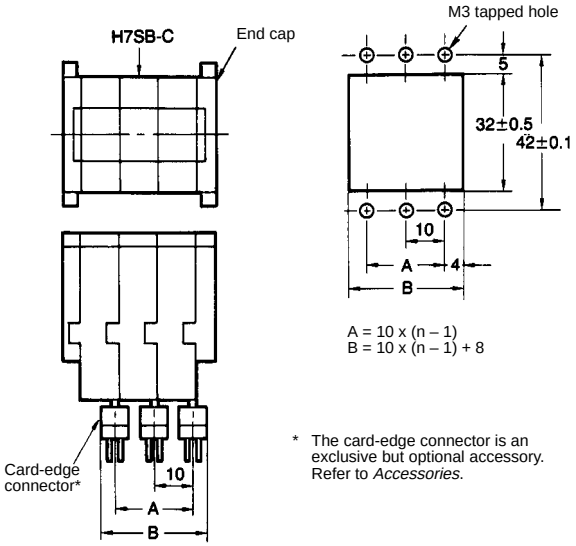
When Multiple H7SAs (n Digits) are Combined with One H7SB-A and One H7SB-D



A = 10 x (n – 1) + 20 + 10
B = 10 x (n – 1) + 20 + 10 + 8

* The card-edge connector is an exclusive but optional accessory. Refer to *Accessories*.

When Multiple H7SB-Cs (n Digits) are Used



A = 10 x (n – 1)
B = 10 x (n – 1) + 8

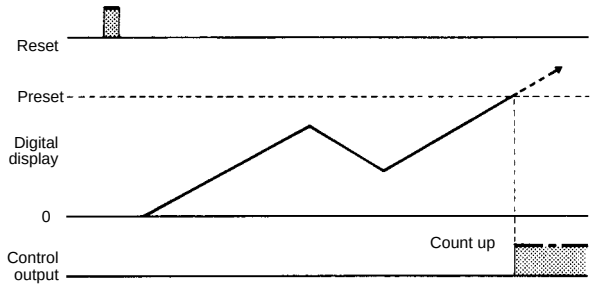
* The card-edge connector is an exclusive but optional accessory. Refer to *Accessories*.

Timing Charts/Operation Modes

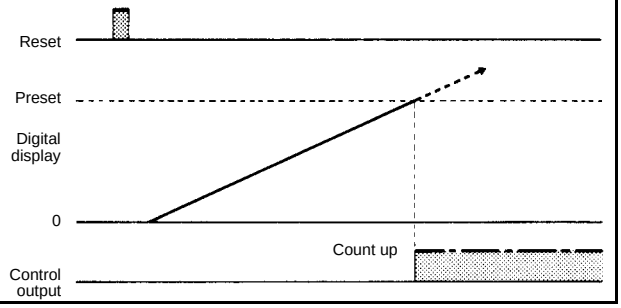
■ Operations (Basic Combination of H7SA with H7SB-A)

Preset Mode

Up/Down A, Up/Down B, Up/Down C

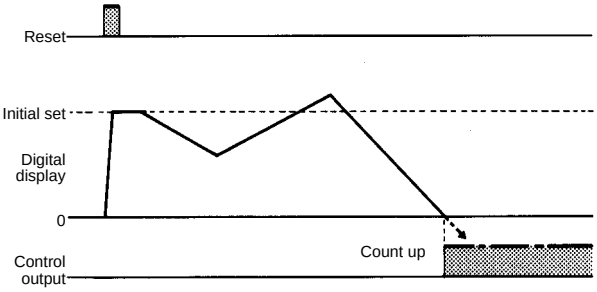


Up Type

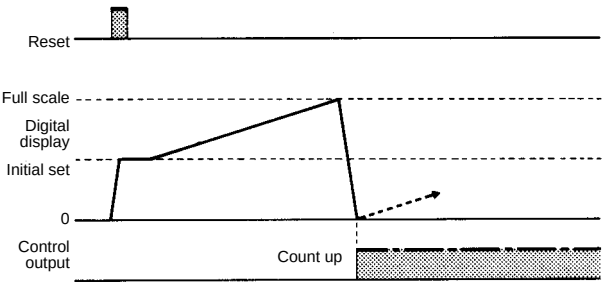


Initial Set Mode

Up/Down A, Up/Down B, Up/Down C



Up Type



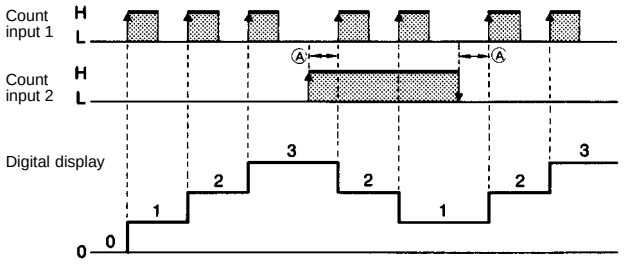
Input Mode

Note: 1. No-voltage input type
H: 1 kΩ max. of impedance when the contact turns ON
1 V max. of residual voltage when the contact turns ON
L: 100 kΩ min. of impedance when the contact turns OFF

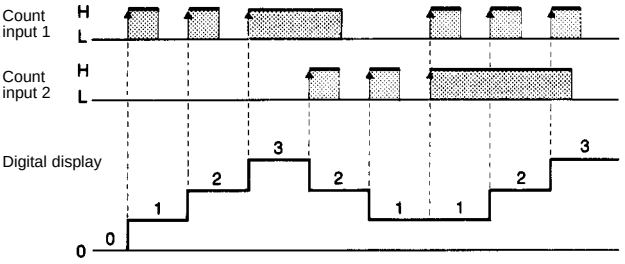
Voltage input type
H: Input signal voltage +4 to +30 V
L: Input signal voltage 0 to 2 V

2. Up/Down A Counter (Command input)
The duration of A must be more than the minimum signal width (30 cps: 16.7 ms; 1 kcps: 0.5 ms).
3. Up/Down B Counter (Separate input)
There is no limitation on the phase relationship between Count input 1 and Count input 2.
4. Up/Down C Counter (Phase differential input)
The duration of B must be more than half the minimum signal width. Count input 1 and Count input 2 must be of the same counting speed.

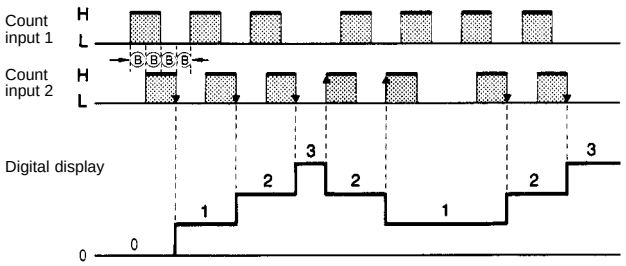
Up/Down A Command Input



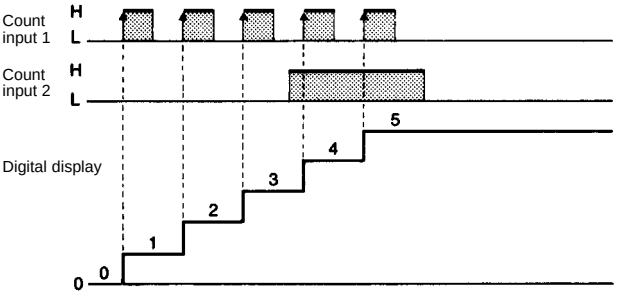
Up/Down B Individual Input



Up/Down C Phase Difference Input



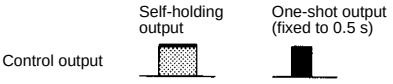
Up Type



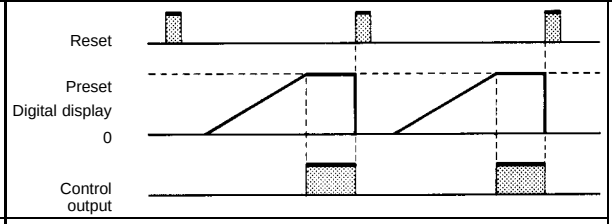
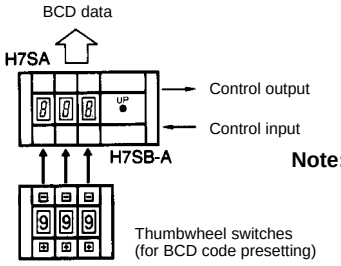
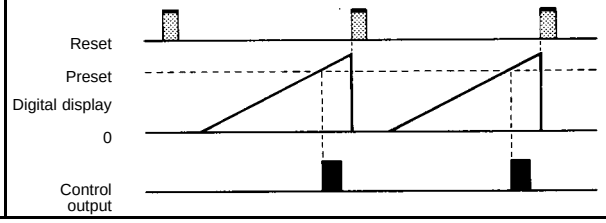
* Gate input is not triggered by Count input 2.

■ Basic Operation Mode (H7SA + H7SB-A)

(Basic Combination of H7S with H7SB-A)

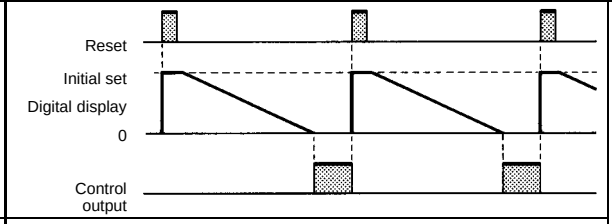
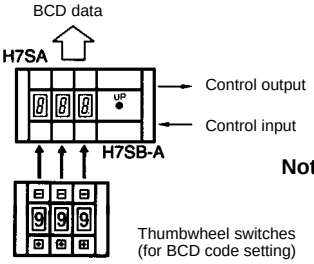
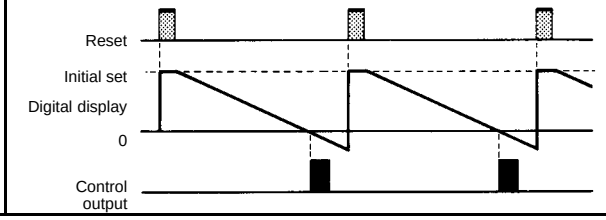


Preset Mode (Up/Down A, B, C, and Up Type)

	Timing chart	Configuration
N		
K		

Note: As soon as the preset value is changed to 0 in N mode, the output is produced.

Initial Set Mode (Up/Down A, B, C)

	Timing chart	Configuration
N		
K		

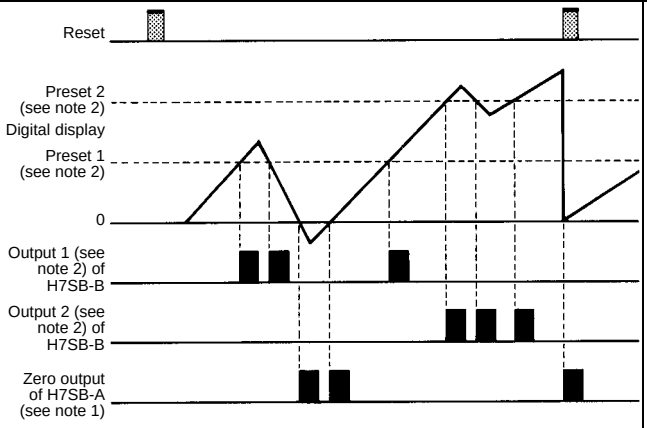
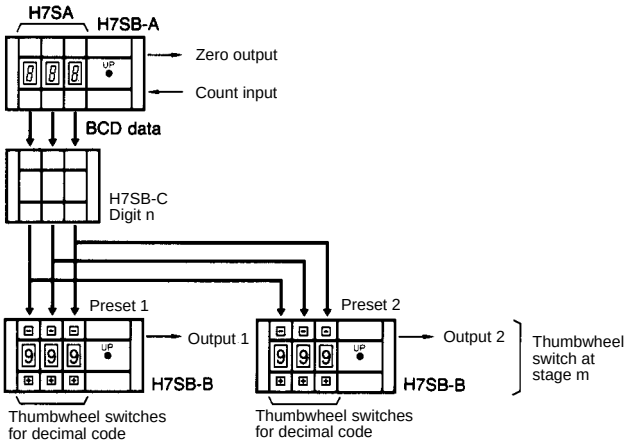
Note: The initial set value must be other than 0 in N mode.

■ Applied Operation Mode (H7SA + H7SB-A + H7SB-C + H7SB-B)

(In the case of multiple stages and digits)
Set the H7SA in K mode.

Preset Mode (Up/Down A, B, C)

(See note 1.)

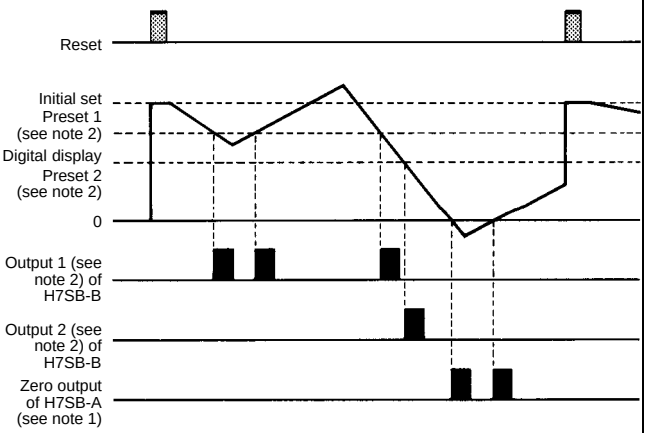
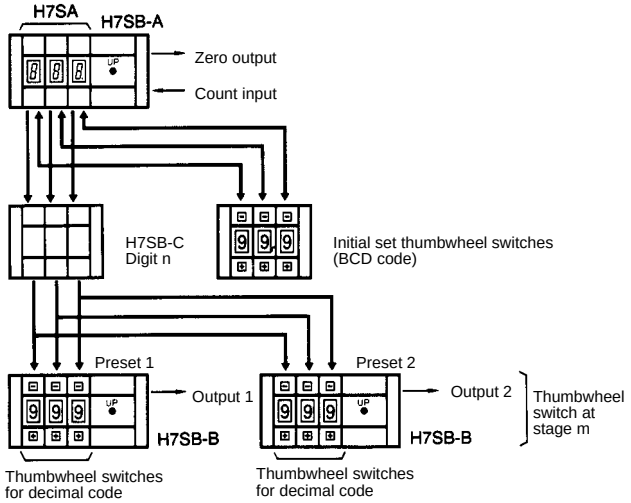
Timing chart	Configuration
	

Note: H7SB-C: decimal code mode

Note: 1. The above timing chart applies to the H7SB-A in preset without presetting thumbwheel switches connected.

2. “Preset” means a value preset by the thumbwheel switches combined with the H7SB-B. Control outputs 1 and 2 respectively indicate the outputs to be produced by the H7SB-B when present value coincides with presets 1 and 2.

Initial Set Mode (Up/Down A, B, C)

Timing chart	Configuration
	

Note: H7SB-C: decimal code mode

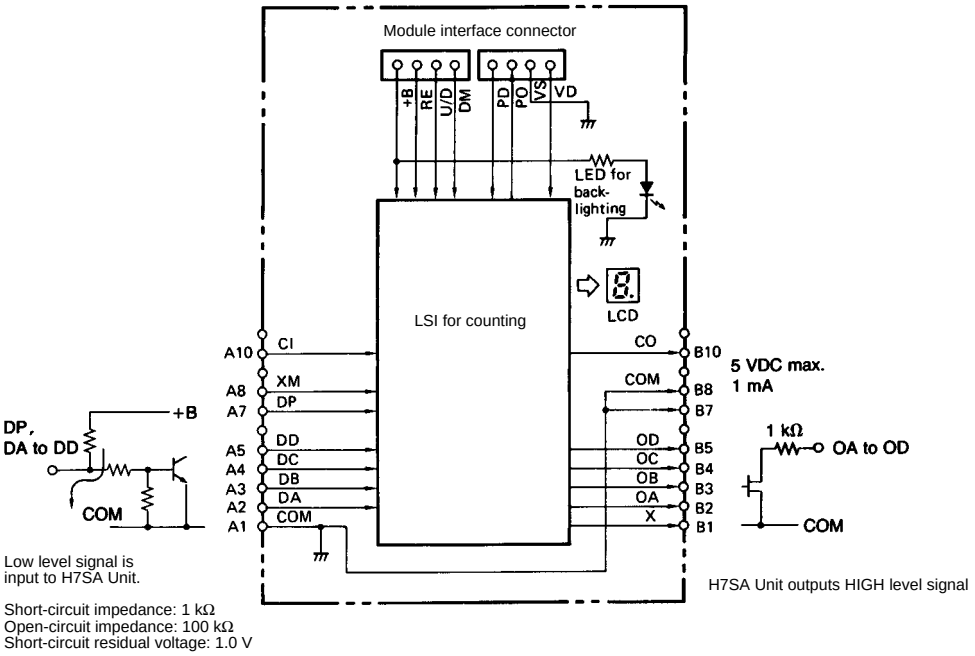
Note: 1. The H7SB-A produces its output when the present count value is 0 in initial set mode.

2. “Preset” means a value preset by the thumbwheel switches combined with the H7SB-B. Control outputs 1 and 2 respectively indicate the outputs to be produced by the H7SB-B when present value coincides with presets 1 and 2.

Functions of I/O Terminals

■ H7SA

Block Diagram



I/O Signals

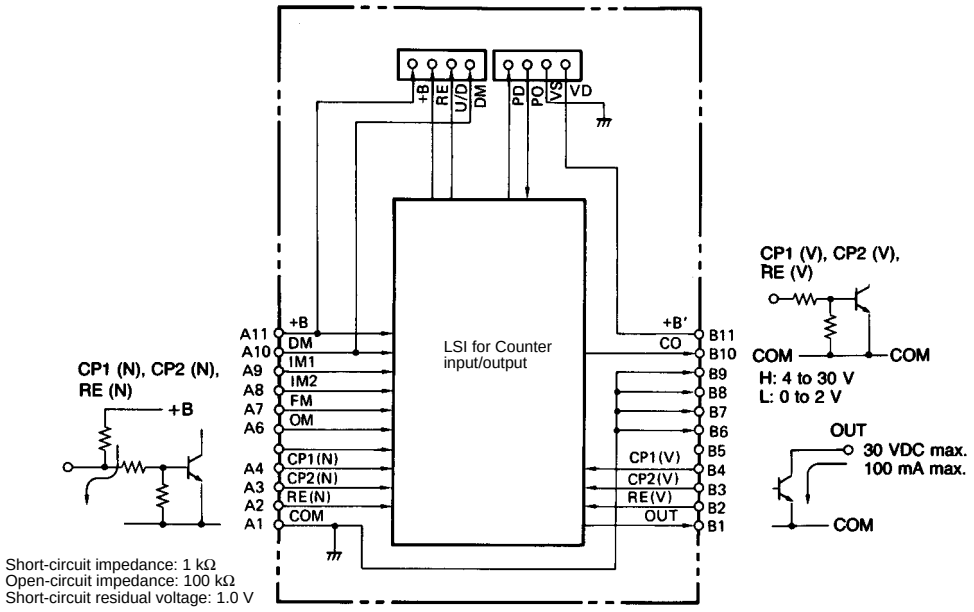
Terminal No.	Signal	Function
A1	COM	0 V terminal
A2	DA	Terminals for BCD data input from external devices such as thumbwheel switch and PC. Each terminal represents the following place value: DA DB DC DD 1 2 4 8
A3	DB	
A4	DC	
A5	DD	
A6	Vacant	---
A7	DP	Terminal for specifying the decimal point lighting on LCD. The decimal point illuminates when this terminal is connected to any of the COM terminals.
A8	XM	Terminal for setting the arbitrary number system function. When this terminal is connected to any of the COM terminals, any number system may be specified.
A9	Vacant	---
A10	CI	Terminal for count pulse input from the low-order digit. (The 1st digit is for pulse input from the H7SB-A.)
A11	Vacant	---
B1	X	Terminal for setting any base when the arbitrary number system function is in effect. This terminal is connected to terminals B2 (OA) through B5 (OD).
B2	OA	Terminals for BCD data output to external devices such as PC and display. Each terminal represents the following place value. OA OB OC OD 1 2 4 8
B3	OB	
B4	OC	
B5	OD	
B6	Vacant	---
B7	COM	0 V terminal
B8	COM	0 V terminal
B9	Vacant	---
B10	CO	Terminal for count pulse output (carry) to the high-order digit.
B11	Vacant	---

Output Status of OA to OD

Count value	OA	OB	OC	OD
0	0	0	0	0
1	1	0	0	0
2	0	1	0	0
3	1	1	0	0
4	0	0	1	0
5	1	0	1	0
6	0	1	1	0
7	1	1	1	0
8	0	0	0	1
9	1	0	0	1
ON: 0, OFF: 1				

■ H7SB-A

Block Diagram



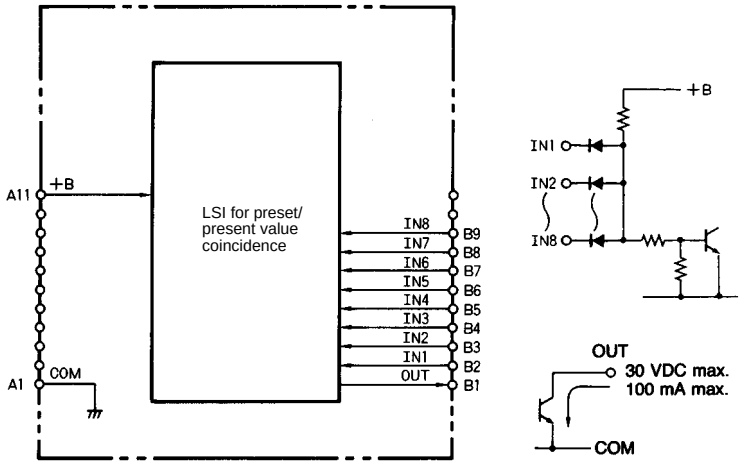
I/O Signals

Terminal No.	Signal	Function
A1	COM	0 V terminal
A2	RE (N)	Reset input terminal (No voltage input: Reset input signal is applied when this terminal is short-circuited or opened.)
A3	CP2 (N)	Count input terminals (No voltage input: CP2 and CP1 are applied when these terminals are short-circuited or opened.)
A4	CP1 (N)	
A5	Vacant	---
A6	OM	Terminal for specifying the operation mode of control output. The operation mode is set to “N” mode when this terminal is connected to any of the COM terminals and to “K” mode when left open.
A7	FM	Terminal for specifying the maximum counting speed of the Counter. The counting speed is set to 30 cps when this terminal is connected to any of the COM terminals and to 1,000 cps when left open.

Terminal No.	Signal	Function
A8	IM2	Terminals for input mode specification. IM1 IM2 Mode selected H H Up/Down A H L Up/Down B L H Up/Down C L L Up only **Note:** "L" refers to IM1 or IM2 connected to any of the COM terminals, while "H" refers to IM1 or IM2 left open.
A9	IM1	
A10	DM	Terminal for data mode specification. The data mode is set to "Initial Set" mode when this terminal is connected to terminal COM and to "Preset" mode when left open.
A11	+B	Terminal for control power supply application
B1	OUT	Terminal for control output when the count value of H7SA coincides with its preset value with respect to all digits.
B2	RE (V)	Reset input terminal (Voltage input)
B3	CP2 (V)	Count input terminals (Voltage input)
B4	CP1 (V)	
B5	Vacant	---
B6	COM	0 V terminal
B7	COM	0 V terminal
B8	COM	0 V terminal
B9	COM	0 V terminal
B10	CO	Terminal for count pulse output to H7SA
B11	+B'	Power terminal for battery backup

■ H7SB-B

Block Diagram

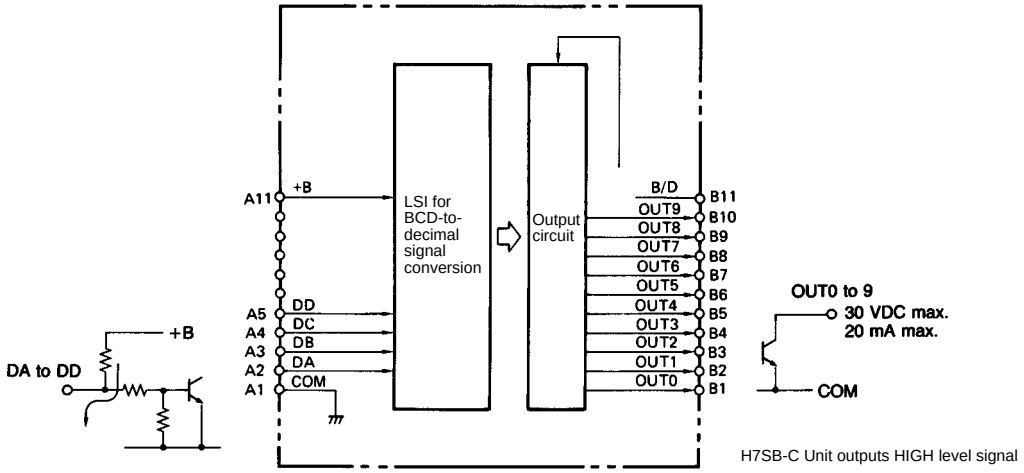


I/O Signals

Terminal No.	Signal	Function
A1	COM	0 V terminal
A11	+B	Terminal for control power supply application
B1	OUT	Terminal for control output when the input value of H7SB-C coincides with its preset value with respect to all digits
B2	IN1	Terminals for coincidence signal input from thumbwheel switches (decimal-coded).
B3	IN2	
B4	IN3	
B5	IN4	
B6	IN5	
B7	IN6	
B8	IN7	
B9	IN8	

■ H7SB-C

Block Diagram



Low level signal is input to H7SB-C.

Short-circuit impedance: 1 kΩ
Open-circuit impedance: 100 kΩ
Short-circuit residual voltage: 1.0 V

H7SB-C Unit outputs HIGH level signal

I/O Signals

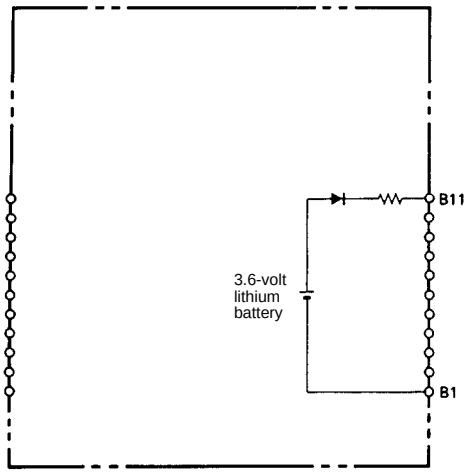
<table>
<tr><th>Terminal No.</th><th>Signal</th><th>Function</th></tr>
<tr><td>A1</td><td>COM</td><td>0 V terminal</td></tr>
<tr><td>A2
A3
A4
A5</td><td>DA
DB
DC
DD</td><td>Terminals for BDC data input from H7SA.
Each terminal represents the following place value: DA/1 DB/2 DC/4 DD/8</td></tr>
<tr><td>A11</td><td>+B</td><td>Terminal for control power supply application</td></tr>
<tr><td>B1
B2
B3
B4
B5
B6
B7
B8
B9
B10</td><td>OUT0
OUT1
OUT2
OUT3
OUT4
OUT5
OUT6
OUT7
OUT8
OUT9</td><td>Terminals for decimal or BCD data output as specified by B/D (No. B11).
<table>
<tr><th rowspan="2">Signal</th><th colspan="2">Output</th></tr>
<tr><th>BCD code</th><th>Decimal code</th></tr>
<tr><td>OUT0</td><td>$\overline{A}$</td><td>0</td></tr>
<tr><td>OUT1</td><td>$\overline{B}$</td><td>1</td></tr>
<tr><td>OUT2</td><td>$\overline{C}$</td><td>2</td></tr>
<tr><td>OUT3</td><td>$\overline{D}$</td><td>3</td></tr>
<tr><td>OUT4</td><td>---</td><td>4</td></tr>
<tr><td>OUT5</td><td>A</td><td>5</td></tr>
<tr><td>OUT6</td><td>B</td><td>6</td></tr>
<tr><td>OUT7</td><td>C</td><td>7</td></tr>
<tr><td>OUT8</td><td>D</td><td>8</td></tr>
<tr><td>OUT9</td><td>---</td><td>9</td></tr>
</table>
In the above table, A, B, C, and D indicate place values 1, 2, 4, and 8, respectively.
Do not use OUT 4 and 9 when using BCD codes.</td></tr>
<tr><td>B11</td><td>B/D</td><td>Terminal for specifying the contents of data on output terminals. When this terminal is connected to COM, decimal codes are output from OUT0 through OUT9. When left open, BCD codes are output from OUT0 through OUT3 and OUT5 through OUT8.</td></tr>
</table>

Output Status of OUT 0 to 9

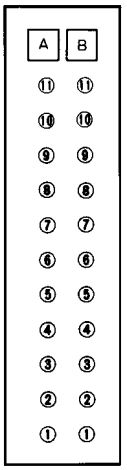
Input				Decimal code										BCD code									
				OUT										OUT									
DA	DB	DC	DD	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0
1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	0
0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	0	0	1	0	0	0
1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0
0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	1	0	1	1	0	0	1	0	0
1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	1	0	1	0	0
0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	1	0	0
1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	1	1	0	0
0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	1	0
1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1	0	0	1	1
ON: 0, OFF: 1																							

■ H7SB-D

Block Diagram



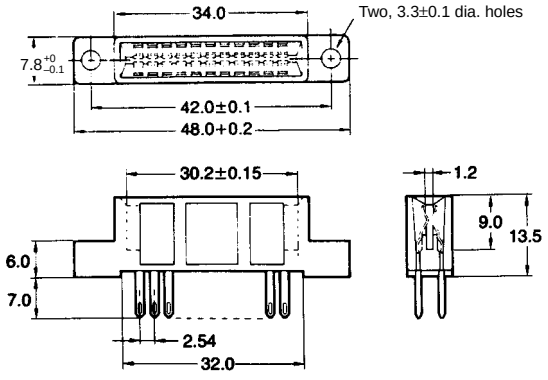
Terminal Arrangement when Connector is Mounted



(REAR VIEW)

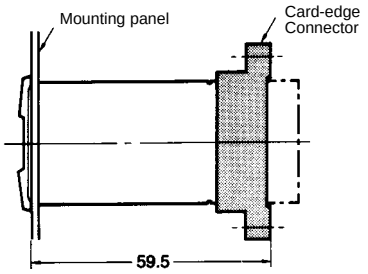
Accessories (Order Separately)

P7S-22P Card-edge Connector

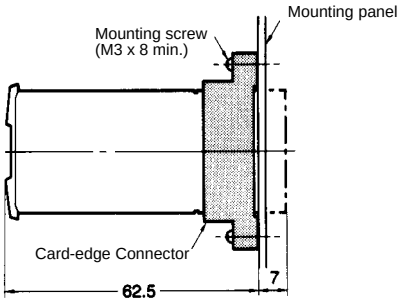


Mounting Height with Connector

Flush Mounting



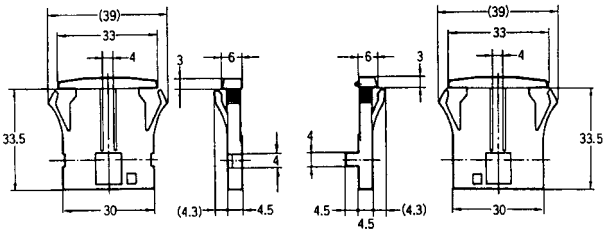
Front Mounting



A7P-M End Caps

End Caps are attached to each end of the assembled Counter system components and are used to secure the Counter system to a mounting panel.

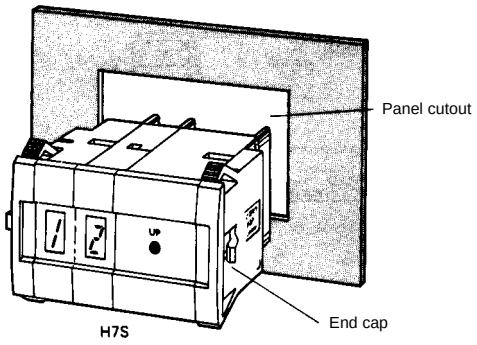
(Left) **(Right)**



Precautions

Flush Mounting

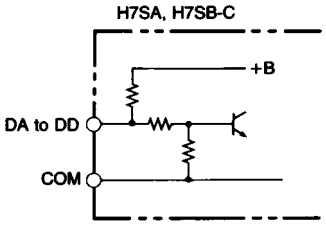
After assembling the component units with end caps at both ends, push the assembly into the panel cutout and make sure that it is secured and flush with the surface of the mounting panel.



Connections

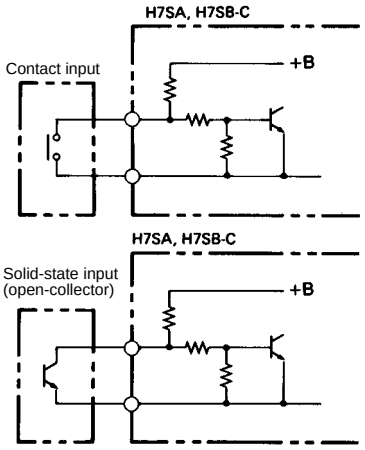
Data Input Terminals

The data input terminal circuits of both the H7SA Counter Unit and H7SB-C Fan-out Unit are as shown below.



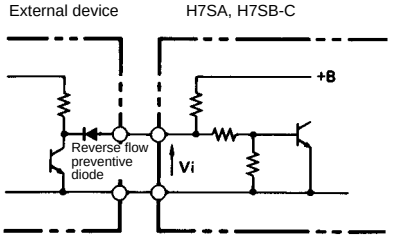
(No Voltage Input)

For no voltage input, either of the following methods of connection is recommended for the data input terminals (DA through DD) of both the H7SA and H7SB-C Units.



(Voltage Input)

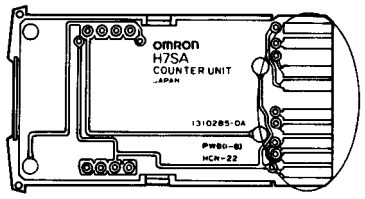
If it is likely that a voltage of 5 V or more will be applied to the data input terminals of the H7SA and H7SB-C Units, be sure to insert a diode as shown in the diagram below.



Note: When the external device is in the ON state, Vi must be 1 V or less.

Card-edge Connector

Each component unit is externally connected through a Card-edge Connector. Leave intact the edge of the PC board except when mounting the Card-edge Connector (P7S-22P) supplied as an exclusive but optional accessory.
Do not solder any leads to the I/O terminals on the board edge.



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. M015-E1-3C **In the interest of product improvement, specifications are subject to change without notice.**

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