

## Transistor I/O Link Modules

**B7A/B7AS** 

# Reduce Wiring Back to PLC Rack for 32 I/O Points

- Transmit 16 input signals over just 2 wires (3 wires if only one terminal has a power supply)
- Normal I/O delay (19.2 ms typical) or short I/O delay (3 ms typical) models
- Output models offer Hold or Load Off options for handling transmission errors
- Compact B7AS measures 30% shorter than conventional 16-point blocks
- Printed circuit board models available



## **(471**

3. Number of I/O Points

## Ordering Information

### **■ MODEL NUMBER LEGEND**

**Input Models** 

1. Series

None: Standard S: Small

2. Input/Output Classification

T:Input

= 1

3. Number of I/O Points 6: 16

### 4. Input Logic/Internal I/O Common

4	Input logic	Internal I/O common
Α	NPN compatible	- common
В	NPN compatible	+/- common
С	PNP compatible	+/- common
D	PNP (TTL) compatible	

### 5. I/O Delay Time (Typical)/Appearance

5	I/O delay	Appearance
1	19.2 ms	Screw terminals
2	19.2 ms	Printed circuit board model
6	3 ms	Screw terminals
7	3 ms	Printed circuit board model

### **Output Models**

1. Series

None: Standard S: Small

2. Input/Output Classification

R: Output

### 4. Output Logic/Output Capacity

3	Output logic	Output capacity	
Α	NPN open collector	0.05 A/point	
В	NPN open collector	0.1 A/point	
С	NPN open collector	0.5 A/point	
F	PNP open collector	0.1 A/point	
G	PNP open collector	0.5 A/point	

### 5. Error Processing

1: HOLD

3: LOAD OFF

5: HOLD/LOAD OFF

### 6. I/O Delay (Typical)/Appearance

5	I/O delay time	Appearance
1	19.2 ms	Screw terminals
2	19.2 ms	Printed circuit board model
6	3 ms	Screw terminals
7	3 ms	Printed circuit board model

### **■ 16-POINT LINK MODULES**

### **Screw Terminal Models**

Appearance	I/O classification	I/O configuration	I/O delay (typical)	Internal I/O common	Error processing (See Note 1)	Part number
	Input	NPN compatible	Normal speed 19.2 ms	- common		B7A-T6A1 (See Note 2)
				+/- common		B7A-T6B1 (See Note 2)
		PNP compatible		+/- common		B7A-T6C1
		NPN compatible	High speed 3 ms	- common		<b>B7A-T6A6</b> (See Note 2)
				+/- common		<b>B7A-T6B6</b> (See Note 2)
		PNP compatible		+/- common		B7A-T6C6
	Output	NPN open collector	Normal speed	+ common	HOLD	B7A-R6B11
		100 mA/point	19.2 ms		LOAD OFF	B7A-R6B31
		NPN open collector 500 mA/point (See Note 3)			HOLD	B7A-R6C11
					LOAD OFF	B7A-R6C31
		PNP open collector		- common	HOLD	B7A-R6F11
		100 mA/point			LOAD OFF	B7A-R6F31
		PNP open collector			HOLD	B7A-R6G11
		500 mA/point (See Note 4)			LOAD OFF	B7A-R6G31
		NPN open collector	High speed	+ common	HOLD	B7A-R6B16
		100 mA/point	3 ms		LOAD OFF	B7A-R6B36
		NPN open collector			HOLD	B7A-R6C16
		500 mA/point (See Note 3)			LOAD OFF	B7A-R6C36
		PNP open collector		- common	HOLD	B7A-R6F16
		100 mA/point			LOAD OFF	B7A-R6F36
		PNP open collector			HOLD	B7A-R6G16
		500 mA/point (See Note 4)			LOAD OFF	B7A-R6G36

Note: 1. HOLD: The previous output condition will be on hold when an error occurs.

LOAD OFF: All outputs will be OFF when an error occurs.

2. The 16-point B7A-T6A $\square$  and 16-point B7A-T6B $\square$  are different from each other in terminal configuration.

### **Small Screw Terminal Models**

Appearance	I/O classification	I/O configuration	I/O delay (typical)	Internal I/O common	Error processing (See Note 1)	Part number
	Input	NPN compatible	Normal speed 19.2 ms	+/- common		B7AS-T6B1
			High speed 3 ms			B7AS-T6B6
	Output NPN open collector 100 mA/point		Normal speed 19.2 ms		HOLD	B7AS-R6B11
A STATE OF THE STA		100 mA/point			LOAD OFF	B7AS-R6B31
			High speed		HOLD	B7AS-R6B16
			3 ms		LOAD OFF	B7AS-R6B36

Note: 1. HOLD: The previous output condition will be on hold when an error occurs. LOAD OFF: All outputs will be OFF when an error occurs.

- 2. The 16-point B7A-T6A $\square$  and 16-point B7A-T6B $\square$  are different from each other in terminal configuration.
- 3. N-channel MOS FET open drain output
- 4. P-channel MOS FET open drain output

### **Printed Circuit Board Models**

Appearance	I/O classification	I/O configuration	I/O delay (typical)	Error processing (See Note)	Part number
	Input	TTL input	Normal speed 19.2 ms		B7A-T6D2
Series III			High speed 3 ms		B7A-T6D7
	Output	NPN open collector	Normal speed 19.2 ms	HOLD/LOAD OFF	B7A-R6A52
		50 mA/point	High speed 3 ms	selected by wiring	B7A-R6A57

Note: HOLD: The previous output condition will be on hold when an error occurs.

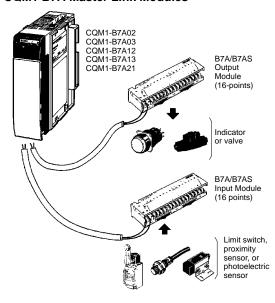
LOAD OFF: All outputs will be OFF when an error occurs.

### **■ POWER SUPPLIES**

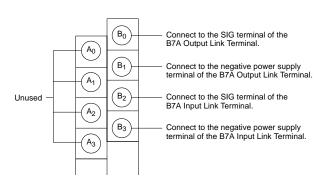
Input voltage	Output rating	Application	Part number
120 to 240 VAC	0.13 A, 24 VDC	Use one to power each input or output block	S82K-00324
	0.3 A, 24 VDC	Use one to power two blocks from a single power supply	S82K-00724
	0.6 A, 24 VDC	Use this to power blocks connected to sensors, relays indicator lights	S82K-01524
	1.3 A, 24 VDC	Use one where excess power is needed	S82K-03024

## **Application Examples**

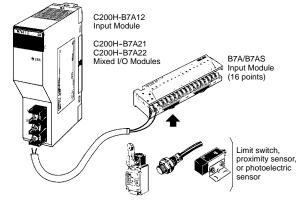
### **CQM1 B7A Master Link Modules**



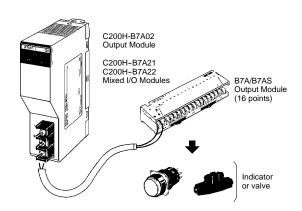
### **CQM1 Connecting Terminals**



### **C200H B7A Master Link Modules**



Note: B7A-series high-speed models cannot be used with C200H-B7Al1 and C200H-B7AO1.



## Specifications -

### **■ CHARACTERISTICS**

### General

ltem	Normal speed	High speed		
Communication method	Unidirectional, time-division multiplex			
Transmission distance (See Note 1)	500 m max.	100 m max. (See Note 2)		
I/O delay	Typical: 19.2 ms; 31 ms max.	Typical: 3 ms; 5 ms max.		
Minimum input time (See Note 3)	16 ms	2.4 ms		
Operating voltage range	12 to 24 VDC (10.8 to 26.4 VDC) (See Note 1)			
Insulation resistance	100 $M\Omega$ min. at 500 V between each terminal and external parts			
Dielectric strength	1,000 VAC, 50/60 Hz for 1 min between each terminal and external parts			
Noise immunity (See Note 4) Noise level: 1.5 kV; pulse width: 100		0 ns to 1 μs (on transmission line due to coupling)		
Vibration resistance	10 to 55 Hz, 1.5 mm double amplitude			
Shock resistance	300 m/s <sup>2</sup> (approx. 30G)			
Ambient temperature	Operating: -10°C to 55°C (14°F to 131°F) with Storage: -25°C to 65°C (-13°F to 149°F) with			
Ambient humidity	Operating: 35% to 85% with no condensation			

- Note: 1. The transmission distance values stated in this table are based on one power supply attached to each Input or Output Link Terminal. If two Input or Output Link Terminals share one power supply, the transmission distance will be derated, and the voltage must be 24 VDC ±10%. The derated transmission distance for normal-speed models is 100 m maximum and that of a high-speed model is 50 m maximum. Additional information on power supply connections follows in Operation section.
  - 2. A shielded transmission cable or plain twisted pair cable with a thickness of 0.75 mm<sup>2</sup> minimum must be used for signal transmission. If twisted pair cable is used, however, the transmission distance will be 10 m maximum regardless of whether or not independent power supplies for the Input and the Output Link Terminals are used.
  - 3. The minimum input time is required for the B7A/B7AS to read an input signal.
  - 4. For high-speed models, these values are possible without grounding the shielded line.

### **Input Models**

Item	Screw terminal models				
	B7A-T6A1/-T6A6	B7A-T6B1/-T6B6	B7AS-T6B1/-T6B6		
Compatible inputs	Switches, two-wire sensors with DC	output, three-wire NPN sensors (Se	ee Note 1)		
Input logic	Active low				
I/O delay	B7A□-T6□1: standard (typical 19.2	2 ms); B7A□-T6□6: high speed (typ	pical 3 ms)		
Current consumption	120 mA max. with all input terminal	s ON (See Note 2)			
Operating voltage range	12 to 24 VDC				
Input voltage range	0 VDC to supply voltage				
Input current range	-6 to -3 mA/point (current flowing from input terminals)				
Minimum input time	B7A□-T6□1: 16 ms; B7A□-T6□6:	2.4 ms			
ON/OFF threshold	OFF threshold  No-contact input: ON voltage: 4 V max. OFF voltage: 6 V min. Contact input: ON discrimination resistance: 660 Ω max. OFF discrimination resistance: 2 kΩ min.				
Mounting strength	No damage when 5 kgf (49 N) pull is applied for 1 min each in all directions (except in direction of DIN rail)				
Terminal strength	No damage when 5 kgf (49 N) pull i	s applied each in all directions			
Tightening torque	8 to 12 kgf • cm (0.78 to 1.18 N • m)				
Weight	Approx. 160 g		Approx. 130 g		

Note: 1. All B terminals of the B7A-T6A□ are negative terminals; power must be supplied to the three-wire sensor via the positive power supply terminal or from an independent power supply.

Two-wire sensors must satisfy the following requirements:

Residual voltage: 4 V max. Current leakage: 1.5 mA max.

The lower limit of control output: 3 mA (Use a breeder resister to eliminate this restriction.)

2. Consumption when all 16 points are ON. Excludes external sensor current for Input Terminals.

### **Input Models continued**

Item	Screw terminal models	Printed circuit board models	
	B7A-T6C1/-T6C6	B7A-T6D2/-T6D7	
Compatible inputs	Switches, two-wire sensors with DC output, three-wire PNP sensors	TTLs, switches, 3-wire PNP sensors (See Note 2)	
Input logic	Active high		
I/O delay	B7A-T6C1: standard (typical 19.2 ms); B7A-T6C6: high speed (typical 3 ms)	B7A-T6D2: standard (typical 19.2 ms); B7A-T6D7: high speed (typical 3 ms)	
Current consumption (See Note 3)	120 mA max. with all input terminals ON	60 mA max. with all input terminals ON	
Operating voltage range	12 to 24 VDC		
Input voltage range	0 VDC to supply voltage		
Input current range	3 to 6 mA/point	0.2 to 2 mA/point (input voltage: 5 to 24 VDC)	
Minimum input time (See Note 4)	B7A-T6C1: 16 ms; B7A-T6C6: 2.4 ms	B7A-T6D2: 16 ms; B7A-T6D7: 2.4 ms	
ON/OFF threshold  No-contact input:  ON voltage: $-4 \text{ V max.}$ OFF voltage: $-6 \text{ V min.}$ Contact input:  ON discrimination resistance: $660 \Omega \text{ max.}$ OFF discrimination resistance: $2 \text{ k}\Omega \text{ min.}$		ON voltage: 2.2 V min. OFF voltage: 0.8 V max.	
Mounting strength  No damage when 5 kgf (49 N) pull is applied for each in all directions (except in direction of DIN			
Terminal strength	No damage when 5 kgf (49 N) pull is applied each in all directions		
Tightening torque	8 to 12 kgf • cm (0.78 to 1.18 N • m)		
Weight	Approx. 160 g	Approx. 23 g	

- Note: 1. If there is a possibility of noise interference from the power supply, input, and/or output lines, add appropriate noise protection circuits. Refer to *Noise Protection Circuits* in the Technical Reference Section
  - 2. A three-wire NPN sensor with a residual voltage of 0.8 V maximum and a built-in collector load can be used. In this case, however, when the output transistor of the sensor is ON, the B7A will be OFF.
  - 3. Consumption when all 16 points are ON. Excludes external sensor current for Input Terminals.
  - 4. The minimum input time is required for the B7A to read an input signal.

### **Output Models**

Item	Screw terminal models (100 mA/point)				
	B7A-R6B11/-R6B16/ -R6B31/-R6B36	B7AS-R6B11/-R6B16/ -R6B31/-R6B36	B7A-R6F11/-R6F16/ -R6F31/-R6F36		
Output configuration	NPN open collector		PNP open collector		
I/O delay	B7A□-R6□□1: standard (typical	19.2 ms); B7A□ IR6□ □6: high spe	eed (typical 3 ms)		
Error processing	B7A□-R6□1□: HOLD; B7A□ IR6	S□3□: LOAD OFF			
Current consumption (See Note)	80 mA max. with all output terminals ON	120 mA max. with all output terminals ON	80 mA max. with all output terminals ON		
Power supply voltage	12 to 24 VDC				
Rated load voltage	5 to 24 VDC				
Output residual voltage	0.8 V max.				
Output current	Sink current, 100 mA max./point		Source current, 100 mA max./point		
Mounting strength	Mounting strength No damage when 5 kgf (49 N) pull is applied for 1 min each in all directions (except in direction track)				
Terminal strength	No damage when 5 kgf (49 N) pull is applied each in all directions (except in direction of DIN track)				
Tightening torque	ue 8 to 12 kgf • cm (0.78 to 1.18 N • m)				
Weight	Approx. 160 g Approx. 130 g Approx. 160 g				

Note: Consumption when all 16 points are ON. Excludes external load current and error load current for Output Terminals.

### **Output Models continued**

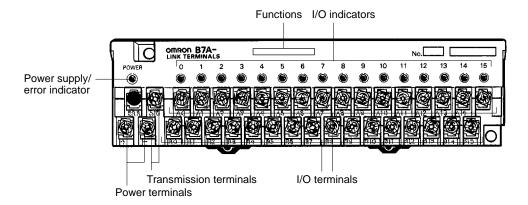
	Screw terminal mo	Printed circuit board models		
Item	B7A-R6C11/-R6C16/ -R6C31/-R6C36	B7A-R6G11/-R6G16/ -R6G31/-R6G36	B7A-R6A52/-R6A57	
Output configuration	N-channel MOSFET open drain (NPN compatible)	P-channel MOSFET open drain (PNP compatible)	NPN open collector	
I/O delay	B7A-R6□□1: standard (typical 19.2 ms); B7A-R6□□6: high speed (typical 3 ms)		B7A-R6A52: standard (typical 19.2 ms) B7A-R6A57: high speed (typical 3 ms)	
Error processing	B7A-R6□1□: HOLD; B7A-R6□3	HOLD (H/L terminals open) LOAD OFF (H/L terminals connected to 0 V)		
Current consumption (See Note 1)	100 mA max. with all output termi	40 mA max. with all output terminals ON		
Power supply voltage	12 to 24 VDC			
Rated load voltage	5 to 24 VDC			
Output residual voltage	0.8 V max.			
Output current	Sink current, 500 mA max./point (See Note 2)	Source current, 500 mA max./point (See Note 2)	Sink current, 50 mA max./point	
Mounting strength	No damage when 5 kgf (49 N) pul directions (except in direction of D			
Terminal strength	No damage when 5 kgf (49 N) pul (except in direction of DIN track)			
Tightening torque	8 to 12 kgf • cm (0.78 to 1.18 N •			
Output logic			Active high (N/P terminals open) Active low (N/P terminals connected to 0 V) (See Note 3)	
Weight	Approx. 170 g	Approx. 23 g		

Note: 1. Consumption when all 16 points are ON. Excludes external load current and error load current for Output Terminals.

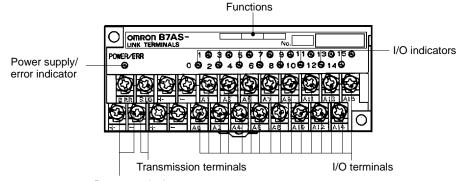
- 2. If a single power supply is connected to the Input or Output Link Terminal via a twisted pair cable with a thickness of 0.75 mm<sup>2</sup> minimum, the current flow must not exceed 1.8 A.
- 3. Refer to B7A Technical Reference for information regarding the relationship between the output logic and output ON/OFF status of the B7A.

## Nomenclature -

### В7А







Power terminals

### **Indication Operation**

Indicator		Function	
POWER (Input Terminal)	G	Lit when power is supplied and the Terminal is operating.	
	Ν	Not lit when power is not supplied.	
POWER/ERR (Output Terminal)	G	Lit when power is supplied and the Terminal is operating without error.	
	R	Lit during transmission errors.	
	N	Not lit when power is not supplied.	
I/O	0	Lit when the input signals are ON.	
	Ν	Not lit when the signals are OFF.	

Note: G: Green indicator lit; R: Red indicator lit;

O: Orange indicator lit; N: Not lit

### **Functions**

I/O classification	Display	Description	
Input	NPN 3ms	Input configuration Indicates the compatible transistor type for the input device.  I/O delay	
		Indicates the typical I/O delay time of the B7A. Use a combination of an Input and an Output Link Terminal with the same I/O delay time.	
Output		Output configuration Indicates the compatible transistor type for the output transistor.	
	NPN 0.1A 3ms	Output current Indicates the rated output current value of the B7A per point.	
		I/O delay Indicates the typical I/O delay time of the B7A. Use a combination of an Input and Output Link Terminal with the same I/O delay time.	

### **Recommended Solderless Terminals**

Wire	JIS specifications	
0.75 mm <sup>2</sup> (AWG#18)	RAV 1.25 to 3.5 (vinyl-insulated round wire) or RAP 1.25 to 3.5 (nylon-insulated round wire)	
1.25 mm <sup>2</sup> (AWG#16)	(nylon-insulated round wire)	

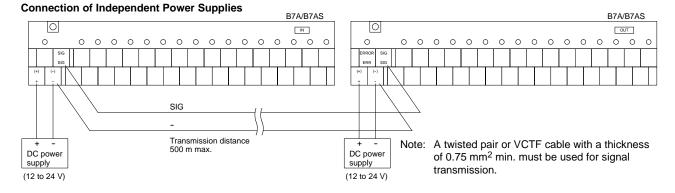
## Operation

### **■ POWER SUPPLY**

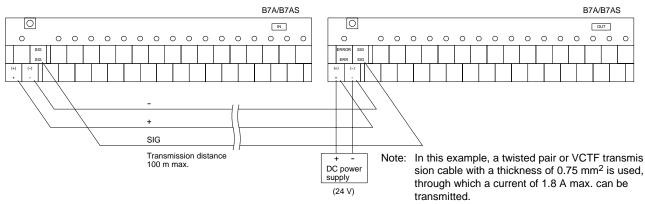
There are 16-point models with standard and high-speed transmission speeds, which are different in recommended transmission cable and transmission distance. If one power supply is connected to two Input or Output Modules, the current on the power line will be limited.

#### **Screw Terminal Models**

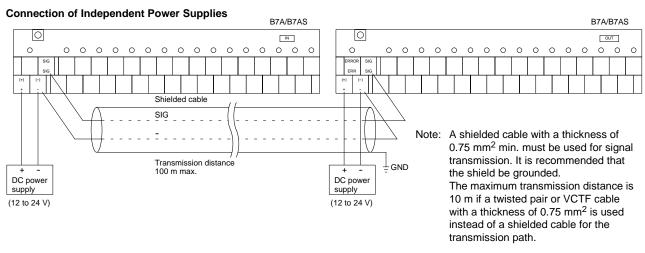
### I/O Delay: Normal Speed



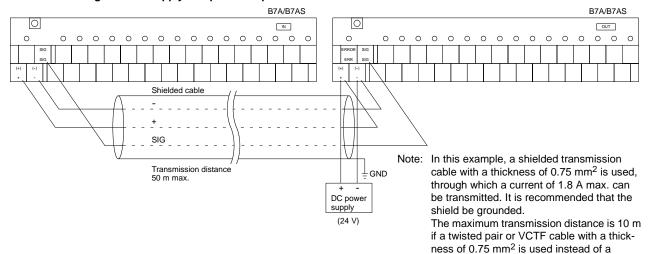
### **Connection of Single Power Supply to Input or Output Terminal**



### I/O Delay: High Speed



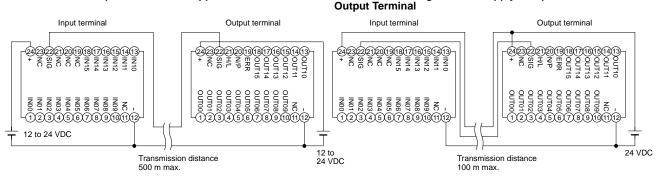
#### Connection of Single Power Supply to Input or Output Terminal



#### **Printed Circuit Board Models**

### I/O Delay: Normal Speed

#### **Connection of Independent Power Supplies**



Note: A twisted pair or VCTF cable with a thickness of 0.75 mm<sup>2</sup> min. must be used for signal transmission.

Note: In this example, a twisted pair or VCTF transmission cable with a thickness of 0.75 mm<sup>2</sup> min. is used, through which a current of 1.8 A max. can be transmitted.

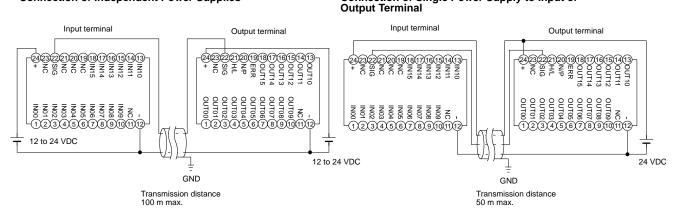
Connection of Single Power Supply to Input or

Connection of Single Power Supply to Input or

shielded cable for the transmission path.

### I/O Delay: High Speed

### **Connection of Independent Power Supplies**



Note: A shielded cable with a thickness of 0.75 mm<sup>2</sup> min. must be used for signal transmission. It is recommended that the shield be grounded.

The maximum transmission distance is 10 m if a twisted pair or VCTF cable with a thickness of 0.75 mm<sup>2</sup> is used instead of a shielded cable for the transmission path.

Note: In this example, a shielded transmission cable with a thickness of 0.75 mm² min. is used, through which a current of 1.8 A max. can be transmitted. It is recommended that the shield be grounded.

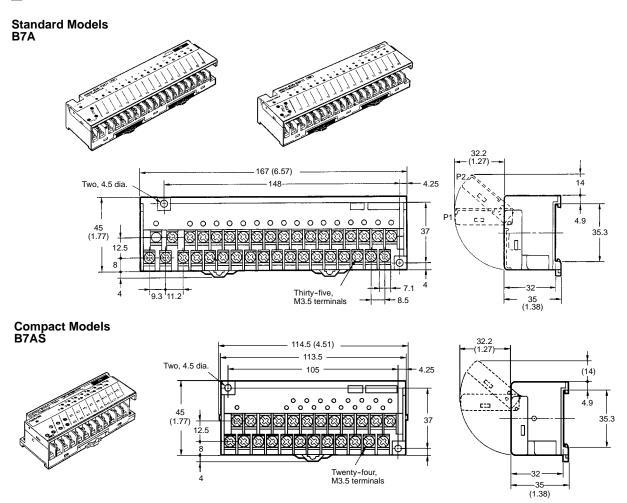
The maximum transmission distance is 10 m if a twisted pair or VCTF cable with a thickness of  $0.75~\rm mm^2$  is used instead of a shielded cable for the transmission path.

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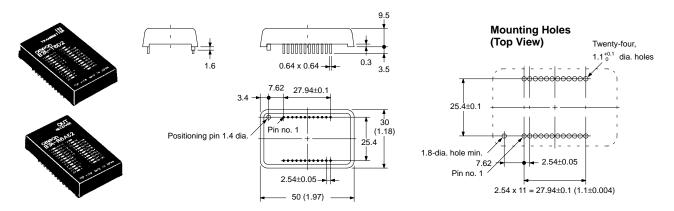
## Dimensions

Unit: mm (inch)

### ■ SCREW TERMINAL MODELS



### **■ PRINTED CIRCUIT BOARD MODELS**

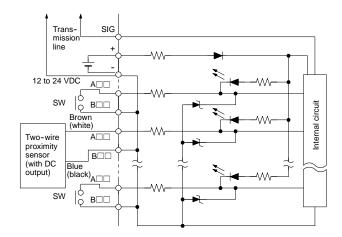


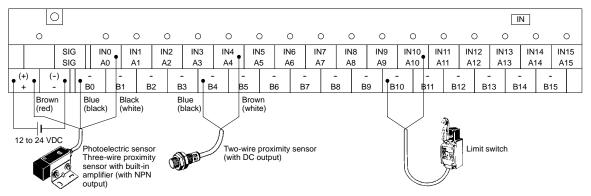
## Installation -

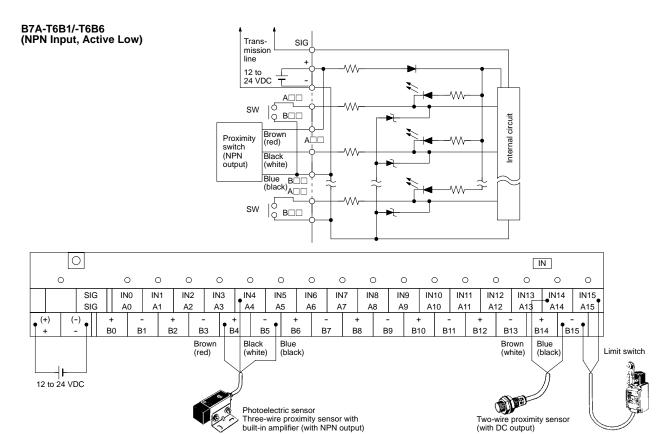
### **■ INTERNAL CIRCUITS AND TERMINAL ARRANGEMENT**

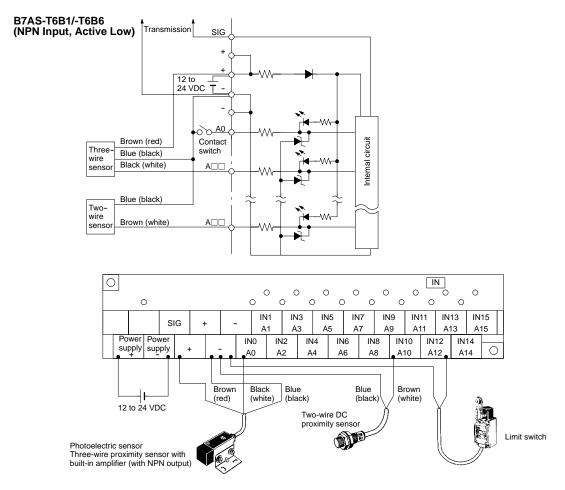
**Screw Terminal Models** 

B7A-T6A1/-T6A6 (NPN Input, Active Low)



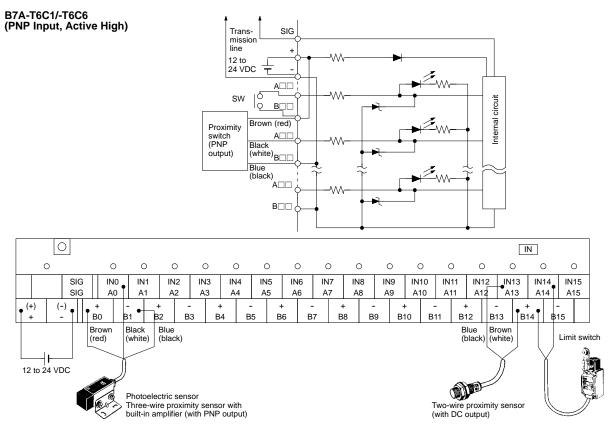






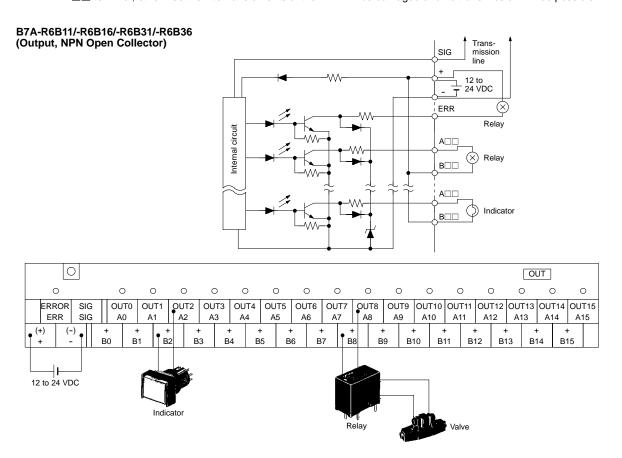
Note: 1. IEC wire colors for photoelectric sensors and proximity sensors are shown first. The colors in parentheses refer to the old colors.

2. Do not short-circuit the SIG terminal with the positive power supply terminal, negative power supply terminal, or a B terminal, otherwise the internal elements of the B7A will be damaged and no transmission will be possible.

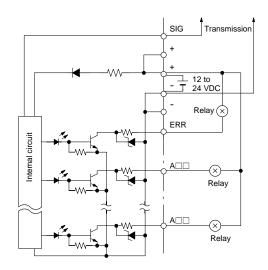


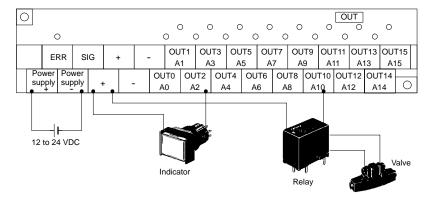
Note: 1. IEC wire colors for photoelectric sensors and proximity sensors are shown first. The colors in parentheses refer to the old colors.

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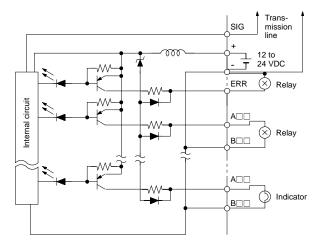
B7AS-R6B11/-R6B16/-R6B31/-R6B36 (Output, NPN Open Collector)

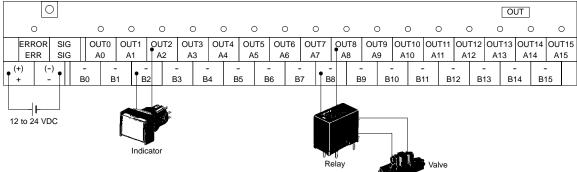




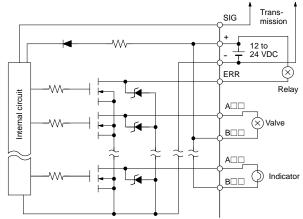
Note: Do not short-circuit terminals  $A \square \square$  and  $B \square \square$ , otherwise the internal element(s) of the B7A may be damaged.

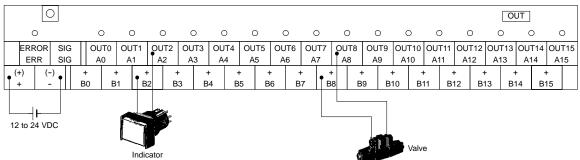


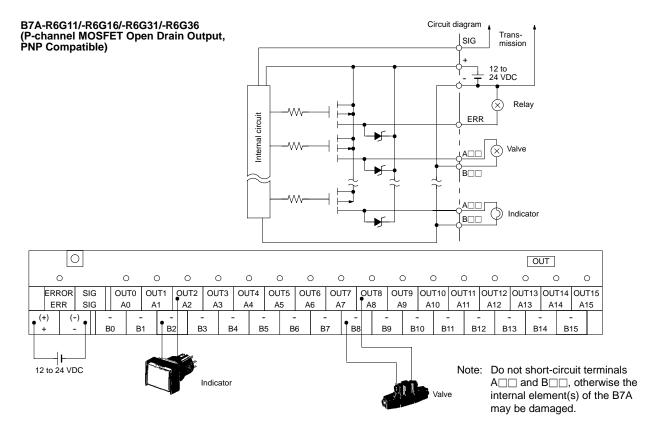






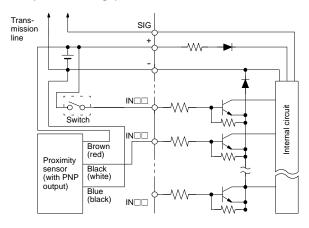




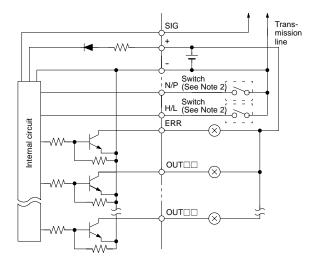


### **Printed Circuit Board Models**

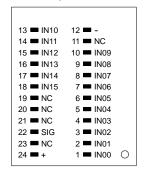
#### B7A-T6D2/-T6D7 (PNP Input, Active High)



#### B7A-R6A52/-R6A57 (Output, NPN Open Collector)

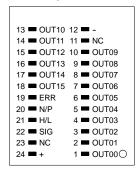


### **Top View**



- Note: 1. IEC wire colors for photoelectric sensors and proximity sensors are shown first. The colors in parentheses refer to the old colors.
  - Do not short-circuit the SIG terminal with a positive or negative power supply terminal, or internal elements of B7A will be damaged and no transmission will occur.

#### **Top View**



- Note: 1. Do not short-circuit any output terminal with the positive terminal, or the internal elements of the B7A will be damaged.
  - Logic output processing and error output processing methods can be selected with the selectors. The selectors are not required when the B7A is used with its output fixed to the output logic.

N/P: Negative/Positive		H/L: HOLD/LOAD OFF	
Terminal processing	Function	Terminal processing	Function
Open	Output logic active H	Open	Error output processing: HOLD
Connected to 0 V	Output logic active L	Connected to 0 V	Error output processing: LOAD OFF

NOTE: DIMENSIONS SHOWN ARE IN MILLIMETERS. To convert millimeters to inches divide by 25.4.

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