

Barrier Relay System

TBR-100 Series

Instruction Manual

- Thank you for purchasing this product.
- This instruction manual provides information necessary to use this product correctly and keep it in an optimal state. Before using the product, be sure to read this manual.
- Keep this instruction manual in a safe location for future use.

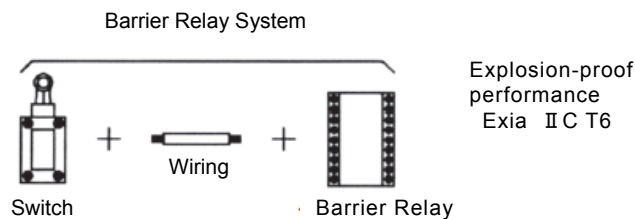
Overview

A barrier relay system means an overall barrier relay system including switches and wirings.

A barrier relay is a signal transfer converter with an intrinsically safe explosion-proof structure.

This product allows you to use contact switching parts in a hazardous area.

This product is type-certified, based on a set of technical standards related and conforming to the required international standard.



Safety Precautions and Information

Warning

- Observe the ratings, performance, specifications, and handling instructions when using the product. Mishandling may cause malfunction, explosion, or burning of the product, resulting in death, serious injury, or other physical damage.
- To use the product correctly and safely, follow this instruction manual and the appropriate explosion-proofing instruction manual.
- Before using the product, make sure that your planned operation area meets the environmental requirements.
- Only qualified personnel who have knowledge and skills related to explosion-proof structures, related laws and regulations, and electrical installation should handle the product, including installation, wiring, adjustment, operation, maintenance, and inspection.
- This barrier relay does not prevent or protect against accidents. You should prepare such a protection mechanism in the control system.
- We are not responsible for any damage caused by or resulting from use of this product in your facilities.

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Performance, Rating, and Specification

SERIES NAME		TBR-100 Series Relay output								TBR-100 Series Transistor output								TBR-100 Series Photo MOS Relay output																																		
WIRING METHOD OF INTRINSICALLY SAFE CIRCUIT		For both common wiring and separate wiring				Only for common wiring				For both common wiring and separate wiring				Only for common wiring				For both common wiring and separate wiring				Only for common wiring																														
INTRINSICALLY SAFE CIRCUIT	NUMBER OF CHANNELS	1	2	3	5	10	4	8	16	1	2	3	5	10	4	8	16	1	2	3	5	10	4	8	16																											
	EXPLOSION-PROOF STRUCTURE	Intrinsically safe explosion-proof structure (Based on technical standards related to the required international standard 1996)																																																		
	EXPLOSION-PROOF PERFORMANCE	Switch: Exia II C T6												Barrier Relay :[Exia] II C																																						
	MAXIMUM VOLTAGE (U ₀)	12.5V																																																		
	MAXIMUM CURRENT (I ₀)	177.6mA(Common wiring)/11.1mA(Separate wiring)																																																		
	MAXIMUM POWER (P ₀)	555.2mW(Common wiring)/34.7mW (Separate wiring)																																																		
	EXTERNAL CAPACITANCE (C _w)	800nF																																																		
	EXTERNAL INDUCTANCE (L _w)	1mH(Common wiring)/160mH (Separate wiring)																																																		
	MAXIMUM VOLTAGE OF NON-INTRINSICALLY SAFE CIRCUIT (U _m)	AC250V 50/60Hz DC250V																																																		
GENERAL CIRCUIT (LOAD SIDE)	OUTPUT MODE	Relay contact output 1a Rate: 3A(AC250V DC30V)Max. Resistance load (Common terminal of common type total current 10A)								NPN type Open collector output Rate: Sink current 100mA(DC30V) Max. Residual voltage 1.5 V Max								Photo MOS relay output Rate: 100mA(DC30V) Max. (Sink type or source type can be selected for use according to power polarity.)																																		
		POWER SUPPLY	AC POWER		AC100~240V 50/60Hz																								DC POWER		DC24V±10% Ripple 10%																					
RESPONSE TIME		11ms Max.								1ms Max.								3ms Max.																																		
POWER CONSUMPTION	AC POWER (W)	5	5.2	5.8	6.3	8.1	6	7.3	10.4	5	5.2	5.8	6.3	8.1	6	7.3	10.4	5	5.2	5.8	6.3	8.1	6	7.3	10.4																											
CURRENT CONSUMPTION	DC POWER (mA)	45	58	71	97	163	84	137	242	45	58	71	97	163	84	137	242	45	58	71	97	163	84	137	242																											
WIRING METHOD		Terminal connection The tightening torque shall be 0.3N·m Max.																																																		
SHORT PROTECTION		—												provided																																						
INDICATING LIGHT		Power indicating light: Green LED Operation indicating light: Orange LED...each number of channels																																																		
MATERIAL		Case: PPE Panel plate: PET																																																		
WEIGHT (approx.) g		95	180	185	230	360	190	245	390	95	180	185	230	360	190	245	390	95	180	185	230	360	190	245	390																											
ACCESSORY		Instruction Manual, Type Certificate Label, Explosion protection item indication																																																		

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General Performance (Environment, Testing, etc.)

OPERATING AMBIENT TEMPERATURE		-20 to +60°C (Non-freezing)
OPERATING AMBIENT HUMIDITY		40 to 85% RH (Non-condensation)
ATMOSPHERIC PRESSURE		800 to 1,100hPa
INSULATING RESISTANCE		10MΩ or more ,DC500V mega (between the same polar with withstand voltage)
WITHSTAND VOLTAGE (for 1 minute, 2mA)		Between intrinsically safe circuit and non-intrinsically safe circuit: AC 1600V Between power source and output: AC 1500V (excluding DC power transistor output)
RESISTANCE TO VIBRATION	AT DIRECT ATTACHMENT	Repetitive amplitude 0.75mm (10 to 55Hz) ※
	AT ATTACHMENT ON DIN RAIL	
RESISTANCE TO SHOCK	AT DIRECT ATTACHMENT	500m/s ² (Three times for each of X, Y, and Z direction)
	AT ATTACHMENT ON DIN RAIL	300m/s ² (Three times for each of X, Y, and Z direction) ※

※When using a DIN rail, use a guide lock and anti-skid stopper to secure the relay firmly.

Safety barrier requirement

INSTALLATION PLACE	Non hazardous place(The switch connected with intrinsically safe circuit is hazardous place)		
MOUNTING PLACE	Inside of instrumental panel (Keep in a suitable enclosure when using it outside of the panel.)		
INTRINSICALLY SAFE CIRCUIT RATING	Switch	Wiring	Barrier Relay
	MAXIMUM VOLTAGE COMMON WIRING SEPARATE WIRING	U _i :15V I _i :200mA I _i :50mA	U _o :12.5V I _o :177.6mA I _o :11.1mA
PARAMETER	COMMON WIRING SEPARATE WIRING	C _i : ≒ 0nF L _i : ≒ 0mH	C _o :800nF L _o :1mH L _w :160mH L _o :160mH
	WIRING METHOD	Try to make safe wiring referring to "Technical standards related and conforming to the required international standard 1996" or "USERS'GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry 1994" Reference: "RECOMMENDED PRACTICES for Explosion-Protected Electrical Installations in General Industries" (Gas vapor explosion-proof 2006) • Common wiring type is compatible with Max.16 channels.	

Switch Requirements for Use in a Hazardous Area

EXPLOSION – PROOF PERFORMANCE	Exia II C T6
OPERATING AMBIENT TEMPERATURE	-20 to +60°C (Non-freezing)
OPERATING AMBIENT HUMIDITY	40 to 85% RH (Non-condensation)
ATMOSPHERIC PRESSURE	800 to 1,100 hPa
PROTECTIVE STRUCTURE	IP20 or higher
INSTALLATION	Hazardous area
MATERIAL	Metal/plastic
RATED VOLTAGE	24 V or more (recommended)
RATED CURRENT	200 mA or more for common connection, 50 mA or more for separate connection (recommended)
WITHSTAND VOLTAGE	500 VAC or more for 1 minute at 2 mA (against ground, external wiring)
INSULATING RESISTANCE	10 MΩ or more DC500V mega (against ground, external wiring)

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Model table

POWER SUPPLY	Relay output	Transistor output	Photo MOS Relay output
AC100~240V 50/60Hz	TBR-AB101R	TBR-AB101S	TBR-AB101M
	TBR-AB102R	TBR-AB102S	TBR-AB102M
	TBR-AB103R	TBR-AB103S	TBR-AB103M
	TBR-AB105R	TBR-AB105S	TBR-AB105M
	TBR-AB110R	TBR-AB110S	TBR-AB110M
	TBR-AC104R	TBR-AC104S	TBR-AC104M
	TBR-AC108R	TBR-AC108S	TBR-AC108M
	TBR-AC116R	TBR-AC116S	TBR-AC116M
DC24V±10% Ripple 10%	TBR-DB101R	TBR-DB101S	TBR-DB101M
	TBR-DB102R	TBR-DB102S	TBR-DB102M
	TBR-DB103R	TBR-DB103S	TBR-DB103M
	TBR-DB105R	TBR-DB105S	TBR-DB105M
	TBR-DB110R	TBR-DB110S	TBR-DB110M
	TBR-DC104R	TBR-DC104S	TBR-DC104M
	TBR-DC108R	TBR-DC108S	TBR-DC108M
	TBR-DC116R	TBR-DC116S	TBR-DC116M

1. Installation

- Be sure to install the barrier relay in a non-hazardous area.
The barrier relay can be mounted in any orientation. Use a 35 mm-wide DIN rail or M4 screws to secure it firmly so that it does not loosen due to vibration and other factors.
- When using a DIN rail, use a guide lock and anti-skid stopper to secure the relay firmly.
- When using M4 screws to mount the barrier relay, use a tightening torque of 0.6 N·m (recommended).
- Use the barrier relay and switches within an ambient temperature range from -20 to +60°C.

2. Suitable Contact Switching Parts

The barrier relay can be used with a contact switching part like a push-button switch or limit switch. Any of the following types of switching parts are suitable for use with the barrier relay:

- Various operation switches
 - Various limit switches and micro-switches
 - Rotary switches and selector switches
 - Pressure switches (with a contact which opens/closes according to the pressure variation.)
 - Temperature switches (with a contact which opens/closes according to the temperature variation.)
 - ★ Other switches with a contact which opens/closes.
 - ★ Metallic switches whose light metal content is 10% or less by weight (for a metal such as Al or Mg) or which contain 7.5% or less of light metal by weight (for a non-Al metal)
 - ★ Fully or partially plastic switches whose projected plastic surface area is 20 cm² or less
- Unsuitable switches
- a) Switches with an exposed charger
Note, however, that these switches can be used if they are in an IP20 or higher metallic case.
 - b) Non-mechanical contact switches (with an electric element such as a resistor, lamp, or volume control)
 - c) Switches whose contact rating is less than the specified rating
 - The rated voltage is 12.5 V or less.
 - The rated current is 11.1 mA or less (or 177.6 mA or less for common connection).
 - d) Fully or partially plastic switches whose maximum projected plastic surface area is 20 cm² or less
Note, however, that these switches can be used if they are in an IP20 or higher metallic case to protect them against static electricity.

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3. Wiring for Intrinsically Safe Circuitry

Before performing wiring, read the precautions for use given in the relevant explosion-proofing instruction manual.

- a) Type and length of wiring to be used
- Wire the barrier relay and switches according to the intrinsically safe ratings and parameters and explosion-proofing instructions.
 - Use wire with a withstand voltage against ground of 500 V or more as insulation performance and a conductor cross section of 0.5 mm² or more.

b) Wiring methods

- Use separate cable wiring for each intrinsically safe circuit.
- A separate intrinsically safe circuit consists of one channel for separate wiring or 16 channels for common wiring.
- To prevent electromagnetic or electrostatic induction, separate each intrinsically safe circuit from the others, using a shielded wire or duct (intrinsically safe separation).

(1) Common wiring

- Common wiring uses a multi-wire cable, one wire for each channel, to form a separate intrinsically safe circuit.
- To use common wiring to connect two or more barrier relays, connect each relay to its adjacent relay via its B terminal.

(2) Separate wiring

- Use separate wiring to form a separate intrinsically safe circuit for each channel.

c) Connection and branching

- Connection and branching may occur at a Class 0 location, but a Class 1 or 2 location is recommended.
- Use a terminal block in a dedicated IP20 or higher metallic connecting box (which only contains a separate intrinsically safe circuit) for relaying or branching.
- Use an insulated crimp-type terminal with a withstand voltage against grounding of 500 V or more.
- If there is another intrinsically safe circuit, separate them by at least 2 mm or use separating plates.

d) Antistatic

If the plastic portion of a switch container exceeds a maximum projected surface area of 20 cm², use a metallic container so that the surface area of the exposed portion becomes 20 cm² or less.

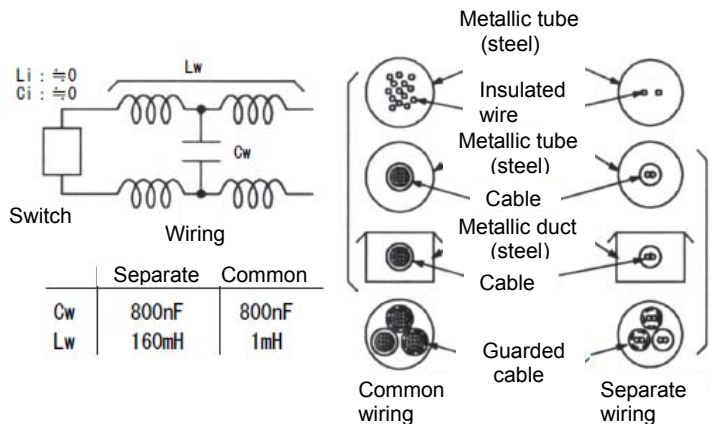
e) Prevention of light metal particle explosion

(aluminum, magnesium, or other metal)

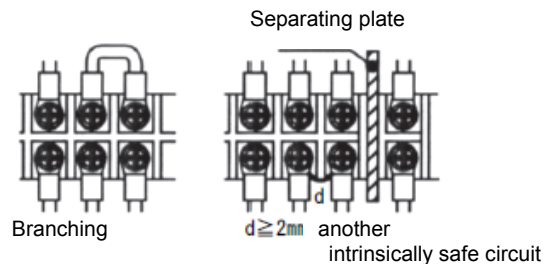
- For switches and other metallic components, take the measures necessary to prevent accumulated light metal particle explosion.

f) Distinguishing intrinsically safe circuits

In order to distinguish an intrinsically safe circuit externally connected to the barrier relay from other non-intrinsically safe circuits (intrinsically safe-related and other general circuits), use a light blue insulated wire or wrap a wire with insulation tape to distinguish it by color.

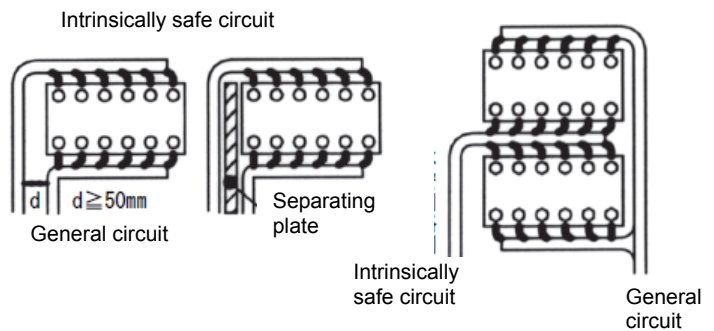


	Separate	Common
Cw	800nF	800nF
Lw	160mH	1mH



4. Barrier Relay Connection in a Non-Hazardous Area

- a) Prevention of explosive gas leaks
 - Use a compound material or the like to prevent possible explosive gas leak where a hazardous area is separated from a non-hazardous area.
- b) Connection to the barrier relay
 - Use an insulated crimp-type terminal to secure each input terminal (terminals A and B) firmly. (Use a 5.5 mm-diam. or smaller screwdriver and a tightening torque of 0.3 N·m (recommended)).
 - Since the intrinsically safe circuit (hazardous side) is insulated from the operating power supply and the output of the relay, the circuit does not need to be grounded to the earth.
 - In order to prevent possible electromagnetic and electrostatic induction, separate any intrinsically safe circuit wiring by at least 50mm from other general circuit wiring or separate them with grounded metallic plates or complete separating plates.



5. General circuit connection

Type	Common/separate type	Common dedicated type
Relay output example		
Transistor output example		
Photo MOS output example		

a) Connection precautions

- When connecting transistor outputs, be careful of their polarity.
- If a relay output needs to be protected against short-circuit, take external measures.
- Although a semiconductor output has internal short-circuit protection, overvoltage or reverse voltage may damage the semiconductor.
- To use common wiring for an output circuit, connect the adjacent C terminals.
 - A common dedicated circuit has one common terminal for eight channels.
- Lightly tighten the unused terminal screws.

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6. Usage Precautions

- Power input
 - Exceeding the rating may cause damage to the relay.
 - Do not disconnect and reconnect the barrier relay repeatedly.
 - If the internal protective circuit functions, the barrier relay may be recovered by turning it off and then on again.

7. Type Certificate Label

- Be sure to attach a supplied certificate label and explosion-proof plate on each switch used with the barrier relay.
- If the barrier relay is replaced, replace the existing certificate label and explosion-proof plate with new ones.

8. No Modification or change

Do not make any modification to the barrier relay that may result in or lead to an electrical circuit constant change or a change to any internal part, wiring, connection, or specification.

9. Maintenance and Inspection

Before performing maintenance or inspection other than a visual check, remove the external wiring from the connected intrinsically safe circuit and make sure that no dangerous gas exists.

- Visually check to see that:
 - The lamp turns on and off.
 - There is no damage on the container or cover.
- Check visually or by touching to see that:
 - No terminal connection is loose.
- Clean the plastic portion of each switch.
 - Use a soft cloth or tissue dampened with water to wipe off dust and dirt gently.
- Use instrumentation to see that:
 - The barrier relay works normally at the rated power supply voltage.
 - The lamp on the barrier relay and output from it turn on when the switch is turned to ON.
- Check to see that insulation performance is achieved:
 - Withstand voltage test: 500 V or more (against ground) at 10 MΩ or higher insulation resistance

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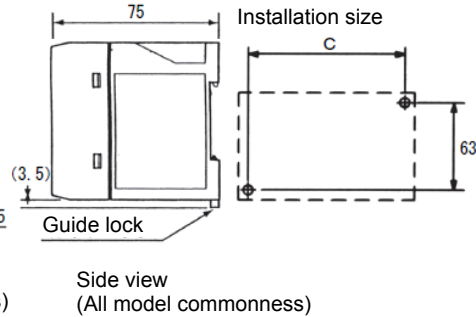
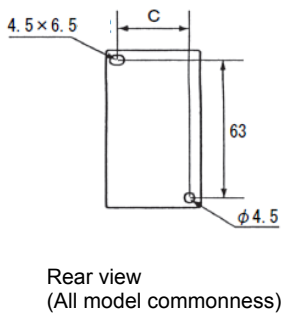
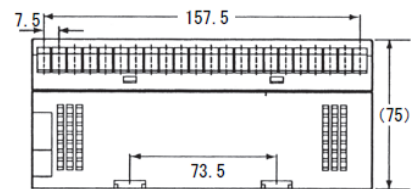
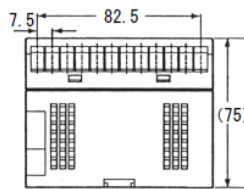
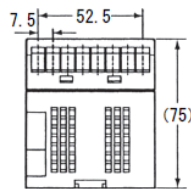
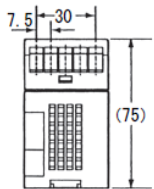
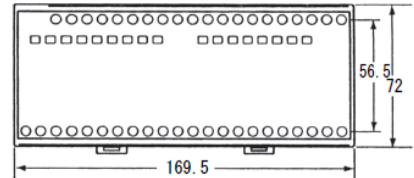
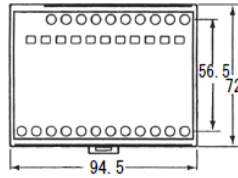
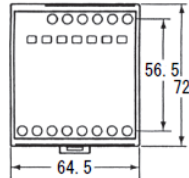
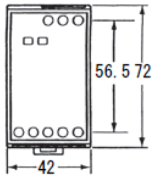
10. Dimensions (mm)

: TBR-AB101□
TBR-DB101□

: TBR-AB102□ TBR-DB102□
TBR-AB103□ TBR-DB103□
TBR-AC104□ TBR-DC104□

: TBR-AB105□ TBR-DB105□
TBR-AC108□ TBR-DC108□

: TBR-AB110□ TBR-DB110□
TBR-AC116□ TBR-DC116□



Installation size

※ □ R: Relay output S: Transistor output
M: Photo MOS Relay output

Type		(※)
AC	DC	C
TBR-AB101□	TBR-DB101□	32
TBR-AB102□	TBR-DB102□	54.5
TBR-AB103□	TBR-DB103□	
TBR-AC104□	TBR-DC104□	
TBR-AB105□	TBR-DB105□	84.5
TBR-AC108□	TBR-DC108□	
TBR-AB110□	TBR-DB110□	159.5
TBR-AC116□	TBR-DC116□	

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