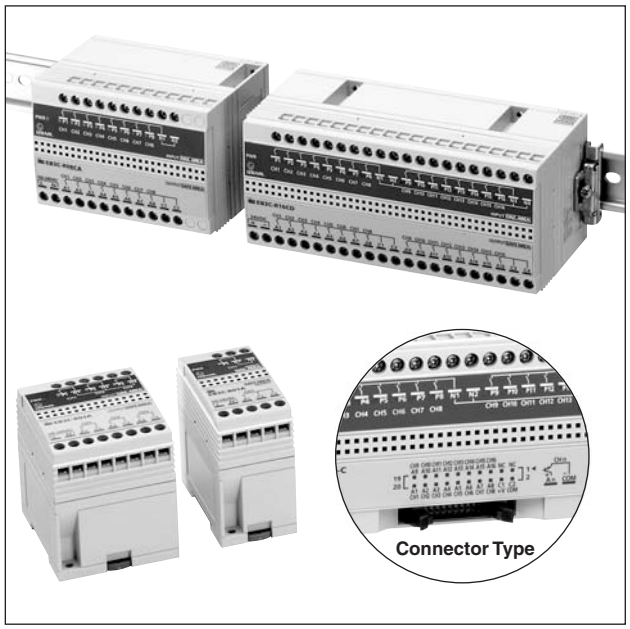
EB3C Relay Barrier

Input contacts can be used in any explosive gas and Zone 0/Class I Div. 1 areas.

Explosion protection	
Relay Barrier:	[Exia] II C
Switch:	Exia II CT6 or Exia II BT6

- IEC60079 compliant
- Dry-contact switches with 0.5Ω maximum contact resistance can be connected to the EB3C.
- Compact and lightweight (46% footprint and 36% weight compared to IDEC's 10-circuit IBRC)
- 8- and 16-circuit types are available in common wiring types, ideal for connection to PLCs. 16-circuit types are also available with a connector.
- Universal AC power voltage (100 to 240V AC)
- No grounding required
- IDEC's original spring-up terminal minimizes wiring time.
- Installation
  35-mm-wide DIN rail mounting or direct screw mounting
- Global usage
  USA: FM
  Canada: CSA
  Europe: CE marking, ATEX
  Japan: TIIS
- Ship class: ClassNK (Japan)



Types

Power Voltage	Number of Channels	Connection to Non-intrinsically Safe Circuit	Input Wiring Method	Output		Type No.
100 to 240V AC	1	Screw Terminal	Separate/Common Wiring Compatible	Relay		EB3C-R01A
	2					EB3C-R02A
	3					EB3C-R03A
	5					EB3C-R05A
	6					EB3C-R06A
	8					EB3C-R08A
	10					EB3C-R10A
	8		Common Wiring Only			EB3C-R08CA
	6		Separate/Common Wiring Compatible	Transistor (Sink/Source)		EB3C-T06A
	8					EB3C-T08A
	10					EB3C-T10A
	8		Common Wiring Only	Transistor (Sink)		EB3C-T08CKA
24V DC	8		Common Wiring Only	Relay		EB3C-R08CD
	10		Separate/Common Wiring Compatible			EB3C-R10D
	16		Common Wiring Only			EB3C-R16CD
	10		Separate/Common Wiring Compatible	Transistor (Sink/Source)		EB3C-T10D
	8		Common Wiring Only	Transistor	Sink	EB3C-T08CKD
	16					EB3C-T16CKD
	8				Source	EB3C-T08CSD
	16					EB3C-T16CSD
	16	Connector			Sink	EB3C-T16CKD-C
					Source	EB3C-T16CSD-C

Accessories

Name	Type No.	Order No.	Package Quantity	Description
DIN Rail	BAA1000	BAA1000PN10	10	Aluminum (1 m long)
	BAP1000	BAP1000PN10	10	Steel (1 m long)
Mounting Clip	BNL5	BNL5PN10	10	For fastening EB3C units on the DIN rail.
	BNL6	BNL6PN10	10	

Explosion-Protection and Electrical Specifications

Explosion Protection			Intrinsic safety type (IEC compliant) [Exia] II C	
Degree of Protection			IP20 (IEC60529)	
Installation Location	Relay Barrier		Safe indoor place (non-hazardous area)	
	Switch		For zone 0, 1, 2 hazardous areas	
Non-intrinsically Safe Circuit Maximum Voltage (Um)			250V AC 50/60Hz, 250V DC	
Intrinsically Safe Circuits	Wiring Method		1-channel Separate Wiring	16-channel Common Wiring
	Rated Operating Voltage		12V DC ±10%	
	Rated Operating Current		10 mA DC ±20%	
	Maximum Output Voltage (Uo)		13.2V DC	
	Maximum Output Current (Io)		14.2 mA	227.2 mA
	Maximum Output Power (Po)		46.9 mW	750 mW
	Maximum External Inductance (Lo) (Note)		175 (125) mH	0.68 (0.68) mH
	Maximum External Capacitance (Co) (Note)		900 (740) nF	
	Allowable Wiring Resistance (Rw)		300Ω	600/(n+1)Ω (n = number of common channels)
	Maximum Channels per Common Line		–	16
Non-intrinsically Safe Circuits	Relay Output	Contact Configuration	1NO	
		Rated Insulation Voltage (Ui)	250V AC, 125V DC	
		Thermal Current (Ith)	3A (common terminal: 8A)	
		Contact Allowable Power: Resistive Load	AC: 750 VA, DC: 72W	
		Contact Allowable Power: Inductive Load	AC: 750 VA (cos ø = 0.3 to 0.4) DC: 48W (L/R = 7 ms)	
		Rated Load: Resistive Load	250V AC 3A, 24V DC 3A	
		Rated Load: Inductive Load	250V AC 3A (cos ø = 0.3 to 0.4) 24V DC 2A (L/R = 7 ms)	
		Minimum Applicable Load	0.1V DC, 0.1 mA (reference value)	
		Contact Resistance	50 mΩ maximum (initial value)	
		Turn ON Time	12 ms maximum (rated voltage)	
		Turn OFF Time	10 ms maximum (rated voltage)	
		Mechanical Life	20,000,000 operations minimum (at 18,000 operations/hour, without load)	
		Electrical Life	100,000 operations minimum (at 1,800 operations/hour, rated load)	
		Short-circuit Protection	None	
	Transistor Output	Rated Voltage	24V DC	
		Maximum Voltage	30V DC	
		Maximum Current	100 mA (connector type: 15 mA)	
		Leakage Current	0.1 mA maximum	
		Voltage Drop	1V maximum	
		Clamping Voltage	33V (1W)	
		Inrush Current	0.5A maximum (1 sec)	
		Turn ON Time	0.1 ms maximum (resistive load)	
		Turn OFF Time	0.4 ms (typical) (resistive load)	
		Short-circuit Protection	None	

Note: Values in ( ) are those approved by TIIS (Technology Institution of Industrial Safety, Japan).

Certification No.

Certification Organization	Explosion Protection	Certification No.
FM	Class I, II, III Div. 1 Group A, B, C, D, E, F, G	3015417 (terminal type) 3019223 (connector type)
	Class I, Zone 0 AEx [ia] IIC	
CSA	Class I Div. 1 Group A, B, C, D	166730
NEMKO	[EExia] II C	Nemko 02ATEX279
TIIS Japan	Relay barrier: [Exia] II C	C15753
	Switch (EB9Z-A): Exia II CT6	C15758
	Switch (EB9Z-A1): Exia II BT6	C15961
ClassNK	Exia II C	02T606

Note: For details about switches, see “Switch Explosion-Protection Specifications” on page 5 and “3. Switches in the Hazardous Area” on page 9.

General Specifications

Power Voltage Type		AC Power Type	DC Power Type
Rated Power Voltage		100 to 240V AC	24V DC
Allowable Voltage Range		85 to 264V AC	21.6 to 26.4V DC
Rated Frequency		50/60 Hz (allowable range: 47 to 63 Hz)	—
Inrush Current		10A (100V AC) 20A (200V AC)	10A
Dielectric Strength (1 minute, 1 mA)		Between intrinsically safe circuit and non-intrinsically safe circuit: 1500V AC	
		Between AC power and output terminal: 1500V AC	
		Between DC power and transistor output terminal: 1000V AC	
Operating Temperature		–20 to +60°C (no freezing)	
Storage Temperature		–20 to +60°C (no freezing)	
Operating Humidity		45 to 85% RH (no condensation)	
Atmosphere		800 to 1100 hPa	
Pollution Degree		2 (IEC60664)	
Insulation Resistance		10 MΩ minimum (500V DC megger, between the same poles as the dielectric strength)	
Vibration Resistance	Damage Limits	Panel mounting: 10 to 55 Hz, amplitude 0.75 mm	
		DIN rail mounting: 10 to 55 Hz, amplitude 0.35 mm	
	Operation Extremes (relay output only)	Panel mounting: 10 to 55 Hz, amplitude 0.5 mm	
		DIN rail mounting: 10 to 55 Hz, amplitude 0.35 mm	
Shock Resistance	Damage Limits	Panel mounting: 500 m/s^2 (3 times each on X, Y, Z)	
		DIN rail mounting: 300 m/s^2 (3 times each on X, Y, Z)	
Terminal Style		M3 screw terminal	
Mounting		35-mm-wide DIN rail or panel mounting (M4 screw)	
Power Consumption (approx.)		9.6 VA (EB3C-R10A at 200V AC) 4.8 W (EB3C-R16CD at 24V DC)	
Weight (approx.)		0.39 kg (EB3C-R16CD)	

Switch Explosion-Protection Specifications (TIIS Japan)

Simple apparatuses in accordance with relevant standards of each country can be installed in the hazardous area and connected to the EB3C located in the safe area. In Japan, any switches, though regarded as simple apparatuses, must be certified for explosion-proof devices. EB9Z-A and EB9Z-A1 are IDEC’s generic Type No. of any single apparatuses certified by TIIS Japan for use with the EB3C, therefore simple apparatuses with specifications shown below can be used as those approved by the Japanese explosion-proof certification.

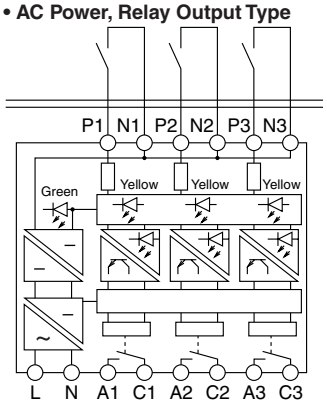
Switch Type No.	EB9Z-A	EB9Z-A1
Explosion Proof	Exia II CT6	Exia II BT6
Operating Temperature	–20 to +60°C (no freezing)	
Operating Humidity	45 to 85% RH (no condensation)	
Degree of Protection	IP20	
Dielectric Strength	500V AC, 1 mA	
Intrinsic Safety Ratings and Parameters	1-channel Separate Wiring Maximum input voltage (Ui): 13.2V Maximum input current (Ii): 14.2 mA Maximum input power (Pi): 46.9 mW Internal inductance (Li): ≤ 5 µH Internal capacitance (Ci): ≤ 2 nF	
	16-channel Common Wiring Maximum input voltage (Ui): 13.2V Maximum input current (Ii): 227.2 mA Maximum input power (Pi): 750 mW Internal inductance (Li): ≤ 80 µH Internal capacitance (Ci): ≤ 32 nF	
Enclosure Material	Metallic: Magnesium content must be 6% or less (steel and aluminum are acceptable)	
	Plastic: Switch operator exposed area IIC: 20 cm^2 maximum IIB: 100 cm^2 maximum When the switch has a wider exposed area, attach a caution label as shown at right. **Caution** To prevent electrostatic charges, do not rub the switch surface during operation. Use a soft cloth dipped with water for cleaning. **Caution Label Example**	
Switch Ratings	Contact rating: Ui, Ii minimum Contact resistance: 0.5Ω maximum Cross sectional area of wire: 0.000962 mm^2 maximum Printed circuit board: Thickness 0.5 mm minimum Copper foil width 0.15 mm minimum Thickness 18 µm minimum one/both side(s) A resistor to prevent contact welding and an LED can be connected to 1-channel separate wiring circuits. Consult IDEC for details.	

Note: For details, see “3. Switches in the Hazardous Area” on page 9.

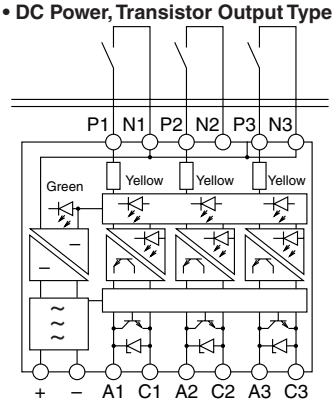
EB3C Relay Barrier

Internal Circuit Block Diagram

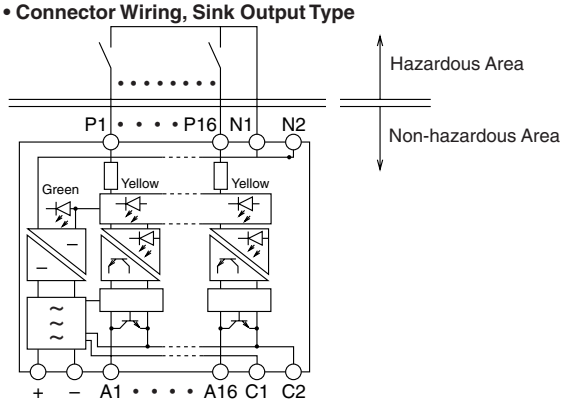
• AC Power, Relay Output Type



• DC Power, Transistor Output Type

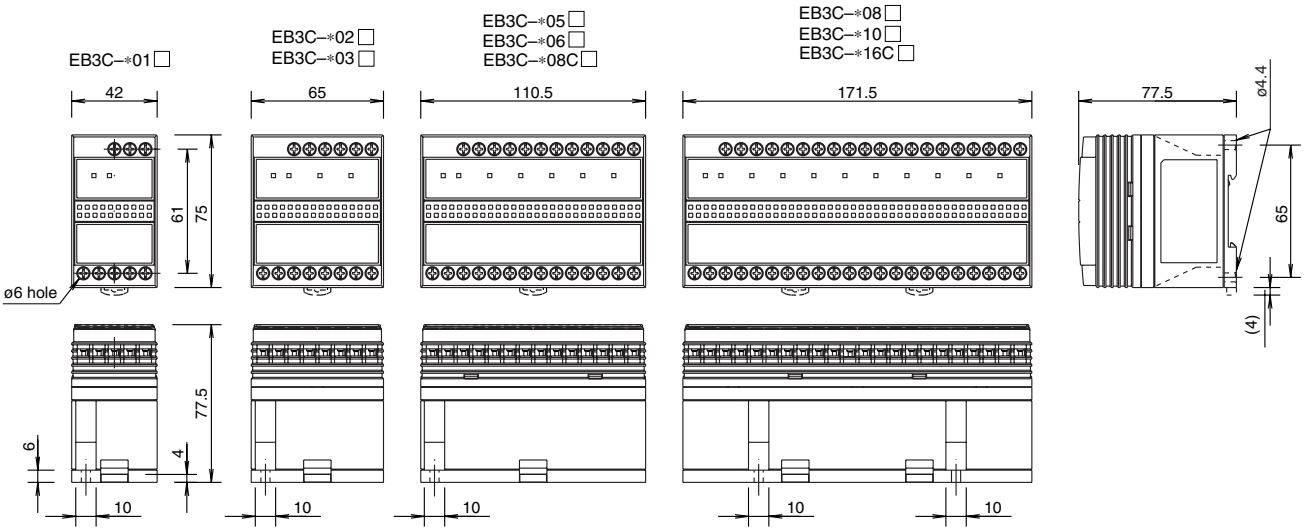


• Connector Wiring, Sink Output Type

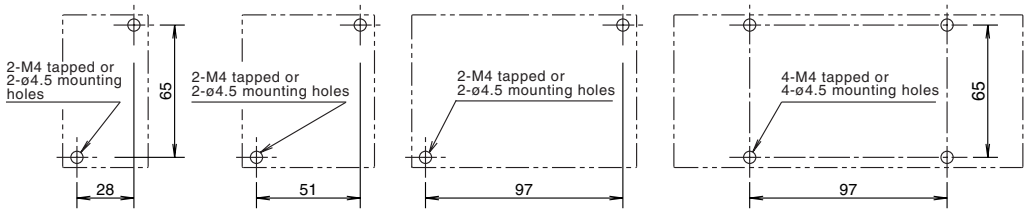


Dimensions

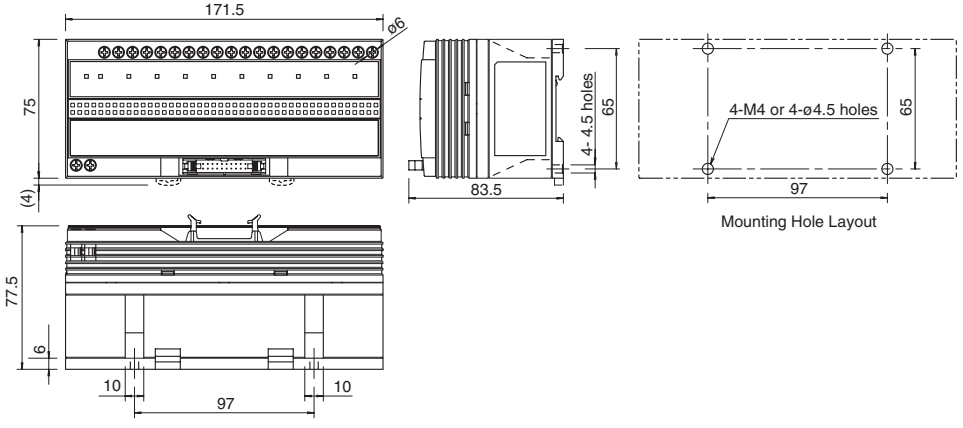
• Screw Terminal Type



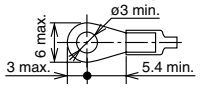
Mounting Hole Layout (Screw Mounting)



• Connector Type

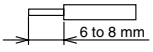


Applicable Crimping Terminal

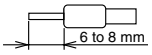


Stripping the Wire End

Solid Wire



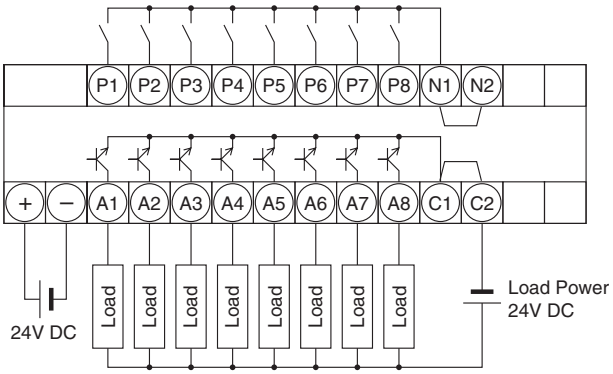
Stranded Wire (Ferrule)



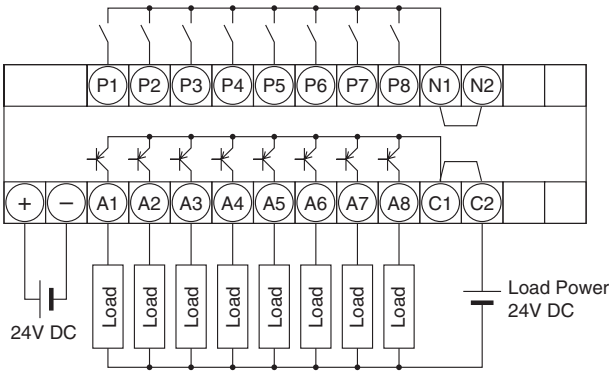
All dimensions in mm.

External Wiring Examples

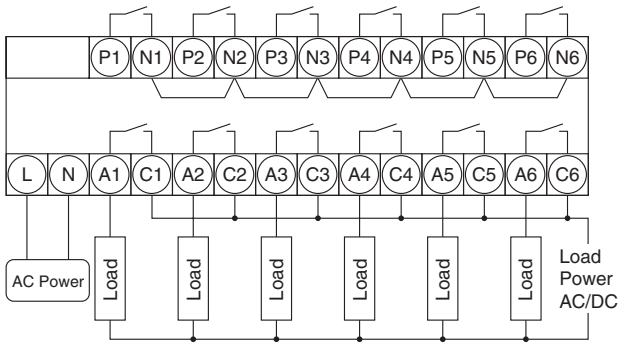
• Transistor Sink Output Type (Ex.: EB3C-T08CKD)



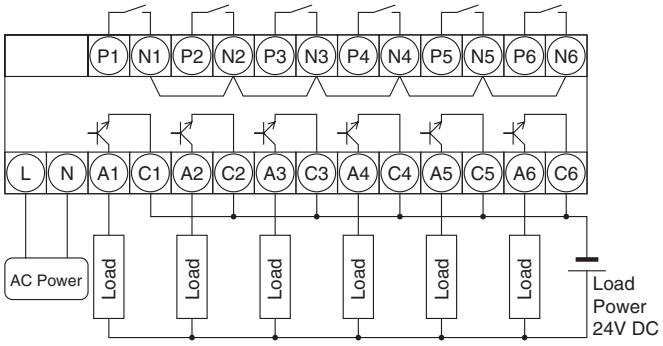
• Transistor Source Output Type (Ex.: EB3C-T08CSD)



• Relay Output Type (Ex.: EB3C-R06A)

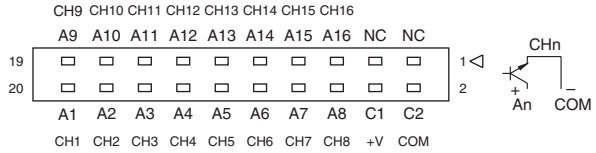


• Transistor Output Type (Ex.: EB3C-T06A)

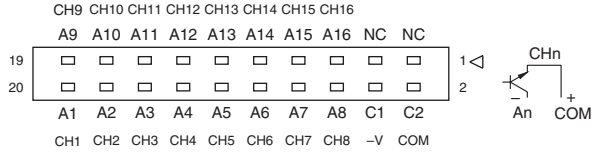


Connector Type Output Wiring Diagram

• EB3C-T16CKD-C



• EB3C-T16CSD-C



Wiring Example with IDEC's PLC MicroSmart

EB3C-T16CKD-C		FC4A-N16B3	
Terminal	Output	Input	Terminal
20	A1	I0	20
19	A9	I10	19
18	A2	I1	18
17	A10	I11	17
16	A3	I2	16
15	A11	I12	15
14	A4	I3	14
13	A12	I13	13
12	A5	I4	12
11	A13	I14	11
10	A6	I5	10
9	A14	I15	9
8	A7	I6	8
7	A15	I16	7
6	A8	I7	6
5	A16	I17	5
4	+V	COM	4
3	NC	COM	3
2	COM(–)	NC	2
1	NC	NC	1

EB3C-T16CSD-C		FC4A-N16B3	
Terminal	Output	Input	Terminal
20	A1	I0	20
19	A9	I10	19
18	A2	I1	18
17	A10	I11	17
16	A3	I2	16
15	A11	I12	15
14	A4	I3	14
13	A12	I13	13
12	A5	I4	12
11	A13	I14	11
10	A6	I5	10
9	A14	I15	9
8	A7	I6	8
7	A15	I16	7
6	A8	I7	6
5	A16	I17	5
4	–V	COM	4
3	NC	COM	3
2	COM(+)	NC	2
1	NC	NC	1

Note 1: The wiring in dashed line does not affect the operation of the MicroSmart.
Note 2: Applicable connector is IDEC's JE1S-201.

EB3C Relay Barrier

Wiring

1. Separate Wiring

• **Each input line of the EB3C makes up one independent intrinsically safe circuit.**

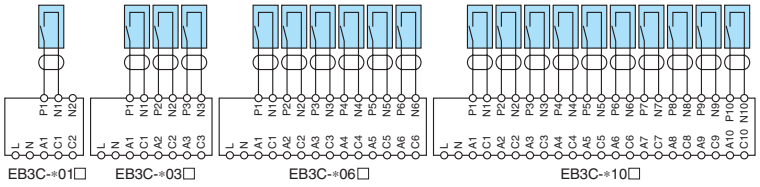
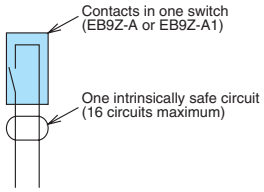
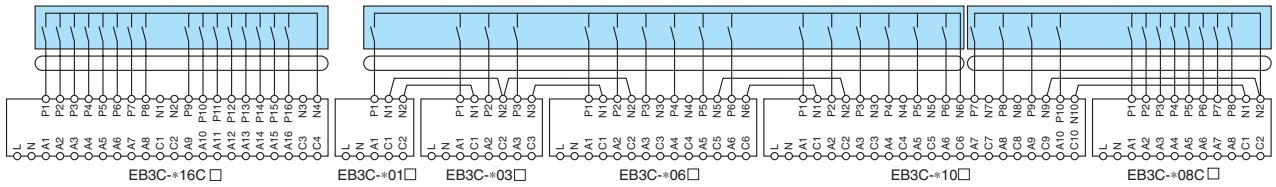


Diagram Symbols

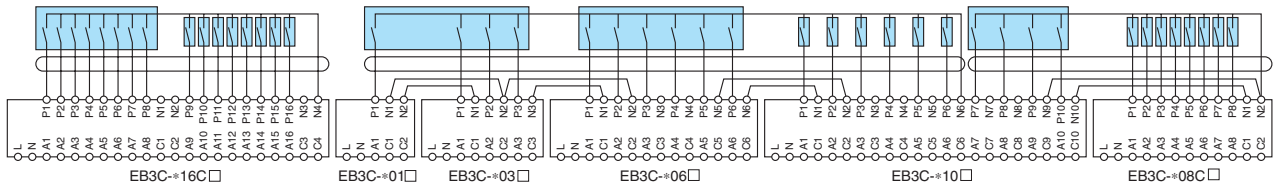


2. Common Wiring (Maximum 16 cicuits)

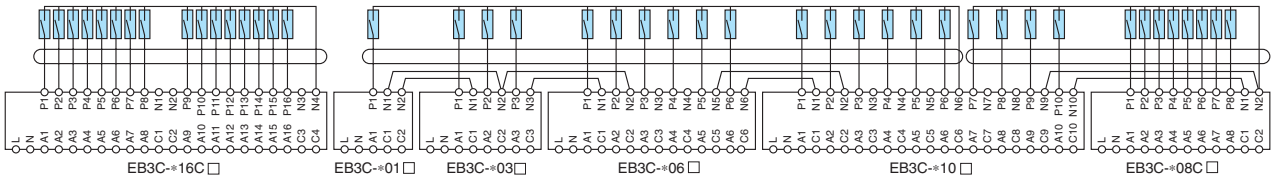
• **All input lines are wired to a common line inside the intrinsically safe switch (one common line per intrinsically safe circuit).**



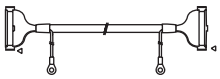
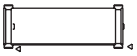
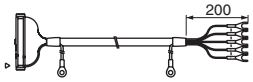
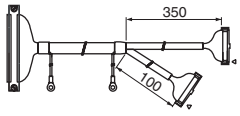
• **Some input lines are wired to a common line inside the intrainsically safe switches, while others are outside the switches (one common line per intrinsically safe circuit).**



• **All input lines are wired to a common line outside the intrinsically safe switches (one common line per intrinsically safe circuit).**



Recommended Connector Cable for Connector Types

Description		No. of Poles	Length (m)	Type No.	Appearance	Applicable Type
I/O Terminal Cable	With Shield	20	0.5	FC9Z-H050A20		MicroSmart I/O Module
			1	FC9Z-H100A20		
			2	FC9Z-H200A20		
			3	FC9Z-H300A20		
	Without Shield		0.5	FC9Z-H050B20		MicroSmart I/O Module
			1	FC9Z-H100B20		
			2	FC9Z-H200B20		
			3	FC9Z-H300B20		
Cable with Crimping Terminal			1	BX9Z-H100E4		Screw Terminal Type
			2	BX9Z-H200E4		
			3	BX9Z-H300E4		
40-pin Cable for PLC			1	BX9Z-H100L		Mitsubishi A, Q Series Input Module (positive common) ↓ EB3C-T16CKD-C
			2	BX9Z-H200L		
			3	BX9Z-H300L		

Precautions for Operation

1. Installation of EB3C Relay Barriers

(1) The EB3C can be installed in any direction.

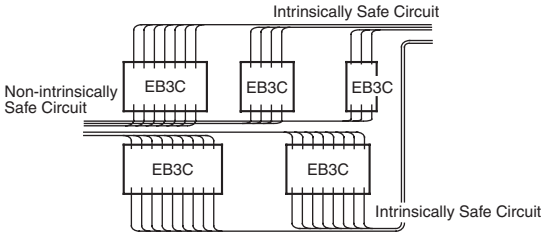
(2) Install the EB3C relay barrier in a safe area (non-hazardous area) in accordance with intrinsic safety ratings and parameters. To avoid mechanical shocks, install the EB3C in an enclosure which suppresses shocks.

(3) When installing or wiring the EB3C, prevent electromagnetic and electrostatic inductions in the intrinsically safe circuit. Also prevent the intrinsically safe circuits from contacting with another intrinsically safe circuit and any other circuits.

Maintain at least 50 mm clearance, or provide a metallic separating board between the intrinsically safe circuit and non-intrinsically safety circuit. When providing a metallic separating board, make sure that the board fits closely to the enclosure (top, bottom, and both sides). Allowable clearance between the enclosure and board is 1.5 mm at the maximum.

The clearance of 50 mm between the intrinsically safe circuit and non-intrinsically safe circuit may not be sufficient when a motor circuit or high-voltage circuit is installed nearby. In this case, provide a wider clearance between the circuits referring to 5 (3) “Minimum Parallel Distance between the Intrinsically Safe Circuit and Other Circuits.”

(4) In order to prevent contact between intrinsically safe circuits and non-intrinsically safe circuits, mount EB3C units with terminals arranged in the same direction.



(5) Maintain at least 6 mm (or 3 mm according to IEC60079-11: 1999) clearance between the terminal of intrinsically safe circuit and the grounded metal part of a metal enclosure, and between the relay terminal block of an intrinsically safe circuit and the grounded metal part of a metal enclosure.

(6) For installing the EB3C, mount on a 35-mm-wide DIN rail or directly on a panel using screws. Make sure to install securely to withstand vibration. When mounting on a DIN rail, push in the clamp completely. Use the BNL5 or BNL6 mounting clips on both sides of the EB3C to prevent from moving sideways.

(7) Excessive extraneous noise may cause malfunction and damage to the EB3C. When extraneous noise activates the voltage limiting circuit (thyristor), remove the noise source and restore the power.

2. Terminal Wiring

(1) Using a ø5.5 mm or smaller screw driver, tighten the terminal screws (including unused terminal screws) to a torque of 0.6 to 1.0 N·m (recommended value).

(2) Make sure that IP20 is achieved when wiring. Use insulation tubes on bare crimping terminals.

(3) To prevent disengaged wires from contacting with other intrinsically safe circuits, bind together the wires of one intrinsically circuit.

(4) When the adjacent terminal is connected to another intrinsically safe circuit, provide an insulation distance of at least 6 mm.

3. Switches in the Hazardous Area (For Japan application only)

(1) A switch contains the switch contact, enclosure, and internal wiring. A switch contact refers to an ordinary switching device which consists of contacts only, such as a pushbutton switch. See below.

Applicable Switches

Control Switches	Push-pull Switches	Pushbutton, Foot, Trigger, Rocker, Grip
	Twisting Switches	Rotary, Selector, Cam, Drum, Thumb wheel
	Lever and Slide Switches	Toggle, Multidirectional, Wobble stick, Lever, Slide switch
Sensing Switches	Displacement Switches	Microswitch, Limit, Magnetic proximity, Door, Reed, Mercury
	Level Switches	Liquid level
	Others	Pressure, Temperature

Note: For installation in hazardous areas and connection to the EB3C, use switches which are certified, approved, or considered to be simple apparatus in relevant standards in each country.

(2) When the switch has internal wiring or lead wire, make sure that the values of internal inductance (Li) and capacitance (Ci) are within the certified values.

(3) Enclose the switch contact’s bare live part in an enclosure of IP20 or higher protection.

(4) Depending on the explosion-protection specifications according to TIIS Japan, the exposed area of plastic switch operator is limited as follows:

- Exia II CT6 (EB9Z-A): 20 cm^2 maximum
- Exia II BT6 (EB9Z-A1): 100 cm^2 maximum

(5) Attach the certification mark supplied with the EB3C on the EB9Z-A or EB9Z-A1 switch (for Japan application).

(6) Magnesium content of metallic enclosure must be 6% or less (steel and aluminum are acceptable).

(7) When the switch operator of plastic enclosure has a wider exposed area than the following limits, attach a caution label as shown below.

IIC: 20 cm^2 maximum
IIB: 100 cm^2 maximum

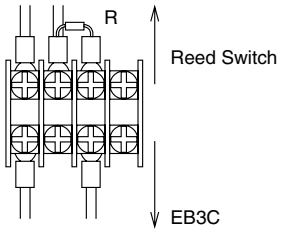
Caution
To prevent electrostatic charges, do not rub the switch surface during operation.
Use a soft cloth dipped with water for cleaning.

Caution Label Example

(8) For the 1-circuit separate wiring, a resistor to prevent reed switch contact welding and an LED miniature pilot lights can be connected in series with the contact. See below. Use the terminal screw of M3 or larger.

Applicable Resistor Ratings

Resistance	100Ω maximum
Rated Wattage	0.5 to 3W
Type	Metal (oxide) film resistors



- Applicable LED Type

IDEC’s IPL1 series LED miniature pilot lights.

Precautions for Operation

4. Output Specifications

(1) When wiring the output from the EB3C, connect the non-intrinsically safe circuit to terminals A and C. The EB3C output circuit is not equipped with short-circuit protection. If required, provide a protection in the external circuit.

(2) Relay Output

Some types of loads generate reverse emf (such as solenoids) or cause a large inrush current (incandescent lamps), resulting in a shorter operation life of output relay contacts. The operation life of contacts can be extended by preventing the reverse emf using a diode, RC, or varistor, or by suppressing the inrush current using a resistor or RL.

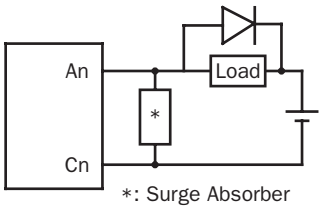
Contacts are made of gold-clad silver. When using at a small current and a low voltage (reference value: 0.1 mA, 0.1V), test the contact on the actual circuit in advance.

(3) Transistor Output

When connecting a small load, the load may not turn off because of a leakage current, even though the transistor output is turned off. If this is the case, connect a resistor in parallel with the load to bypass the leakage current.

When an excessively high voltage (clamps at 33V, 1W) or a reverse voltage is applied to the output terminals, the clamping circuit or output transistor may be damaged.

When driving an inductive load, be sure to connect a diode across the load to absorb reverse emf.



Example of Overvoltage Absorption Circuit

(4) In the common wiring only types, the output terminals are not isolated from each other.

(5) When connecting the connector type EB3C's in parallel, use one power supply to power the EB3C's. Do not connect any wiring to the C1 and C2 terminals.

5. Wiring for Intrinsic Safety

(1) The voltage applied on the general circuit connected to the non-intrinsically safe circuit terminals of the EB3C relay barrier must be 250V AC, 50/60Hz, or 250V DC at the maximum under any conditions, including the voltage of the input power and the internal circuit.

(2) When wiring, take into consideration the prevention of electromagnetic and electrostatic charges on intrinsically safe circuits. Also, prevent intrinsically safe circuits from contacting with other circuits.

(3) The intrinsically safe circuits must be separated from non-intrinsically safe circuits. Contain intrinsically safe circuits in a metallic tube or duct, or separate the intrinsically safe circuits referring to the table below.

Note: Cables with a magnetic shield, such as a metallic sheath, prevent electromagnetic induction and electrostatic induction, however, a non-magnetic shield prevents electrostatic induction only. For non-magnetic shields, take a preventive measure against electromagnetic induction.

Finely twisted pair cables prevent electromagnetic induction. Adding shields to the twisted pair cables provides protection against electrostatic induction.

Minimum Parallel Distance between the Intrinsically Safe Circuit and Other Circuits (mm)

Voltage and Current of Other Circuits	Over 100A	100A or less	50A or less	10A or less
Over 440V	2000	2000	2000	2000
440V or less	2000	600	600	600
220V or less	2000	600	600	500
110V or less	2000	600	500	300
60V or less	2000	500	300	150

(4) When identifying intrinsically safe circuits by color, use light blue terminal blocks and cables.

(5) When using two or more EB3C's to set up one intrinsically safe circuit in the common wiring configuration, interconnect two neutral terminals (N1 through N10) on each EB3C between adjacent EB3C's in parallel.

(6) Make sure that the power of the EB3C and contact are turned off before starting inspection or replacement.

Note: For the details of wiring the intrinsically safe circuits, refer to a relevant test guideline for explosion-proof electric equipment in each country.