

### Protective Doors Are Locked Until Machines Completely Stop Operating

- Two types:
  - Mechanical lock/Solenoid release
  - Solenoid lock/Mechanical release
- Operation Keys:
  - Horizontal mounting
  - Vertical mounting
  - Vertical mounting (horizontal adjustable)
- Auxiliary release key ensures easy maintenance and unlocks the door in the case of a power failure.
- Tough aluminum die-cast Unit incorporating a switch box with IP67 degree of protection (EN60529, IEC529).
- Equipped with a horizontal conduit opening and vertical conduit opening.
- Models incorporating easy-to-see indicators for monitoring and those using an adjustable Operation Key for double-leafed hinged doors are available.
- Safety Standards:
  - Conformity:
    - Machinery directive
    - Low voltage directive
    - EN1088
    - JIS C 4508



### Approved Standards

Agency	Standard	File No.
TÜV Rheinland	EN60947-5-1 (⊕)	R9451050
UL	UL508	E76675 Vol.3 Sec.11
CSA	CSA C22.2, No.14	LR45746
BIA	GS-ET-19	Mechanical lock: 9402293 Solenoid lock: 1998 20462-01
SUVA	SUVA	E6186/1.d

# Ordering Information

## ■ Model Number Legend

### Lock Switch

D4BL -     -   
           1   2   3   4   5

#### 1. Conduit

- 1: PG13.5
- 2: G1/2
- 3: 1/2-14NPT

#### 2. Built-in Switch

- C: 1NC/1NO (Slow-action) + 1NC (Slow-action)
- D: 2NC (Slow-action) + 1NC (Slow-action)

#### 3. Head Mounting Direction

- R: Mounting possible in 4 directions (mounted in the right direction at time of delivery)

#### 4. Door Lock/Release Methods

(Auxiliary Release Key is Incorporated by All Models)

- A: Mechanical lock/24-VDC solenoid release
- B: Mechanical lock/110-VAC solenoid release
- C: Mechanical lock/230-VAC solenoid release
- G: 24-VDC Solenoid lock/Mechanical release

#### 5. Indicator

- Blank: Without indicator
- A: 1 mA at 10 to 115 VAC or VDC driving (with red and green LED indicator unit)
- D: 1 mA at 250 VAC driving (with red and green neon lamp indicator unit)

## Operation Key

D4BL - K   
           1

#### 1. Operation Key Type

- 1: Horizontal mounting
- 2: Vertical mounting
- 3: Horizontal-adjustable vertical mounting

## ■ List of Models

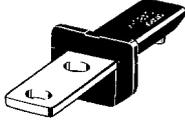
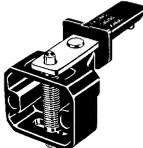
### Lock Switches

Lock method	Conduit size	Voltage for solenoid	Without indicator 1NC/1NO+ 1NC (Slow-action)	With LED indicator 1NC/1NO+ 1NC (Slow-action)	*With neon lamp indicator 1NC/1NO+ 1NC (Slow-action)	Without indicator 2NC+ 1NC (Slow-action)	With LED indicator 2NC+ 1NC (Slow-action)	*With neon lamp indicator 2NC+ 1NC (Slow-action)
Mechanical lock	PG13.5	24 VDC	D4BL-1CRA	D4BL-1CRA-A	D4BL-1CRA-D	D4BL-1DRA	D4BL-1DRA-A	D4BL-1DRA-D
		110 VAC	D4BL-1CRB	D4BL-1CRB-A	D4BL-1CRB-D	D4BL-1DRB	D4BL-1DRB-A	D4BL-1DRB-D
		230 VAC	D4BL-1CRC	D4BL-1CRC-A	D4BL-1CRC-D	D4BL-1DRC	D4BL-1DRC-A	D4BL-1DRC-D
	G1/2	24 VDC	D4BL-2CRA	D4BL-2CRA-A	D4BL-2CRA-D	D4BL-2DRA	D4BL-2DRA-A	D4BL-2DRA-D
		110 VAC	D4BL-2CRB	D4BL-2CRB-A	D4BL-2CRB-D	D4BL-2DRB	D4BL-2DRB-A	D4BL-2DRB-D
		230 VAC	D4BL-2CRC	D4BL-2CRC-A	D4BL-2CRC-D	D4BL-2DRC	D4BL-2DRC-A	D4BL-2DRC-D
	1/2-14NPT	24 VDC	D4BL-3CRA	D4BL-3CRA-A	D4BL-3CRA-D	D4BL-3DRA	D4BL-3DRA-A	D4BL-3DRA-D
		110 VAC	D4BL-3CRB	D4BL-3CRB-A	D4BL-3CRB-D	D4BL-3DRB	D4BL-3DRB-A	D4BL-3DRB-D
		230 VAC	D4BL-3CRC	D4BL-3CRC-A	D4BL-3CRC-D	D4BL-3DRC	D4BL-3DRC-A	D4BL-3DRC-D
Solenoid lock	Pg 13.5	24 VDC	D4BL-1CRG	D4BL-1CRG-A	---	D4BL-1DRG	D4BL-1DRG-A	---
	G1/2	24 VDC	D4BL-2CRG	D4BL-2CRG-A	---	D4BL-2DRG	D4BL-2DRG-A	---
	2 1/2-14NPT	24 VDC	D4BL-3CRG	D4BL-3CRG-A	---	D4BL-3DRG	D4BL-3DRG-A	---

**Note:** Items marked with asterisks are not approved by BIA SUVA, UL and CSA.

## ■ Accessories (Order Separately)

### Operation Key

Mounting type	Model
Horizontal mounting 	D4BL-K1
Vertical mounting 	D4BL-K2
Horizontal-adjustable vertical mounting 	D4BL-K3

## Specifications

### ■ Approved Standard Ratings

TÜV (EN60947-5-1)

Item	Standard model	Indicator model
Utilization category	AC-15	AC-15
Rated operating current (Ie)	3 A	6 A
Rated operating voltage (Ue)	250 V	115 V

As protection against short-circuiting, use either a gI-type or gG-type 10-A fuse (IEC269-approved).

### UL/CSA (UL508, CSA C22.2 No. 14)

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
120 VAC	10 A	60 A	6 A	7,200 VA	720 VA
250 VAC		30 A	3 A		

## ■ Characteristics

Degree of protection	IP67 (See note 2.)
Life expectancy (See note 3.)	Mechanical: 1,000,000 operations min. Electrical: 500,000 operations min.
Operating speed	0.05 to 0.5 m/s
Operating frequency	30 operations/min max.
Rated frequency	50/60 Hz
Operating characteristics	Positive opening force: 19.61 N min. (EN60947-5-1) Positive opening stroke: 20 mm min. (EN60947-5-1) All stroke: 23 mm min.
Locked resistive pulling force	700 N min. (GS-ET-19)
Insulation resistance	100 MΩ min. (at 500 VDC)
Rated insulation voltage (U <sub>i</sub> )	300 VAC (EN60947-5-1)
Conventional enclosed thermal current (I <sub>the</sub> ) (rated continuous current)	10 A (EN60947-5-1)
Dielectric strength (U <sub>imp</sub> )	Impulse dielectric strength (U <sub>imp</sub> ) 4 kV (EN60947-5-1) between terminals of different polarity, between each terminal and ground, and between each terminal and non-current-carrying metal part; 2.5 kV between solenoid and ground
Short-circuit protective device	10-A fuse (type gI or gG) (IEC269)
Conditional short-circuit current	100 A (EN60947-5-1)
Operating environmental pollution level	Pollution degree 3 (EN60947-5-1)
Electric shock protection class	Class I (with grounded terminal)
Counter electromotive voltage at switching	1,500 V max. (EN60947-5-1)
Contact resistance	50 mΩ max. (initial value)
Vibration resistance	Malfunction: 10 to 55 Hz, 0.35-mm single amplitude with an imposed acceleration of 50 m/s <sup>2</sup> max. (IEC68-2-6)
Shock resistance	Destruction: 1,000 m/s <sup>2</sup> min. (IEC68-2-27) Malfunction: 300 m/s <sup>2</sup> min. (IEC68-2-27)
Ambient temperature	Operating: -10°C to 55°C (with no icing)
Ambient humidity	Operating: 95% max.
Weight	Approx. 800 g

Note: 1. The values provided in the above table are the initial values.

2. Although the switch box does not allow the penetration of dust, oil or water, avoid as much as possible the penetration of dust, oil, or water into the head's Operation Key insertion slot.

3. The life expectancy is for an ambient temperature of 5°C to 35°C and ambient humidity of 40% to 70%. For further conditions, consult your OMRON sales representative.

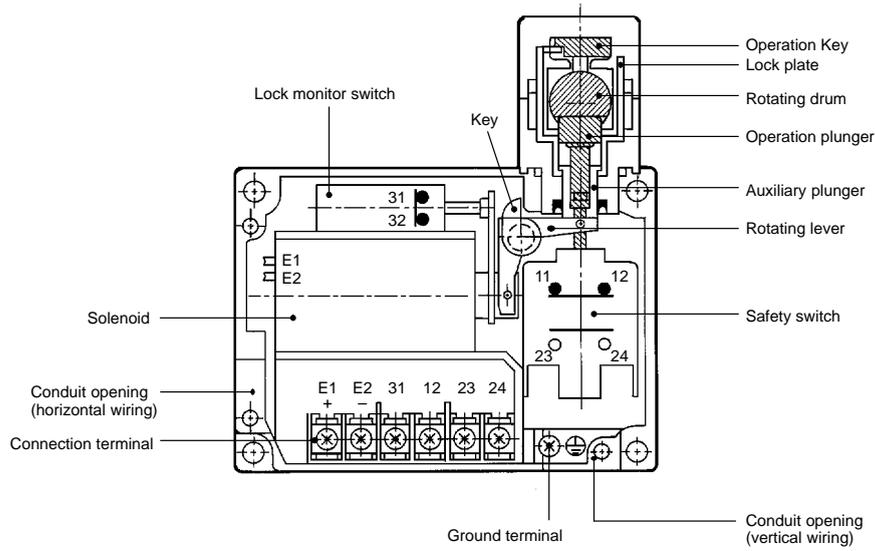
## Solenoid Coil Characteristics

Item	24-VDC Mechanical lock models	110-VAC Mechanical lock models	24-VAC Solenoid lock models
Rated operating voltage	24 VDC +10%/-15% (100% ED)	110 VAC ±10% (50/60 Hz)	24 VDC +10%/-15% (100% ED)
Current consumption	Approx. 300 mA	Approx. 98 mA	Approx. 300 mA
Insulation class	Class F (130°C or less)		

## Indicator Characteristics

Item	LED
Rated voltage	10 to 115 VAC/VDC
Current consumption	Approx. 1 mA
Indicator color (LED)	Orange, green

# Nomenclature



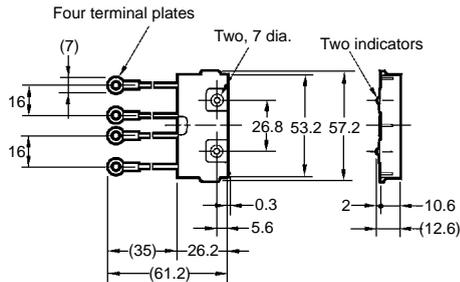
# Operation

## ■ Contact Form

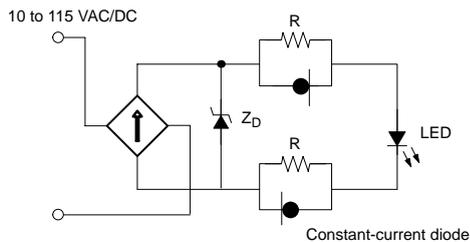
Model	Contact	Diagrams	Remarks
D4BL- □C□□- □	1NC/1NO+1NC		<p>Terminal numbers 11-12 and 31-32 have an approved positive opening mechanism. (→)</p> <p>Terminal numbers 11-12 and 23-24 can be used as unlike poles.</p>
D4BL- □D□□- □	2NC+1NC		<p>Terminal numbers 11-12, 21-22 and 31-32 all have an approved positive opening mechanism. (→)</p> <p>Terminal numbers 11-12 and 21-22 can be used as unlike poles.</p>

Indicator Unit

Dimensions

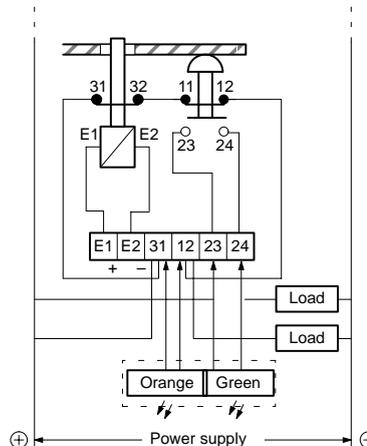


Internal Circuit



Recommended Circuit Connection Example

1. Connect the crimp-style terminals of each indicator unit to the internal terminals (terminals 31 and 12, 23 and 24, and 21 and 22) of the D4BL.
2. Each indicator unit must be connected in parallel with the contacts. When the contacts are open, the indicators will be lit.



Operating Mode

(Example of Electromagnetic Interlock System Operating Mode of D4BL-C-A-A)

Operating mode	I	II	III	IV
Door	The protective door is open.	The protective door is closed.	The protective door is closed and the machine is operating.	The protective door is closed and the solenoid is operating.
Door switch	Operation Key: The mechanical lock is released (contacts 31 and 32 are OFF). Main Switch: The normally closed contact is forcibly opened (contacts 11 and 12 are OFF). Operation Key (door)	Operation Key: Mechanically locked (contacts 31 and 32 are ON). Main Switch: The normally closed contact is closed (contacts 11 and 12 are ON). Operation Key (door)	The protective door is closed and the machine is operating. Operation Key (door)	Operation Key: The mechanical lock is released (contacts 31 and 32 are OFF). Operation Key (door)
Contact	31 and 12 OFF	31 and 12 ON	31 and 12 ON	31 and 12 OFF
Control device	(1) Confirmation of door opening (2) Safety work indication	(3) Confirmation of door closing	(4) Start signal (5) Machine interrupt signal (6) Confirmation of machine interruption	(7) Lock release signal (8) Release confirmation signal
Machine		(Interruption)	(Processing) (Start) (See note) (Completion)	(Interruption)
Indicator	Orange: ON Green: OFF	Orange: OFF Green: ON	Orange: OFF Green: ON	Orange: ON Green: ON

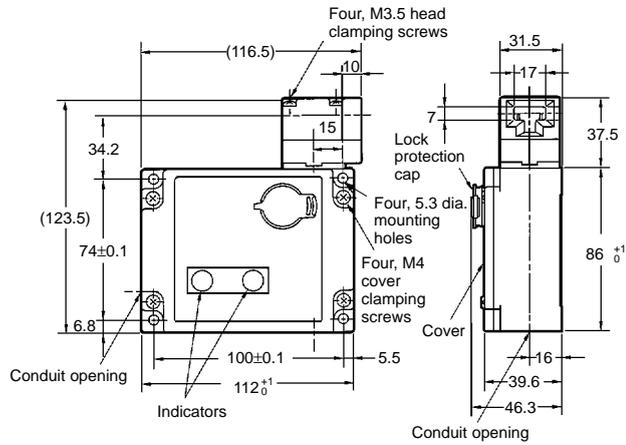
- Note:**
1. Be sure to use the dedicated push button to start or stop the machine or release the door lock.
  2. Solenoid terminals E1 and E2 of 24-VDC solenoid release models have the following polarities. Confirm the polarities before wiring.  
E1: +  
E2: -
  3. Solenoid terminals E1 and E2 of 110-VAC solenoid release models have no polarity.

# Dimensions

- Note:** 1. All units are in millimeters unless otherwise indicated.  
 2. Unless otherwise specified, a tolerance of  $\pm 0.4$  mm applies to all dimensions.

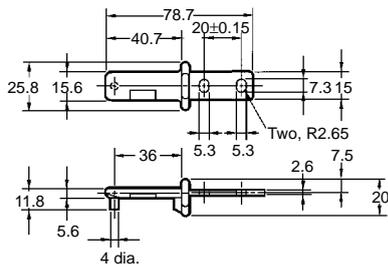
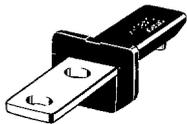
## Switches

D4BL-□□□□-□

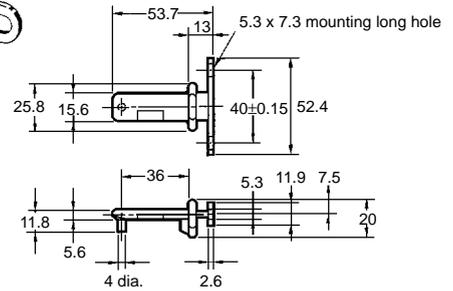


## Operation Keys

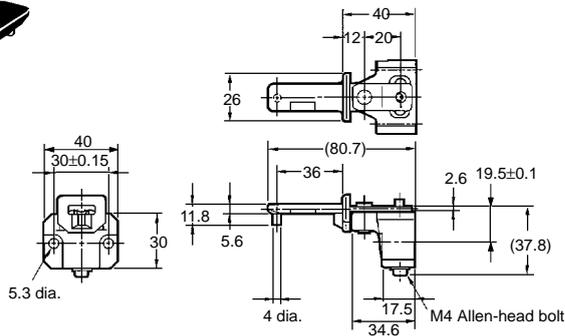
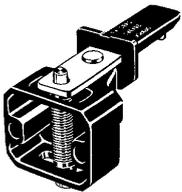
**D4BL-K1**  
Horizontal Mounting



**D4BL-K2**  
Vertical Mounting



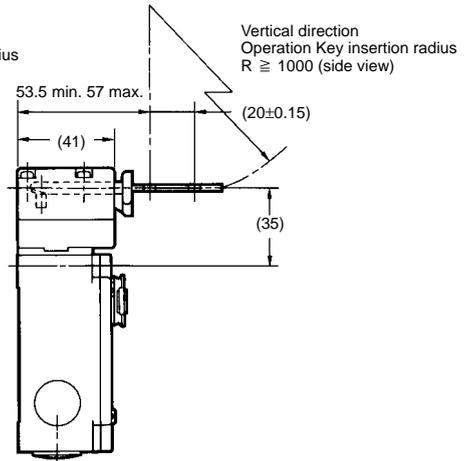
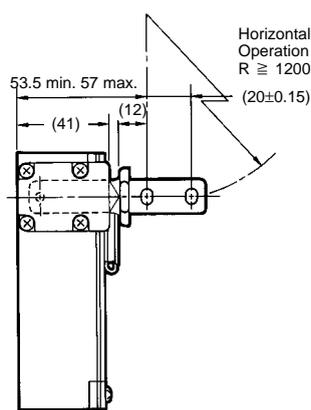
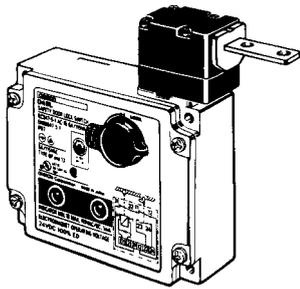
**D4BL-K3**  
Horizontal-adjustable Vertical Mounting



■ With Operation Key Inserted

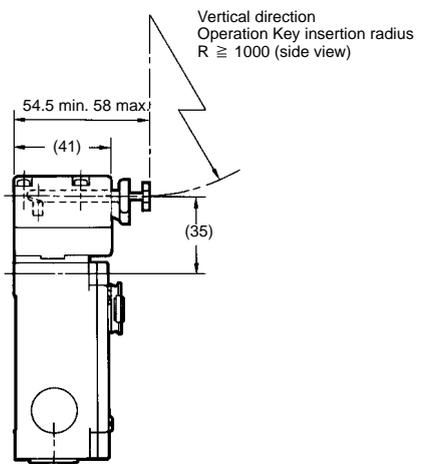
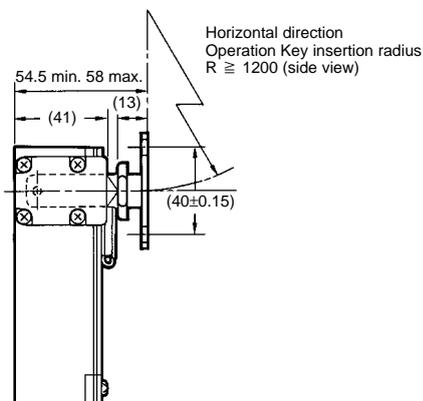
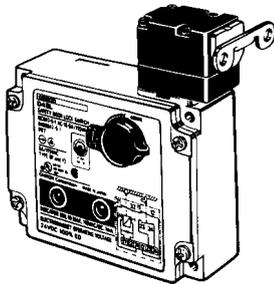
Horizontal Mounting

D4BL + D4BL-K1



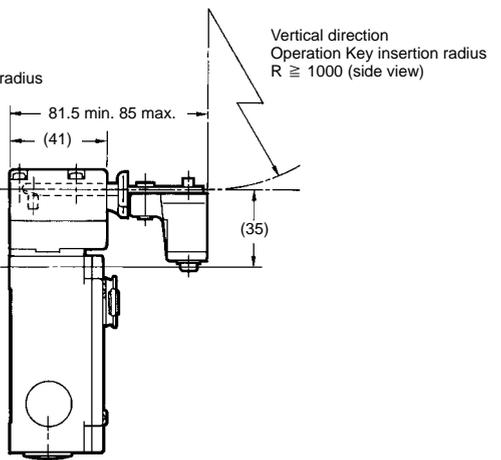
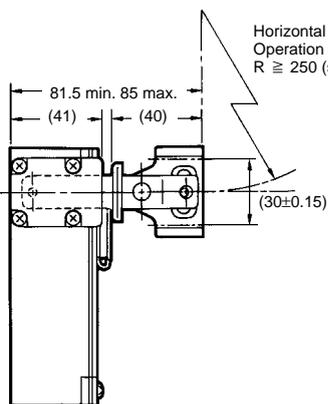
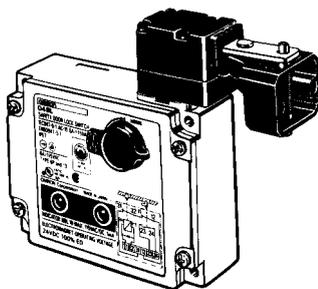
Vertical Mounting

D4BL + D4BL-K2



Horizontal-adjustable Vertical Mounting

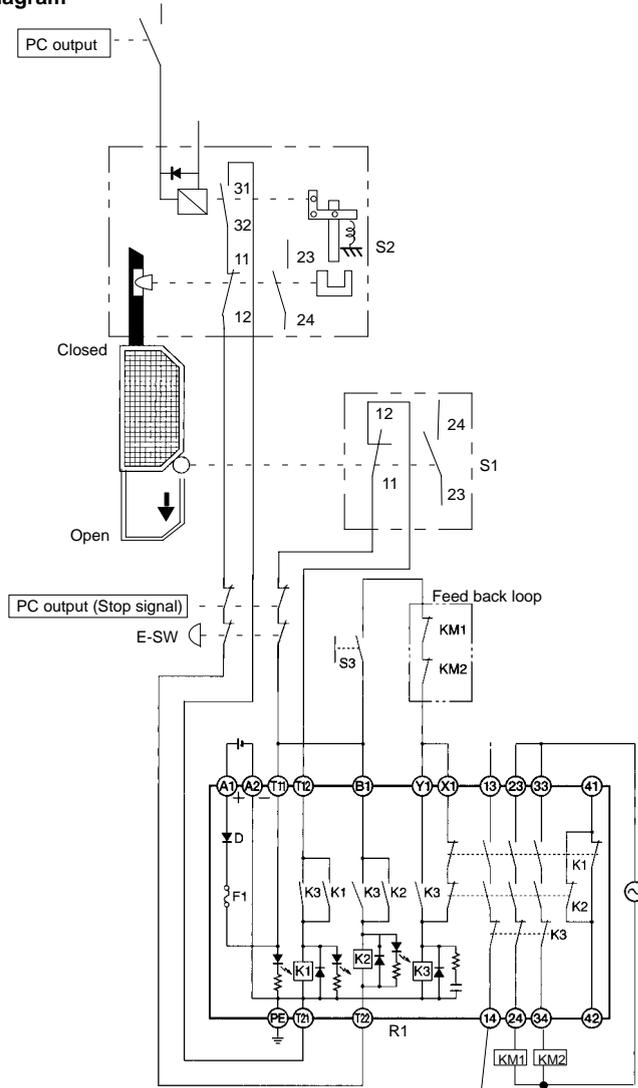
D4BL + D4BL-K3



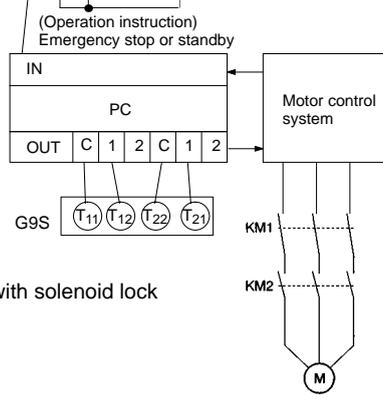
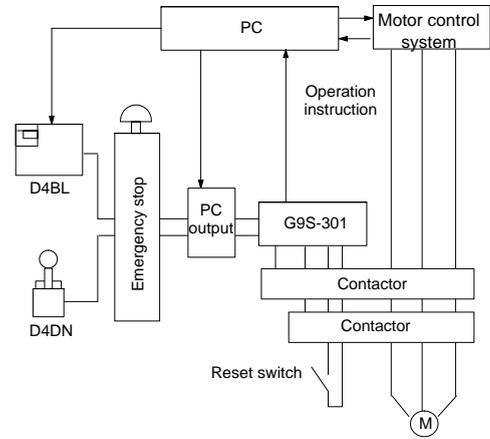
# Installation

## ■ Connection Example with OMRON's G9S Safety Relay Unit

G9S-301 (24 VDC)+D4BL-□CRG-□ (Solenoid lock type)+D4D-□520 N  
Circuit Diagram



### Product Configuration

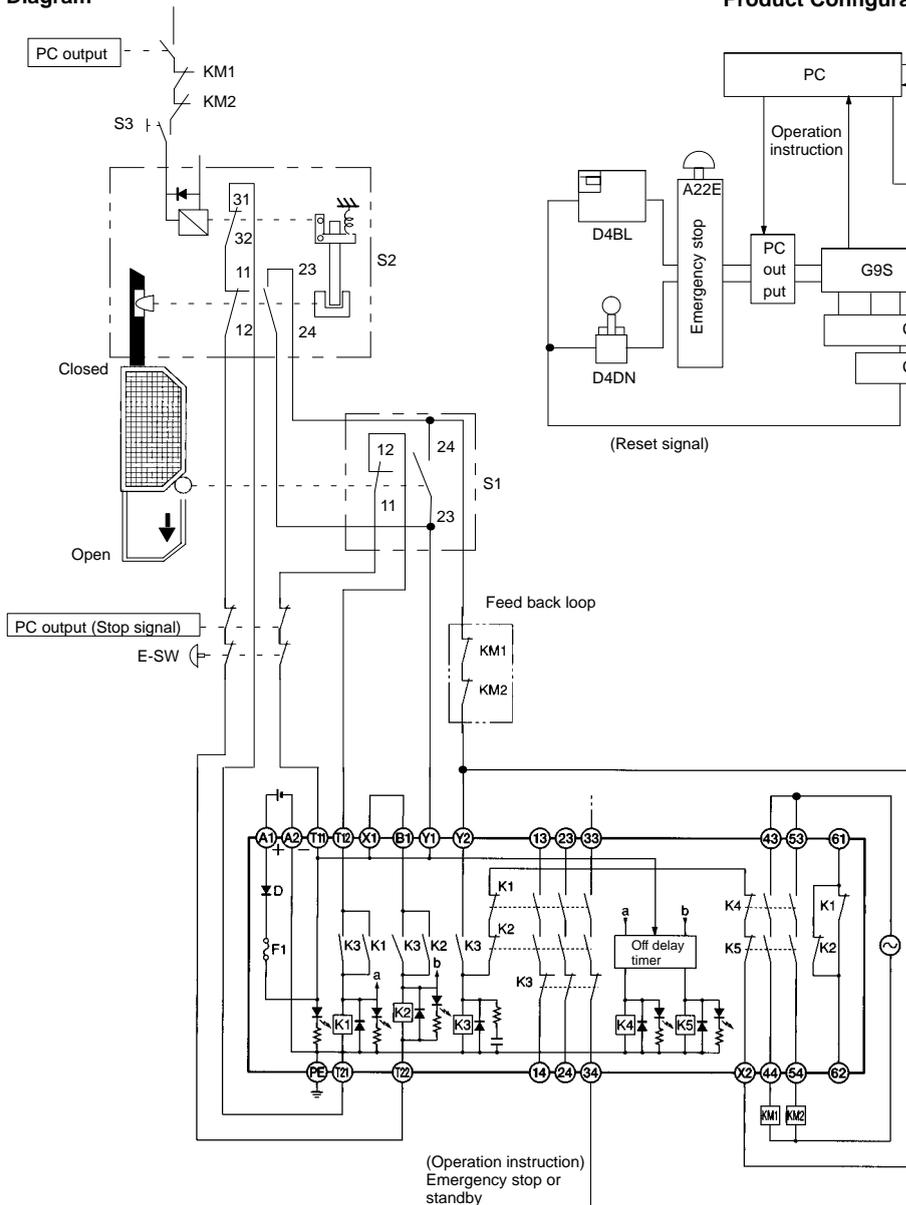


- S1: D4DN or D4BN Safety-door Lock Switch
- S2: D4BL Guard Lock Safety-door Lock Switch with solenoid lock
- S3: Reset switch
- KM1, KM2: J7K Magnet Contactor
- M: 3-phase motor
- E-SW: Emergency stop switch (A22E)

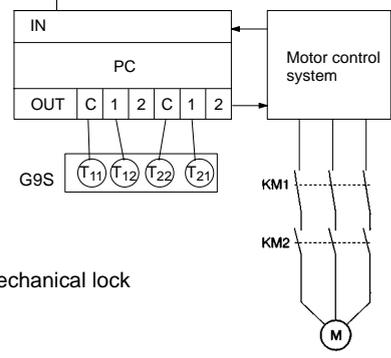
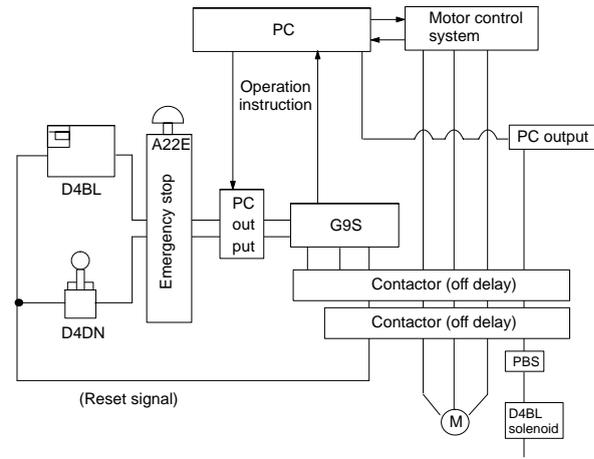
■ Connection Example with OMRON G9S Safety Relay Unit

G9S-321-T□ (24 VDC)+D4BL-□CRA-□/□CRB-□ (Mechanical lock type)+D4D-□520N

Circuit Diagram



Product Configuration



- S1: Safety Switch (D4D-□520N)
- S2: D4BL Guard Lock Safety-door Lock Switch with mechanical lock
- KM1, KM2: Magnet Contactor (LC1-D)
- M: 3-phase motor
- E-SW: Emergency-stop switch (A22E)

## Precautions

### ▲ CAUTION

Do not insert the Operation Key into the key hole while the protective door is open. Before using the machine, be sure to remove the shock-absorbing damper, which is provided before shipping. Otherwise the machine will operate and injury may result.

Be sure to mount the Operation Key so that it will not come into contact with the human body, otherwise injury may result.

If the D4BL is applied to an emergency stop circuit or safety circuit for prevention of injury, use the NC contact, which has a force-separation mechanism, and make sure that the D4BL operates in the positive mode. Furthermore, secure the D4BL with screws or equivalent parts that are tightened in a single direction so that the D4BL or Operation Key cannot be easily removed, or install a protection cover for the D4BL and post a warning label near the D4BL.

In order to protect the D4BL from damage due to short-circuiting, connect a fuse breaking a current 1.5 to 2 times higher than the rated current in parallel with the D4BL.

If an application satisfying EN standards is to employ the D4BL, apply a 10-A gI or gG fuse approved by IEC269.

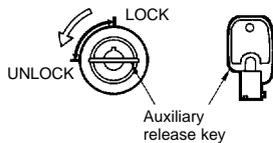
In order to prevent the D4BL from burning due to overvoltage, insert a protection fuse into the solenoid circuit.

If the D4BL is imposed with force exceeding the lock strength, the D4BL may break and the equipment may continue to operate.

### Auxiliary Release Key

The auxiliary release key is used to unlock the D4BL in case of emergency cases or in case the power supply to the D4BL fails.

Use an appropriate tool to set the auxiliary release key to UNLOCK so that the lock will be released and the door can be opened.



The auxiliary release key applied to the door of a machine room ensures the safety of people adjusting the equipment in the machine room. If the auxiliary release key is set to UNLOCK, the door will not be locked when the door is closed and no power will be supplied to the equipment.

To lock the door, set the auxiliary release key to LOCK.

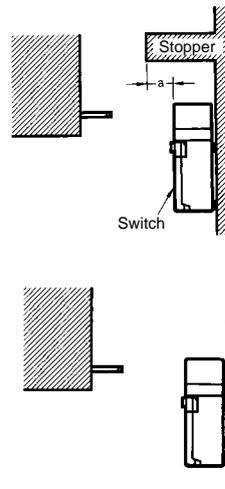
Do not use the auxiliary release key to start or stop machines.

To prevent the auxiliary release key from being handled carelessly by unauthorized people, seal the auxiliary release key with sealing wax and the provided seal cap to ensure IP67.

Make sure that the auxiliary release key is kept with the person in charge.

Before attaching the cover to the D4BL, make sure that the auxiliary release key position is set to LOCK.

### Stopper



Do not apply the D4BL to the door of a machine room without applying a stopper to the door. If excessive force is imposed on the D4BL, the lock mechanism may break and the equipment in the machine room may start to operate.

## ■ Correct Use

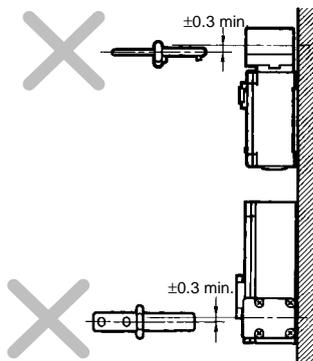
### Operating Environment

- Due to the wear and tear of the sealing of the D4BL, water and some types of oil and chemical sprayed onto the D4BL may cause contact or insulation failures, current leakages, or fires.
- Do not use the D4BL in the following places.
  - Places with radical temperature changes.
  - Places with excessive humidity that may cause condensation.
  - Places with excessive vibration.
  - Places where metal dust, oil, or chemical may be sprayed to the D4BL.

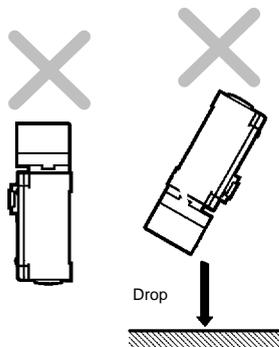
### Operation Key

The D4BL is provided with a shock-absorbing damper to protect the D4BL from damage that may result from dropping the D4BL during transportation. Be sure to remove the damper after mounting the D4BL.

The mounting tolerance of the Operation Key is  $\pm 0.3$  mm vertically or horizontally. Be sure to mount the D4BL correctly without leaning, otherwise the D4BL may soon break or wear out.



Do not drop the D4BL with the Operation Key inserted, otherwise the Operation Key may deform or break.



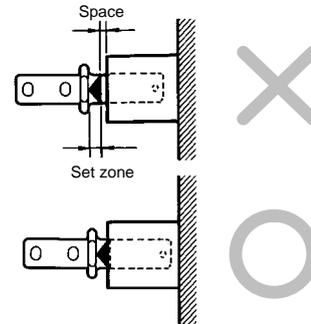
The head is constructed so that it cannot be operated with tools such as screwdrivers. Always use OMRON's Operation Key to operate the head in order to ensure the safety of the machine and protect the D4BL from damage.

The Operation Key provided for the D4BL is not compatible with that of the D4BS.

Mount the Operation Key and only secure it with screws that will tighten when turned clockwise or counterclockwise.

### Door Security

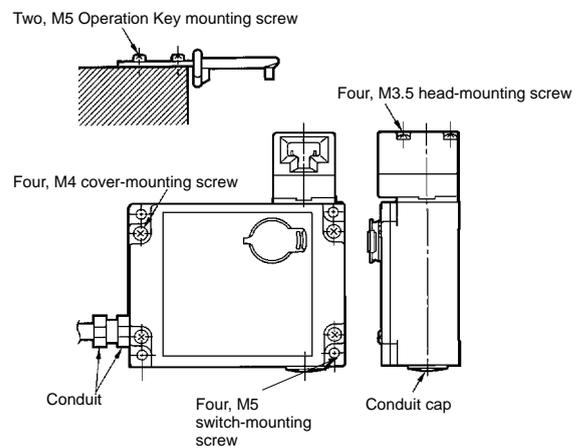
The D4BL may break soon if the door opens accidentally or a space is present between the set zone of the Key and the D4BL as shown below. This may be due to the weight of the door, vibration of the machine, or bouncing of the door against the rubber bumper. Be sure to apply appropriate parts, such as hooks, so that no such space will exist.



### Tightening Torque

Be sure to tighten each screw of the D4BL properly, otherwise the D4BL may soon malfunction.

	Type	Proper tightening torque
1	Terminal screws and ground terminal screws	0.59 to 0.78 N • m
2	Cover-mounting screws	1.18 to 1.37 N • m
3	Head-mounting screws	0.78 to 0.98 N • m
4	Switch-mounting screws (M5)	4.90 to 5.88 N • m
5	Operation Key mounting screws	2.35 to 2.75 N • m
6	Connectors	1.77 to 2.16 N • m
7	Cap screws	1.27 to 1.67 N • m

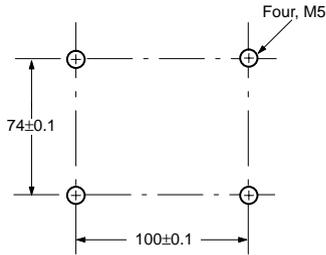


### Switch and Operation Key Mounting

Mount the D4BL and Operation Key with four M5 screws with washers and tighten each screw to the specified torque.

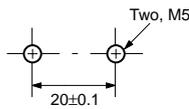
### Mounting Dimensions

#### Switch Mounting Dimensions

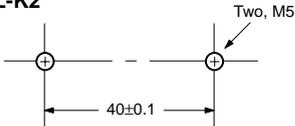


#### Mounting Holes

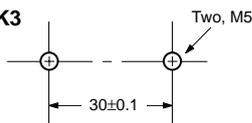
##### D4BL-K1



##### D4BL-K2



##### D4BL-K3

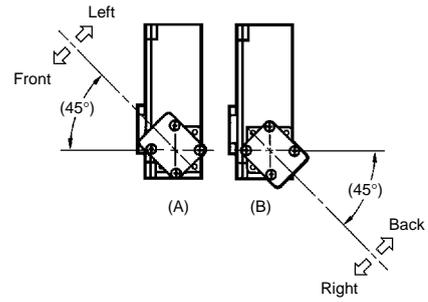


### Head Directions

The head can be mounted in four directions. To remove the head, turn the head by 45° as shown in figures A and B below.

To change the direction of the head, make sure that the protruding part of the rotating lever engages with the groove of the plunger. Then turn the head clockwise or counterclockwise to the desired direction. At that time, make sure that the groove of the plunger is located under the rotating lever. If the direction of the head is not set when the plunger is rotated by 45°, the groove of the plunger presses the rotating lever. The head, plunger, or the built-in switch may be damaged as a result.

### Head Direction Changes

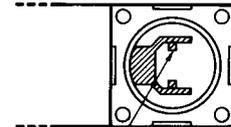


#### Head Bottom View



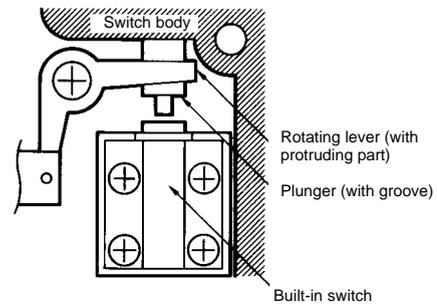
Operation plunger and groove mechanism

#### Switch Top View



Rotation lever and protruding part

### Normal Positions of Rotating Lever and Plunger



Be sure to check the mechanical lock and solenoid release functions when mounting the D4BL.

If the head direction is changed, recheck the tightening torque of each of screw. Make sure that no foreign materials will penetrate through the key hole on the head.

### ■ Processing and Connecting Cable/Conduit

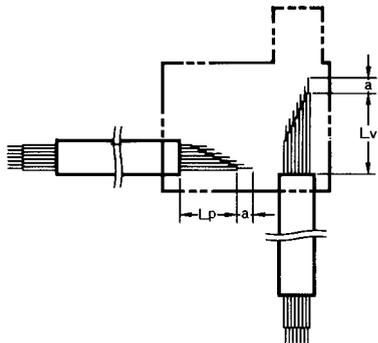
The following procedures are recommended for mounting and wiring the indicator unit securely.

In order to ensure IP67, use OMRON's SC-□M and Nippon Flex's ABS-08Pg13.5 and ABS-12 Pg13.5 Connectors.

Recommended cable: UL2464-type cable that is 20 to 18 AWG (0.5 to 1.0 mm<sup>2</sup>) in size and has seven conductors

If the 1/2-14NPT is used, cover the cable and conduit end with sealing tape in order to ensure IP67. Tighten the connector to a torque of 1.77 to 2.16 N • m.

Connect the indicator unit after connecting the seven-conductor cable.

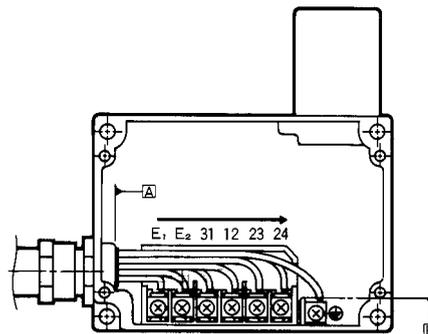


Terminal no.	Lp (mm)	Lv (mm)	a (mm)
E <sub>1</sub>	30±2	80±2	8±1
E <sub>2</sub>	35±2	75±2	
31	45±2	60±2	
12	55±2	50±2	
23 (21)	65±2	45±2	
24 (22)	70±2	35±2	
⊕	90±2	50±2	

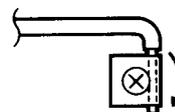
Properly attach and securely tighten the provided conduit cap to the unused conduit opening when wiring the D4BL.

### Cable Connection Example

- (1) Connect the wires to the terminals in the order shown below for wiring efficiency.

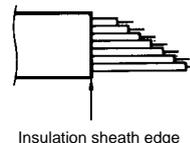


Tighten each wired terminal clockwise to a torque of 0.59 to 0.78 N • m.



Twist the wire two or three times and make sure that no bare wire exists outside the terminal when tightening the terminal.

- (2) The insulation sheath of the seven-conductor cable must come into contact with the wall of the conduit mouth, side A or side B.



### Maintenance and Repairs

Contact your OMRON representative for any repair or maintenance work on the D4BL. The D4BL must not be maintained or repaired by any unauthorized party.

### Others

Do not touch the solenoid because the solenoid radiates heat while power is being supplied.

**ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.**  
 To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.