

### Protective Doors Are Locked Until Machine Completely Stops Operation

- Select mechanical lock/solenoid release or solenoid lock/mechanical release models
- Dedicated release lock ensures both easy maintenance and door-unlock at power failure
- Tough aluminum die-cast unit incorporating a switch box with IP67 enclosure rating (EN60529, IEC529)
- Equipped with horizontal and vertical conduit openings
- Models available with LED indicators
- Head can be rotated in 4 directions
- Approved Standards



Agency	Standard	File No.
TÜV	EN60947-5-1 (→)	R9451050
Rheinland	(IEC947-5-1, (→) VDE0660 Part 200, 206 (→))	
UL	UL508	E76675
CSA	CSA C22.2, No.14	LR45746
BIA	GS-ET-19	9402293
SUVA	SUVA	5643

## ■ ACCESSORIES (ORDER SEPARATELY)

### Operation Key

Mounting type	Part number
Horizontal	D4BL-K1
Vertical	D4BL-K2
Adjustable	D4BL-K3

## ■ NOMENCLATURE

### 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: Right

#### 4. Door Lock/Release Methods

(Dedicated 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 indicator unit)

### Operation Key


D4BL - K   
           1

#### 1. Operation Key Type

- 1: Horizontal mounting
- 2: Vertical mounting
- 3: Adjustable mounting

## Specifications

## ■ RATINGS

1. IEC 947-5-1 and EN60947-5-1   
 AC-15 3A/250 V (6A/115 V for Display Models)
2. NEMA A300 (UL/CSA Pilot Duty)

Rated voltage	Current			Switching power	
	Continuous	Make	Break	Make	Break
120 VAC	10 A	60 A	6 A	7,200 VA	720 VA
250 VAC		30 A	3 A		

## 3. General Ratings

Rated voltage	Non-inductive load				Inductive load			
	Resistive load		Lamp load		Inductive load		Motor load	
	NC	NO	NC	NO	NC	NO	NC	NO
125 VAC	10 A		3 A	1.5 A	10 A		5 A	2.5 A
250 VAC	10 A		2 A	1 A	10 A		3 A	1.5 A
8 VDC	10 A		6 A	3 A	10 A		6 A	
14 VDC	10 A		6 A	3 A	10 A		6 A	
30 VDC	6 A		4 A	3 A	6 A		4 A	
125 VDC	0.8 A		0.2 A	0.2 A	0.8 A		0.2 A	
250 VDC	0.4 A		0.1 A	0.1 A	0.4 A		0.1 A	

- Note: 1. Resistive loads have a power factor ( $\cos = \phi$ ) of 1.  
 2. Inductive loads have a power factor of 0.4 min. (AC) and a time constant of 7 ms max. (DC).  
 3. Lamp loads have an inrush current of 10 times the steady-state current, while motor loads have an inrush current of 6 times the steady-state current.  
 4. Inrush current: NC: 30 A max.; NO: 30 A max.

## ■ CHARACTERISTICS

Operating speed		0.05 to 0.5 m/s
Operating frequency		30 operations/min max.
Operating characteristics	Positive opening force	19.61 N (4.41 lbf) min.
	Positive opening stroke	20 mm (0.79 inch) min.
	All stroke	23 mm (0.91 inch) min.
Locked resistive pulling force		700 N (157 lbf) min.
Insulation resistance		100 M $\Omega$ min. (at 500 VDC)
Rated insulation voltage ( $U_i$ )		300 VAC
Conventional enclosed thermal current ( $I_{the}$ ) (rated continuous current)		10 A
Dielectric strength ( $U_{imp}$ )		Impulse dielectric strength ( $U_{imp}$ ) 4 kV (IEC 947-5-1) 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 gl) (IEC269)
Contact resistance		50 m $\Omega$ 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> (5G) max. (IEC68-2-6)
Shock resistance	Destruction	1,000 m/s <sup>2</sup> (100G) min. (IEC68-2-27)
	Malfunction	300 m/s <sup>2</sup> (30G) min. (IEC68-2-27)
Life expectancy	Mechanical	1,000,000 operations min.
	Electrical	500,000 operations min. (with a load rate of 0.5)
Ambient temperature	Operating	-10 to 55°C (14 to 131°F) with no icing
Ambient humidity	Operating	95% max.
Operating environmental pollution level		Pollution degree 3 (IEC947-5-1)
Insulation class		Insulation class I (IEC536)
Enclosure rating (See Note.)	UL	6P and 13
	NEMA	6P and 13
	IEC529	IP67 (60947-5-1)

Note: Although the switch box does not allow the penetration of dust, oil or water, keep the operation key insertion slot free of dust, oil, and water.

## ■ SOLENOID COIL CHARACTERISTICS

Item	24 VDC models	110 VAC models	230 VAC models
Rated operating voltage	24 VDC $+10\%/-15\%$ (100% ED)	110 VAC $\pm 10\%$ (50/60 Hz)	230 VAC $\pm 10\%$ (50/60 Hz)
Current consumption	Approx. 300 mA	Approx. 98 mA	Approx. 45 mA
Insulation class	Class F 130°C (266°F) or less		

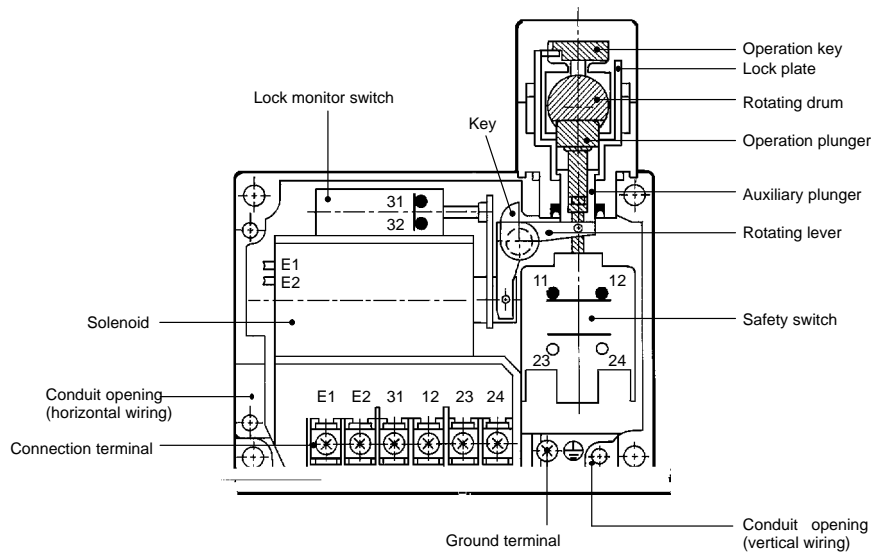
## ■ INDICATOR CHARACTERISTICS

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

## ■ OPERATING CHARACTERISTICS

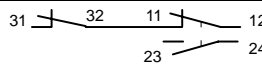
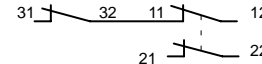
Model	D4BL-□□□□
Operating force (extraction)	19.61 N (4.41 lbf) min.
Release force (insertion)	19.61 N (4.41 lbf) min.
Pretravel	15 mm (0.59 inch) max.

## Construction

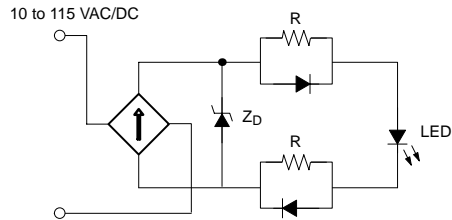


# Operation

## CONTACT FORM

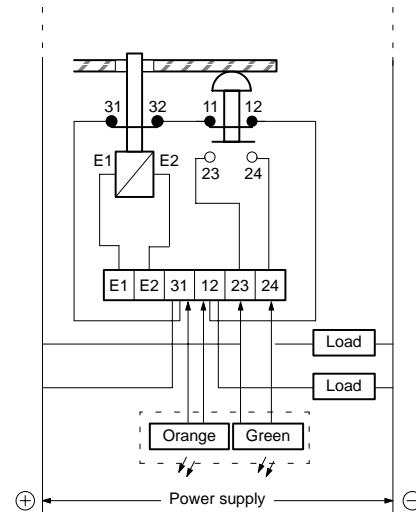
Model	Contact	Contact form
D4BL-□C□□□-□	DPDB-1NC/1NO+ DPDB-1NC	
D4BL-□D□□□-□	DPDB-2NC+DPDB-1NC	

### 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□□)

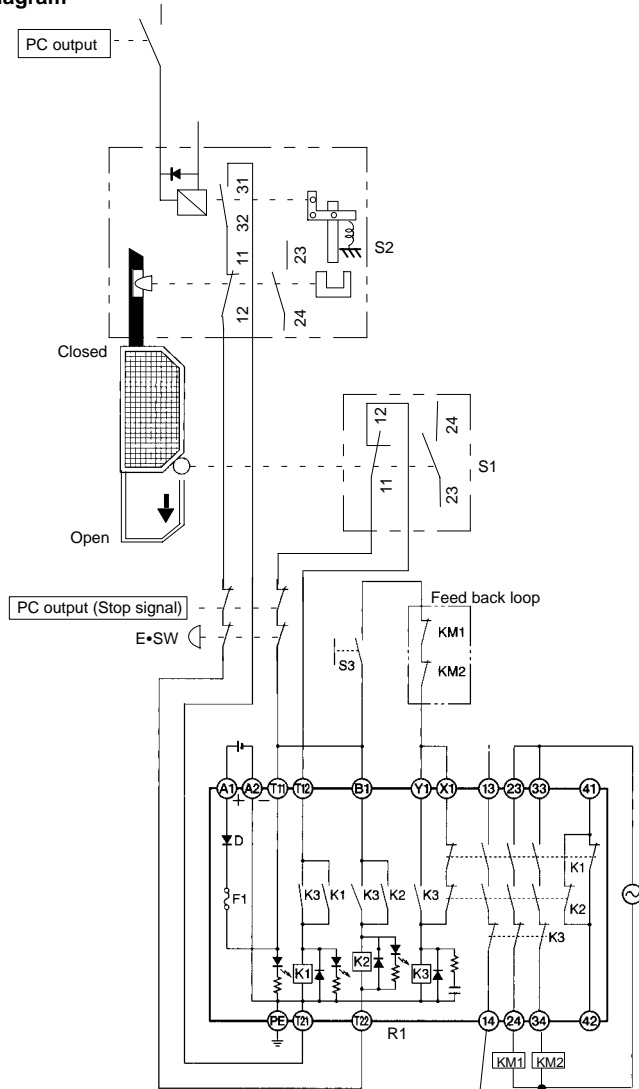
Operating mode	I	II	III	IV
Door	The protective door is open.	The protective door is closed.	The protective door is closed and the machine is operating.	The protective door is closed and the solenoid is operating.
Door switch	<p>Operation Key: The mechanical lock is released (contacts 31 and 32 are OFF).</p> <p>Main Switch: The normally closed contact is forcibly opened (contacts 11 and 12 are OFF).</p> <p>Operation key (door)</p>	<p>Operation Key: Mechanically locked (contacts 31 and 32 are ON).</p> <p>Main Switch: The normally closed contact is closed (contacts 11 and 12 are ON).</p> <p>Operation key (door)</p>	<p>Operation key (door)</p>	<p>Operation key (door)</p>
Contact	31 and 12 OFF	23 and 24 ON	31 and 12 ON	23 and 24 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: Be sure to use the dedicated push button to start or stop the machine or release the door lock.

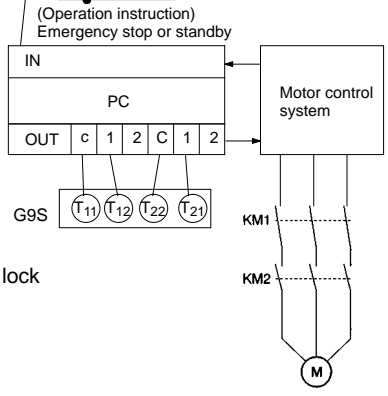
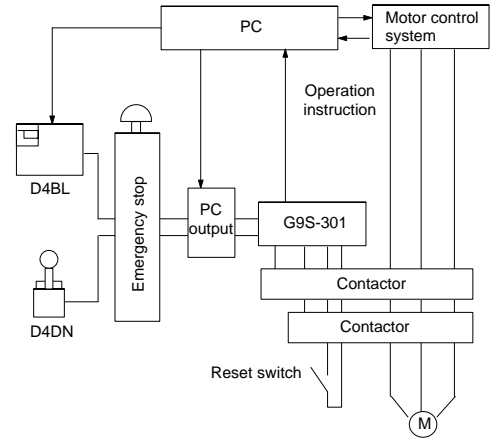
# Application Examples

## 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

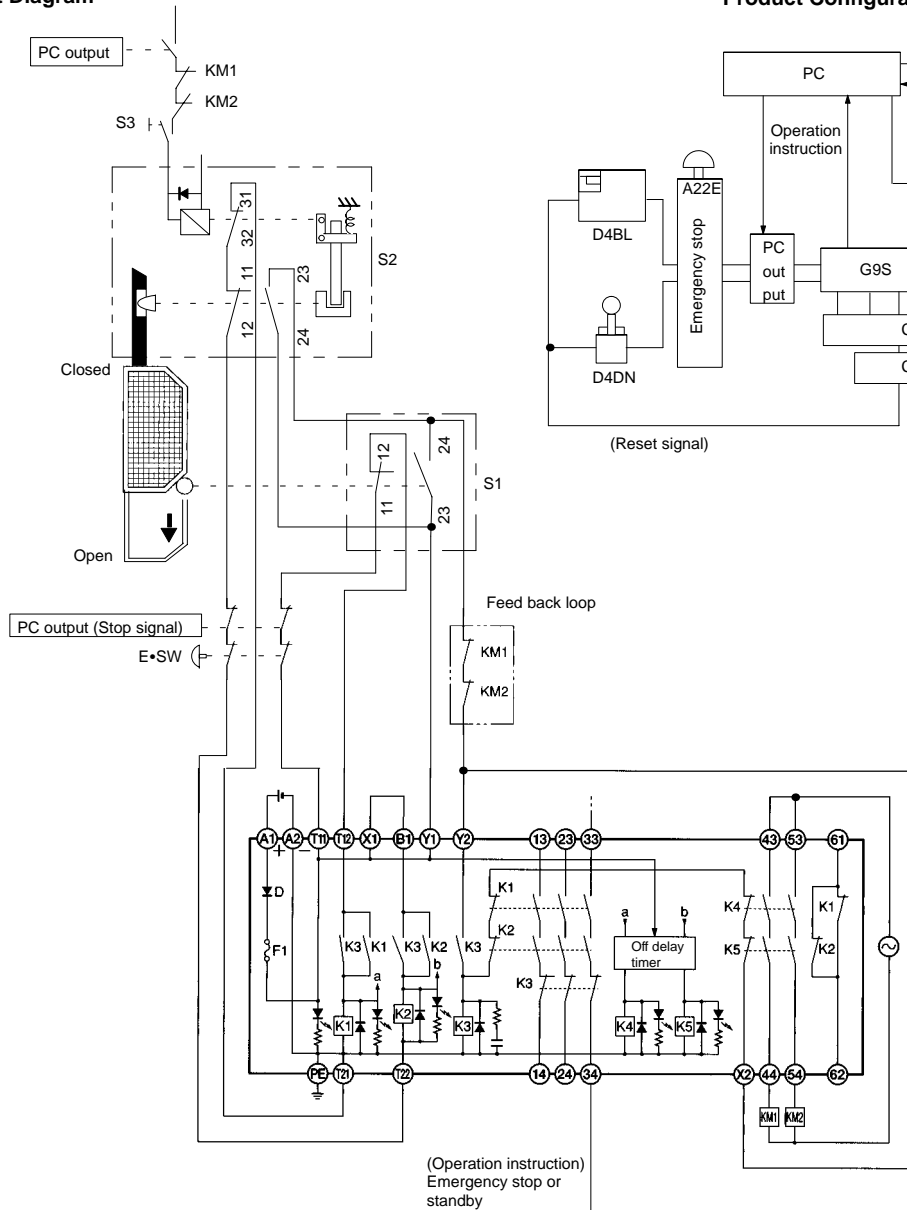


- S1: D4DN or D4BN Safety-door Lock Switch
- S2: D4BL Safety-door Lock Switch with solenoid lock
- S3: Reset switch
- KM1, KM2: J7K Magnet Contactor
- M: 3-phase motor
- E-SW: Emergency stop switch

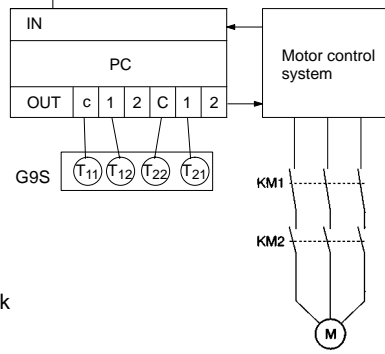
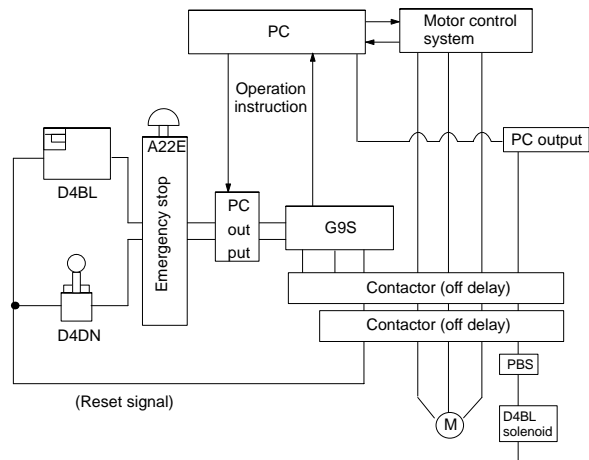
■ CONNECTION EXAMPLE WITH OMRON G9S SAFETY RELAY UNIT

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

Circuit Diagram



Product Configuration



- S1: Safety Switch (D4D-j520N)
- S2: D4BL Safety-door Lock Switch with mechanical lock
- KM1, KM2: Magnet Contactor (LC1-D)
- M: 3-phase motor
- ESSW: Emergency-stop switch (A22E)



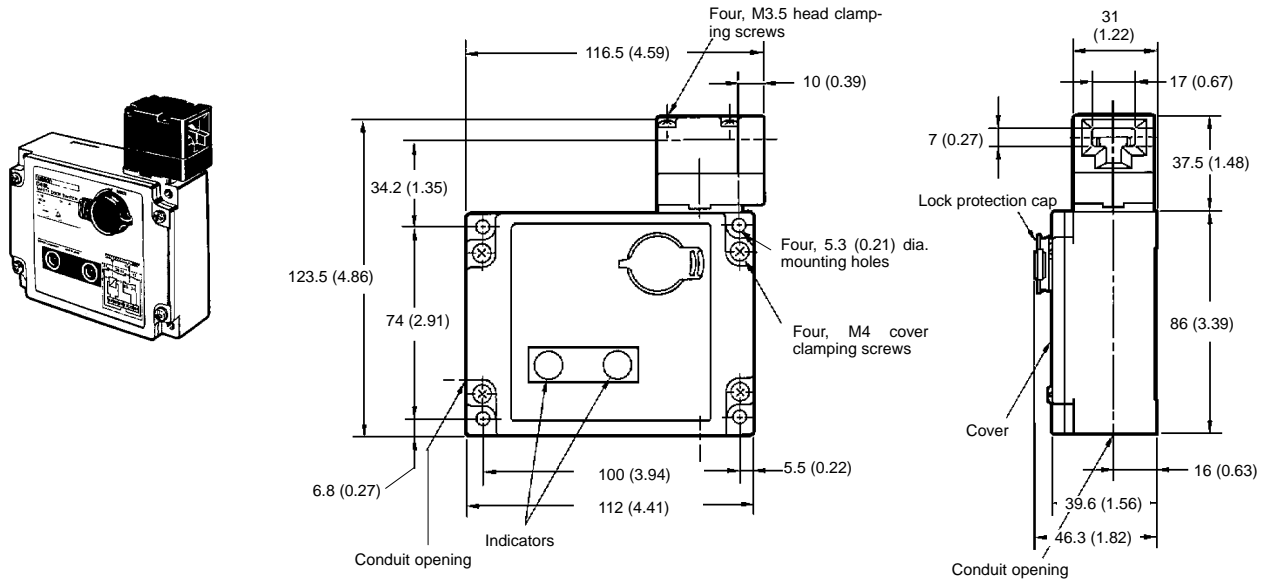
# Dimensions

Unit: mm (inch)

Note: Unless otherwise specified, a tolerance of  $\pm 0.4$  mm applies to all dimensions.

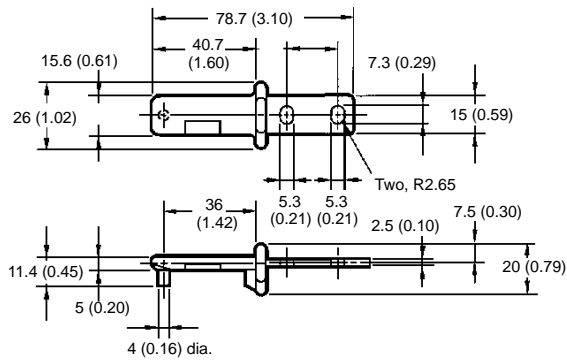
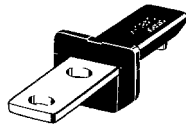
## SAFETY DOOR SWITCH

D4BL-□□□□-□

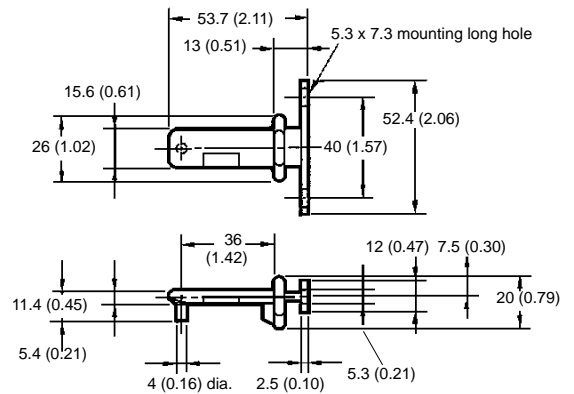
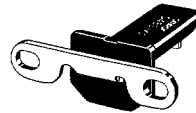


## OPERATION KEYS

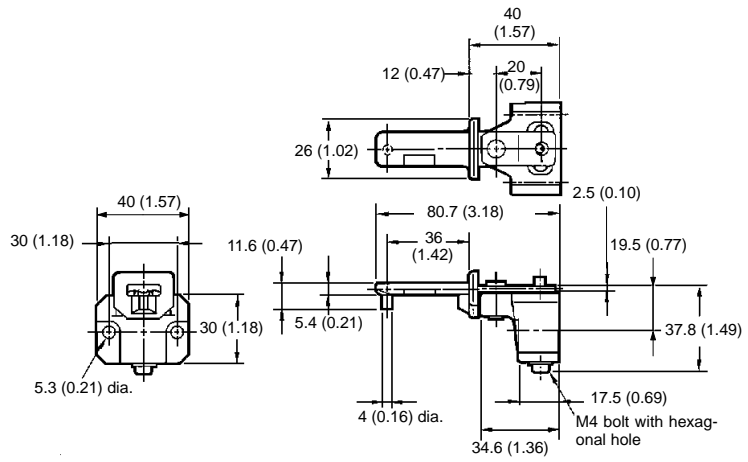
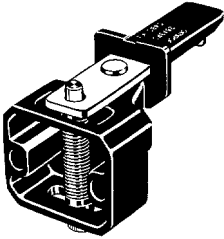
D4BL-K1



D4BL-K2

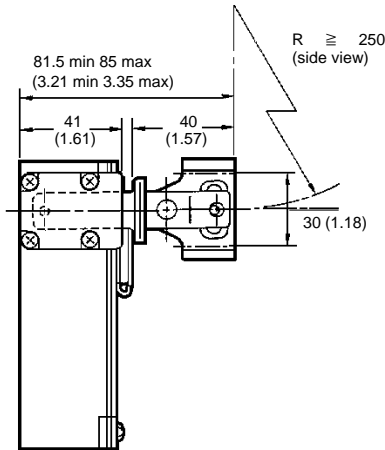
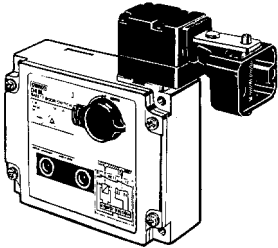


D4BL-K3

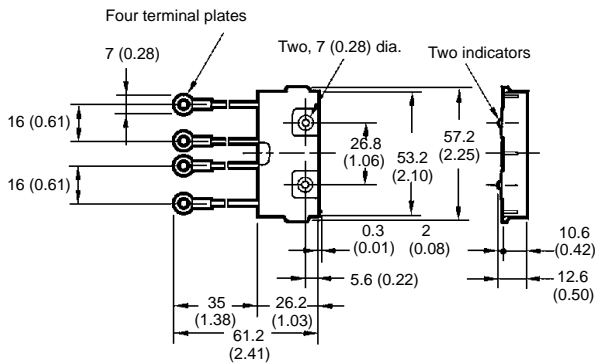


■ WITH OPERATION KEY INSERTED

D4BL + D4BL-K3



■ INDICATOR UNIT



# Installation

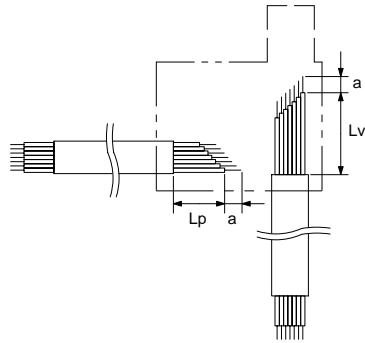
## ■ PROCEDURE FOR CONNECTING CABLE

The following procedure is recommended so that the D4BL can be wired or connected to the Indicator Units with ease.

Recommended connecting cable:  
AWB20 to AWG18 with seven conductors  
A UL2464-style cable is recommended.

Apply sealing tape to the cable and conduit opening so that the D4BL can conform to IP67. Tighten the connector to a torque of 1.8 to 2.2 N•m (15.93 to 19.47 in lbs).

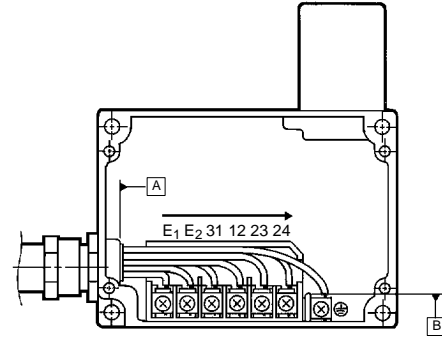
Connect the Indicator Units to the D4BL after connecting the 7-conductor cable to the D4BL.



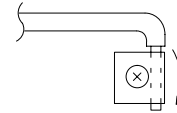
Terminal no.	Lp mm (inch)	Lv mm (inch)	a mm (inch)
E <sub>1</sub>	30±2 (1.18±0.08)	80±2 (3.15±0.08)	8±1 (0.31±0.08)
E <sub>2</sub>	35±2 (1.38±0.08)	75±2 (2.95±0.08)	
31	45±2 (1.77±0.08)	60±2 (2.36±0.08)	
12	55±2 (2.17±0.08)	50±2 (1.97±0.08)	
23 (21)	65±2 (2.56±0.08)	45±2 (1.77±0.08)	
24 (22)	70±2 (2.76±0.08)	35±2 (1.38±0.08)	
Ground	90±2 (3.54±0.08)	50±2 (1.9±0.087)	

## Cable Connecting Example

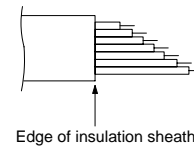
- As shown in the following illustration, the wires must be connected in sequence beginning with the terminal nearest to the conduit opening.



The wire leads must be wrapped around the screws clockwise. Tighten each screw to a torque of 0.5 to 0.7 N•m (4.43 to 6.20 in lbs).



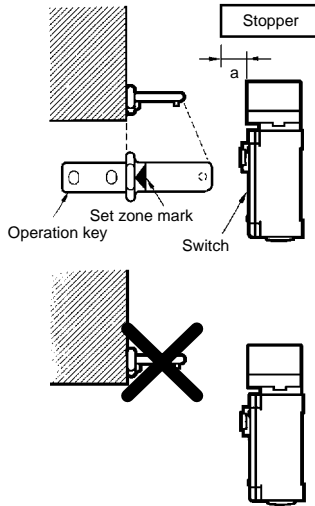
- The external insulation sheath of the 7-conductor cable must contact with side A or B as shown in the above D4BL illustration.



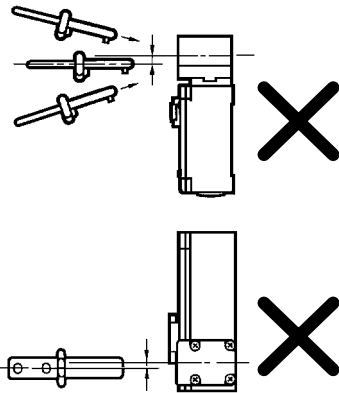
# Precautions

## ■ MOUNTING

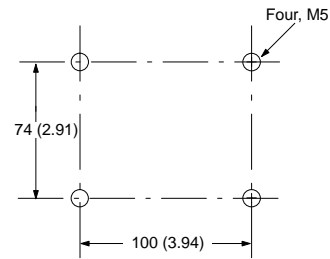
Be sure to install a stopper as shown in the following illustration when mounting the Safety-door Lock Switch. The range of space "a" must be determined according to the available set zone 4 mm (0.16 inch) max. of the Operation Key.



Refer to *Dimensions* for the mounting dimensions of the Operation Key to mount the Operation Key correctly. The Operation Key will quickly become damaged or worn away if it is not mounted correctly.

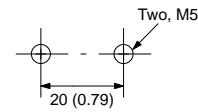


### Switch Mounting Holes

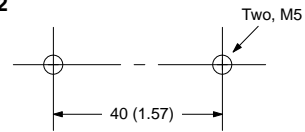


### Operation Key Mounting Holes

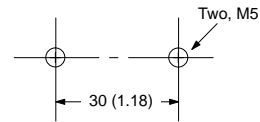
#### D4BL-K1



#### D4BL-K2

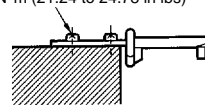


#### D4BL-K3



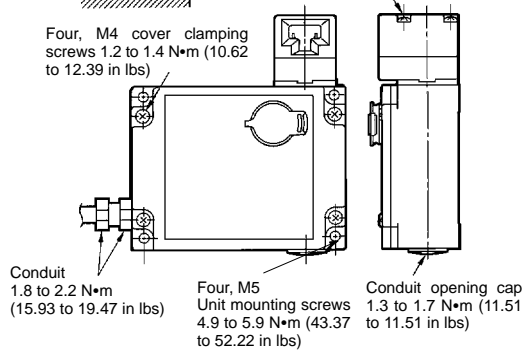
### Proper Mounting Screw Tightening Torque

Two, M5 operation key clamping screws 2.4 to 2.8 N•m (21.24 to 24.78 in lbs)



Four, M3.5 head clamping screws 0.8 to 1.0 N•m (7.08 to 8.85 in lbs)

Four, M4 cover clamping screws 1.2 to 1.4 N•m (10.62 to 12.39 in lbs)

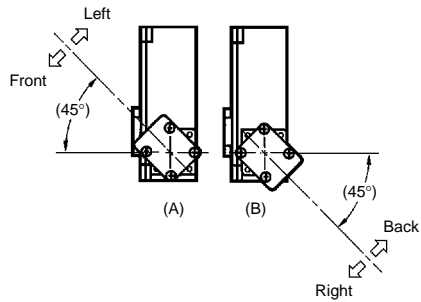


## ■ HEAD DIRECTIONS

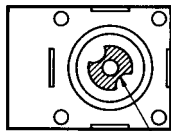
The head can be mounted in four directions. To remove the head, turn the head by 45° as shown in figures A and B below.

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

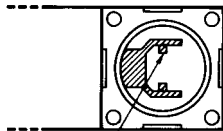


Head Bottom View



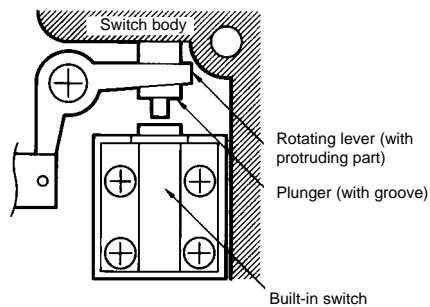
Operation plunger and groove mechanism

Switch Top View



Rotation lever and protruding part

## Normal Positions of Rotating Lever and Plunger



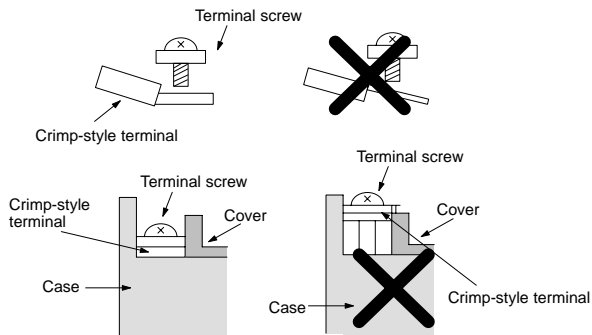
Be sure to check the mechanical lock and solenoid release functions when mounting the D4BL.

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.

## ■ OTHERS

When connecting lead wires with crimp-style terminals to the built-in switch terminals, do not impose excessive force on the crimp-style terminals.

Each crimp-style terminal must be connected in the direction as shown in the following illustrations and the crimp-style terminal must not be on the case or cover.



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

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