

# Guard Lock Safety-door Switch D4NL

CSM\_D4NL\_DS\_E\_8\_1

## Best-selling Guard Lock Safety-door Switch Available in Several Compact, Multi-contact Models



For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

Be sure to read the "Safety Precautions" on page 16.

## Model Number Structure

### Model Number Legend

#### Switch (Standard type)

D4NL-□□□□-□□□□  
1 2 3 4 5 6 7

- Conduit Size**
  - 1: Pg13.5
  - 2: G1/2
  - 4: M20
- Built-in Switch (with Door Open/Closed Detection Switch and Lock Monitor Switch Contacts)**
  - A: 1NC/1NO (slow-action contacts) + 1NC/1NO (slow-action contacts)
  - B: 1NC/1NO (slow-action contacts) + 2NC (slow-action contacts)
  - C: 2NC (slow-action contacts) + 1NC/1NO (slow-action contacts)
  - D: 2NC (slow-action contacts) + 2NC (slow-action contacts)
  - E: 2NC/1NO (slow-action contacts) + 1NC/1NO (slow-action contacts)
  - F: 2NC/1NO (slow-action contacts) + 2NC (slow-action contacts)
  - G: 3NC (slow-action contacts) + 1NC/1NO (slow-action contacts)
  - H: 3NC (slow-action contacts) + 2NC (slow-action contacts)
- Head Mounting Direction and Material**
  - F: Four mounting directions possible (Front-side mounting at shipping)/plastic
  - D: Four mounting directions possible (Front-side mounting at shipping)/metal
- Door Lock and Release**
  - A: Mechanical lock/24 VDC solenoid release
  - B: Mechanical lock/110 VAC solenoid release
  - G: 24 VDC solenoid lock/mechanical release
  - H: 110 VAC solenoid lock/mechanical release
- Indicator**
  - B: 10 to 115 VAC/VDC (orange LED indicator)
- Release Key Type**
  - Blank: Standard (resin)
  - 4: Special release key (resin)  
(Note: Release keys are provided.)
- Release Key Position**
  - Blank: Bottom
  - S: Front

#### Switch (Metallic release key type)

D4NL-□□□□-□□□□-SJ  
1 2 3 4 5 6 7

- Conduit Size**
  - 2: G1/2 (1-conduit)
  - 4: M20 (1-conduit)
- Built-in Switch**
  - E: 2NC/1NO + 1NC/1NO
  - F: 2NC/1NO + 2NC
  - G: 3NC + 1NC/1NO
  - H: 3NC + 2NC
- Head Material**
  - F: resin
- Door Lock and Release**
  - A: Mechanical lock/ 24 VDC solenoid release
  - G: 24 VDC solenoid lock/ mechanical release
- Indicator**
  - B: 10 to 115 VAC/VDC (orange LED indicator)
- Release Key Type**
  - Blank: Standard (metal)
- Release Key Position**
  - Blank: Bottom

### Operation Key

D4DS-K□  
1

- Operation Key Type**
  - 1: Horizontal mounting
  - 2: Vertical mounting
  - 3: Adjustable mounting (horizontal)
  - 5: Adjustable mounting (horizontal/vertical)

## Ordering Information

### List of Models

#### Switches (Operation Keys are sold separately.)

■: Models with certified direct opening contacts.

Consult with your OMRON representative when ordering any models that are not listed in this table.

Head material	Release key position	Release key type	Solenoid voltage/indicator	Lock and release types	Contact configuration (door open/closed detection switch and lock monitor switch contacts) (slow-action) Certified direct opening NC contact	Conduit opening	Model
Plastic *1	Bottom	Standard (resin)	Solenoid: 24 VDC Orange LED: 10 to 115 VAC/VDC	Mechanical lock Solenoid release	1NC/1NO+1NC/1NO	Pg13.5	D4NL-1AFA-B
						G1/2	D4NL-2AFA-B
						M20	D4NL-4AFA-B
					1NC/1NO+2NC	Pg13.5	D4NL-1BFA-B
						G1/2	D4NL-2BFA-B
						M20	D4NL-4BFA-B
					2NC+1NC/1NO	Pg13.5	D4NL-1CFA-B
						G1/2	D4NL-2CFA-B
						M20	D4NL-4CFA-B
					2NC+2NC	Pg13.5	D4NL-1DFA-B
						G1/2	D4NL-2DFA-B
						M20	D4NL-4DFA-B
					2NC/1NO+1NC/1NO	Pg13.5	D4NL-1EFA-B
						G1/2	D4NL-2EFA-B *2
						M20	D4NL-4EFA-B *2
					2NC/1NO+2NC	Pg13.5	D4NL-1FFA-B
						G1/2	D4NL-2FFA-B *2
						M20	D4NL-4FFA-B *2
					3NC+1NC/1NO	Pg13.5	D4NL-1GFA-B
						G1/2	D4NL-2GFA-B *2
						M20	D4NL-4GFA-B *2
					3NC+2NC	Pg13.5	D4NL-1HFA-B
						G1/2	D4NL-2HFA-B *2
						M20	D4NL-4HFA-B *2
				Solenoid lock Mechanical release	1NC/1NO+1NC/1NO	Pg13.5	D4NL-1AFG-B
						G1/2	D4NL-2AFG-B
						M20	D4NL-4AFG-B
					1NC/1NO+2NC	Pg13.5	D4NL-1BFG-B
						G1/2	D4NL-2BFG-B
						M20	D4NL-4BFG-B
					2NC+1NC/1NO	Pg13.5	D4NL-1CFG-B
						G1/2	D4NL-2CFG-B
						M20	D4NL-4CFG-B
					2NC+2NC	Pg13.5	D4NL-1DFG-B
						G1/2	D4NL-2DFG-B
						M20	D4NL-4DFG-B
					2NC/1NO+1NC/1NO	Pg13.5	D4NL-1EFG-B
						G1/2	D4NL-2EFG-B *2
						M20	D4NL-4EFG-B *2
					2NC/1NO+2NC	Pg13.5	D4NL-1FFG-B
						G1/2	D4NL-2FFG-B *2
						M20	D4NL-4FFG-B *2
					3NC+1NC/1NO	Pg13.5	D4NL-1GFG-B
						G1/2	D4NL-2GFG-B *2
						M20	D4NL-4GFG-B *2
					3NC+2NC	Pg13.5	D4NL-1HFG-B
						G1/2	D4NL-2HFG-B *2
						M20	D4NL-4HFG-B *2

\*1. Switches with metal heads can also be manufactured upon request. Ask your OMRON representative for details.

\*2. Models with Korean S-mark certification.

Head material	Release key position	Release key type	Solenoid voltage/indicator	Lock and release types	Contact configuration (door open/closed detection switch and lock monitor switch contacts) (slow-action) Certified direct opening NC contact	Conduit opening	Model
Plastic *1	Bottom	Special release key (resin)	Solenoid: 24 VDC Orange LED: 10 to 115 VAC/VDC	Mechanical lock Solenoid release	1NC/1NO+1NC/1NO	Pg13.5	D4NL-1AFA-B4
						G1/2	D4NL-2AFA-B4
						M20	D4NL-4AFA-B4
					1NC/1NO+2NC	Pg13.5	D4NL-1BFA-B4
						G1/2	D4NL-2BFA-B4
						M20	D4NL-4BFA-B4
					2NC+1NC/1NO	Pg13.5	D4NL-1CFA-B4
						G1/2	D4NL-2CFA-B4
						M20	D4NL-4CFA-B4
					2NC+2NC	Pg13.5	D4NL-1DFA-B4
						G1/2	D4NL-2DFA-B4
						M20	D4NL-4DFA-B4
					2NC/1NO+1NC/1NO	Pg13.5	D4NL-1EFA-B4
						G1/2	D4NL-2EFA-B4 *2
						M20	D4NL-4EFA-B4 *2
					2NC/1NO+2NC	Pg13.5	D4NL-1FFA-B4
						G1/2	D4NL-2FFA-B4 *2
						M20	D4NL-4FFA-B4 *2
				3NC+1NC/1NO	Pg13.5	D4NL-1GFA-B4	
					G1/2	D4NL-2GFA-B4 *2	
					M20	D4NL-4GFA-B4 *2	
				3NC+2NC	Pg13.5	D4NL-1HFA-B4	
					G1/2	D4NL-2HFA-B4 *2	
					M20	D4NL-4HFA-B4 *2	
				Solenoid lock Mechanical release	1NC/1NO+1NC/1NO	Pg13.5	D4NL-1AFG-B4
						G1/2	D4NL-2AFG-B4
						M20	D4NL-4AFG-B4
					1NC/1NO+2NC	Pg13.5	D4NL-1BFG-B4
						G1/2	D4NL-2BFG-B4
						M20	D4NL-4BFG-B4
					2NC+1NC/1NO	Pg13.5	D4NL-1CFG-B4
						G1/2	D4NL-2CFG-B4
						M20	D4NL-4CFG-B4
					2NC+2NC	Pg13.5	D4NL-1DFG-B4
						G1/2	D4NL-2DFG-B4
						M20	D4NL-4DFG-B4
2NC/1NO+1NC/1NO	Pg13.5	D4NL-1EFG-B4					
	G1/2	D4NL-2EFG-B4 *2					
	M20	D4NL-4EFG-B4 *2					
2NC/1NO+2NC	Pg13.5	D4NL-1FFG-B4					
	G1/2	D4NL-2FFG-B4 *2					
	M20	D4NL-4FFG-B4 *2					
3NC+1NC/1NO	Pg13.5	D4NL-1GFG-B4					
	G1/2	D4NL-2GFG-B4 *2					
	M20	D4NL-4GFG-B4 *2					
3NC+2NC	Pg13.5	D4NL-1HFG-B4					
	G1/2	D4NL-2HFG-B4 *2					
	M20	D4NL-4HFG-B4 *2					

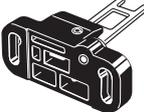
\*1. Switches with metal heads can also be manufactured upon request. Ask your OMRON representative for details.

\*2. Models with Korean S-mark certification.

Head material	Release key position	Release key type	Solenoid voltage/indicator	Lock and release types	Contact configuration (door open/closed detection switch and lock monitor switch contacts) (slow-action) Certified direct opening NC contact	Conduit opening	Model
Plastic	Bottom	Standard (metal)	Solenoid: 24 VDC Orange LED: 10 to 115 VAC/VDC	Mechanical lock Solenoid release	2NC/1NO+1NC/1NO	G1/2	D4NL-2EFA-B-SJ *2
						M20	D4NL-4EFA-B-SJ *2
					2NC/1NO+2NC	G1/2	D4NL-2FFA-B-SJ *2
						M20	D4NL-4FFA-B-SJ *2
					3NC+1NC/1NO	G1/2	D4NL-2GFA-B-SJ *2
						M20	D4NL-4GFA-B-SJ *2
					3NC+2NC	G1/2	D4NL-2HFA-B-SJ *2
						M20	D4NL-4HFA-B-SJ *2
				Solenoid lock Mechanical release	2NC/1NO+1NC/1NO	G1/2	D4NL-2EFG-B-SJ *2
						M20	D4NL-4EFG-B-SJ *2
					2NC/1NO+2NC	G1/2	D4NL-2FFG-B-SJ *2
						M20	D4NL-4FFG-B-SJ *2
					3NC+1NC/1NO	G1/2	D4NL-2GFG-B-SJ *2
						M20	D4NL-4GFG-B-SJ *2
					3NC+2NC	G1/2	D4NL-2HFG-B-SJ *2
						M20	D4NL-4HFG-B-SJ *2

\*2. Models with Korean S-mark certification.

## Operation Keys

Type	Model
Horizontal mounting 	<b>D4DS-K1</b>
Vertical mounting 	<b>D4DS-K2</b>
Adjustable mounting (Horizontal) 	<b>D4DS-K3</b>
Adjustable mounting (Horizontal/Vertical) 	<b>D4DS-K5</b>

## Specifications

### Standards and EC Directives

Conforms to the following EC Directives:

- Machinery Directive
- Low Voltage Directive
- EN ISO 14119
- EN 60204-1
- GS-ET-19

### Certified Standards

#### Standard type

Certification body	Standard	File No.
TÜV SÜD	EN60947-5-1 (certified direct opening)	Consult your OMRON representative for details.
UL *1	UL508, CSA C22.2 No.14	E76675
CQC (CCC)	GB14048.5	2003010305064267
KOSHA *2	EN60947-5-1	Consult your OMRON representative for details.

\*1. Certification for CSA C22.2 No. 14 is authorized by the UL mark.

\*2. Only certain models have been certified.

#### Metallic release key type

Certification body	Standard	File No.
TÜV SÜD	EN60947-5-1 (certified direct opening)	Consult your OMRON representative for details.
KOSHA	EN60947-5-1	Consult your OMRON representative for details.

### Certified Standard Ratings

TÜV (EN60947-5-1), CCC (GB14048.5)

Item	Utilization category	AC-15	DC-13
Rated operating current (I <sub>e</sub> )		3 A	0.27 A
Rated operating voltage (U <sub>e</sub> )		240 V	250 V

**Note:** Use a 10 A fuse type gI or gG that conforms to IEC60269 as a short-circuit protection device. This fuse is not built into the Switch.

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

#### A300

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

#### Q300

Rated voltage	Carry current	Current (A)		Volt-amperes (VA)	
		Make	Break	Make	Break
125 VDC	2.5 A	0.55	0.55	69	69
250 VDC		0.27	0.27		

### Solenoid Coil Characteristics

Item	Type	24 VDC	110 VAC
Rated operating voltage (100% ED)		24 VDC <sup>+10%</sup> <sub>-15%</sub>	110 VAC ±10%
Current consumption		Approx. 200 mA	Approx. 50 mA
Insulation		Class B (130°C max.)	

### Indicator Characteristics

Item	Type	LED
Rated voltage		10 to 115 VAC/VDC
Current leakage		Approx. 1 mA
Color (LED)		Orange

## Characteristics

<b>Degree of protection *1</b>		IP67 (EN60947-5-1)
<b>Durability *2</b>	<b>Mechanical</b>	1,000,000 operations min.
	<b>Electrical</b>	500,000 operations min. (3 A resistive load at 250 VAC) *3
<b>Operating speed</b>		0.05 to 0.5 m/s
<b>Operating frequency</b>		30 operations/minute max.
<b>Direct opening force *4</b>		60 N min. (EN60947-5-1)
<b>Direct opening travel *4</b>		10 mm min. (EN60947-5-1)
<b>Holding force *5</b>		1,300 N min.
<b>Contact resistance</b>		25 mΩ max. (per contact)
<b>Minimum applicable load *6</b>		1 mA resistive load at 5 VDC (N-level reference value)
<b>Rated insulation voltage (U<sub>i</sub>)</b>		300 V (EN60947-5-1)
<b>Rated frequency</b>		50/60 Hz
<b>Protection against electric shock</b>		Class II (double insulation)
<b>Pollution degree (operating environment)</b>		3 (EN60947-5-1)
<b>Impulse withstand voltage (EN60947-5-1)</b>	<b>Between terminals of same polarity</b>	2.5 kV
	<b>Between terminals of different polarity</b>	4 kV
	<b>Between each terminal and non-current carrying metallic parts</b>	6 kV
<b>Insulation resistance</b>		100 MΩ min. (at 500 VDC)
<b>Contact gap</b>		2 × 2 mm min.
<b>Vibration resistance</b>	<b>Malfunction</b>	10 to 55 Hz, 0.75 mm single amplitude
	<b>Destruction</b>	1,000 m/s <sup>2</sup> min.
<b>Shock resistance</b>	<b>Malfunction</b>	100 m/s <sup>2</sup> min.
	<b>Conditional short-circuit current</b>	100 A (EN60947-5-1)
<b>Conventional free air thermal current (I<sub>th</sub>)</b>		10 A (EN60947-5-1)
<b>Ambient operating temperature</b>		-10 to 55°C (with no icing)
<b>Ambient operating humidity</b>		95% max.
<b>Weight</b>		Approx. 370 g (D4NL-1AFA-B)

**Note: 1.** The above values are initial values.

**2.** The Switch contacts can be used with either standard loads or microloads. Once the contacts have been used to switch a load, however, they cannot be used to switch smaller loads. The contact surfaces will become rough once they have been used and contact reliability for smaller loads may be reduced.

**\*1.** The degree of protection is tested using the method specified by the standard (EN60947-5-1). Confirm that sealing properties are sufficient for the operating conditions and environment beforehand. Although the switch box is protected from dust or water penetration, do not use the D4NL in places where foreign material may enter through the key hole on the head, otherwise Switch damage or malfunctioning may occur.

**\*2.** The durability is for an ambient temperature of 5 to 35°C and an ambient humidity of 40% to 70%. For more details, consult your OMRON representative.

**\*3.** Do not pass the 3 A, 250 VAC load through more than 2 circuits.

**\*4.** These figures are minimum requirements for safe operation.

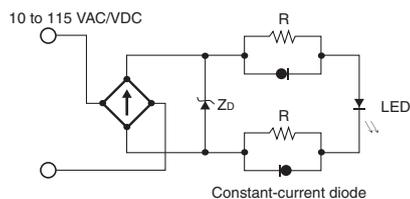
**\*5.** This figure is based on the GS-ET-19 evaluation method.

**\*6.** This value will vary with the switching frequency, environment, and reliability level. Confirm that correct operation is possible with the actual load beforehand.

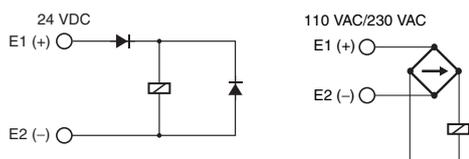
# Connections

## Internal Circuit Diagram

### Indicator



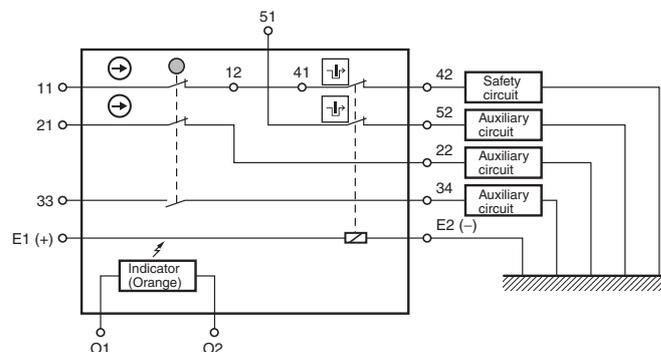
### Solenoid



## Circuit Connection Example

### Connection Example for D4NL-□F□□-B

- Terminals 12 and 41 are connected internally. When connecting inputs to safety circuits, use terminals 11 and 42. (GS-ET-19).
- Connect terminals 21 and 22 and terminals 51 and 52 in series when using as safety-circuit inputs (redundancy circuit for terminals 11 and 12 and terminals 41 and 42 below). Connect the terminals individually when using as auxiliary-circuit inputs (e.g., terminals 21 and 22 for safety-door open/closed monitoring and terminals 51 and 52 for monitoring the lock status).
- In the following connection example, terminals 21 and 22 and terminals 51 and 52 are used as auxiliary-circuit inputs.
- Direct opening contacts used as safety-circuit inputs are indicated with the ⊖ mark. Terminals 11 and 42, and terminals 21 and 22 have direct opening contacts.
- Connect the indicators in parallel to the auxiliary circuits or terminals E1 and E2 (D4NL-□□□□A-B, -□□□□G-B, -□□□□B-B, and -□□□□H-B only).  
Connecting to contacts with direct opening mechanisms may result in short-circuit current flowing if the indicator is destroyed, possibly resulting in incorrect equipment operation.
- Do not switch circuits for two or more standard loads at the same time. Doing so may adversely affect insulation performance.
- DC solenoids have polarity. Confirm terminal polarity before wiring.



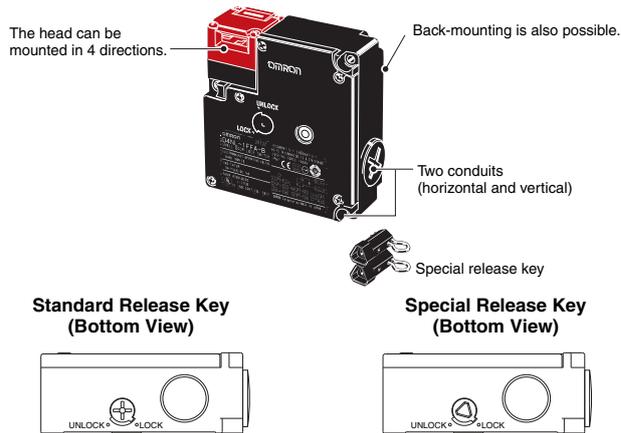
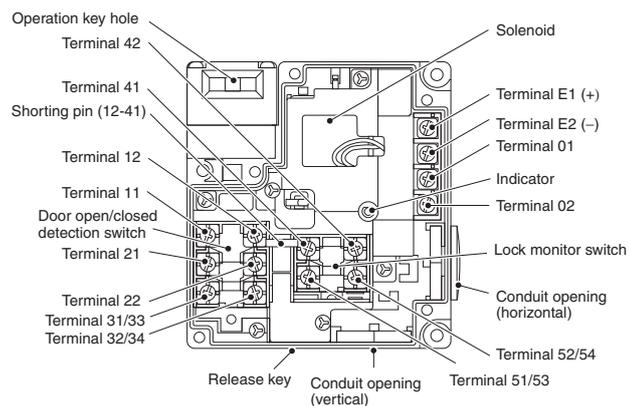
# Operation Method

## Operation Principles

<p><b>Mechanical lock models</b></p>		<p>When the Operation Key is inserted, it is locked by the lock spring. The door will stay locked even if there is a power interruption.</p>	<p>The solenoid is released only when the lock is turned ON.</p>
<p><b>Solenoid lock models</b></p>		<p>If the solenoid is OFF, the door will not be locked when the Operation Key is inserted. This means that the door can be opened and closed easily when replacing workpieces or parts.</p>	<p>The door is locked only when the solenoid is turned ON. This means that the door will be unlocked if there is a power interruption and so this model cannot be used in systems that would maintain a hazardous state (e.g., systems requiring toxic gases, high temperatures, or gears that would continue to turn due to inertia).</p>

## Structure and Nomenclature

### Structure



**Note:** Terminal numbers vary with the model.

## Contact Form

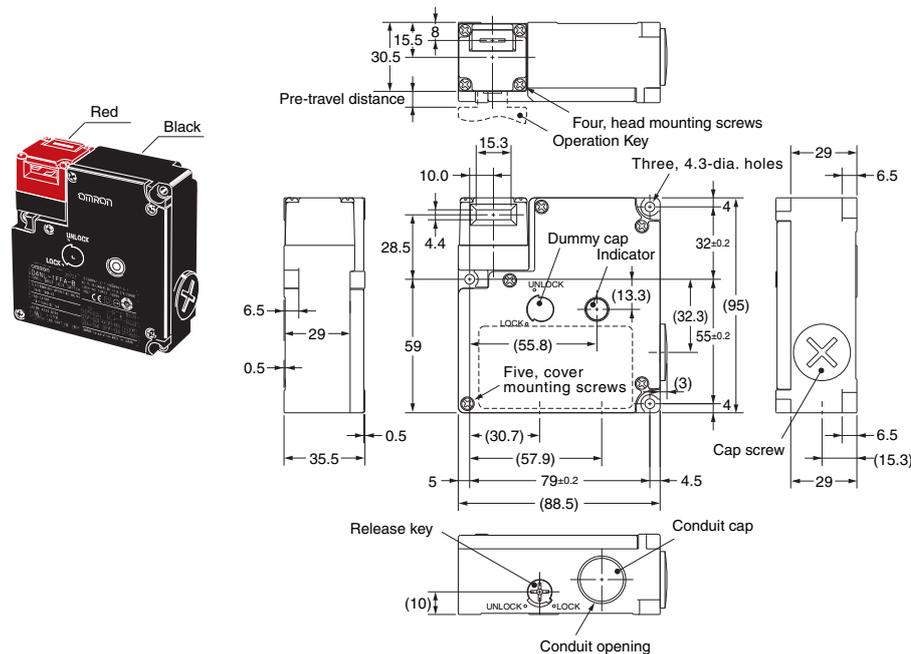
Indicates conditions where the Key is inserted and the lock is applied. Terminals 12 and 41 are connected internally (as per GS-ET-19).

Model	Contact (door open/closed detection and lock monitor)	Contact form		Operating pattern	Remarks
		Door open/ closed detection	Lock monitor		
D4NL-□AF□-□	1NC/1NO + 1NC/1NO				Only NC contacts 11-12 have a certified direct opening mechanism. (→) The terminals 11-42, 33-34, and 53-54 can be used as unlike poles.
D4NL-□BF□-□	1NC/1NO + 2NC				Only NC contacts 11-12 have a certified direct opening mechanism. (→) The terminals 11-42, 33-34, and 51-52 can be used as unlike poles.
D4NL-□CF□-□	2NC + 1NC/1NO				Only NC contacts 11-12 and 31-32 have a certified direct opening mechanism. (→) The terminals 11-42, 31-32, and 53-54 can be used as unlike poles.
D4NL-□DF□-□	2NC + 2NC				Only NC contacts 11-12 and 31-32 have a certified direct opening mechanism. (→) The terminals 11-42, 31-32, and 51-52 can be used as unlike poles.
D4NL-□EF□-□	2NC/1NO + 1NC/1NO				Only NC contacts 11-12 and 21-22 have a certified direct opening mechanism. (→) The terminals 11-42, 21-22, 33-34, and 53-54 can be used as unlike poles.
D4NL-□FF□-□	2NC/1NO + 2NC				Only NC contacts 11-12 and 21-22 have a certified direct opening mechanism. (→) The terminals 11-42, 21-22, 33-34, and 51-52 can be used as unlike poles.
D4NL-□GF□-□	3NC + 1NC/1NO				Only NC contacts 11-12, 21-22, and 31-32 have a certified direct opening mechanism. (→) The terminals 11-42, 21-22, 31-32, and 53-54 can be used as unlike poles.
D4NL-□HF□-□	3NC + 2NC				Only NC contacts 11-12, 21-22, and 31-32 have a certified direct opening mechanism. (→) The terminals 11-42, 21-22, 31-32, and 51-52 can be used as unlike poles.

# Dimensions

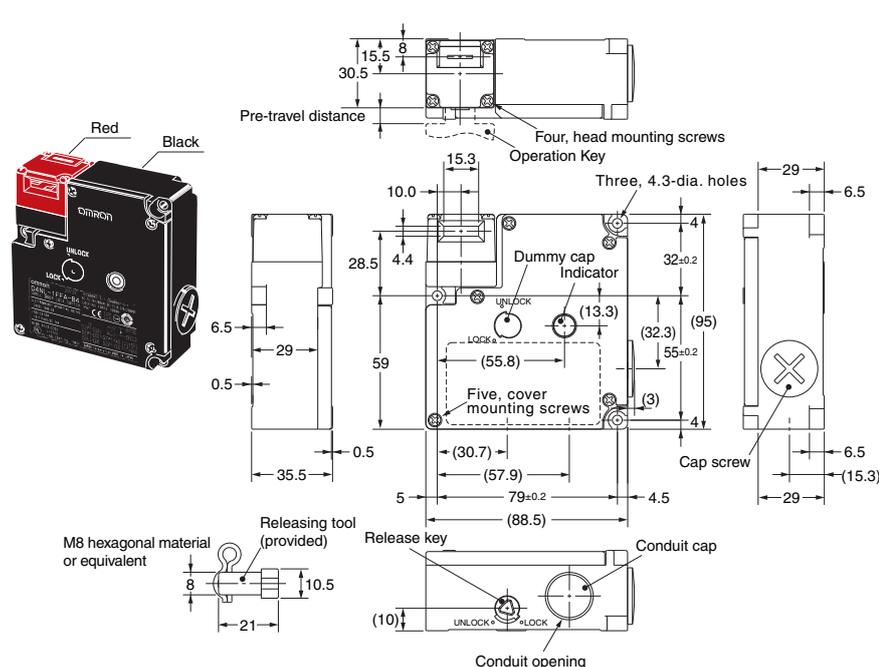
## Dimensions and Operating Characteristics Switches

### D4NL-□□□□-B



Operating characteristics	Model	D4NL-□□□□-B
Key insertion force		15 N max.
Key extraction force		30 N max.
Pre-travel distance		9 mm max.
Movement before being locked		3 mm min.

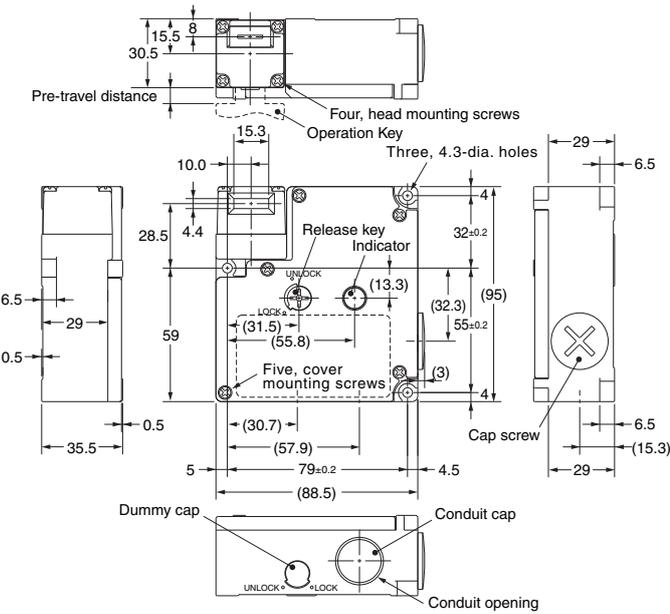
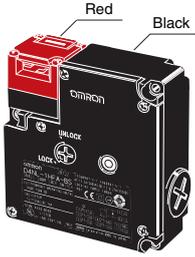
### D4NL-□□□□-B4



Operating characteristics	Model	D4NL-□□□□-B4
Key insertion force		15 N max.
Key extraction force		30 N max.
Pre-travel distance		9 mm max.
Movement before being locked		3 mm min.

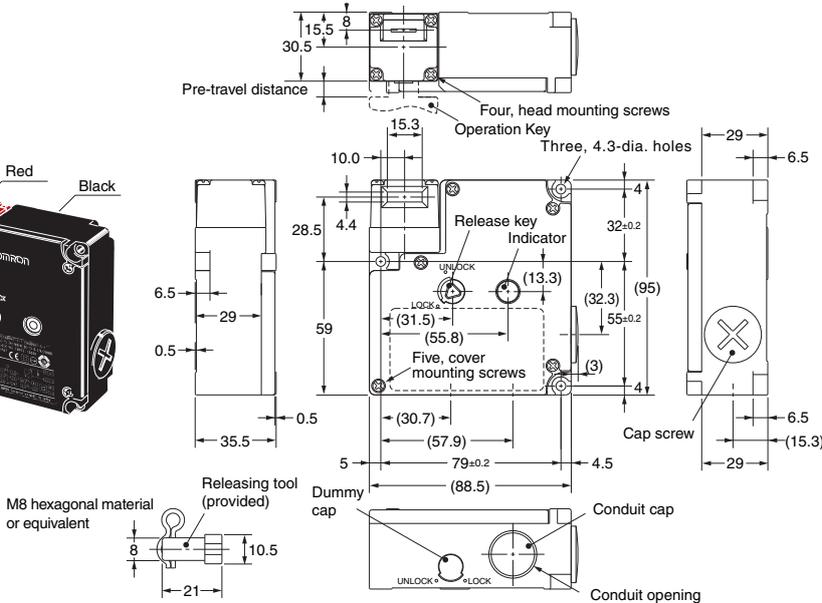
**Note:** 1. Unless otherwise specified, a tolerance of  $\pm 0.4$  mm applies to all dimensions.  
 2. There are fluctuations in the contact ON/OFF timing for Switches with multiple poles (2NC, 2NC/1NO, or 3NC). Confirm performance before application.

D4NL-□□□□-BS



Operating characteristics	Model	D4NL-□□□□-BS
Key insertion force		15 N max.
Key extraction force		30 N max.
Pre-travel distance		9 mm max.
Movement before being locked		3 mm min.

D4NL-□□□□-B4S

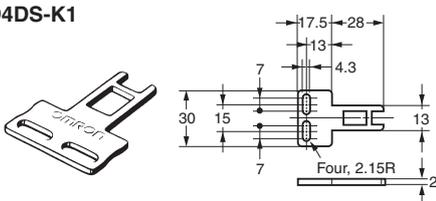


Operating characteristics	Model	D4NL-□□□□-B4S
Key insertion force		15 N max.
Key extraction force		30 N max.
Pre-travel distance		9 mm max.
Movement before being locked		3 mm min.

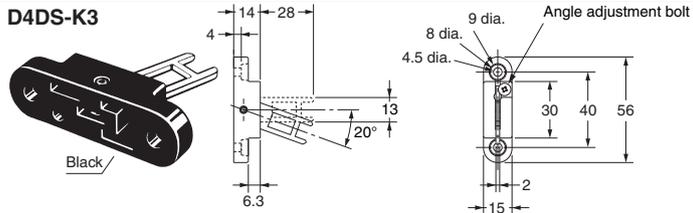
**Note: 1.** Unless otherwise specified, a tolerance of  $\pm 0.4$  mm applies to all dimensions.  
**2.** There are fluctuations in the contact ON/OFF timing for Switches with multiple poles (2NC, 2NC/1NO, or 3NC). Confirm performance before application.

Operation Keys

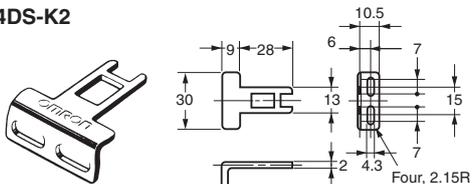
D4DS-K1



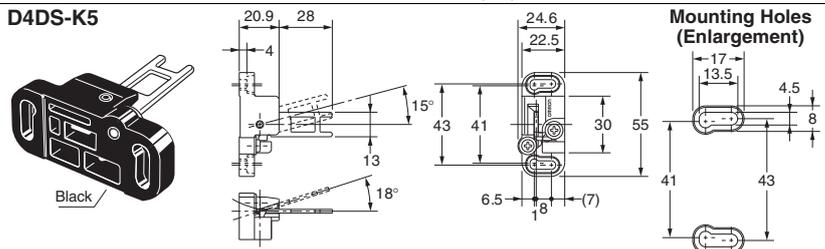
D4DS-K3



D4DS-K2



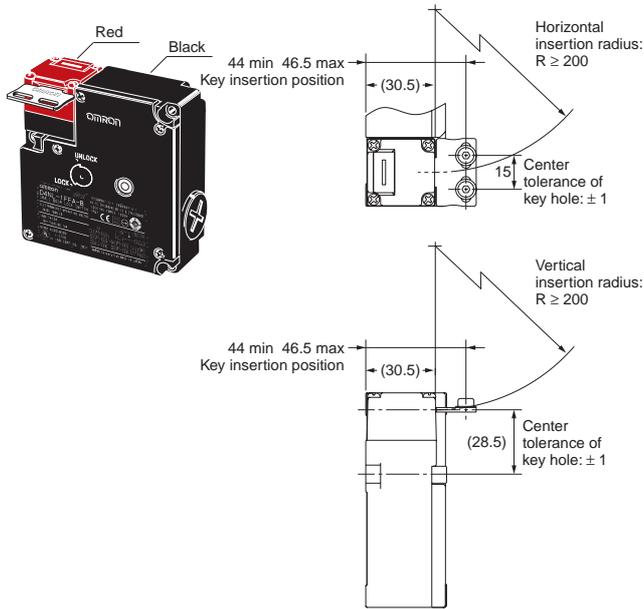
D4DS-K5



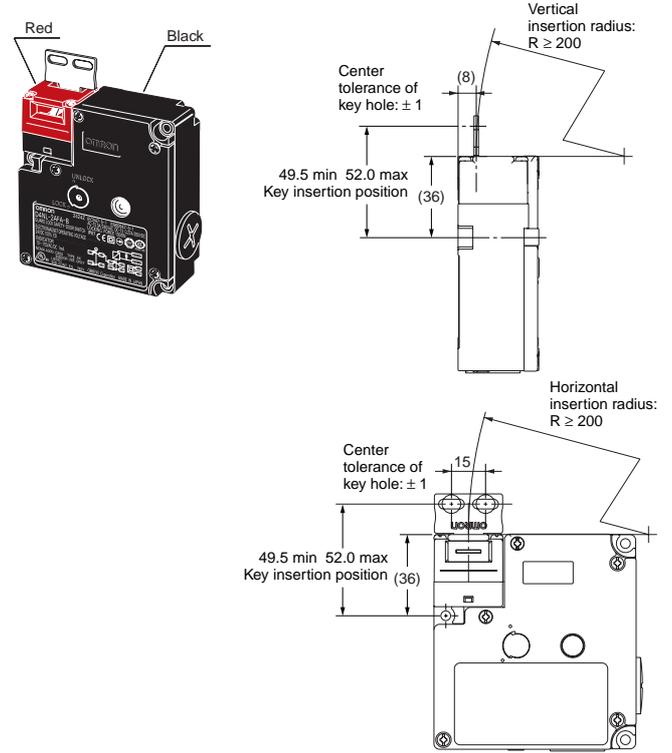
**Note:** Unless otherwise specified, a tolerance of  $\pm 0.4$  mm applies to all dimensions.

With Operation Key Inserted

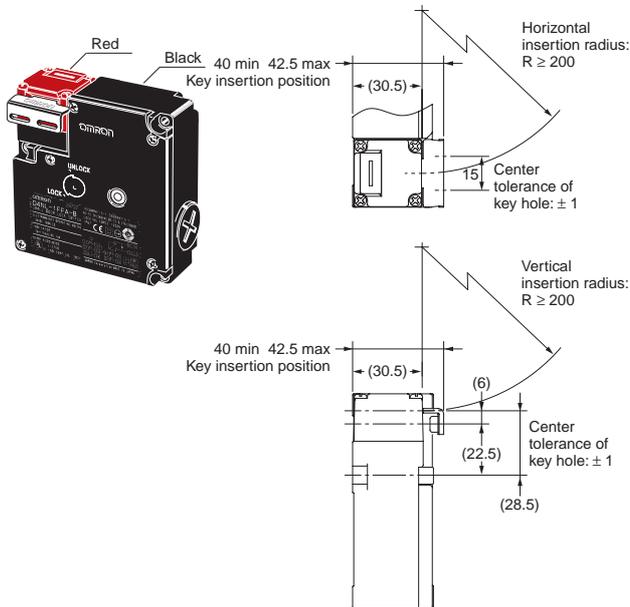
**D4NL + D4DS-K1**  
(with Front-inserted Operation Key)



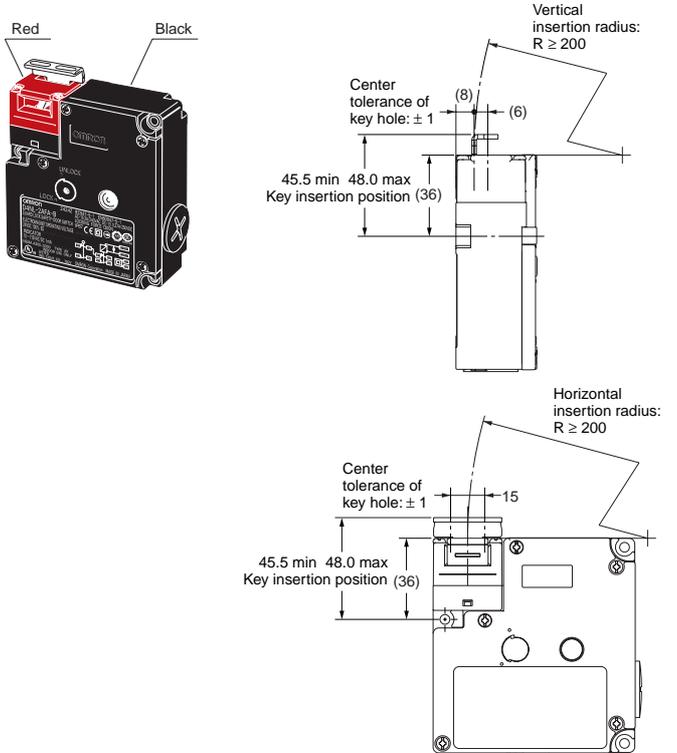
**D4NL + D4DS-K1**  
(with Top-inserted Operation Key)



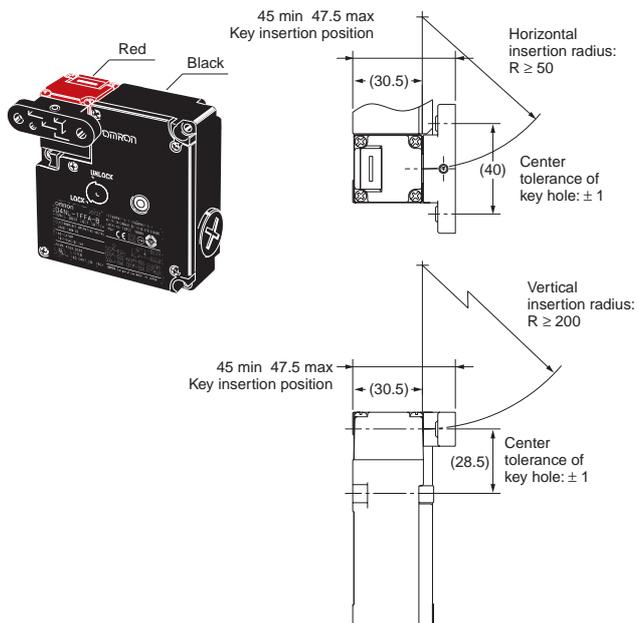
**D4NL + D4DS-K2**  
(with Front-inserted Operation Key)



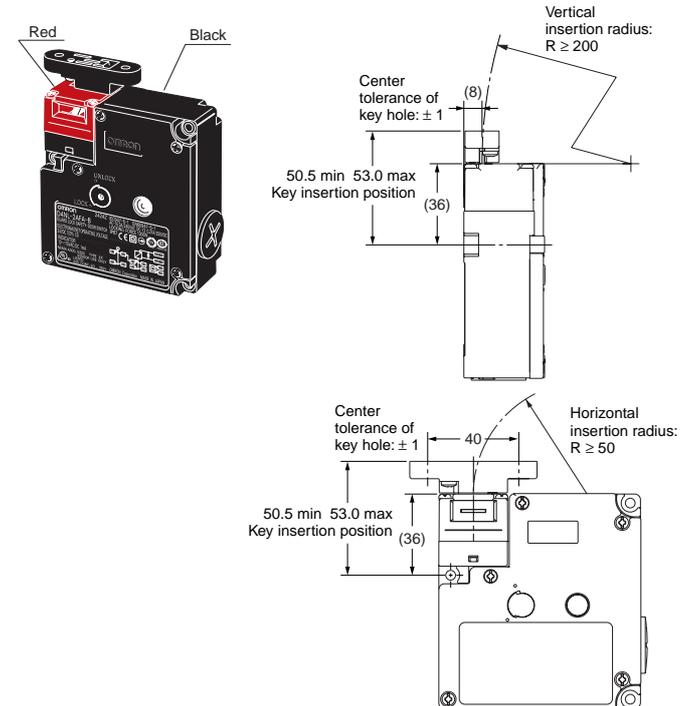
**D4NL + D4DS-K2**  
(with Top-inserted Operation Key)



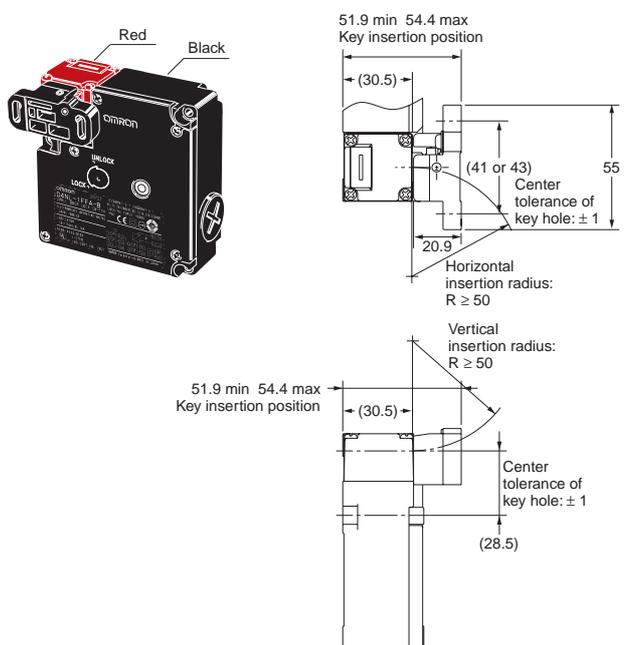
**D4NL + D4DS-K3**  
(with Front-inserted Operation Key)



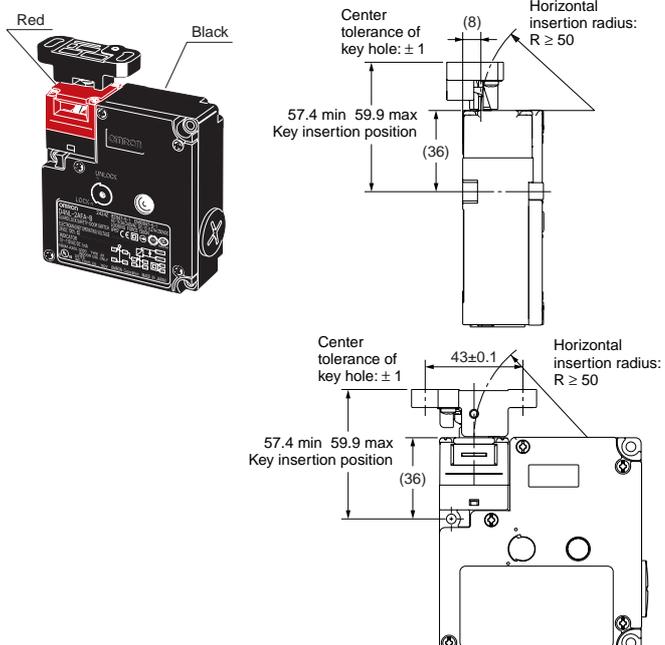
**D4NL + D4DS-K3**  
(with Top-inserted Operation Key)



**D4NL + D4DS-K5**  
(with Front-inserted Operation Key)



**D4NL + D4DS-K5**  
(with Top-inserted Operation Key)



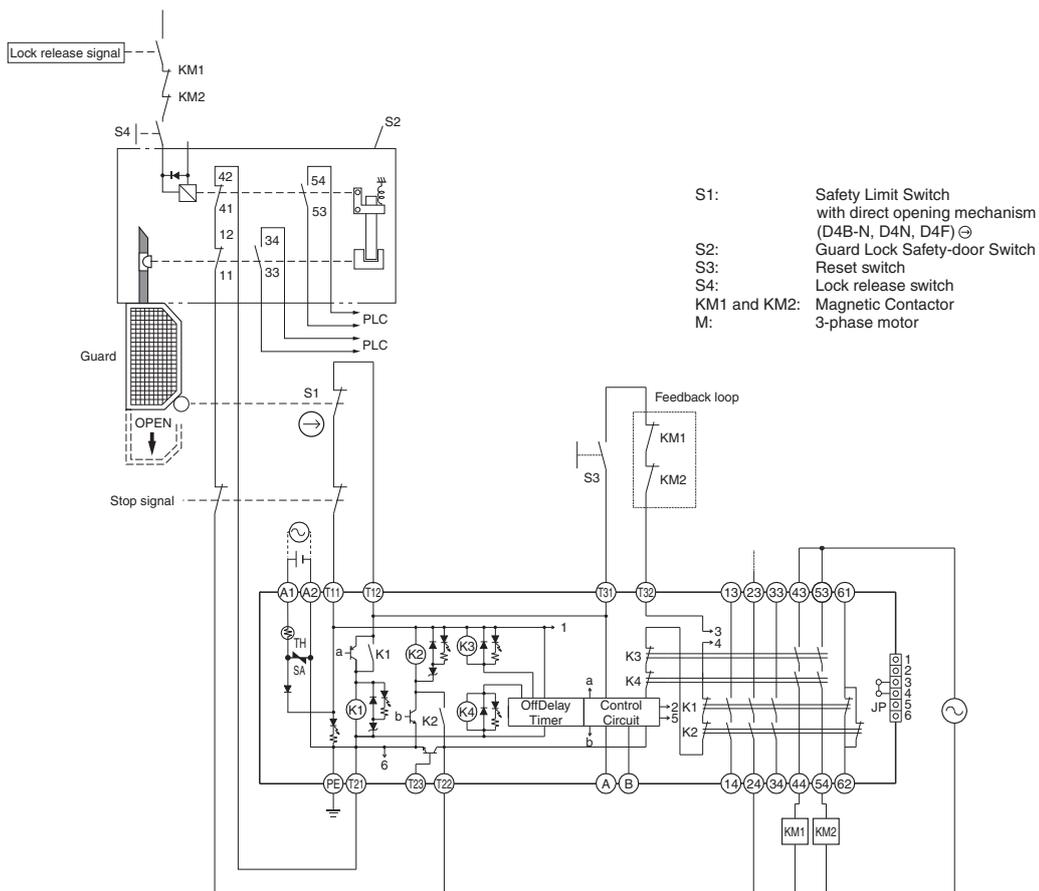
# Application Examples

PL/safety category	Model	Stop category	Reset
PLd/3 equivalent	Guard Lock Safety-door Switch D4NL-□A□A-□, -□A□B-□, -□A□C-□ (Mechanical Lock Type) Safety Relay Unit G9SA-321-T□ (24 VAC/VDC)	1	Manual

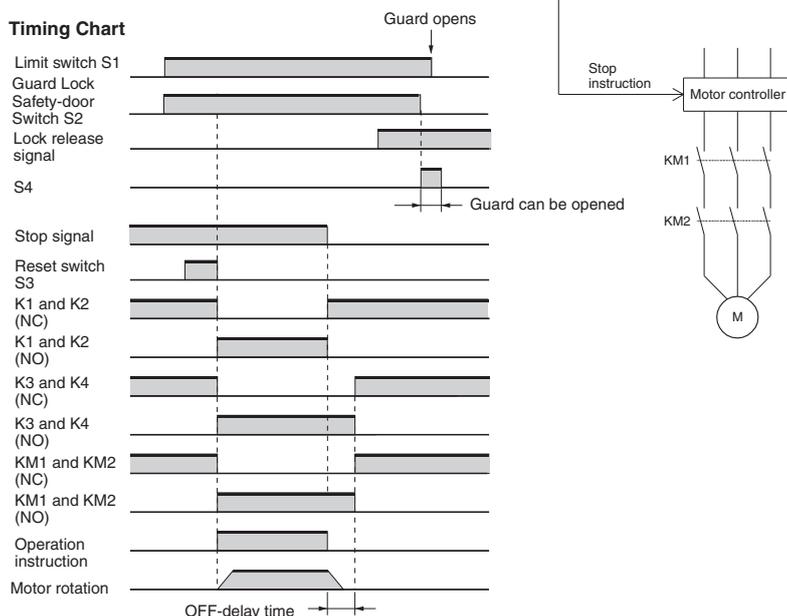
**Note:** The above PL is only the evaluation result of the example. The PL must be evaluated in an actual application by the customer after confirming the usage conditions.

## Application Overview

- The stop signal is sent to the motor controller.
- The power supply to the motor M is turned OFF after OFF-delay time.
- The lock release signal enables the guard to be opened.
- The S1 and S2 monitor the guard, and the power supply to the motor M is kept OFF while the guard is opened.
- The power supply to the motor M is turned ON again when the reset switch S3 is pressed while the guard is closed and locked.



### Timing Chart

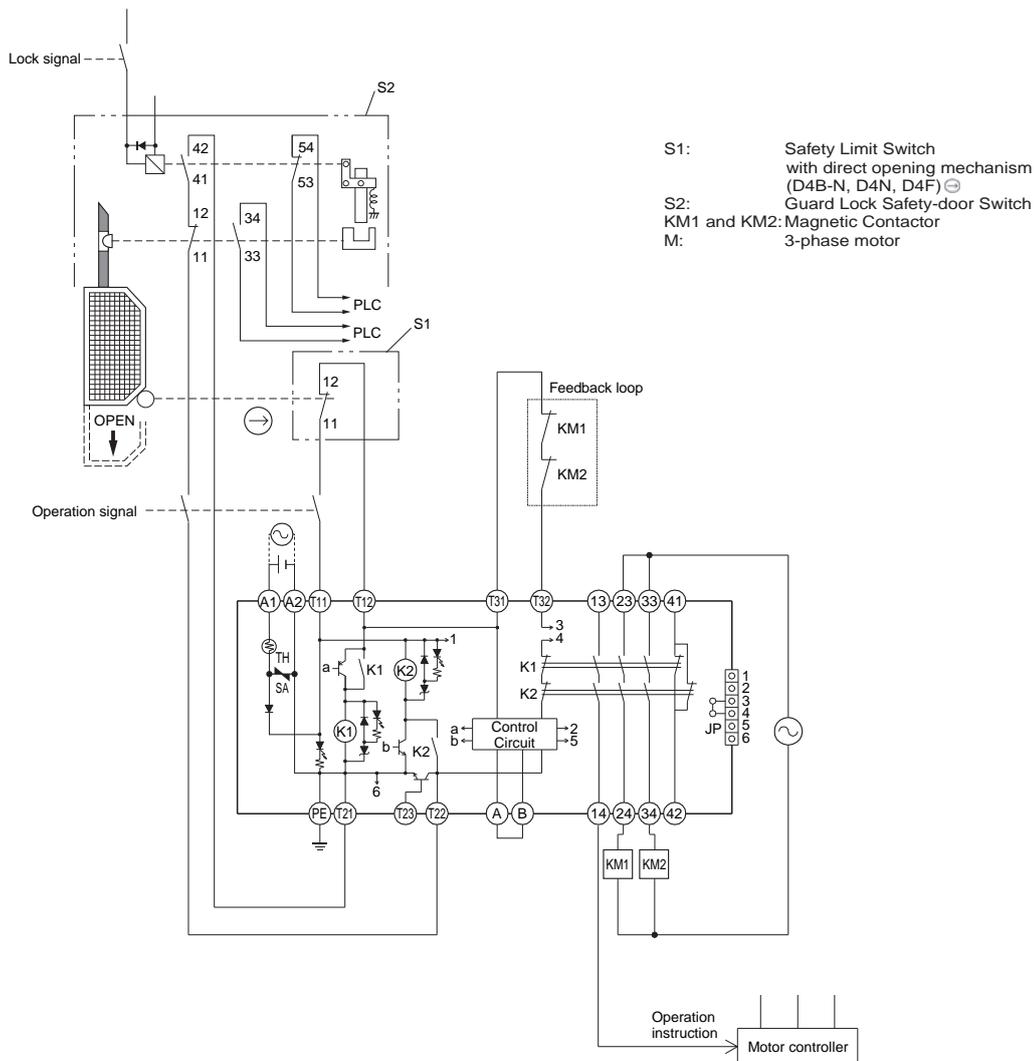


PL/safety category	Model	Stop category	Reset
PLe/4 equivalent	Guard Lock Safety-door Switch D4NL-□AFG-□, -□A□H-□, -□A□J-□ (Solenoid Lock Type) Safety Relay Unit G9SA-301 (24 VAC/VDC)	0	Auto

**Note:** The above PL is only the evaluation result of the example. The PL must be evaluated in an actual application by the customer after confirming the usage conditions.

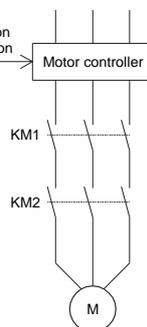
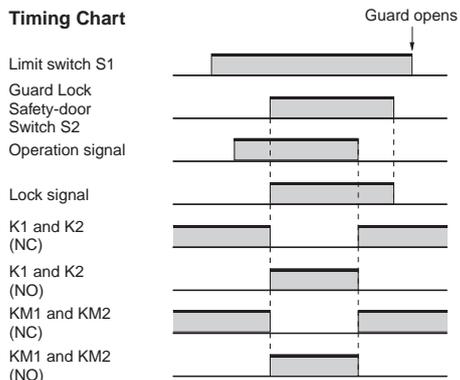
### ●Application Overview

- The power supply to the motor M is turned OFF immediately by the stop signal.
- The guard can be opened by turning OFF the lock signal.
- The S1 and S2 monitor the guard, and the power supply to the motor M is kept OFF while the guard is opened.
- The power supply to the motor M is turned ON again when the guard is closed and locked.



S1: Safety Limit Switch with direct opening mechanism (D4B-N, D4N, D4F) ⊖  
 S2: Guard Lock Safety-door Switch  
 KM1 and KM2: Magnetic Contactor  
 M: 3-phase motor

#### Timing Chart



**Note:** The lock can be released at any time. Therefore, do not use a model with a solenoid lock in applications where the operator may be exposed to danger when the guard opens. Use a model with a mechanical lock.

## Safety Precautions

Be sure to read the precautions for **All Safety Door Switches** in the website at: <http://www.ia.omron.com/>.

### Indication and Meaning for Safe Use

<b>⚠ DANGER</b>	Indicates an imminently hazardous situation which, if not avoided, is likely to result in serious injury or may result in death. Additionally there may be severe property damage.
<b>⚠ CAUTION</b>	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.
<b>Precautions for Safe Use</b>	Supplementary comments on what to do or avoid doing, to use the product safely.
<b>Precautions for Correct Use</b>	Supplementary comments on what to do or avoid doing, to prevent failure to operate, or undesirable effect on product performance.

### ⚠ DANGER

Injury may occasionally occur. Always check to make sure that the safety functions operate correctly before using the machine. The safety functions may not operate correctly because of wiring mistakes, setting mistakes, or Switch malfunction, causing some machines to continue operating in situations where they should be stopped.



Injury may occasionally occur. If the machine is used with the release key in the UNLOCK position, the electromagnetic lock may not operate, causing some machines to continue operating in situations where they should be stopped. Be sure to put the release key in the LOCK position before using the machine. Also, check the condition of the lock and safety circuits.



Injury may occasionally occur. Always ensure that the release key is set to "UNLOCK" or that the Operation Key is inserted before changing the direction of the head. Not doing so may damage the Switch, causing some machines to continue operating in situations where they should be stopped. Refer to "Release Key" on page 16.



Injury may occasionally occur. When the electromagnetic lock function or Switch function is damaged, some machines may continue operating in situations where they should be stopped. Do not use the electromagnetic lock function of the Switch in place of a door lock. Always provide a lock separate from the Switch, attach a warning seal to prevent people from using excessive force to open the door when it is locked, or provide an indicator lamp to show the locked/unlocked status of the door.



### ⚠ CAUTION

Electric shock may occasionally occur. Do not use metal connectors or metal conduits.



### Precautions for Safe Use

#### Installation Environment

- Do not use the Switch submerged in oil or water or in locations continuously subject to splashes of oil or water. Doing so may result in oil or water entering the Switch. (The IP67 degree of protection of the Switch specifies the amount of water penetration after the Switch is submerged in water for a certain period of time.)

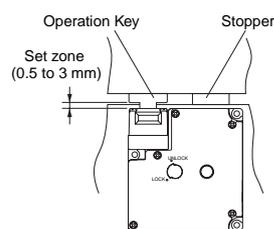
#### Wiring

- Do not switch circuits for two or more standard loads (250 VAC, 3 A). Doing so may adversely affect insulation performance.

- Always attach the cover after completing wiring and before using the Switch. Do not supply power when the cover is not attached. Electric shock may occur if the Switch is used without the cover attached.

#### Installation

- Make sure the Switch is mounted securely to prevent it from falling off. Otherwise injury may result.
- Do not use the Switch as a stopper. Be sure to install a stopper as shown in the following illustration to ensure that the base of the Operation Key does not strike the Head, and adjust the stopper to be within the setting zone (0.5 to 3 mm) of the base of the Operation Key.
- Do not subject the Switch to a shock that exceeds the Switch's shock resistance of 1,000 m/s<sup>2</sup>.



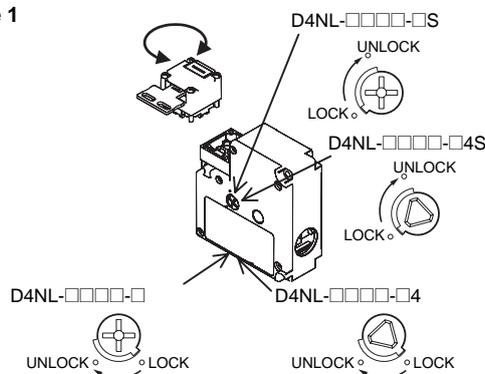
### Precautions for Correct Use

The Switch contacts can be used with either standard loads or microloads. Once the contacts have been used to switch a load, however, they cannot be used to switch smaller loads. The contact surfaces will become rough once they have been used and contact reliability for smaller loads may be reduced.

#### Release Key

- The release key is used to unlock the Switch in case of emergency or if the power supply to the Switch stops.
- If the release key setting is changed from LOCK to UNLOCK, the lock will be released and the safety door can be opened (mechanical lock models only).
- The release key is set in the unlock position at the factory for the D4NL-□□□A/B/C and to the lock position for the D4NL-□□□G/H/J.
- Do not use the release key to start or stop machines.
- The auxiliary lock must only be released by authorized personnel.
- Do not impose a force exceeding 1 N·m on the release key screws.
- The release key may be damaged and may not operate properly.
- To prevent the release key from being used by unauthorized personnel, set it to LOCK and seal it with sealing wax.

Figure 1



#### Hinged Door

If an attempt is made to open the door beyond the lock position when the Switch is used for a hinged door at a location near to the hinged side, where the Operation Key's insertion radius is comparatively small, the force imposed will be much larger than for locations far from the hinged side, and the lock may be damaged. Mount the Switch close to the handle.

## Solenoid Lock Models

The solenoid lock locks the door only when power is supplied to the solenoid. Therefore, the door will be unlocked if the power supply to the solenoid stops. Therefore, do not use solenoid lock models for machines that may be operating and dangerous even after the machine stops operating.

## Mounting

### Appropriate Tightening Torque

- Be sure to tighten each screw of the Switch properly. Loose screws may result in malfunction.

Type	Appropriate tightening torque
Terminal screw	0.59 to 0.78 N·m
Cover mounting screw	0.49 to 0.69 N·m
Head mounting screw	0.49 to 0.59 N·m
Operation Key mounting screw	2.35 to 2.75 N·m
Switch mounting screw	0.49 to 0.69 N·m
Connector	1.77 to 2.16 N·m
Cap screw	1.27 to 1.67 N·m

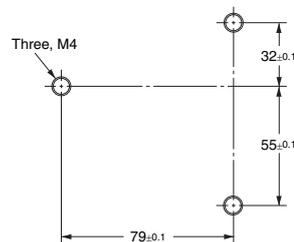
- When loosening a screw with an electrical screwdriver or similar tool while pressing down on the screw head, do not continue turning the screw past the point where the threads disengage. Doing so may strip the end of the threads.

### Switch and Operation Key Mounting

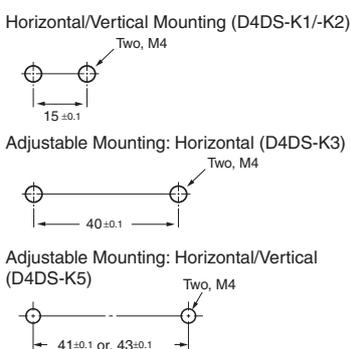
- Use M4 screws and washers to mount the Switch and Operation Key, and tighten the screws to a suitable torque.

To ensure safety, use screws that cannot be easily removed or another means to prevent the Switch and Operation Key from easily being removed.

#### Mounting Holes for Switches



#### Mounting Holes for Operation Keys



- If the Switch is back-mounted, the release key can be operated only from the bottom and the indicator cannot be used.
- Ensure that the alignment offset between the Operation Key and the key hole does not exceed  $\pm 1$  mm. If the Operation Key is offset or at an angle, accelerated wear or damage to the Switch may result.
- Observe the specified insertion radius for the Operation Key and insert it in a direction perpendicular to the key hole.
- Do not impose excessive force on the Operation Key while the Key is inserted into the Switch or drop the Switch with the Operation Key inserted. Doing either of these may deform the Key or break the Switch.

### Head Direction

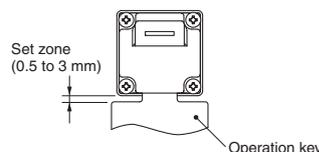
- Remove the four screws of the head to enable changing the mounting direction of the head. The head can be mounted in four directions. Ensure that no foreign material enters the interior of the Switch.
- Do not change the head direction with the cover removed.
- Do not insert or remove the Operation Key with the Switch head removed. Doing so may make it impossible to insert the Operation Key.

## Attaching a Cover

- When attaching a cover, be sure that the seal rubber is in place and that there is no foreign material present. If the cover is attached with the seal rubber out of place or if foreign material is stuck to the rubber, a proper seal will not be obtained.
- Do not use any screws to connect the cover other than the specified ones. The seal characteristics may be reduced.

## Securing the Door

When the door is closed (with the Operation Key inserted), the Operation Key may exceed the set zone because of, for example, the door's own weight, machine vibration, or the door cushion rubber. Then, when an attempt is made to open the door, it may result in damage or malfunction. Also, it may not be possible to unlock the Switch if there is weight placed on the Operation Key. Do not rely on the Switch to substitute for a door locking device. Secure the door with a stopper so that the Operation Key remains within the set zone.



## Solenoid

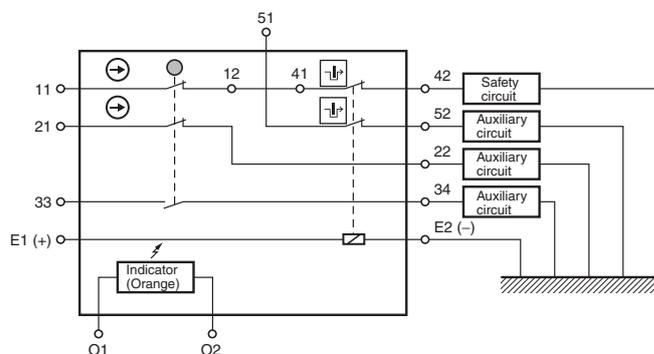
- The solenoid will heat when it carries current. Do not touch it.
- A DC solenoid has polarity. Confirm terminal polarity before wiring it.

## Wiring

### Circuit Connection Example for the D4NL-□F□□-B

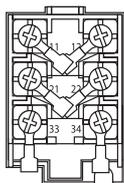
- Direct opening contacts used as safety-circuit inputs are indicated with the  $\ominus$  mark. Terminals 11 and 42, and terminals 21 and 22 have direct opening contacts.
- Connect terminals 21 and 22 and terminals 51 and 52 in series when using as safety-circuit inputs (redundancy circuit for terminals 11 and 12 and terminals 41 and 42 below). Connect the terminals individually when using as auxiliary-circuit inputs (e.g., terminals 21 and 22 for safety-door open/closed monitoring and terminals 51 and 52 for monitoring the lock status).
- In the following connection example, terminals 21 and 22 and terminals 51 and 52 are used as auxiliary-circuit inputs.
- Connect the indicators in parallel to the auxiliary circuits or terminals E1 and E2 (D4NL-□□□□A-B, -□□□□G-B, -□□□□B-B, and -□□□□H-B only).

Connecting to contacts with direct opening mechanisms may result in short-circuit current flowing if the indicator is destroyed, possibly resulting in incorrect equipment operation.



### Wiring Precautions

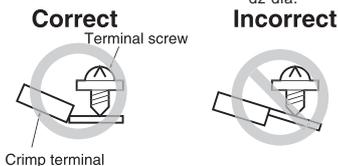
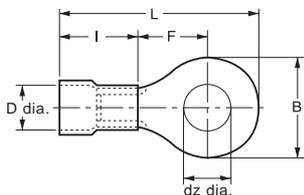
- Do not wire the Switch while power is being supplied. Doing so may result in electric shock.
- Do not let particles, such as small pieces of lead wire, enter the switch body when wiring.
- When connecting to the terminals via insulating tube and M3.5 crimp terminals, cross the crimp terminals as shown above so that they do not rise up onto the case or the cover.
- Applicable lead wire size: AWG20 to AWG18 (0.5 to 0.75 mm<sup>2</sup>). Use lead wires of an appropriate length. Not doing so may result in excess length causing the cover to rise and not fit properly.
- Do not push crimp terminals into gaps in the case interior. Doing so may cause damage or deformation of the case.
- Use terminals having the thickness of 0.5 mm or less to avoid the contact between the terminal and the interior of the Switch case.



**[Reference]** The terminals listed below have thickness of 0.5 mm or less.

Manufacturer	Model
J.S.T. Mfg Co.	FN0.5-3.7 (F Type) No. 5-3.7 (Straight Type)

- t: 0.5 mm
- dz dia.: 3.7 mm
- D dia.: 2.9 mm
- B: 6.6 mm
- L: 19 mm
- F: 7.7 mm
- I: 8.0 mm



### Processing the Conduit Opening

- Connect a recommended connector to the opening of the conduit and tighten the connector to the proper torque. The case may be damaged if excessive tightening torque is applied.
- Make sure that the outer diameter of the cable connected to the connector is correct.
- Attach a conduit cap to the unused conduit opening when wiring and tighten it to a suitable torque. The conduit cap is provided with the Switch.

### Recommended Connectors

- Use a connector with a screw section not exceeding 11 mm. Otherwise the screws will protrude into the case interior. The connectors given in the following table have connectors with screw sections not exceeding 11 mm. Use the following connectors to ensure conformance to IP67.

Size	Manufacturer	Model	Applicable cable diameter
G1/2	LAPP	ST-PF1/2 5380-1002	6.0 to 12.0 mm
	OHM ELECTRIC CO.	OA-W1609	7.0 to 9.0 mm
OA-W1611		9.0 to 11.0 mm	
Pg13.5	LAPP	ST-13.5 5301-5030	6.0 to 12.0 mm
M20	LAPP	ST-M20 × 1.5 5311-1020	7.0 to 13.0 mm

Use LAPP connectors together with Seal Packing (JPK-16, GP-13.5, or GPM20), and tighten to the applicable torque. Seal Packing is sold separately.

- LAPP is a German manufacturer.
- OHM Electric Co. is a Japanese manufacturer.

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2015.4

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