Safety Sensors / Components

Safety Light Curtain / Multi-Beam Safety Sensor

F3SN-A/F3SH-A

- **Type 4 sensor complying with IEC and EN standards (IEC61496-1, -2, EN61496-1). Complies with EU machine directives (certified by BG/DEMKO).**
- **Detection height = Sensor length meets the user's requirements**
- **Detection height 189 to 1822 mm. Sensing distance 7 and 10 m.**
- **Various functions can be set by means of setting console.**
- **Equipped with a LED bar for easy adjustment of the optical axis and quick detection of failures.**

Features

Select the optimum safety sensor for the application. Omron provides two safety types, the "Safety Light Curtain" and the "Multi-Beam Safety Sensor".

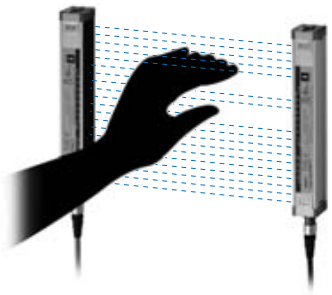
Finger protection

Safety light curtain

F3SN-A□□□□P14(H)

Sensing distance : 7 m

- Minimum detectable object: 14 mm dia. (9 mm optical axis pitch)
- Detection height: 189 to 1611 mm



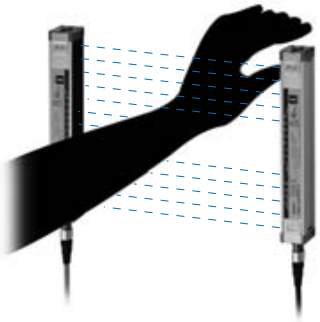
Hand protection

Safety light curtain

F3SN-A□□□□P25

Sensing distance : 10 m

- Minimum detectable object: 25 mm dia. (15 mm optical axis pitch)
- Detection height: 217 to 1822 mm



For presence inspection with a horizontal installation, types with minimum detectable object sizes of 40 mm (optical axis pitch: 30 mm) and 70 mm (optical axis pitch: 60 mm) can also be manufactured. (Please contact your OMRON Representative.)

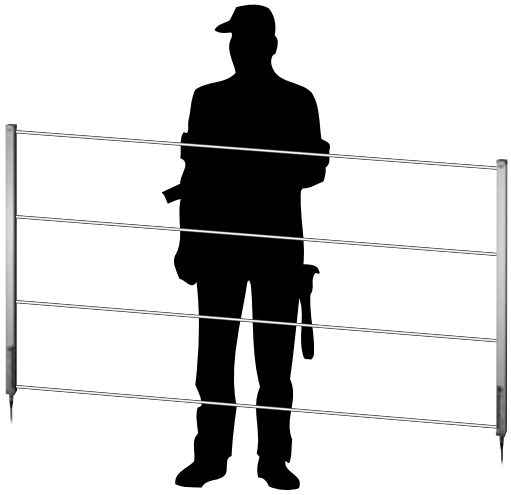
Body protection

Multi-beam safety curtain

F3SH-A09P03

Sensing distance : 10 m

- Number of optical axes: 4 beams (300 mm optical axis pitch)

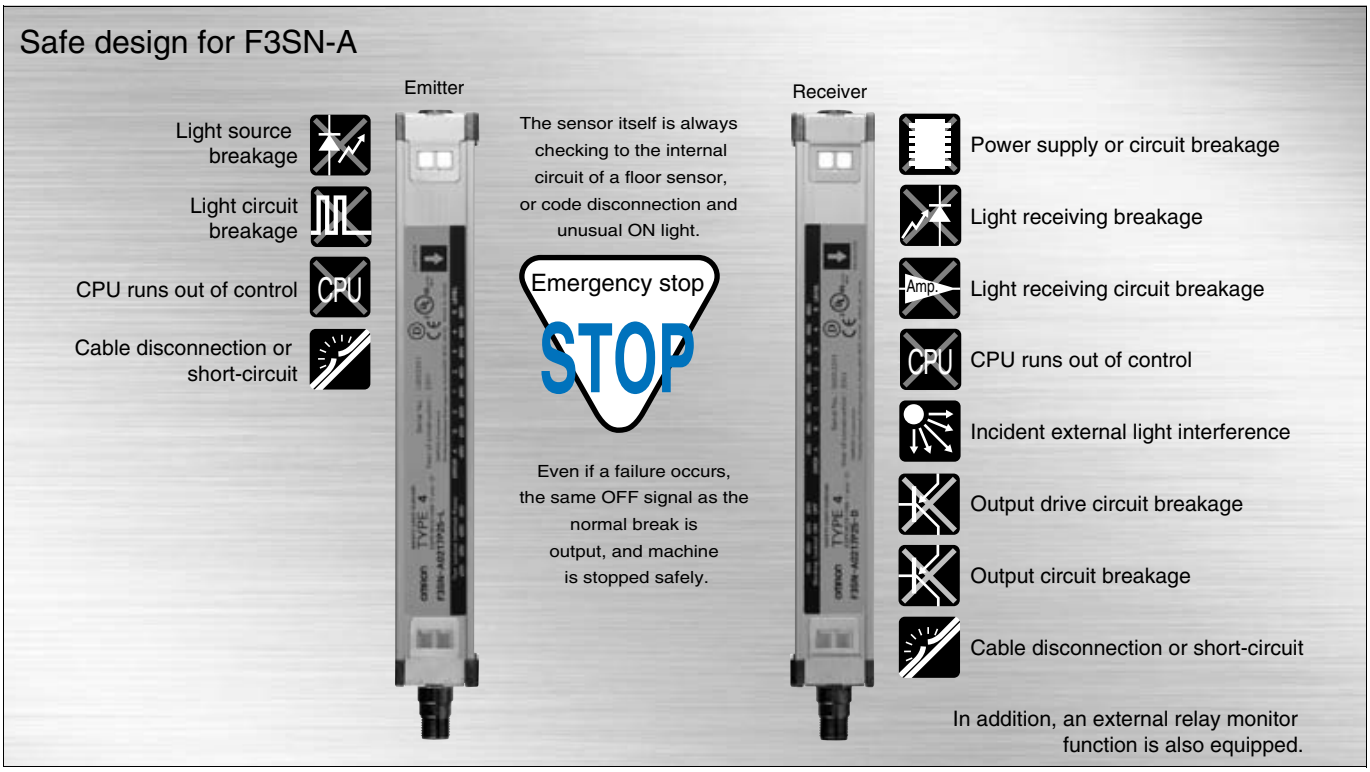


Features

A superior standard of safety design prevents machine accidents.

Wide-range implementation of fail-safe design.

Self-failure diagnosis triggers output shut off.

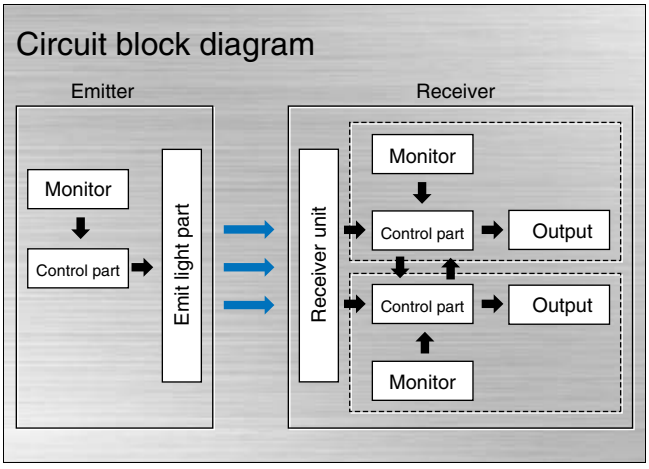


Technology-supported safety design

Safety is top priority based on the maximum standards of safety design and FMEA analysis.

Fail-safe design based on dual CPUs for mutual checking and duplex signal processing and output circuits. Relentless pursuit of safety based FMEA analysis * to prove safe operation.

* FMEA: Failure Mode and Effects Analysis



Meets global safety standards for safety sensors.

Type 4 sensors complying with IEC and EN standards

Complies with international standards IEC61496-1 and IEC61496-2, and EN standard EN61496-1, which are state-of-the-art "musts" for safety sensors.

Complies with EU directives

Certification of compliance with EC testing and EMC directives received from DEMKO and BG.

Received UL certification for models for the U.S. and Canada.

(Can be used in machines subject to OSHA rules and ANSI standards.)

Received UL listing and UL listing for Canadian safety standards based on UL508 and IEC61496-1/2. Can be used in machines subject to OSHA directives (29 CFR 1910.212), which are directives related to labor safety in the U.S. Meets also the requirements of ANSI/RIA R15.06-1999, a U.S. standard for industrial robots.

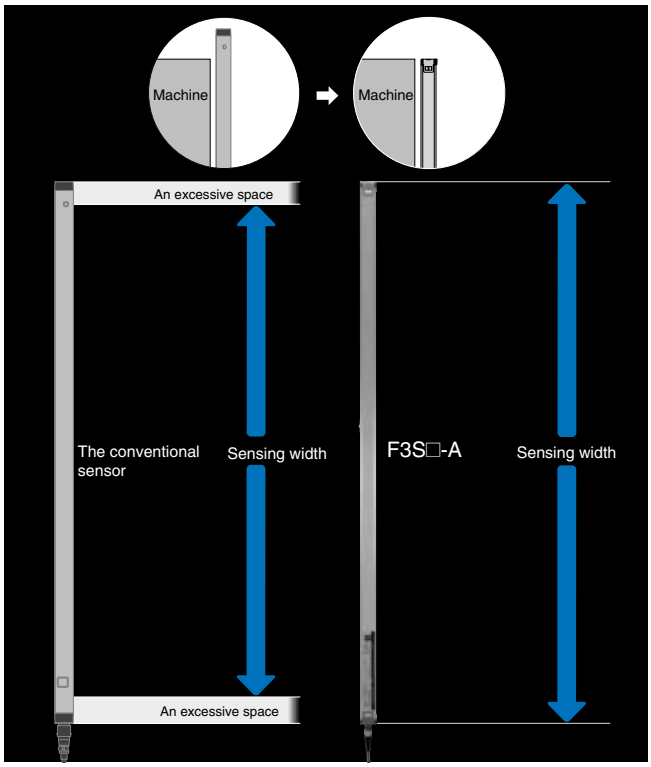
UL CE IEC61496-1 IEC61496-2 Type 4

Features

We provide the perfect size for use in hazardous areas.

A new concept that perfectly fits the needs of the user.

The detection height equals to the sensor length.
Excess space has been minimized.

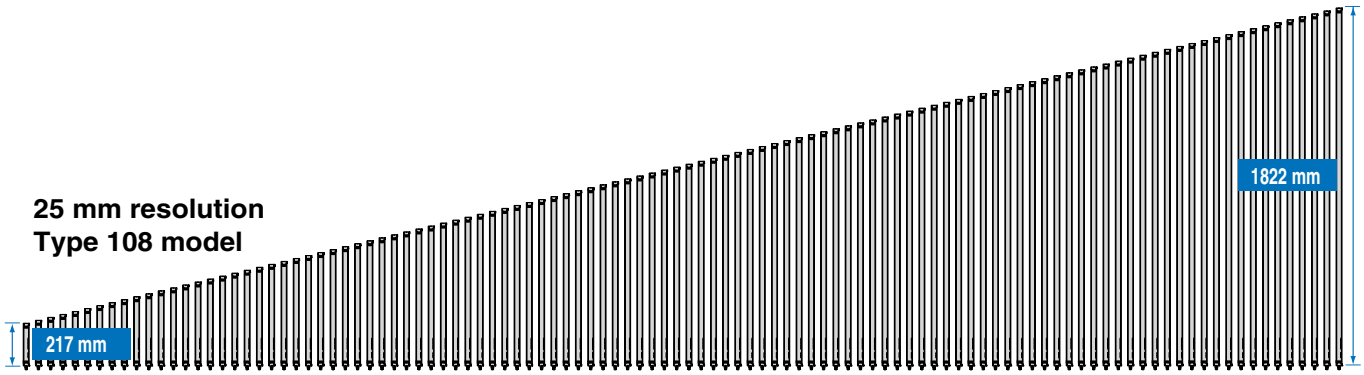


Up to 3 sets can be connected in series. Mutual interference can be prevented.

A standard type and a link-up type with a connector can be combined to connect up to 3 sets in series.

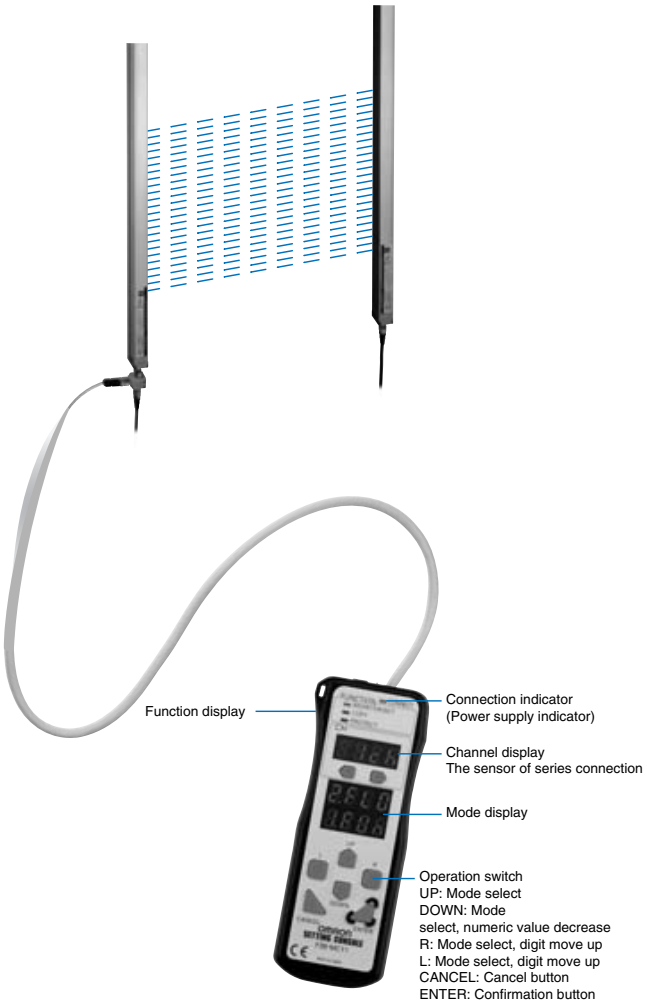
Note: When you order for a series connection type, please place an order with model-code F3SN-A□□□□P□□ -01.

Select the optimum length



Features

The setting console--the first in the industry--allows you an easy and safe setting of various functions.



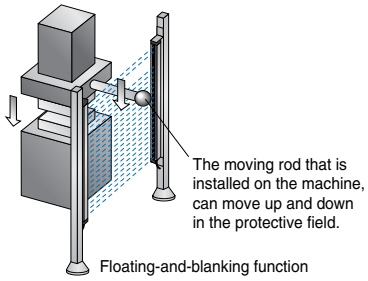
Includes two types of blanking functions

Blanking function for changing the detection pattern of the safety light curtain.

Basic pattern 1: Floating blanking function

This function allows you to disable an unspecified 1, 2, or 3 optical axes. If more than the set optical axes is interrupted, the output shuts off.

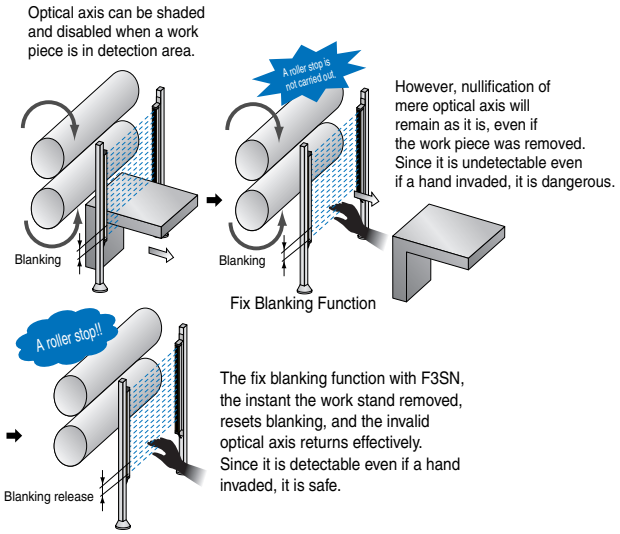
(Example of floating blanking function)



Basic pattern 2: Fixed blanking function

Specific optical axes are masked by teaching and disabled.

(Example of fixed blanking function)



Other functions to be set with the setting console

- Auxiliary outputs: Outputs such as ON at Dark, ON at Light, light intensity diagnosis, and lockout can be selected.
- Large indicator lamp outputs: large indicator lamp outputs can be selected from ON at Dark, ON at Light, light intensity diagnosis, and lockout.
- External device monitoring function: Allows you to monitor the feedback of external devices.
- Interlock function: Interlocks can be set at power-on and restart.
- Setting copy function: Allows you to copy the settings of one sensor to another sensor.
- Protect function: Changing of sensor settings can be prohibited and restricted.

F3SH-A Multi-beam safety sensor

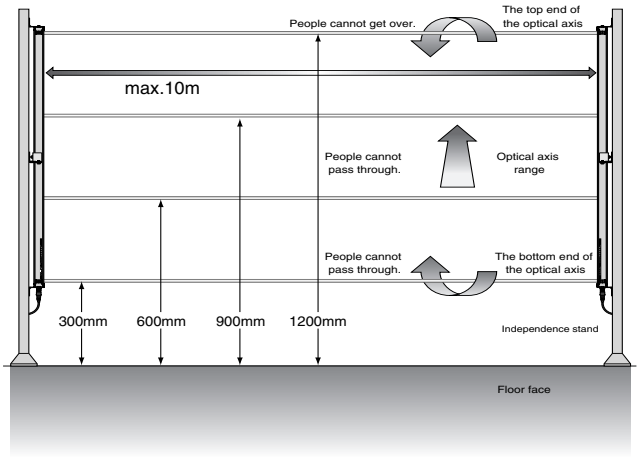
Recommended dimensions of EN standard for F3SH-A (4-optical axis multi-beam)
Human body detection achieved

4 optical axes at a 300 mm pitch. Detects break by entire body.

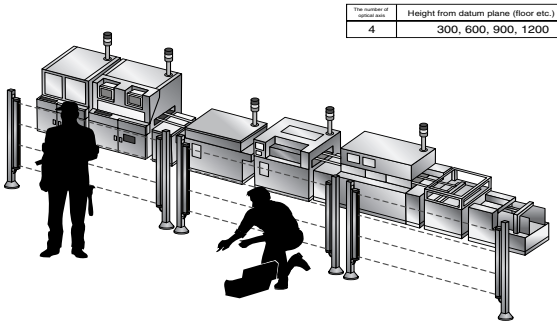
In EN Standard EN999 (machine safety: positioning of protective devices in relation to the approach speed of human body parts), the values in the following table are recommended as the most effective regarding the height from the reference surface (floor, etc.) of each optical axis of the 4 optical axis multi-beam sensor.

The optical axis pitch of the F3SH-A matches the recommended pitch, and, thus, in the installation shown in the following diagram, every type of intrusion is detected, including intrusion by passing under the lowest optical axis and intrusion by passing over the highest optical axis.

(Installation example based on EN999 recommended dimensions for multi-beam safety sensors)



The number of optical axis	Height from datum plane (floor etc.) (mm)
4	300, 600, 900, 1200



Easy safety application

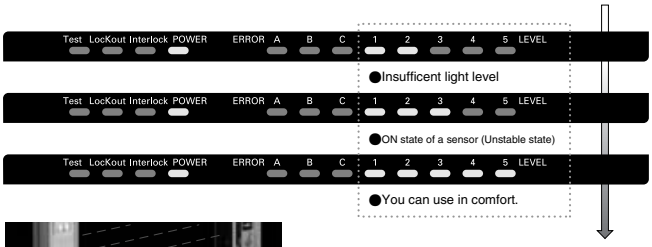
Various safety functions are implemented. Can be adapted to various safety circuit system configurations.

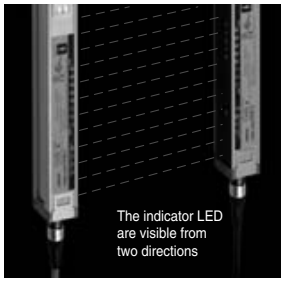
- Interlock function
- Auto reset / manual reset can be selected
- External device monitoring function

Equipped with LED bar for easy use.

Easy optical axis adjustment using LED displays. Enables certain installation.

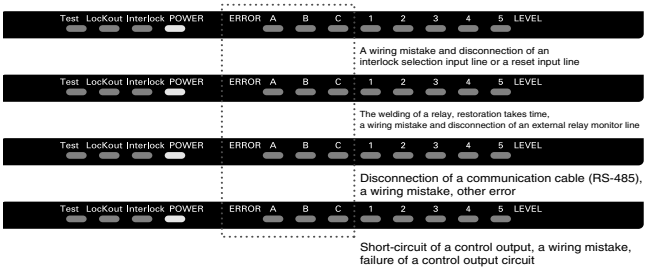
- Optical axis adjustment indicator (green only)





Error modes can be clearly indicated to provide a safety backup.

Error display example (red only)

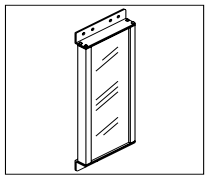


Full lineup of accessories (optional)

●Large-sized display indicator F39-A

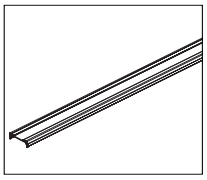
When connecting, a series connection model (model end number -01) is required.The setting console can select the kind of signal.

●Reflecting mirror F39-MDG



When the optical axis from an emitter is reflected at the angle of 90 degrees with using a mirror, the 2nd plane and the 3rd plane can be protected by one set of sensors. Sensing distance is lowered 15% per mirror.

●Spatter protection cover F39-HN



- Protective tube
- Slit cover
- Free location brackets
- Muting controller
- PSDI controller

Ordering information

Sensors

Safety light curtain

Infrared ray

Minimum detection object	Optical axis pitch	Shape	Sensing distance	Number of optical axes	Detection width	Series connection, connector	Model*1
14 mm dia. (Finger protection)	9 mm		0.2 to 7m	21 to 179 (odd numbers only)	189 to 1,611 mm (18 mm each)	No	F3SN-A□□□□P14 F3SN-A□□□□P14H
						Yes	F3SN-A□□□□P14-01*2 F3SN-A□□□□P14H-01
25 mm dia. (Hand protection)	15 mm		0.2 to 10m	13 to 120	217 to 1,822 mm (25 mm each)	No	F3SN-A□□□□P25
						Yes	F3SN-A□□□□P25-01
40 mm dia. (for presence protection)	30 mm		0.2 to 10m	7 to 60	217 to 1,807 mm	No	F3SN-A□□□□P40
						Yes	F3SN-A□□□□P40-01
70 mm dia. (for presence detection)	60 mm		0.2 to 10m	5 to 30	277 to 1,777 mm	No	F3SN-A□□□□P70
						Yes	F3SN-A□□□□P70-01

*1. □□□□ in the model name indicates the detection width (mm).
*2. F3SN-A□□□□P14-01is a customized model. For order placement, please contact your OMRON representative.

Multi-beam safety sensor

Infrared ray

Optical axis pitch	Shape	Sensing distance	Number of optical axes	Distance between optical axes at each end	Series connection, connector	Model
Body protection		0.2 to 10m	4	900 mm	No	F3SH-A09P03
					Yes	F3SH-A09P03-01

Accessories (Order Separately)

Control Unit

Appearance	Output	Model	Remarks
	Relay, 3NO + 1NC	**F3SP-B1P**	For connection with the F3SN-A, and F3SH-A, use F39-JC□B cables fitted with connectors at both ends.

Safety Relay Unit

Appearance	Output	Model	Remarks
	Relay, 3NO	**G9SA-300-SC**	For connection with the F3SN-A, and F3SH-A, use F39-JC□C cables fitted with connectors at both ends.

Muting Controller

Appearance	Model	Remarks
	**F3SP-U2P-TGR** **F3SP-U4P-TGR**	For connection with the F3SN-A, and F3SH-A, use F39-JC□A cables fitted with connectors at single end.

Setting Console

Appearance	Model	Accessories
	**F39-MC11**	One branching connector, one connector cap, 2-m cable, instruction manual

Branching Connector

Appearance	Model	Remarks
	**F39-CN1**	Purchase this connector when needed additionally for installing the F39-MC11.

Single-ended Connector Cable (For Emitter and Receiver Set)

Appearance	Cable length	Specification	Model
	3 m	M 12 connector (8 pin)	**F39-JC3A**
	7 m		**F39-JC7A**
	10 m		**F39-JC10A**
	15 m		**F39-JC15A**

Double-ended Connector Cable (For Emitter and Receiver Set)

Appearance	Cable length	Specification	Model	Application
	0.2 m	M12 connector (8 pins)	**F39-JCR2B**	Series connection or connection with F3SP-B1P
	0.5 m		**F39-JCR5B**	
	3 m		**F39-JC3B**	
	5 m		**F39-JC5B**	Connection with F3SP-B1P (see note 1)
	7 m		**F39-JC7B**	
	10 m		**F39-JC10B**	
	15 m		**F39-JC15B**	
	20 m		**F39-JC20B**	
	0.2 m	M12 connector (8 pins)	**F39-JCR2C**	Connection with G9SA-300-SC (see notes 1 and 2)
	1 m		**F39-JC1C**	
	3 m		**F39-JC3C**	
	7 m		**F39-JC7C**	
	10 m		**F39-JC10C**	
	15 m		**F39-JC15C**	

Note: 1. Cannot be used for series-connection purpose.

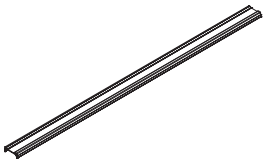
2. When two or more cables have to be used for connection with the G9SA-300-SC, connect the necessary number of F39-JC□B cables to one F39-JC□C cable.
(Example) When a 35 m long cable is required, connect two F39-JC□B cables to one F39-JC□C.

External Indicators (Separate Models for Emitters and Receivers)

Appearance	Specification	Indicator	Type	Model
	M12 connector for PNP output	Red	Emitter	**F39-A01PR-L**
			Receiver	**F39-A01PR-D**
		Green	Emitter	**F39-A01PG-L**
			Receiver	**F39-A01PG-D**

Note: These indicators are used for connecting with series-connection type emitters/receivers (models ending in -01). The desired turn-ON timing (type of signal) can be selected on setting console.

Spatter protection covers (1 set of 2 covers for both Emitter and receiver)

Shape	Applicable models	Model
	F3SN-A□□□□P14	F39-HN□□□□-14
	F3SN-A□□□□P25 F3SN-A□□□□P25-01	F39-HN□□□□-25
	F3SH-A09P03	F39-HH09-03

Note: □□□□ in the model name indicates the 4-digit sensor detection width (in sensor models).

Refection mirror (15% sensing distance attenuation)

Mirror material	Width (mm)	Thickness (mm)	Length (mm)	Model
Glass mirror	125	31	310	F39-MDG0310
			460	F39-MDG0460
			607	F39-MDG0607
			750	F39-MDG0750
			907	F39-MDG0907
			1,057	F39-MDG1057
			1,207	F39-MDG1207
			1,357	F39-MDG1357
			1,500	F39-MDG1500
			1,657	F39-MDG1657

Note: Other sizes are available upon request

IP67 environment-resistant Enclosure (A Package of tube, Gasket, and Bracket; see note)

Appearance	Applicable sensor	Model
	F3SN-A□□□□P14(-01)	**F39-HP□□□□-14**
	F3SN-A□□□□P25(-01) F3SN-A□□□□P40(-01) F3SN-A□□□□P70(-01)	**F39-HP□□□□-25**
	F3SH-A09P03(-01)	**F39-HPH09-03**

Note: Purchase 2 sets when using both an emitter and a receiver.

Mounting Bracket for Sensor (Optional)

Appearance	Specification	Model	Remarks
	Wall mounting bracket Material: Iron (zinc plating) (see note)	**F39-L18**	For emitter: 2 pcs. For receiver: 2 pcs. Total: 4pcs./set
	Free-location bracket Materials: Zinc die-cast (zinc plating) Note: Not provided with an angle deflection mechanism for beam control.	**F39-L19**	Minimum order quantity: 1 pc.
	Free-location bracket Materials Sensor fixing element: Zinc die-cast (zinc plating) Mounting bracket: Iron (zinc plating) Note: Provided with an angle deflection mechanism for beam control	**F39-L20**	Minimum order quantity: 1 pc.

Note: Use these brackets for sensors having an operating range where no intermediate bracket is required (with an operating range of less than 640 mm)

List of Safety Light Curtains

F3SN-A□□□□P14, F3SN-A□□□□P14-01, F3SN-A□□□□P14H-01

Model	Detection height	Number of optical axes
F3SN-A0189P14 (-01)	189	21
F3SN-A0207P14 (-01)	207	23
F3SN-A0225P14 (-01)	225	25
F3SN-A0243P14 (-01)	243	27
F3SN-A0261P14 (-01)	261	29
F3SN-A0279P14 (-01)	279	31
F3SN-A0297P14 (-01)	297	33
F3SN-A0315P14 (-01)	315	35
F3SN-A0333P14 (-01)	333	37
F3SN-A0351P14 (-01)	351	39
F3SN-A0369P14 (-01)	369	41
F3SN-A0387P14 (-01)	387	43
F3SN-A0405P14 (-01)	405	45
F3SN-A0423P14 (-01)	423	47
F3SN-A0441P14 (-01)	441	49
F3SN-A0459P14 (-01)	459	51
F3SN-A0477P14 (-01)	477	53
F3SN-A0495P14 (-01)	495	55
F3SN-A0513P14 (-01)	513	57
F3SN-A0531P14 (-01)	531	59
F3SN-A0549P14 (-01)	549	61
F3SN-A0567P14 (-01)	567	63
F3SN-A0585P14 (-01)	585	65
F3SN-A0603P14 (-01)	603	67
F3SN-A0621P14 (-01)	621	69
F3SN-A0639P14 (-01)	639	71
F3SN-A0657P14 (-01)	657	73

Model	Detection height	Number of optical axes
F3SN-A0675P14 (-01)	675	75
F3SN-A0693P14 (-01)	693	77
F3SN-A0711P14 (-01)	711	79
F3SN-A0729P14 (-01)	729	81
F3SN-A0747P14 (-01)	747	83
F3SN-A0765P14 (-01)	765	85
F3SN-A0783P14 (-01)	783	87
F3SN-A0801P14 (-01)	801	89
F3SN-A0819P14 (-01)	819	91
F3SN-A0837P14 (-01)	837	93
F3SN-A0855P14 (-01)	855	95
F3SN-A0873P14 (-01)	873	97
F3SN-A0891P14 (-01)	891	99
F3SN-A0909P14 (-01)	909	101
F3SN-A0927P14 (-01)	927	103
F3SN-A0945P14 (-01)	945	105
F3SN-A0963P14 (-01)	963	107
F3SN-A0981P14 (-01)	981	109
F3SN-A0999P14 (-01)	999	111
F3SN-A1017P14 (-01)	1,017	113
F3SN-A1035P14 (-01)	1,035	115
F3SN-A1053P14 (-01)	1,053	117
F3SN-A1071P14 (-01)	1,071	119
F3SN-A1089P14 (-01)	1,089	121
F3SN-A1107P14 (-01)	1,107	123
F3SN-A11125P14 (-01)	1,125	125

Model	Detection height	Number of optical axes
F3SN-A1143P14H(-01)	1143	127
F3SN-A1161P14H(-01)	1161	129
F3SN-A1179P14H(-01)	1179	131
F3SN-A1197P14H(-01)	1197	133
F3SN-A1215P14H(-01)	1215	135
F3SN-A1233P14H(-01)	1233	137
F3SN-A1251P14H(-01)	1251	139
F3SN-A1269P14H(-01)	1269	141
F3SN-A1287P14H(-01)	1287	143
F3SN-A1305P14H(-01)	1305	145
F3SN-A1323P14H(-01)	1323	147
F3SN-A1341P14H(-01)	1341	149
F3SN-A1359P14H(-01)	1359	151
F3SN-A1377P14H(-01)	1377	153
F3SN-A1395P14H(-01)	1395	155
F3SN-A1413P14H(-01)	1413	157
F3SN-A1431P14H(-01)	1431	159
F3SN-A1449P14H(-01)	1449	161
F3SN-A1467P14H(-01)	1467	163
F3SN-A1485P14H(-01)	1485	165
F3SN-A1503P14H(-01)	1503	167
F3SN-A1521P14H(-01)	1521	169
F3SN-A1539P14H(-01)	1539	171
F3SN-A1557P14H(-01)	1557	173
F3SN-A1575P14H(-01)	1575	175
F3SN-A1593P14H(-01)	1593	177
F3SN-A1611P14H(-01)	1611	179

Highlighted products are prefered stock types

F3SN-A□□□□P25, F3SN-A□□□□P25-01

Model	Detection height	Number of optical axes
F3SN-A0217P25 (-01)	217	13
F3SN-A0232P25 (-01)	232	14
F3SN-A0247P25 (-01)	247	15
F3SN-A0262P25 (-01)	262	16
F3SN-A0277P25 (-01)	277	17
F3SN-A0292P25 (-01)	292	18
F3SN-A0307P25 (-01)	307	19
F3SN-A0322P25 (-01)	322	20
F3SN-A0337P25 (-01)	337	21
F3SN-A0352P25 (-01)	352	22
F3SN-A0367P25 (-01)	367	23
F3SN-A0382P25 (-01)	382	24
F3SN-A0397P25 (-01)	397	25
F3SN-A0412P25 (-01)	412	26
F3SN-A0427P25 (-01)	427	27
F3SN-A0442P25 (-01)	442	28
F3SN-A0457P25 (-01)	457	29
F3SN-A0472P25 (-01)	472	30
F3SN-A0487P25 (-01)	487	31
F3SN-A0502P25 (-01)	502	32
F3SN-A0517P25 (-01)	517	33
F3SN-A0532P25 (-01)	532	34
F3SN-A0547P25 (-01)	547	35
F3SN-A0562P25 (-01)	562	36
F3SN-A0577P25 (-01)	577	37
F3SN-A0592P25 (-01)	592	38
F3SN-A0607P25 (-01)	607	39
F3SN-A0622P25 (-01)	622	40
F3SN-A0637P25 (-01)	637	41
F3SN-A0652P25 (-01)	652	42
F3SN-A0667P25 (-01)	667	43
F3SN-A0682P25 (-01)	682	44
F3SN-A0697P25 (-01)	697	45
F3SN-A0712P25 (-01)	712	46
F3SN-A0727P25 (-01)	727	47
F3SN-A0742P25 (-01)	742	48

Model	Detection height	Number of optical axes
F3SN-A0757P25 (-01)	757	49
F3SN-A0772P25 (-01)	772	50
F3SN-A0787P25 (-01)	787	51
F3SN-A0802P25 (-01)	802	52
F3SN-A0817P25 (-01)	817	53
F3SN-A0832P25 (-01)	832	54
F3SN-A0847P25 (-01)	847	55
F3SN-A0862P25 (-01)	862	56
F3SN-A0877P25 (-01)	877	57
F3SN-A0892P25 (-01)	892	58
F3SN-A0907P25 (-01)	907	59
F3SN-A0922P25 (-01)	922	60
F3SN-A0937P25 (-01)	937	61
F3SN-A0952P25 (-01)	952	62
F3SN-A0967P25 (-01)	967	63
F3SN-A0982P25 (-01)	982	64
F3SN-A0997P25 (-01)	997	65
F3SN-A1012P25 (-01)	1,012	66
F3SN-A1027P25 (-01)	1,027	67
F3SN-A1042P25 (-01)	1,042	68
F3SN-A1057P25 (-01)	1,057	69
F3SN-A1072P25 (-01)	1,072	70
F3SN-A1087P25 (-01)	1,087	71
F3SN-A1102P25 (-01)	1,102	72
F3SN-A1117P25 (-01)	1,117	73
F3SN-A1132P25 (-01)	1,132	74
F3SN-A1147P25 (-01)	1,147	75
F3SN-A1162P25 (-01)	1,162	76
F3SN-A1177P25 (-01)	1,177	77
F3SN-A1192P25 (-01)	1,192	78
F3SN-A1207P25 (-01)	1,207	79
F3SN-A1222P25 (-01)	1,222	80
F3SN-A1237P25 (-01)	1,237	81
F3SN-A1252P25 (-01)	1,252	82
F3SN-A1267P25 (-01)	1,267	83
F3SN-A1282P25 (-01)	1,282	84

Model	Detection height	Number of optical axes
F3SN-A1297P25 (-01)	1,297	85
F3SN-A1312P25 (-01)	1,312	86
F3SN-A1327P25 (-01)	1,327	87
F3SN-A1342P25 (-01)	1,342	88
F3SN-A1357P25 (-01)	1,357	89
F3SN-A1372P25 (-01)	1,372	90
F3SN-A1387P25 (-01)	1,387	91
F3SN-A1402P25 (-01)	1,402	92
F3SN-A1417P25 (-01)	1,417	93
F3SN-A1432P25 (-01)	1,432	94
F3SN-A1447P25 (-01)	1,447	95
F3SN-A1462P25 (-01)	1,462	96
F3SN-A1477P25 (-01)	1,477	97
F3SN-A1492P25 (-01)	1,492	98
F3SN-A1507P25 (-01)	1,507	99
F3SN-A1522P25 (-01)	1,522	100
F3SN-A1537P25 (-01)	1,537	101
F3SN-A1552P25 (-01)	1,552	102
F3SN-A1567P25 (-01)	1,567	103
F3SN-A1582P25 (-01)	1,582	104
F3SN-A1597P25 (-01)	1,597	105
F3SN-A1612P25 (-01)	1,612	106
F3SN-A1627P25 (-01)	1,627	107
F3SN-A1642P25 (-01)	1,642	108
F3SN-A1657P25 (-01)	1,657	109
F3SN-A1672P25 (-01)	1,672	110
F3SN-A1687P25 (-01)	1,687	111
F3SN-A1702P25 (-01)	1,702	112
F3SN-A1717P25 (-01)	1,717	113
F3SN-A1732P25 (-01)	1,732	114
F3SN-A1747P25 (-01)	1,747	115
F3SN-A1762P25 (-01)	1,762	116
F3SN-A1777P25 (-01)	1,777	117
F3SN-A1792P25 (-01)	1,792	118
F3SN-A1807P25 (-01)	1,807	119
F3SN-A1822P25 (-01)	1,822	120

Highlighted products are prefered stock types

F3SN-A□□□□P40, F3SN-A□□□□P40-01

Model	Detection height	Number of optical axes
F3SN-A0217P40(-01)	217	7
F3SN-A0247P40(-01)	247	8
F3SN-A0277P40(-01)	277	9
F3SN-A0307P40(-01)	307	10
F3SN-A0337P40(-01)	337	11
F3SN-A0367P40(-01)	367	12
F3SN-A0397P40(-01)	397	13
F3SN-A0427P40(-01)	427	14
F3SN-A0457P40(-01)	457	15
F3SN-A0487P40(-01)	487	16
F3SN-A0517P40(-01)	517	17
F3SN-A0547P40(-01)	547	18
F3SN-A0577P40(-01)	577	19
F3SN-A0607P40(-01)	607	20
F3SN-A0637P40(-01)	637	21
F3SN-A0667P40(-01)	667	22
F3SN-A0697P40(-01)	697	23
F3SN-A0727P40(-01)	727	24

Model	Detection height	Number of optical axes
F3SN-A0757P40(-01)	757	25
F3SN-A0787P40(-01)	787	26
F3SN-A0817P40(-01)	817	27
F3SN-A0847P40(-01)	847	28
F3SN-A0877P40(-01)	877	29
F3SN-A0907P40(-01)	907	30
F3SN-A0937P40(-01)	937	31
F3SN-A0967P40(-01)	967	32
F3SN-A0997P40(-01)	997	33
F3SN-A1027P40(-01)	1027	34
F3SN-A1057P40(-01)	1057	35
F3SN-A1087P40(-01)	1087	36
F3SN-A1117P40(-01)	1117	37
F3SN-A1147P40(-01)	1147	38
F3SN-A1177P40(-01)	1177	39
F3SN-A1207P40(-01)	1207	40
F3SN-A1237P40(-01)	1237	41
F3SN-A1267P40(-01)	1267	42

Model	Detection height	Number of optical axes
F3SN-A1297P40(-01)	1297	43
F3SN-A1327P40(-01)	1327	44
F3SN-A1357P40(-01)	1357	45
F3SN-A1387P40(-01)	1387	46
F3SN-A1417P40(-01)	1417	47
F3SN-A1447P40(-01)	1447	48
F3SN-A1477P40(-01)	1477	49
F3SN-A1507P40(-01)	1507	50
F3SN-A1537P40(-01)	1537	51
F3SN-A1567P40(-01)	1567	52
F3SN-A1597P40(-01)	1597	53
F3SN-A1627P40(-01)	1627	54
F3SN-A1657P40(-01)	1657	55
F3SN-A1687P40(-01)	1687	56
F3SN-A1717P40(-01)	1717	57
F3SN-A1747P40(-01)	1747	58
F3SN-A1777P40(-01)	1777	59
F3SN-A1807P40(-01)	1807	60

F3SN-A□□□□P70, F3SN-A□□□□P70-01

Model	Detection height	Number of optical axes
F3SN-A0277P70(-01)	277	5
F3SN-A0337P70(-01)	337	6
F3SN-A0397P70(-01)	397	7
F3SN-A0457P70(-01)	457	8
F3SN-A0517P70(-01)	517	9
F3SN-A0577P70(-01)	577	10
F3SN-A0637P70(-01)	637	11
F3SN-A0697P70(-01)	697	12
F3SN-A0757P70(-01)	757	13
F3SN-A0817P70(-01)	817	14

Model	Detection height	Number of optical axes
F3SN-A0877P70(-01)	877	15
F3SN-A0937P70(-01)	937	16
F3SN-A0997P70(-01)	997	17
F3SN-A1057P70(-01)	1057	18
F3SN-A1117P70(-01)	1117	19
F3SN-A1177P70(-01)	1177	20
F3SN-A1237P70(-01)	1237	21
F3SN-A1297P70(-01)	1297	22
F3SN-A1357P70(-01)	1357	23
F3SN-A1417P70(-01)	1417	24

Model	Detection height	Number of optical axes
F3SN-A1477P70(-01)	1477	25
F3SN-A1537P70(-01)	1537	26
F3SN-A1597P70(-01)	1597	27
F3SN-A1657P70(-01)	1657	28
F3SN-A1717P70(-01)	1717	29
F3SN-A1777P70(-01)	1777	30
F3SN-A1657P70(-01)	1657	28
F3SN-A1717P70(-01)	1717	29
F3SN-A1777P70(-01)	1777	30

Rating/Performance (see the operation manual for details)

Sensors

F3SN-A/F3SH-A

Model / Item		F3SN-A□□□□P14 (see notes 1 and 8)	F3SN-A□□□□P25 (see note 1)	F3SN-A□□□□P40 (see note 1)	F3SN-A□□□□P70 (see note 1)	F3SH-A09P03
Model / Item	Series connection	F3SN-A□□□□P14-01 (see notes 1, 2 and 8)	F3SN-A□□□□P25-01 (see note 1)	F3SN-A□□□□P40-01 (see note 1)	F3SN-A□□□□P70-01 (see note 1)	F3SH-A09P03-01
Sensor type		Type 4 Safety Light Curtain				
Applicable safety category		4, 3, 2, 1, B				
Operating range		0.2 to 7 m	0.2 to 10 m			
Beam pitch (P)		9 mm	15 mm	30 mm	60 mm	300 mm
Number of beams (n)		21 to 179 (odd numbers only)	13 to 120	7 to 60	5 to 30	4
Protective height (PH)		189 to 1611 mm PH = n × P	217 to 1822 mm PH = (n – 1) × P + 37	217 to 1807 mm PH = (n – 1) × P + 37	277 to 1777 mm PH = (n – 1) × P + 37	——
Outermost beam gap		——				900 mm
Detection capability		Non-transparent: 14 mm in diameter	Non-transparent: 25 mm in diameter	Non-transparent: 40 mm in diameter	Non-transparent: 70 mm in diameter	——
Effective aperture angle (EAA)		Within ±2.5° for the emitter and receiver at a detection distance of at least 3 m according to IEC 61496-2				
Light source (luminous wavelength)		Infrared LED (870 nm)				
Supply voltage (Vs)		24 VDC ±10% (ripple p-p 10% max.)				
Current consumption (under no-load conditions)	Emitter	Up to 50 beams: 140 mA max., 51 to 85 beams: 155 mA max., 86 beams and more: 170 mA max., 210 mA max. for 179 beams				140 mA max.
	Receiver	Up to 50 beams: 100 mA max., 51 to 85 beams: 110 mA max., 86 beams and more: 120 mA max., 140 mA max. for 179 beams				100 mA max.
OSSD		Two PNP transistor outputs, load current 300 mA max., residual voltage 2 V max. (except for voltage drop due to cable extension)				
Auxiliary output (non-safety output)		One PNP transistor output, load current 50 mA max., residual voltage 2 V max. (except for voltage drop due to cable extension)				
External indicator output (non-safety output) (see note 3)		One PNP transistor output, load current 40 mA max., residual voltage 2 V max. (except for voltage drop due to cable extension)				
Output operation mode		OSSD output: Light-ON Auxiliary output: Dark-ON (can be changed by the F39-MC11) External indicator output: Light-ON (can be changed by the F39-MC11) (see note 3)				
Input voltage		For test input, interlock selection input, reset input, and external relay monitor input voltages; ON voltage: 9 to 24 V (with a sink current of 3 mA max.), OFF voltage: 0 to 1.5 V or open				
Test functions		Self-test (after power ON, and during operation, one cycle during response time) External test (light emission stop function by test input)				
Mutual interference prevention function (see note 3)		Time-shared beam projection system by series connection Number of series connected light curtains: Up to 3 sets Number of beams: Up to 240 beams Length of the series connection cable: 3 m max.				
Safety-related functions		Auto reset/manual reset (interlock) (see note 4) EDM (External Device Monitoring) Fixed blanking (see note 5) Floating blanking (see note 5)				Auto reset mode/manual reset mode (interlock) (see note 4) EDM (External Device Monitoring)
Protection		Output short-circuit protection, reverse polarity protection				
Response time (under stable light incident condition)		ON to OFF: 10 to 15.5 ms max., 19,5 ms max. for 179 beams OFF to ON: 40 to 78 ms max.				ON to OFF: 10 ms max. OFF to ON: 40 ms max.
Startup waiting time		1 s max.				
Ambient light intensity		Incandescent lamp: 3000 lx max. (light intensity on the receiver surface) Sunlight: 10000 lx max. (light intensity on the receiver surface)				
Ambient temperature		Operating: –10 to +55 °C, storage: –30 to +70 °C (with no icing or condensation)				
Ambient humidity		Operating/storage: 35 to 95% RH (with no condensation)				
Insulation resistance		20 MΩ min. (at 500 VDC)				
Dielectric strength voltage		1000 VAC 50/60 Hz 1 min.				
Vibration resistance (malfunction)		10 to 55 Hz, double amplitude: 0.7 mm, X, Y and Z directions: 20 sweeps				
Shock resistance (malfunction)		100 m/s^2, X, Y and Z directions: 1000 times				
Degree of protection		IP65 (IEC60529)				
Connection method		M12 connector (8 pins)				
Weight (in packaging)		Calculate with the following equation: Weight of light curtain with protective height of 189 mm to 738 mm: (g) = (Protective height + 100) × 2 + 1300 Weight of light curtain with protective height of 747 mm to 1402 mm: (g) = (Protective height + 100) × 2 + 1700 Weight of light curtain with protective height of 1417 mm to 1822 mm: (g) = (Protective height + 100) × 2 + 2100				
Materials		Case: Aluminum, cap: Zinc die-cast, optical cover: PMMA (acrylic resin)				
Accessories		Test rod (see note 6), instruction manual, error mode label, mounting brackets (top and bottom), mounting brackets (intermediate) (see note 7)				

Model / Item						
Model	Stand-alone	F3SN-A□□□□P14 (see notes 1 and 8)	F3SN-A□□□□P25 (see note 1)	F3SN-A□□□□P40 (see note 1)	F3SN-A□□□□P70 (see note 1)	F3SH-A09P03
Item	Series connection	F3SN-A□□□□P14-01 (see notes 1, 2 and 8)	F3SN-A□□□□P25-01 (see note 1)	F3SN-A□□□□P40-01 (see note 1)	F3SN-A□□□□P70-01 (see note 1)	F3SH-A09P03-01
Applicable standard		IEC61496-1, EN61496-1 Type 4 ESPE (Electro-Sensitive Protective Equipment) IEC61496-2 Type 4 AOPD (Active Opto-electronic Protective Devices)				

Note: 1 . The 4 digits in □□□□ in the model number represent the protective height. Use the formula given in the information on protective height specifications to calculate the height.
For example, if the beam gap is 9 mm, and the No. of beams is 21, the protective height will be 9 × 21 = 189 mm. The model with this protective height is F3SN-A0189P14.
2 . F3SN-A□□□□P14-01 is a customized model. Consult with your OMRON representative when ordering this model.
3 . Models ending in -01 only.
4 . For the factory setting, the manual reset mode is set to the “start/restart” interlock.
Using the F39-MC11 can select either the start interlock or the restart interlock.
5 . For the factory setting, the function is not set. It can be enabled with the F39-MC11.
6 . Not provided with the F3SN-A□□□□P70 and F3SH-A.
7 . The intermediate mounting bracket is supplied with the following types:
Types which have the total length of the light curtain from 640 mm to 1280 mm: 1 set for each of emitter and receiver.
Types which have the total length of the light curtain over 1280 mm: 2 sets for each of emitter and receiver.
8 . For sizes above 1,125 mm add „H“ after P14, e.g. F3SN-A1143P14H. Ask for supplemental manual.

Accessories

Control unit

Item / Model		F3SP-B1P	G9SA-300-SC (See note)
Applicable sensor		F3SN-A, F3SH-A	
Supply voltage		24 VDC ±10%	
Power consumption		1.7 W DC max. (does not include the sensor’s current consumption)	24 VDC: 0.7 WDC max. (does not include the sensor’s current consumption)
Operating time		100 ms max. (does not include the sensor’s response time)	300 ms max. (does not include the sensor’s response time and bouncetime)
Response time		10 ms max. (does not include the sensor’s response time)	10 ms max. (does not include the sensor’s response time and bouncetime)
Relay output	No. of contact	3 NO + 1 NC	3 NO
	Rated load	25 VAC, 5 A (cos diameter = 1), 30 VDC, 5 A L/R = 0 ms	250 VAC, 5 A
	Rated carry voltage	5 A	
Connection method	Between sensor’s	M12 connector (8 pins)	
	Other	Terminal block	
Weight (in packaging)		Approx. 280 g	Approx. 300 g
Accessory		Instruction manual	

Note: 1 . For further details on the G9SA-300-SC, refer to the G9SA catalogue.

Setting console

Item / Model	F39-MC11
Applicable sensor	F3SN-A, F3SH-A
Supply voltage	24 V DC ±10% (supplied from sensor)
Connection method	Special cable (accessory)
Weight (Packed state)	360 g
Accessories	Branch connector (1), special cable (2 m), connector cap (1), operation manual

For details on the setting console,
see the manual included with the product.

Large indicator lamps

Model / Item	F39-A01PR-L (for emitter) F39-A01PR-D (for light receiver)	F39-A01PG-L (for emitter) F39-A01PG-D (for light receiver)
Applicable sensor	F3SN-A□□□□P□□-01 F3SH-A09P03-01	
Light source	Red LED	Green LED
Supply voltage	24 V DC ±10% (supplied by sensor)	
Current consumption	40 mA or less (supplied by sensor)	
Connection method	M12 connector (8-pin)	
Weight (Packed state)	80 g	

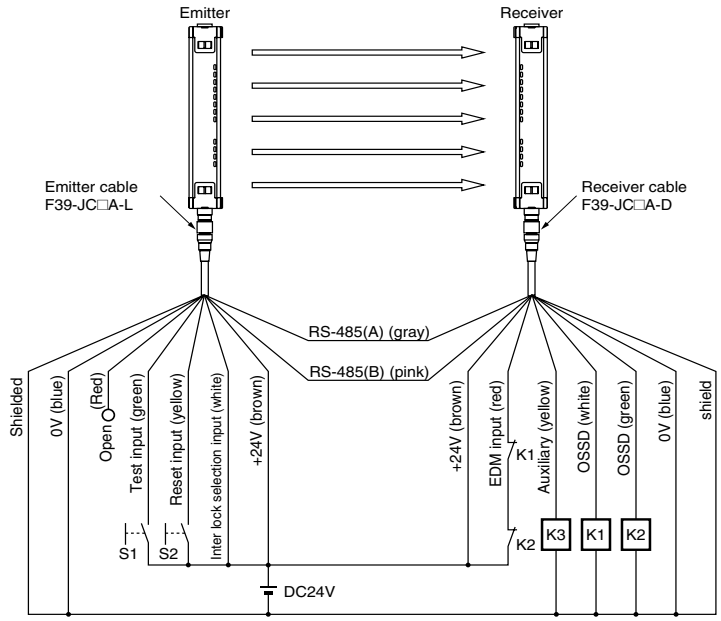
Environment-resistant Enclosure

Item / Model	F39-HP□□□□-14	F39-HP□□□□-25 F39-HPH09-03
Applicable sensor	F3SN-A□□□□P14(-01)	F3SN-A□□□□P25(-01)/P40(-01)/P70(-01), F3SH-A09P03(-01)
Operating range characteristics	0.2 to 6 m	0.2 to 10 m
Degree of protection (see note)	IP67 (IEC60529)	
Materials	Case: Acrylic resin, rubber: NBR60, mounting bracket: SUS316L, screw: SUS316L	

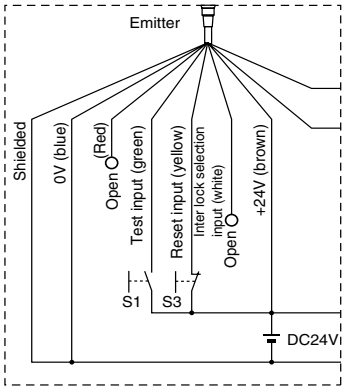
Note: To conform to IP67, tighten the screws according to the “Cautions for Use” as described in the manual packaged together with the product.

Connection

Using a manual reset function and an external device monitoring function



When using a auto reset function



S1: External test switch
S2: Interlock/lockout reset switch
S3: Lock-out reset switch (if the switch is not needed, connect to 24 V DC)
K1, K2: Relays for control of dangerous parts of machine.
K3: Load, PLC, etc. (for monitor)

Note: If you do not intend to use the external relay monitor, connect the auxiliary output that is set for dark: ON operation to the external relay monitor input, or use F39-MC11 to disable the external relay monitor function.

Correct Usage

This catalog is intended as a guide for product selection. Be sure to use the instruction manual provided with the product for actual operation.

Regulations and Standards

1. "Type Approval" specified in the Chapter 44. 2 of the Industrial Safety and Health Law in Japan does not apply to independent units of the F3SN-A/F3SH-A sensors. This law applies to systems incorporated with the sensor's.
   When using the F3SN-A/F3SH-A sensor in Japan as "safety devices for presses or shearing machines" as specified in the Chapter 42 of the same law, apply for approval as a system.

2. (1) The F3SN-A/F3SH-A is electro-sensitive protective equipment (ESPE) in accordance with European Union (EU) Machinery Directive Annex IV, B, Safety Components, Item 1.

   (2) The F3SN-A/F3SH-A complies with the following regulations and standards:

   1. EU Regulations
      - Machinery Directive: Directive 98/37/EC
      - EMC Directive: Directive 89/336/EEC
   2. European standards: EN61496-1 (TYPE 4 ESPE), prEN61496-2 (TYPE 4 AOPD)
   3. International standards: IEC61496-1 (TYPE 4 ESPE), IEC61496-2 (TYPE 4 AOPD)
   4. American standards: UL61496-1 (type 4 ESPE), UL61496-2 (type 4 AOPD), UL508, UL1998, CAN/CSA22.2 No. 14, CAN/CSA22.2 No. 0.8
   5. JIS standards: JIS B9704-1 (type 4 ESPE), JIS B9704-2 (type 4 AOPD)

   (3) The F3SN-A/F3SH-A received the following approvals from the EU accredited body DEMKO A/S:
   - EC Type-Examination in accordance with the EU Machinery Directive (TYPE 4 ESPE)
   - Certificate of a competent body for EMC
   - DEMKO Type Approval
     Type 4 ESPE (EN61496-1)
     Type 4 AOPD (prEN61496-2)

   (4) The F3SN-A/F3SH-A received the following approvals from the Third Party Assessment Body UL:
   - Certificate of UL listing for US and Canadian safety standards
     Both of which are: TYPE 4 ESPE (UL61496-1),
     TYPE 4 AOPD (UL61496-2)

   (5) The F3SN-A/F3SH-A received the following approvals from BG-PRUFZERT of Germany:
   - BG test and approval mark
     License
     Type 4 ESPE (EN61496-1)
     Type 4 AOPD (prEN61496-2)

3. The F3SN-A/F3SH-A is designed according to the following standards. To make sure that the F3SN-A/F3SH-A complies with the following standards and regulations, you are asked to design and use it as provided by any other related standards, laws, and regulations. (Underlined regulations are applicable to the F3SN-A only.) Consult UL or other standardization bodies if you have any questions.
   - EN415-4, prEN691, EN692, prEN693 (European standards)
   - OSHA 29 CFR 1910. 212 (US Industrial Safety and Health Regulation)
   - OSHA 29 CFR 1910. 217 (US Industrial Safety and Health Regulation)
   - ANSI B11. 1 - B11. 19 (US standard)
   - ANSI/RIA 15. 06 (US standard)

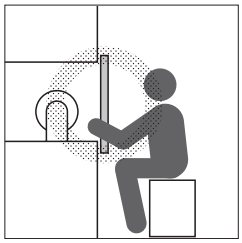
Detection zone and intrusion path

F3SN-A Safety Light Curtain

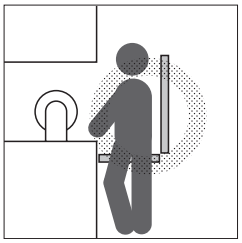
Install protective structures around the machine so that you must pass through the detection zone of the F3SN-A to reach a hazardous part of the machine.
Install the F3SN-A so that some part of the operator's body remains in the detection zone at all times when the operator works in a hazardous area. Failure to do so may result in serious injury.

Correct Installation

A hazardous part of a machine can be reached only by passing through the sensor detection zone.

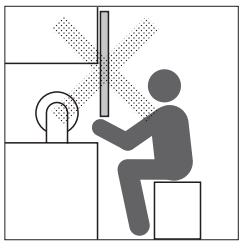


Some part of the operator's body remains in the detection zone while they are working.

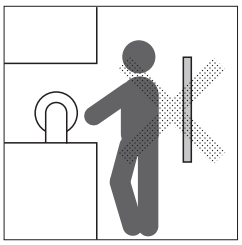


Incorrect Installation

A hazardous part of a machine can be reached without passing through the sensor detection zone.



A worker is between the sensor detection zone and a hazardous part of a machine.



F3SH-A Multi-beam Safety Sensor

Install protective structures around the machine so that you must pass through the detection zone of the F3SH-A to reach a hazardous part of the machine.
If it is possible for an operator to get between the sensor's detection zone and the hazardous part of the machine, design the system so that machinery cannot start up automatically. Make sure that machinery cannot restart while the operator is in the hazardous area. Position the switch for restarting machinery in a location from which the status of the hazardous area can be seen clearly. The switch position location must be a place where the switch cannot be operated from within the hazardous area.
Failure to do so may result in serious injury.

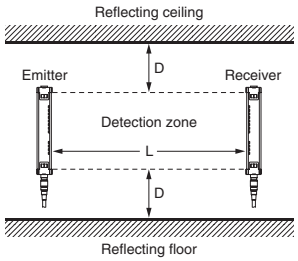
Use of the fixed blanking function

After setting the fixed blanking, check that the F3SN-A detects a test rod at any position in the detection zone through which a person can reach the hazardous part of the machine. If any positions are found by check above, install protective structures to prevent intrusion, which the F3SN-A can not detect.
Failure to do so may result in serious injury.

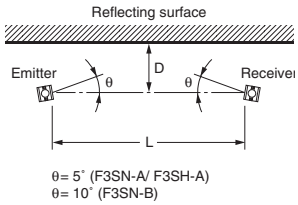
Distances from reflective surfaces

Be sure to install the F3SN-A/F3SH-A to minimize the effects of reflection from nearby surfaces.
Failure to do so may cause detection to fail and may result in serious injury.

Side View



Top View



Install the F3SN-A/F3SH-A with minimum Distance D shown above from reflective surfaces (highly reflective surfaces) such as metal walls, floors, ceilings, and work pieces.

Distance between emitter and receiver (Operating range L)	Minimum installation distance D
	F3SN-A/ F3SH-A
0. 2 to 3 m	0.13 m
over 3 m	L/2 × tan 2.5° = L × 0.044 (m)

Safety distance

Always maintain a safe distance (S) between the light curtain and a hazardous part of a machine.
Failure to do so causes the machine to fail to stop before an operator reaches the dangerous area and may result in serious injury.

Use of the floating blanking increases the size of the detection capability. To calculate a safety distance, be sure to use the increased size of the detection capability.
Failure to do so causes the machine to fail to stop before an operator reaches the dangerous area and may result in serious injury.

The "safety distance" is the minimum distance that must be maintained between the F3SN-A/F3SH-A and a hazardous part of a machine in order to stop the machine before someone or something reaches it. The safety distance is calculated based on the following equation when a person moves perpendicular to the detection zone of a light curtain.

Safety distance (S) = Intrusion speed into the detection zone (K)
× Total response time for the machine and light curtain (T)
+ Additional distance calculated based on the detection capability of the light curtain (C) ..... (1)

The safety distance varies with national standards and individual machine standards. The equation is also different if the direction of intrusion is not perpendicular to the detection zone of the light curtain. Be sure to refer to related standards.

F3SN-A Safety Light Curtain

Reference

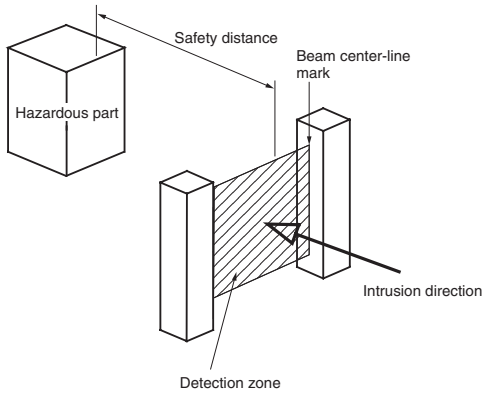
Method for calculating safety distance as provided by European Norm EN999 (for intrusion perpendicular to the detection zone)

Detection capaibility: 40mm or less

Substitute K = 2000 mm/s and C = 8 (d – 14 mm) in equation (1) and calculate as shown below.

S = 2000 mm/s × (Tm + Ts) + 8 (d – 14 mm) ..... (2)
Where: S = Safety distance (mm)
Tm = Machine response time (s) (See note 1)
Ts = Light curtain response time (s) (See note 2)

d = Detection capability of the light curtain (mm)



e. g.:
Tm = 0.05 s, Ts = 0.01 s, d = 14 mm:
S = 2000 mm/s × (0.05 s + 0.01 s) + 8 (14 mm – 14 mm) = 120 mm

Use S = 100 mm if the result of equation (2) is less than 100 mm. Recalculate using the following equation with K = 1600 mm/s if the result is over 500 mm.

S = 1600 mm/s × (Tm + Ts) + 8 (d – 14 mm).....(3)

Use S = 500 mm if the result from equation (3) is less than 500 mm.

Detection capability: over 40mm

Substitute K = 1600 mm/s and C = 850 mm in equation (1) and calculate as shown below.

S = 1600 mm/s × (Tm + Ts) + 850
Where: S = Safety distance (mm)
Tm = Machine response time (s) (See note 1)
Ts = Light curtain response time (s) (See note 2)

e. g.:
Tm = 0.05 s, Ts = 0.01 s:
S = 1600 mm/s × (0.05 s + 0.01 s) + 850 mm = 946 mm

Note: 1 . The machine response time refers to the maximum time from the moment the machine receives a stop signal to the moment the hazardous part of the machine stops. The machine response time should be measured on actual machines. The machine response time should be measured and confirmed periodically.

Response Time Table

Model	Protective height (mm)	Number of beams	Response time	
			ON to OFF	OFF to ON
F3SNA□□□□ P14(-01)	180 to 450	20 to 50	10.0 ms	40 ms
	459 to 765	51 to 85	12.5 ms	50 ms
	774 to 1080	86 to 120	15.0 ms	60 ms
	1089 to 1125	121 to 125	15.5 ms	62 ms

Model	Protective height (mm)	Number of beams	Response time	
			ON to OFF	OFF to ON
F3SN-A□□□□ P25(-01)	217 to 772	13 to 50	10.0 ms	40 ms
	787 to 1297	51 to 85	12.5 ms	50 ms
	1312 to 1822	86 to 120	15.0 ms	60 ms

Model	Protective height (mm)	Number of beams	Response time	
			ON to OFF	OFF to ON
F3SN-A□□□□ P40(-01)	217 to 757	7 to 25	10.0 ms	40 ms
	787 to 1297	26 to 43	12.5 ms	50 ms
	1327 to 1807	44 to 60	15.0 ms	60 ms

Model	Protective height (mm)	Number of beams	Response time	
			ON to OFF	OFF to ON
F3SN-A□□□□ P70(-01)	277 to 757	5 to 13	10.0 ms	40 ms
	817 to 1297	14 to 22	12.5 ms	50 ms
	1357 to 1777	23 to 30	15.0 ms	60 ms

- Response time for series connected types is calculated as follows: (F3SN-A)

  For 2 sets:

  Response time (ON to OFF): Response time of Light curtain 1 + Response time of Light curtain 2 + 3 ms

  Response time (ON to OFF): Response time of Light curtain 1 + Response time of Light curtain 2 + 12 ms

  For 3 sets:

  Response time (ON to OFF): Response time of Light curtain 1 + Response time of Light curtain 2 + Response time of Light curtain 3 + 4 ms

  Response time (ON to OFF): Response time of Light curtain 1 + Response time of Light curtain 2 + Response time of Light curtain 3 + 16 ms

- Response time of F3SP-B1P is 10 ms, operation time is 100 ms.

1 . The light curtain response time refers to the time required for output to change from ON to OFF.
2 . When using the F3SP-B1P, determine the safety distance by adding the response time of the F3SP-B1P to that of the F3SN given in the table above.

Reference

Method for calculating the safety distance as provided by ANSI B11. 19 (US)
Safety distance (S) = Intrusion speed into the detection zone (K)
Response time (Ts + Tc + Tr + Tbm) + Additional distance (Dpf)

Where:
K = Intrusion speed (Recommended value in OSHA standards is 1600 mm/s)
ANSI B11. 19. does not define Intrusion speed (K). When determining K, consider possible factors including physical ability of operators.
Ts = Time required for machine to stop (s)
Tr = Light curtain response time (s) (See note)
Tc = Maximum response time required for machine control circuit to apply brake (s)
Tbm = Additional time (s)
If the machine is provided with a brake monitor, Tbm = brake monitor setting time – (Ts + Tc). If not provided with a brake monitor, it is recommended to determine a value more than 20% of (Ts + Tc) as the additional time.
Dpf = Additional distance.
Dpf is calculated as follows based on ANSI standards:
Dpf = 3.4 × (d – 7.0) where d is the detection capability of the light curtain (mm).

e. g.:
Assume that: K = 1600 mm/s, Ts + Tc = 0.06 s,
Brake monitor setting time = 0.1s, Tr = 0.01s, d = 14 mm.
Then:
Tbm = 0.1 – 0.06 = 0.04 s
Dpf = 3.4 – (14 – 7.0) = 23.8 mm
S = 1600 × (0.06 + 0.01 – 0.04) + 23.8 = 199.8 mm

Note: The light curtain response time refers to the time required for output to change from ON to OFF.

Reference

Method for calculating the safety distance as provided by ANSI/RIA R15.06 (US) (for intrusion perpendicular to the detection zone)
Safety distance (Ds) = K × (Ts + Tc + Tr) + Dpf

Where:

K = Intrusion speed: 1600 mm/s min.

Ts = Maximum stop time of machine/equipment (s)

Tc = Maximum stop time of control system (s)

Tr = Light curtain response time (s)

Os = Diameter of the smallest detectable object (mm)

Dpf = Additional distance (mm)

Assume that the sensor is installed with the lowest beam height above the floor at 300 mm and the highest beam height above the floor at 1200 mm, with the diameter of the smallest detectable object being 64 mm or less. Then, Dpf is determined from:

Dpf = 3.4 × (Os – 6.875 mm).

If the diameter of the smallest detectable object is more than 64 mm, Dpf is calculated to be 900 mm.

e. g.:

• F3SN-A□□□□P40 Safety Light Curtain

Assume that K = 1600 mm/s, Ts + Tc = 0.06 s, Tr = 0.01 s, and Os = 40 mm.

Then:

S = 1600 × (0.06 + 0.01) + Dpf

= 1600 × (0.06 + 0.01) + 3. 4 (40 – 6.875)

= 225 mm

• F3SN-A□□□□P70 Safety Light Curtain

Assume that K = 1600 mm/s, Ts + Tc = 0.06 s, Tr = 0.01 s, and Dpf = 900 mm.

Then:

S = 1600 × (0.06 + 0.01) + 900

= 1012 mm

Note: The light curtain response time refers to the time required for output to change from ON to OFF.

F3SH-A Multi-beam Safety Sensor

Reference

Method for calculating safety distance as provided by European Norm EN999 (for intrusion perpendicular to the detection zone)

Substitute K = 1600 mm/s and C = 850 mm in equation (1) and calculate as shown below.

S = 1600 mm/s × (Tm + Ts) + 850

Where:

S = Safety distance (mm)

Tm = Machine response time (s) (See note 1)

Ts = Sensor response time (s) (See note 2)

e. g.:

Tm = 0.05 s, Ts = 0.01 s:

S = 1600 mm/s × (0.05 s + 0.01 s) + 850 mm = 946 mm

Note: 1 . The machine response time refers to the maximum time from the moment the machine receives a stop signal to the moment the hazardous part of the machine stops. The machine response time should be measured on actual machines. The machine response time should be measured and confirmed periodically.

2 . The sensor response time refers to the time required for output to change from ON to OFF.

Installation

How to prevent mutual interference

The emitter and the receiver to be set facing each other should be a pair of the same set. Erroneous combination may create a zone where objects cannot be detected.

Do not use the sensors for a system where the beam is reflected, or object detection may be disabled. In such an application, use a beam path diversion mirror to prevent the beam reflected from an object from entering the receiver.

When installing two or more pairs of the F3SN-A/F3SN-B/F3SH-A, take necessary measures to prevent mutual interference. Examples of such measures include electrical interconnection and the use of baffle plates.

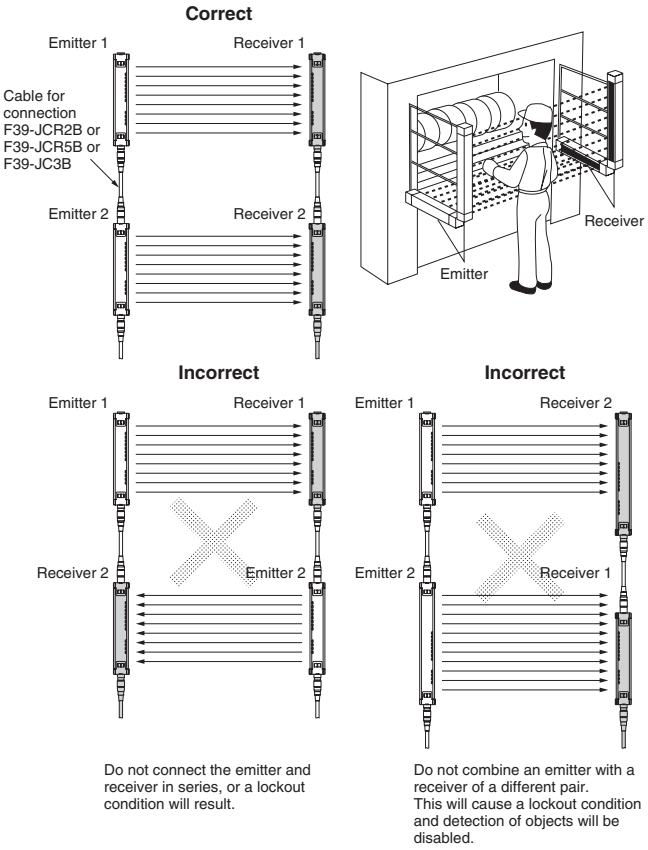
Correct Use

Installation

How to prevent mutual interference

Series connection (Up to 3 sets, 240 beams, sensor models ending in -01, -03, -04, and -05 are required for series connection)

Two or more pairs of the F3SN-A can be connected in series. When connected in series, the F3SN-A sensors generate beams in a time-sharing manner. Thus, they prevent mutual interference and ensure safety.



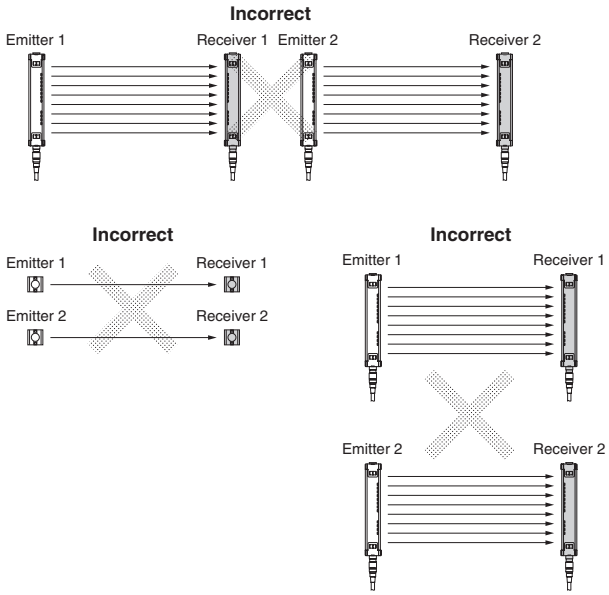
Do not connect the emitter and receiver in series, or a lockout condition will result.

Do not combine an emitter with a receiver of a different pair. This will cause a lockout condition and detection of objects will be disabled.

When not connected

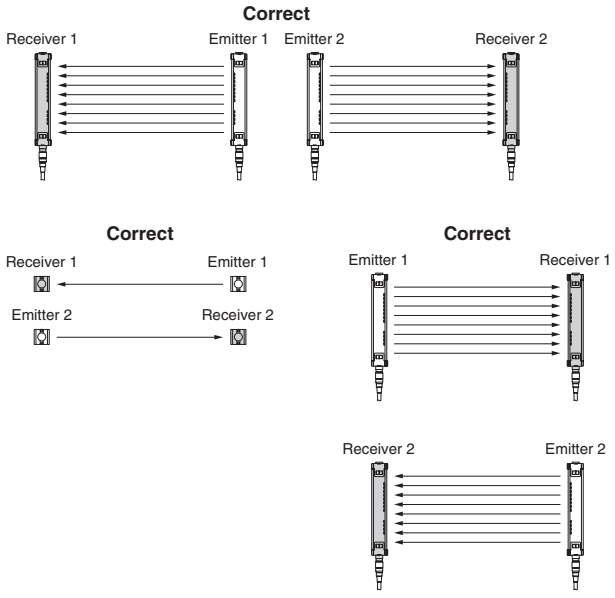
When installing two or more pairs of light curtains independently from each other due to inconvenience of wiring or other reason, take proper measures to prevent mutual interference. If mutual interference occurs, a lockout condition will result for the F3SN-A/F3SH-A.

• Installation which may cause mutual interference

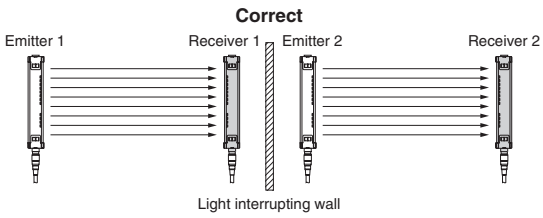


• Installation to prevent mutual interference

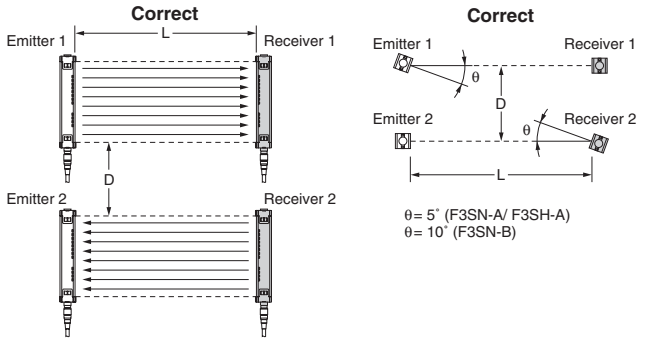
(1) Install so that the two light curtains emit in the opposite directions (staggered).



(2) Install a light interrupting wall in between sensors.



(3) Install the light curtains facing away from the one another to eliminate mutual interference.



Distance between emitter and receiver (Operating range L)	Minimum installation distance D
	F3SN-A/ F3SH-A
0. 2 to 3 m	0.26 m
over 3 m	L × tan 5° = L × 0.088 (m)

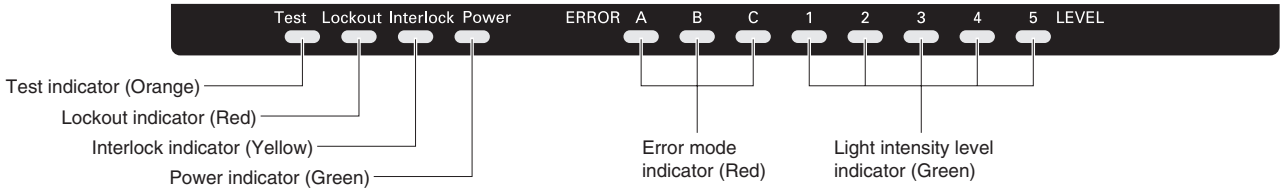
(4) Use a F39-HS spatter protection slit cover.

Operating range

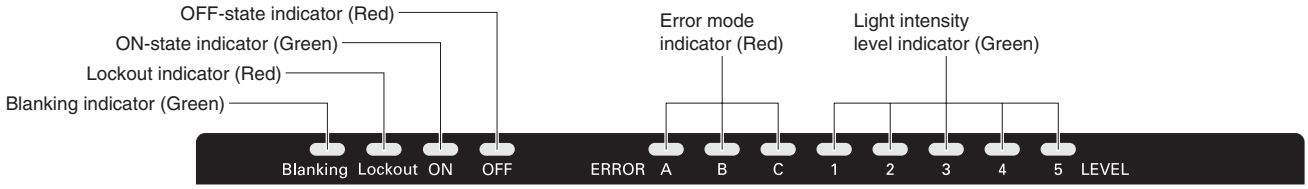
If the distance between the emitter and the receiver is less than 0.2 m, there is a possibility of chattering. Be sure to use the sensors within the rated operating range.

Names and Functions of Parts

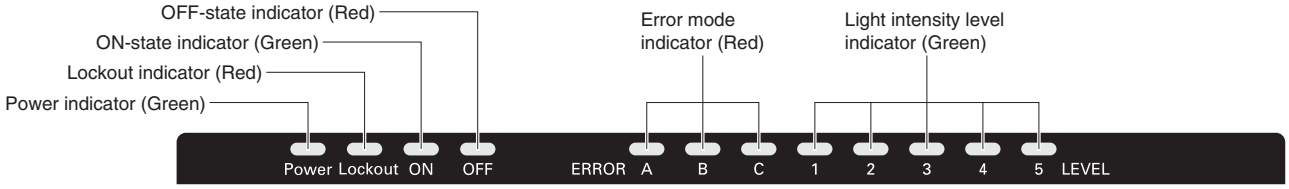
Emitter (F3SN-A/ F3SH-A)



Receiver (F3SN-A)



Receiver (F3SH-A)



Function

Power indicator	Lit when power is supplied (always lit) ..... F3SN-A, F3SH-A Emitter Lit when power is supplied, flashing when the F39-MC11 is connected ..... F3SH-A Receiver (see note)
Interlock indicator	Lit during interlock condition
Lockout indicator	Flashing during lockout condition
Test indicator	Lit during external test (see note)
ON-state indicator	Lit when OSSD outputs are in ON-state
OFF-state indicator	Lit when OSSD outputs are in OFF-state
Blanking indicator (F3SN-A only)	Lit when blanking is set, flashing when the F39-MC11 is connected (see note)

Note: As a preventive maintenance feature, these indicators will flash after a lapse of 30000 hours.

	1	2	3	4	5	Light intensity level
Light intensity level indicator Lit Not lit	●	●	●	●	●	200% and above of ON threshold level
	●	●	●	●	○	150 to 200% of ON threshold level
	●	●	●	○	○	100 to 150% of ON threshold level
	●	●	○	○	○	75 to 100% of ON threshold level
	●	○	○	○	○	50 to 75% of ON threshold level
	○	○	○	○	○	Less than 50% of ON threshold level

	A	B	C	Cause of error
Error mode indicator Flashing Not lit	●	○	○	The Interlock selection input line or the reset input line is not wired correctly or became open.
	○	●	○	Relay contact is welded. Releasing time of the relay takes too long. The EDM input line is not wired correctly or became open.
	○	○	●	Communication line (RS-485) is not wired correctly, became open, or causes other errors.
	●	●	○	One of the OSSD outputs is shorted or is not wired correctly. Other failure in OSSD outputs.
	○	●	●	Mutual interference. Interference light is received.
	●	○	●	Types of the receiver and emitter are not the same. Numbers of the receiver and emitter connected in series are not the same.
	●	●	●	External noise. Internal hardware failure of the receiver or the emitter.

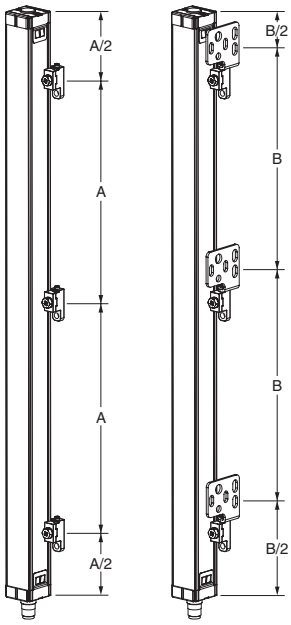
Installation

How to attach mounting bracket (F39-L19/L20)

To fully utilize the performance of sensors, locate the F39-L19/L20 mounting brackets in the number satisfying the dimensions “A” and “B” in the sensor longitudinal direction.

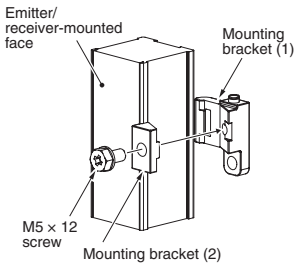
- For the F39-L19
  Spacing “A”: 670 mm max.
- For the F39-L20
  Spacing “B”: 400 mm max.

Note: When installing sensors at locations susceptible to vibration and shock, increase the number of mounting brackets.



Mounting bracket	Screw × length (mm)	Tightening torque
F39-L19	M5 × 12 screw	2.0 N·m
F39-L20	M4 × 8 screw	1.2 N·m

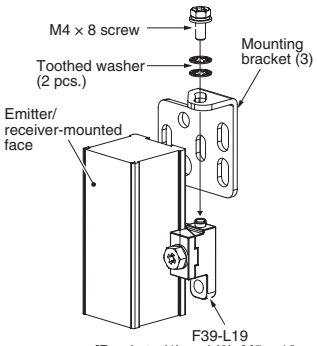
F39-L19



Brackets and screws included in one set

- Mounting bracket (1) 1
- Mounting bracket (2) 1
- M5 × 12 screw 1

F39-L20



Brackets and screws included in one set

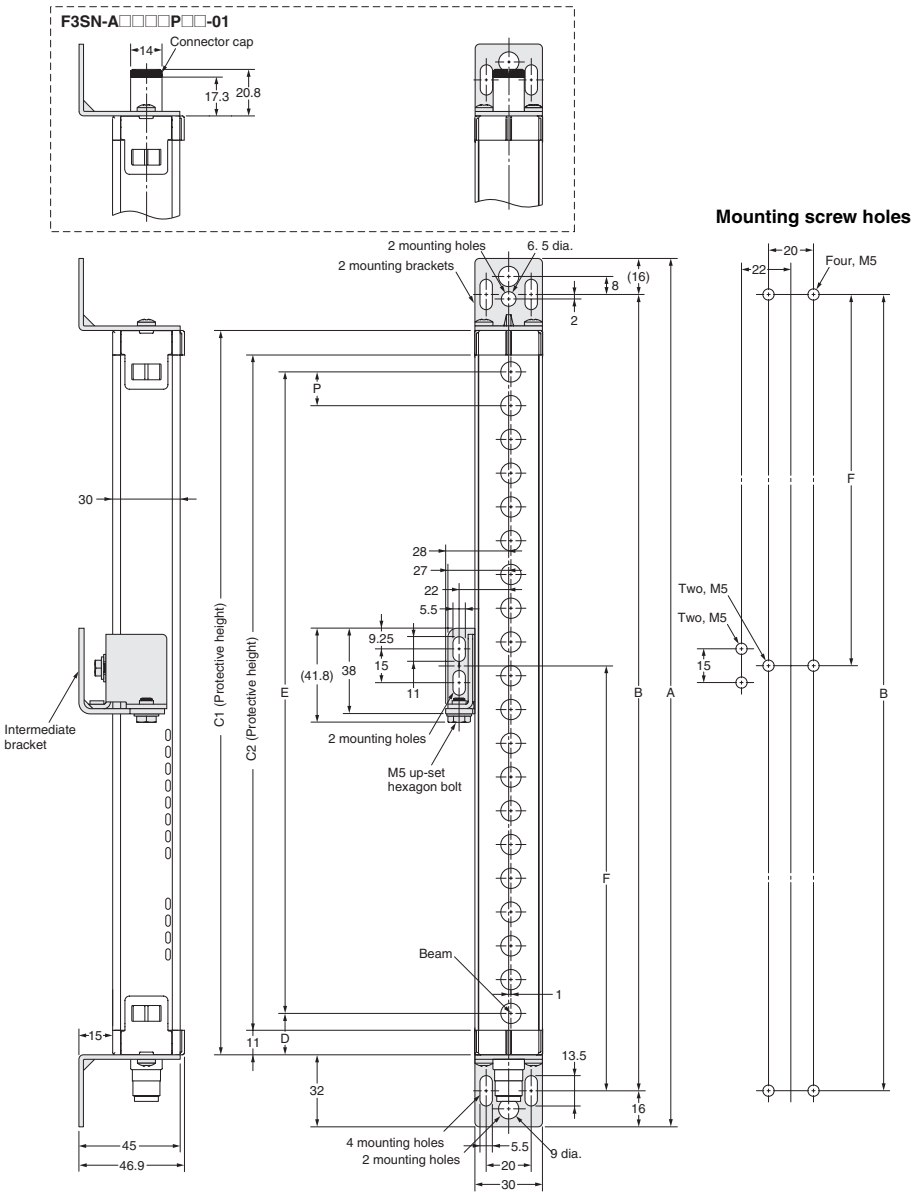
- Mounting bracket (1) 1
- Mounting bracket (2) 1
- M5 × 12 screw 1
- Mounting bracket (3) 1
- M4 × 8 screw 1
- Toothed washer 2

Dimensions

(Unit: mm)

Main unit

F3SN-A□□□□P□□
F3SN-A□□□□P□□-01



Dimensions according to the model can be calculated by using the following equations.

• F3SN-A□□□□P14(-01)

Dimension C2 (protective height): 4 digits in the model name
Dimension A = C2 + 86
Dimension B = C2 + 54
Dimension D = 15.5
Dimension E = C2 – 9
Dimension F: See the table below.
Dimension P = 9

C2 (protective height)	Number of intermediate mounting bracket	Dimension F (see note)
to 0620	0	——
0621 to 1125	1	F = B/2

Note: If value F obtained from the above equation is not used, set F to 670 mm or less.

• F3SN-A□□□□P25(-01)/P40(-01)/P70(-01), F3SN-B□□□□P25/P40/P70

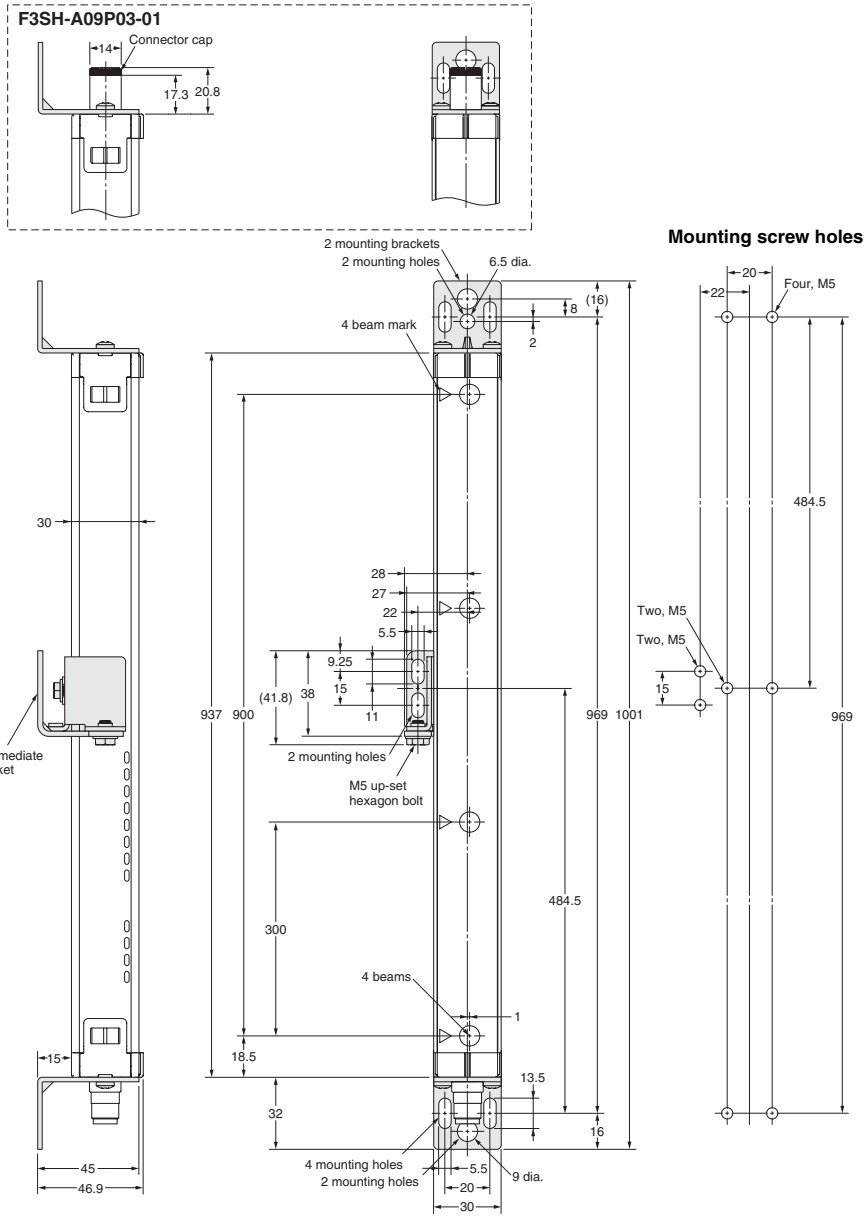
Dimension C1 (protective height): 4 digits in the model name
Dimension A = C1 + 64
Dimension B = C1 + 32
Dimension D = 18.5
Dimension E = C1 – 37
Dimension F: See the table below.

C1 (protective height)	Number of intermediate mounting bracket	Dimension F (see note)
to 0640	0	——
0641 to 1280	1	F = B/2
1281 to 1822	2	F = B/3

Dimension P: See the table below

Detection capability	Dimension P
25	15
40	30
70	60

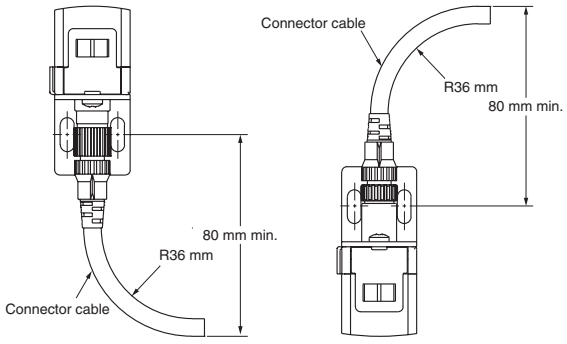
F3SH-A09P03
F3SH-A09P03-01



Mounting Precautions

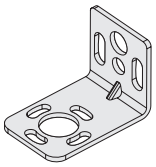
Note: 1 . The mounting bracket (3) (see Mounting brackets (intermediate)) is shown on the left-hand side of the sensor as an example. If the mounting bracket (3) is on the right-hand side of the sensor then the mounting holes must also be on the right-hand side.

2 . When using with the cable bent, allow at least the dimensions shown on the right.
(Minimum bending radius of cable: R36 mm.)



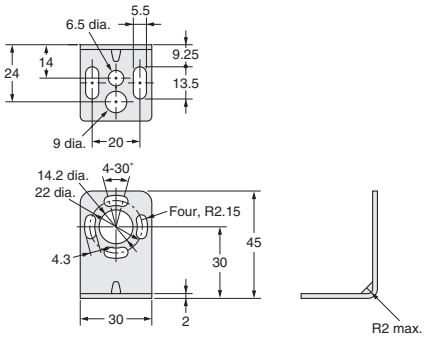
Accessories

Mounting brack et (top and bottom)

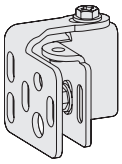


Material: Iron (zinc plating)

Note: Provided with the product.

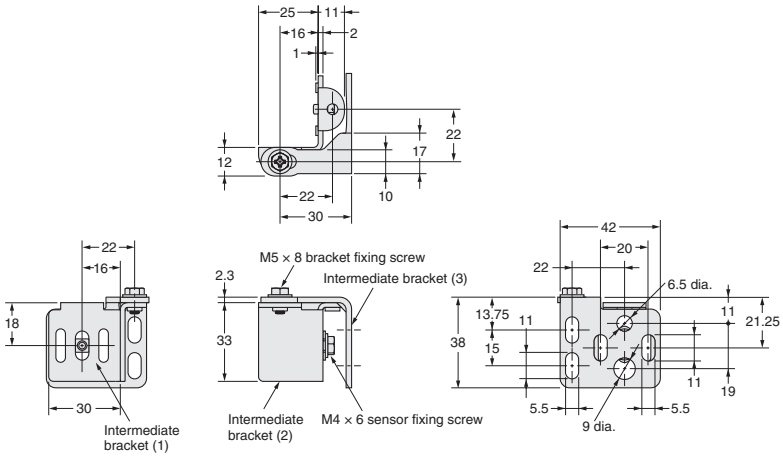


Mounting brackets (intermediate)



Material: Iron (zinc plating)

Note: Provided with the product.
The number of brackets required depends on the total length of the Sensor.

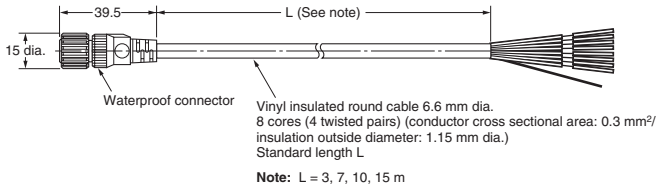


Accessories (Optional)

Single-ended connector cable

F39-JC3A (L = 3 m)
F39-JC7A (L = 7 m)
F39-JC10A (L = 10 m)
F39-JC15A (L = 15 m)

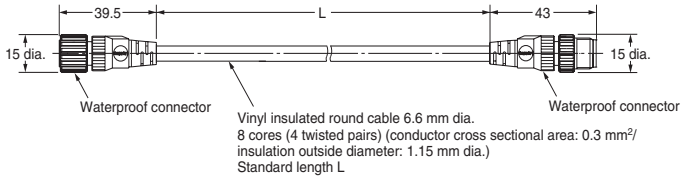
Color: Emitter (gray)
Receiver (black)



Double-ended connector cable

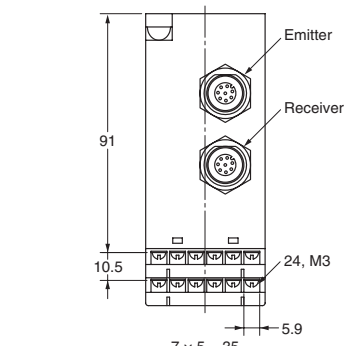
F39-JCR2B (L = 0.2 m)
F39-JCR5B (L = 0.5 m)
F39-JC3B (L = 3 m)
F39-JC5B (L = 5 m)
F39-JC7B (L = 7 m)
F39-JC10B (L = 10 m)
F39-JC15B (L = 15 m)
F39-JC20B (L = 20 m)
F39-JCR2C (L = 0.2 m)
F39-JC1C (L = 1 m)
F39-JC3C (L = 3 m)
F39-JC7C (L = 7 m)
F39-JC10C (L = 10 m)
F39-JC15C (L = 15 m)

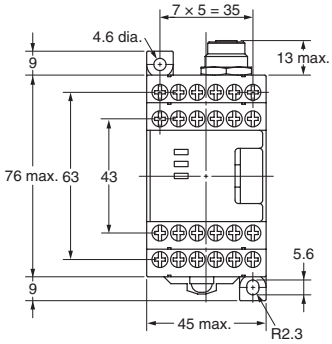
Color: Emitter (gray)
Receiver (black)

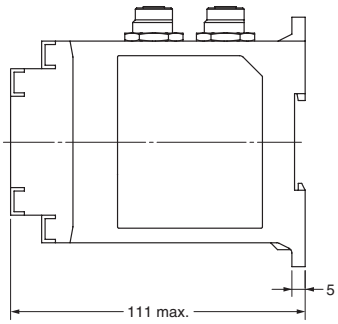


Control unit

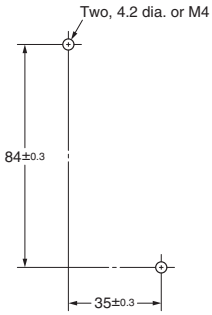
F3SP-B1P





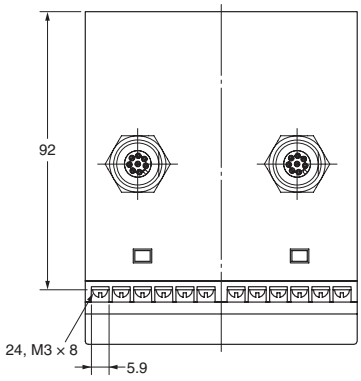


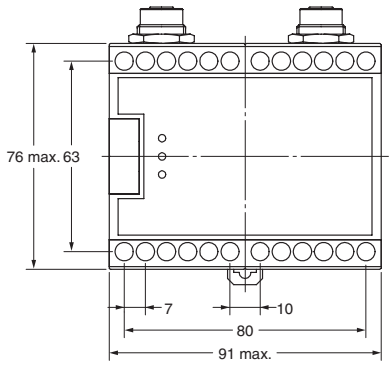
Mounting screw holes

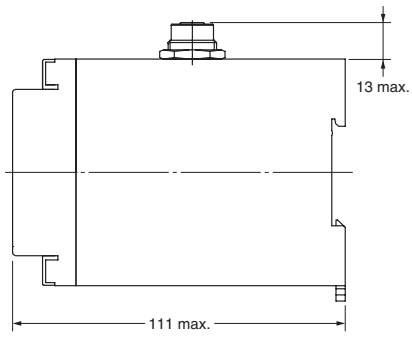


Safety relay unit

G9SA-300-SC

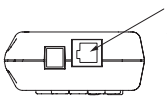


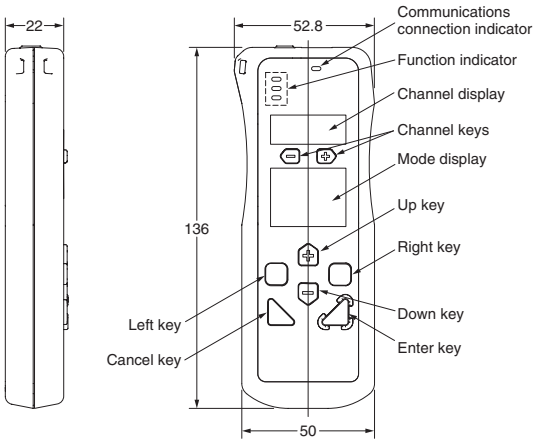




Setting console

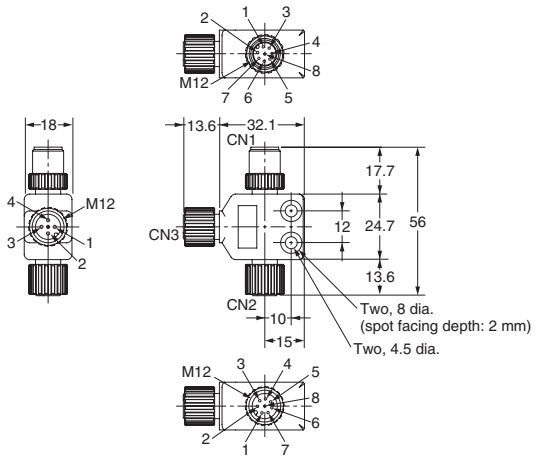
F39-MC11





Branching connector (supplied with F39-MC11)

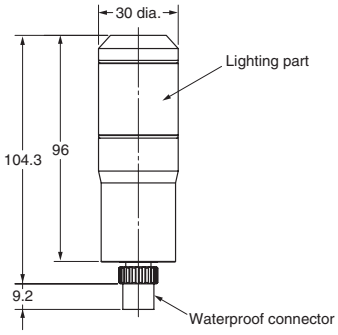
F39-CN1



CN1	Connector cable
CN2	Sensor
CN3	Setting console

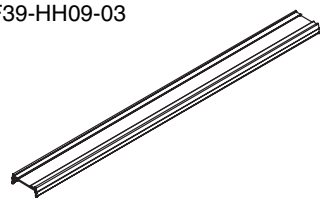
External indicator

F39-A01PR-L/-D
F39-A01PG-L/-D

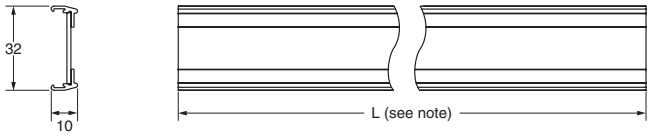


Spatter protection cover

F39-HN□□□□-14
F39-HN□□□□-25
F39-HH09-03



Protection cover

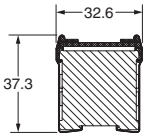


Note: L is as follows.

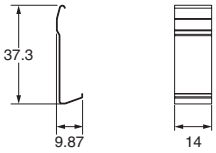
F39-HN□□□□-14	L = □□□□ mm
F39-HN□□□□-25	L = □□□□ – 22 mm
F39-HH09-03	L = 915 mm

Materials: PC (transparent area)
ABS (non-transparent area)

Mounting dimensions



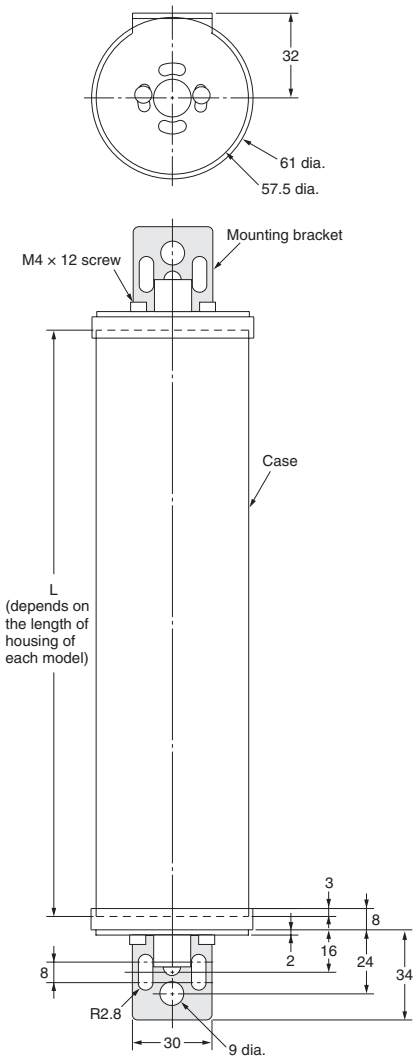
Fixing bracket



Materials: SUS

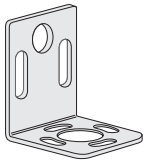
Environment-resistant enclosure

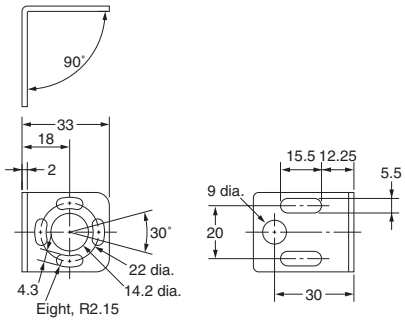
F39-HP□□□□-14
F39-HP□□□□-25
F39-HPH09-03



Wall mounting bracket

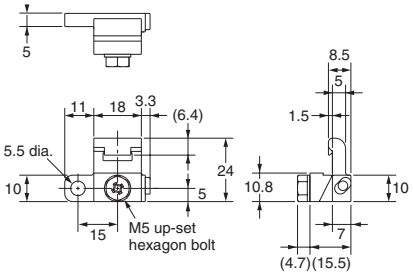
F39-L18



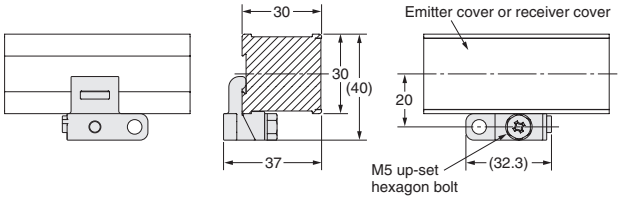


Free-location bracket

F39-L19

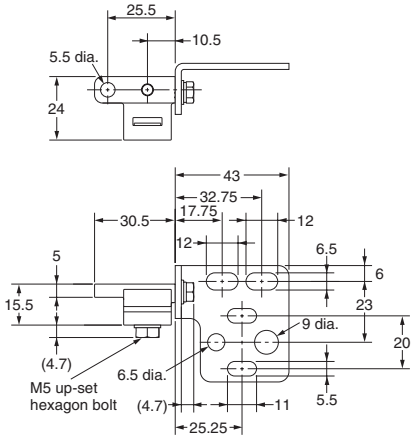


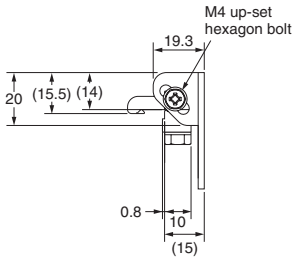
Mounting



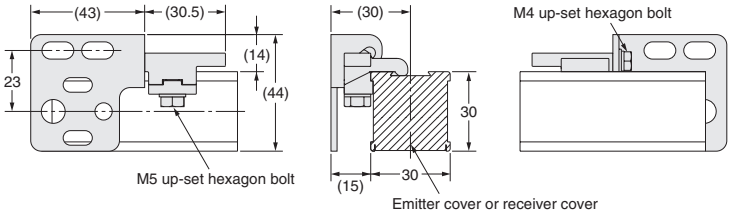
Free-location bracket

F39-L20

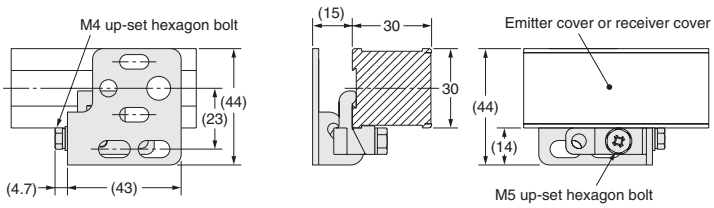




Side mounting



Back mounting



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

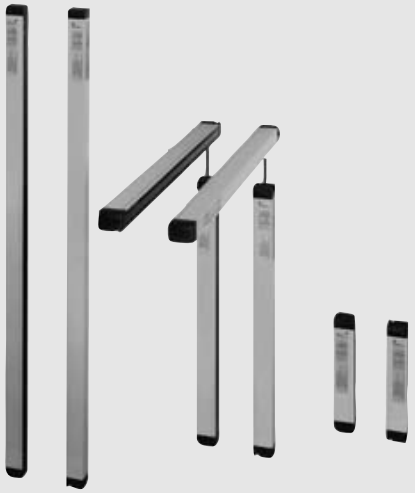
Cat. No. E700-EN2-01-X In the interest of product improvement, specifications are subject to change without notice.

Safety Light Curtain

F3S-B

Suitable for Detecting Human Bodies in a Dangerous Area

Safety Design for Category 2.



Features

- The F3S-B is a type 2 Safety Light curtain intended to be used as or with the safety related parts of the control system of a machine to category 2, 1 or B as defined in the European standard EN954-1.
- Compliance with IEC 61496-2, EN 61496-1 standards and machine and EMC directive.
- Received certificates from Notified Bodies as Type 2 ESPE (Electro-Sensitive-Protective-Equipment).
- UL/CSA approved.
- Pursuing safety with high level of safety design and FMEA.
- Series configuration of two units is possible.
- Units available with an axis pitch of 25 mm (hand protection), 50 mm (arm protection) or 75 mm (body protection) in protective height ranging from 300 mm to 1650 mm.
- Human body detection system without a dedicated control box.
- M12 Connector

Ordering Information

F3S-B [M] [36] [2] [P] [12] - [L]

- M: blank = Stand-alone; M = Master unit for series connection; S = Slave unit for series connection
- 36: No. of optical axis (4-66)
- 2: 2 = 25 mm optical pitch; 5 = 50 mm optical pitch; 7 = 75 mm optical pitch
- P: blank = Slave unit; P = PNP outputs
- L: blank = Complete set of emitter and receiver; L = Emitter unit only; D = Receiver unit only
- 12: blank = Stand-alone or slave unit; 12 = No. of optical axis of the connected slave unit
  for 25 mm optical pitch type: 12, 18, 24, or 30
  for 50 mm optical pitch type: 06, 09, 12, or 15
  for 75 mm optical pitch type: 04, 06, 08, or 10

Stand-alone	Master unit	Slave unit	Optical resolution	No. of optical axes	Protective height	Weight (without accessories)
F3S-B122P	F3S-BM122P□□	F3S-BS122	30 mm	12	300 mm	0.9 kg
F3S-B182P	F3S-BM182P□□	F3S-BS182		18	450 mm	1.2 kg
F3S-B242P	F3S-BM242P□□	F3S-BS242		24	600 mm	1.5 kg
F3S-B302P	F3S-BM302P□□	F3S-BS302		30	750 mm	1.8 kg
F3S-B362P	F3S-BM362P□□	-		36	900 mm	2.1 kg
F3S-B422P	F3S-BM422P□□	-		42	1,050 mm	2.5 kg
F3S-B482P	F3S-BM482P□□	-		48	1,200 mm	2.8 kg
F3S-B542P	F3S-BM542P□□	-		54	1,350 mm	3.1 kg
F3S-B602P	F3S-BM602P□□	-		60	1,500 mm	3.4 kg
F3S-B662P	F3S-BM662P□□	-		66	1,650 mm	3.7 kg
F3S-B065P	F3S-BM065P□□	F3S-BS065	55 mm	6	300 mm	0.9 kg
F3S-B095P	F3S-BM095P□□	F3S-BS095		9	450 mm	1.2 kg
F3S-B125P	F3S-BM125P□□	F3S-BS125		12	600 mm	1.5 kg
F3S-B155P	F3S-BM155P□□	F3S-BS155		15	750 mm	1.8 kg
F3S-B185P	F3S-BM185P□□	-		18	900 mm	2.1 kg
F3S-B215P	F3S-BM215P□□	-		21	1,050 mm	2.5 kg
F3S-B245P	F3S-BM245P□□	-		24	1,200 mm	2.8 kg
F3S-B275P	F3S-BM275P□□	-		27	1,350 mm	3.1 kg
F3S-B305P	F3S-BM305P□□	-		30	1,500 mm	3.4 kg
F3S-B335P	F3S-BM335P□□	-		33	1,650 mm	3.7 kg
F3S-B047P	F3S-BM047P□□	F3S-BS047	80 mm	4	300 mm	0.9 kg
F3S-B067P	F3S-BM067P□□	F3S-BS067		6	450 mm	1.2 kg
F3S-B087P	F3S-BM087P□□	F3S-BS087		8	600 mm	1.5 kg
F3S-B107P	F3S-BM107P□□	F3S-BS107		10	750 mm	1.8 kg
F3S-B127P	F3S-BM127P□□	-		12	900 mm	2.1 kg
F3S-B147P	F3S-BM147P□□	-		14	1,050 mm	2.5 kg
F3S-B167P	F3S-BM167P□□	-		16	1,200 mm	2.8 kg
F3S-B187P	F3S-BM187P□□	-		18	1,350 mm	3.1 kg
F3S-B207P	F3S-BM207P□□	-		20	1,500 mm	3.4 kg
F3S-B227P	F3S-BM227P□□	-		22	1,650 mm	3.7 kg

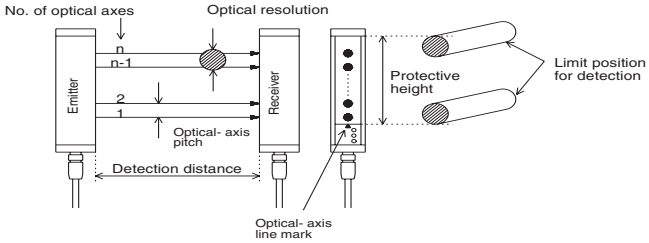
Nomenclature

Protective height

The F3S-B can detect in the area indicated by ”Protective height” in the figure below. The protective height is from ”the Optical-axis line mark above the indicator area” to ”the end of the yellow metal case”.

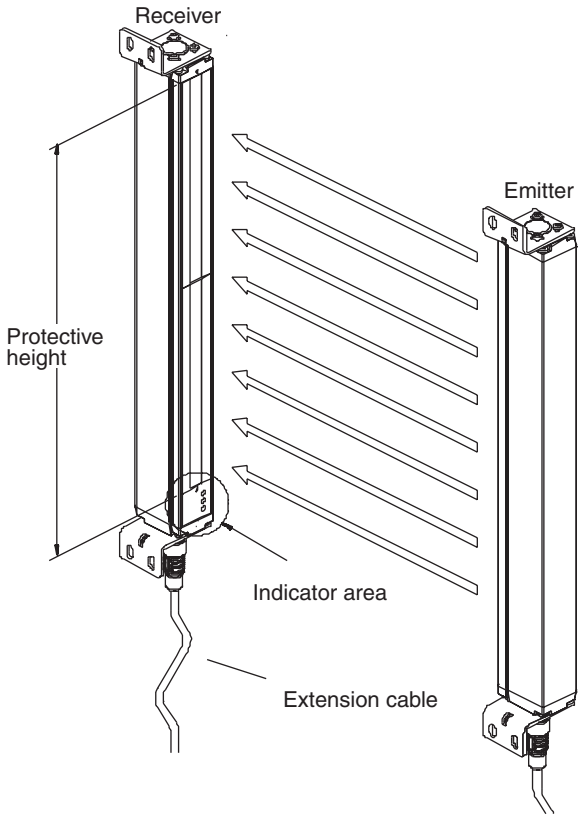
Optical-axis line mark

The center line for optical axes is indicated by the triangle mark. This position is a reference line for measuring safety distance.



Stand-alone type

This is the most common configuration, and it is used to protect a hazardous part of a machine when approached from one direction only.

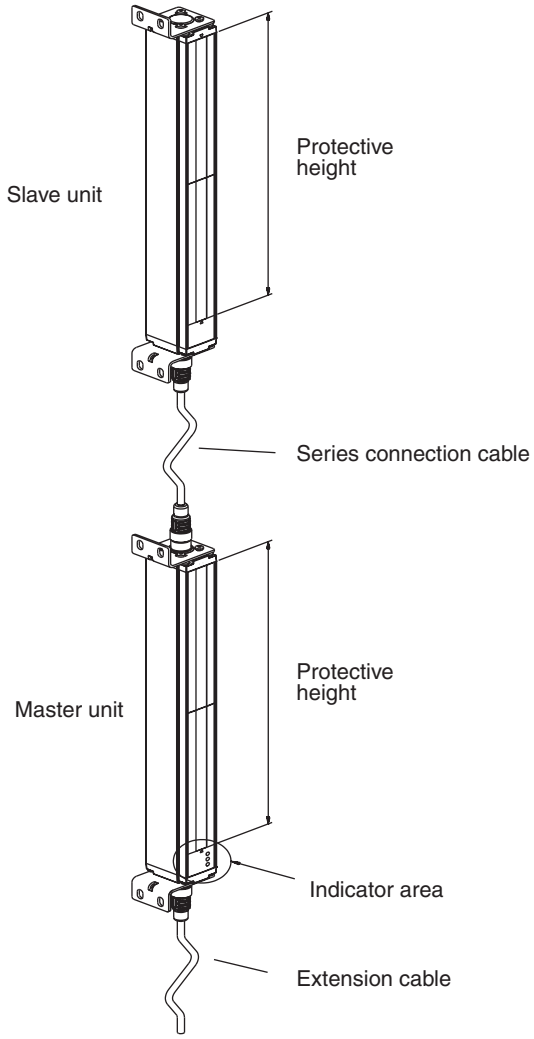


Series connection types

When your application requires an additional protective zone, for example, to prevent someone from staying behind a primary detection zone, the F3S-B may be connected in series. The system consists of a master unit, a slave unit, and a series connection cable, type F39-JB1B.

The series connection allows up to 96 axes and 2.4 m of protective height in total.

Series connection types have the same characteristics as a stand-alone types. When the detection zone of the master unit or that of the slave unit is interrupted, the outputs of the master unit go to the OFF-state.



Note: Slave unit does not have indicators.
Master unit and slave unit need to be ordered separately.

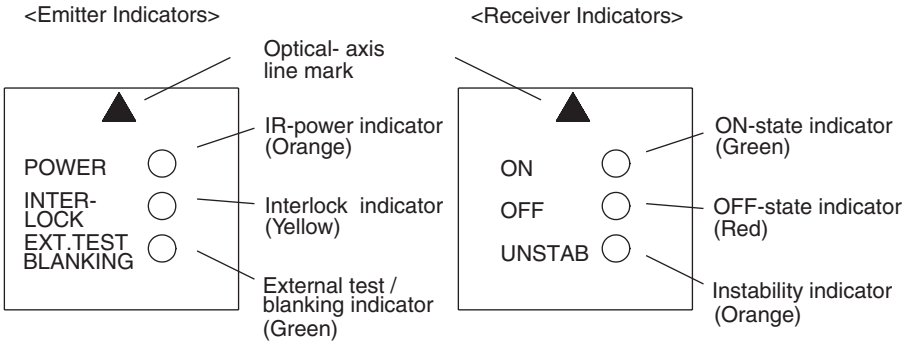
Rating and Performance

Type	F3S-B□□□P[*1] Stand-alone			F3S-BM□□□P□□ [*1] Master unit for series connection			F3S-BS□□□[*1] Slave unit for series connection		
No. of optical axes	12 to 66	6 to 33	4 to 22	12 to 66	6 to 33	4 to 22	12 to 30	6 to 15	4 to10
Optical-axis pitch	25 mm	50 mm	75 mm	25 mm	50 mm	75 mm	25 mm	50 mm	75 mm
Optical resolution (Detection capability)	Non-transparent: in diameter								
	30 mm	55 mm	80 mm	30 mm	55 mm	80 mm	30 mm	55 mm	80 mm
Protective height	300 / 450 / 600 / 750 / 900 / 1,050 / 1,200 / 1,350 / 1,500 / 1,650 mm						300 / 450 / 600 / 750 mm		
Detection distance	0.3 to 5.0 m, up to 8 m on request								
Response time	ON to OFF: See table “Response Time” OFF to ON[*2]: Default 100 ms (selectable with F39-U1E, 80 to 400 ms)								
Startup waiting time	2 s max.								
Supply voltage: Vs	24 VDC ± 20% (including 5 Vp-p ripple)								
Current consumption	400 mA max. (under no-load conditions)								
Light source	Infrared LED (880 nm wavelength). Lifetime: 50,000 hrs. at 25 °C.								
Effective aperture angle	Within ± 5° for the emitter and receiver at a detection distance of at least 3 m according to IEC 61496-2								
Operating mode	Light ON								
Control output	Two PNP transistor outputs, load current 200 mA max., residual voltage 2 V max. (except for voltage drop due to cable extension)								
Instability output	PNP transistor output (not safety-related control output), activated during an insufficient light detection, failure detection and connection with F39-E1, load current 100 mA max., residual voltage 2 V max. (except for voltage drop due to cable extension)								
Protection circuit	Output short-circuit protection, power supply reverse connection protection								
Start/restart interlock function	Mode selection before power ON by connecting ”Interlock selection input” line to: Active: No connection or 0 to 2.5 VDC, 3 mA max. Inactive: Instability output line Reset of start/restart interlock by connecting ”Interlock selection input” line to: Interlock reset: 17 VDC to Vs, 20 mA max. Duration time 15 to 2,500 ms								
External test function	Mode selection by connecting ”External test input” line to: Active: 17 VDC to Vs, 10 mA max. Duration time at least 15 ms Inactive: No connection or 0 to 2.5 VDC, 2 mA max.								
Relay monitoring function (optional)	Default inactive, selectable with F39-U1E Relay monitoring input line with NC contact connected, Available level: 17 VDC to Vs, 10 mA max. Allowed relay delay time[*3]: Selectable between 20 and 300 ms Termination when not selected: No connection or 0 to 2.5 VDC, 2 mA max.								
Start interlock function (optional)	Default inactive, selectable with F39-U1E								
Blanking function (optional)	Default inactive, selectable with F39-U1E								
Indicator	See ”Indicators”						No indicators		
Connection method	For Extension cable: 8 pins, M12 connector For Series connection cable: 6 pins, M12 connector								
Ambient temperature	During operation: –10 to 55 °C (with no freezing) During storage: –25 to 70 °C								
Ambient humidity	During operation: 35 to 85 %RH (with no condensation) During storage: 35 to 95 %RH								
Insulation resistance	20 MΩ min. (at 500 VDC)								
Dielectric strength voltage	1,000 VAC 50/60 Hz for 1 min								
Degree of protection	IEC60529 IP65								
Vibration resistance	Normal operation: 10 to 55 Hz, double-amplitude: 0.7mm, X, Y and Z directions 20 sweeps								
Shock resistance	Normal operation: 100 m/s^2 [10 G], X, Y and Z directions: 1000 times								
Materials	Case: Aluminum Front cover: PMMA (acrylic resin) End caps: PA6								
Size (cross section)	30 x 40 mm								

Type	F3S-B□□□P[*1] Stand-alone	F3S-BM□□□P□□ [*1] Master unit for series connection	F3S-BS□□□ [*1] Slave unit for series connection
Accessories	Test rod[*3], mounting brackets (top and bottom), mounting brackets (intermediate)[*4], mounting plates[*5], Instruction manual[*5]		
Applicable standard	IEC(EN)61496-1 TYPE 2 ESPE (Electro-Sensitive Protective Equipment) IEC 61496-2 TYPE 2 AOPD (Active Opto-electronic Protective Devices)		

Note: 1 . For detailed type names and optical specifications, see „Type Naming Rule“
2 . Nominal value (set time). The accuracy is -0 ... +70% of the ON to OFF response time.
3 . Only with F3S-B□□□2P and BM□□□2P□□.
4 . For the 1,050 mm protective height and longer types.
5 . Only with F3S-B□□□P□ and BM□□2P□□.

Indicators



Emitter	IR-power indicator: Interlock indicator: External test/ blanking indicator:	Lit when emitting. Lit during start/restart interlock or start interlock. Lit during external test. / Flashing when using blanking function.
Receiver	ON-state indicator: OFF-state indicator: Instability indicator:	Lit when receiving light. Lit with interrupted light. Flashing during connection with F39-E1 or with failure. Lit with an insufficient light reception or failure. Flashing during connection with F39-E1.

Table of Response Time

Stand-alone type

	Response time [ms]			Response time [ms]			Response time [ms]
F3S-B122P	20		F3S-B065P	20		F3S-B047P	20
F3S-B182P	20		F3S-B095P	20		F3S-B067P	20
F3S-B242P	20		F3S-B125P	20		F3S-B087P	20
F3S-B302P	23		F3S-B155P	20		F3S-B107P	20
F3S-B362P	27		F3S-B185P	20		F3S-B127P	20
F3S-B422P	30		F3S-B215P	21		F3S-B147P	20
F3S-B482P	34		F3S-B245P	22		F3S-B167P	20
F3S-B542P	37		F3S-B275P	24		F3S-B187P	20
F3S-B602P	41		F3S-B305P	26		F3S-B207P	20
F3S-B662P	45		F3S-B335P	28		F3S-B227P	21

Series connection types

The following chart shows the response time of combinations of a master unit and a slave unit connected in series. For example, the response time of the combination of F3S-BM122P30 and F3S-BS302 is 30 ms.

	Response time [ms]			
Slave unit F3S- Master unit	BS122	BS182	BS242	BS302
F3S-BM122P□□	20	23	27	30
F3S-BM182P□□	23	27	30	34
F3S-BM242P□□	27	30	34	37
F3S-BM302P□□	30	34	37	41
F3S-BM362P□□	34	37	41	45
F3S-BM422P□□	37	41	45	49
F3S-BM482P□□	41	45	49	54
F3S-BM542P□□	45	49	54	57
F3S-BM602P□□	49	54	57	61
F3S-BM662P□□	54	57	61	65

	Response time [ms]			
Slave unit F3S- Master unit	BS047	BS067	BS087	BS107
F3S-BM047P□□	20	20	20	20
F3S-BM067P□□	20	20	20	20
F3S-BM087P□□	20	20	20	20
F3S-BM107P□□	20	20	20	20
F3S-BM127P□□	20	20	20	21
F3S-BM147P□□	20	20	21	23
F3S-BM167P□□	20	21	23	24
F3S-BM187P□□	21	23	24	25
F3S-BM207P□□	23	24	25	26
F3S-BM227P□□	24	25	26	27

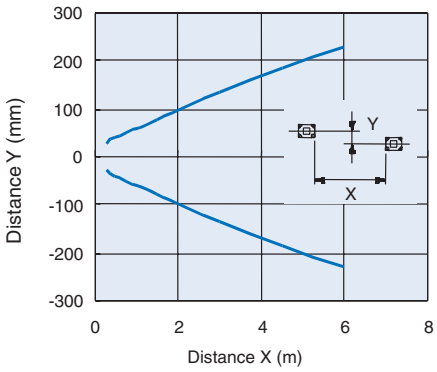
	Response time [ms]			
Slave unit F3S- Master unit	BS065	BS095	BS125	BS155
F3S-BM065P□□	20	20	20	21
F3S-BM095P□□	20	20	21	22
F3S-BM125P□□	20	21	22	24
F3S-BM155P□□	21	22	24	26
F3S-BM185P□□	22	24	26	28
F3S-BM215P□□	24	26	28	30
F3S-BM245P□□	26	28	30	32
F3S-BM275P□□	28	30	32	34
F3S-BM305P□□	30	32	34	35
F3S-BM335P□□	32	34	35	37

Characteristic data

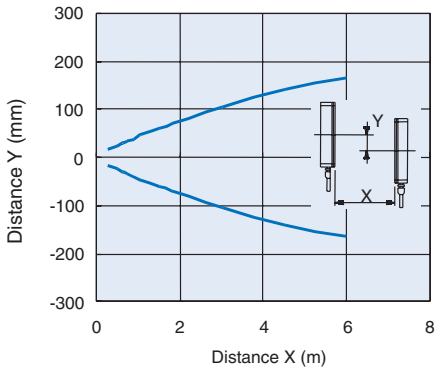
Operating Range

F3S-B122P

Parapendicular to Center Line of Lenses

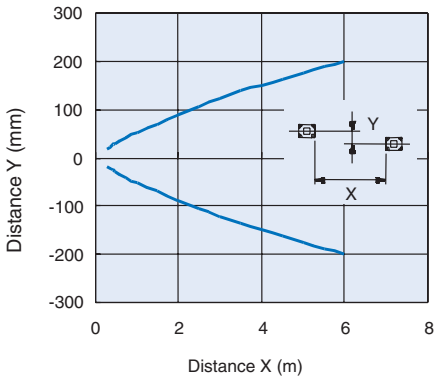


Parallel to Center Line of Lenses

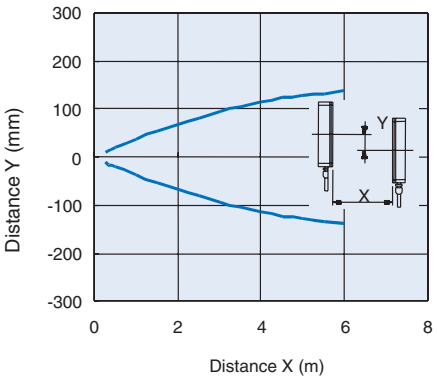


F3S-B662P

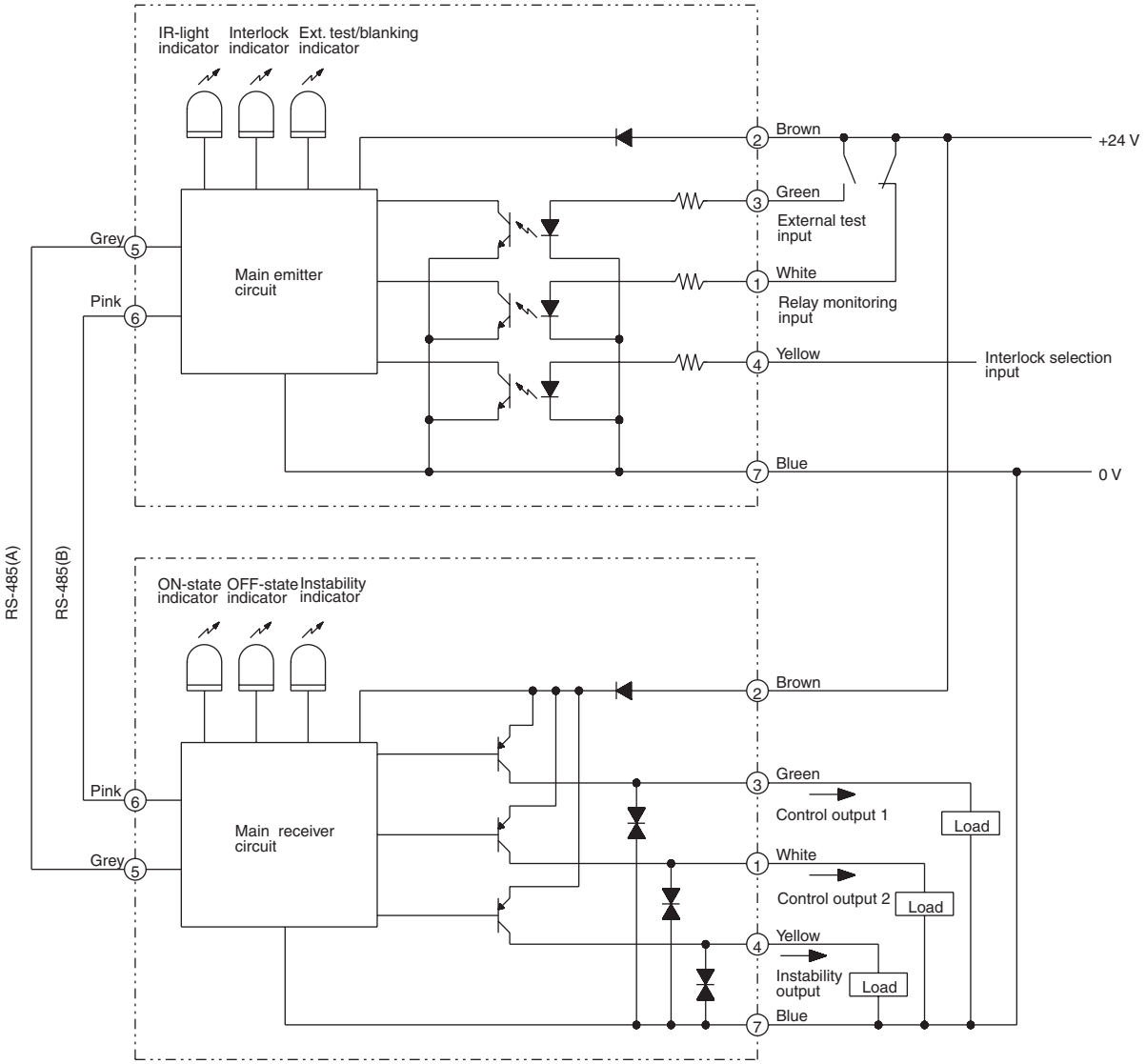
Parapendicular to Center Line of Lenses



Parallel to Center Line of Lenses



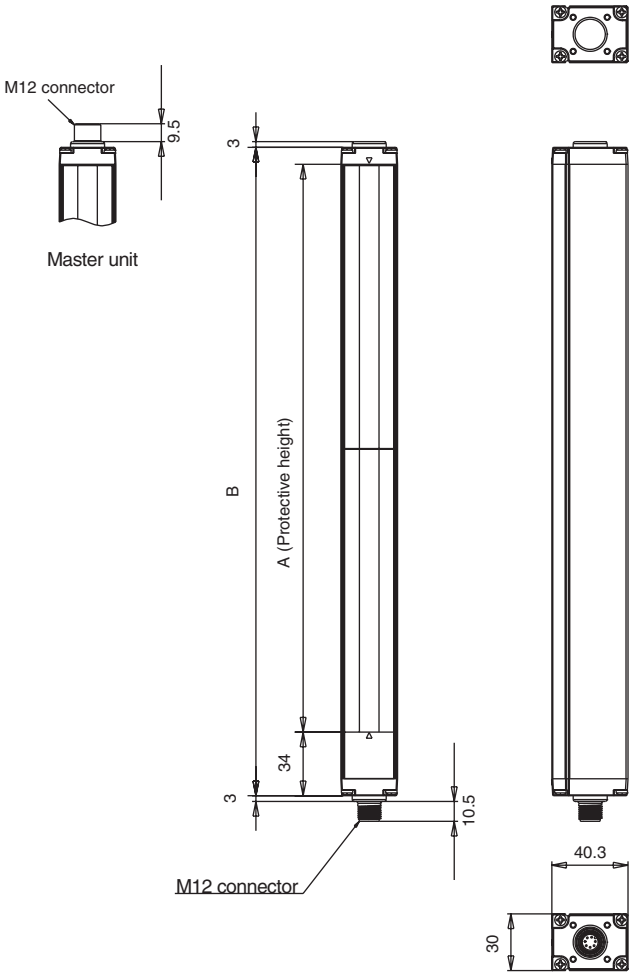
I/O Circuit Diagram



Dimensions

Safety Light Curtain

F3S-B

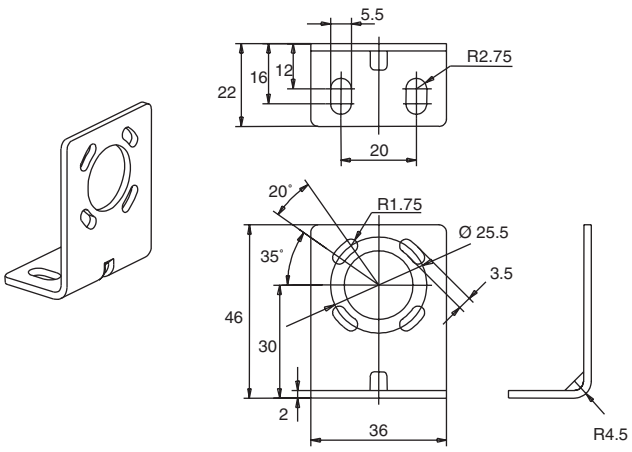


Type	**A** Protective height	**B** Full length
F3S-B122, -B065, -B047	300	343
F3S-B182, -B095, -B067	450	493
F3S-B242, -B125, -B087	600	643
F3S-B302, -B155, -B107	750	793
F3S-B362, -B185, -B127	900	943
F3S-B422, -B215, -B147	1050	1093
F3S-B482, -B245, -B167	1200	1243
F3S-B542, -B275, -B187	1350	1393
F3S-B602, -B305, -B207	1500	1543
F3S-B662, -B335, -B227	1650	1693

Note:All units are in Millimeters unless otherwise indicated.

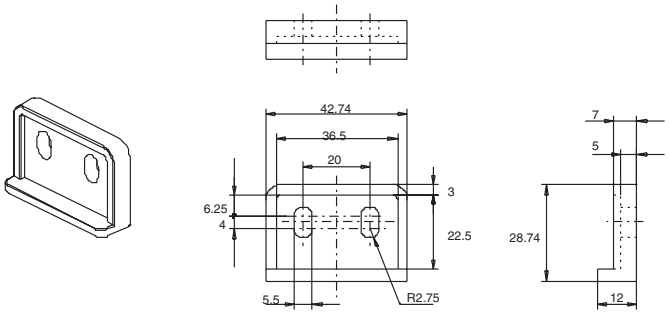
Accessoires

Mounting Bracket (Top and Bottom)



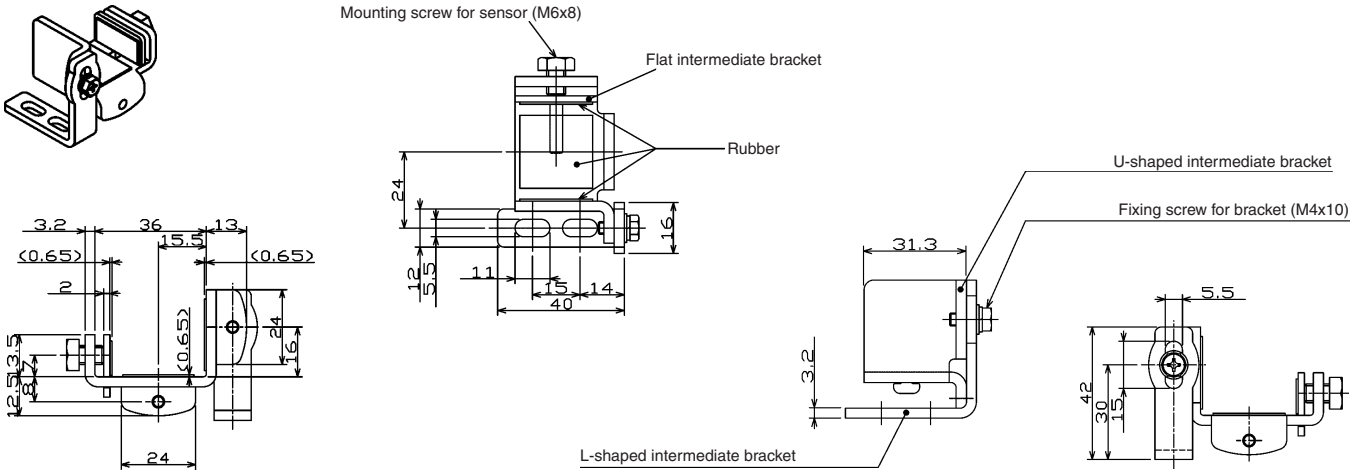
Mounting Plate

Only supplied with types which have a protective height of 1050 mm or longer (Including intermediate brackets). Only needed for rear mounting



Intermediate Mounting Bracket

Only needed for types which have a protective height of 1050 mm or longer

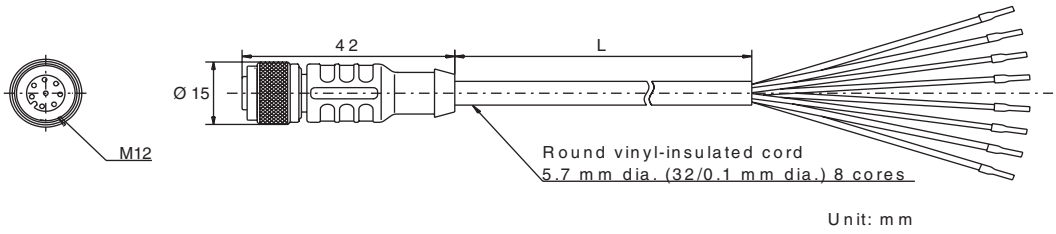


Options (Order Separately)

Extension Cable

(Set of 2: Emitter > gray, Receiver > black)

F39-JB1A (L = 3 m)
F39-JB2A (L = 7 m)
F39-JB3A (L = 10 m)

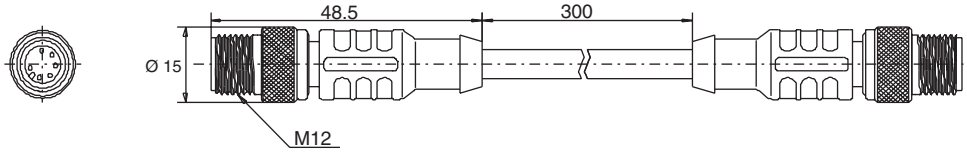


Unit: mm

Series Connection Cable

(Set of 2: Emitter > gray, Receiver > black)

F39-JB1B



Unit: mm

Optional Function Kit

F39-EU1E

This set includes the following items:

- F39-U1E OptionalFunction Software
- F39-E1 Interface Unit
- F39-JB1C Interface Cable

The F39-U1E Optional Function Software is the WINDOWS® -based software for use with the F39-E1 Interface Unit to program the F3S-B Safety Light Curtain, and provided with one 3.5 inch floppy disk. This software has the following features:

- Set the following functions to the F3S-B
  - Start interlock function
  - Relay monitoring function
  - Blanking function
- Display each axis and each input line condition of the F3S-B
- Change the ON delay time

Note: The F3S-B is not in normal operation during connection with the F39-E1. The control outputs are held in their OFF-state. For detailed information please refer to “Details of F39-EU1E” in this data sheet.

⚠ WARNING

After setting the blanking function, check that the F3S-B detects a test rod at any position in the F3S-B detection zone through which a person reaches the hazardous part of the machine. If any positions are found by check above, install protective structures to there to prevent intrusion which F3S-B can not detect. Failure to do so may result in serious injury.
Perform the installation check and the periodical inspection described in the F3S-B manual.
Disconnect the outputs of the F3S-B from the load when programming it using the F39-U1E software and with F39-E1 interface unit. Failure to do so may result in serious injury.
Do not connect the F39-E1 to a power supply with a voltage higher than 24 VDC +20 %. Do not connect the F39-E1 to an AC power supply.

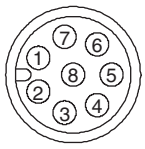
Installation

Wiring

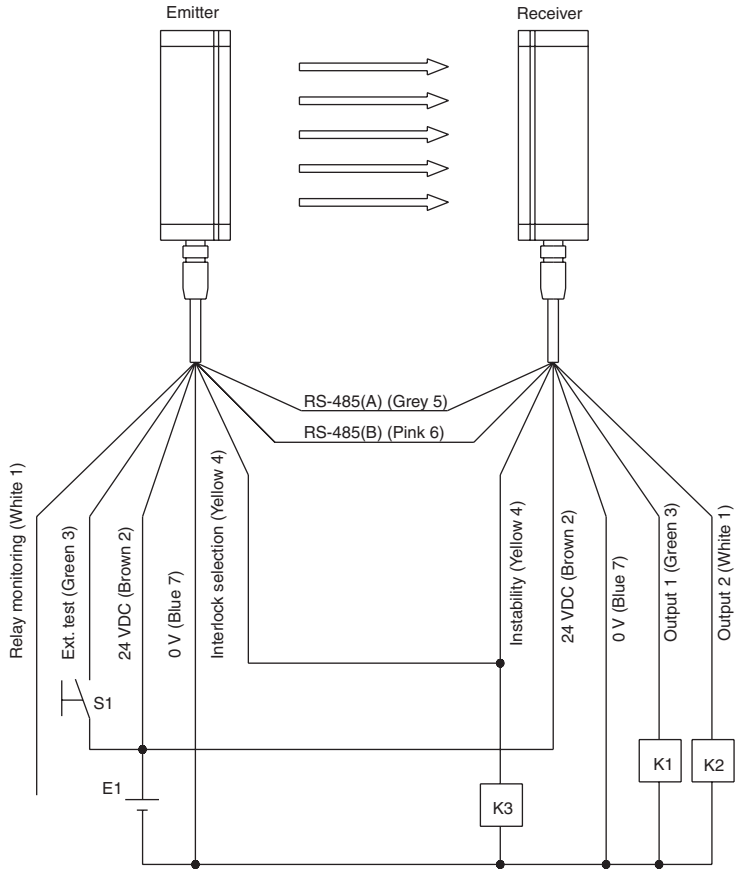
Disconnect all sources of power before wiring the F3S-B to a machine.

- Connect the emitter extension cable (F39-JBxA-L optional, gray color outer jacket) to the emitter. (The emitter uses gray color plastic caps.)
- Connect the receiver extension cable (F39-JBxA-D optional, black color outer jacket) to the receiver. (The receiver unit uses black color plastic caps.)
- Connect the 0 V line of the power supply directly to protective earth (PE).

Note: Note:Be sure to wire correctly. Failure to do so may damage the F3S-B.

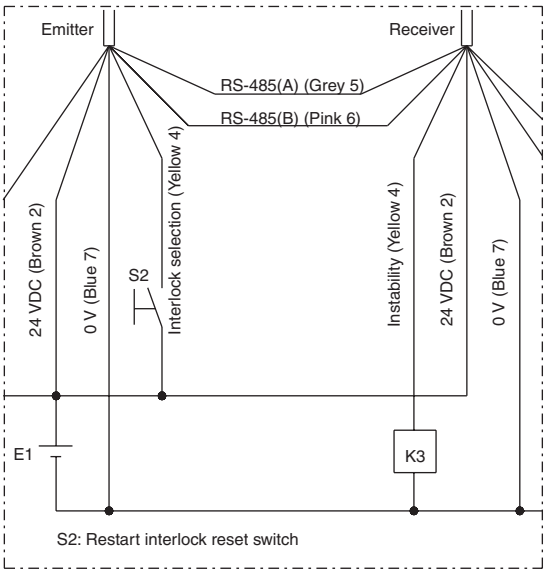
Front View	Pin No.	Signal Name		Wire Color of Extension Cable
		Receiver	Emitter	
	1	Control output 2	Relay monitoring input	White
	2	24 VDC	24 VDC	Brown
	3	Control output 1	External test input	Green
	4	Instability output	Interlock selection input	Yellow
	5	RS-485 (A)	RS-485 (A)	Grey
	6	RS-485 (B)	RS-485 (B)	Pink
	7	0 V	0 V	Blue
	8	N.C. / reserved*1	N.C. / reserved	Red

*1. N.C. / reserved: do not connect

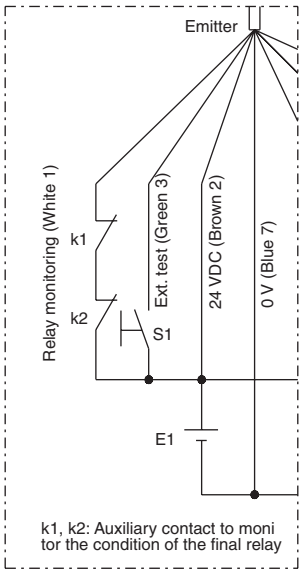


E1: 24 VDC Power supply
S1: External test switch
K1, K2: Relay
K3: Relay to indicate unstable condition

When using START/RESTART FUNCTION



When using optional RELAY MONITORING FUNCTION



Details of F39-EU1E Optional Function Kit

1. Installation

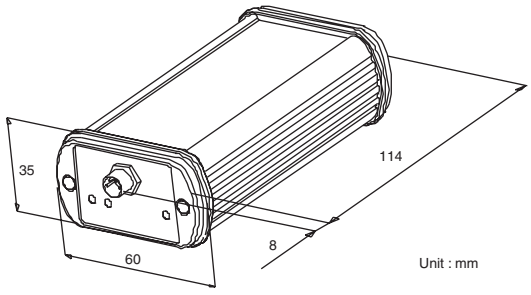
1.1 Preparation

⚠ WARNING

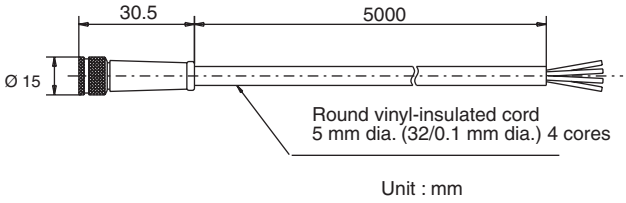
Perform the installation check and the periodical inspection described in the F3S-B manual.
Do not disassemble, repair or modify the F39-E1.
Do not use the F39-E1 in flammable or explosive environments.

To use the F39-U1E software, the following items are necessary.

- Personal Computer (not included)
  - Windows® 95, Windows® 98, or Windows NT®
  - 133MHz Pentium® processor or better
  - 32MB RAM or higher for Windows® 95 and Windows® 98
  - 64MB RAM or higher for Windows NT®
  - A 115kBd RS-232 serial interface port or better
- F39-E1 Interface Unit

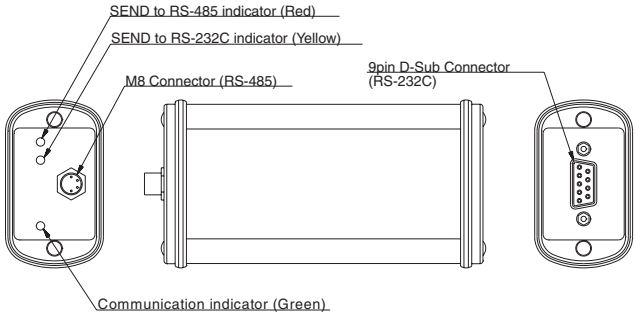


- F39-JB1C Interface cable 5 m cable length, M8 connector (4 pins)



- RS-232C cable (not included)

1.2 Component Names and Functions of the F39-E1 Interface Unit



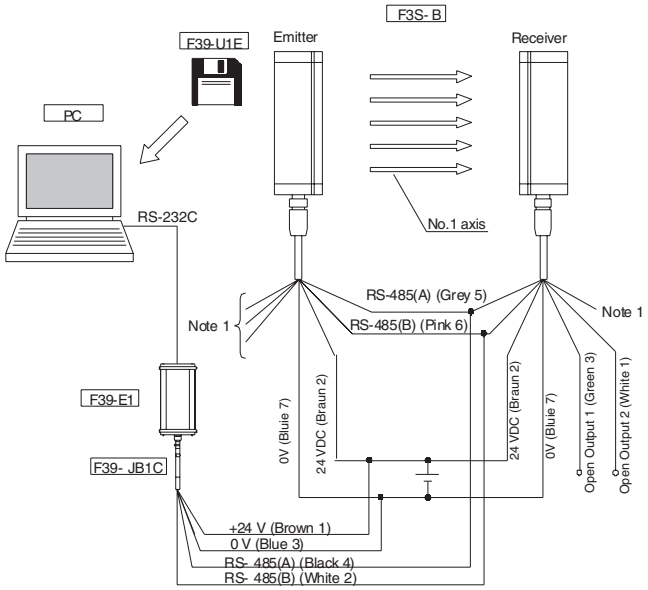
SEND to RS-485 Indicator (Red)
Lit when the F39-E1 sends data to the F3S-B via RS-485.
SEND to RS-232C Indicator (Yellow)
Lit when the F39-E1 sends data to the PC via RS-232C.
COMMUNICATION Indicator (Green)
Flashing during communication between the F3S-B and the F39-E1.

1.3 Hardware Connection

⚠WARNING

Disconnect the outputs of the F3S-B from the load when programming it using the F39-U1E software and with F39-E1 interface unit. Failure to do so may result in serious injury.
Do not connect the F39-E1 to a power supply with a voltage higher than 24 VDC +20 %.
Do not connect the F39-E1 to an AC power supply.

1.3.1 Wiring Diagram



Note 1: See the instruction manual of F3S-B for wiring

1.3.2 Wiring Procedure

1. Connect the F3S-B (see the instruction manual of the F3S-B for wiring.)
2. Connect the Interface cable (F39-JB1C) to the Interface unit (F39-E1).
3. Connect the 4 wires of the Interface cable to each appropriate line of the F3S-B.
4. Connect an RS-232C cable to the PC and the Interface unit.

1.4 Software-Installation

Copy the file „F39-U1E_ver#.#.exe“ and F39-U1E_ver#.#dat from the enclosed 3.5-inch floppy disk onto the hard disk of the PC.

2. Function Description

2.1 Start Interlock

When the Start interlock function is used, the F3S-B does not go to the ON-state automatically after power ON. Interrupting one or more axes resets the start interlock condition of the F3S-B then starts normal operation. The duration of the interruption must be equal or shorter as defined in the „Max. interruption time (sec)“.

Max. Interruption Time

The max interruption time can be set between 0.3 and 2 s.

Note: In the case both the Start interlock and the Start/restart interlock are selected, only the Start/restart interlock will be activate.

Start/Restart interlock is a function which is selected by wiring. Refer to the instruction manual of the F3S-B for more detailed information.

2.2 Relay Monitoring

MPCEs (Machine Primary Control Elements) are usually relays or contactors used to control hazardous movement directly. The state of the MPCEs can be checked with the Relay monitoring function.

A voltage of 17 VDC to Vs (Supplied voltage to F3S-B) has to be applied to the Relay monitoring input through the NC contacts of the MPCEs when the F3S-B control outputs are in the OFF-state (see the F3S-B manual for wiring information). To ensure this logic relation, the MPCEs must be safety approved types, with forcibly guided contacts.

Allowed Relay Delay Time

The allowed relay delay time can be set between 20 and 300 ms. This delay time has to be set at least 20 milliseconds shorter than the Outputs ON delay time.

2.3 Outputs ON Delay

You can set the ON delay time of control outputs between 80 and 400 ms. This corresponds to the time which the control outputs go to ON-state after the detection zone is not interrupted.

Note: 1 . When the Relay monitoring function is also used, the ON delay time must meet the formula below.
2 . ON delay time Allowed relay delay time + 20 ms After the Relay monitoring function is set, if the ON delay time does not meet the above formula, the ON delay time will be changed automatically into "Allowed relay delay time" + 20 ms.

2.4 Blanking

With the Blanking function, one or more axes can be disabled. This function is useful in an application where a part of the F3S-B detection zone is always interrupted. The Manual-setting and the Teaching-setting are available to select the blanked axes.

Note: 1 . In the case the blanked zone is not filled with structure completely and remains some opening, the opening must be filled with the protective structure.
2 . All axes can not be disabled. At least one axis needs to be active.

3. Ratings and Performance

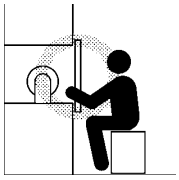
Type	F39-E1 Interface unit
Supply voltage	24 VDC ± 20% (including 5 Vp-p ripple)
Current Consumption	120 mA max.
Interface	RS-232C interface, RS-485 interface
Indicator	See 1-2
Connection method	RS-485: 4pins, M 8 connector
	RS-232C: D-SUB connector, 9 pins
Protection circuit	RS 485 protection against wrong wiring
Ambient Temperature	During operation: –10 to 55° C (with no freezing)
	During storage: –25 to 70° C
Ambient Humidity	During operation : 35 to 85% RH (with no condensation)
Ambient Humidity	During storage: 35 to 95% RH
Insulation Resistance	20 MΩ min. (at 500 VDC)
Dielectric strength voltage	500 VAC 50/60 Hz for 1 min.
Degree of Protection	IEC60529 IP20
Shock resistance	Normal operation: 150 m/s^2 [15 G], ±X, ±Y and ±Z directions: 3 times
Vibration resistance	Normal operation: 10 to 55 Hz, double-amplitude: 0.3mm, X, Y and Z directions: 10 sweeps
Cable length	RS-485 cable: 5 m (4 pin 0.25 mm^2)
	RS-232C cable: Standard
Materials	Case: Aluminum
Size	122 x 60 x 35 mm
Conformity	EMC Directive

Precautions

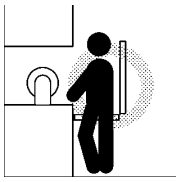
⚠WARNING

1. Do not use the F3S-B on machines that can not be stopped by electrical control in case of an emergency.
2. Do not use the F3S-B in flammable or explosive environments
3. Always maintain the safety distance between F3S-B and a hazardous part of the machine. Serious injury may result if the machine does not stop before someone reaches the hazardous part.
4. Install protective structures around a machine so that you must pass through the detection zone to reach a hazardous part of the machine.
5. Install F3S-B so that some parts of the operator's body remain in the detection zone at all times when the operator works in the hazardous area.
6. Failure to do so may result in serious injury.

Correct installation



A hazardous part of a machine can be reached only by passing through the sensor detection zone.



Some part of the operator's body remains in the detection zone while they are working.

Incorrect installation

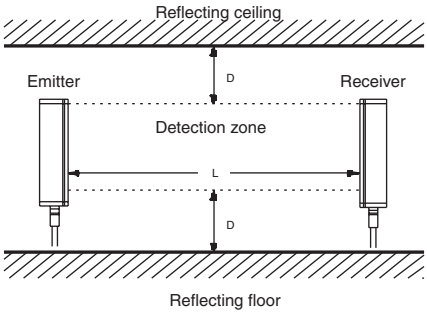
A hazardous part of the machine can be reached without passing through the sensor detected zone.

A worker is between the sensor detection zone and a hazardous part of a machine.

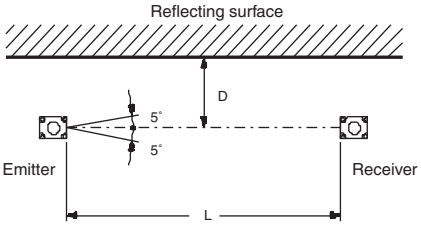
⚠WARNING

1. Be sure to install the F3S-B to minimize the effects of reflections from reflective surfaces. Failures to do so will create an inability to detect and may result in serious injury
2. Install the F3S-B with a minimum distance D as shown below form the reflective surface (highly reflective surfaces) like metal walls, floors, ceilings, and work pieces.

<Side View>



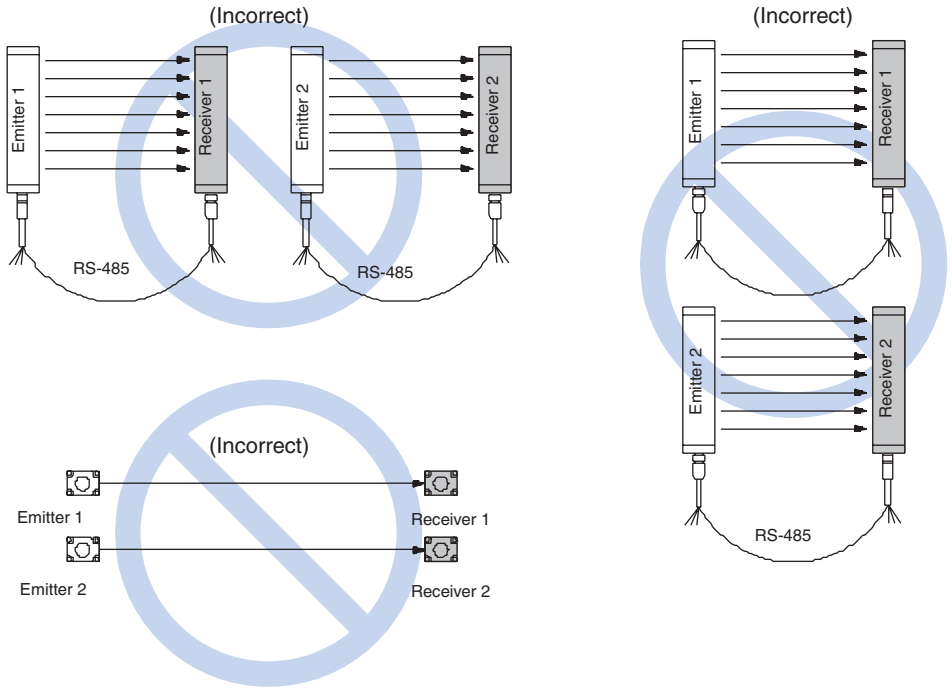
<Top View>



Distance between emitter and receiver (detection distance L)	Minimum installation distance D
0.3 to 3 m	0.26 m
3 to 5 m	L x tan 5° = L x 0.088 (m)

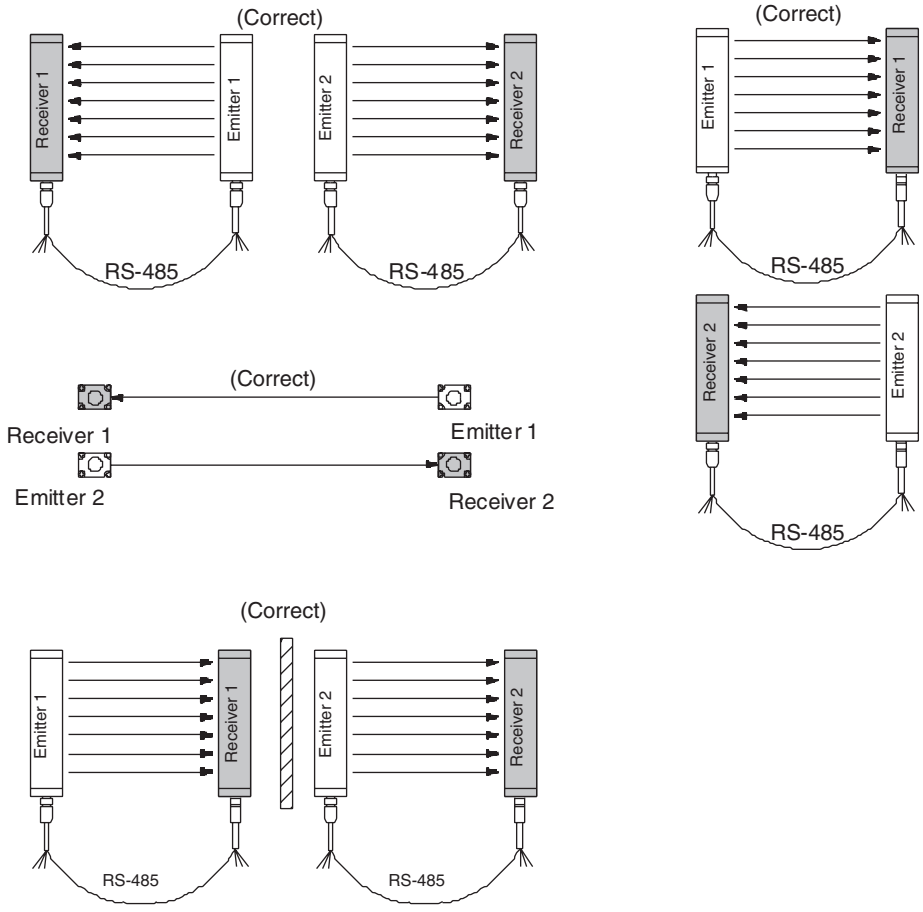
⚠WARNING

When using multiple sets of the F3S-B, install them so that mutual interference is not incurred.



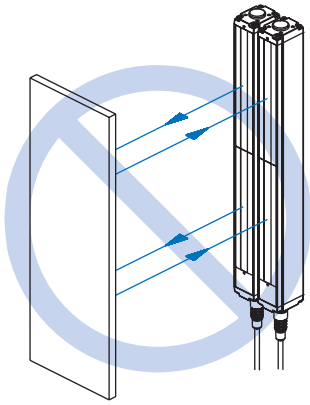
Alternate emitters and receivers

Correct installations are shown below to prevent mutual interference.



⚠WARNING

1. The F3S-B is a TYPE 2 Electro-sensitive protective equipment, intended to be used as or with the safety related part of control system to category 2, 1 or B as defined in the European standard EN954-1.
   Do not use the F3S-B in category 3 or 4 systems.
2. A qualified person, as determind by local regulations, must confirm that installation, inspection and maintenance are implemented correctly.
3. Do not short the output lines to the +24 V line. Doing so will cause the output to be always ON, creating a hazardous situation.
4. Do not connect the F3S-B to a power supply with voltage higher than 24 VDC + 20%. Do not connect the F3S-B to an AC power supply.
5. Be sure to conduct inspections regularly.
6. The F3S-B cannot be used in applications where hazardous projectiles may exit the protected zone.
7. Do not disassemble, repair or modify the F3S-B.
8. DC power supply units must satisfy all of the conditions below so that the F3S-B can comply with the applicable standards IEC 61496-1 and UL 508.
   (1.) The power supply voltage must be within rating (24 VDC ± 20%).
   (2.) The power supply is connected only to the F3S-B and to the electro-sensitive protective function of the F3S-B, such as a safety controller and muting sensors, and it has enough rated current for all the devices.
   (3.) The power supply uses double or reinforced insulation between the primary and secondary circuits.
   (4.) The power supply automatically resets overcurrent protection characteristics (voltage drop).
   (5.) The power supply maintains an output holding time of at least 20 ms.
   (6.) FG (frame ground terminal) must be connected to PE (protective earth) when using a commercially available switching regulator.
   (7.) The power supply must have output characterisitics required for the power source for Class 2 Circuit or Limited Voltage / Current Circuit as defined in UL508.
   (8.) The power supply must conform to regulatory requirements and standards, regarding EMC and electrical equipment safety, of the country where the F3S-B is installed and where machinery will be operated, for example: The EMC Directive (industrial environment) and the Low Voltage Directive in EU.
9. Do not use the F3S-B in a direct retroreflective configuration. Otherwise detection may fail.



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

Cat. No. E503-E2-01-X

Safety sensor for Palletisers

F3S-TGR-SB□C series

Features

For Palletiser

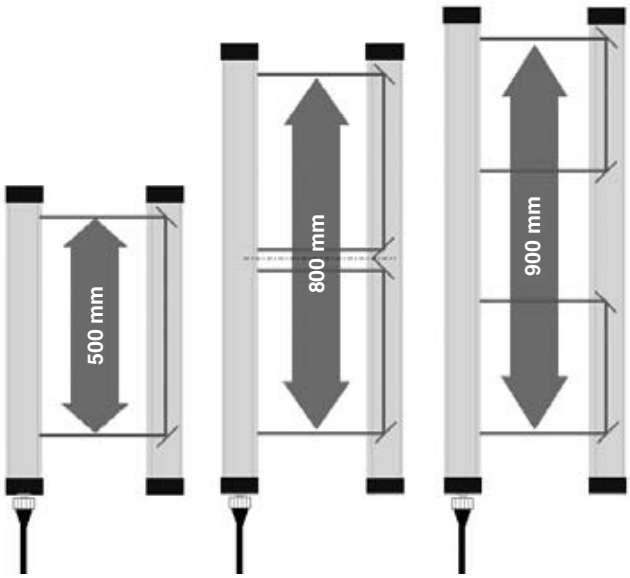
F3S-TGR-SB□C series has been developed especially for Palletisers and wrapping machine access protection applications.

Active - Passive system and Plug and play

By using a mirror system we can achieve an active - passive multi beam system. This active passive system will improve installation time and reduce costs.

3 Different types available

We provide 3 different Types as following:
- 2 beam Type (beam pitch 500 mm)
- 3 beam Type (beam pitch 400 mm)
- 4 beam Type (beam pitch 300 mm)



Muting functions are integrated

Following Muting functions are integrated:
- Muting sensor inputs
- Muting Lamp output
- Override input (120 second max)
- Test / Reset input
- Interlock function and Test Reset input

Decentralized Muting connection Box

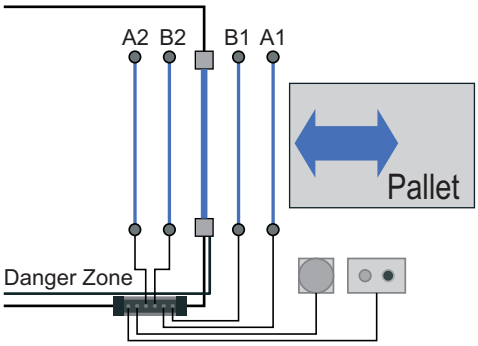
Furthermore, using a F39-TGR-SB-CMB1, it's possible to reduce the wiring time and wiring material for the muting Sensors and Muting Lamp etc.

Ex. 1 Ex. 2

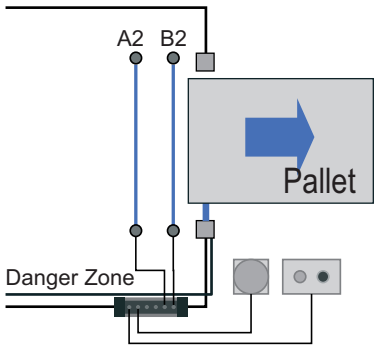
In the conventional solution all wires from the light curtain, mute sensors, lamp, reset are wired back to the mute controller in the control cabinet (See Ex. 1)
As you can see this solution need JUST ONE WIRE to the cabinet (See Ex. 2)

Multiple mute connections are possible

1. PARALLEL MUTING and TWO WAY direction

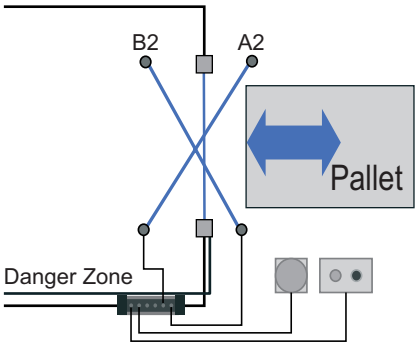


2. PARALLEL MUTING and ONE WAY direcion

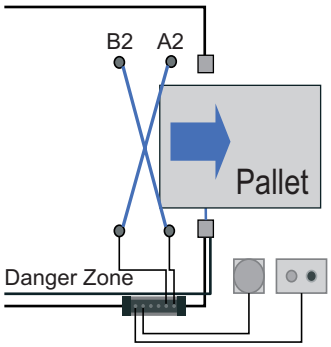


Please add MTL*. Ex. F3S-TGR-SB4-K1CMTL

3. CROSS MUTING and TWO WAY direction



4. CROSS MUTING and ONE WAY direction



Please add MTL*. Ex. F3S-TGR-SB4-K1CMTL

Reference

Muting Lamp | Override and Test Switch | F3S-TGR-SB□-K□C | Muting sensor | F3S-TGR-SB-CMB□

Mechanical Guard

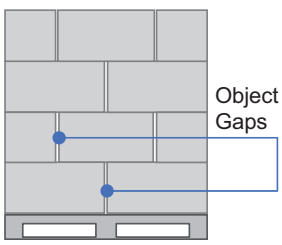
***MTL** has a special software inside of F3S-TGR-SB□C which works to finalize a Muting function.

Muting Sensors Recommendation

It is recommended to use the E3Z or E3G as muting sensor. Please refer to the E3Z datasheet *Cat.No. E701-E2-Cat04-01* and the E3G datasheet *Cat.No. E278-E2-Cat04-03*.

SOLUTION 1: Object Gaps

In many palletiser applications there is a gap between objects on the pallet. The Muting function may not work correctly because of this gap. To avoid the mutual interruption, we recommend to Use E3G□□□□T as muting sensor. E3G-□□□□T has ON delay timer internally (0 to 5 seconds)



SOLUTION 2: Misalignment of pallets

When using a CROSS MUTING system, It may cause that unexpected behavior when the pallets get out of alignment then E3G□□□□T also solves the problem by OFF delay timer (0 to 5 seconds).

List of Models

Safety Multi beam Sensors

F3S-TGR-SB2-K□C Mirror Reflection Type (Type 2)

Shape	Number of optical axes	Sensing Distance	Beam Pitch	Model
	2	0.5 to 6 m	500	F3S-TGR-SB2-K2C-500(MTL)*
	3	0.5 to 5 m	400	F3S-TGR-SB2-K3C-800(MTL)*
	4		300	F3S-TGR-SB2-K4C-900(MTL)*

*. If you want to have a ONE WAY direction Type, (see Page D-26) Please add the MTL behind of Model Name. Ex. F3S-TGR-SB4-K2C-500MTL

F3S-TGR-SB4-K□C Mirror Reflection Type (Type 4)

Shape	Number of optical axes	Sensing Distance	Beam Pitch	Model
	2	0.5 to 6 m	500	F3S-TGR-SB4-K2C-500(MTL)*
	3	0.5 to 5 m	400	F3S-TGR-SB4-K3C-800(MTL)*
	4		300	F3S-TGR-SB4-K4C-900(MTL)*

*. If you want to have a ONE WAY direction Type, (see Page D-26) Please add the MTL behind of Model Name. Ex. F3S-TGR-SB4-K2C-500MTL

Muting Connecting Box (Order Separately)

Flexible Connecting Box

Appearance	SLC Connection Type	Other connection	Model
	M12 8pin connector without cable	4 x Muting sensor connection (4pin) 1 x Muting Lamp M12 (4pin) 1 x Override/Test input M12 (4pin) 1 x cabinet connection M12 (8pin)	F39-TGR-SB-CMB1
	M12 8pin connector with 100 mm cable		F39-TGR-SB-CMB2

Accessories (Order Separately)

Connector Cable

Appearance	Cable length	Specification	Model
	2 m	M12 connector (8pin Socket) For cabinet connection (From F3S-TGR-SB□-K□C or F3S-TGR-SB-CMB□)	F39-TGR-SB4-CVLB2R
	5 m		F39-TGR-SB4-CVLB5R
	10 m		F39-TGR-SB4-CVLB10R
	2 m	M12 connector (4pin Plug) For Muting sensor, Muting Lamp connection and Override/Test connection	F39-TGR-SB4-CVLB2MC

Connector Plug Assemblies, Screw-on Type

Appearance	Cable connection direction	Specification	Connection method	Applicable cable diameter	Model
	Straight	DC only 4pin Plug	Screw-on	3 dia. (3 to 4 dia.)	XS2G-D4S5
	Right angle				XS2G-D4S6

Muting Lamp

Appearance	Specification	Model
	24 V DC	F39-A11

Bulb for Maintenance

Appearance	Specification	Model
	24 V DC 3 W E14	F39-A11MB

Laser alignment Kit

Appearance	Model
	F39-LKK2-SB

Rating and Performance

Safety sensors

F3S-TGR-SB□-K□C

Item	Model	
	F3S-TGR-SB4-K□C-□□□(MTL)*	F3S-TGR-SB2-K□C-□□□(MTL)*
Sensor type	Type 4	Type 2
Applicable safety category	4, 3, 2, 1, B	2, 1, B
Operating range	F3S-TGR-SB□-K2C 0.5 - 6 m F3S-TGR-SB□-K3C/K4C 0.5 - 6 m	
Beam pitch and Number of beam	F3S-TGR-SB□-K2C 500 mm 2 beam with mirror F3S-TGR-SB□-K3C 400 mm 3 beam with mirror F3S-TGR-SB□-K4C 300 mm 4 beam with mirror	
Outermost beam gap	F3S-TGR-SB□-K2C 500 mm F3S-TGR-SB□-K3C 800 mm F3S-TGR-SB□-K4C 900 mm	
Effective aperture angle (EAA)	Within ±2.5°	Within ±5°
Light source	Infrared LED (880 nm)	
Power supply	24 VDC ± 20%	
Current Consumption	420 mA	
OSSD	Two PNP transistor outputs, 250 mA each. (500 mA sum)	
Output operation mode	Light - ON	
Test functions	Self-test (after power ON and during operation, one cycle during response time)	
Protection	Output short-circuit protection, Reverse Polarity protection	
Response time	ON to OFF 16ms max OFF to ON 300 ms (Maximum Power-ON time is 900 ms)	
Ambient temperature	Operating: -10 to +55 °C (with no dew condensation)	
Ambient humidity	15% to 95% (non condensing)	
Metal housing (Al) painted	Yellow (RAL 1303 F14)	
Degree of protection	IP65	
Accessories	M6 T-Bolt x 8, M6 Nut x 8 Mounting fixture x 4	
Applicable standards	EN61496-1; 1997 prEN61496-2; 1997	

*. If you want to have a ONE WAY direction Type, (see Page D-26) Please add the MTL behind of Model Name. Ex. F3S-TGR-SB4-K2C-500MTL

Muting Connecting Box

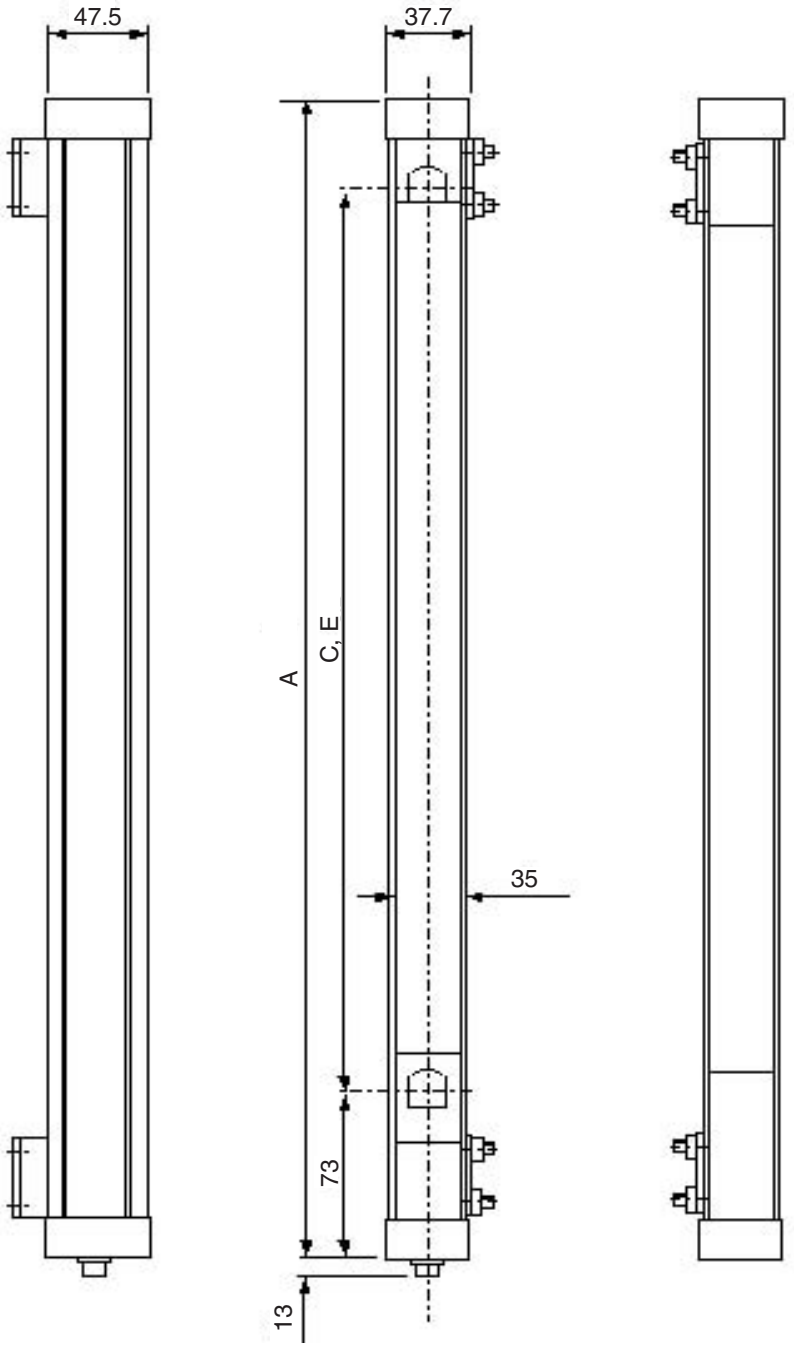
F3S-TGR-SB-CMB□

Item		Model	F39-TGR-SB-CMB□
Power supply			24 VDC ± 20%
Consumption			10 W max
Ambient temperature			During operation: -10 to +55 °C (with no dex condensation)
Ambient humidity			15% to 95% (non condensing)
RX connector			M12 8 pins female
Cabinet connector			M12 8 pins male
Sensor connector			4 x M12 4 pins female
Muting indicator			M12 4 pins female
Test / Override connectors			M12 4 pins female
Metal housing (Al) painted			Yellow (RAL 1303 F14)
Degree of protection			IP65
Material	Case		Aluminium
	Connector		Brass with nickel plate
	Front Cover		Aluminium
Weight			0.5 kg
Accessories			M6 T-Bolt x 4, M6 Nut x 4 Mounting fixture x 2, Connector cover x 2

Item / Model	F39-TGR-SB-CMB□
Applicable standards	93/68/EEC DIN V VDE 0801:1990 and am.A1:1994 EN 50081-2:1993 EN 55022:1998

Dimensions

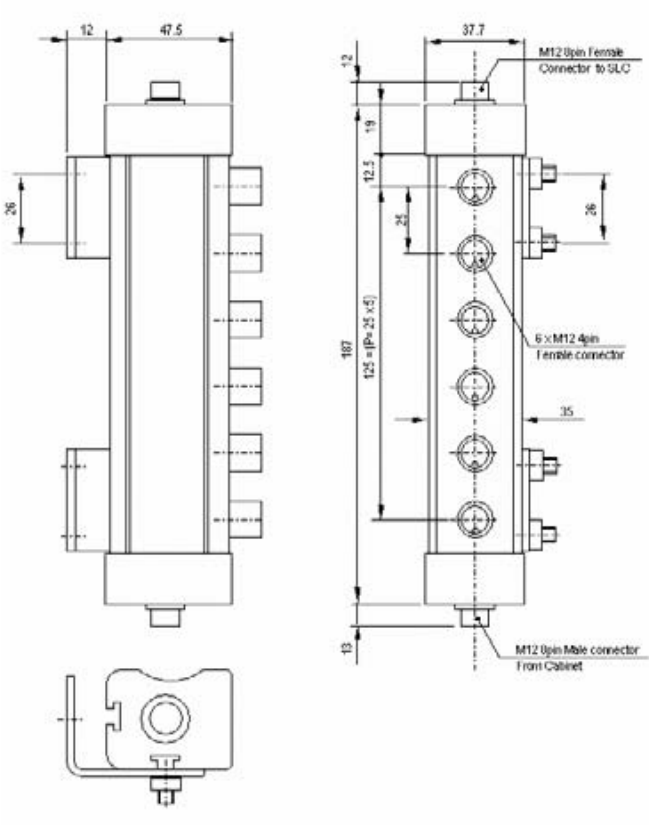
F3S-TGR-SB-K□C-□□□ with Mounting Brackets



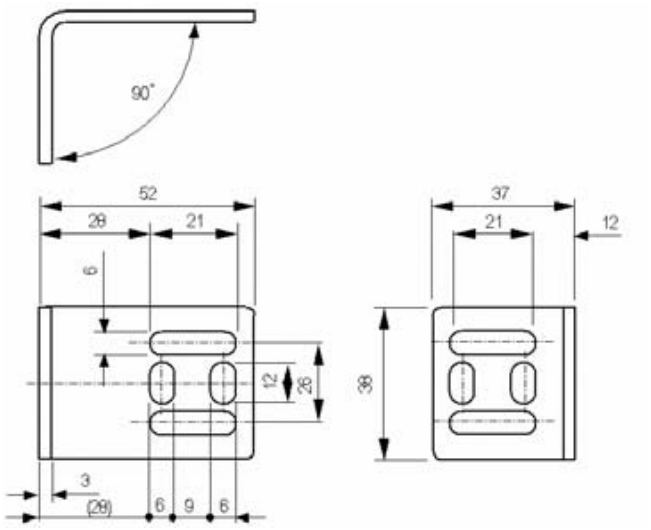
Model	A	C	E
F3S-TGR-SB□-K2C500	614 mm	500 mm	500 mm
F3S-TGR-SB□-K3C800	914 mm	800 mm	400 mm
F3S-TGR-SB□-K4C900	1,014 mm	900 mm	300 mm

F39-TGR-SB-CMB1

Muting connection box

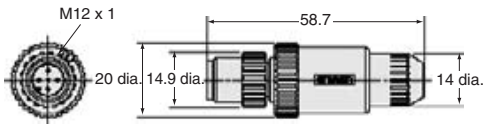


Mounting bracket (Common bracket for F3S-TGR-SB□-K□C and F39-TGR-SB-CMB□

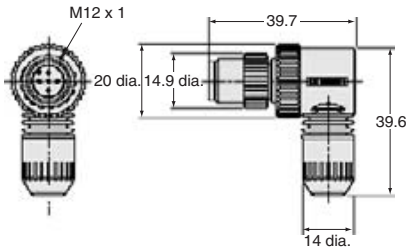


Connector Plug Assemblies, Screw-on Type

XS2G-D4S5



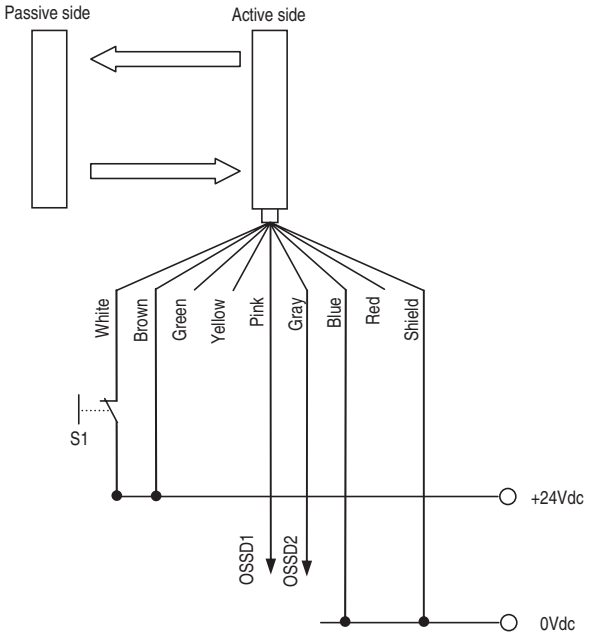
XS2G-D4S6

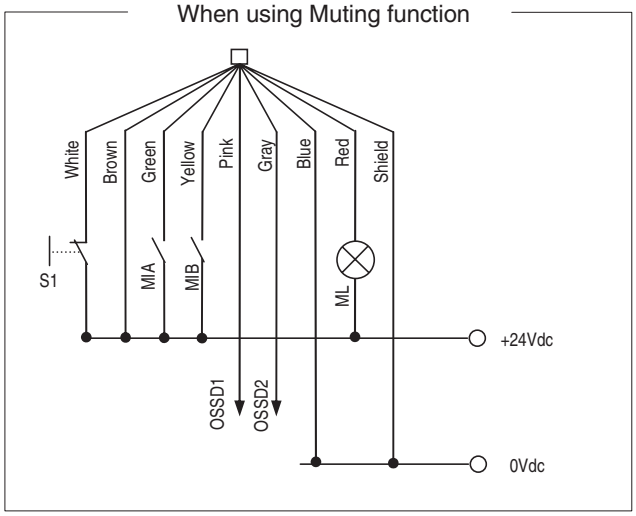


Connection

F3S-TGR-SB□-K□C

Connection example





S1: External Test / Interlock reset Switch

MIA : Muting input A

MIB : Muting input B

ML : Muting Lamp

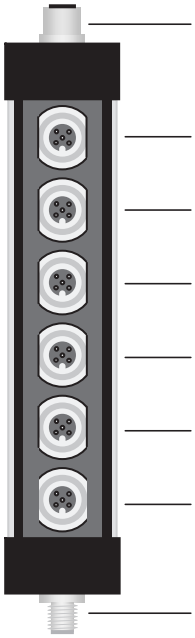
In case of Cat 4 (EN954-1), OSSD1/2 must be connected Safety Relay Unit (G9SA, G9SB-301B etc.) with feedback monitor

Pin reference

Front View	Pin No.	Signal Name	Wire Color
	1	Test and Reset Input	White
	2	+24 Vdc	Brown
	3	Muting A Input	Green
	4	Muting B Input	Yellow
	5	OSSD1 (OUT1)	Gray
	6	OSSD2 (OUT2)	Pink
	7	0 Vdc	Blue
	8	Muting Lamp (0 Vdc)	Red

F3S-TGR-SB-CMB□

Pin and Plug reference



1) To Barrier (F3S-TGR-SB series)
M12 8pin connector (Female) *1

2) Muting Sensor B2
M12 5pin connector (Female)

3) Muting Sensor A2
M12 5pin connector (Female)

4) Muting Sensor B1
M12 5pin connector (Female)

5) Muting Sensor A1
M12 5pin connector (Female)

6) Muting Lamp
M12 5pin connector (Female)

7) Test/Override
M12 5pin connector (Female)

8) From Cabinet
M12 8pin connector (Male)

*1 In case of F3S-TGR-SB-CMB2,
M12 8pin connector with 100 mm cable

1) To F3S-TGR-SB Series

Front View	Pin No.	Signal Name	Wire Color
	1	Test and Reset Input	White
	2	+24 Vdc	Brown
	3	Muting A Input	Green
	4	Muting B Input	Yellow
	5	OSSD1 (OUT1)	Gray
	6	OSSD2 (OUT2)	Pink
	7	0 Vdc	Blue
	8	Muting Lamp (0 Vdc)	Red

2), 3) 4), 5) Wiring of Muting Sensor connection

Front View	Pin No.	Signal Name	Wire Color
	1	+24 Vdc	Brown
	2	No connect	White
	3	0 V	Blue
	4	PNP Input	Black

6) Wiring of Muting Lamp connection

Front View	Pin No.	Signal Name	Wire Color
	1	+24 Vdc	Brown
	2	No connect	White
	3	No connect	Blue
	4	0 V	Black

7) Test/Override connection

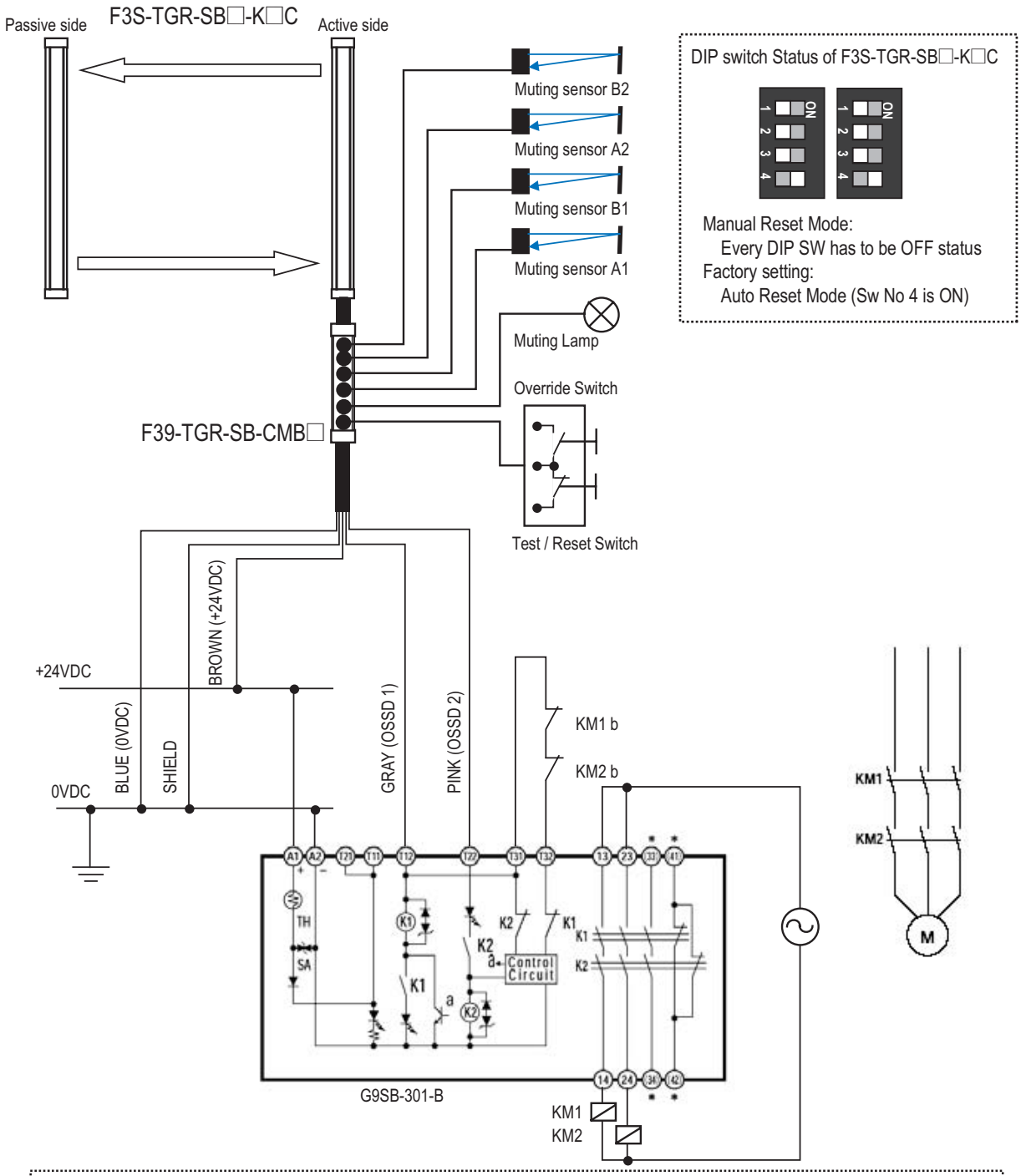
Front View	Pin No.	Signal Name	Wire Color
	1	+24 Vdc	Brown
	2	Test input	White
	3	No connect	Blue
	4	Override input	Black

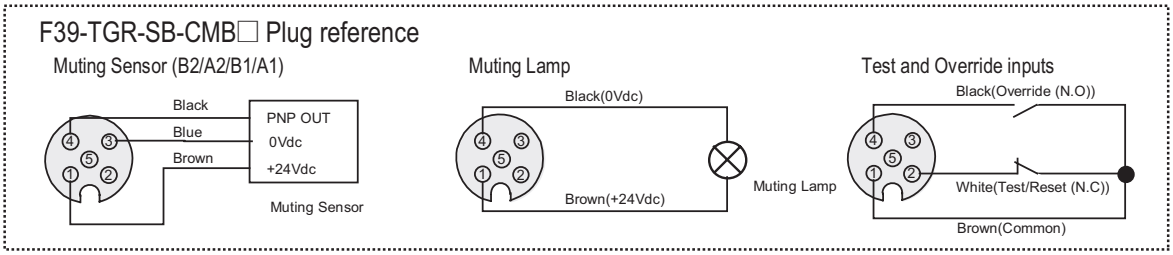
8) From Cabinet

Front View	Pin No.	Signal Name	Wire Color
	1	Test and Reset Input	White
	2	+24 Vdc	Brown
	3	Muting A Input	Green
	4	Muting B Input	Yellow
	5	OSSD1 (OUT1)	Gray
	6	OSSD2 (OUT2)	Pink
	7	0 Vdc	Blue
	8	Muting Lamp (0 Vdc)	Red

Manual Reset Mode (by Safety barrier)

F3S-TGR-SB4-K2C / F39-TGR-SB-CMB□ / G9SB-200-B or 301-B





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

Cat. No. E19E-EN-01 In the interest of product improvement, specifications are subject to change without notice.

Safety light curtain for long distance detection

F3SL

20-m long-distance detection. Safety light curtain (Type 4) is ideal for detection of intrusion of human bodies in large machines and conveyor lines.

Features

- Complies with IEC standards, EN standards, and North American standards. EC-based certification from TÜV for EU machine directives. Can be used as a safety guard for satisfaction of OSHA requirements for on-site labor safety in North America.
- Special controller not needed. Detection of human body intrusion is possible using just the sensor unit.
- Includes "Start/restart interlock function" to prevent automatic reset of output.
- Includes floating blanking function (disables 1 or 2 non specific beams) and Fixed Blanking (disables specific beams)
- Built-in EDM (External Device Monitor). Feedback check is possible without a controller

Ordering Information

Sensors

Infrared ray

Sensor type	Shape	Sensing distance	Operating mode	Detection width (mm)	Model
Through-beam		0.3 to 20m	Light ON	351	F3SL-A0351P30
				523	F3SL-A0523P30
				700	F3SL-A0700P30
				871	F3SL-A0871P30
				1,046	F3SL-A1046P30
				1,219	F3SL-A1219P30
				1,394	F3SL-A1394P30
				1,570	F3SL-A1570P30
				1,746	F3SL-A1746P30
				1,920	F3SL-A1920P30
				2,095	F3SL-A2095P30

Accessories (Order Separately)

Special cable (please order one each for the emitter and the receiver)

Cable length	Specifications	Model	
		For emitter	For receiver
10 m	Connector	F39-JL10A-L	F39-JL10A-D
15 m		F39-JL15A-L	F39-JL15A-D
30 m		F39-JL30A-L	F39-JL30A-D

Refection mirror (15% sensing distance attenuation)

Mirror material	Width (mm)	Thickness (mm)	Length (mm)	Model
Glass mirror	125	31	460	F39-MDG460
			607	F39-MDG0607
			750	F39-MDG0750
			907	F39-MDG0907
			1,057	F39-MDG1057
			1,357	F39-MDG1357
			1,500	F39-MDG1500
			1,657	F39-MDG1657
			1,807	F39-MDG1807

Note: Other sizes are available upon request.

Safety Relay Unit

For controlling the outputs we recommend to use safety relay units G9SA or G9SB

Appearance	Output	Model
	Expandable relay unit series with up to 8 safety relay outputs. Time delay for stop category 1 can be realized. (Please refer to page G-109)	G9SA series
	Small size safety relay unit with 17.5 mm and 22.5 mm size. Up to 3 safety relay outputs are available. (Please refer to page G-123)	G9SB series
	Fletible and expandable safety unit with solid state outputs	G9SX series

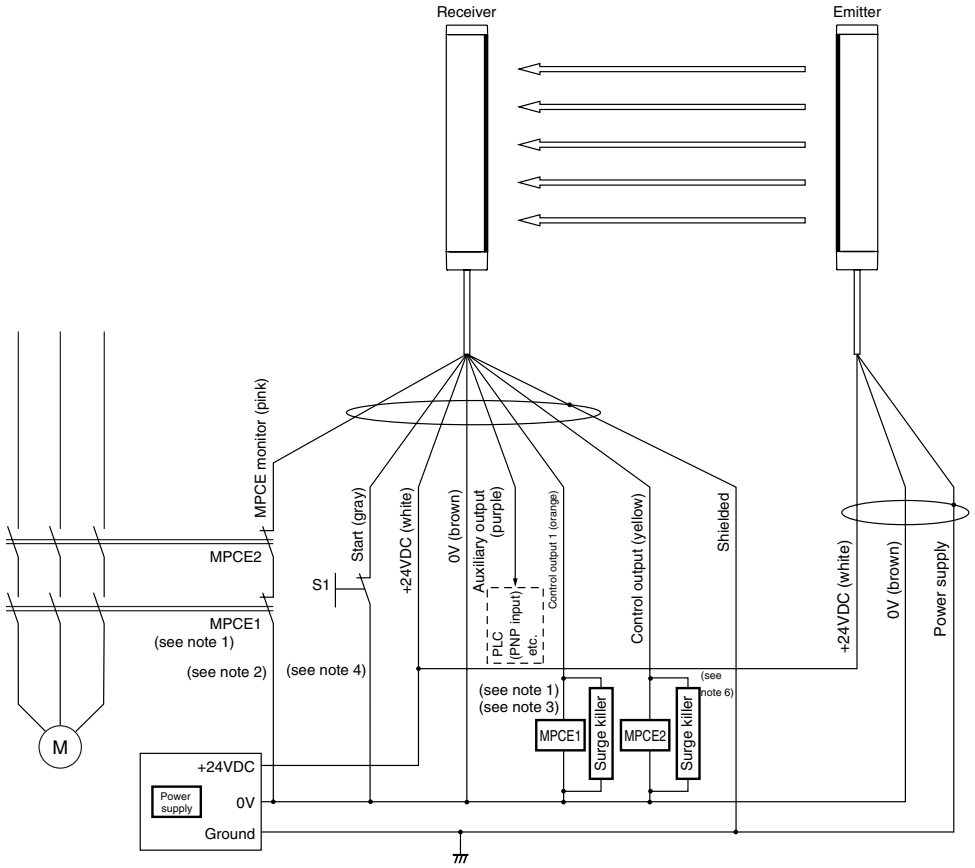
Rating/performance

Item	Model	F3SL-A0351 P30	F3SL-A0523 P30	F3SL-A0700 P30	F3SL-A0871 P30	F3SL-A1046 P30	F3SL-A1219 P30	F3SL-A1394 P30	F3SL-A1570 P30	F3SL-A1746 P30	F3SL-A1920 P30	F3SL-A2095P 30
Sensing distance		0.3 to 20 m										
Optical axis pitch		22 mm										
Number of optical axes		16	24	32	40	48	56	64	72	80	88	96
Protective height		351 mm	523 mm	700 mm	871 mm	1,046mm	1,219mm	1,394mm	1,570mm	1,746mm	1,920mm	2,095mm
Min. sensing object		Opaque object, 30-mm dia. or greater (52-mm or 74-mm dia. when using floating blanking)										
Effective Aperture angle		Emitter/receiver: ±2.5° or less each (based on IEC61496-2 at detection distance of 3 m or greater)										
Light source (wave length)		Infrared LED (850 nm)										
Power supply voltage		24 V DC ±20% including 5% ripple (p-p)										
Startup time after turning on power		3 s max.										
Current consumption		Emitter: 285 mA or less, receiver: 1.4 A or less (including load output current)										
Control output		PNP transistor outputs x 2, load current 500 mA or less (residual voltage 2 V or less) (excluding voltage drop due to cable extension), Light ON										
Auxiliary output		Same signal as control output: PNP transistor outputs x 1 output (non-safety output), load current 100 mA or less (residual voltage 1 V or less) (excluding voltage drop due to cable extension)										
Protective circuits		Output load short circuit protection, reverse power connection protection										
Safety functions		Start/restart interlock function (select enable/disable with DIP switch) • Blanking functions ① Channel select (fixed blanking) ② Floating blanking ③ No blanking (initial setting) Select ①, ②, or ③ with DIP switch. The optical axes for ① fixed blanking are set by a teach button.										
Diagnosis functions		• Self diagnosis functions when the power is turned on • External relay (MPCE) monitor function (connect external relay monitor input wire to contact b of external relay, 50 mA 24 V DC)										
Response time ON–OFF		20 ms max.				25 ms max.			30 ms max.			35 ms max.
Ambient temperature		Operating/Storage: 0°C to 55°C (with no icing or condensation)										
Ambient humidity		Operating./Storage: 35% to 95% RH (no condensation)										
Vibration resistance		Malfunction / durability: 10 to 50 Hz, amplitude 0.7 mm, 20 sweeps each in X, Y, and Z directions										
Shock resistance		Wrong operation / durability: 100 m/s2, 1,000 times each in X, Y, and Z directions										
Protective Degree		IEC Standard IP65										
Connection method		M12 Connector										
Weight (Packed state)		11kg max.										
Materi-al	Case	Aluminum										
Accessories		Test rod, mounting brackets (upper/lower), operation manual, special hex wrench for program button access, test load resistors (1 kΩ, 2 resistors), surge protector (2)										
Applicable standards		IEC (EN) 61496-1 TYPE4 ESPE *1 IEC61496-2 TYPE4 AOPD *2										

*1) ESPE (Electro-Sensitive Protective Equipment)
*2) AOPD (Active Opto-electronic Protective Devices)

Connection

Wire the F3SL only after all power has been turned off.

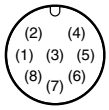


M: Mechanical drive unit including 3-phase motor
S1: Start switch for interlock reset (NC contact)
MPCE1, MPCE2: Contactor or safety relay with compulsory guide mechanism (G7SA is recommended)

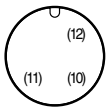
Note: 1 . Please use a safety relay with forcibly guided contacts (such as the G7SA) for MPCE1 and MPCE2, which are relays that perform ultimate control of the machine.
2 . If you do not intend to use the MPCE monitor function, short the MPCE monitor line (pink) to power supply 0 V.
3 . If a load is not connected to control output 1 and control output 2, an error will result and normal operation will not take place. For testing purposes during installation or at other times, connect the 10 kΩ resistors included with the operation manual to the MPCE1 and MPCE2 positions.
4 . If you intend to use auto start mode, short the start line (gray) to power supply 0 V.
5 . Take care when wiring not to make any mistakes regarding the cable colors. In particular, the wire colors of the power supply line (+ 24 V DC: white, 0 V: brown) are different from the regular sensor wires.
6 . Connect the provided surge protector in parallel with MPCE1 and MPCE2.

Wiring method

Receiver unit connector

Front view diagram	Pin No.	Signal name Receiver	Wire color of special cable
	1	Control output 1 (OSSD1)	Orange
	2	0V	Brown
	3	Shielded	---
	4	+DC24V	White
	5	Auxiliary output (AUXIL-	Purple
	6	MPCE monitor	Pink
	7	Start	Gray
	8	Control output 2 (OSSD2)	Yellow

Emitter unit connector

Front view diagram	Pin No.	Signal name Emitter	Wire color of special cable
	10	Shielded	---
	11	+DC24V	White
	12	0V	Brown

Special cable (purchased separately)

For emitter (3-pin)		For receiver (8-pin)		Cable length
F39-JL10A-L	Black connector	F39-JL10A-D	Red connector	10 m
F39-JL15A-L		F39-JL15A-D		15 m
F39-JL30A-L		F39-JL30A-D		30 m

Note: Please order one each for the emitter and the receiver.

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

Cat. No. E15E-EN-01

In the interest of product improvement, specifications are subject to change without notice.

Safety Single Beam Sensor & Controller

E3FS series with F3SP-U3P-TGR and F3SP-U5P-TGR

Features

The E3FS is a type 2 Safety Single beam sensor intended to be used with the control units F3SP-U3P -TGR and F3SP-U5P-TGR.

- Safety Single Beam (E3FS)
  1) Up to Category 2 (EN954-1)
     Type2 ESPE and Type2 AOPD.
     Approved by TÜV Product Service
  2) High protection against water
     IP67 (IEC60529)
  3) Small Sensor
     M18 x 65 mm
  4) 4 different model available
     Plastic case (with cable type and connector type)
     Brass case (with cable type and connector type)
- Muting Controller for Safety single beam sensor (F3SP-U3P-TGR and F3SP-U5P-TGR)
  1) Muting functions are integrated
     Muting inputs
     Override function
     Muting Lamp output
     Interlock function and Test Reset input
  2) 2 different model available
     2 beam unit (F3SP-U3P-TGR)
     4 beam unit (F3SP-U5P-TGR)
  3) Small Controller
     2 beam unit W=22.5 mm
     4 beam unit W=45.0 mm

Ordering Information

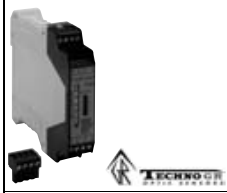
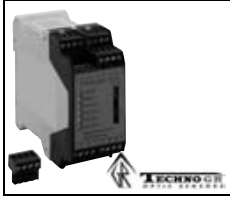
Safety Single beam Sensors (Type 2)

E3FS-10B4 series

Appearance	Case material	Operation distance	Model	
	Plastic	0 to10 m	Cable Type	E3FS-10B4
			Plug Type	E3FS-10B4-P1
	Nickel Brass		Cable Type	E3FS-10B4-M
			Plug Type	E3FS-10B4-M1-M

Controller for Safety Single beam Sensors

F3SP-UxP series

Appearance	Sensors	Output contacts	Width	Model
	1 to 2 Safety Single beam sensors	2 NO 2.5 A	22.5 mm	F3SP-U3P-TGR
	1 to 4 Safety Single beam sensors		45 mm	F3SP-U5P-TGR

Accessories

Muting Lamp

Appearance	Model
	F39-A11

Bulb for Maintenance

Appearance	Specification	Model
	24 V DC 3 W E14	F39-A11MB

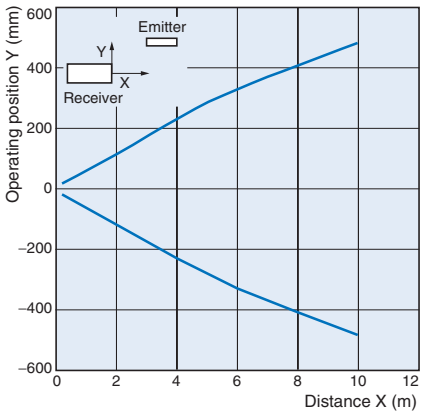
Rating and Performance

Sensors

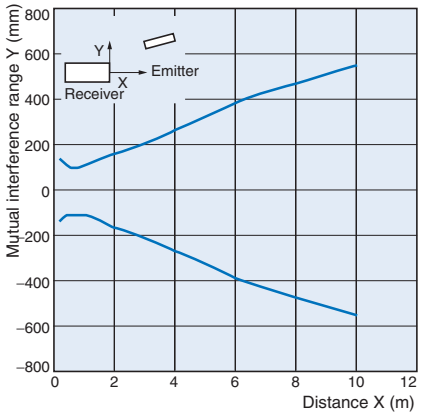
E3FS-10B4 series

Sensing method		Through-beam
Controller		F3SP-U3P-TGR, F3SP-U5P-TGR
Supply voltage		24 VDC ± 10% (ripple p-p 10% max.)
Effective aperture angle (EAA)		±5° (at 3 m)
Current consumption		Emitter:50 mA max. Receiver:25 mA max.
Sensing distance		10 m
Standard sensing object		Opaque object: 11 mm min. in diameter
Response time		2.0 ms (E3FS only) Response time of controller = Response time of the system
Control output		PNP transistor output, load current: 100 mA max., residual voltage: 2 V max. (Except for voltage drop due to cable extension)
Test input (Emitter)		21.5 to 24 VDC: Emitter OFF (source current: 3 mA max.) Open or 0 to 2.5 V: Emitter ON (leakage current: 0.1 mA max.)
Power supply reset time		100 ms
Ambient light intensity		Incandescent lamp: 3.000 lx max. (light intensity on the receiver surface) Sunlight: 10,000 lx max. (light intensity on the receiver surface)
Ambient temperature		Operating: -10 to 55°C, storage: -30 to 70°C (with no icing or condensation)
Ambient humidity		Operating: 35% to 85%, storage: 35% to 95% (with no icing or condensation)
Insulation resistance		20 MΩ min. (at 500 VDC)
Dielectric strength		1,000 VAC 50/60 Hz 1 min
Vibration resistance	Malfunction	10 to 55 Hz, double amplitude: 1.5 mm, 2 h each in the X, Y, and Z directions
	Operating limit	10 to 55 Hz, double amplitude: 0.7 mm, 50 min each in the X, Y, and Z directions
Shock resistance	Malfunction	500 m/s² (approx. 50 G), 3 times each in the X, Y, and Z directions
	Operating limit	100 m/s² (approx. 10 G), 1,000 times in the X, Y, and Z directions
Degree of protection		IP67 (IEC standard)
Light source		Infrared LED
Operation indicators		Emitter: Emitting (orange) Receiver: Output ON (green), Output OFF (red)
Protection		Output short-circuit protection, reverse polarity protection
Weight (in packaging)		E3FS-10B4 2M (ABS resin case): approx. 150 g for 1 set (weight without cable: approx. 55 g) E3FS-10B4-M1-M (metal case): approx. 125 g for 1 set
Applicable standard		IEC61496-1, EN61496-1 Type 2 ESPE (Electro-Sensitive Protective Equipment) IEC61496-2, prEN61496-2 Type 2 AOPD (Active Opto-electronic Protective Devices)
Accessories		Emitter, Receiver, four nuts for mounting, and an instruction manual

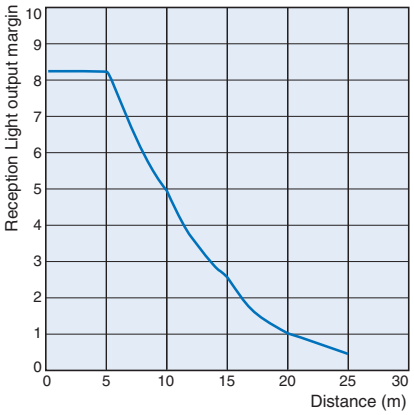
Parallel Operating Range



Mutual interference Range



Excess Gain Ratio



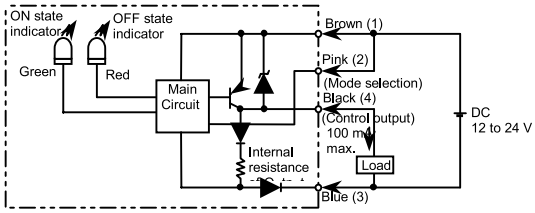
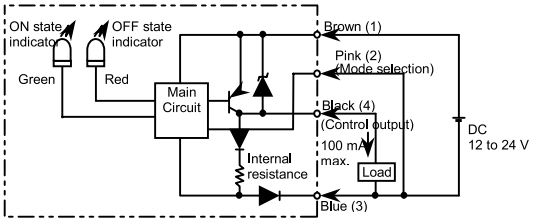
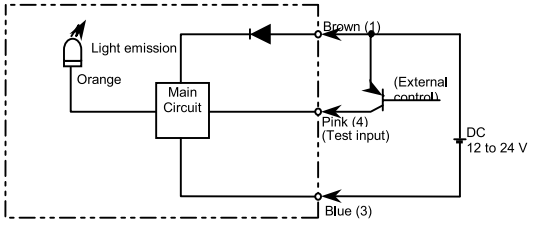
Controllers

F3SP-U series

	F3SP-U3P	F3SP-U5P
Number of sensors	1 to 2 Safety Single beam sensor	1 to 4 Safety Single beam Sensor
Width	22.5 mm	45 mm
Muting Input	2 Inputs	4 Inputs
Safety related function	Override function Muting Lamp Connection Interlock System (Automatic and manual reset)	
Power supply voltage	24 VDC ±10%	
Power consumption	420 mA max.	
Output contacts	2 NO 2.5 A (protected by fuse), 115 V AC max.	2 NO 2.5 A (protected by fuse), 250 V AC max.
Indicators	6 LED for status and diagnostics	
Enclosure rating	IP20	
Terminal	16 screw terminals, Detachable blocks with '4pin'	32 screw terminals, Detachable blocks with '4pin'
Response time	≤30 ms	
Ambient temperature	Operation: -10°C +55°C	
Housing material	Plastic; DIN rail mounting	
Weight	0.3 kg	

Operating Instructions

Output Circuit

Model	Connection method	Output transistor	Output circuit
E3FS-10DB4 2M E3FS-10DB4-P1 E3FS-10DB4-M 2M E3FS-10DB4-M1-M Receiver circuit	Connect the pink and brown wire	ON when light is incident (Li-ght-ON)	
	Connect the pink and blue wire	ON when light is interrupted (Dark-ON)	
E3FS-10LB 2M E3FS-10LB-P1 E3FS-10LB-M 2M E3FS-10LB-M1-M Emitter circuit			

Timing Chart

Output mode and timing chart

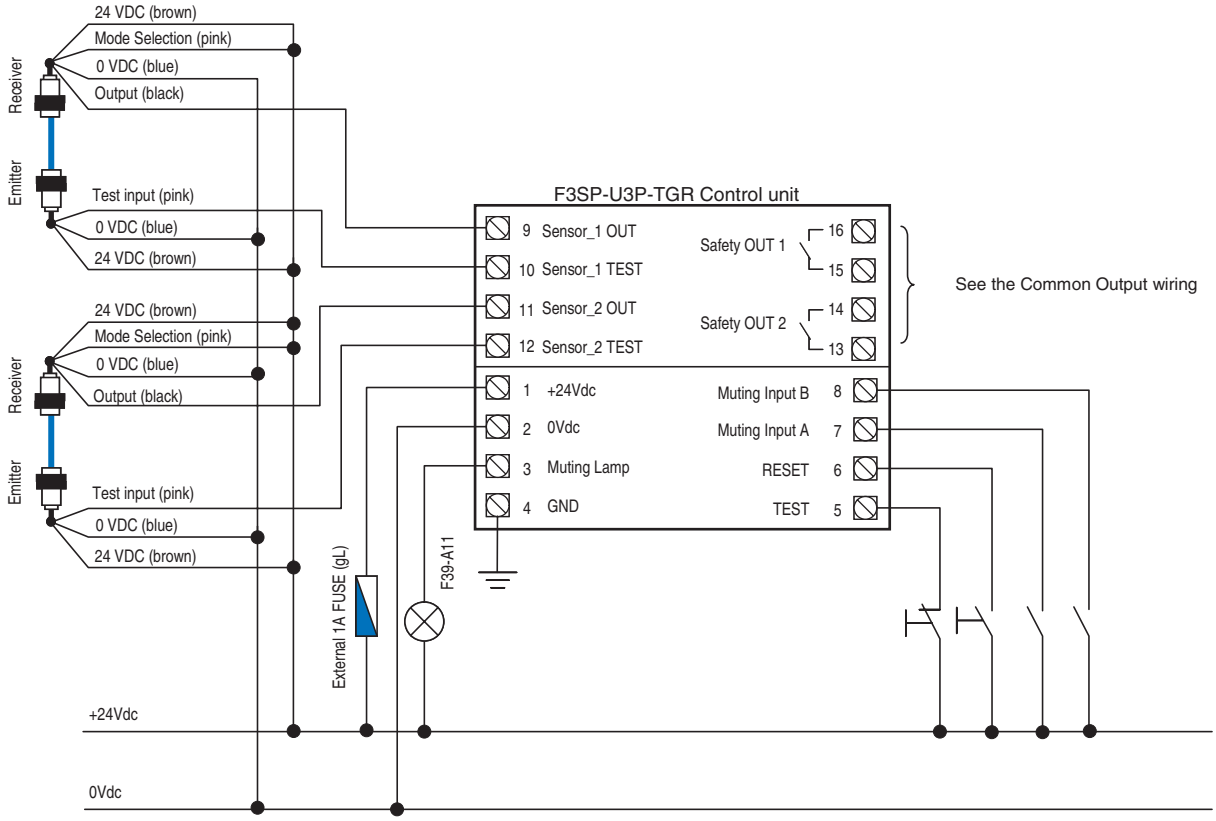
Receiver connection		Connect Pink (2) to Brown(1)	Connect Pink (2) to Blue (3)
Mode of output		ON when Incident (Light ON)	ON when interrupted (Dark ON)
Light Incident Light interrupted			
Indicator	Green Red		
Control output	ON OFF		
Load (Relay)	ON OFF		

Emitting timing chart

		Timing chart
Test input	ON OFF	
Light emission	ON OFF	
Indicator	ON OFF	

Connection

F3SP-U3P Manual Reset (Cat2)



WARNING: Both safety contacts OUT1 and OUT2 must be connected. If the machine has a single locking circuit, the two normally opened contacts must be connected in series.

WARNING: The power supply of Safety sensors must be taken from the same supply of F3S-U3P-TGR unit.

Dip Switch setting

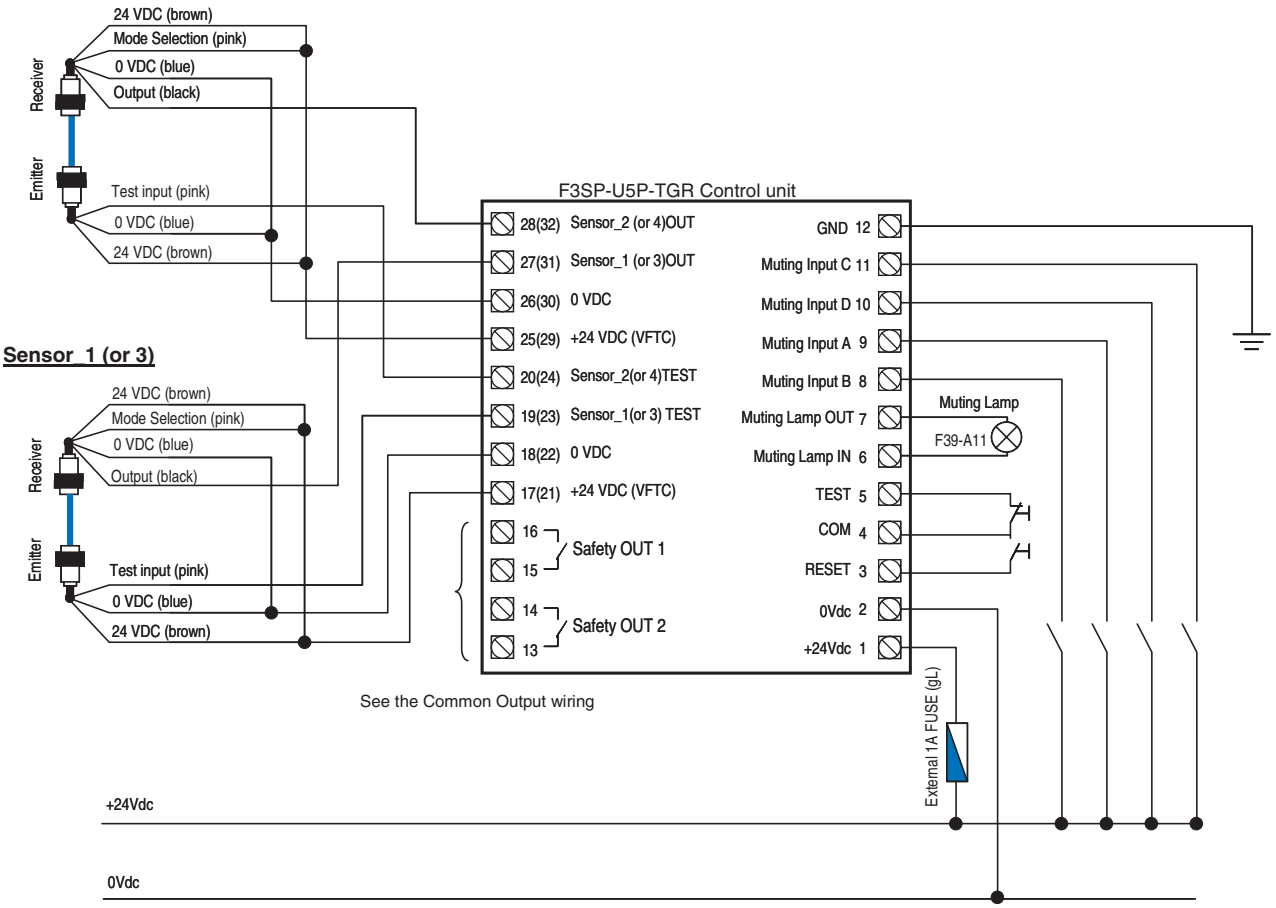
	Function	ON	OFF
4	Not used	----------	----------
3	Muting Activate	It will be muting Sensor_1 only	**It will be muting both Sensor**
2	Muting Duration	Infinite	**60 Second**
1	Reset mode	**Auto Reset**	Manual Reset

The **underlines** are initial setting (Factory setting)

Factory setting

F3SP-U5P Manual Reset (Cat 2)

Sensor_2 (or 4)



Sensor_1 (or 3)

24 VDC (brown)
Mode Selection (pink)
0 VDC (blue)
Output (black)
Receiver
Emitter
Test input (pink)
0 VDC (blue)
24 VDC (brown)

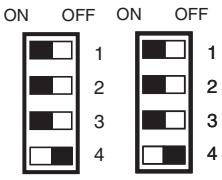
See the Common Output wiring

WARNING: Both safety contacts OUT1 and OUT2 must be connected. If the machine has a single locking circuit, the two normally opened contacts must be connected in series.

Dip Switch setting

	Function	ON	OFF
4	Not used	----------	----------
3	Muting Activate	Muting inputs A-B act on the sensor_1. Muting inputs C-D act on the sensor_2. Other sensor 3-4 continue to work	**Muting inputs A-B act on the sensor 1 and 2.** **Muting inputs C-D act on the sensor 3 and 4.**
2	Muting Duration	Infinite	**60 Second**
1	Reset mode	**Auto Reset**	Manual Reset

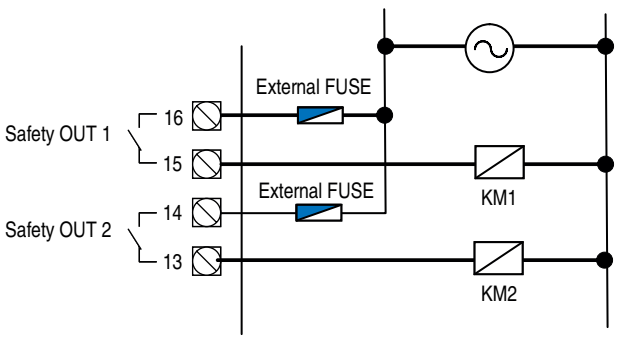
The **underlines** mean initial setting (Factory setting)



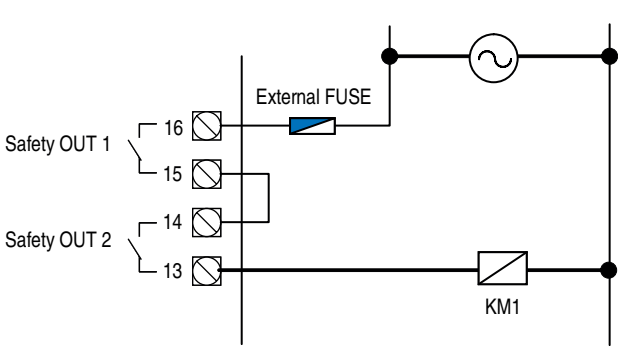
Factory setting

Common Output wiring

In case of 2 load



In case of 1 load



Precautions for Correct Use

⚠ Warning

OMRON's Single-beam Safety Sensor input Module (B1 Module) from the F3SX Series is the only controller that can be used for the E3FS-10B4□□□ (type 2). Normal operation may not be possible if another Single-beam Sensor Controller is used.

The Sensor cannot be used as part of a safety system when the mode selection input of the Single-beam Safety Sensor Receiver is connected to 0 V because the Sensor will turn ON when light is interrupted (Dark ON). Be sure to connect the mode selection input to 24 VDC if you want the Sensor to turn ON when light is incident (Light ON).

Safety Distance

The safety distance is the minimum distance that must be maintained between the Sensor and a hazardous part of the machine in order to stop the machine before someone or something reaches it. The safety distance is calculated based on the following equation when a person moves perpendicular to the detection zone of the Sensor.

Safety distance (S)= Intrusion speed into the detection zone (K) x Total response time for the machine and Sensor + Additional distance calculated based on the detection capability of the Sensor (C)

The safety distance varies with the national standards and individual machine standards. The equation is also different if the direction of intrusion is not perpendicular to the detection zone of the Sensor. Be sure to refer to the related standards.

Here T = T1 + T2 + T3, where
- T1 = Maximum machine stop time (s)
- T2 = Sensor response time (s)
  (From ON to OFF: 2.0 ms for the E3FS)
- T3 = F3SP response time (s)
  (From ON to OFF: Refer to Response Time.)

The maximum stop time for a machine is the time it takes to actually stop dangerous parts after the machine receives a stop signal from the F3SP.

⚠ Warning

Measure the actual maximum stop time for the machine and the periodical check it to see if the time changes.

Reference: Method for Calculating Safety Distance as Defined in the European Standard EN999 (with Intrusion Perpendicular to the Detection Zone)

K and C are as follows for the Single-beam Safety Sensors.

1) When a Single-beam Safety Sensor is used alone (when the risk assessment indicates that a single beam is sufficient)
   K = 1600 mm/s
   C = 1200 mm
   Height of the beam from the ground or from a reference surface: 750 mm (EN999 recommendation)
2) When multiple Single-beam Safety Sensors are installed at different heighte.
   K = 1600 mm/s
   C = 850 mm

The beam heights in the following table are the EN999 recommendations.

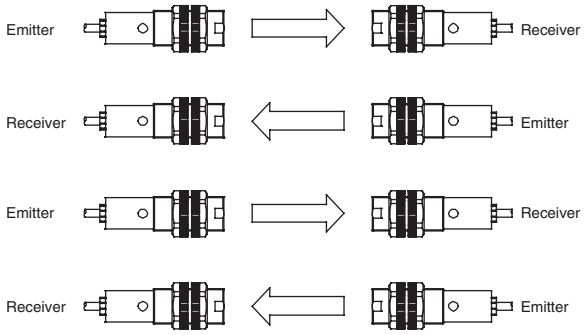
No. of beams	Height from the reference surface (example: the floor)
2	400 mm, 900 mm
3	300 mm, 700 mm, 1,100 mm
4	300 mm, 600 mm, 900 mm, 1,200 mm

Note: Refer to the F3SN/F3SH instruction manuals for details on Safety Light curtains and Multi-beam Safety Sensord.

Preventing Mutual Interference

Observe the following items during installation to prevent Single-beam Safety Sensors from interfering with each other or with Safety Light Curtains.

- Leave adequate space between the Sensors during installation. (Refer to the instruction manuals for the E3FS.)
- Use baffle plates to seperate Sensors.
- Alternate Emitters and Receivers during installation. (See the figure below.)



Check for mutual interference between Single-beam Safety Sensors or Safety Light Curtains connected to the same or different Control Units before finalizing placement and starting normal operation.

⚠ Warning

When installing multiple Safety Light Curtains, Multi-beam Safety Sensors, and Single-beam Safety Sensors, take necessary steps to prevent mutual interference. Otherwise detection may fail and serious injury may result.

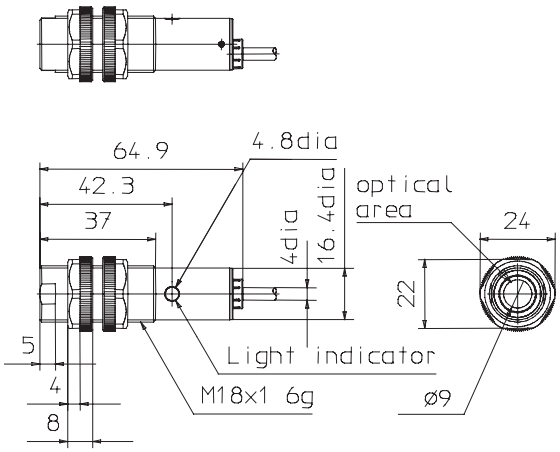
Dimensions

Note: All units are in millimeters unless otherwise indicated

Plastic housing

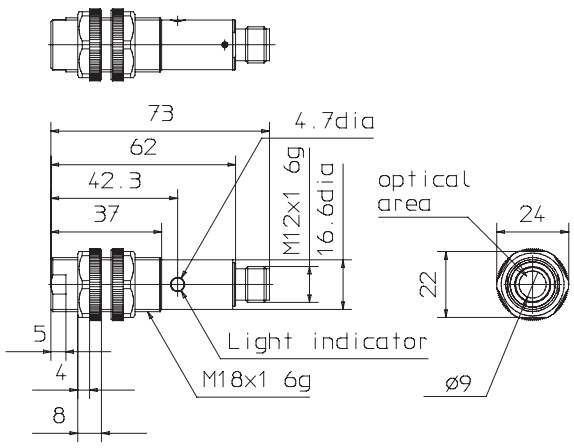
Cable type:

E3FS-10LB
E3FS-10DB4



Connector type:

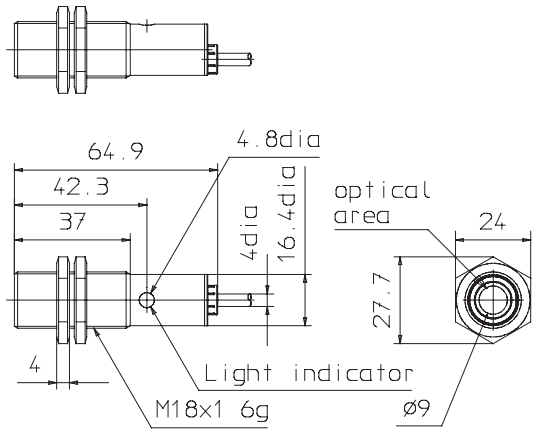
E3FS-10LB-P1
E3FS-10DB4-P1



Metallic housing

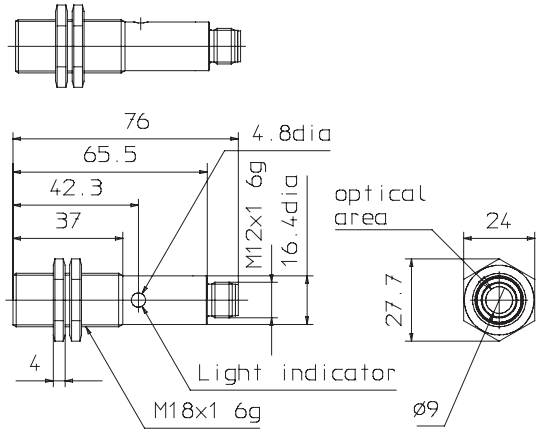
Cable type:

E3FS-10LB-M
E3FS-10DB4-M



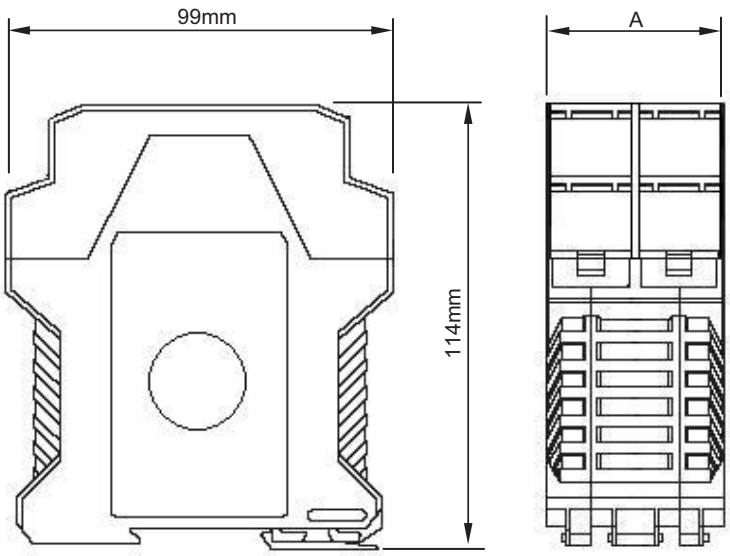
Connector type:

E3FS-10LB-M1-M
E3FS-10DB4-M1-M



Controller

F3SP-U3P and F3SP-U5P



Model	A
F3SP-U3P-TGR	22.5 mm
F3SP-U5P-TGR	45 mm

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

Cat. No. E25E-EN-02

Muting Controller for Safety Light Curtain

F3SP-U4P

Muting controller for one or two Safety Light Curtain.

- **High functionality (two independent muting functions, override function, automatic and manual reset).**
- **Category 2 or 4 depending on safety light curtain.**
- **Only 45 mm width**
- **Double output safety relay.**
- **6 LED for status and diagnostics.**
- **Detachable terminals for easy installation.**
- **Controlls 1 or 2 safety light curtains**
- **TÜV approved**

List of Models

Controller

Description	Model
 Muting Controller for Safety Light Curtain F3S-B, F3SN and F3SH	F3SP-U4P-TGR

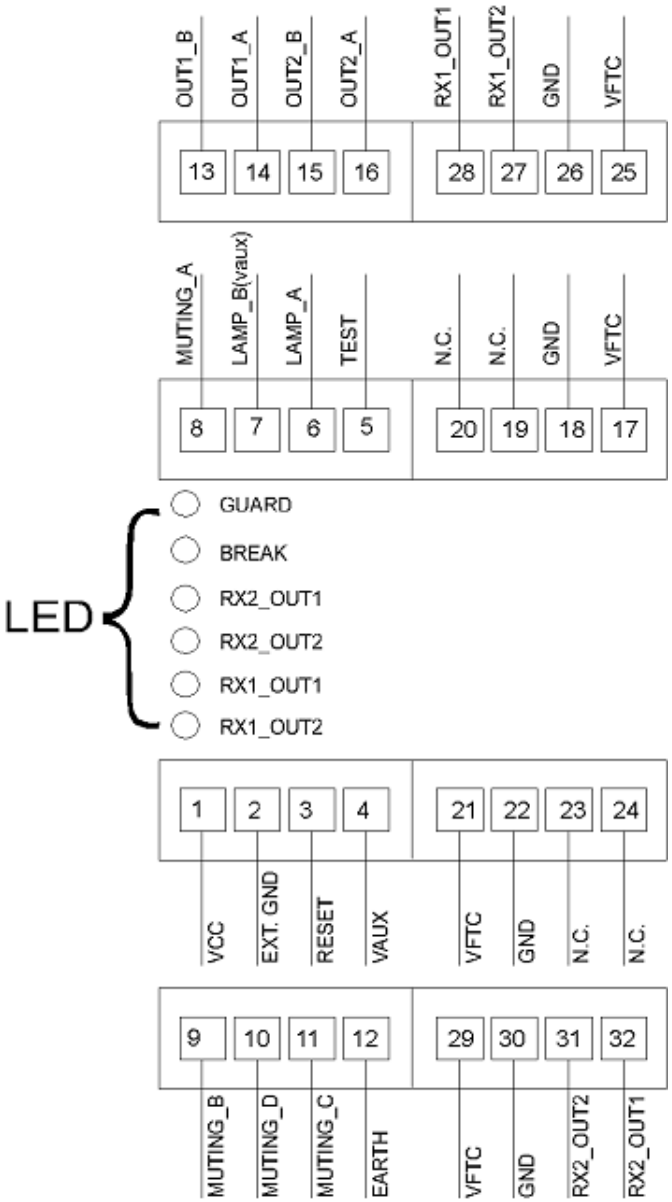
Accessories

Description	Model
 Muting lamp	F39-A11

Rating / performance

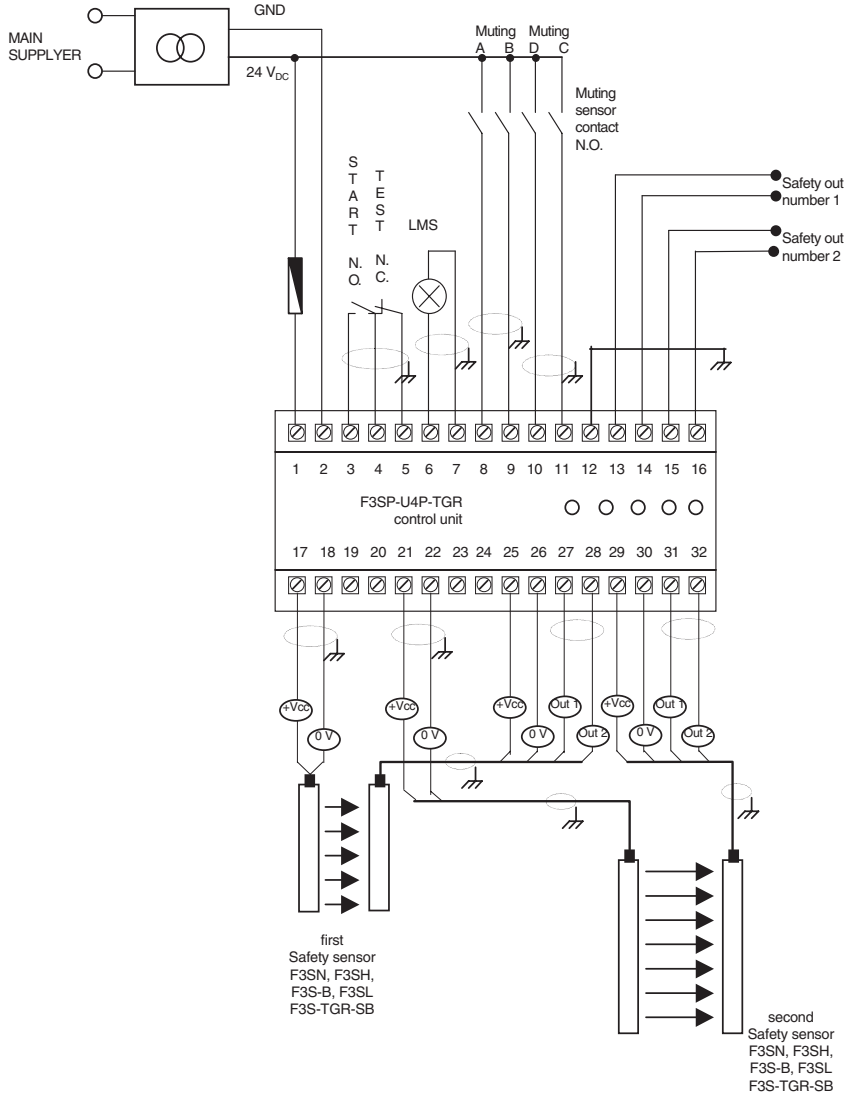
	F3SP-U4P-TGR
Power supply voltage	24 VDC ±10%
Power consumption	420 mA max. (excl. SLC power consumption)
Output contacts	2 NO 2,5 A (protected by fuse)
Indicators	6 LEDs for status and diagnostics.
Enclosure rating	IP20
Terminal	32 screw terminals (1,5 mm²), detachable blocks with 4 screws each
Response time	≤30 ms
Ambient temperature	Operating: -10 °C +55 °C
Housing material	Plastic, DIN rail mounting
Weight	0,6 kg

Pin Overview

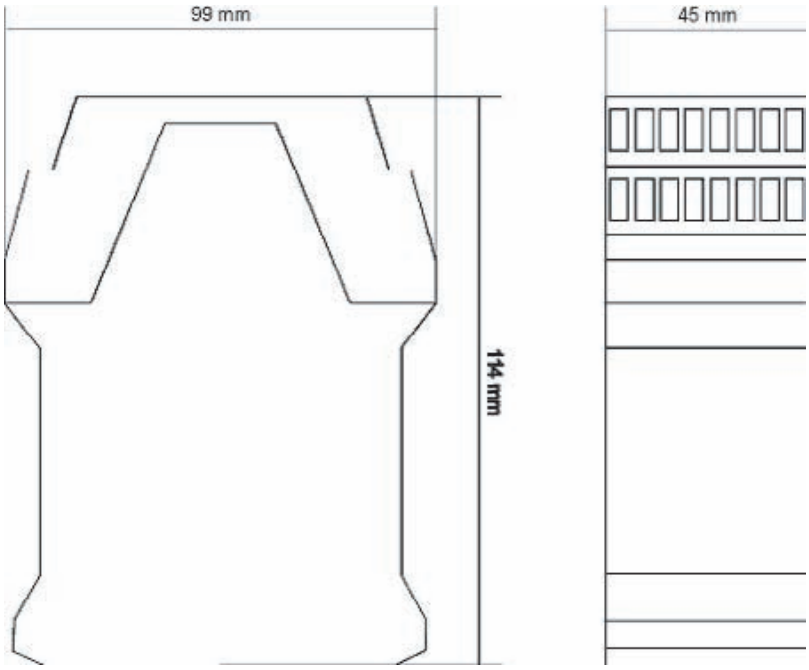


Wiring Example

Control unit F3SP-U4P-TGR in a mixed configuration that allowes the use of several OMRON safety light curtains and perimetrical guards.



Dimensions



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

Cat. No. E28E-EN-01

DeviceNet Safety System

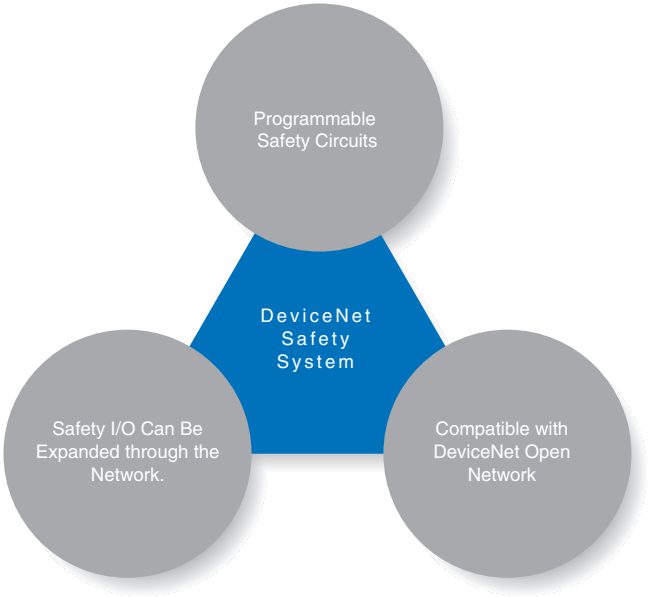
NE1A/DST1

Omron now offers a DeviceNet compatible Safety System, that can be used 3-ways: as a Stand-alone controller, as a Safety network expandable with remote I/O blocks, or combined with DeviceNet to form a combined Network.

- Conforms to Global Safety Standards
- Individual I/O LED status and error indicators
- USB Programming Port
- IEC 61508 SIL 3
- EN954-1 Category 4
- UL1604 Class 1, Div. 2 Group A,B,C,D

Product Information

Introducing a Safety Network System that dramatically alters previous safety design.
Programmable safety circuits are incorporated to facilitate efficient designing and modifications. Moreover, Safety I/O Terminals can be added to increase safety I/O capacity for distributed allocation through the network. DeviceNet wiring on the existing network can be used as is, facilitating efficient design by expanding on the existing system.
The programmability of safety circuits, expandability of I/O using the network, and compatibility with the DeviceNet open network effects major changes to the framework of previous safety design systems.



Complies with the Highest Safety Standards in the world

The DeviceNet Safety System conforms to IEC 61508 SIL3 for functional safety, and EN 954-1 Category 4 for machine safety, complying with the world's highest level of safety standards.

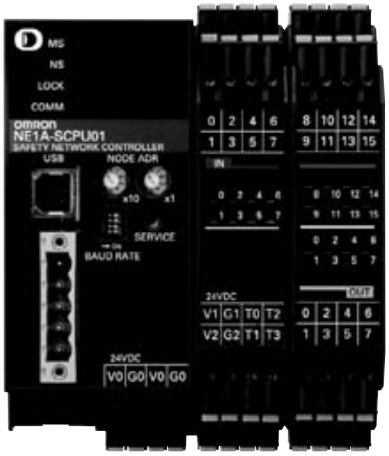
IEC 61508 SIL 3

Safety circuits must be able to function to provide safety at anytime. Conversely, the degree of lack of safety is used as the indicator. In IEC 61508, safety is defined as the Probability of Failure per Hour, or PFH. Based on this, the SIL (Safety Level) is classified into four levels. SIL 3 indicates a probability of dangerous failure of once in 1,000 years, which is the highest level in machine safety.

EN 954-1 Safety Category 4

EN standards evaluate the level of machine risk and require the incorporation of risk minimization measures. In EN 954-1, five safety categories have been established, with Safety Category 4 indicating designs that require the highest safety design level. This category is demanded for machines with the highest level of danger, wherein "serious injury (severed limbs, death, etc.) will occur frequently, with little chance of escaping danger." This category demands that a single fault (failure) in any part of the machine, or a series of faults, will not lead to loss of the machine's safety functions.

NE1A-SCPU01 Safety Network Controller



Programmable Safety Control

- Incorporates 16 safety inputs and 8 safety outputs.
  Functions as a compact safety PLC even without using a network.
- Construct safety circuits easily with special Function Blocks.
- Up to 128 Function Blocks can be used.

DeviceNet Safety Communications Functions

- Provides DeviceNet Safety Master functionality.
  Connect up to 16 Safety Slaves.
  Expand using up to sixteen Input Slaves with 12 points each (192 points total) and eight I/O Slaves with 16 points each (128 points total).
- Safety Slave functionality is also included. Interlock control can be incorporated between Safety Network Controllers.

DeviceNet Slave Functionality

- Monitor safety I/O and status information from the DeviceNet Master.

DST1-series Safety I/O Terminals

Safety Input and Safety I/O Models Available

- Safety inputs: 12-point model (DST1-ID12SL-1)
- Safety I/O: 8-point/8-point model (DST1-MD16SL-1)
- Safety I/O: 4-point/4-point (relay outputs) model (DST1-MRD08SL-1)

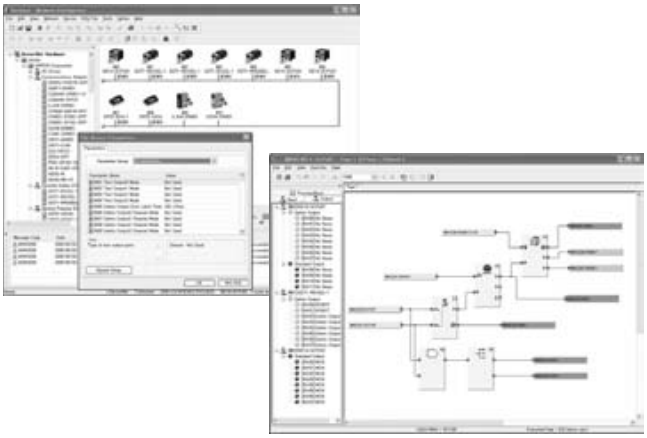
DeviceNet Slave Functionality

- Safety I/O and status information can be allocated as a DeviceNet Slave.
- Maintenance functions are provided for measuring the number of operations or the operating time for safety devices.

Easy Wiring

- Superior construction and preventive maintenance using clamp connectors.

WS02-CFSC1-E Safety Network Configurator



Network Configurator Functions

- Includes previous DeviceNet Configurator functions.
- Performs setup for the DeviceNet Safety network configuration.

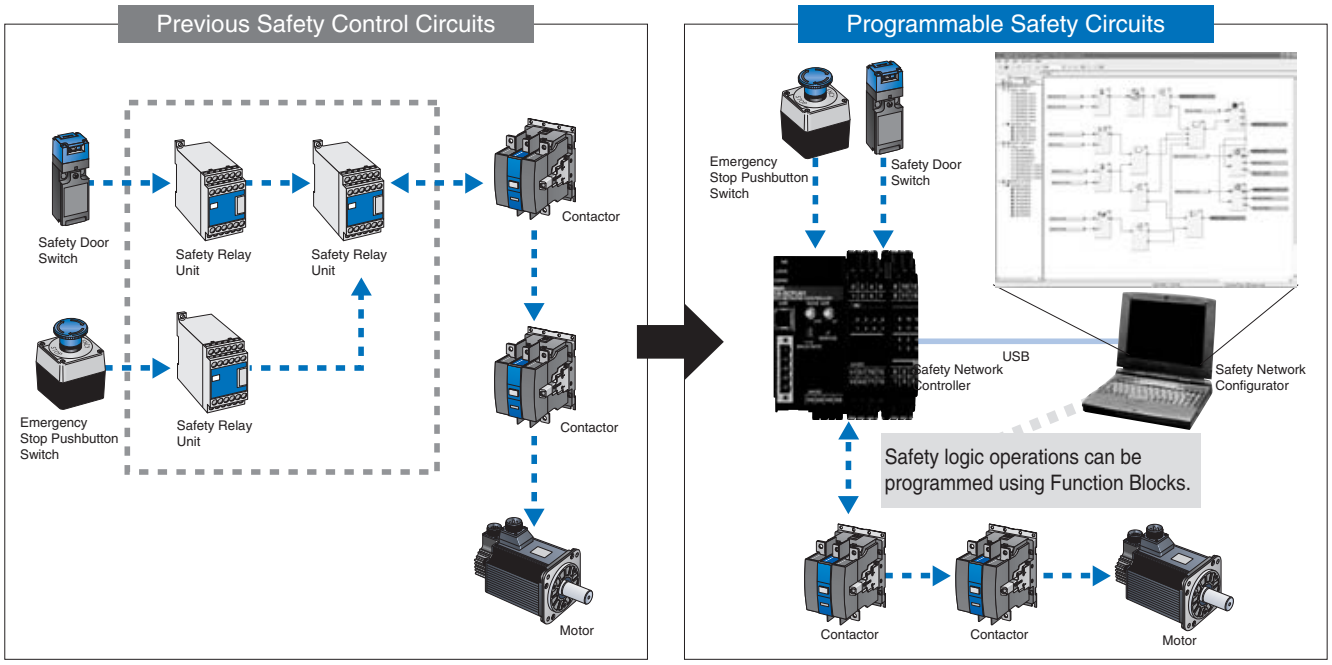
Programming Functions

- I/O configuration functions for Safety Network Controllers and Safety I/O Terminals.
- Programming functions for safety circuits.
- Monitor programs.

Stand-Alone Programmable Controller

Programmable Safety Circuits

Until now, safety design involved combining safety relays to configure safety control circuits. This process involved tedious wiring, and moreover, any changes required direct modification of the wiring. The DeviceNet Safety System uses programmable safety circuits, dramatically improving the ease of design and modification.

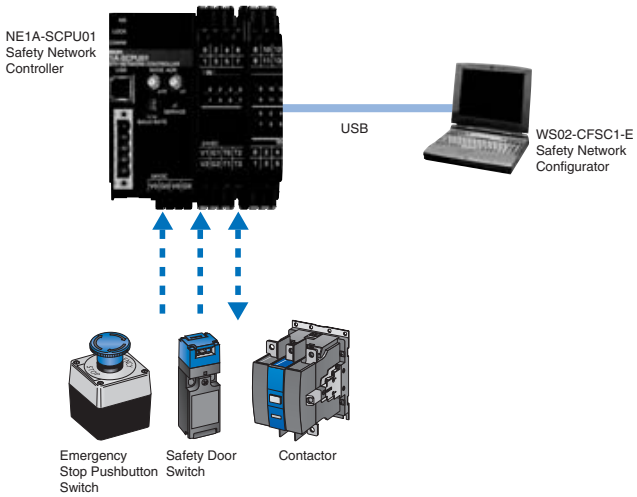


System Configuration 1

Configuration Example for High-speed Safety I/O Response Using Small Number of Points

- NE1A-SCPU01
- WS02-CFSC1-E

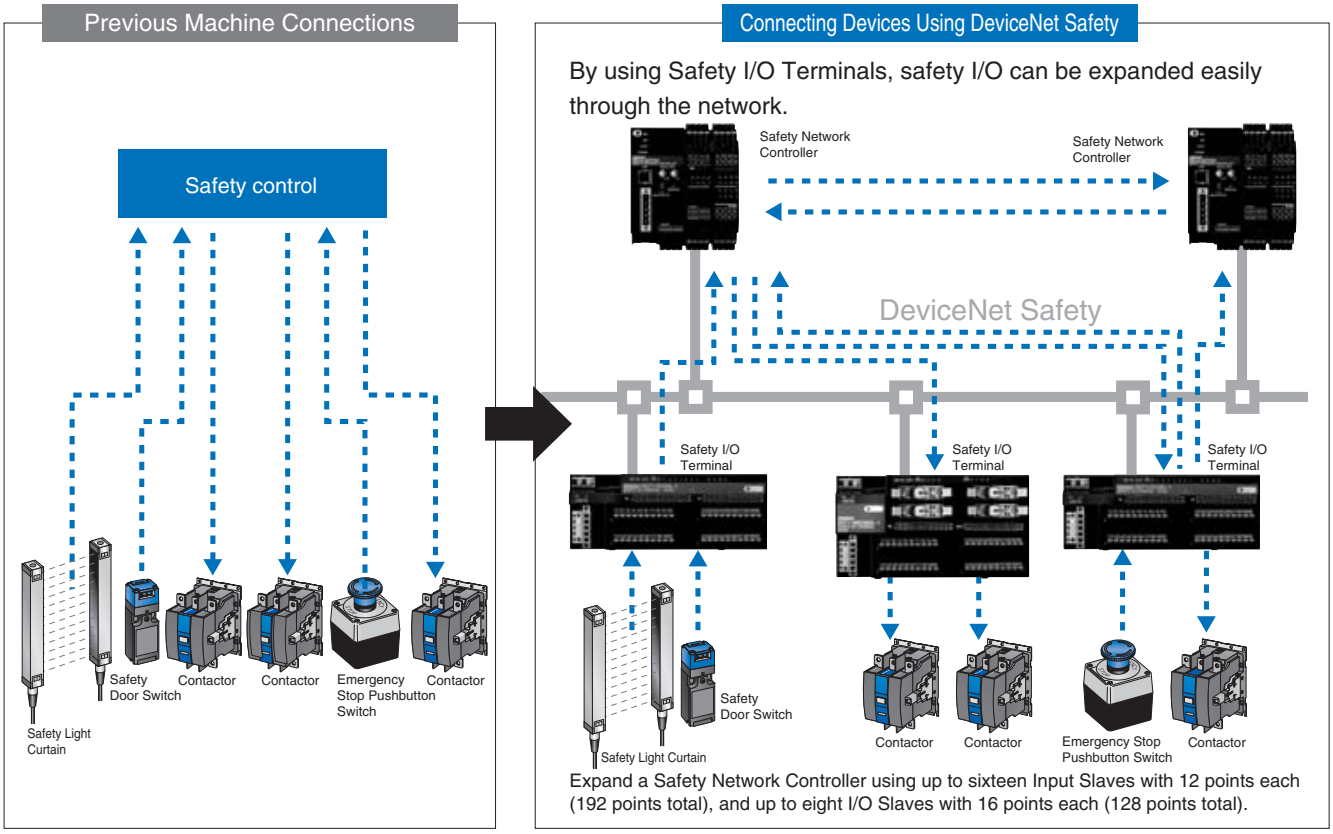
Delivers high-speed I/O response in a single Unit with up to 16 safety inputs and 8 safety outputs.



Safety Network

Expand Safety I/O Through Networks

Safety components distributed over many different installation locations required long and complicated wiring.
Replacing the wiring with a network between safety components greatly improves productivity

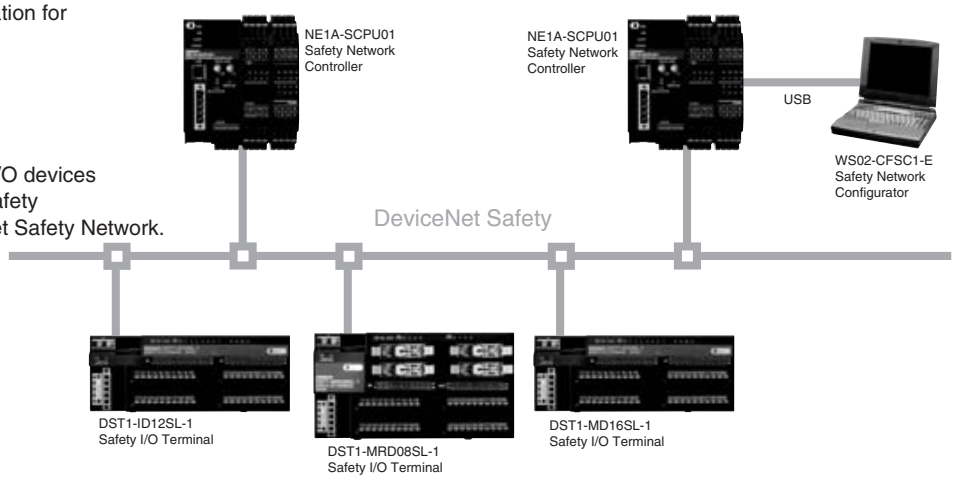


System Configuration 2

Example of Safety I/O Configuration for Distributed Hazard Sources

- NE1A-SCPU01
- DST1 Series
- WS02-CFSC1-E

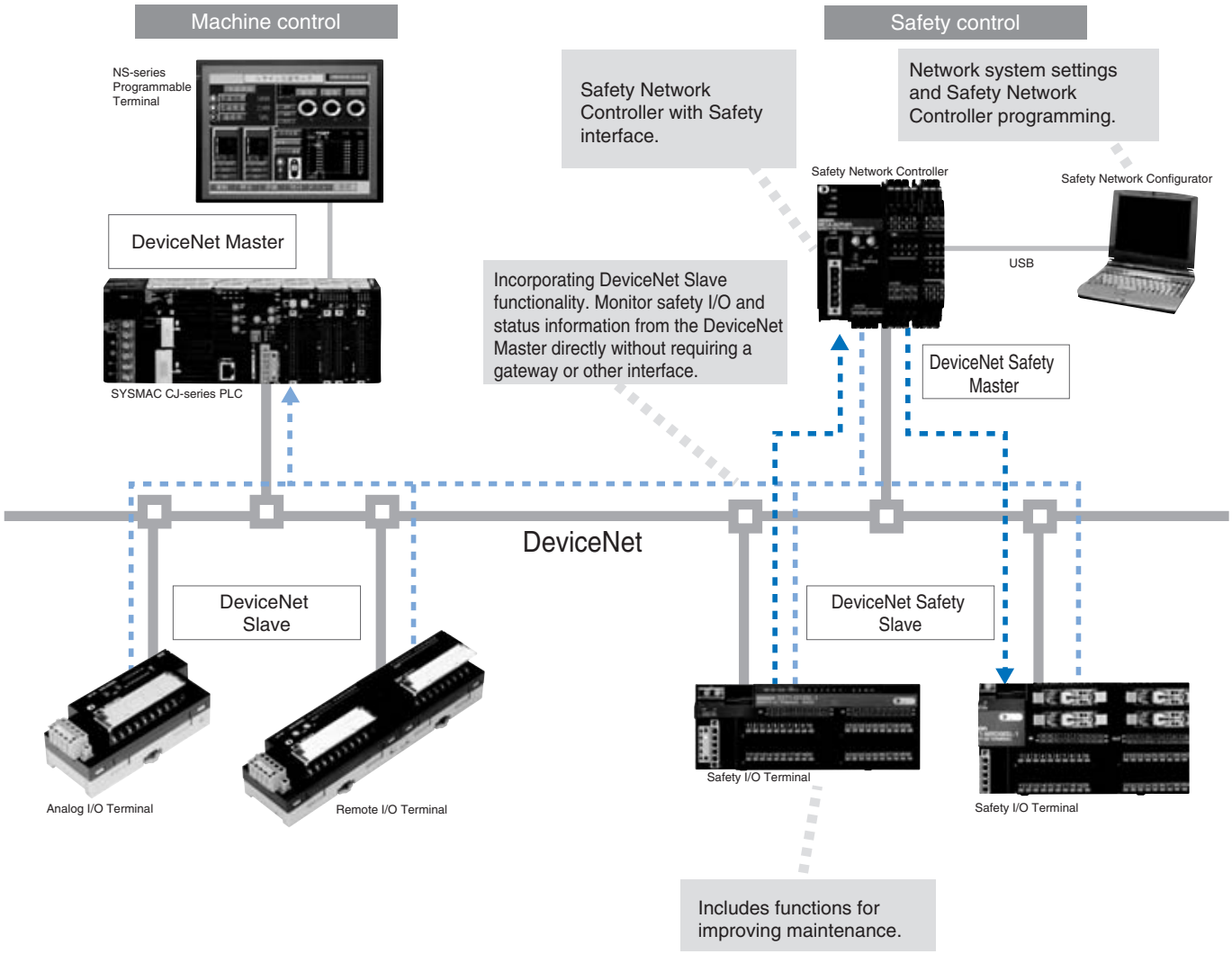
Distributed allocation of safety I/O devices can be achieved easily using Safety I/O Terminals and the DeviceNet Safety Network.



Combined Safety / DeviceNet Network

Compatible with the DeviceNet Open Network

Linking machine control is indispensable for achieving total control. By linking to machine control data, safety control can be monitored from the PLC, enabling the location of an error to be identified in an instant and improving maintenance.
DeviceNet Safety System utilizes the DeviceNet wiring from the existing network as is.

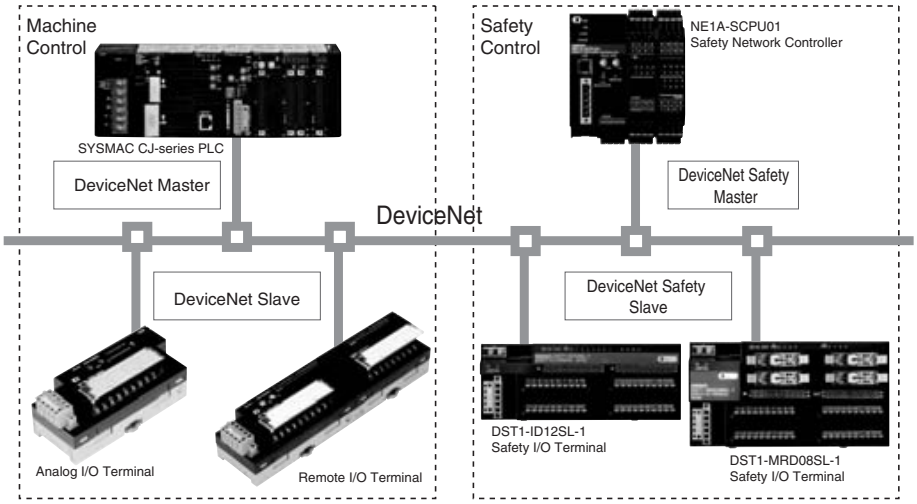


System Configuration 3

System Configuration Example for Total Control of Machine Control and Safety Control

- SYSMAC CJ Series
- NE1A-SCPU01
- DST1 Series
- WS02-CFSC1-E

The DeviceNet Network can be used to monitor the status of safety I/O and safety circuits on the DeviceNet Safety Network from existing DeviceNet Masters or other PLCs.



Ordering Information

Safety I/O Terminals

Appearance	Appearance Description	Part Number
Safety Network Controller 	16 PNP Inputs 8 PNP Outputs 4 Test Outputs 128 Function Block Programming Removable Cage Clamp Terminals	NE1A-SCPU01

IP20 Safety I/O Terminals

Appearance	Appearance Description	Part Number
Input Terminal 	12 PNP Inputs 4 Test Outputs Removable Cage Clamp Terminals	DST1-ID12SL-1
Mixed I/O Terminal 	8 PNP Inputs 8 PNP Outputs 4 Test Outputs Removable Cage Clamp Terminals	DST1-MD16SL-1
Mixed I/O Terminal 	4 PNP Inputs 4 relay Outputs (4 x 2-single pole) 4 Test Outputs Removable Cage Clamp Terminals	DST1-MRD08SL-1

Software

Appearance	Appearance Description	Part Number
Safety Network Configurator 	Installation Disk (CD-ROM) IBM PC/AT Compatible Windows 2000 or XP	WS02-CFSC1-E (English Version)

Specifications

NE1A-SCPU01

General Specifications

DeviceNet communications power supply voltage		11 to 25 VDC (supplied from communications connector)
Unit power supply voltage		20.4 to 26.4 VDC (24 VDC 15% +10%)
I/O power supply voltage		
Consumption current	Communications power supply	24 VDC, 15 mA
	Internal circuit power supply	24 VDC, 230 mA
Overvoltage category		II
Noise immunity		Conforms to IEC 61131-2
Vibration resistance		10 to 57 Hz: 0.35 mm, 57 to 150 Hz: 50 m/s2
Shock resistance		150 m/s2: 11 ms
Mounting method		35-mm DIN Track
Ambient operating temperature		-10 to +55°C
Ambient operating humidity		10% to 95% (with no condensation)
Ambient storage temperature		-40 to +70°C
Degree of protection		IP20
Weight		460 g max.

Safety Input Specifications

Input type	Sinking inputs (PNP)
ON voltage	11 VDC min. between each input terminal and G1
OFF voltage	5 VDC min. between each input terminal and G1
OFF current	1 mA max.
Input current	4.5 mA

DST1-□SL-1

General Specifications

DeviceNet communications power supply voltage		11 to 25 VDC (supplied from communications connector)
Unit power supply voltage		20.4 to 26.4 VDC (24 VDC 15% +10%)
I/O power supply voltage		
Consumption current	Communications power supply	DST1-ID12SL-1/MD16SL-1: 100 mA DST1-MRD08SL-1: 110 mA
Overvoltage category		II
Noise immunity		Conforms to IEC 61131-2
Vibration resistance		10 to 57 Hz: 0.35 mm, 57 to 150 Hz: 50 m/s2
Shock resistance		DST1-ID12SL-1/MD16SL-1: 150 m/s² 11 ms DST1-MRD08SL-1: 100 m/s² 11 ms
Mounting method		35-mm DIN Track
Ambient operating temperature		-10 to +55°C
Ambient operating humidity		10% to 95% (with no condensation) DST1-MRD08SL-1: 10% to 85% (with no condensation)
Ambient storage temperature		-40 to +70°C
Degree of protection		IP20
Weight		DST1-ID12SL-1/MD16SL-1: 420 g DST1-MRD08SL-1: 600 g

Safety Input Specifications

Input type	Sinking inputs (PNP)
ON voltage	11 VDC min. between each input terminal and G1
OFF voltage	5 VDC min. between each input terminal and G1
OFF current	1 mA max.
Input current	6 mA

Note: For details on operating precautions and other information required to use the product, be sure to read the following operation manual: DeviceNet Safety DST1-series Safety I/O Terminals Operation Manual (Z904)

Safety Output Specifications

Output type	Sourcing outputs (PNP)
Rated output current	0.5 A max. per output
Residual voltage	1.2 V max. between each output terminal and V2
Leakage current	0.1 mA max.

Test Output Specifications

Output type	Sourcing outputs (PNP)
Rated output current	0.7 A max. per output (See note.)
Residual voltage	1.2 V max. between each output terminal and V1
Leakage current	0.1 mA max.

Note: Total simultaneous ON current: 1.4 A

Standards

Certifying body	Standards
TÜV Rheinland	EN954-1:1996, EN60204-1:1997, EN61000-6-2:2001, EN61000-6-4:2001, EN418:1992, IEC61508 part1-7/ 12.98-05.00, IEC61131-2/02.03, NFPA 79-2002, ANSI RIA15.06-1999, ANSI B11.19-2003
UL	UL1998 (pending), NFPA79 (pending), UL508, CSA22.2 No14, UL1604

Note: For details on operating precautions and other information required to use the product, be sure to read the following operation manual: DeviceNet Safety Network Controller Operation Manual (Z906)

Safety Output Specifications

Output type	Sourcing outputs (PNP)
Rated output current	0.5 A max. per output
Residual voltage	1.2 V max. between each output terminal and V2
Leakage current	0.1 mA max.

Test Output Specifications

Output type	Sourcing outputs (PNP)
Rated output current	0.7 A max. per point
Residual voltage	1.2 V max. between each output terminal and V1
Leakage current	0.1 mA max.

Safety Output Specifications for Realy Outputs

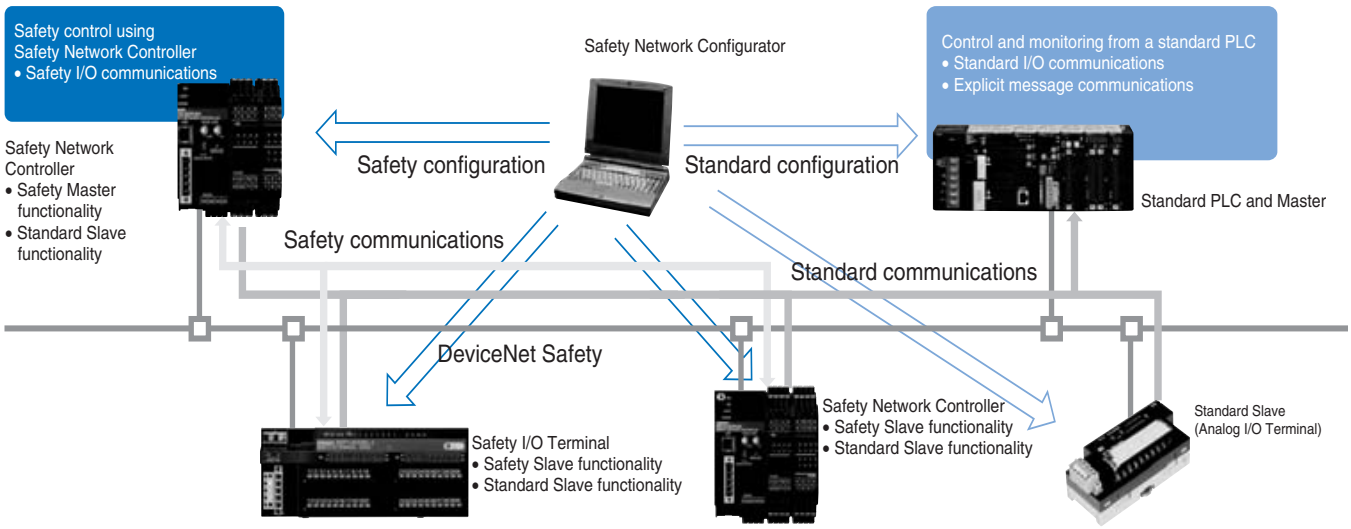
Relays	G7SA-2A2B, EN 50205 Class A
Minimum applicable load	1 mA at 5 VDC
Rated load for a resistive load	240 VAC: 2 A, 30 VDC: 2 A
Rated load for an inductive load	2 A at 240 VAC (cos =0.3), 1 A at 24 VDC
Mechanical life expectancy	5,000,000 operations min. (switching frequency of 7,200 operations/h)
Electrical life expectancy	100,000 operations min. (at rated load and switching frequency of 1,800 operations/h)

Standards

Certifying body	Standards
TÜV Rheinland	EN954-1/12.96, EN60204-1/12.97, EN61000-6-2/10.01, EN61000-6-4/10.01,EN418/1992, IEC61508 part1-7/ 12.98-05.00,IEC61131-2/02.03, NFPA 79-2002,ANSI RIA15.06-1999, ANSI B11.19-2003
UL	UL1998, NFPA79, UL508, CSA22.2 No14, UL1604 (DST1-ID12SL-1 and DST1-MD16SL-1 only)

WS02-CFSC1-E

System Configuration



General Specifications

Compatible computer	IBM PC/AT or compatible
CPU	Pentium 300 MHz min.
OS	Windows 2000 or XP
Supported languages	English
Memory	128 Mbytes min.
Hard disk	40 Mbytes min. available space
Monitor	Display functionality of S-VGA monitor or higher
CD-ROM	One CD-ROM drive min.
Communications port	Either of the following communications ports is required. • USB port: For online communications via SNC USB port (USB1.1) • DeviceNet Interface Card (3G8E2-DRM21-EV1): For online communications via DeviceNet.

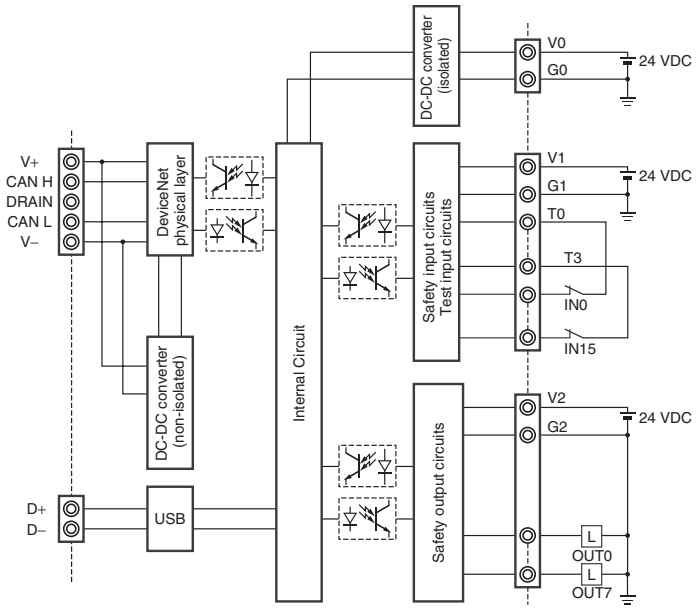
Note: Windows is a registered trademark of Microsoft.
IBM is a registered trademark of International Business Machines Corp.

Manuals

Description	Reference Number
Devicenet Safety Network Controller Operation Manual	Z906
Devicenet Safety DST1-series Safety I/O Terminals Operation Manual	Z904
Devicenet Safety System Configuration Manual	Z905

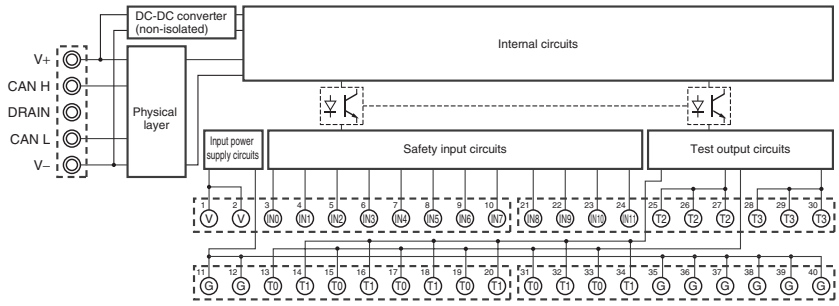
Internal Circuit Configuration

NE1A-SCPU01

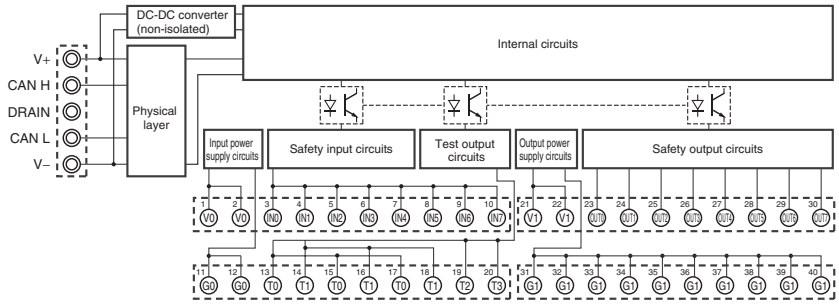


Safety I/O Terminals

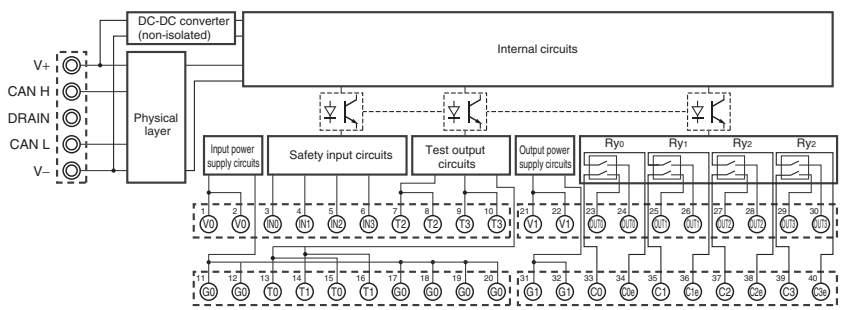
DST1-ID12SL-1



DST1-MD16SL-1



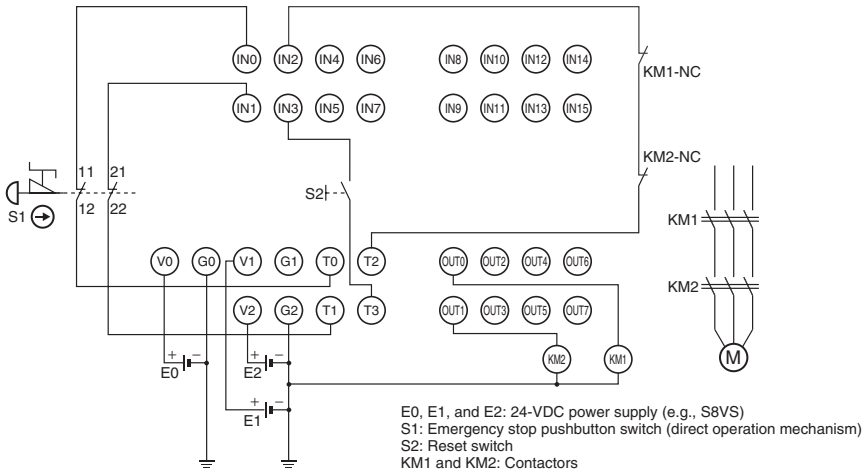
DST1-MRD08SL-1



Wiring Diagrams

NE1A-SCPU01

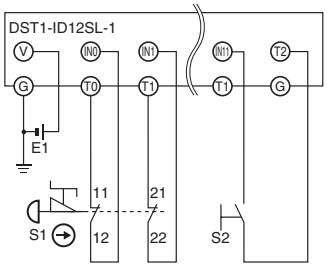
Emergency Stop Applications (Manual Reset)



E0, E1, and E2: 24-VDC power supply (e.g., S8VS)
S1: Emergency stop pushbutton switch (direct operation mechanism)
S2: Reset switch
KM1 and KM2: Contactors

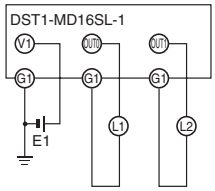
Safety I/O Terminals

● Emergency Stop Switch and Reset



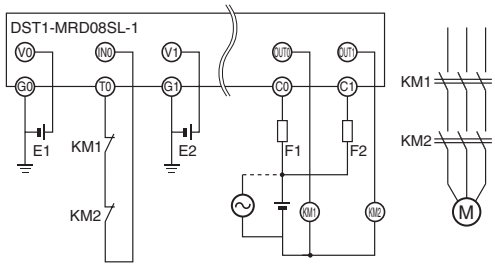
E1: 24-VDC Power Supply (e.g., S8VS)
S1: Emergency stop pushbutton switch (direct operation mechanism)
S2: Reset switch

● Safety Outputs



E1: 24-VDC Power Supply (e.g., S8VS)
L1 and L2: Loads

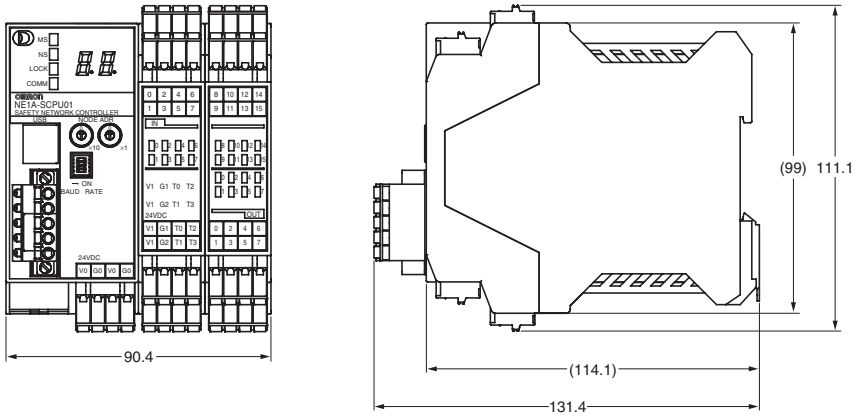
● Safety Output and Output Feedback



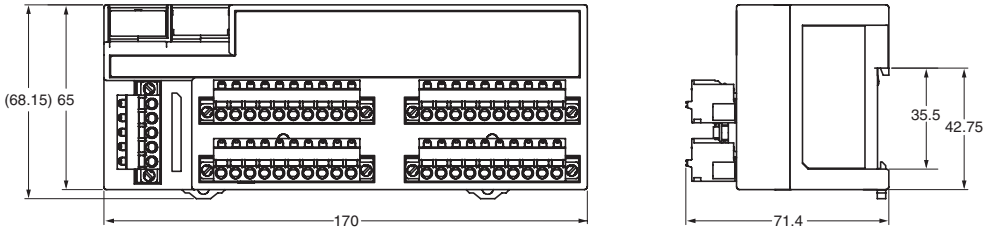
E1: 24-VDC Power Supply (e.g., S8VS)
KM1 and KM2: Contactors
F1 and F2: Fuses

Dimensions

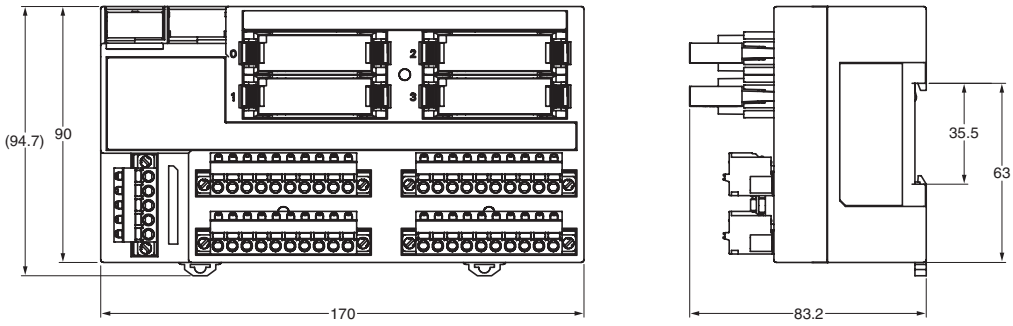
NE1A-SCPU01



DST1-ID12SL-1
DST1-MD16SL-1



DST1-MRD08SL-1



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

Cat. No. Z907-E2-01-X In the interest of product improvement, specifications are subject to change without notice.

Flexible Safety Unit

G9SX

Logical AND Function in combination with clever I/O Expansion and Diagnosis offers Flexibility, Transparency and Availability

- Facilitates clear and transparent segmentation of your safety system
- Solid-state outputs for long live, and relay expansion units for up to 25 outputs per path.
- Detailed LED indications enable easy diagnosis
- Small size saves space.
- Clever Feeback outputs to feed status into control system
- Approved for compliance to EN954-1 (cat4) and IEC/EN61508 (SIL3) by TÜV Produkt Service
- Approved by UL and CSA for global market.

Note: Refer to *Precautions* on page G-103.

Model Number Legend

G9SX-□□□□□-□□□-□□

1 2 3 4 5 6

1. **Functions**
   AD: Advanced Unit
   BC: Basic Unit
   EX: Expansion Unit
2. **Output Configuration (Instantaneous Safety Outputs)**
   0: None
   2: 2 outputs
   3: 3 outputs
   4: 4 outputs
3. **Output Configuration (OFF-delayed Safety Outputs)**
   0: None
   2: 2 outputs
   4: 4 outputs
4. **Output Configuration (Auxiliary Outputs)**
   1: 1 output
   2: 2 outputs
5. **Max. OFF-delay Time**
   Advanced Unit
   T15: 15 s
   Basic Unit
   No indicator: No OFF delay
   Expansion Unit
   No indicator: No OFF delay
   T: OFF delay
6. **Terminal Block Type**
   RT: Screw terminals
   RC: Spring-cage terminals

Ordering Information

List of Models

Advanced Unit

Safety outputs		Auxiliary outputs	No. of input channels	Max. OFF-delay time (See note 1.)	Rated voltage	Terminal block type	Model
Instantaneous	OFF-delayed (See note 2.)						
3 (solid state) (See note 3.)	2 (solid state) (See note 3.)	2 (solid state) (See note 4.)	1 or 2 channels	15 s	24 VDC	Screw terminals	G9SX-AD322-T15-RT
						Spring-cage terminals	G9SX-AD322-T15-RC

Note: 1. The OFF-delay time can be set in 16 steps as follows:
T15: 0/0.2/0.3/0.4/0.5/0.6/0.7/1/1.5/2/3/4/5/7/10/15 s

2. The OFF-delayed output becomes an instantaneous output by setting the OFF-delay time to 0 s.

3. P channel MOS FET transistor output

4. PNP transistor output

Basic Unit

Safety outputs		Auxiliary outputs	No. of input channels	Rated voltage	Terminal block type	Model
Instantaneous	OFF-delayed					
2 (solid state) (See note 1.)	---	2 (solid state) (See note 2.)	1 or 2 channels	24 VDC	Screw terminals	G9SX-BC202-RT
					Spring-cage terminals	G9SX-BC202-RC

Note: 1. P channel MOS FET transistor output

2. PNP transistor output

Expansion Unit

Safety outputs		Auxiliary outputs	OFF-delay time	Rated voltage	Terminal block type	Model
Instantaneous	OFF-delayed					
4 PST-NO (contact)	---	1 (solid state) (See note 1.)	---	24 VDC	Screw terminals	G9SX-EX401-RT
					Spring-cage terminals	G9SX-EX401-RC
---	4 PST-NO (contact)		(See note 2.)		Screw terminals	G9SX-EX041-T-RT
					Spring-cage terminals	G9SX-EX041-T-RC

Note: 1. PNP transistor output

2. The OFF-delay time is synchronized to the OFF-delay time setting in the connected G9SX-AD-□ Advanced Unit.

Specifications

Ratings

Power input

Item	G9SX-AD322-□	G9SX-BC202-□	G9SX-EX-□
Rated supply voltage	24 VDC		
Operating voltage range	−15% to 10% of rated supply voltage		
Rated power consumption (See note.)	4 W max.	3 W max.	2 W max.

Note: Power consumption of loads not included.

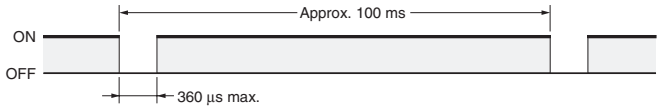
Inputs

Item	G9SX-AD322-□	G9SX-BC202-□
Safety input	Operating voltage: 20.4 VDC to 26.4 VDC, internal impedance: approx. 2.8 kΩ	
Feedback/reset input		

Outputs

Item	G9SX-AD322-□	G9SX-BC202-□
Instantaneous safety output OFF-delayed safety output (See note 1.)	P channel MOS FET transistor output Load current: Using 2 outputs or less: 1 A DC max. (See note 2.) Using 3 outputs or more: 0.8 A DC max.	P channel MOS FET transistor output Load current: Using 1 output: 1 A DC max. (See note 2.) Using 2 outputs: 0.8 A DC max.
Auxiliary output	PNP transistor output Load current: 100 mA max.	

Note: 1. While safety outputs are in the ON state, the following signal sequence is output continuously for diagnosis. When using the safety outputs as input signals to control devices (i.e. Programmable Controllers), consider the OFF pulse shown below.



2. The following derating is required when Units are mounted side-by-side.
G9SX-AD322-□/G9SX-BC202-□: 0.4 A max. load current

Expansion Unit

Item	G9SX-EX-□
Rated load	250 VAC, 3A / 30 VDC, 3A (resistive load)
Rated carry current	3 A
Maximum switching voltage	250 VAC, 125 VDC

Characteristics

Item		G9SX-AD322-□	G9SX-BC202-□	G9SX-EX-□
Over-voltage category (IEC/EN 60664-1)		II		II (Safety relay outputs 13 to 43 and 14 to 44: III)
Operating time (OFF to ON state) (See note 1.)		50 ms max. (Safety input: ON) (See note 2.) 100 ms max. (Logical AND connection input: ON) (See note 3.)	50 ms max. (Safety input: ON)	30 ms max. (See note 4.)
Response time (ON to OFF state) (See note 1.)		15 ms max.		10 ms max. (See note 4.)
ON-state residual voltage		3.0 V max. (safety output, auxiliary output)		
OFF-state leakage current		0.1 mA max. (safety output, auxiliary output)		
External connection impedance		100 Ω max. and 10 nF max.		---
Reset input time (Reset button pressing time)		100 ms min.		
Accuracy of OFF-delay time (See note 5.)		Within ±5% of the set value	---	Within ±5% of the set value
Insulation resistance	**Between logical AND connection terminals, and power supply input terminals and other input and output terminals connected together**	20 MΩ min. (by 100 VDC megger)	---	---
	Between all terminals connected together and DIN rail		20 MΩ min. (at 100 VDC)	100 MΩ min. (at 500 VDC)

Item		G9SX-AD322-□	G9SX-BC202-□	G9SX-EX-□
Dielectric strength	**Between logical AND connection terminals, and power supply input terminals and other input and output terminals connected together**	500 VAC for 1 min	---	---
	Between all terminals connected together and DIN rail		500 VAC for 1 min	1,200 VAC for 1 min
	Between different poles of outputs	---	---	
	Between safety relay outputs connected together and other terminals connected together			2,200 VAC for 1 min
Vibration resistance		Frequency: 10 to 55 to 10 Hz, 0.375-mm single amplitude (0.75-mm double amplitude)		
Mechanical shock resistance	**Destruction**	300 m/s^2		
	Malfunction	100 m/s^2		
Durability	**Electrical**	---		100,000 cycles min. (rated load, switching frequency: 1,800 cycles/hour)
	Mechanical	---		5,000,000 cycles min. (switching frequency: 7,200 cycles/hour)
Ambient temperature		−10 to 55°C (no icing or condensation)		
Ambient humidity		25% to 85%		
Terminal tightening torque (See note 6.)		0.5 N·m		
Weight		Approx. 160 g	Approx. 100 g	Approx. 145 g

Note: 1. When two or more Units are connected by logical AND, the operating time and response time are the sum total of the operating times and response times, respectively, of all the Units connected by logical AND.

2. Represents the operating time when the safety input turns ON with all other conditions set.

3. Represents the operating time when the logical AND input turns ON with all other conditions set.

4. This does not include the operating time or response time of Advanced Units that are connected.

5. This does not include the operating time or response time of internal relays in the G9SX-EX-□.

6. For the G9SX-□-RT (with screw terminals) only

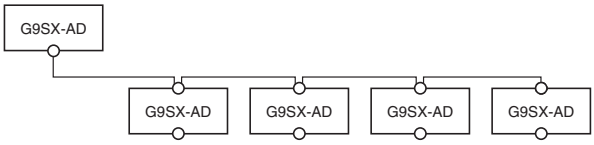
Logical AND Connection

Item	G9SX-AD322-□	G9SX-BC202-□	G9SX-EX-□
Number of Units connected per logical AND output	4 Units max.		---
Total number of Units connected by logical AND (See note 2.)	20 Units max.		---
Number of Units connected in series by logical AND	5 Units max.		---
Max. number of Expansion Units connected (See note 3.)	---		5 Units
Maximum cable length for logical AND input	100 m		---

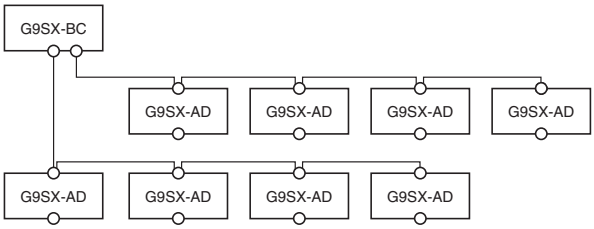
Note: 1. See Logical AND Connection Combinations below for details.
2. The number of G9SX-EX401-□ Expansion Units or G9SX-EX041-T-□ Expansion Units (OFF-delayed Model) not included.
3. G9SX-EX401-□ Expansion Units and G9SX-EX041-T-□ Expansion Units (OFF-delayed Model) can be mixed.

Logical AND Connection Combinations

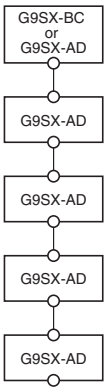
1. One logical AND connection output from an Advanced Unit can be logical AND connected to up to four Advanced Units.



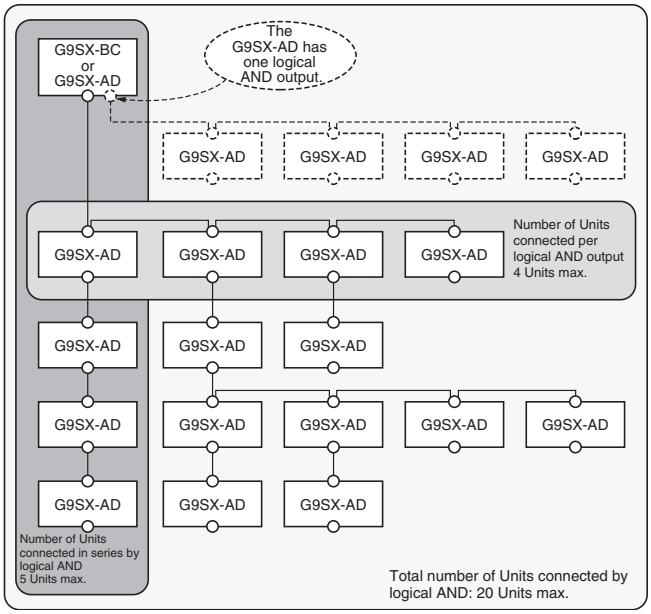
2. Two logical AND outputs from a Basic Unit can be logical AND connected to up to eight Advanced Units.



3. Any Advanced Unit with logical AND input can be logical AND connected to Advanced Units on up to five tiers.



4. The largest possible system configuration contains a total of 20 Advanced and Basic Units. In this configuration, each Advanced Unit can have up to five Expansion Units.



Response Time and Operating Time

The following table shows the response time for two or more Units that are logical AND connected.

Item / Tier	Block flow diagram	Max. response time (not including Expansion Units) (See note 1.)	Max. response time (including Expansion Units) (See note 2.)	Max. operating time (not including Expansion Units) (See note 3.)	Max. operating time (including Expansion Units) (See note 4.)
First tier	 Advanced Unit or Basic Unit	15 ms	25 ms	50 ms	80 ms
Second tier	Advanced Unit	30 ms	40 ms	150 ms	180 ms
Third tier	Advanced Unit	45 ms	55 ms	250 ms	280 ms
Fourth tier	Advanced Unit	60 ms	70 ms	350 ms	380 ms
Fifth tier	Advanced Unit 	75 ms	85 ms	450 ms	480 ms

Note: 1. The maximum response time (not including Expansion Units) in this block flow diagram is the time it takes the output from the Unit on the lowest tier to switch from ON to OFF after the input to the Unit on the highest tier switches from ON to OFF.

2. The maximum response time (including Expansion Units) in this block flow diagram is the time it takes the output from the Expansion Unit connected to the Unit on the lowest tier to switch from ON to OFF after the input to the Unit on the highest tier switches from ON to OFF.

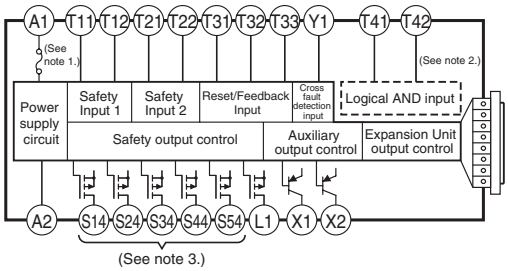
3. The maximum operating time (not including Expansion Units) in this block flow diagram is the time it takes the output from the Unit on the lowest tier to switch from OFF to ON after the input to the Unit on the highest tier switches from OFF to ON.

4. The maximum operating time (including Expansion Units) in this block flow diagram is the time it takes the output from the Expansion Unit connected to the Unit on the lowest tier to switch from OFF to ON after the input to the Unit on the highest tier switches from OFF to ON.

Connections

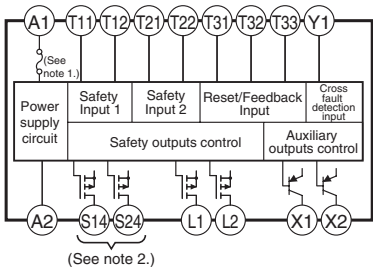
Internal Connection

G9SX-AD-322-T15-□ (Advanced Unit)



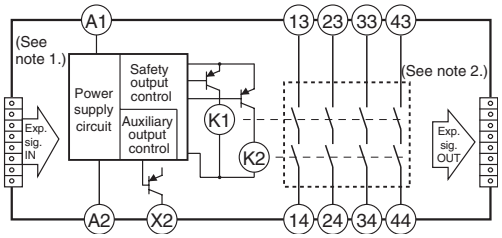
Note: 1. Internal power supply circuit is not isolated.
2. Logical AND input is isolated.
3. Outputs S14 to S54 are internally redundant.

G9SX-BC202-□ (Basic Unit)



Note: 1. Internal power supply circuit is not isolated.
2. Outputs S14 and S24 are internally redundant.

G9SX-EX401-□/G9SX-EX041-T-□ (Expansion Unit / Expansion Unit OFF-delayed model)



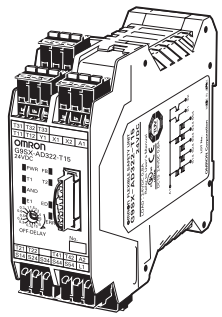
Note: 1. Internal power supply circuit is not isolated.
2. Relay outputs are isolated

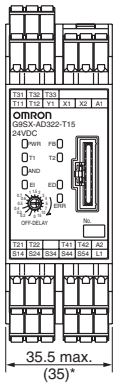
Dimensions

Note: All units are in millimeters unless otherwise indicated.

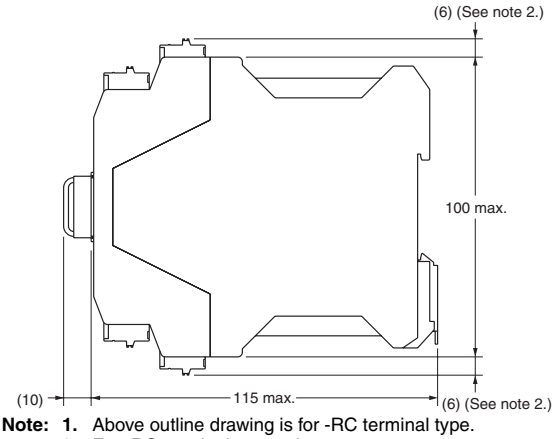
Advanced Unit

G9SX-AD322-□



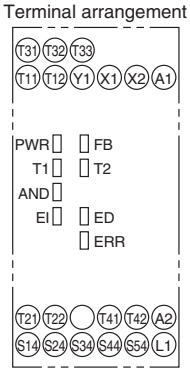


* Typical dimension



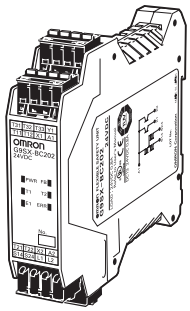
Note: **1.** Above outline drawing is for -RC terminal type.
2. For -RC terminal type only.

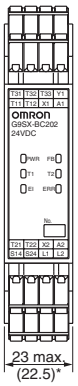
Terminal arrangement



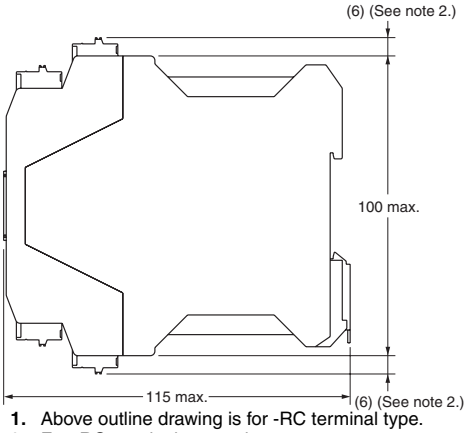
Basic Unit

G9SX-BC202-□



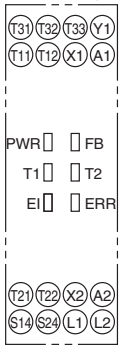


* Typical dimension



Note: **1.** Above outline drawing is for -RC terminal type.
2. For -RC terminal type only.

Terminal arrangement

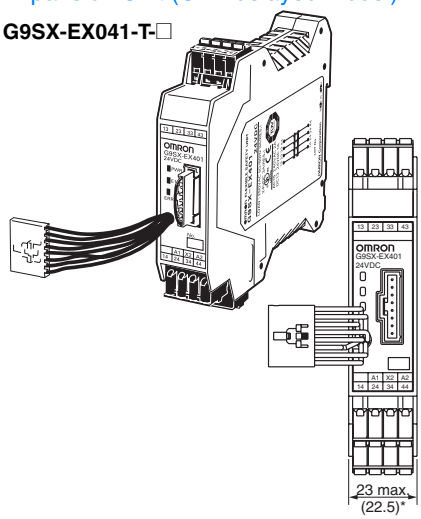


Expansion Unit

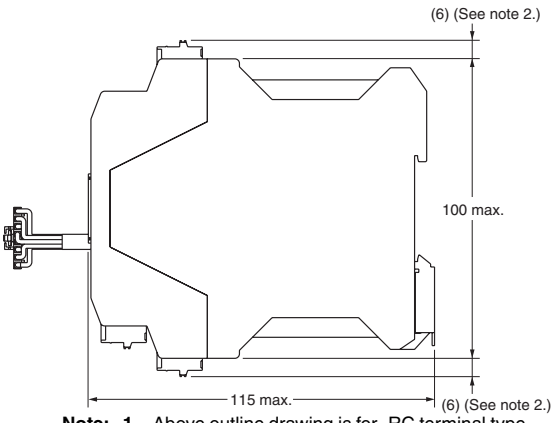
G9SX-EX401-□

Expansion Unit (OFF-delayed Model)

G9SX-EX041-T-□



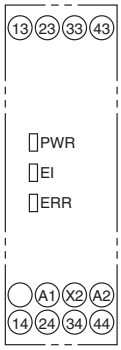
* Typical dimension



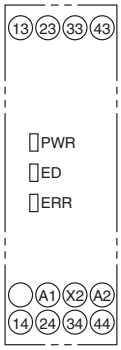
Note: **1.** Above outline drawing is for -RC terminal type.
2. For -RC terminal type only.

Terminal arrangement

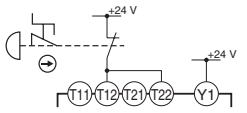
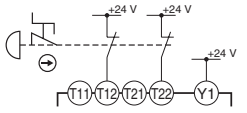
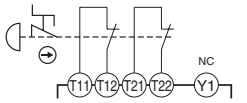
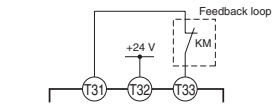
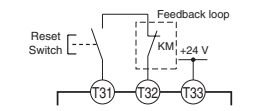
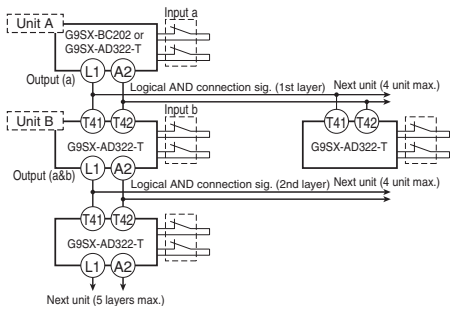
G9SX-EX401-□ (Expansion Unit)



G9SX-EX041-T-□ (Expansion Unit with OFF Delay)

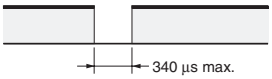


Wiring of Inputs and Outputs

Signal name	Terminal name	Description of operation	Wiring	
Power supply input	A1, A2	The input terminals for power supply. Connect the power source to the A1 and A2 terminals.	Connect the power supply plus (24 VDC) to the A1 terminal. Connect the power supply minus (GND) to the A2 terminal.	
Safety input 1	T11, T12	To set the safety outputs in the ON state, the HIGH state signals must be input to both safety input 1 and safety input 2. Otherwise the safety outputs cannot be in the ON state.	Corresponds to Safety Category 2 (EN954-1)	
Safety input 2	T21, T22		Corresponds to Safety Category 3 (EN954-1)	
			Corresponds to Safety Category 4 (EN954-1)	
Feedback/reset input	T31, T32, T33	To set the safety outputs in the ON state, the ON state signal must be input to T33. Otherwise the safety outputs cannot be in the ON state.	Auto reset	
		To set the safety outputs in the ON state, the signal input to T32 must change from the OFF state to the ON state, and then to the OFF state. Otherwise the safety outputs cannot be in the ON state.	Manual reset	
Logical AND connection input	T41, T42	The logical AND connection means that one unit (Unit A) outputs a safety signal "a" to a subsequent unit (Unit B) and Unit B calculates the logical multiplication (AND) of the signal "a" and safety signal "b", which is input to Unit B. Thereby the logic of the safety output of Unit B is "a" AND "b". To set the safety outputs of the subsequent Unit in the ON state, its logical AND connection preset switch must be set to AND (enable) and the HIGH state signal must be input to T41 of the subsequent unit.		
Cross fault detection input	Y1	Selects the mode for the failure detecting (cross fault detecting) function for the safety inputs of G9SX corresponding to the connection of the cross fault detection input.	Keep Y1 open when using T11, T21. (Wiring corresponding to category 4) Connect Y1 to 24 VDC when not using T11, T21. (Wiring corresponding to category 2 or 3, or when connecting safety sensors)	
Instantaneous safety output	S14, S24, S34	Turns ON/OFF according to the state of the safety inputs, feedback/reset inputs, and logical AND connection inputs. During OFF-delay state, the Instantaneous safety outputs are not able to turn ON.	Keep these outputs open when not used.	
OFF-delayed safety output	S44, S54	OFF-delayed safety outputs. The OFF-delay time is set by the OFF-delay preset switch. When the delay time is set to zero, these outputs can be used as non-delay outputs.	Keep these outputs open when not used.	
Logical connection output	L1, L2	Outputs a signal of the same logic as the instantaneous safety outputs.	Keep these outputs open when not used.	
Auxiliary monitor output	X1	Outputs a signal of the same logic as the instantaneous safety outputs	Keep these outputs open when not used.	
Auxiliary error output	X2	Outputs when the error indicator is lit or blinking.	Keep these outputs open when not used.	

Connecting Safety Sensors and the G9SX

1. When connecting safety sensors to the G9SX, the Y1 terminal must be connected to 24 VDC.
   The G9SX will detect a connection error, if the Y1 terminal is open.
2. In many cases, safety sensor outputs include an OFF-shot pulse for self diagnosis.
   The following condition of test pulse is applicable as safety inputs for the G9SX.
   - OFF-shot pulse width of the sensor, during the ON-state: 340 µs max. OMRON safety sensors comply to this specification. For 3rd party products refer to OSSD specification

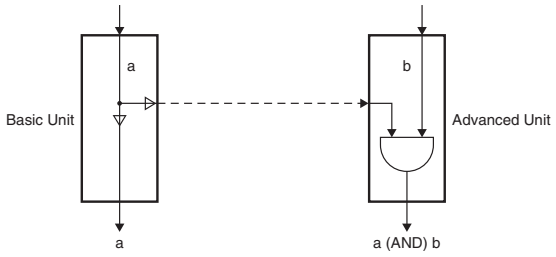


Operation

Functions

Logical AND Connection

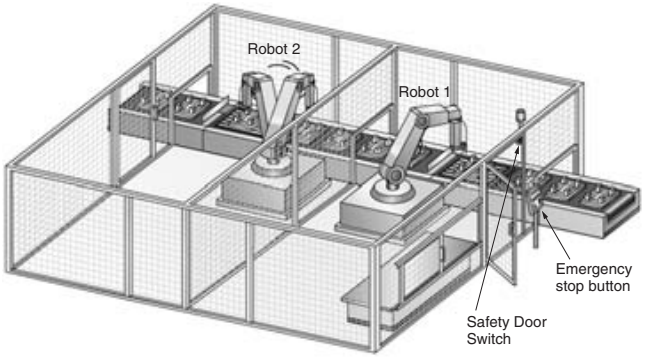
The logical AND connection means that the Basic Unit (or Advanced Unit) outputs a safety signal "a" to an Advanced Unit, and the Advanced Unit calculates the logical multiplication (AND) of the safety signal "a" and safety signal "b." The safety output of an Advanced Unit with the logical AND connection shown in the following diagram is "a" AND "b".

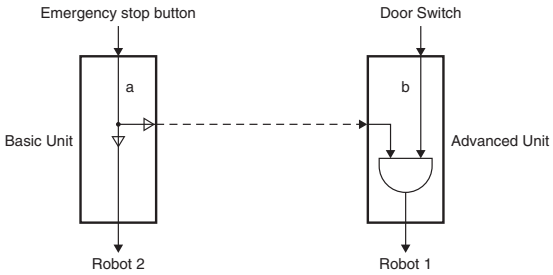


This is illustrated using the application in the following diagram as an example. The equipment here has two hazards identified as Robot 1 and Robot 2, and it is equipped with a safety door switch and an emergency stop button. You may have overall control where both Robot 1 and Robot 2 are stopped every time the emergency stop button is pressed. You may also have partial control where only Robot 1, which is closest to the door, is stopped when the door is opened. In that case, Robot 2 will continue to operate.

The actual situation using a G9SX for this application is shown in this example.

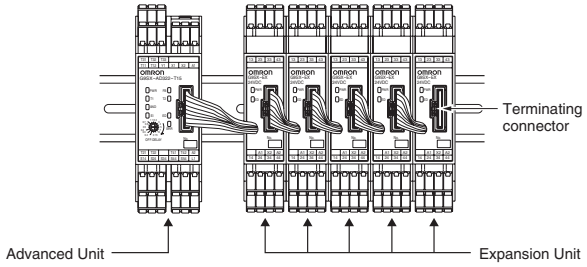
(Note: The logical AND setting on the Advanced Unit must be set to AND (enabled).)





Connecting Expansion Units

- The G9SX-EX and G9SX-EX-T Expansion Units can be connected to a G9SX-AD-□ Advanced Unit to increase the number of safety outputs. (They cannot be connected to a Basic Unit.)
- A maximum of five Expansion Units can be connected to one Advanced Unit. This may be a combination of G9SX-EX Instantaneous types and G9SX-EX-T OFF-delayed types.
- Remove the terminating connector from the receptacle on the Advanced Unit and insert the Expansion Unit cable connector into the receptacle. Insert the terminating connector into the receptacle on the Expansion Unit at the very end (rightmost).
- When Expansion Units are connected to an Advanced Unit, make sure that power is supplied to every Expansion Unit. (Refer to the following diagram for actual Expansion Unit connection.)

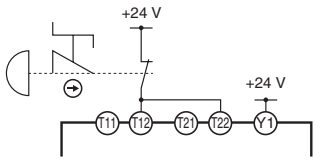
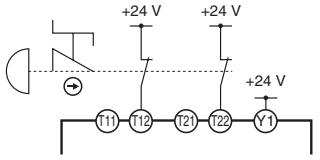
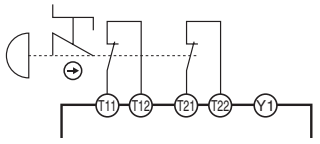


Setting Procedure

1. Cross Fault Detection (Advanced Unit/Basic Unit)

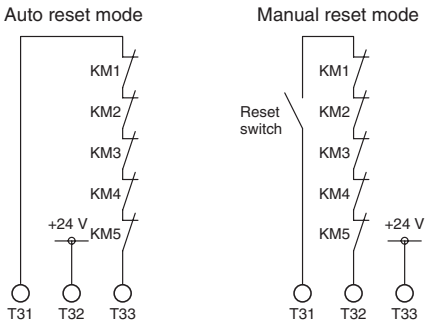
Set the cross fault detection mode for safety inputs by shorting Y1 to 24 V or leaving it open. When cross fault detection is set to ON, short-circuit failures are detected between safety inputs T11-T12 and T21-22. When a cross fault is detected, the following will occur.

1. The safety outputs and logical AND outputs lock out.
2. The LED error indicator is lit.
3. The error output (auxiliary output) turns ON.

Cross fault detection	Wiring	
OFF	Corresponds to Safety Category 2	
	Corresponds to Safety Category 3	
ON	Corresponds to Safety Category 4	

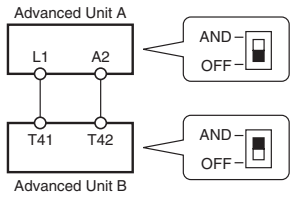
2. Reset Mode (Advanced Unit/Basic Unit)

Set the reset mode using feedback/reset input terminals T31, T32, and T33.
Auto reset mode is selected when terminal T32 is shorted to 24 V and manual reset mode is selected when terminal T33 is shorted to 24 V.



3. Setting Logical AND Connection (Advanced Unit)

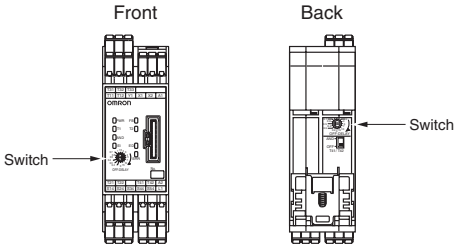
When connecting two or more Advanced Units (or Basic Units) by logical AND connection, set the logical AND connection preset switch on the Advanced Unit that is on the input side (Advanced Unit B in the following diagram) to AND.



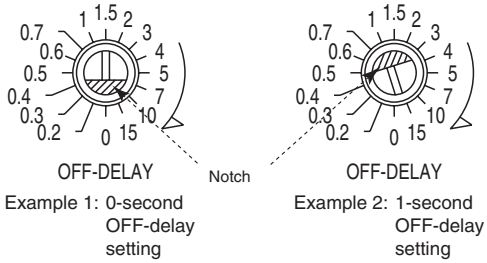
Note: 1. A setting error will occur and Advanced Unit B will lock out if the logical AND setting switch on the Unit is set to OFF.
2. Set the logical AND setting switch on Advanced Unit A to OFF or an error will occur.
3. A logical AND input cannot be sent to a Basic Unit.

4. Setting the OFF-delay Time (Advanced Unit)

The OFF-delay preset time on an Advanced Unit is set from the OFF-delay time preset switch (1 each on the front and back of the Unit). Normal operation will only occur if both switches are identically set. An error will occur if the switches are not identically set.



Refer to the following illustration for details on setting switch positions.



Example 1: 0-second OFF-delay setting

Example 2: 1-second OFF-delay setting

⚠ Make sure AND and off delay time is set properly. Otherwise safety outputs remain in safe off state.

LED Indicators

Marking	Color	Name	G9SA-AD	G9SX-BC	G9SX-EX	G9SX-EX-T	Function	Reference
PWR	**Green**	**Power supply indicator**	❍	❍	❍	❍	Lights up while power is supplied.	---
T1	**Orange**	**Safety input #1 indicator**	❍	❍	---	---	Lights up while a HIGH state signal is input to T12. Blinks when an error relating to safety input #1 occurs.	(See note.)
T2	**Orange**	**Safety input #2 indicator**	❍	❍	---	---	Lights up while a HIGH state signal is input to T22. Blinks when an error relating to safety input #2 occurs.	
FB	**Orange**	**Feedback/ reset input indicator**	❍	❍	---	---	Lights up in the following cases: With automatic reset while a HIGH state signal is input to T33. With manual reset while a HIGH state signal is input to T32. Blinks when an error relating to feedback/reset input occurs.	
AND	**Orange**	**Logical AND input indicator**	❍	---	---	---	Lights up while a HIGH state signal is input to T41. Blinks when an error relating to logical AND connection input occurs.	
EI	**Orange**	**Safety output indicator**	❍	❍	❍	---	Lights up while the Instantaneous safety outputs (S14, S24, S34) are in the ON-state. Blinks when an error relating to the instantaneous safety output occurs.	
ED	**Orange**	**OFF-delayed safety output indicator**	❍	---	---	❍	Lights up while OFF-delayed safety outputs (S44, S54) are in the ON-state. Blinks when an error relating to OFF-delayed safety output occurs.	
ERR	**Red**	**Error indicator**	❍	❍	❍	❍	Lights up or blinks when an error occurs.	

Note: Refer to *Fault Detection* on the next page for details.

Settings Indication (at Power ON)

Settings for the G9SX can be checked by the orange indicators for approx. 3 seconds after the power is turned ON. During this settings indication period, the ERR indicator will light, however the auxiliary error output will remain OFF

Indicator	Item	Setting position	Indicator status	Setting mode	Setting status
T1	Cross fault detection mode	Y1 terminal	Lit	Detection mode	Y1 = open
			Not lit	Non-detection mode	Y1 = 24 VDC
FB	Reset mode	T32 or T33 terminal	Lit	Manual reset mode	T33 = 24 VDC
			Not lit	Auto reset mode	T32 = 24 VDC
AND	Logical AND connection input mode	Logical AND connection preset switch	Lit	Enable logical AND input	“AND”
			Not lit	Disable logical AND input	“OFF”

Fault Detection

When the G9SX detects a fault, the ERR indicator and/or other indicators light up or blink to inform the user about the fault.

Check and take necessary measures referring to the following table, and then re-supply power to the G9SX.

(Advanced Unit/Basic Unit)

ERR indicator	Other indicator	Fault	Expected causes of the fault	Check points and measures to take
Blinks	---	Fault due to electro-magnetic disturbance or of internal circuits.	1) Excessive electro-magnetic disturbance 2) Failure of the internal circuit	1) Check the disturbance level around the G9SX and the related system. 2) Replace with a new product.
Lights up	T1 blinks	Fault involved with safety input 1	1) Failure involving the wiring of safety input 1 2) Incorrect setting of cross fault detection input 3) Failure of the circuit of safety input 1	1) Check the wiring to T11 and T12. 2) Check the wiring to Y1. 3) Replace with a new product.
	T2 blinks	Fault involved with safety input 2	1) Failure involving the wiring of safety input 2 2) Incorrect setting of cross fault detection input 3) Failure of circuits of safety input 2	1) Check the wiring to T21 and T22. 2) Check the wiring to Y1. 3) Replace with a new product.
	FB blinks	Faults involved with feedback/reset input	1) Failures involving the wiring of feedback/reset input. 2) Failures of the circuit of feedback/reset input	1) Check the wiring to T31, T32 and T33. 2) Replace with a new product.
		Fault in Expansion Unit	1) Improper feedback signals from Expansion Unit 2) Abnormal supply voltage to Expansion Unit 3) Failure of the circuit of safety relay contact outputs	1) Check the connecting cable of Expansion Unit and the connection of the termination socket. 2) Check the supply voltage to Expansion Unit. **Note:** Make sure that all Expansion units' PWR indicators are lit. 3) Replace the Expansion Unit with a new one.
	EI blinks	Fault involved with instantaneous safety outputs or logical connection outputs or auxiliary monitor output	1) Failure involving the wiring of instantaneous safety outputs 2) Failure of the circuit of Instantaneous safety outputs 3) Failure involving the wiring of the logical connection output 4) Failure of the circuit of the logical connection output 5) Failure involving the wiring of the auxiliary monitor output 6) Impermissible high ambient temperature	1) Check the wiring to S14, S24, and S34. 2) Replace with a new product. 3) Check the wiring to L1 and L2. 4) Replace with a new product. 5) Check the wiring to X1. 6) Check the ambient temperature and spacing around the G9SX.
	ED blinks	Fault involved with OFF-delayed safety outputs	1) Failure involving the wiring of OFF-delayed safety relay contact outputs 2) Incorrect set values for OFF-delay time 3) Failure of the circuit of OFF-delayed safety relay contact outputs 4) Impermissible high ambient temperature	1) Check the wiring to S44 and S54 2) Confirm the set values of the two OFF-delay time preset switches. 3) Replace with a new product. 4) Check the ambient temperature and spacing around the G9SX.
	AND blinks	Fault involved with logical AND connection input	1) Failure involving the wiring of the logical AND connection input 2) Incorrect setting for the logical AND connection input 3) Failure of the circuit of the logical AND connection input	1) Check the wiring to T41 and T42 **Note:** Make sure that the wiring length for the T41 or T42 terminal is less than 100 meters. **Note:** Make sure that the logical AND connection signal is branched for less than 4 units. 2) Confirm the set value of the logical AND connection preset switch. 3) Replace with a new product.
	All indicators except PWR blink	Supply voltage outside the rated value	1) Supply voltage outside the rated value	1) Check the supply voltage to Expansion Units.

When indicators other than the ERR indicator blink, check and take necessary actions referring to the following table.

ERR indicator	Other indicators		Fault	Expected cause of the fault	Check points and measures to take
○ Off	T1 T2	☼ Blink	Mismatch between input 1 and input 2.	The input status between input 1 and input 2 is different, due to contact failure or a short circuit of safety input device(s) or a wiring fault.	Check the wiring from safety input devices to the G9SX. Or check the input sequence of safety input devices. After removing the fault, turn both safety inputs to the OFF state.

(Expansion Unit)

ERR indicator	Other indicators	Fault	Expected cause of the faults	Check points and measures to take
● Light up	---	Fault involved with safety relay outputs of Expansion Units	1) Welding of relay contacts 2) Failure of the internal circuit	Replace with a new product.

Precautions

Precautions for Correct Use

Serious injury may possibly occur due to breakdown of safety outputs.
Do not connect loads beyond the rated value to the safety outputs.

Serious injury may possibly occur due to loss of required safety functions.
Wire G9SX properly so that supply voltages or voltages for loads do NOT touch the safety inputs accidentally or unintentionally.

Serious injury may possibly occur due to damages of safety inputs.
Apply protection circuitry against back electromotive force in case connecting inductive loads to safety outputs.

Serious injury may possibly occur due to loss of safety functions. Use devices appropriate for the application and the condition where G9SX is used.

Control Devices	Requirements
Emergency stop switch	Use approved devices with Direct Opening Mechanism complying with IEC/EN 60947-5-1
Door interlocking switch Limit switch	Use approved devices with Direct Opening Mechanism complying with IEC/EN 60947-5-1 and capable of switching micro loads of 24VDC, 5mA.
Safety Sensor	Use approved devices complying with the relevant product standards, regulations and rules in the country where it is used. Consult a certification body to assess that the entire system satisfies the required safety category level.
Relay with forcibly guided contacts	Use approved devices with forcibly guided contacts complying with EN 50205. For feedback purpose use devices with contacts capable of switching micro loads of 24VDC, 5mA.
Contactor	Use contactors with forcibly guided mechanism to input the signal to Feedback/Reset input of G9SX through the NC contact of the contactor. For feedback purpose use devices with contacts capable of switching micro loads of 24VDC, 5mA. Failure to open contacts of a contactor cannot be detected by monitoring its auxiliary NC contact without forcibly guided mechanism.
Other devices	Evaluate whether devices used are appropriate to satisfy the requirements of safety category level.

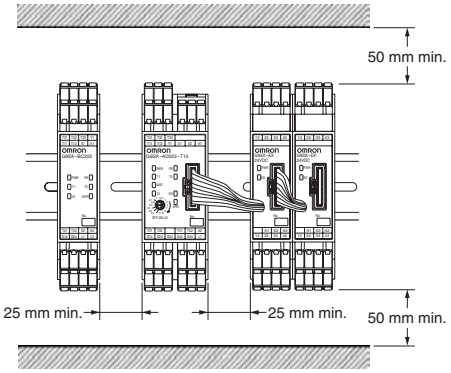
Precautions for Safe Use

1. Use G9SX within an enclosure with IP54 protection or higher of IEC/EN60529.
2. Incorrect wiring may lead to loss of safety function. Wire conductors correctly and verify the operation of G9SX before commissioning the system in which G9SX is incorporated.
3. Do not apply DC voltages exceeding the rated voltages, or any AC voltages to the G9SX power supply input.
4. Use DC supply satisfying requirements below to prevent electric shock.
   - DC power supply with double or reinforced insulation, for example, according to IED/EN60950 or EN50178 or a transformer according to IEC/EN61558.
   - DC supply satisfies the requirement for class 2 circuits or limited voltage/current circuit stated in UL 508.
5. Apply properly specified voltages to G9SX inputs.
   Applying inappropriate voltages cause G9SX to fail to perform its specified function, which leads to the loss of safety functions or damages to G9SX
6. Auxiliary error outputs and auxiliary monitoring outputs are NOT safety outputs. Do not use auxiliary outputs as any safety output. Such incorrect use causes loss of safety function of G9SX and its relevant system.
   Also Logical connection outputs can only be used for logical connections between G9SXs.
7. After installation of G9SX, qualified personnel should confirm the installation, and should conduct test operations and maintenance. The qualified personnel should be qualified and authorized to secure the safety on each phases of design, installation, running, maintenance and disposal of system.
8. A person in charge, who is familiar to the machine in which G9SX is to be installed, should conduct and verify the installation.
9. Turn OFF the signal to Safety input or Logical AND connection input every 24hours and make sure G9SX operates without faults by checking the state of the ERR indicator.
10. Do not dismantle, repair, or modify G9SX. It may lead to loss of its safety functions.
11. Use only appropriate components or devices complying with relevant safety standards corresponding to the required level of safety categories.
    Conformity to requirements of safety category is determined as an entire system.
    It is recommended to consult a certification body regarding assessment of conformity to the required safety level.
12. OMRON shall not be responsible for conformity with any safety standards regarding to customer's entire system.
13. Disconnect G9SX from power supply when wiring, to prevent electric shock or unexpected operation.
14. Be cautious not to have your fingers caught when attaching terminal sockets to the plugs on G9SX.
15. The lifetime of G9SX depends on the conditions of switching of its outputs. Be sure to conduct its test operation under actual operating conditions in advance and use it within appropriate switching cycles
16. Do not use in combustible gases or explosive gases. Arcs or heat generated by switching elements of G9SX can lead to fire or explosion.

Precautions for Correct Use

1. Handle with care
   Do not drop G9SX to the ground or expose to excessive vibration or mechanical shocks. G9SX may be damaged and may not function properly.
2. Conditions of storage
   Do not store in such conditions stated below.
   a. In direct sunlight
   b. At ambient temperatures out of the range of −10 to 55°C.
   c. At relative humidity out of the range of 25% to 85% or under such temperature change that causes condensation.
   d. In corrosive or combustible gases
   e. With vibration or mechanical shocks out of the rated values.
   f. Under splashing of water, oil, chemicals
   g. In the atmosphere containing dust, saline or metal powder.
   G9SX may be damaged and may not function properly.
3. Mounting
   Mount G9SX to DIN rails with attachments (TYPE PFP-M, not incorporated to this product), not to drop out of rails by vibration etc. especially when the length of DIN railing is short compared to the widths of G9SX.

4. Following spacing around G9SX should be available to apply rated current to outputs of G9SX and for enough ventilation and wiring:
   a. At least 25 mm beside side faces of the Advanced Unit (G9SX-AD322-□-□) and side faces of the Basic Unit (G9SX-BC202-□).
   b. At least 50 mm above top face of G9SX and below bottom face of G9SX.



5. Wiring
   a. For model G9SX-□-RT (with screw terminals)
   • Use the following to wire to G9SX-□-RT.

Solid wire	0.2 to 2.5mm^2 AWG24 to AWG12
Stranded wire (Flexible wire)	0.2 to 2.5mm^2 AWG24 to AWG12

   • Tighten each screw with a specified torque of 0.5 to 0.6Nm, or the G9SX may malfunction or generate heat.
   • Strip the cover of wire no longer than 7mm.
   b. For model G9SX-□-RC (with spring-cage terminals)
   • Use the following to wire to G9SX-□-RC

Solid wire	0.2 to 2.5mm^2 AWG24 to AWG12
Stranded wire	0.34 to 1.5mm^2 AWG22 toAWG16

   • It is recommended that stranded wire should be terminated with insulation-covered bar terminal (DIN 46228-4 standard compatible type) at its ends before using for connection.
6. When connecting Expansion Units (G9SX-EX□-□) to Advanced Unit (G9SX-AD322-□-□):
   a. Follow the procedure below:
   • Remove the termination connector from the receptacle on Advanced Unit (G9SX-AD322-□-□),
   • Insert the head of the connecting cable of Expansion Unit to the receptacle on the Advanced Unit
   • Set the termination connector to the receptacle on the Expansion Unit at the end position. When Advanced Unit is used without expansion units, leave the termination connector set on the Advanced Unit.
   b. Do not remove the termination connector or the connecting cable of the Expansion Unit while the system is operating.
   c. Before applying supply voltage, confirm that the connecting sockets and plugs are locked firmly.
   d. All of the Expansion Units should be supplied with its specified voltages within 10s after the connected Advanced Unit is supplied with voltage.
   Otherwise, Advanced Unit detects the power-supply error for the Expansion Units.
7. Use cables with length less than 100m to connect to Safety Inputs, Feed-back/Reset inputs, or between Logical AND connection inputs and Logical connection outputs, respectively.
8. Set the time duration of OFF-delay to an appropriate value that does not cause the loss of safety function of system.
9. Logical connection between Units:
   a. When using Logical AND connection inputs, set the Logical connection preset switch to 'AND' position for the units which the logical connection signal are input to.
   b. Connect Logical connection outputs appropriately to Logical AND connection inputs of the relevant unit. Verify the operation of G9SX before commissioning the system.
   c. When configuring the safety related system, be sure to consider that the delay of response time caused by logical connections do not degrade the safety function of the system.
10. To determine safety distance to hazards, take into account the delay of Safety outputs caused by the following time:
   a. Response time of Safety inputs
   b. Response time of Logical AND connection input (See also "Ratings and specifications, note 5")
   c. Preset off-delay time
   d. Accuracy of off-delay time
11. Start entire system after more than 5s have passed since applying supply voltage to all G9SXs in the system.
12. G9SX may malfunction due to electro-magnetic disturbances. Be sure to connect the terminal A2 to ground. To suppress electrical noise, apply a surge absorber to the coil of inductive load.
13. Devices connected to G9SX may operate unexpectedly. When replacing G9SX, disconnect it from power supply.
14. Adhesion of solvent such as alcohol, thinner, trichloroethane or gasoline on the product should be avoided. Such solvents make the marking on G9SX illegible and cause deterioration of parts.
15. Do NOT mix AC load and DC load to be switched in one G9SX-EX□-□. When switching of both AC load and DC load is necessary, connect more than two G9SX-EX□-□ and use each unit for AC load and DC load exclusively.

Category of EN 954-1

In the condition shown in *Application Examples*, G9SX can be used for the corresponding categories up to category 4.
This does NOT mean that G9SX can always be used for required category under all the similar conditions and situations.
Conformity to the categories must be assessed as a whole system.
When using G9SX for safety categories, be sure to confirm the conformity as a whole system.

1. Input the signals to both of the Safety inputs (T11-T12 and T21-T22)
2. Input a signal to the Safety inputs (T11-T12 and T21-T22) through switches with Direct Opening Mechanism.
   When using limit switches, at least one of them must have Direct Opening Mechanism.
3. When connecting Safety sensor with G9SX, use TYPE 4 safety sensor.
4. Input the signal through a NC contact of the contactor to Feedback/Reset input (T31-T32 for manual reset or T31-T33 for auto reset).(Refer to *Application Examples*)
5. Keep Cross fault detection mode input (Y1) open. However, when connecting devices with self-diagnosis function, such as safety sensors, apply 24VDC to Y1.
6. Be sure to Connect A2 to ground.
7. When using a G9SX-EX-□-□ Expansion Unit, connect fuses with a current rating of 3.15 A max. to the safety relay outputs to prevent the contacts from welding.

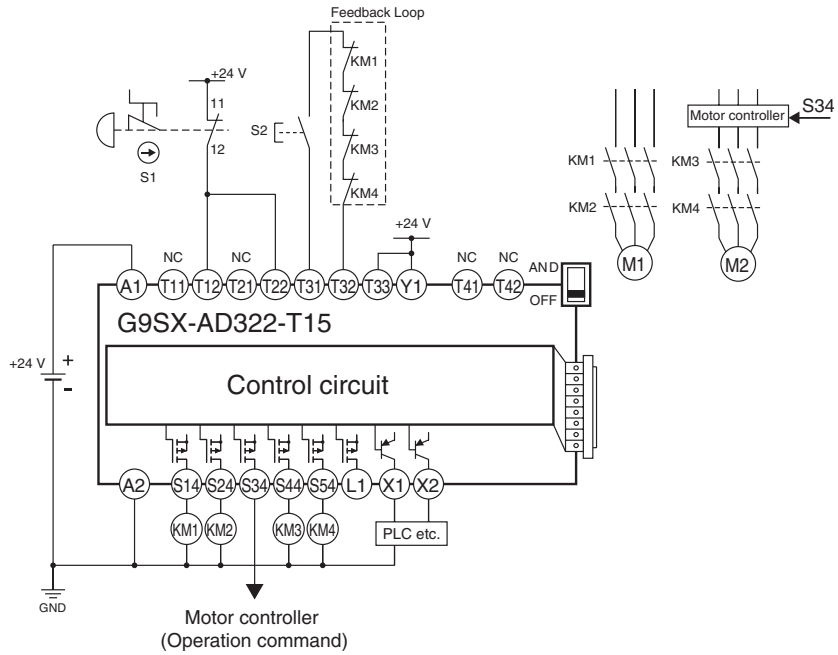
Compliance with International Standards

G9SX-AD-□/G9SX-BC-□/G9SX-EX-□

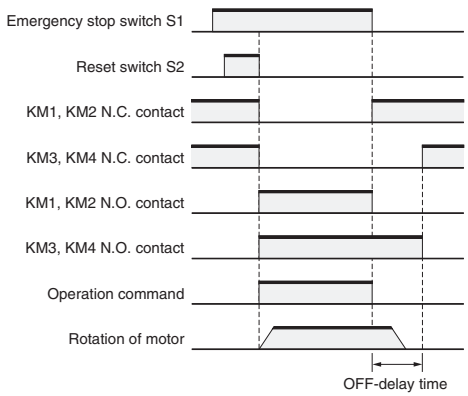
- Approved by TÜV Product Service
  EN50178
  IEC/EN60204-1
  EN954-1 Cat.4
  IEC/EN61508 SIL3
  IEC/EN61000-6-2
  IEC/EN61000-6-4
- Approved by UL
  UL508
  UL1998
  NFPA79
  IEC61508
- Approved by CSA
  CAN/CSA C22.2 No.142

Application Examples

G9SX-AD322-T15 (24 VDC) (1-channel Emergency Stop Switch Input / Manual Reset)



Timing chart



S1: Emergency stop switch

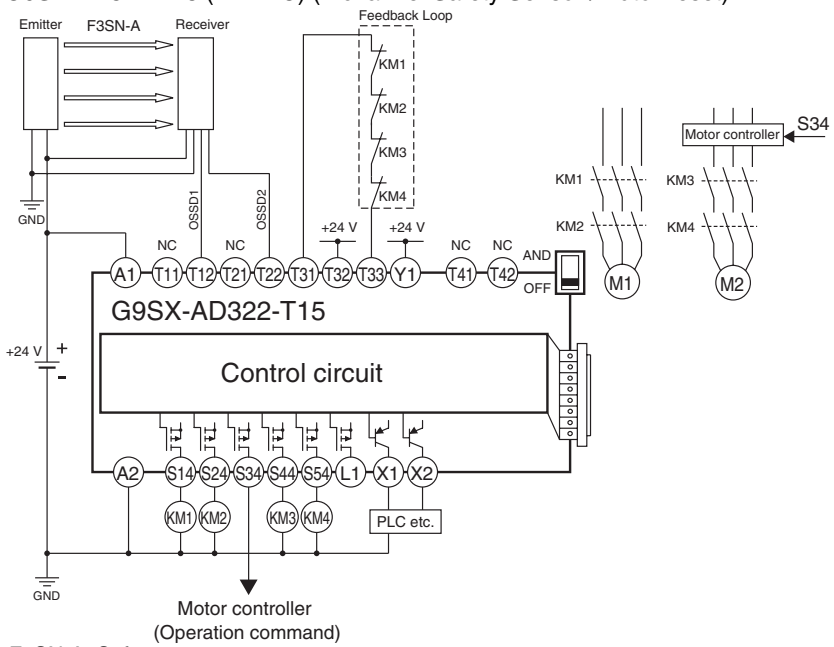
S2: Reset switch S2

KM1 to KM4: Contactor

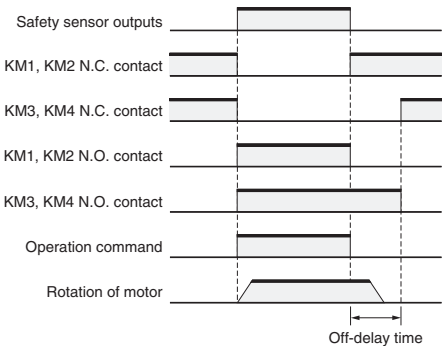
M1, M2: 3-phase motor

Note: This example corresponds to category 2 (EN 954-1)

G9SX-AD322-T15 (24 VDC) (2-channel Safety Sensor / Auto Reset)



Timing chart



F3SN-A: Safety sensor

KM1 to KM4: Contactor

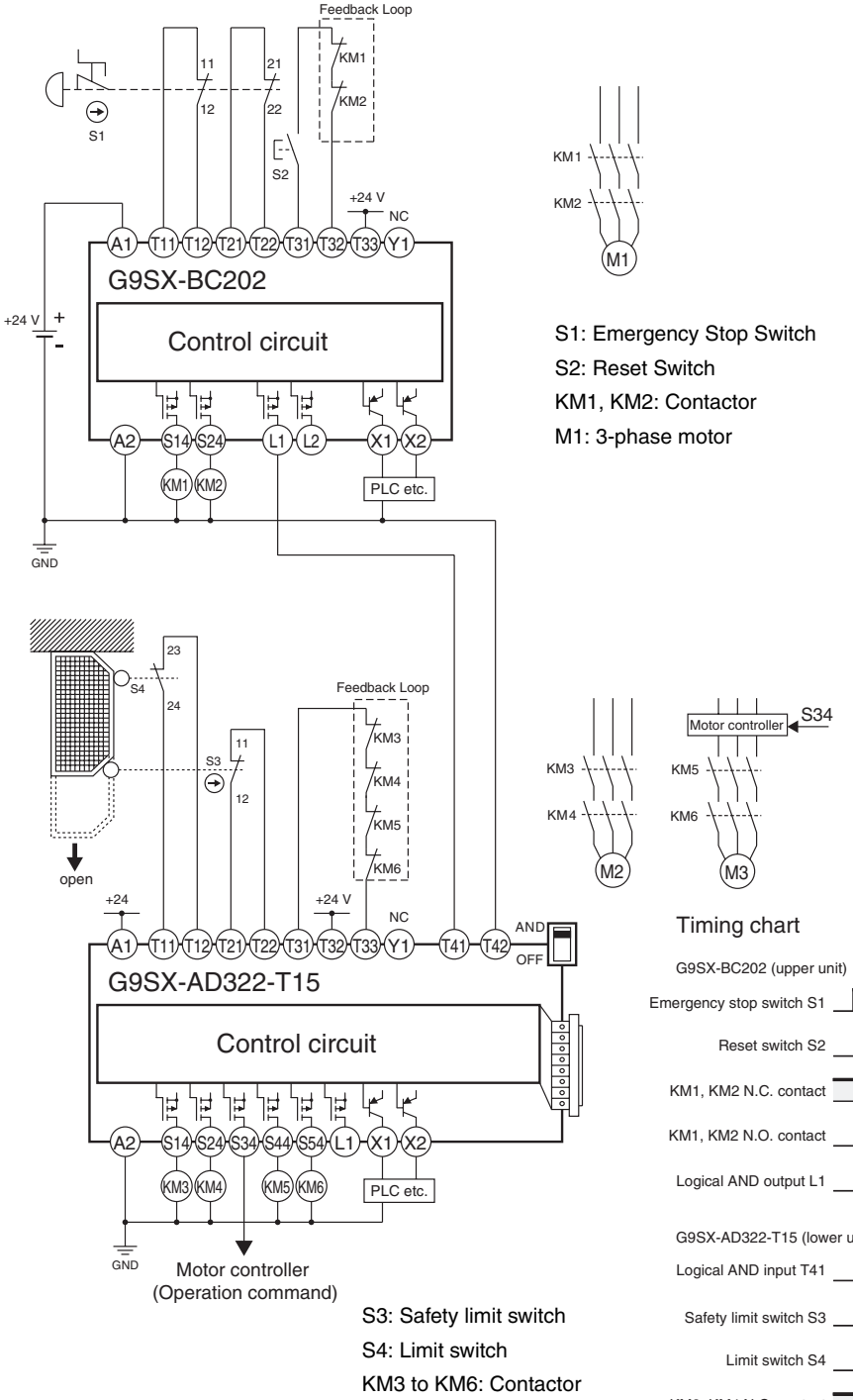
M1, M2: 3-phase motor

Note: 1. This example corresponds to category 4 (EN 954-1)

2. For further information of settings and wiring, refer to the catalog or instruction manual of the connected sensor.

3. Use safety sensors with PNP outputs.

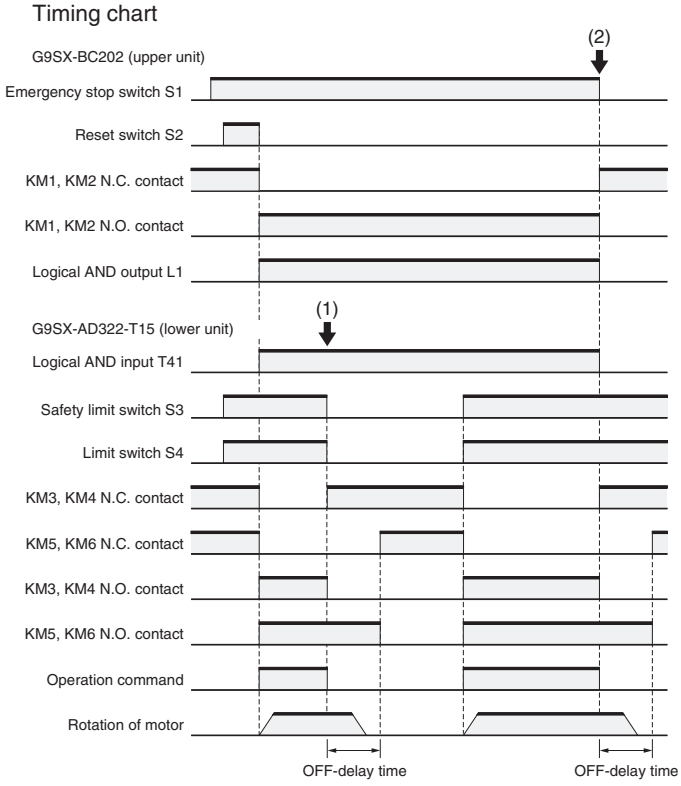
G9SX-BC202 (24 VDC) (2-channel Emergency Stop Switch Input / Manual Reset) +
G9SX-AD322-T15 (24 VDC) (2-channel Safety Limit Switch Input / Auto Reset)



S1: Emergency Stop Switch
S2: Reset Switch
KM1, KM2: Contactor
M1: 3-phase motor

S3: Safety limit switch
S4: Limit switch
KM3 to KM6: Contactor
M2, M3: 3-phase motor

Timing chart

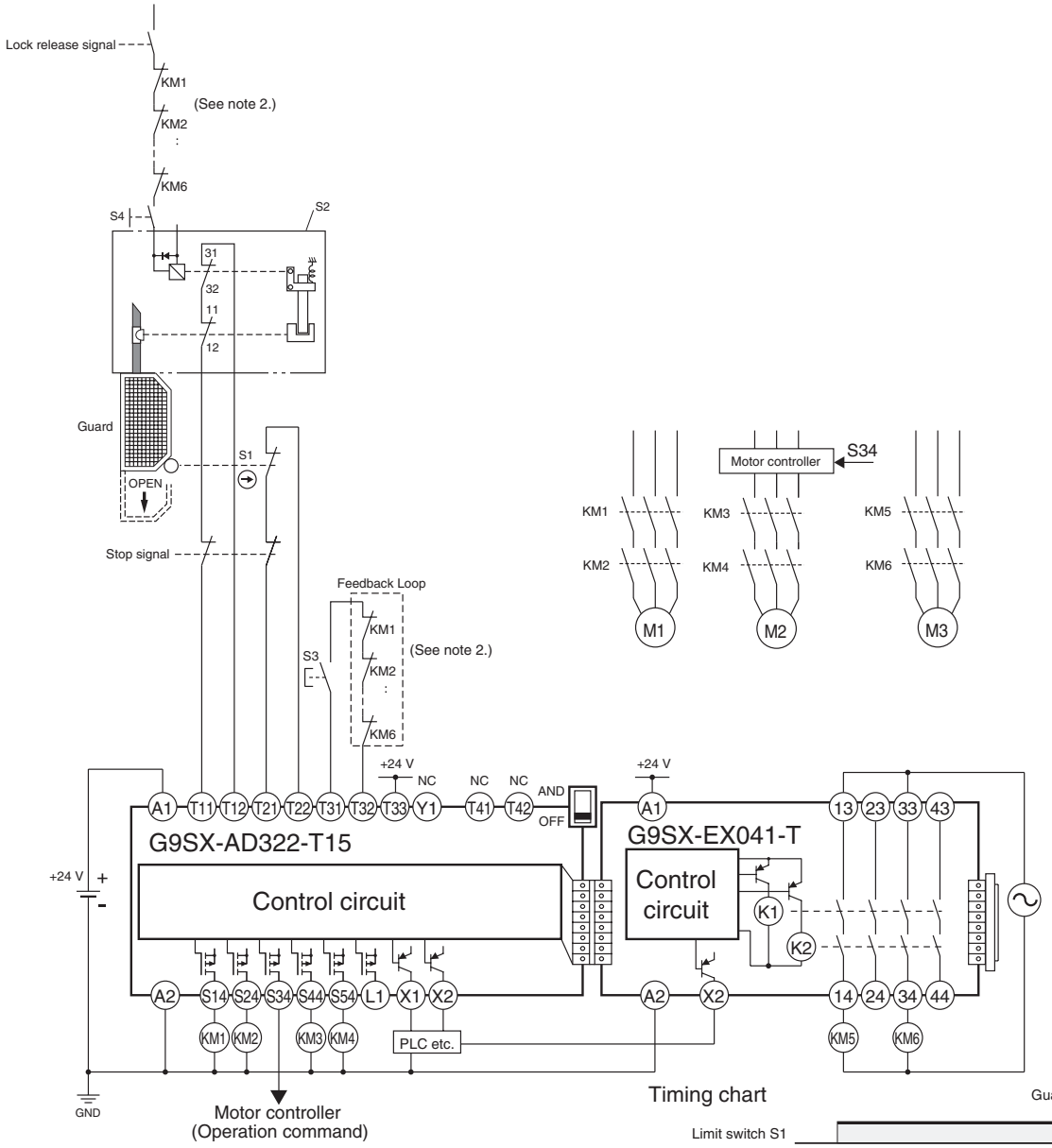


(1) Door opened: Only the lower Unit stops
(2) Emergency stop button pressed: Both the upper and lower Unit stop

Note: This example corresponds to category 4 (EN 954-1).

G9SX-AD322-T15 (24 VDC) + G9SX-EX041-T (24 VDC)

(Guard Lock Safety Door Switch (Mechanical Lock), 2-channel Safety Limit Switch Inputs / Manual Reset)



S1: Safety limit switch

S2: Guard lock safety door switch

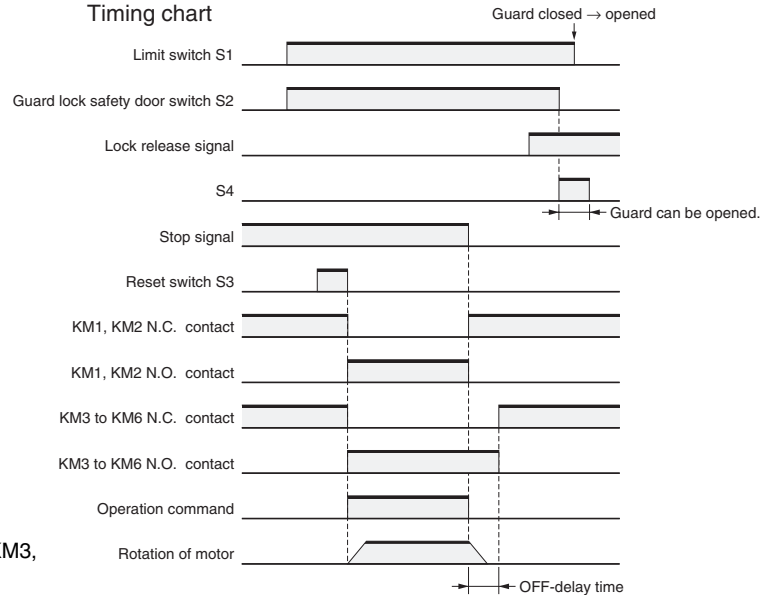
S3: Reset switch

S4: Lock release switch

KM1 to KM6: Contactor

M1 to M3: 3-phase motor

Timing chart



Note: 1. This example corresponds to category 4 (EN 954-1)

2. Connect the N.C. contacts of contactors KM1, KM2, KM3, KM4, KM5, and KM6 in series.

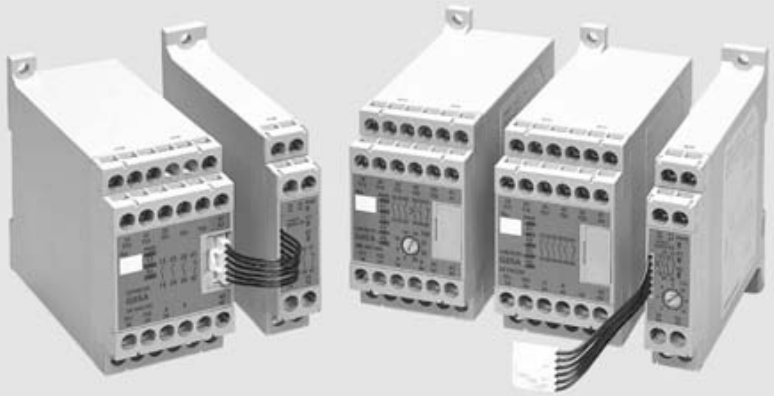
ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. J150-E2-01A-X In the interest of product improvement, specifications are subject to change without notice.

Safety Relay Unit

G9SA

The G9SA Series Offers a Complete Line-up of Compact Units.



- Four kinds of 45-mm wide Units are available:
  A 3-safety contact model, a 5-safety contact model, and models with 3 safety contacts and 2 OFF-delay safety contacts.
  Also available are 17.5-mm wide Expansion Units with 3 safety contacts and 3 OFF-delay safety contacts.
- Two hand controller (type III C, EN 574)
- Simple expansion connection.
- OFF-delay models have 15-step OFF-delay settings.
- Conforms to EN standards. (BG approval)
- Approved by UL and CSA.
- Both DIN track mounting and screw mounting are possible.
- Suitable for PNP OSSD outputs of safety sensors, F3SN, F3SH, F3S-B, F3S-TGR, F3SL

Ordering Information

Emergency-stop Units

Main contacts	Auxiliary contact	Number of input channels	Rated voltage	Model	Category
3PST-NO	SPST-NC	1 channel or 2 channels possible	24 VAC/VDC	G9SA-301	4
			100 to 240 VAC		
5PST-NO	SPST-NC	1 channel or 2 channels possible	24 VAC/VDC	G9SA-501	
			100 to 240 VAC		

Emergency-stop OFF-delay Units

Main contacts	OFF-delay contacts	Auxiliary contact	Number of input channels	OFF-delay time	Rated voltage	Model	Category
3PST-NO	DPST-NO	SPST-NC	1 channel or 2 channels possible	7.5 s	24 VAC/VDC	G9SA-321-T075	Main contacts: 4 OFF-delay contacts: 3
					100 to 240 VAC		
				15 s	24 VAC/VDC	G9SA-321-T15	
					100 to 240 VAC		
				30 s	24 VAC/VDC	G9SA-321-T30	
					100 to 240 VAC		

Note: The following 15-step OFF-delay time settings are available:
T075: 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, and 7.5 s
T15: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15 s
T30: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, and 30 s

Two-hand Controller

Main contacts	Auxiliary contact	Number of input channels	Rated voltage	Model	Category
3PST-NO	SPST-NC	2 channels	24 VAC/VDC	G9SA-TH301	4 (IIIc, EN574)
			100 to 240 VAC		

Expansion Unit

The Expansion Unit connects to a G9SA-301, G9SA-501, G9SA-321, or G9SA-TH301.

Main contacts	Auxiliary contact	Model	Category
3PST-NO	SPST-NC	G9SA-EX301	4

Expansion Units with OFF-delay Outputs

The Expansion Unit connects to a G9SA-301, G9SA-501, G9SA-321, or G9SA-TH301.

Main contact form	Auxiliary contact	OFF-delay time	Model	Category
3PST-NO	SPST-NC	7.5 s	G9SA-EX031-T075	3
		15 s	G9SA-EX031-T15	
		30 s	G9SA-EX031-T30	

Note: The following 15-step OFF-delay time settings are available:
T075: 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, and 7.5 s
T15: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15 s
T30: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, and 30 s

Model Number Legend

G9SA-□□□□□□-□□□□
1 2 3 4 5 6

1. **Function**
   None: Emergency stop
   EX: Expansion Unit
   TH: Two-hand Controller
2. **Contact Configuration (Safety Output)**
   0: None
   3: 3PST-NO
   5: 5PST-NO
3. **Contact Configuration (OFF-delay Output)**
   0: None
   2: DPST-NO
   3: 3PST-NO
4. **Contact Configuration (Auxiliary Output)**
   0: None
   1: SPST-NC
5. **Input Configuration (for G9SA-301/501/321)**
   None: 1-channel or 2-channel input possible
6. **OFF-delay Time (Max. setting time)**
   None: No OFF-delay
   T075: 7.5 seconds
   T15: 15 seconds
   T30: 30 seconds

Specifications

Ratings

Power Input

Item	G9SA-301/TH301	G9SA-501	G9SA-321-T□
Power supply voltage	24 VAC/VDC:24 VAC, 50/60 Hz, or 24 VDC 100 to 240 VAC:100 to 240 VAC, 50/60 Hz		
Operating voltage range	85% to 110% of rated power supply voltage		
Power consumption (See note.)	24 VAC/VDC: 1.8 VA/1.7 W max. 100 to 240 VAC: 9 VA max.	24 VAC/VDC: 2.8 VA/2.6 W max. 100 to 240 VAC: 11 VA max.	24 VAC/VDC: 3.5 VA/3.3 W max. 100 to 240 VAC: 12.5 VA max.

Note: When an Expansion Unit is connected, the power consumption is increased by 2 VA/2 W max.

Inputs

Item	G9SA-301/321-T□/TH301	G9SA-501
Input current (See note.)	40 mA max.	60 mA max.

Note: When an Expansion Unit is connected, the input current is increased by 30 mA max.

Contacts

Item	G9SA-301/501/321-T□/TH301/EX301/EX031-T□
	Resistive load (cos ϕ=1)
Rated load	250 VAC, 5 A
Rated carry current	5 A

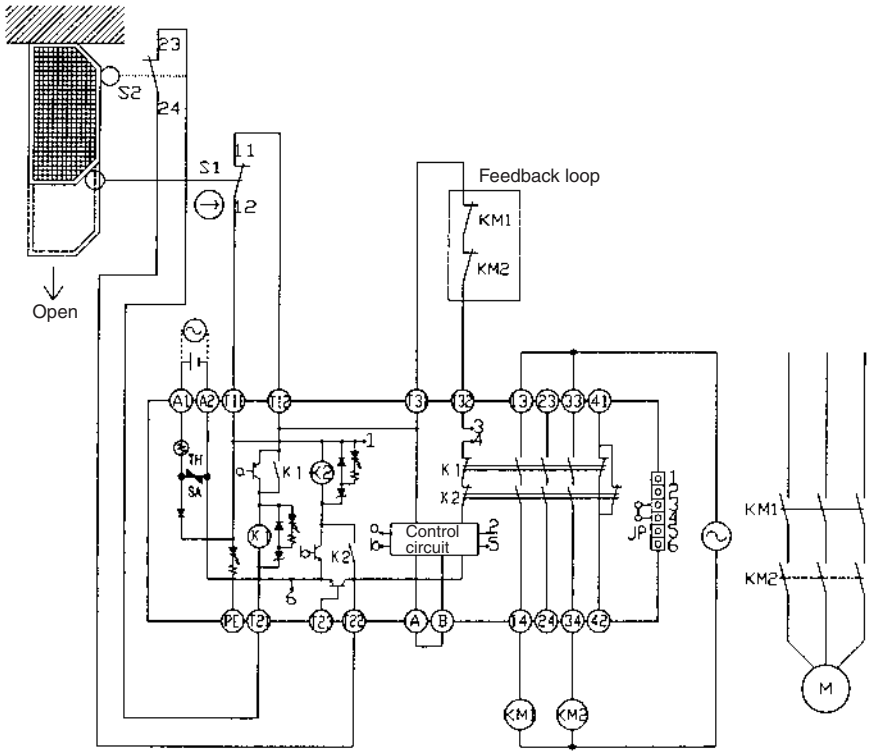
Characteristics

Item		G9SA-301/TH301	G9SA-501/321-T□	G9SA-EX301/EX031-T□
Contact resistance (see note 1)		100 mΩ		
Operating time		30 ms max. (not including bounce time)		
Response time (see note 2)		10 ms max. (not including bounce time)		
Insulation resistance (see note 3)		100 MΩ min. (at 500 VDC)		
Dielectric strength	Between different outputs	2,500 VAC, 50/60 Hz for 1 min		
	Between inputs and outputs			
	Between power inputs and outputs			
	Between power inputs and other inputs (only for 100 to 240-V models)			
Vibration resistance		10 to 55 Hz, 0.75-mm double amplitude		
Shock resistance	Destruction	300 m/s^2		
	Malfunction	100 m/s^2		
Durability	Mechanical	5,000,000 operations min. (at approx. 7,200 operations/hr)		
	Electrical	100,000 operations min. (at approx. 1,800 operations/hr)		
Minimum permissible load (reference value)		5 VDC, 1 mA		
Ambient temperature		Operating:-25°C to 55°C (with no icing or condensation) Storage:-25°C to 85°C (with no icing or condensation)		
Ambient humidity		Operating:35% to 85% Storage:35% to 85%		
Terminal tightening torque		0.98 N·m		
Weight (see note 4)		Approx. 210 g	Approx. 270 g	Approx. 130 g
Approved standards		EN954-1, EN60204-1, EN574 (-TH301), UL508, CSA C22.2 No. 14		
EMC		EMI: EN55011 group 1 class A EMS: EN50082-2 group 1		

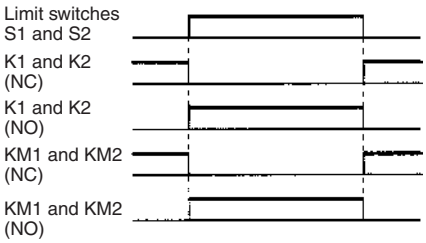
Note: 1. The contact resistance was measured with 1 A at 5 VDC using the voltage-drop method.
2. The response time is the time it takes for the main contact to open after the input is turned OFF.
3. The insulation resistance was measured with 500 VDC at the same places that the dielectric strength was checked.
4. Weight shown is for 24-VAC/VDC type. For 100 to 240-VAC type, add approximately 20 g.

Application Examples

G9SA-301 (24 VAC/VDC) with 2-channel Limit Switch Input/Auto-reset



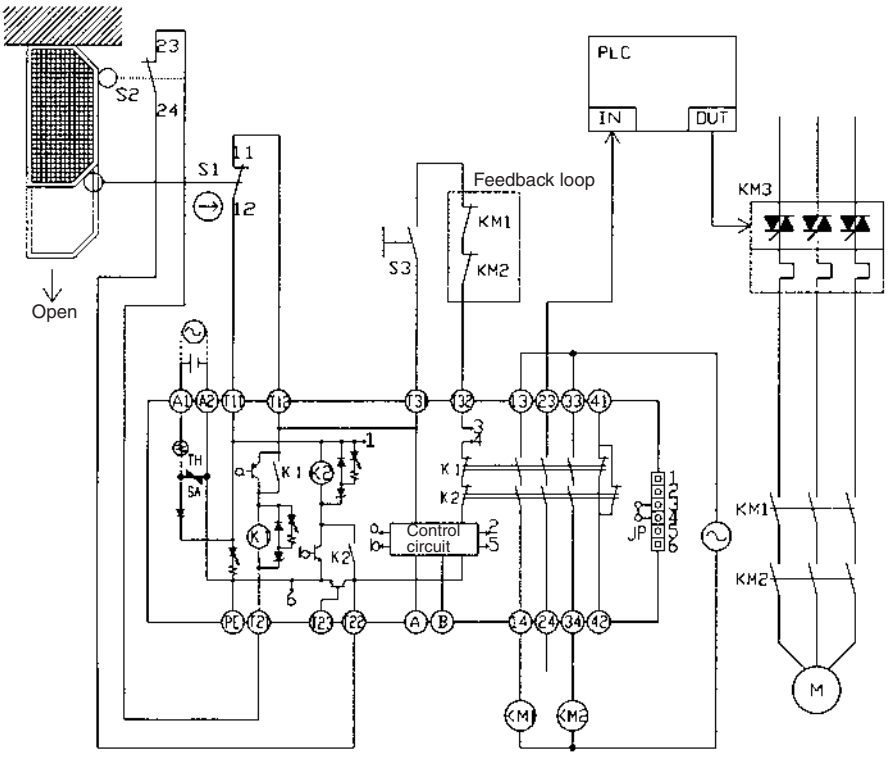
Timing Chart



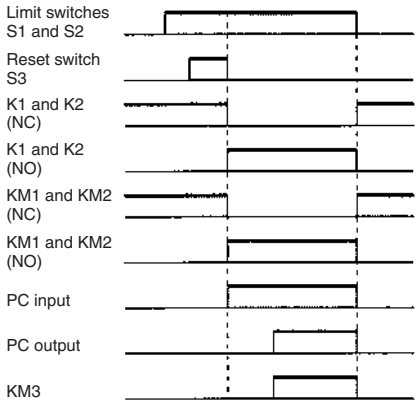
S1: Safety Limit Switch with direct opening mechanism (D4N or D4B)
S2: Limit switch
KM1 and KM2: Magnetic Contactor
M: 3-phase motor

Note: This circuit achieves EN954-1 Safety Category 4.

G9SA-301 (24 VAC/VDC) with 2-channel Limit Switch Input/Manual-reset



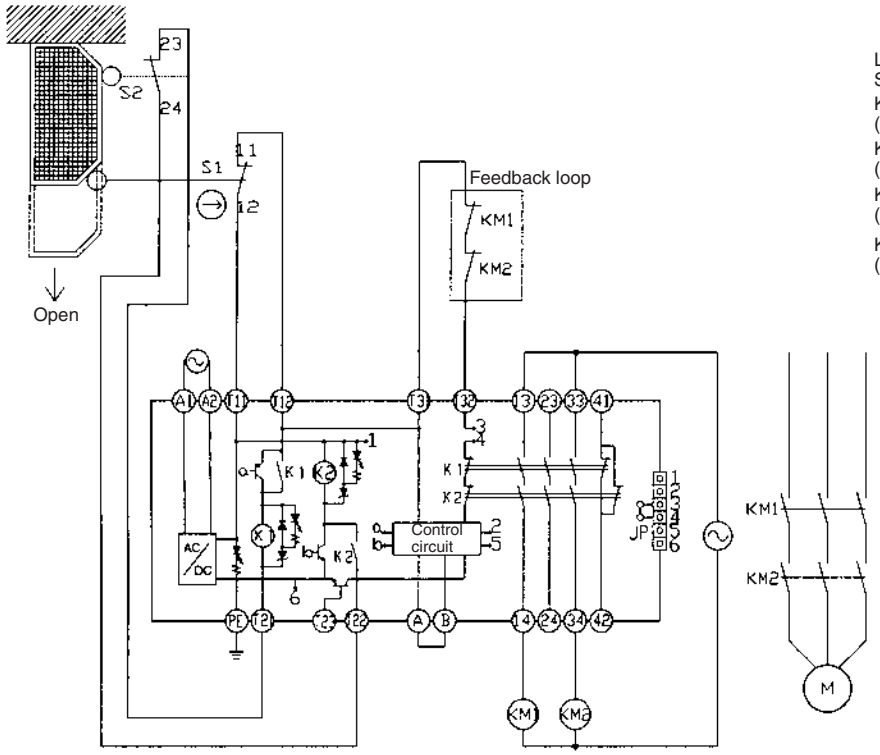
Timing Chart



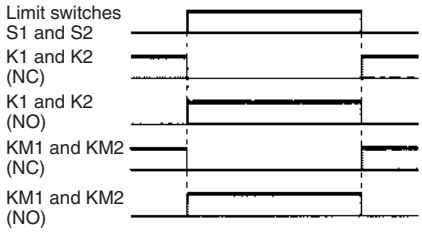
S1: Safety Limit Switch with direct opening mechanism (D4N or D4B)
S2: Limit switch
S3: Reset switch
KM1 and KM2: Magnetic Contactor
KM3: Solid-state Contactor
M: 3-phase motor

Note: This circuit achieves EN954-1 Safety Category 4.

G9SA-301 (100 to 240 VAC) with 2-channel Limit Switch Input/Auto-reset



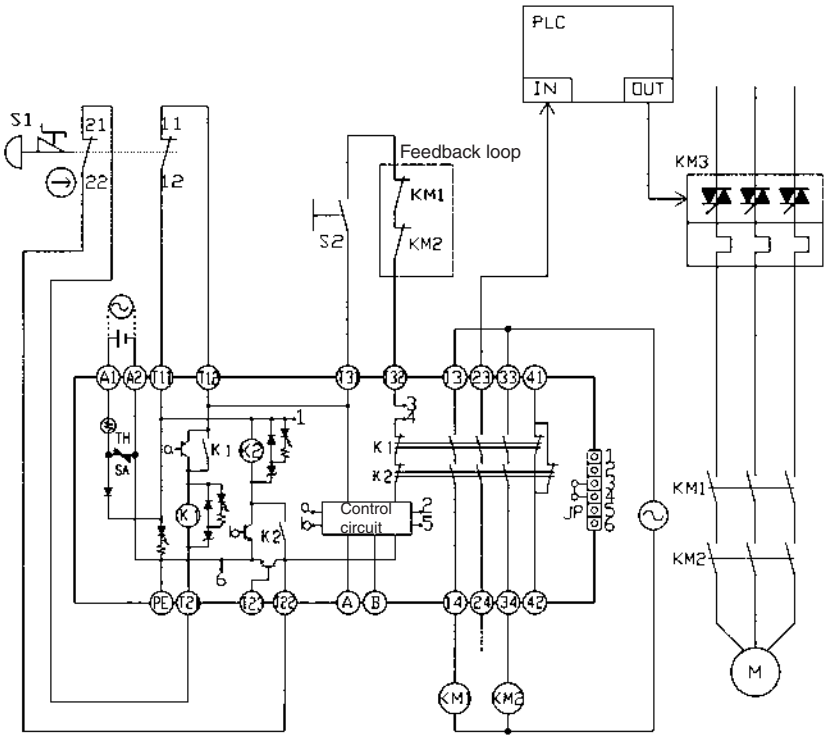
Timing Chart



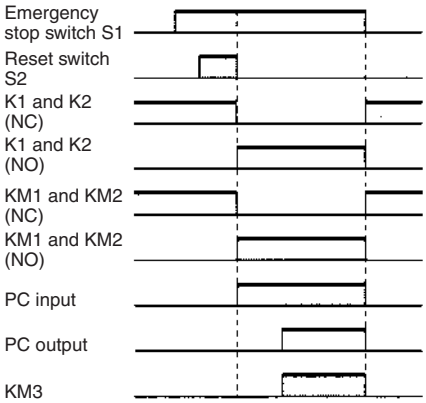
S1: Safety Limit Switch with direct opening mechanism (D4N or D4B)
S2: Limit switch
KM1 and KM2: Magnetic Contactor
M: 3-phase motor

Note: This circuit achieves EN954-1 Safety Category 4.

G9SA-301 (24 VAC/VDC) with 2-channel Emergency Stop Switch Input/Manual-reset



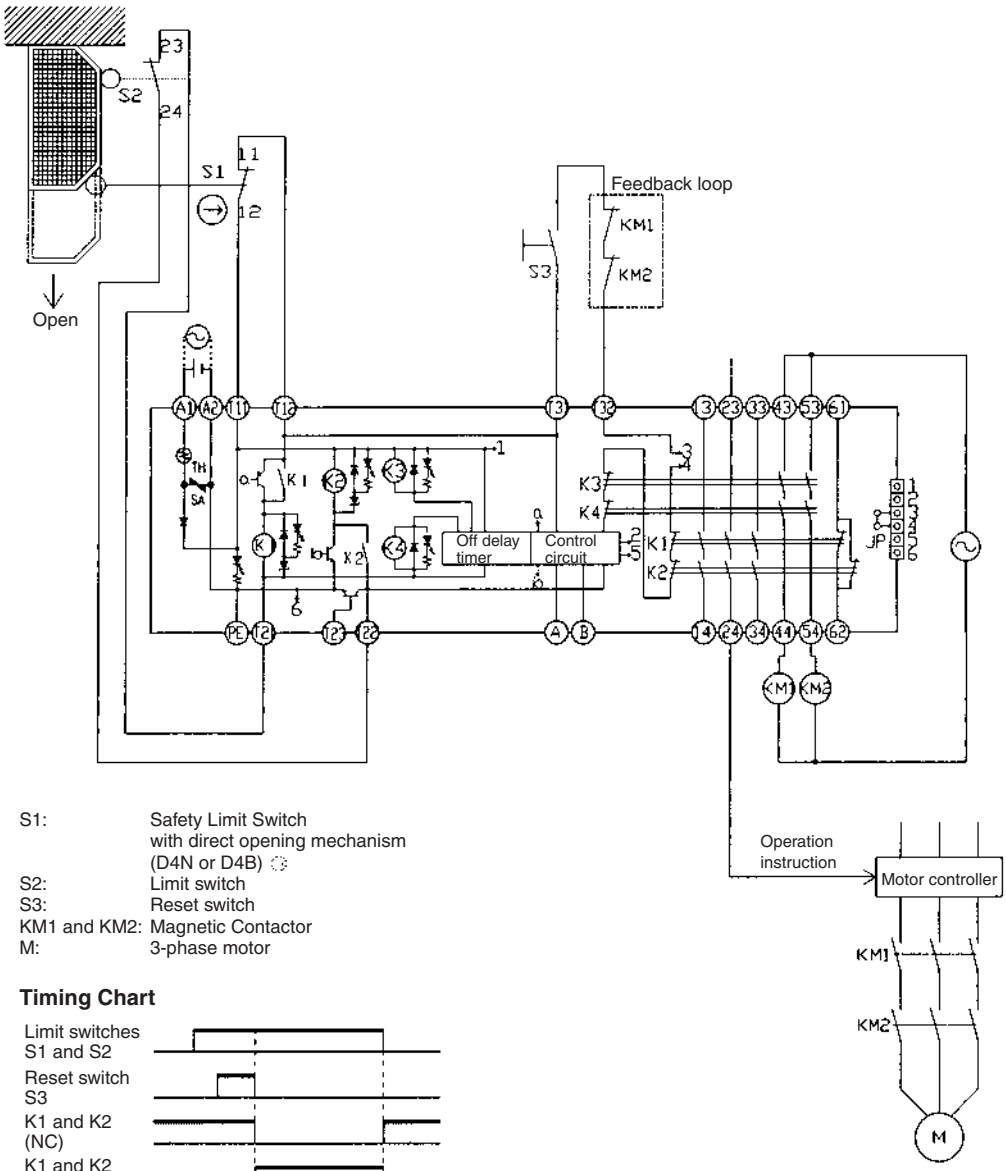
Timing Chart



S1: Emergency stop switch with direct opening mechanism (A165E or A22E)
S2: Reset switch
KM1 and KM2: Magnetic Contactor
KM3: Solid-state Contactor
M: 3-phase motor

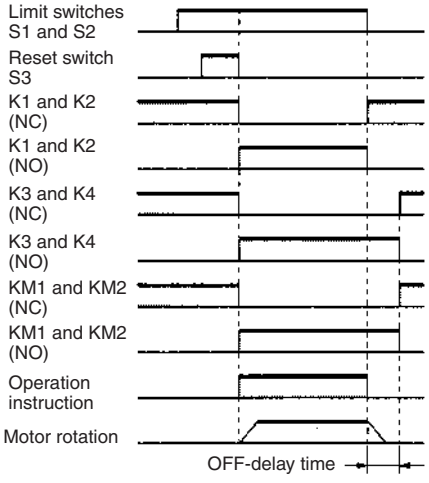
Note: This circuit achieves EN954-1 Safety Category 4.

G9SA-321-T□ (24 VAC/VDC) with 2-channel Limit Switch Input/Manual-reset



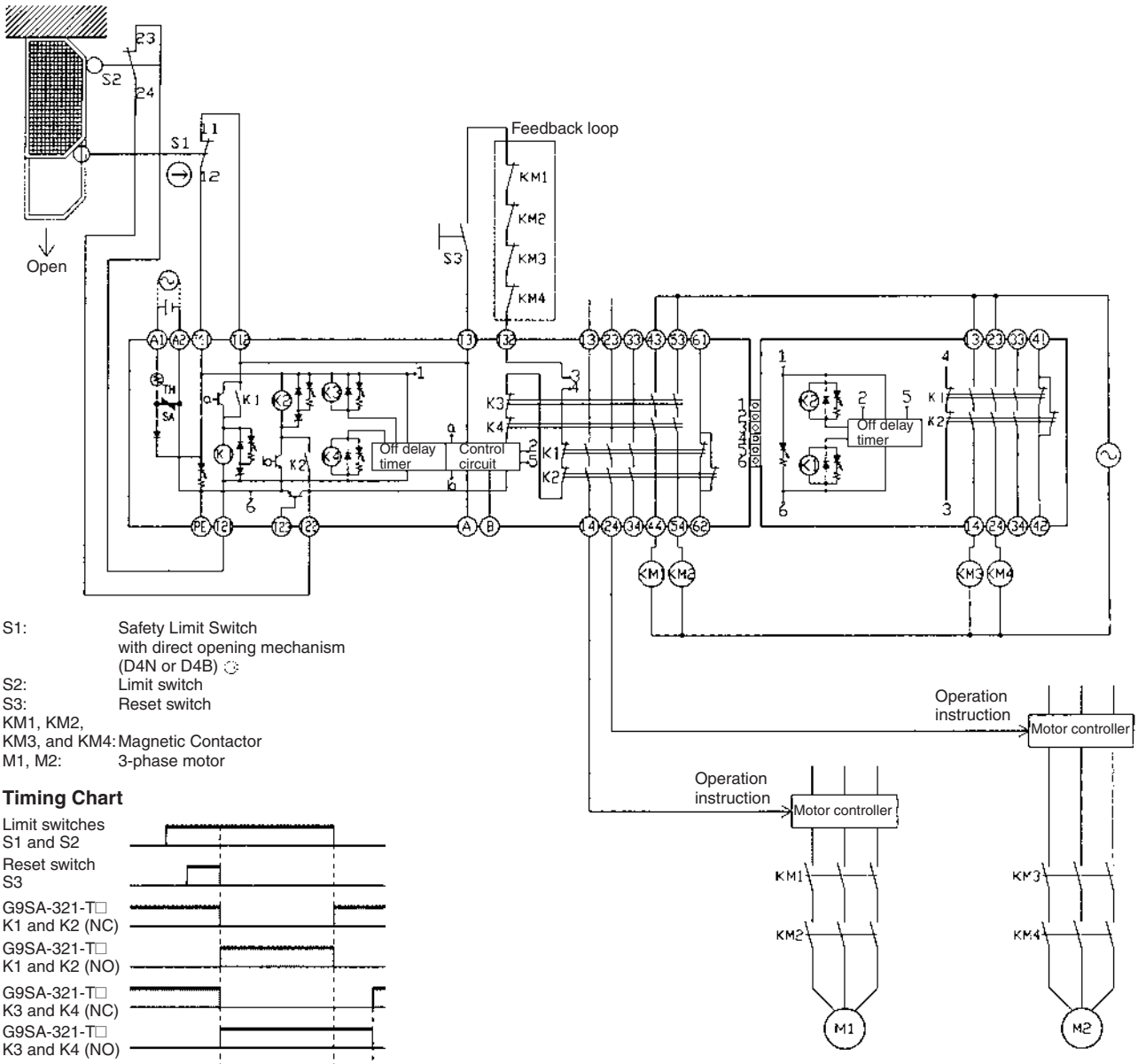
S1:	Safety Limit Switch with direct opening mechanism (D4N or D4B)
S2:	Limit switch
S3:	Reset switch
KM1 and KM2:	Magnetic Contactor
M:	3-phase motor

Timing Chart



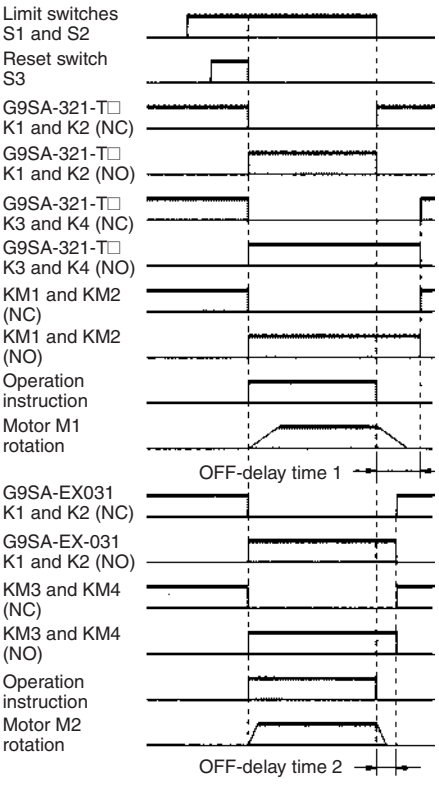
Note: This circuit achieves EN954-1 Safety Category 4. The OFF-delay output, however, achieves EN954-1 Safety Category 3.

G9SA-321-T□ (24 VAC/VDC) + G9SA-EX031-T□ with 2-channel Limit Switch Input/Manual-reset



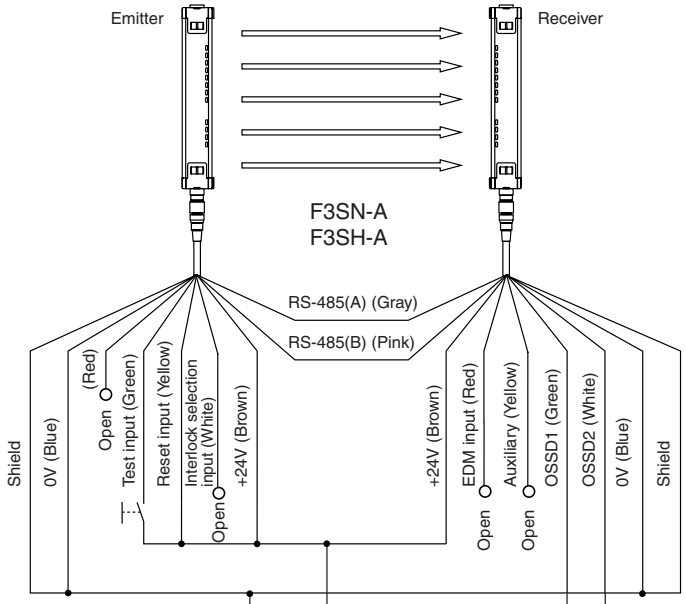
S1: Safety Limit Switch with direct opening mechanism (D4N or D4B)
S2: Limit switch
S3: Reset switch
KM1, KM2, KM3, and KM4: Magnetic Contactor
M1, M2: 3-phase motor

Timing Chart

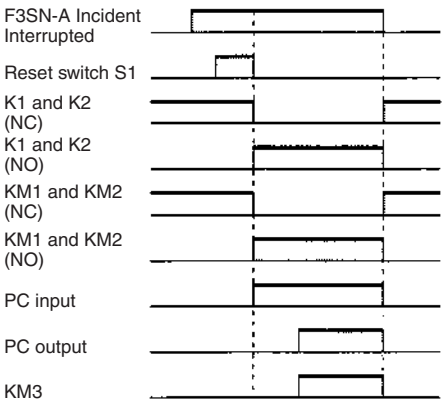


Note: This circuit achieves EN954-1 Safety Category 4. The OFF-delay output, however, achieves EN954-1 Safety Category 3.

G9SA-301 (24 VAC/VDC) with 2-channel Safety Area Sensor/Manual-reset

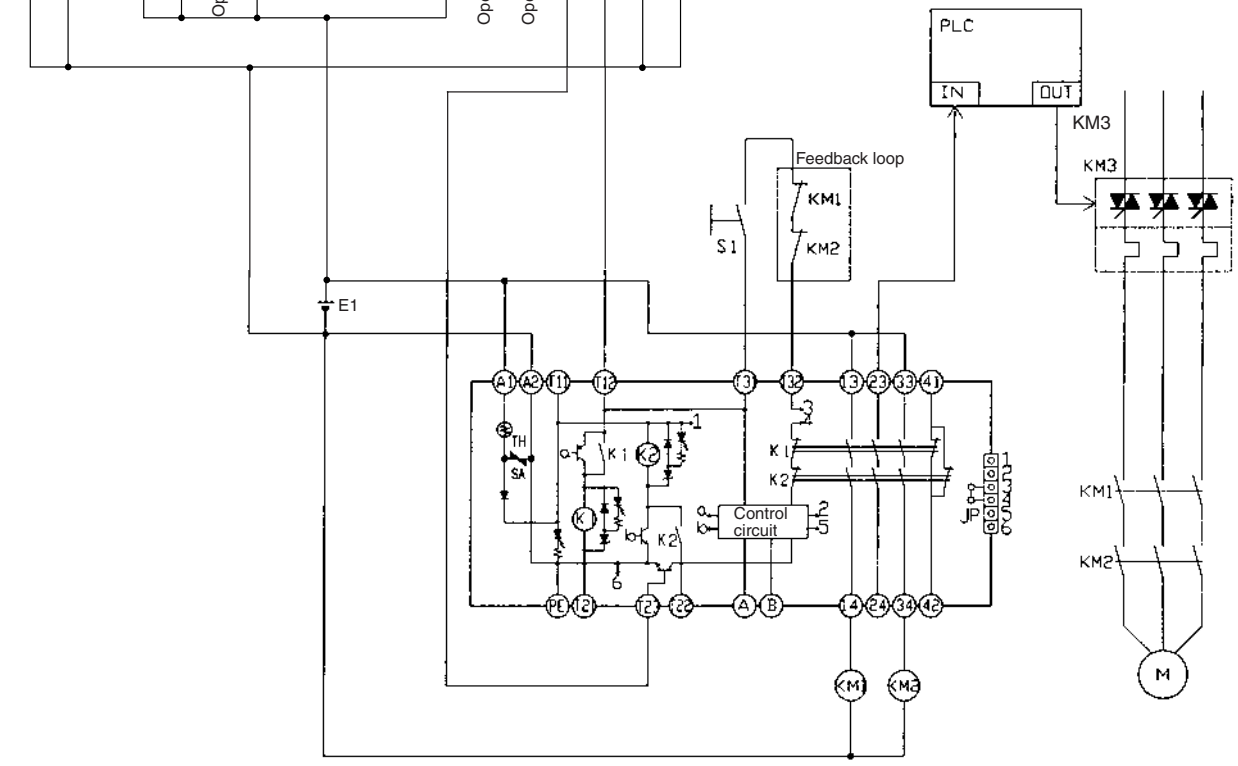


Timing Chart

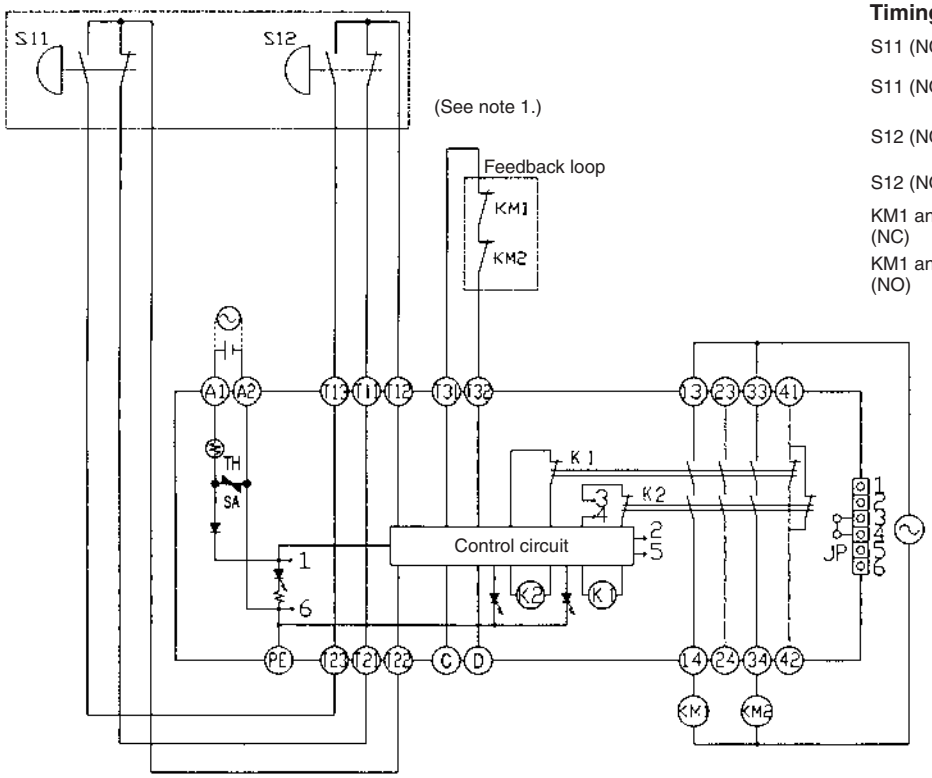


F3SN-A: Safety area sensor
S1: Reset switch
KM1 and KM2: Magnetic Contactor
KM3: Solid-state Contactor
M: 3-phase motor
E1: 24-VDC Power Supply

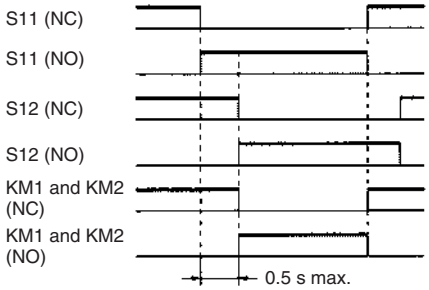
Note: This circuit achieves EN954-1 Safety Category 4.



G9SA-TH301 (24 VDC) with 2-hand Inputs/Auto-reset



Timing Chart



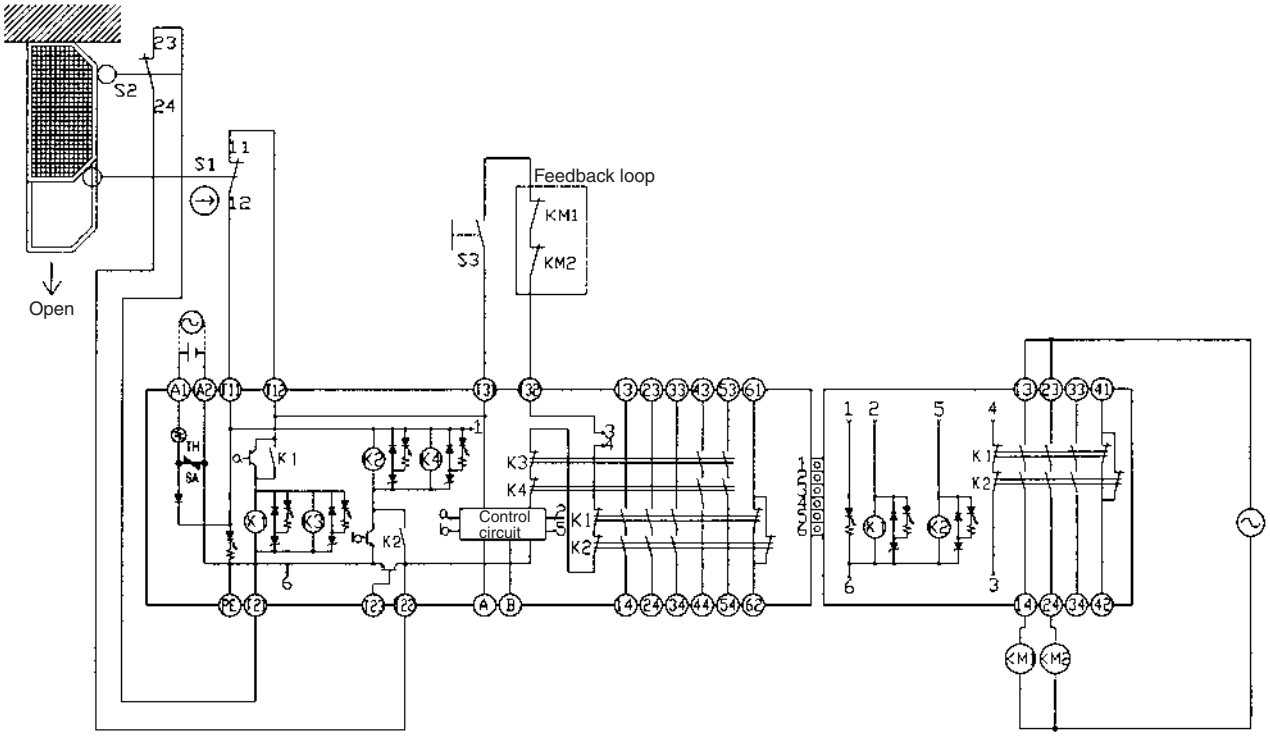
Input time difference operates only when the difference is 0.5 s max.

S11, S12: Two-hand pushbutton switches
KM1 and KM2: Magnetic Contactor

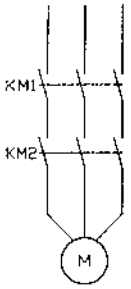
Note: 1. Use a 1NC+1NO switch for S11 and S12.

2. This circuit achieves EN954-1 Safety Category 4.
Typ III C (EN 574)

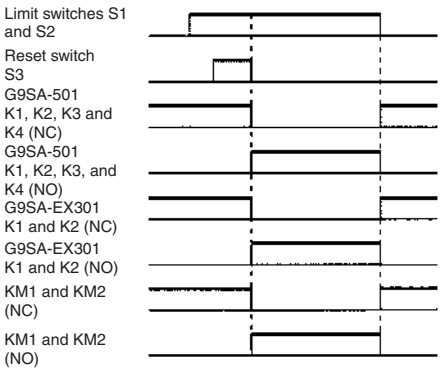
G9SA-501 (24 VAC/VDC) and G9SA-EX301 with 2-channel Limit Switch Input/Manual-reset



S1:	Safety Limit Switch with direct opening mechanism (D4N or D4B)
S2:	Limit switch
S3:	Reset switch
KM1 and KM2:	Magnetic Contactor
M:	3-phase motor



Timing Chart

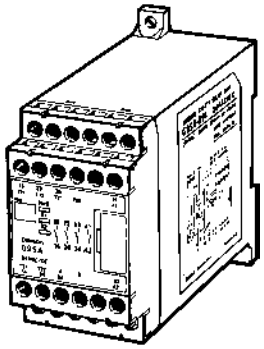


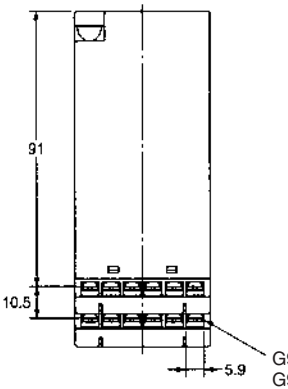
Note: This circuit achieves EN954-1 Safety Category 4.

Dimensions

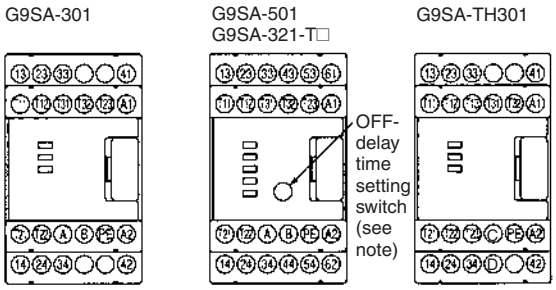
Note: All units are in millimeters unless otherwise indicated. The diagrams are drawn in perspective.

G9SA-301
G9SA-501
G9SA-321-T□
G9SA-TH301

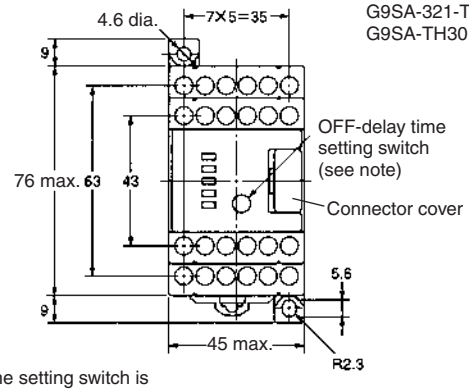


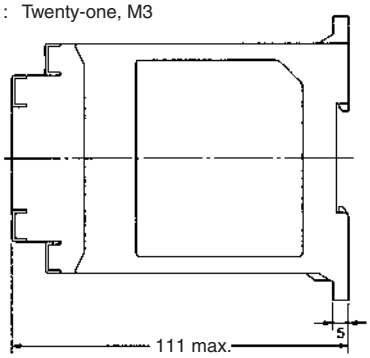


Terminal Arrangement



G9SA-301: Twenty, M3
G9SA-501: Twenty-four, M3
G9SA-321-T□: Twenty-four, M3
G9SA-TH301: Twenty-one, M3

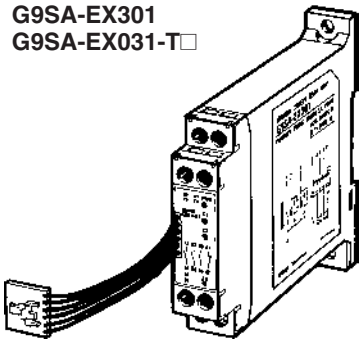


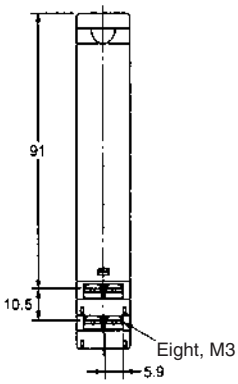


Mounting Holes

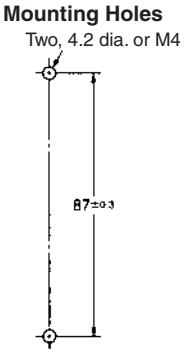
Note: The OFF-delay time setting switch is found on the G9SA-321-T□ only.

G9SA-EX301
G9SA-EX031-T□



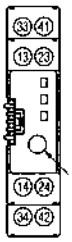


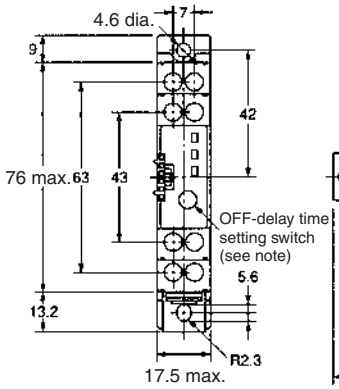
Mounting Holes

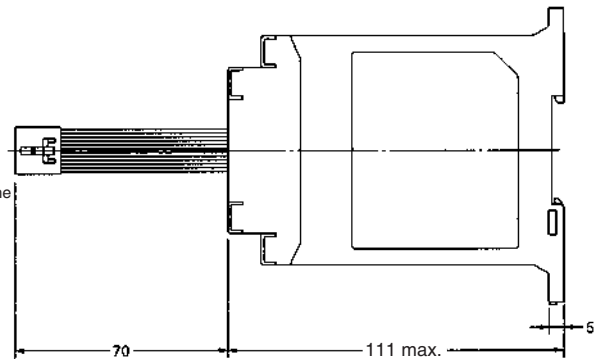


Terminal Arrangement

G9SA-EX301
G9SA-EX031-T□





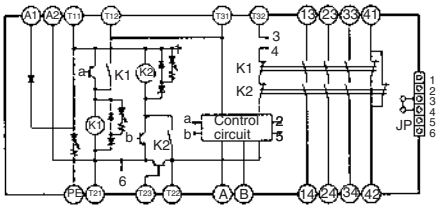


Note: The OFF-delay time setting switch is found on the G9SA-EX031-T□ only.

Installation

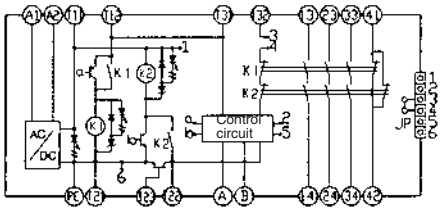
Internal Connections

G9SA-301 (24 VAC/VDC)



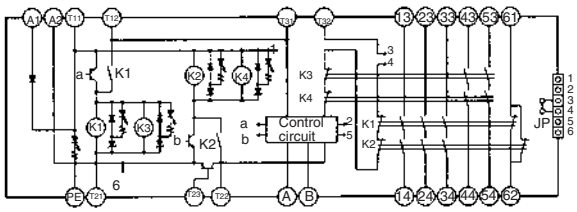
(See note 3.) (See note 1.)

G9SA-301 (100 to 240 VAC)



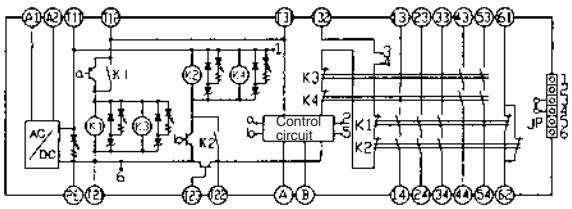
(See note 3.)(See note 1.)

G9SA-501 (24 VAC/VDC)



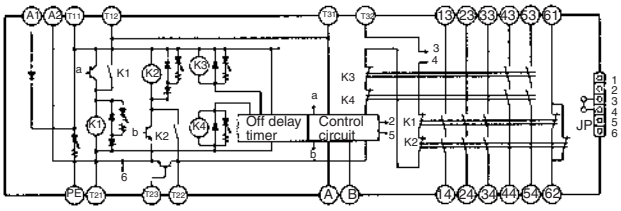
(See note 3.) (See note 1.)

G9SA-501 (100 to 240 VAC)



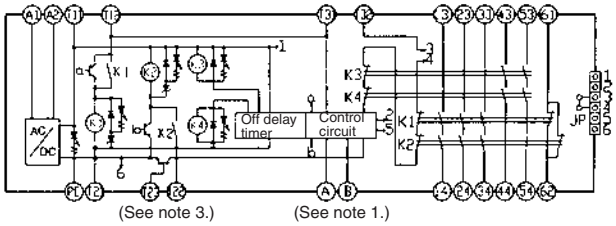
(See note 3.)(See note 1.)

G9SA-321-T□ (24 VAC/VDC)



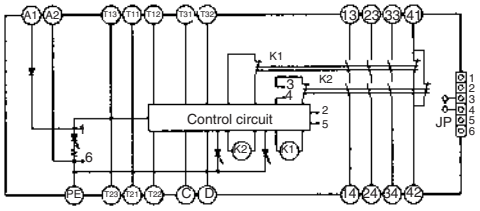
(See note 3.) (See note 1.)

G9SA-321-T□ (100 to 240 VAC)



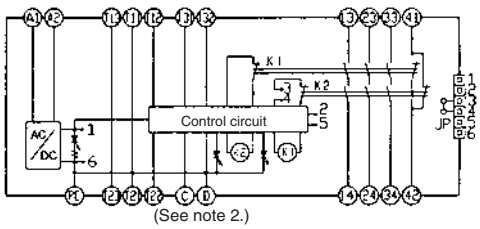
(See note 3.) (See note 1.)

G9SA-TH301 (24 VAC/VDC)



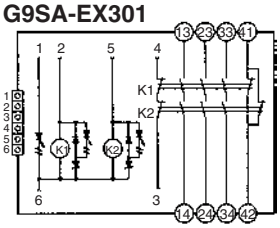
(See note 2.)

G9SA-TH301 (100 to 240 VAC)

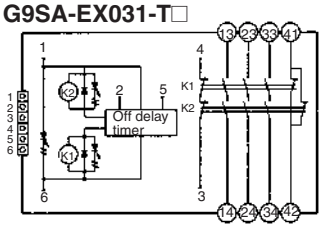


(See note 2.)

G9SA-EX301



G9SA-EX031-T□



Note: 1. Use terminals A and B to switch reset mode.
A to B open: Manual reset
A to B closed: Auto-reset

2. Use terminals C and D to switch input conditions.
C to D open: DPDT input.
C to D closed: DPST-NC input. (Make sure T11 and T21 are open.)

3. Use terminal T23 with + common 2-channel input. When using T23, make sure that T21 and T22 are open. For 1-channel input, make sure T12 and T23 are closed.

4. With 100 to 240-VAC type, be sure to connect PE to a protective ground. With 24-VAC/VDC type, if the power supply is not connected to a protective ground, be sure to connect PE to a protective ground.

5. With 24-VAC/VDC type, the power supply terminals A1 and A2 have polarities. A2 is the negative pole.

Precautions

Do not touch the terminal area of the Relays or the socket terminal area (charged area) while power is ON. Electric shock will result.

Wiring

Turn OFF the G9SA before wiring the G9SA. Do not touch the terminals of the G9SA while the power is turned ON, because the terminals are charged and may cause an electric shock.

Use the following to wire the G9SA.
Stranded wire: 0.75 to 1.5 mm^2
Solid wire: 1.0 to 1.5 mm^2

Tighten each screw to a torque of 0.78 to 1.18 N·m, or the G9SA may malfunction or generate heat.

External inputs connected to T11 and T12 or T21 and T22 of the G9SA-301 must be no-voltage contact inputs.

PE is a ground terminal.

When a machine is grounded at the positive, the PE terminal should not be grounded.

Mounting Expansion Units

Turn OFF the G9SA before connecting the Expansion Unit.

When an Expansion Unit is being used, remove the connector cover from the G9SA Safety Relay Unit (G9SA-301, G9SA-501, G9SA-321□, or G9SA-TH301) and insert the connector of the Expansion Unit's connector cable.

Applicable Safety Category (EN954-1)

G9SA-series Relays meet the requirements of Safety Category 4 of the EN954-1 standards when they are used as shown in the examples provided by OMRON. The Relays may not meet the standards in some operating conditions. The OFF-delay output of models G9SA-321-T□ and EX031-T□, however, conform to Safety Category 3.

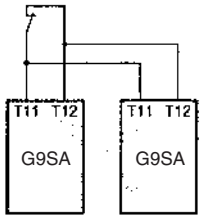
The applicable safety category is determined from the whole safety control system. Make sure that the whole safety control system meets EN954-1 requirements.

Mounting Multiple Units

When mounting multiple Units close to each other, the rated current will be 3 A. Do not apply a current higher than 3 A.

Connecting Inputs

If using multiple G9SA models, inputs cannot be made using the same switch. This is also true for other input terminals.



Earth Short

A positive thermistor is built into the G9SA circuits, so you can detect earth short breakdowns and breakdown shorts between channel 1 and channel 2. If the short breakdown is canceled, reset is automatic.

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

Cat. No. J121-E2-03A-X In the interest of product improvement, specifications are subject to change without notice.

Safety Relay Unit

G9SB

Ultra Slim Safety Relay Unit

- Models of width 17.5 mm available with 2 or 3 safety contacts. Models of width 22.5 mm with 3 safety contacts and auxiliary contact are also available.
- Conforms to EN standards. (TÜV approval)
- DIN track mounting possible.
- Slim size controller dedicated for safey sensors F3SN, F3SH, F3S-B, F3S-TGR, F3SL, F3S-J

Ordering Information

Main contacts	Auxiliary contact	Number of input channels	Reset mode	Input type	Rated voltage	Model	Category (EN954-1)	Size
DPST-NO 2 safety contacts	None	2 channels	Auto-reset	Inverse	24 VAC/VDC	G9SB-2002-A	4	17.5 mm
		1 channel or 2 channels		+ common		G9SB-200-B		
		2 channels	Manual-reset	Inverse		G9SB-2002-C		
		1 channel or 2 channels		+ common		G9SB-200-D		
3PST-NO 3 safety contacts	SPST-NC	None (direct breaking)	Auto-reset	---	24 VDC	G9SB-3010	3	17.5 mm
		2 channels		Inverse	24 VAC/VDC	G9SB-3012-A	4	22.5 mm
		1 channel or 2 channels		+ common		G9SB-301-B		
		2 channels	Manual-reset	Inverse		G9SB-3012-C		
		1 channel or 2 channels		+ common		G9SB-301-D		

Model Number Legend

G9SB-□□□□□ □
1 2 3 4 5 6

1. **Function**
   None: Emergency stop
2. **Contact Configuration (Safety Output)**
   2: DPST-NO
   3: 3PST-NO
3. **Contact Configuration (OFF-delay Output)**
   0: None
4. **Contact Configuration (Auxiliary Output)**
   0: None
   1: SPST-NC
5. **Input Configuration**
   None: 1-channel or 2-channel input possible
   0: None (direct breaking)
   2: 2-channel input
6. **Miscellaneous**
   A: Auto-reset, inverse input
   B: Auto-reset, + common input
   C: Manual-reset, inverse input
   D: Manual-reset, + common input

Specifications

Ratings

Power Input

Item	G9SB-200□-□	G9SB-3010	G9SB-301□-□
Power supply voltage	24 VAC/VDC: 24 VAC, 50/60 Hz, or 24VDC 24 VDC: 24 VDC		
Operating voltage range	85% to 110% of rated power supply voltage		
Power consumption	1.4 VA/1.4 W max.	1.7 W max.	1.7 VA/1.7 W max.

Inputs

Item	G9SB-200□-□	G9SB-3010	G9SB-301□-□
Input current	25 mA max.	60 mA max. (See note.)	30 mA max.

Note: Indicates the current between terminals A1 and A2.

Contacts

Item	G9SB-200□-□	G9SB-3010	G9SB-301□-□
	Resistive load (cos =1)		
Rated load	250 VAC, 5 A		
Rated carry current	5 A		

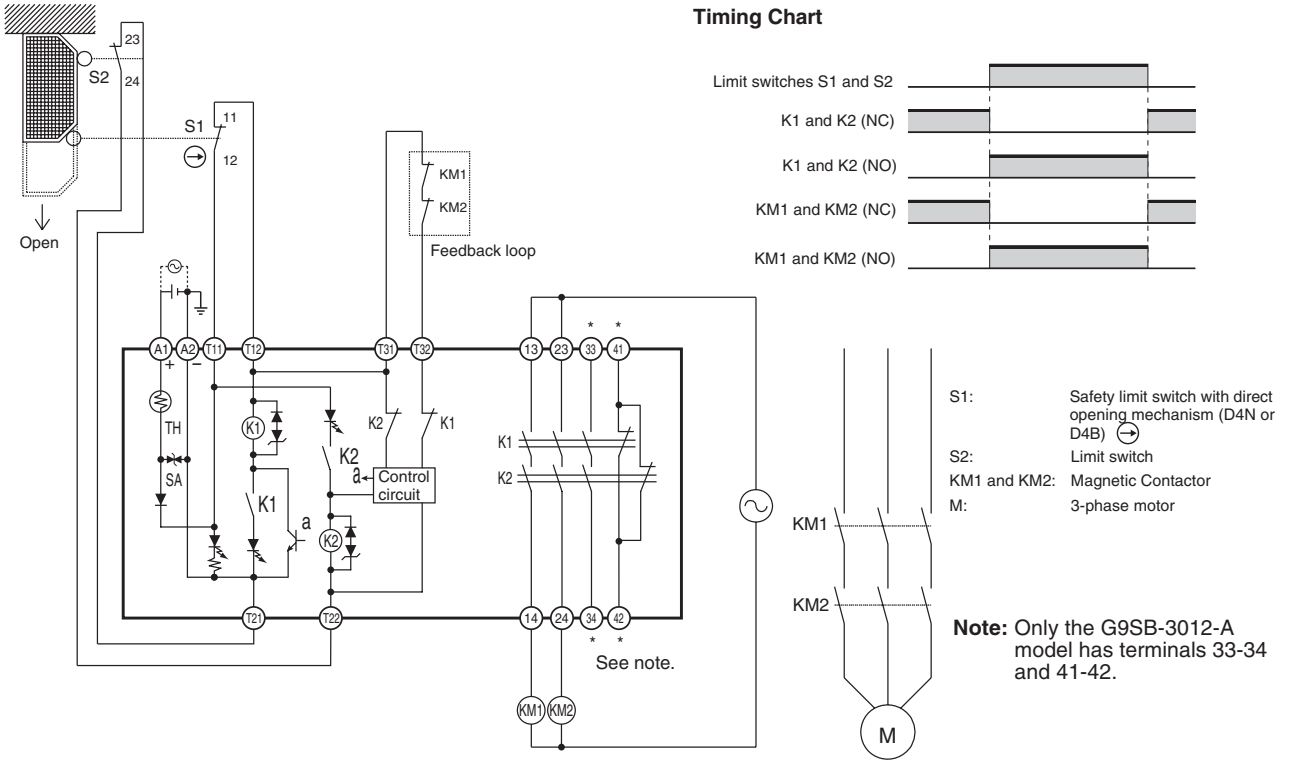
Characteristics

Item		G9SB-200□-□	G9SB-3010	G9SB-301□-□
Contact resistance (See note 1.)		100 mΩ		
Operating time (See note 2.)		30 ms max.		
Response time (See notes 2 and 3.)		10 ms max.		
Insulation resistance (See note 4.)		100 MΩ min. (at 500 VDC)		
Dielectric strength	Between different outputs	2,500 VAC, 50/60 Hz for 1 min		
	Between inputs and outputs			
	Between power inputs and outputs			
Vibration resistance		10 to 55 to 10 Hz, 0.375-mm single amplitude (0.75-mm double amplitude)		
Shock resistance	Destruction	300 m/s^2		
	Malfunction	100 m/s^2		
Durability	Mechanical	5,000,000 operations min. (at approx. 7,200 operations/hr)		
	Electrical	100,000 operations min. (at approx. 1,800 operations/hr)		
Minimum permissable load (reference value)		5 VDC, 1 mA		
Ambient operating temperature		-25 to 55°C (with no icing or condensation)		
Ambient operating humidity		35% to 85%		
Terminal tightening torque		0.5 N·m		
Weight		Approx. 115 g	Approx. 135 g	Approx. 120 g
Approved standards		EN954-1, EN60204-1, UL508, CSA C22.2 No. 14		
EMC		EMI: EN55011 group 1 class A EMS: EN50082-2		

Note: 1. The contact resistance was measured with 1 A at 5 VDC using the voltage-drop method.
2. The bounce time is not included in the figure for operating time.
3. The response time is the time it takes for the main contact to open after the input is turned OFF.
4. The insulation resistance was measured with 500 VDC at the same places that the dielectric strength was checked.

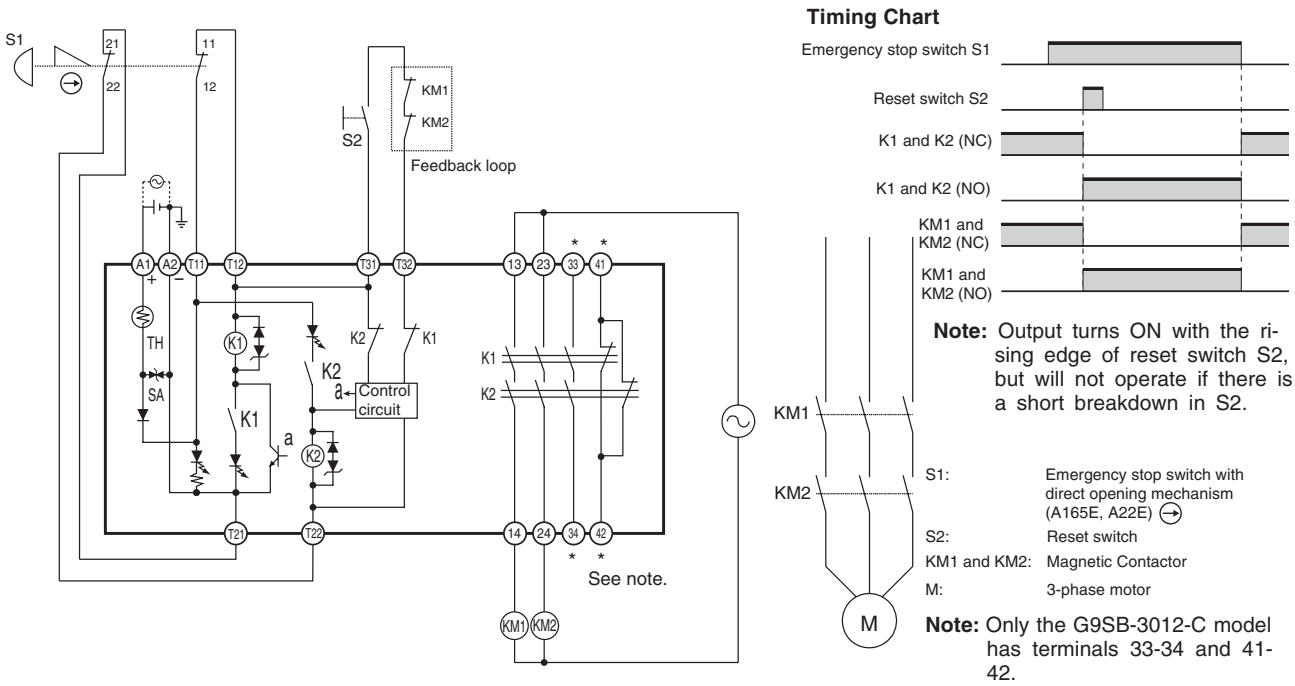
Application Examples

G9SB-2002-A (24 VAC/VDC) or G9SB-3012-A (24 VAC/VDC) with 2-channel Limit Switch Input/Auto-reset



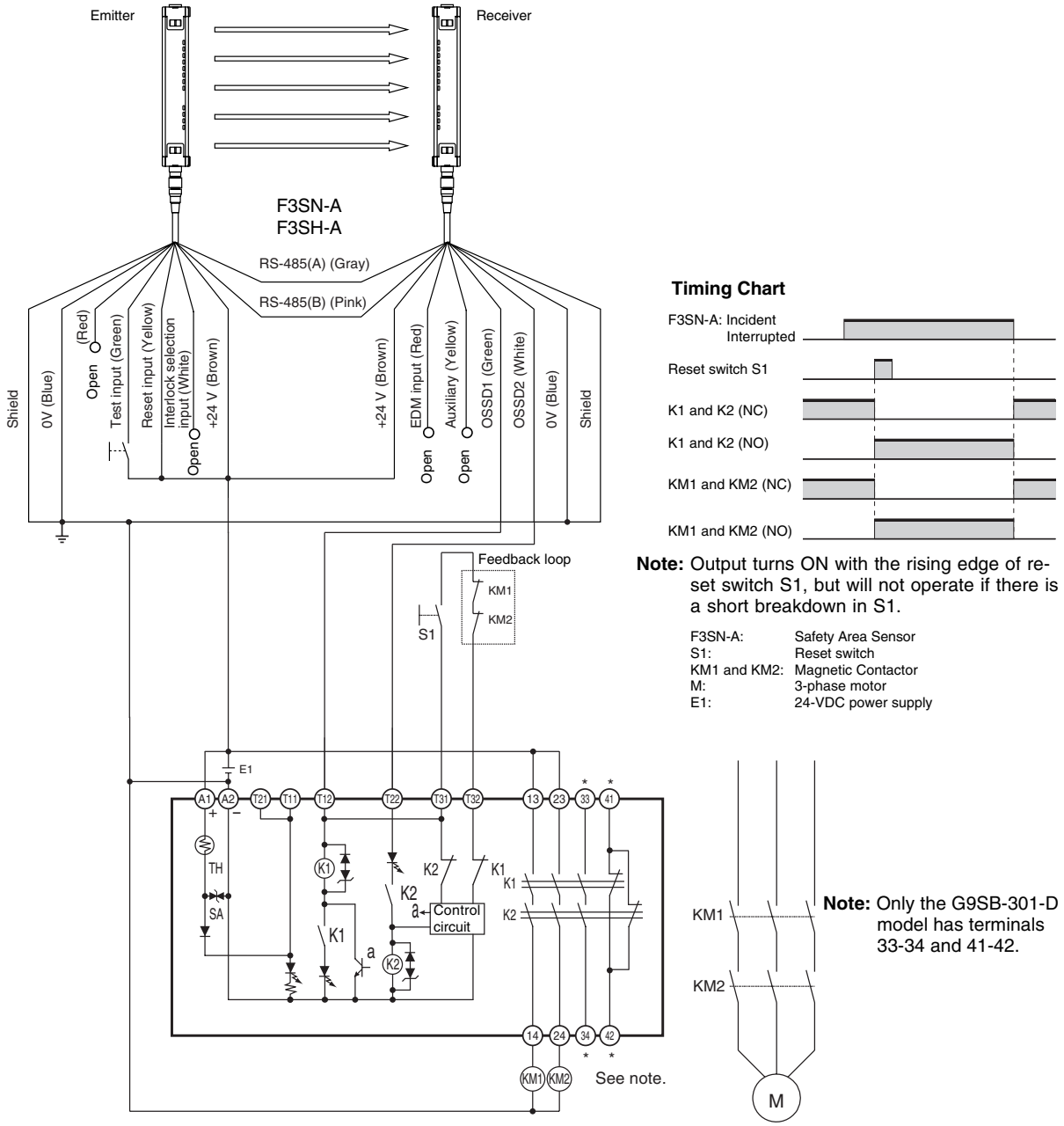
Note: 1. External connections and timing charts for G9SB-200-B/301-B models are the same as those for G9SB-2002-A/3012-A models.
2. This circuit conforms to EN954-1 Safety Category 4.

G9SB-2002-C (24 VAC/VDC) or G9SB-3012-C (24 VAC/VDC) with 2-channel Emergency Stop Switch Input/Manual-reset



Note: 1. External connections and timing charts for G9SB-200-D/301-D models are the same as those for G9SB-2002-C/3012-D models.
2. This circuit conforms to EN954-1 Safety Category 4.

G9SB-200-D (24 VAC/VDC) or G9SB-301-D (24 VAC/VDC) with 2-channel Safety Area Sensor/Manual-reset



Timing Chart

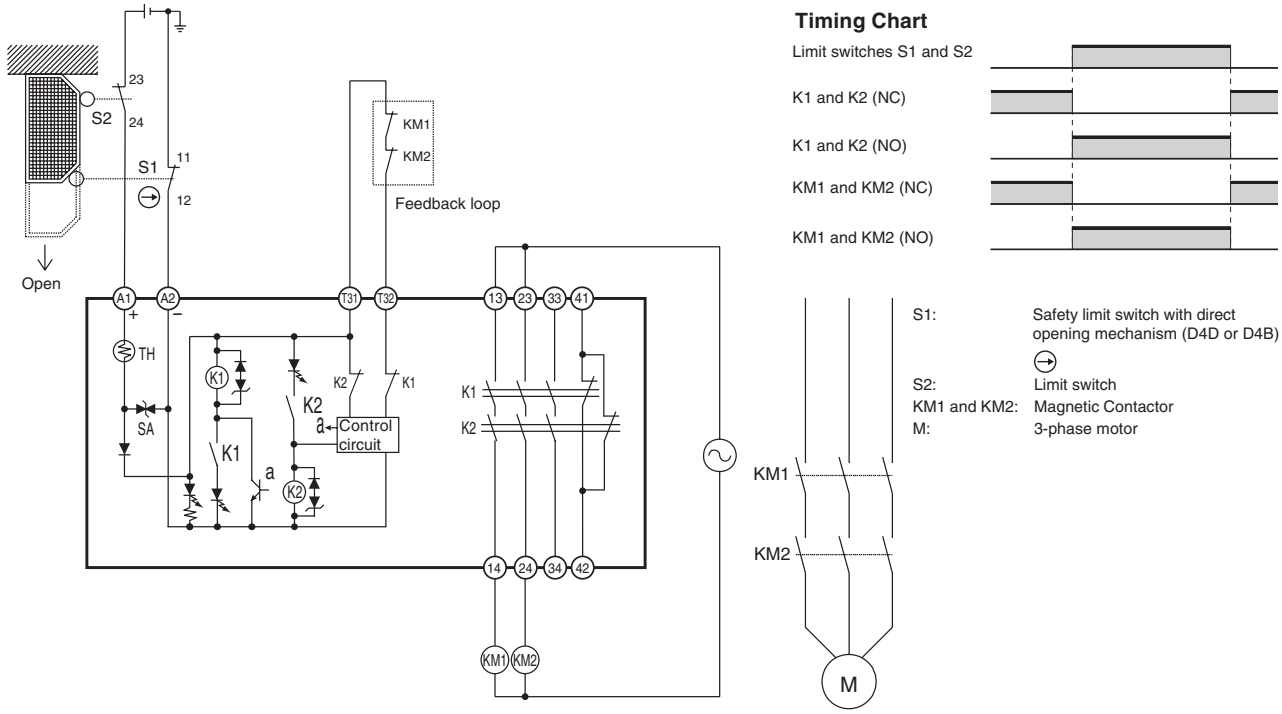
Note: Output turns ON with the rising edge of reset switch S1, but will not operate if there is a short breakdown in S1.

F3SN-A:	Safety Area Sensor
S1:	Reset switch
KM1 and KM2:	Magnetic Contactor
M:	3-phase motor
E1:	24-VDC power supply

Note: Only the G9SB-301-D model has terminals 33-34 and 41-42.

Note: This circuit conforms to EN954-1 Safety Category 4.

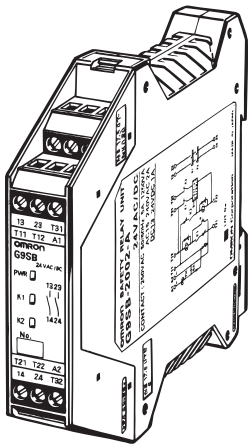
G9SB-3010 (24 VDC) with 2-channel Limit Switch Input/Auto-reset

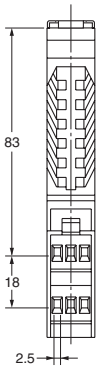


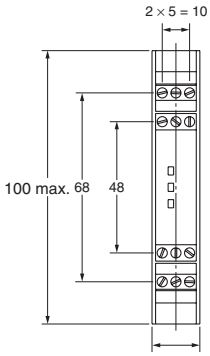
Note: This circuit conforms to EN954-1 Safety Category 3.

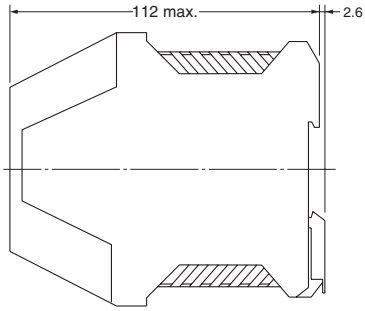
Dimensions

G9SB-200□-□
G9SB-3010





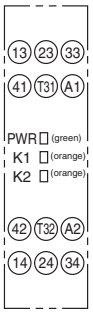




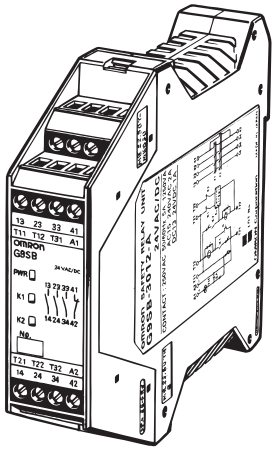
Terminal Arrangement

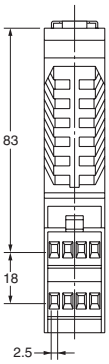
G9SB-200□-□

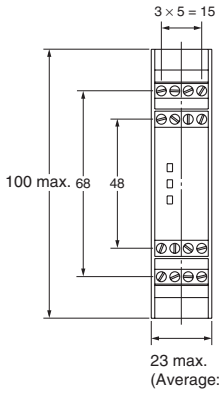
G9SB-3010

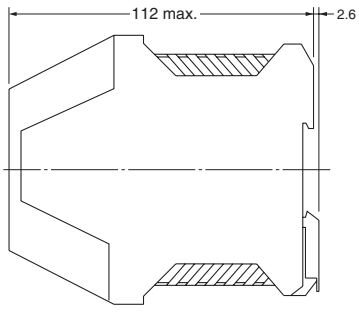


G9SB-301-□



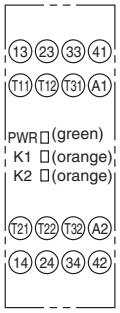






Terminal Arrangement

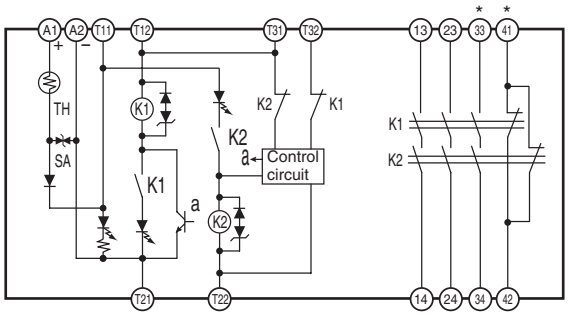
G9SB-200□-□



Installation

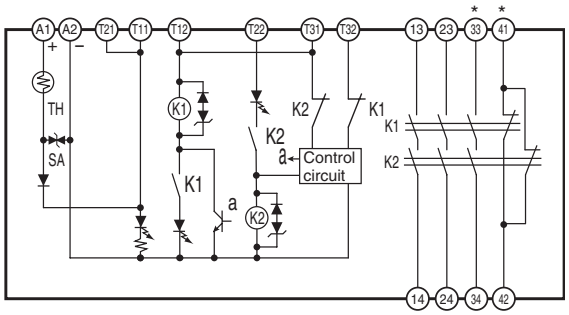
Internal connections

G9SB-2002-A/C (24 VAC/VDC)
G9SB-3012-A/C (24 VAC/VDC)



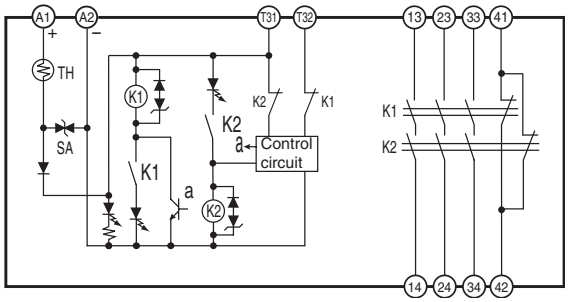
See note 2.

G9SB-200-B/D (24 VAC/VDC)
G9SB-301-B/D (24 VAC/VDC)



See note 2.

G9SB-3010 (24 VDC)



Note: 1. For 1-channel input with G9SB-□□□-B/D models, short terminals T12 and T22.
It is not possible to wire G9SB-□□□2-A/C models for 1-channel input.
2. Only G9SB-301□-□ models have terminals 33-34 and 41-42.

Precautions

Wiring

Turn OFF the G9SB before wiring. Do not touch the terminals of the G9SB while the power is turned ON, because the terminals are charged and may cause an electric shock.

Use the following to wire the G9SB.

Stranded wire:0.2 to 2.5 mm^2

Solid wire:0.2 to 2.5 mm^2

Tighten each screw to a torque of 0.5 to 0.6 N·m, or the G9SB may malfunction or generate heat.

External inputs connected to T11 and T12 or T21 and T22 of the G9SB must be no-voltage contact inputs.

Applicable Safety Category

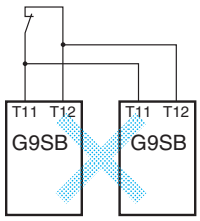
G9SB-200□-□/301□-□ meet the requirements of Safety Category 4 of the EN954-1 standards when they are used as shown in the examples provided by OMRON. Relays may not meet the standards in some operating conditions. The G9SB-3010 can be applied to Safety Category 3 of the EN954-1 using double breaking. The applicable safety category is determined from the whole safety control system. Make sure that the whole safety control system meets EN954-1 requirements.

Mounting Multiple Units

When mounting multiple Units close to each other, the rated current will be 3 A. Do not apply a current higher than 3 A.

Connecting Inputs

If using multiple G9SB models, inputs cannot be made using the same switch. This is also true for other input terminals.



Earth Short

A positive thermistor is built into the G9SB circuits, so you can detect earth short breakdowns and breakdown shorts between channel 1 and channel 2. (Detection of breakdown shorts between channel 1 and channel 2 is supported for G9SB-2002-□/3012-□ models only.)

Note: In order to detect earth short breakdowns, connect the minus side of the power supply to ground.

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

Cat. No. J130-E2-01-X

Safety-door Switch

D4NS

Multi-contact, Labor-saving, Environment-friendly, Next-generation Safety-door Switch

- Lineup includes three contact models with 2NC/1NC and 3NC contact forms in addition to the previous contact forms 1NC/1NO, and 2NC.
- M12-connector models are available, saving on labor and simplifying replacement.
- Standardized gold-clad contacts provide high contact reliability.
- Applicable to both standard loads and micro loads.
- Free of lead, cadmium, and hexavalent chrome, reducing the burden on the environment.

Model Number Structure

Model Number Legend

Switch

D4NS-□□□
1 2 3

1. Conduit/Connector size
- 1: Pg13.5 (1-conduit)
- 2: G1/2 (1-conduit)
- 3: 1/2-14NPT (1-conduit)
- 4: M20 (1-conduit)
- 5: Pg13.5 (2-conduit)
- 6: G1/2 (2-conduit)
- 7: 1/2-14NPT compatible (2-conduit model with M20 conduit size includes an M20-to-1/2-14NPT conversion adapter)
- 8: M20 (2-conduit)
- 9: M12 connector (1-conduit)

2. Built-in Switch
- A: 1NC/1NO (slow-action)
- B: 2NC (slow-action)
- C: 2NC/1NO (slow-action)
- D: 3NC (slow-action)
- E: 1NC/1NO (MBB contact)
- F: 2NC/1NO (MBB contact)

3. Head Mounting Direction
- F: Four mounting directions possible (Front-side mounting at shipping)

Note: An order for the head part or the switch part alone cannot be accepted. The Operation Key is sold separately.

Operation Key

D4DS-K□
1

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 approved direct opening contacts.

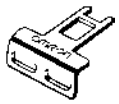
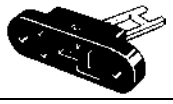
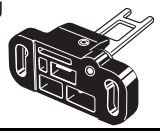
Type	Contact configuration		Conduit opening/Connector	Model
1-conduit	Slow-action	1NC/1NO	Pg13.5	D4NS-1AF (note 3)
			G1/2	D4NS-2AF
			1/2-14NPT	D4NS-3AF
			M20	D4NS-4AF (note 3)
		2NC	Pg13.5	D4NS-1BF (note 3)
			G1/2	D4NS-2BF
			1/2-14NPT	D4NS-3BF
			M20	D4NS-4BF (note 3)
		2NC/1NO	Pg13.5	D4NS-1CF (note 3)
			G1/2	D4NS-2CF
			1/2-14NPT	D4NS-3CF
			M20	D4NS-4CF (note 3)
		3NC	Pg13.5	D4NS-1DF
			G1/2	D4NS-2DF
			1/2-14NPT	D4NS-3DF
			M20	D4NS-4DF (note 3)
	Slow-action MBB contact	1NC/1NO	Pg13.5	D4NS-1EF
			G1/2	D4NS-2EF
			1/2-14NPT	D4NS-3EF
			M20	D4NS-4EF (note 3)
		2NC/1NO	Pg13.5	D4NS-1FF
			G1/2	D4NS-2FF
			1/2-14NPT	D4NS-3FF
			M20	D4NS-4FF (note 3)
2-conduit	Slow-action	1NC/1NO	Pg13.5	D4NS-5AF
			G1/2	D4NS-6AF
			M20, includes M20-to-1/2-14NPT conversion adapter	D4NS-7AF
			M20	D4NS-8AF
		2NC	Pg13.5	D4NS-5BF (note 3)
			G1/2	D4NS-6BF
			M20, includes M20-to-1/2-14NPT conversion adapter	D4NS-7BF
			M20	D4NS-8BF (note 3)
		2NC/1NO	Pg13.5	D4NS-5CF
			G1/2	D4NS-6CF
			M20, includes M20-to-1/2-14NPT conversion adapter	D4NS-7CF
			M20	D4NS-8CF (note 3)
		3NC	Pg13.5	D4NS-5DF
			G1/2	D4NS-6DF
			M20, includes M20-to-1/2-14NPT conversion adapter	D4NS-7DF
			M20	D4NS-8DF
	Slow-action MBB contact	1NC/1NO	Pg13.5	D4NS-5EF
			G1/2	D4NS-6EF
			M20, includes M20-to-1/2-14NPT conversion adapter	D4NS-7EF
			M20	D4NS-8EF
		2NC/1NO	Pg13.5	D4NS-5FF
			G1/2	D4NS-6FF
			M20, includes M20-to-1/2-14NPT conversion adapter	D4NS-7FF
			M20	D4NS-8FF
1-conduit, with connector	Slow-action	1NC/1NO	M12 connector	D4NS-9AF (note 3)
		2NC		D4NS-9BF (note 3)
	Slow-action MBB contact	1NC/1NO		D4NS-9EF (note 3)

Note: 1. The recommended models for equipment and machinery being exported to Europe are those with an M20 or Pg13.5 conduit sizes, and for North America, the recommended models are those with a 1/2-14NPT conduit sizes.

2. Resin is used as the material for the D4NS housing and head. Use the metal D4BS Safety-door Switch for applications requiring greater mechanical strength.

3. Prefered stock item

Operation Keys

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

Specifications

Approved Standards

Agency	Standard	File No.
TÜV Product Service	EN60947-5-1 (approved direct opening) GS-ET-15	B0306 39656052
UL (See note.)	UL508, CSA C22.2 No.14	E76675

Note: Approval for CSA C22.2 No. 14 is authorized by the UL mark.

Standards and EC Directives

- Conforms to the following EC Directives:
  Machinery Directive
  Low Voltage Directive
  EN50047
  EN1088

CCC (China Compulsory Certification) Mark

Agency	Standard	File No.
CQC	GB14048.5	Under application

Approved Standard Ratings

TÜV (EN60947-5-1)

Item / Utilization category	AC-15	DC-13
Rated operating current (I_e)	3 A	0.27 A
Rated operating voltage (U_e)	240 V	250 V

Note: Use a 10-A fuse type gI or gG that conforms to IEC269 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		Volt-amperes	
		Make	Break	Make	Break
120 VAC	10 A	60 A	6 A	7,200 VA	720 VA
240 VAC		30 A	3 A		

Characteristics

Degree of protection (See note 3.)		IP67 (EN60947-5-1) (This applies for the Switch only. The degree of protection for the key hole is IP00.)	
Durability (See note 4.)	**Mechanical**	1,000,000 operations min.	
	Electrical	500,000 operations min. for a resistive load of 3 A at 250 VAC (See note 5.) 300,000 operations min. for a resistive load of 10 A at 250 VAC	
Operating speed		0.05 to 0.5 m/s	
Operating frequency		30 operations/minute max.	
Direct opening force (See note 6.)		60 N min.	
Direct opening travel (See note 6.)		10 mm min.	
Contact resistance		25 mΩ max.	
Minimum applicable load (See note 7.)		Resistive load of 1 mA at 5 VDC (N-level reference value)	
Rated insulation voltage (U_i)		300 V	
Protection against electric shock		Class II (double insulation)	
Pollution degree (operating environment)		3 (EN60947-5-1)	
Impulse withstand voltage (EN60947-5-1)		Between terminals of the same polarity	2.5 kV
		Between terminals of different polarities	4 kV
		Between other terminals and uncharged metallic parts	6 kV
Insulation resistance		100 MΩ min.	
Contact gap		2 x 2 mm min	
Vibration resistance	**Malfunction**	10 to 55 Hz, 0.75-mm single amplitude	
Shock resistance	**Destruction**	1,000 m/s^2 min.	
	Malfunction	300 m/s^2 min.	
Conditional short-circuit current		100 A (EN60947-5-1)	
Rated open thermal current (I_{th})		10 A (EN60947-5-1)	
Ambient temperature		Operating: -30°C to 70°C with no icing	
Ambient humidity		Operating: 95% max.	
Weight		Approx. 96 g (D4NS-1CF)	

Note: 1. The above values are initial values.

2. Once a contact has been used to switch a standard load, it cannot be used for a load of a smaller capacity. Doing so may result in roughening of the contact surface and contact reliability may be lost.

3. 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 D4NS in places where foreign material may penetrate through the key hole on the head, otherwise Switch damage or malfunctioning may occur.

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

5. If the ambient temperature is greater than 35°C, do not pass the 3-A, 250-VAC load through more than 2 circuits.

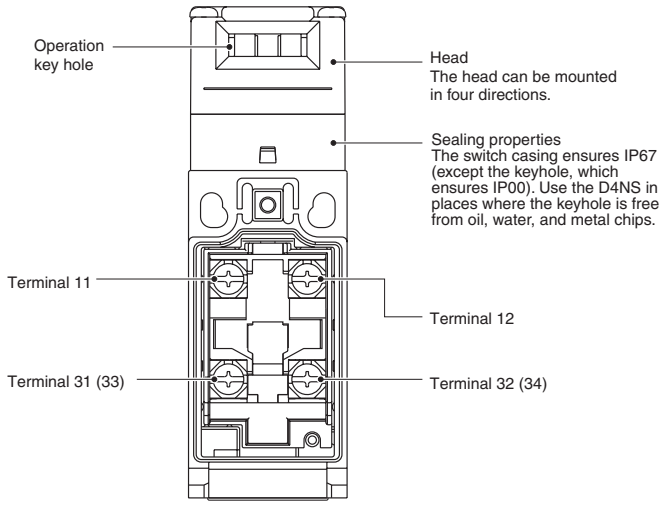
6. These figures are minimum requirements for safe operation.

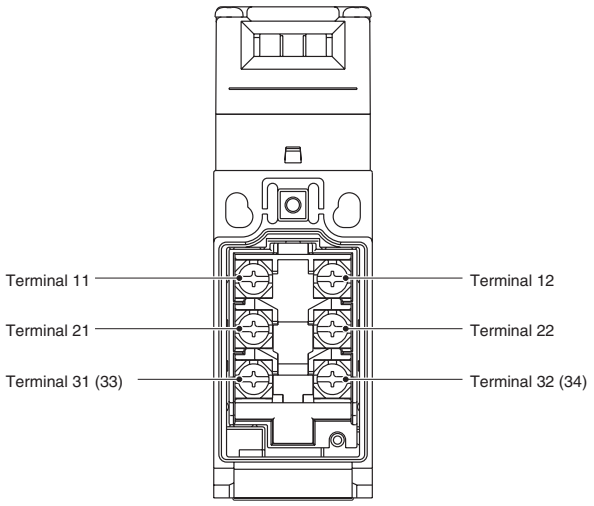
7. This value will vary with the switching frequency, environment, and reliability level. Confirm that correct operation is possible with the actual load beforehand.

Nomenclature

Structure

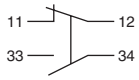
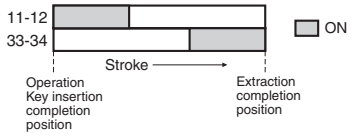
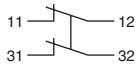
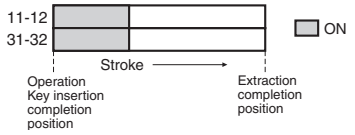
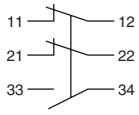
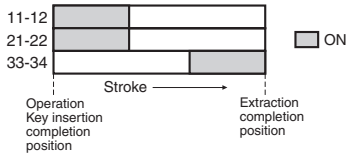
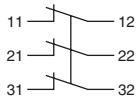
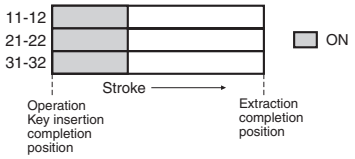
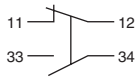
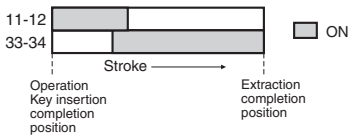
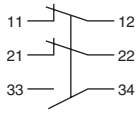
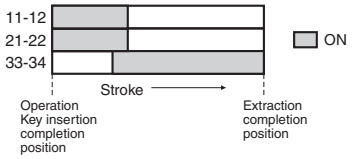
D4NS-□A□, D4NS-□B□, D4NS-□E□
D4NS-□C□, D4NS-□D□, D4NS-□F□





Note: The 2-conduit models have the same terminal arrangement.

Contact Form (Diagrams Show State with Key Inserted)

Model	Contact	Contact form	Operating pattern	Remarks
D4NS-□A□	1NC/1NO			Only NC contacts 11-12 have an approved direct opening mechanism. (→) The terminals 11-12 and 33-34 can be used as unlike poles.
D4NS-□B□	2NC			Only NC contacts 11-12 and 31-32 have an approved direct opening mechanism. (→) The terminals 11-12 and 31-32 can be used as unlike poles.
D4NS-□C□	2NC/1NO			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. (→) The terminals 11-12, 21-22, and 33-34 can be used as unlike poles.
D4NS-□D□	3NC			Only NC contacts 11-12, 21-22, and 31-32 have an approved direct opening mechanism. (→) The terminals 11-12, 21-22, and 31-32 can be used as unlike poles.
D4NS-□E□	1NC/1NO MBB			Only NC contacts 11-12 have an approved direct opening mechanism. (→) The terminals 11-12 and 33-34 can be used as unlike poles.
D4NS-□F□	2NC/1NO MBB			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. (→) The terminals 11-12, 21-22 and 33-34 can be used as unlike poles.

Note: MBB (Make Before Break) contacts have an overlapping structure, so that before the normally closed contact (NC) opens, the normally open contact (NO) closes.

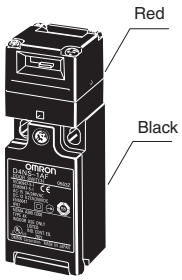
Dimensions/Operating Characteristics

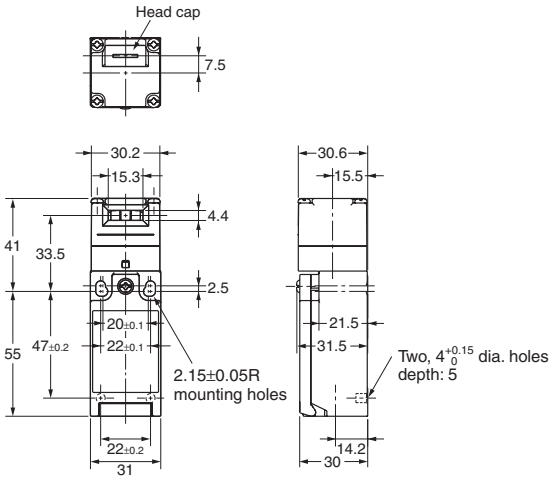
Note: All units are in millimeters unless otherwise indicated.

Switches

1-conduit Models

D4NS-1□F
D4NS-2□F
D4NS-3□F
D4NS-4□F



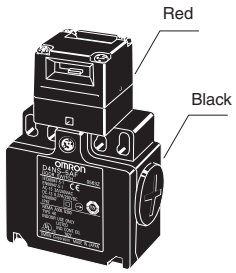


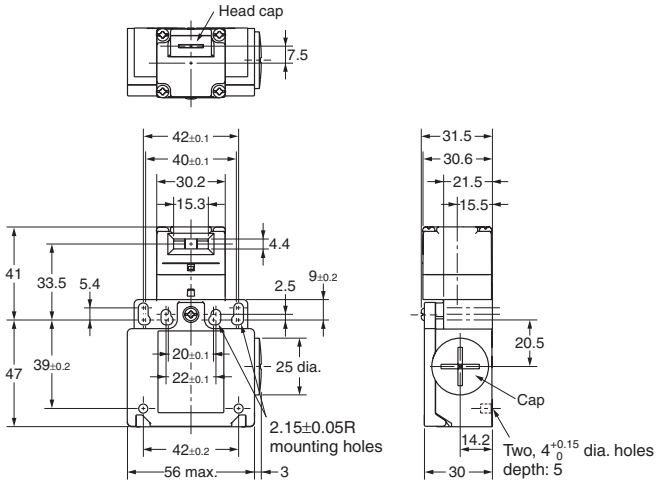
Operating characteristics	D4NS-1□F D4NS-2□F D4NS-3□F D4NS-4□F
Key insertion force Key extraction force	15 N max. 30 N max.
Pretravel (PT)	6±3 mm
Total travel (TT)	(28 mm)
Direct opening force* Direct opening stroke*	60 N min. 10 mm min.

* Always maintain the above operating characteristics for safe use.

2-conduit Models

D4NS-5□F
D4NS-6□F
D4NS-7□F
D4NS-8□F



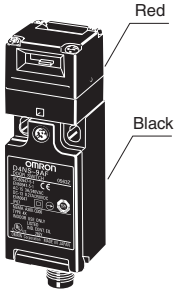


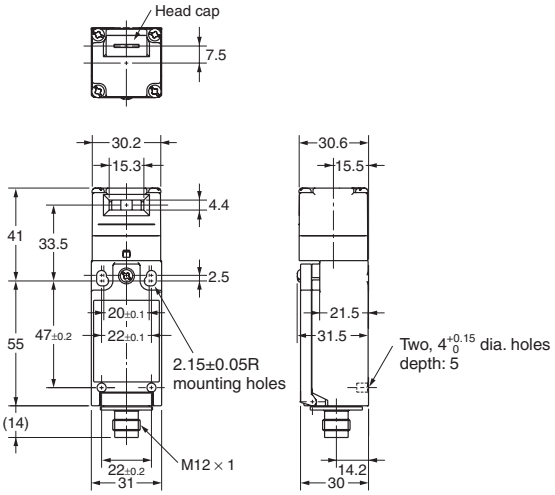
Operating characteristics	D4NS-5□F D4NS-6□F D4NS-7□F D4NS-8□F
Key insertion force Key extraction force	15 N max. 30 N max.
Pretravel (PT)	6±3 mm
Total travel (TT)	(28 mm)
Direct opening force* Direct opening stroke*	60 N min. 10 mm min.

* Always maintain the above operating characteristics for safe use.

1-conduit Connector Models

D4NS-9□F





Operating characteristics	D4NS-9□F
Key insertion force Key extraction force	15 N max. 30 N max.
Pretravel (PT)	6±3 mm
Total travel (TT)	(28 mm)
Direct opening force* Direct opening stroke*	60 N min. 10 mm min.

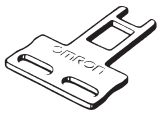
* Always maintain the above operating characteristics for safe use.

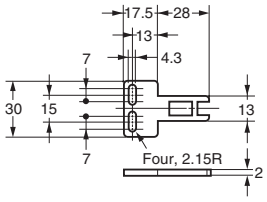
Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

Operation Keys

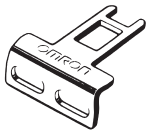
Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

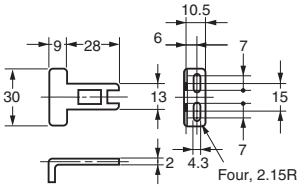
D4DS-K1



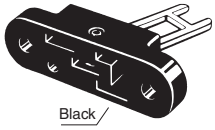


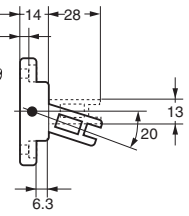
D4DS-K2

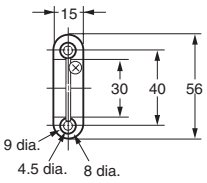




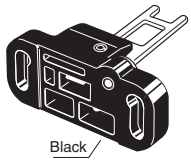
D4DS-K3

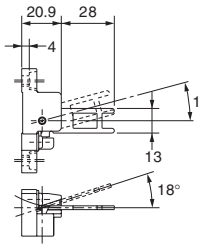


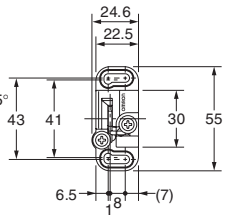




D4DS-K5



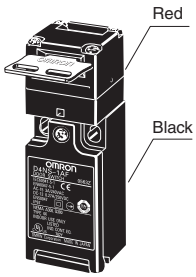


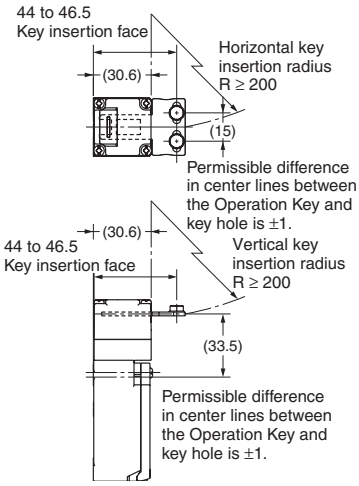


With Operation Key Inserted (Relationship between Insertion Radius and Insertion Hole)

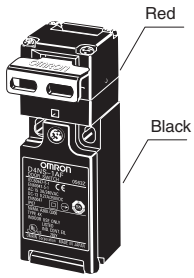
Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

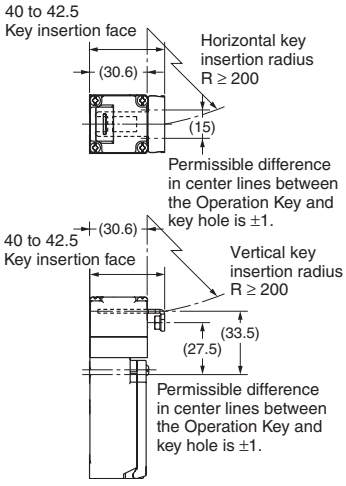
D4NS-1□F + D4DS-K1



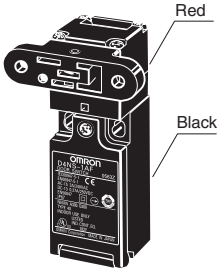


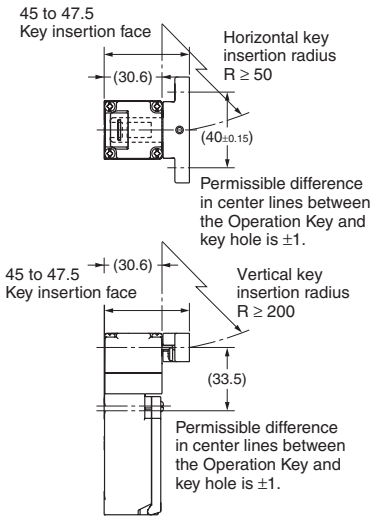
D4NS-1□F + D4DS-K2



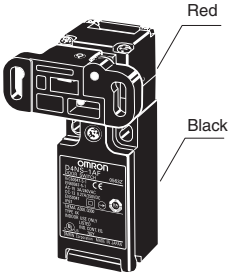


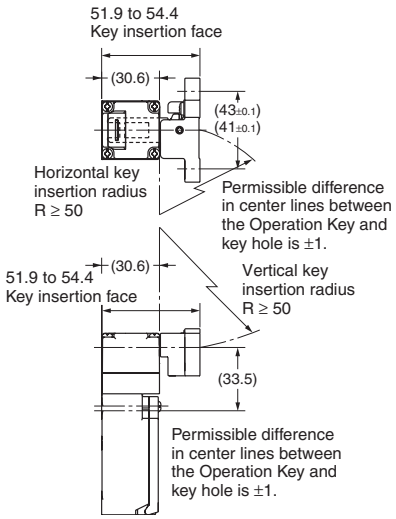
D4NS-1□F + D4DS-K3





D4NS-1□F + D4DS-K5





Safety Precautions

Refer to *OMRON SAFETY COMPONENTS SERIES (Y106)* for common precautions.

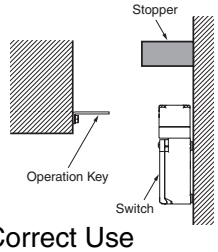
⚠ CAUTION

Do not dismount the operation key from the door intentionally and insert it to the switch with the door open. Machine may start operating and injury or death may be caused.

Do not use metal connector or conduit with this switch. The broken conduit hole may cause electrical shock hazard.

Precautions for Safe Use

- Be careful not to drop your D4NS, or the switch will not fully exhibit its ability.
- Do not disassemble or remodel your D4NS in any case, or the D4NS will not operate normally.
- Do not use the switch where explosive gas, ignitable gas, or any other harmful gasses may be present.
- Install operation key so that it will not hit the operator when the door is open. Injury may be caused.
- Do not use the switch in the oil and in the water. IP67(EN60947-5-1)
- Though the switch body is protected from the ingress of dust or water, avoid the ingress of foreign substance through the key hole on the head.
  Otherwise, wear in short time or break may be caused
- Do not put the electric power when wiring.
- Be sure to install a cover after the wiring.
  Do not put the electric power when opening a cover.
- Connect the fuse to the switch in series to prevent it from short circuit damage.
  The value of the breaking current of the fuse must be increased to cover the rated current by 150 to 200%. When using the switch with EN rating, use 10 A fuse, type gI or gG that complies with IEC 60269.
- Keep the electrical load below the rated value.
- On the switching of general loads (250VAC/3A), do not operate two circuits or more at the same time. Otherwise, insulation performance may be degraded.
- The durability of the switch is seriously affected by operating conditions.
  Evaluate the switch under actual working conditions before permanent installation.
- Please mention in machine manufacturer's Instruction. Manual that the user must not repair nor maintain the switch and must contact machine manufacturer for them.
- Do not use the switch as a stopper.
  Be sure to install a stopper as shown in the following illustration to prevent the edge of the operation key from inadvertently hitting the switch directly.



Precautions for Correct Use

1. Environment

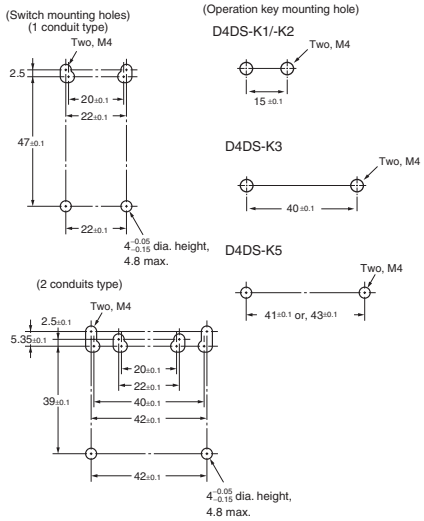
- The switch is intended for indoor use only.
- Do not use your D4NS outdoor, or the switch will malfunction.
- Do not use your D4NS in the atmosphere of hazardous gases (H2S, SO2, NH3, HNO3, Cl2, etc.) or high temperature and humidity, or it will cause the imperfect closing of the contacts or the breakage thereof stemming from corrosion.
- Do not use the switch under any of the conditions mentioned below.
  - Frequent temperature range.
  - High humidity or dew condensation may be generated.
  - Where the switch is subject to severe vibration.
  - Where the metal dust, oil, or chemical is sprayed inside the door.
  - Where thinner is applied.

2. Mounting method

- Mounting Screw Tightening Torque
  Loose mounting may result in malfunction.
  Fasten the screws to the specified torque.

Terminal screw	0.6 to 0.8 N·m
Cover clamping screw	0.5 to 0.7 N·m
Head clamping screw	0.5 to 0.6 N·m
Operation Key clamping screw (See item 4)	2.4 to 2.8 N·m
Body clamping screw (See item 4)	0.5 to 0.7 N·m
Conduit mounting connection (see item 10,11), M12 changing adaptor	1.8 to 2.2 N·m
	1.4 to 1.8 N·m (1/2-14NPT)
Cap screw	1.3 to 1.7 N·m

- Switch, operation key
  - The switch and operation key will be fastened to specified torque in item 2 with M4 screws and washers.
  - Secured more by the studs like below picture 4-0.05/-0.15 dia., 4.8 max. height at the lower two which are inserted from back side of switch.



  - Do not use the operation key other than dedicated OMRON's. Otherwise switch may be damaged.
  - Be sure that the operation key can be inserted properly to key hole with a tolerance of ± 1 mm.

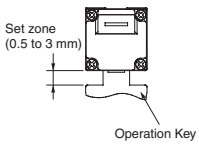
3. Head direction

The rotation of the switch head may be adjusted to any of the four directions by loosening the head clamping screws at the four corners of the head.

4. Securing of the door

If the operation key is pulled in the opening direction due to a force caused by vibration, by the door weight, or by a cushion attached to the door.

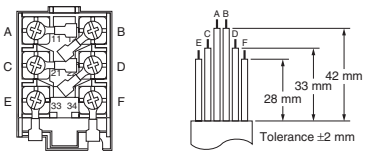
The closed door must be secured with a hook or by similar means.



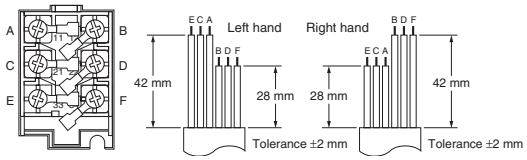
5. Wiring

- When connect with insulation tubes and terminals, connect the terminals as shown in the following figure and wire without overriding to the case and the cover. Adequate conductor size is AWG 20 to 18 (0.5 to 0.75 mm^2).
  Wire leads as shown in the following figure. Otherwise, the switch cover does not fit.

(1 conduit type)



(2 conduits type)

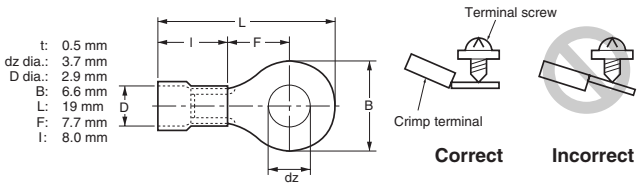


- Do not push the ring connector and the likes into the opening between the parts in order to prevent the case from being broken and deformed.
- Use terminals having the thickness of 0.5 mm or less to avoid the contact between the terminal and the switch case inside.

  The below listed the terminals have thickness of 0.5 mm or less.

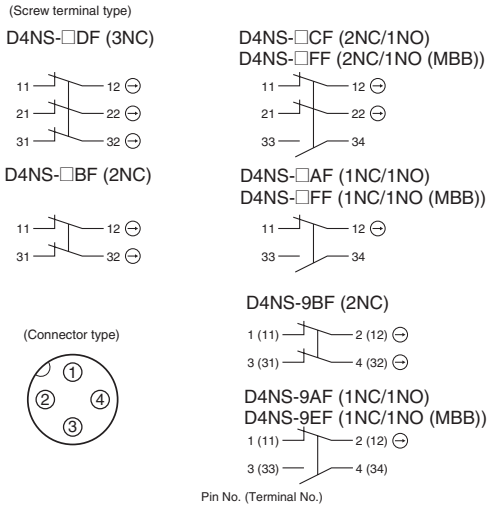
Manufacture	Type	Wire size
J.S.T.	FV0.5-3.7 (F type) V0.5-3.7 (straight type)	AWG22 to 20

J.S.T is a Japanese manufacturer.



6. Contact arrangement

- The following show a safety contact and an auxiliary contact for 3 contacts and 2 contacts types.



Suitable socket is Type XS2F (OMRON).

7. Socket tightening (connector type)

Do not use any tools, such as pliers, otherwise the socket connector may become damaged. Connect the socket connector to the connector threads of the D4NS. Then firmly turn the socket connector by hand so that the connector threaded portion will be completely covered by the socket connector so that space will be almost 0.

Make sure, however, that the socket connector is tightened securely, otherwise the rated degree of protection of the D4NS may not be maintained. Furthermore, the socket connector may be loosened by vibration.

8. Conduit opening

Use the connectors recommended in clause 9 and tighten the connector with specified torque in clause 2. An excessive torque will bring a case breakage.

Apply sealing tape between connector and conduit opening so that the enclosure will conform to IP67.

Use a cable with a suitable diameter for the connector.

For unused conduit opening, apply a conduit cap provided and tighten it to specified torque in clause 2.

9. Recommendation of connector

Use the connector with thread section of 9 mm long or less. In the case of the connector with longer thread section, protruded part may interfere with the other parts inside the body. Use below listed connector to secure IP67.

Size	Manufacture	Type	Adequate cable Diameter
G1/2	LAPP	ST-PF1/2 5380-1002	6.0 to 12.0 mm
	Ohm Denki	OA-W1609	7.0 to 9.0 mm
		OA-W1611	9.0 to 11.0 mm
Pg13.5	LAPP	S-13.5 5301-5030	6.0 to 12.0 mm
M20	LAPP	ST-M20 × 1.5 5311-1020	7.0 to 13.0 mm
1/2-14NPT	LAPP	ST-NPT1/2 5301-6030	6.0 to 12.0 mm
	HEYCO		4.3 to 11.9 mm
M12	LAPP	ST-M12 × 1.5 5301-1000	3.5 to 7.0 mm

When use LAPP's products, use together with a seal packing which is sold separately (Type names, JPK-16, GP-13.5, GPM20. GPM12 is for M12 connector) and tighten with proper tightening torque.

LAPP is a German manufacturer.

Ohm Denki is a Japanese manufacturer.

HEYCO is an American manufacturer.

Before using the 2 conduit type 1/2-14NPT connector, attach the appended changing adapter to the switch, and wind the seal tape about the joint of the adapter and switch.

When use M12 conduit type, connect the above listed connector, after tightened the M12 changing adaptor to the switch.

The M12 changing adaptor is enclosed with the packing.

10. Storage

Do not keep the switch in dusty, humid place and any place where gas may be present for example H2S, SO2, NH3, HNO3, Cl2.

11. Others

- Do not impose excessive force on the key top while the operation key is inserted into the switch body or drop the switch with the operation key inserted to avoid the deformation of the key or the breakage of the switch body.
- Confirm that the seal rubber has no abnormality and then use it. If the seal rubber is displaced or floated, or if foreign matters adhere to the seal rubber, the seal rubber will lose its sealing capability.
- Do not use any screw other than correct one, or the sealing capability of the seal rubber will deteriorate.
- Please do a regular check in premeditation for this switch.

Production Termination

Following the release of the D4NS, production of the D4DS will be terminated.

Date of Production Termination

Production of the D4DS Series will be terminated in July 2006.

Date of Substitute Product Release

Sale of the D4NS Series commenced in July 2003.

Product Replacement

1. Dimensions
   The D4DS and D4NS have basically the same structure, and use the same mounting method, Operation Keys, mounting hole and Operation Key insertion positions. The multi-contact structure and the extra 4 mm in length, however, are different.
2. Terminal Numbers
   For the 2-contact model, the terminals 21, 22, 23, and 24 on the D4DS are 31, 32, 33, and 34 on the D4NS.
3. Recommended Terminals
   If the recommended terminals are not used, the Switch may not be compatible. Make sure that the Switch is compatible with the terminals.

Comparison of the D4DS and Substitute Products

Model	D4NS-□
Switch color	Very similar
Dimensions	Very similar
Wiring/connection	Significantly different
Mounting method	Very similar
Ratings/performance	Very similar
Operating characteristics	Very similar
Operating method	Completely compatible

List of Recommended Substitute Products

Switch

D4DS product	Recommended substitute product
D4DS-15FS	D4NS-1AF
D4DS-25FS	D4NS-2AF
D4DS-35FS	D4NS-3AF
D4DS-55FS	D4NS-5AF
D4DS-65FS	D4NS-6AF
D4DS-1AFS	D4NS-1BF
D4DS-2AFS	D4NS-2BF
D4DS-3AFS	D4NS-3BF
D4DS-5AFS	D4NS-5BF
D4DS-6AFS	D4NS-6BF

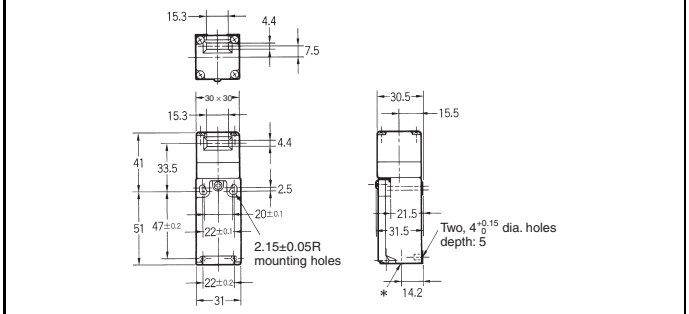
Operation Key

- D4DS-K1
- D4DS-K2
- D4DS-K3
- D4DS-K5

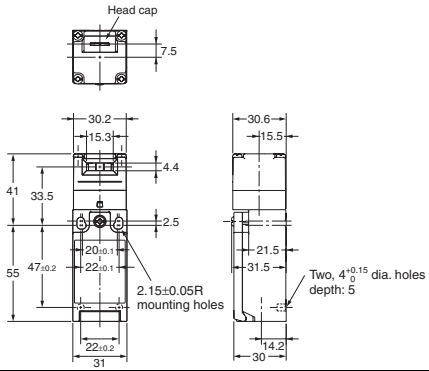
All of the above Operation Keys can be used with the D4NS.

Dimensions (Unit: mm)

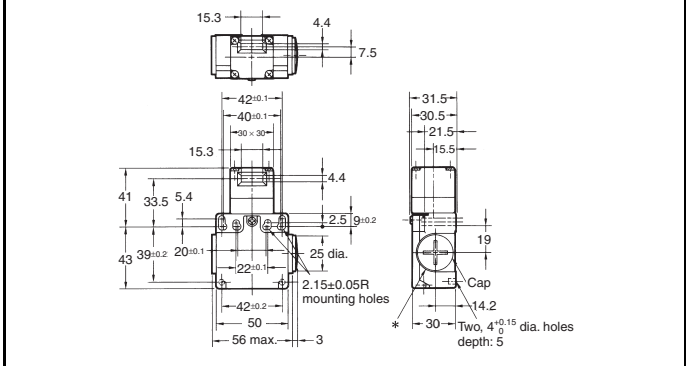
Discontinued Models (1-conduit D4DS)



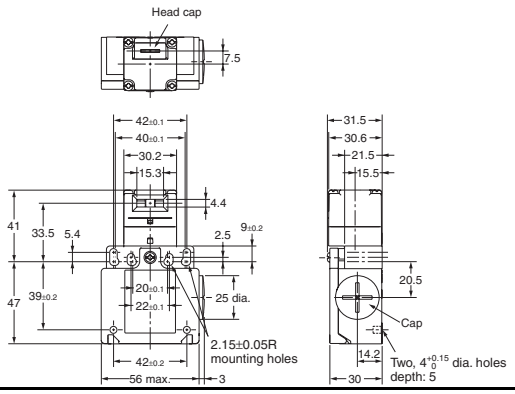
Replacement products (1-conduit D4NS)



Discontinued Model (2-conduit D4DS)



Replacement products (2-conduit D4NS)



⚠ WARNING

This catalog is a guide to help customers select the proper safety product. Observe the following items when choosing products, select the right product for your device or equipment, and develop a safety-related system to fully utilize the product's functions.

Setting up a risk assessment system

The items listed in this catalog must be used properly in terms of product location as well as product performance and functionality. Part of the process of selecting and using these products should include the introduction and development of a risk assessment system early in the design development stage to help identify potential dangers in your equipment that will optimize safety product selection. A badly designed risk assessment system often results in poor choices when it comes to safety products.

- Related international standard: ISO 14121 "Principles of risk assessment."

Safety policy

When developing a safety system for the devices and equipment that use safety products, make every effort to understand and conform to the entire series of international and industrial standards available, such as the examples given below.

- Related international standards: ISO/DIS 12100 "Basic concepts, general principles for design"
  IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems."

Role of safety products

Safety products have functions and mechanisms that ensure safety as defined by standards. These functions and mechanisms are designed to attain their full potential within safety-related systems. Make sure you fully understand all functions and mechanisms, and use that understanding to develop systems that will ensure optimal usage.

- Related international standard: ISO 14119 "Interlocking devices associated with guards- Principles for design and selection."

Installing safety products

Make sure that properly educated and trained engineers are selected to develop your safety-related system and to install safety products in devices and equipment.

- Related international standards: ISO/DIS 12100 "Basic Concepts, general principles for design."
  IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems."

Observing laws and regulations

Safety products should conform to pertinent laws, regulations and standards, but make sure that they are used in accordance with the laws, regulations and standards of the country where the devices and equipment incorporating these products are distributed.

- Related international standard: IEC 60204 "Electrical equipment of machines."

Observing usage precautions

Carefully read the specifications and precautions listed in this catalog for your product as well as all items in the Operating Manual packed with the product to learn usage procedures that will optimize your choice. Any deviation from precautions will lead to unexpected device or equipment failure not anticipated by safety-related systems or fire originating from equipment failure.

Transferring devices and equipment

When transferring devices and equipment, be sure to keep one copy of the Operating Manual and pack another copy with the device or equipment so the person receiving it will have no problem operating it.

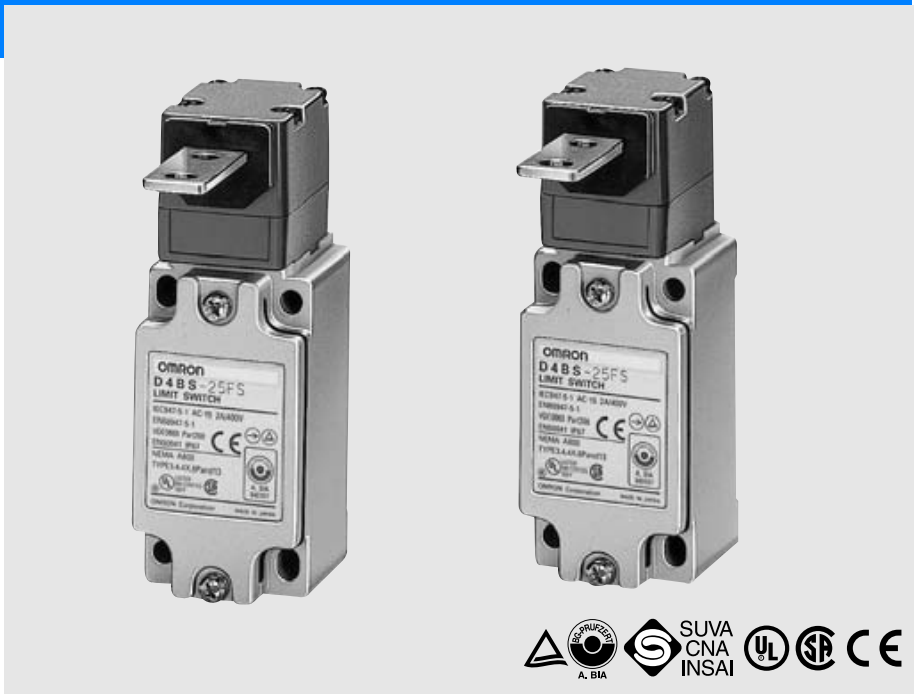
- Related international standards: ISO/DIS 12100 "Basic concepts, general principles for design"
  IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems."

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

Cat. No. C128-E2-03-X

Safety-door Switch

D4BS



Safety-door Switch's Special Operation Key Directly Pulls Apart the Contacts from Each Other and Contributes to the Safety of the Production Site

- Conforms to EN (TÜV) standards corresponding to the CE marking.
- Approved by UL, CSA, BIA, and SUVA standards.
- The switch contact is opened by a direct opening mechanism (NC contacts only) when the protective cover is opened. The EN-approved direct opening mechanism is indicated by ⊖ on the Switch.
- Degree of protection of the switch box: IP67 (EN60947-5-1).
- Series includes models with gold-plated contacts for handling the micro-load range.
- Metric conduit types available.

Model Number Structure

Model Number Legend

Switch

D4BS - □ □ □ S
1 2 3

1. Conduit
1: PG13.5 (1 conduit)
2: G1/2 (1 conduit)
3: 1/2-14NPT (1 conduit)
4: M20
5: PG13.5 (3-conduit)
6: G1/2 (3-conduit)
7: 1/2-14NPT (3-conduit)
8: M20 (3-conduit)

2. Built-in Switch
5: 1NC/1NO (slow-action)
6: 1NC/NO (slow-action), gold-plated contacts
A: 2NC (slow-action)
B: 2NC (slow-action), gold-plated contacts

3. Head Mounting Direction
F: Four mounting directions possible (front-side mounting at shipping)

Operation Key

D4BS - K □
1

1. Operation Key Type
1: Horizontal mounting
2: Vertical mounting
3: Adjustable mounting (Horizontal)

Ordering Information

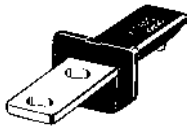
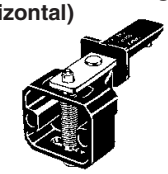
List of Models

Switches

Type	Mounting direction		Conduit size	1NC/1NO (Slow-action)	2NC (Slow-action)
1-conduit	Front-side mounting		Pg13.5	D4BS-15FS	D4BS-1AFS
			G1/2	D4BS-25FS	D4BS-2AFS
			M20	D4BS-45FS	D4BS-4AFS
3-conduit			Pg13.5	D4BS-55FS	D4BS-5AFS
			G1/2	D4BS-65FS	D4BS-6AFS
			M20	D4BS-85FS	D4BS-8AFS

Prefered stock item

Operation Keys (Order Separately)

Type	Model
Horizontal mounting 	D4BS-K1
Vertical mounting 	D4BS-K2
Adjustable mounting (Horizontal) 	D4BS-K3

Specifications

Approved Standards

Agency	Standard	File No.
TÜV Rheinland	EN60947-5-1	R9351022 (Direct opening: approved)
UL	UL508	E76675
CSA	CSA C22.2 No. 14	LR45746
BIA	GS-ET-15	9303323
SUVA	SUVA	E6187.d

Standards and EC Directives

Conforms to the following EC Directives:
Machinery Directive
Low Voltage Directive
EN50041
EN1088

Approved Standard Ratings

TÜV (EN60947-5-1)

Utilization category	AC-15
Rated operating current (Ie)	2 A
Rated operating voltage (Ue)	400 V

Note: Use a 10-A fuse type a gI or gG that conforms to IEC269 as a short-circuit protection device.

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

A600

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
120 VAC	10 A	60 A	6 A	7,200 VA	720 VA
240 VAC		30 A	3 A		
480 VAC		15 A	1.5 A		
600 VAC		12 A	1.2 A		

Characteristics

Degree of protection (see note 2)	IP67 (EN60947-5-1)
Durability (see note 3)	Mechanical:1,000,000 operations min. Electrical:500,000 operations min. (10 A at 250 VAC, resistive load)
Operating speed	0.1 m/s to 0.5 m/s
Operating frequency	30 operations/min max.
Rated frequency	50/60 Hz
Contact gap	2 x 2 mm min.
Direct opening force (see note 4)	19.61 N min. (EN60947-5-1)
Direct opening travel (see note 4)	20 mm min. (EN60947-5-1)
Full stroke	23 mm min.
Insulation resistance	100 MΩ min. (at 500 VDC) between terminals of same or different polarity, between each terminal and ground, and between each terminal and non-current-carrying metal part
Contact resistance	25 mΩ max. (initial value)
Rated insulation voltage (U_i)	600 V (EN60947-5-1)
Conventional enclosed thermal current (I_{the})	20 A (EN60947-5-1)
Dielectric strength (Uimp)	Impulse dielectric strength (U_{imp}) 4 kV (EN60947-5-1) between terminals of same or different polarity, between current-carrying metal parts and ground, and between each terminal and non-current-carrying metal part
Switching overvoltage	1,500 V max. (EN60947-5-1)
Conditional short-circuit current	100 A (EN60947-5-1)
Pollution degree (operating environment)	3 (EN60947-5-1)
Insulation class	Class I (with ground terminal)
Vibration resistance	Malfunction: 10 to 500 Hz, 0.65-mm single amplitude
Shock resistance	Destruction:1,000 m/s^2 min. (IEC68-2-27) Malfunction:300 m/s^2 min. (IEC68-2-27)
Ambient temperature	Operating:-40°C to 80°C (with no icing)
Ambient humidity	Operating:95% max.
Weight	Approx. 285 g (in the case of D4BS-15FS)

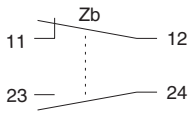
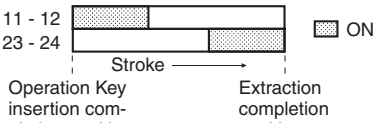
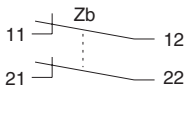
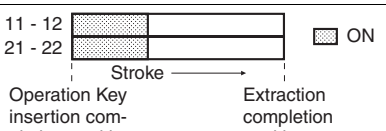
Note: 1. The above values are initial values.

2. Although the switch box is protected from dust, oil, or water penetration, do not use the D4BS in places where dust, oil, water, or chemicals may penetrate through the key hole on the head, otherwise Switch damage or malfunctioning may occur.

3. The durability is for an ambient temperature of 5°C to 35°C and an ambient humidity of 40% to 70%. Contact your OMRON sales representative for more detailed information on other operating environments.

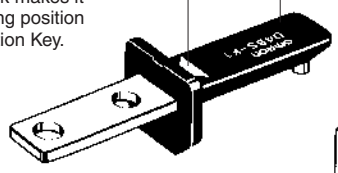
4. These figures are minimum requirements for safe operation.

Contact Form (Diagrams Show State with Key Inserted)

Model	Contact form		Diagram	Remarks
D4BS-□5□S	1NC/1NO			Only NC contact 11-12 has an approved direct opening mechanism. ⊖ Terminals 11-12 and 23-24 can be used as unlike poles.
D4BS-□A□S	2NC			NC contacts 11-12 and 21-22 have an approved direct opening mechanism. ⊖ Terminals 11-12 and 21-22 can be used as unlike poles.

Note: The terminal numbers are in accordance with EN50013, and the contact symbols are in accordance with IEC947-5-1.

Nomenclature



Operation Key
D4BS's exclusive-use Operation Key is provided to assure accurate switching operation.

Set Zone Mark
A triangular Set Zone Mark makes it easy to adjust the operating position when inserting the Operation Key.

Head
The switch head is coated with easy-to-see red paint. The mounting direction of the switch head can be varied to any of the four directions.

Seal Ring (NBR)

Oil Seal (NBR)
The operation plunger employs an oil seal, with which the switch box meets the requirements of IP67 (the sealing capability of the Operation Key's insertion mouth is IP00).

Built-in Switch
A shearing force contact separating mechanism (NC contact) is employed, which positively pulls apart the contacts from each other by using shearing force if any abnormality such as contact welding should occur in the contact area.

There is a difference in level between the NC and NO terminal, which assures easy wiring.

Seal Packing (NBR)

Conduit Opening
Available in four different types of conduit threads: Pg 13.5, G1/2, or 1/2-14NPT, M20.

Ground Terminal Screw
A ground terminal is provided to improve safety. (Built into the Unit.)

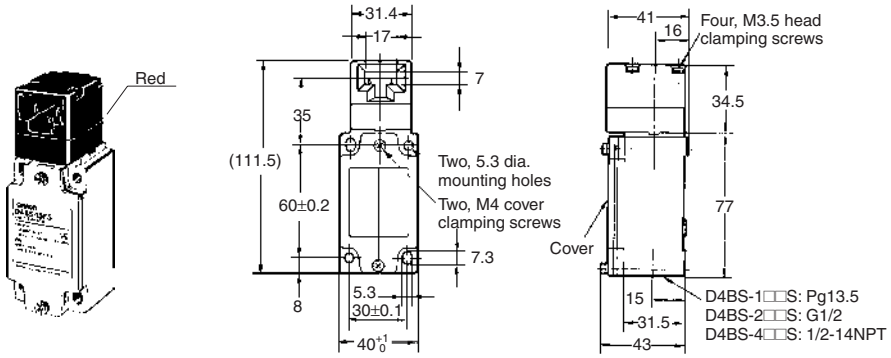
Dimensions

Note: 1. All units are in millimeters unless otherwise indicated.
2. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
3. The conduit thread varies with the model as follows:.

Conduit thread	Model
Pg 13.5	D4BS-1□□S, D4BS-5□□S
G1/2	D4BS-2□□S, D4BS-6□□S
M20	D4BS-4□□S, D4BS-8□□S

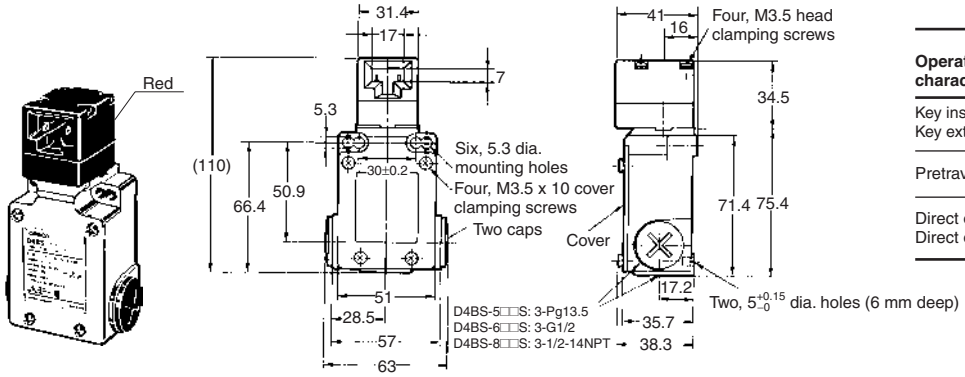
Switches

1-conduit
D4BS-1□□S
D4BS-2□□S
D4BS-4□□S



Operating characteristics	D4BS-1□□S D4BS-2□□S D4BS-4□□S
Key insertion force Key extraction force	19.61 N max. 19.61 N max.
Pretravel (PT)	10±5 mm
Direct opening force Direct opening stroke	19.61 N min. 20 mm min.

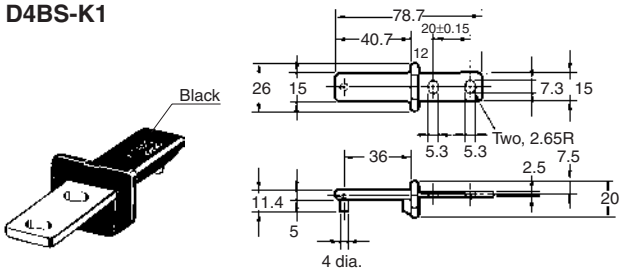
3-conduit
D4BS-5□□S
D4BS-6□□S
D4BS-8□□S



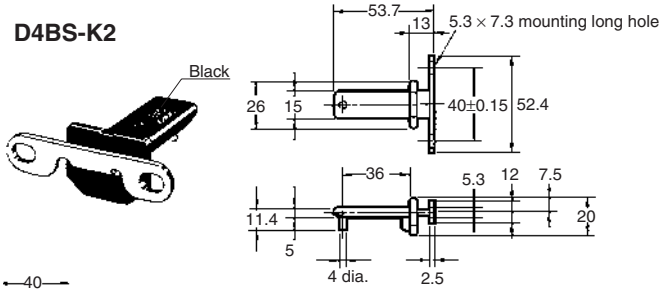
Operating characteristics	D4BS-5□□S D4BS-6□□S D4BS-8□□S
Key insertion force Key extraction force	19.61 N max. 19.61 N max.
Pretravel (PT)	10±5 mm
Direct opening force Direct opening stroke	19.61 N min. 20 mm min.

Operation Keys

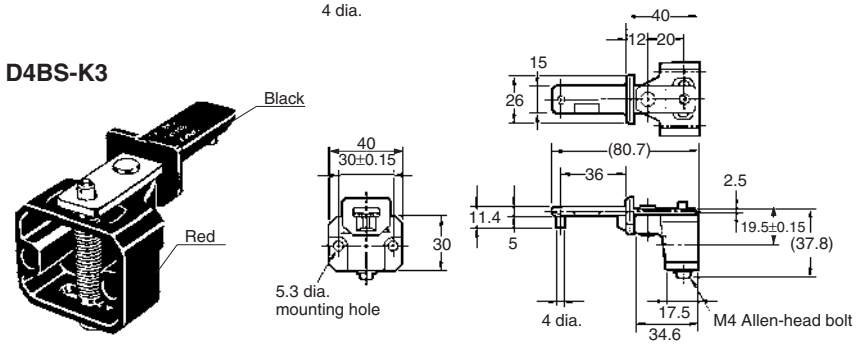
D4BS-K1



D4BS-K2



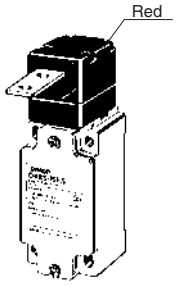
D4BS-K3

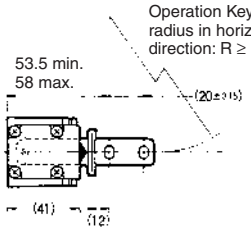


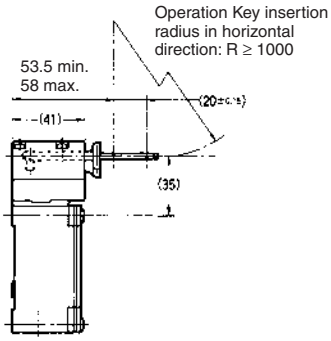
With Operation Key Inserted

Horizontal Mounting

D4BS-1□□S +D4BS-K1
D4BS-2□□S +D4BS-K1
D4BS-4□□S +D4BS-K1

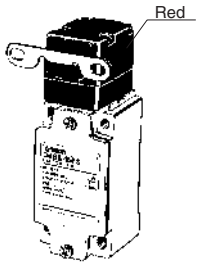


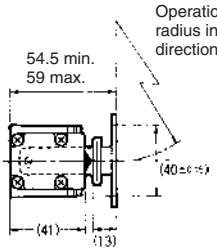


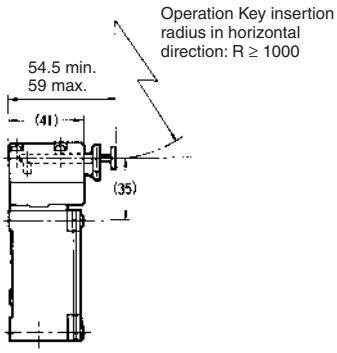


Vertical Mounting

D4BS-1□□S +D4BS-K2
D4BS-2□□S +D4BS-K2
D4BS-4□□S +D4BS-K2

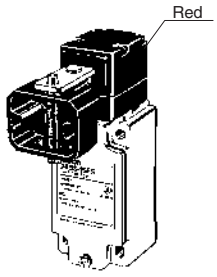


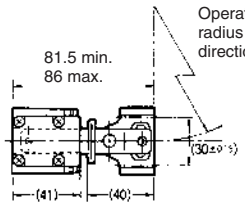


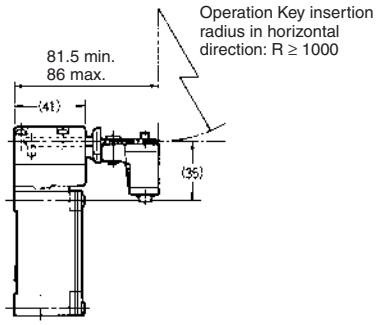


Adjustable Mounting (Horizontal)

D4BS-1□□S +D4BS-K3
D4BS-2□□S +D4BS-K3
D4BS-4□□S +D4BS-K3







Note: "R" is the Operation Key insertion radius.

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

Precautions

Do not dismount the Operation Key from the door intentionally and insert it to the Switch with the door open. Machine may start operating and injury or death may be caused.

Mount the Operation Key at a location where it will not come in contact with users when the door is opened or closed.

When operating the D4BS as a part of a safety category circuit to prevent injury, operate the NC contacts that have a direct opening mechanism in direct opening mode. For safety purposes, tighten the switch body and Operation Key with one-way screws or equivalents or install a switch protection cover and warning label for safety purposes to prevent easy removal of the D4BS.

Connect the fuse to the D4BS in series to prevent it from short-circuit damage. The value of the breaking current of the fuse must be calculated by multiplying rated current by 150% to 200%. When using the D4BS with EN ratings, use 10-A fuse Type gI or gG that complies with IEC60269.

Correct Use

Operating Environment

Make sure in advance that the environment is suitable, with no oil, water, or chemicals, as these may cause the seal to deteriorate, resulting in faulty contact, faulty isolation, current leakage, or burning.

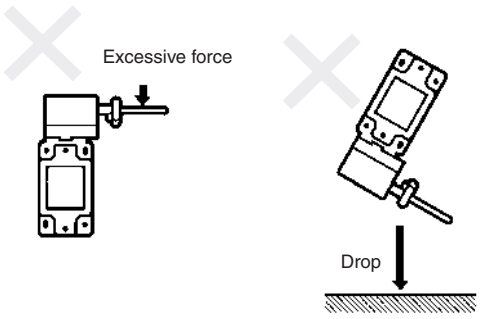
Do not use the D4BS in the following locations:

- Locations subject to severe temperature changes
- Locations subject to high temperatures or condensation
- Locations subject to severe vibration
- Locations where the product may come into direct contact with processing waste or dust

Operation Key

Be sure to use a special Operation Key only. Do not operate the D4BS with anything other than the special Operation Key, otherwise the D4BS may break or the safety of the system may not be maintained.

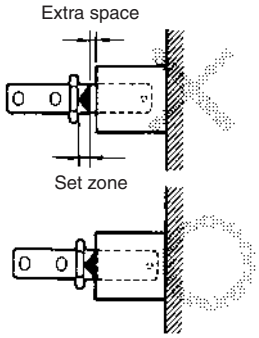
Do not impose excessive force on the Operation Key inserted into the D4BS or drop the D4BS with the Operation Key inserted, otherwise the Operation Key may deform or break.



Secure the Operation Key with a one-way screw, or an equivalent, so that the Operation Key cannot be easily removed.

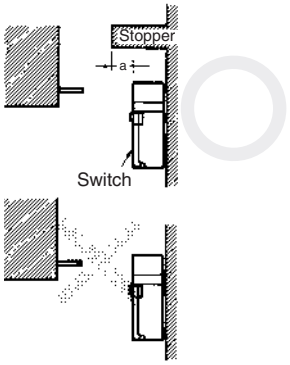
Securing the Door

If the Operation Key on the closed door is pulled outside the set zone by a force caused by vibration, the door's weight, or the door cushion rubber, the switch contact may be opened (causing the machinery to stop) or the D4BS may be damaged. Secure the door with hooks so that it will remain within the set zone.



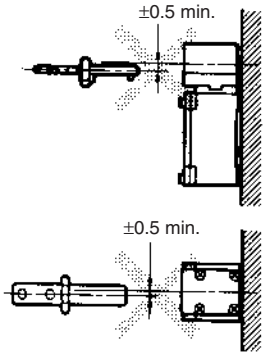
Mounting

Do not use the Switch as a stopper. Be sure to install a stopper as shown in the following illustration when mounting the Switch. The range of space "a" must be determined according to the available set zone of the Operation Key.



Refer to *Dimensions* for the mounting dimension of the Operation Key and mount the Operation Key correctly. The Operation Key will soon become damaged or worn out if it is not mounted correctly.

Make sure that the Operation Key can be inserted properly with a tolerance of ±0.5 mm in the upward, downward, left, or right direction, otherwise the D4BS may soon become damaged.

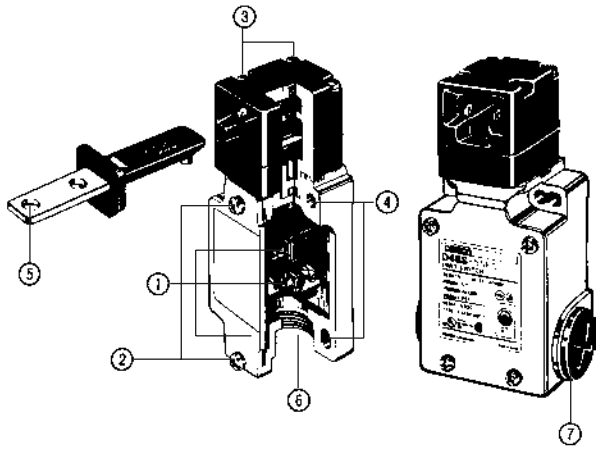


Other

Make sure that the D4BS is located outside the safety door and that no metal dust, oil, or chemical will be sprayed onto the D4BS. Otherwise, the D4BS may soon fail to operate due to the penetration of metal dust, oil, or chemical.

Tightening Torque

Be sure to tighten each screw of the D4BS properly, otherwise the D4BS may malfunction.



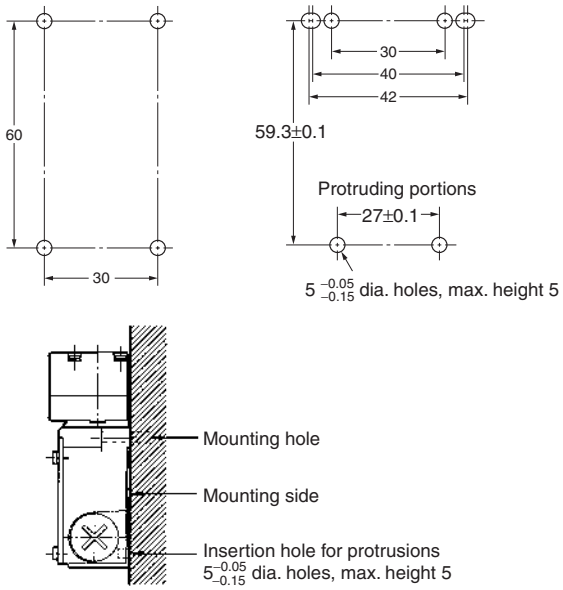
No.	Type	Torque
1	M3.5 terminal screw (including ground terminal screw)	0.59 to 0.78 N·m
2	Cover mounting screw (see note 1)	1.18 to 1.37 N·m
3	Head mounting screw	0.78 to 0.98 N·m
4	M5 body mounting screw (see note 2)	4.90 to 5.88 N·m
5	Operation Key mounting screw	2.35 to 2.75 N·m
6	Connector	1.77 to 2.16 N·m
7	Cap screw	1.27 to 1.67 N·m

Note: 1. Apply a torque of 0.78 o 0.88 N·m if the D4BS is a three-conduit model.

2. Apply a torque of 4.90 to 5.88 N·m in the case of an Allen-head bolt. If it is a pan head screw, apply a torque of 2.35 to 2.75 N·m.

Mounting Dimensions (M5)

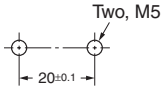
Standard Model **Three-conduit Model**



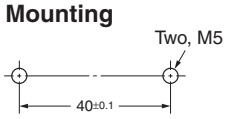
The D4BS can be mounted more securely by adding two protruding portions, each of which is 5 mm maximum in height and 5 $^{-0.05}/_{-0.15}$ mm in diameter as shown below.

Operating Key Mounting Dimensions

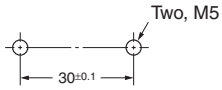
Horizontal Mounting



Vertical Mounting



Adjustable Mounting (Horizontal)



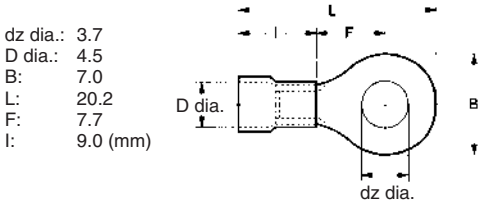
Changes in Head Mounting Direction

By removing the screws on the four corners of the head, the head can be reset in any of four directions. The head direction can be changed with or without the Operation Key inserted in the head. Make sure that no foreign materials penetrate through the head and that the head is tightened securely within the proper torque range.

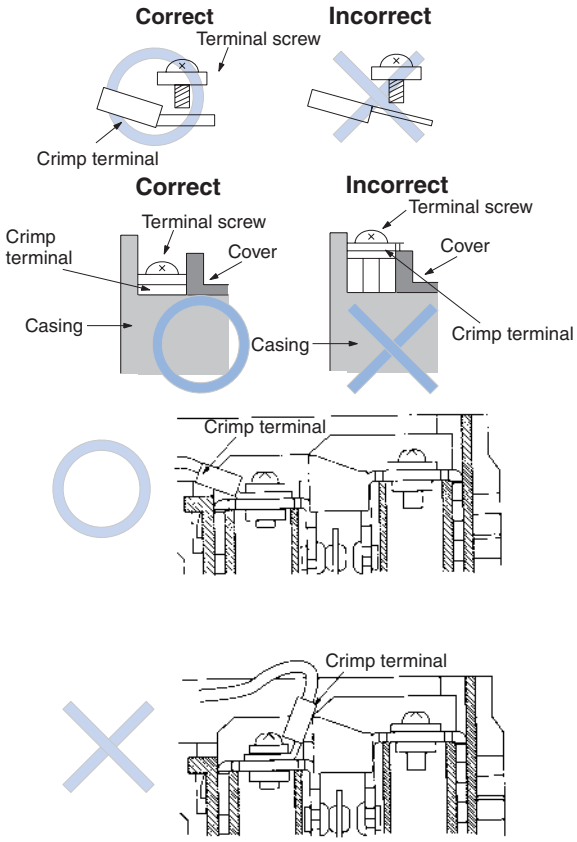
Wiring

Do not connect the lead wires directly to the terminals. Connect the lead wires through insulation tubes and M3.5 crimp terminals. Tighten each terminal screw within the proper torque range.

The proper lead wire is AWG20 to AWG14 (0.5 to 2.5 mm^2) in size.



Make sure that all crimp terminals are correctly connected and located within the casing or cover as shown below.



Connector

Tighten the connector to a suitable torque. Excessive tightening torque may damage the casing.

When using a 1/2-14NPT conduit, apply sealing tape between connector and conduit opening so that the enclosure will confirm to IP67. If using a Pg13.5 conduit, use an ABS-08 Pg13.5 connector or an ABS-12 Pg13.5 connector (manufactured by Nippon Flex).

Use a connector (SC Series, sold separately) suitable for the outer diameter of the cable.

When wiring a 3-conduit model, securely tighten the cap screw provided for unused conduit openings.

Maintenance and Repairs

The user must not maintain or repair equipment incorporating any D4BS model. Contact the manufacturer of the equipment for any maintenance or repairs required.

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

Cat. No. C094-E2-04A-X In the interest of product improvement, specifications are subject to change without notice.

Guard Lock Safety-door Switch

D4NL

Lead-free, Environment-friendly Design

- Contains no harmful substances, such as lead or cadmium, reducing the burden on the environment.
- Models with 4-contact and 5-contact built-in switches are available.
- Key holding force of 1,300 N min.
- Can be used for either standard loads or microloads.
- Lineup includes models with a conduit size of M20.
- IP67 degree of protection.
- Operation key compatible to D4DS, D4NS and D4GL.

Model Number Structure

Model Number Legend

Switch

D4NL-□□□□-□□□
1 2 3 4 5 6 7

1. Conduit Size
- 1: Pg13.5
- 2: G1/2
- 4: M20

2. Built-in Switch (with Door Open/Closed Detection Switch and Lock Monitor Switch Contacts)
- A: 1NC/1NO slow-action contacts plus 1NC/1NO slow-action contacts
- B: 1NC/1NO slow-action contacts plus 2NC slow-action contacts
- C: 2NC slow-action contacts plus 1NC/1NO slow-action contacts
- D: 2NC slow-action contacts plus 2NC slow-action contacts
- E: 2NC/1NO slow-action contacts plus 1NC/1NO slow-action contacts
- F: 2NC/1NO slow-action contacts plus 2NC slow-action contacts
- G: 3NC slow-action contacts plus 1NC/1NO slow-action contacts
- H: 3NC slow-action contacts plus 2NC slow-action contacts

3. Head Mounting Direction and Material
- F: Four mounting directions possible (Front-side mounting at time of delivery)/plastic
- D: Four mounting directions possible (Front-side mounting at time of delivery)/metal

4. Door Lock and Release
- 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
- H: 110-VAC solenoid lock/mechanical release
- J: 230-VAC solenoid lock/mechanical release

5. Indicator
- B: 10 to 115 VAC/VDC (orange LED indicator)
- E: 100 - 230V VAC (orange neon lamp indicator)

6. Release Key Type
- Blank: Standard
- 4: Special release key

7. Release Key Position
- Blank: Bottom
- S: Front

Operation Key

D4DS-K□
1

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

Ordering Information

List of Models

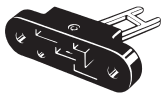
For 110V and 230V version ask your local OMRON Representative

Switches (Operation Keys are sold separately.)

: Models with approved direct opening contacts. **Prefered stock item***

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) Approved direct opening NC contact	Conduit opening	Model
Plastic	Bottom	Standard	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
						M20	**D4NL-4EFA-B***
					2NC/1NO+2NC	Pg13.5	D4NL-1FFA-B
						G1/2	D4NL-2FFA-B
						M20	D4NL-4FFA-B
					3NC+1NC/1NO	Pg13.5	D4NL-1GFA-B
						G1/2	D4NL-2GFA-B
						M20	D4NL-4GFA-B
					3NC+2NC	Pg13.5	D4NL-1HFA-B
						G1/2	D4NL-2HFA-B
						M20	D4NL-4HFA-B
				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
						M20	**D4NL-4EFG-B***
					2NC/1NO+2NC	Pg13.5	D4NL-1FFG-B
						G1/2	D4NL-2FFG-B
						M20	D4NL-4FFG-B
					3NC+1NC/1NO	Pg13.5	D4NL-1GFG-B
						G1/2	D4NL-2GFG-B
						M20	D4NL-4GFG-B
					3NC+2NC	Pg13.5	D4NL-1HFG-B
						G1/2	D4NL-2HFG-B
						M20	D4NL-4HFG-B

Operation Keys

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

Specifications

Standards and EC Directives

Applicable EC Directives and Standards

- Machinery Directive
- Low Voltage Directive
- EN1088
- EN60204-1
- GS-ET-19

Approved Standards

Agency	Standard	File No.
TÜV Product Service	EN60947-5-1 (approved direct opening)	(See note 1.)
UL (See note 2.)	UL508, CSA C22.2 No.14	E76675

Note: 1. Consult your OMRON representative for details.
2. Approval for CSA C22.2 No. 14 is authorized by the UL mark.

Approved Standard Ratings

TÜV (EN60947-5-1)

Item / Utilization category	AC-15	DC-13
Rated operating current (I_e)	3 A	0.27 A
Rated operating voltage (U_e)	240 V	250 V

Note: Use a 10-A fuse type gI or gG that conforms to IEC269 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		Volt-amperes	
		Make	Break	Make	Break
120 VAC	10 A	60 A	6 A	7,200 VA	720 VA
240 VAC		30 A	3 A		

Solenoid Coil Characteristics

Item	24 VDC	110 VAC	230 VAC
Rated operating voltage (100% ED)	24 VDC +10%/-15%	110 VAC ±10%	230 VAC ±10%
Current consumption	Approx. 200 mA	Approx. 50 mA	Approx. 30 mA
Insulation	Class F (130°C max.)		

Indicator Characteristics

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

Characteristics

Degree of protection (see note 2)		IP67 (EN60947-5-1) (This applies for the Switch only. The degree of protection for the key hole is IP00.)	
Durability (see note 3)	**Mechanical**	1,000,000 operations min.	
	Electrical	500,000 operations min. for a resistive load of 3 A at 250 VAC (see note 4)	
Operating speed		0.05 to 0.5 m/s	
Operating frequency		30 operations/minute max.	
Rated frequency		50/60 Hz	
Contact gap		2 x 2 mm min	
Direct opening force (see note 5)		60 N min. (EN60947-5-1)	
Direct opening travel (see note 5)		10 mm min. (EN60947-5-1)	
Holding force (see note 6)		1,300 N min.	
Insulation resistance		100 MΩ min. (at 500 VDC)	
Minimum applicable load (see note 7)		Resistive load of 1 mA at 5 VDC (N-level reference value)	
Rated insulation voltage (U_i)		300 V (EN60947-5-1)	
Rated open thermal current (I_{th})		10 A (EN60947-5-1)	
Impulse withstand voltage (EN60947-5-1)		Between terminals of the same polarity	2.5 kV
		Between terminals of different polarities	4 kV
		Between other terminals and uncharged metallic parts	6 kV
Conditional short-circuit current		100 A (EN60947-5-1)	
Pollution degree (operating environment)		3 (EN60947-5-1)	
Protection against electric shock		Class II (double insulation)	
Contact resistance		25 mΩ max. per contact (initial value)	
Vibration resistance	**Malfunction**	10 to 55 Hz, 0.75-mm single amplitude	
Shock resistance	**Destruction**	1,000 m/s^2 min.	
	Malfunction	300 m/s^2 min. (100 m/s^2 min. for the lock monitor switch)	
Ambient temperature		Operating:−10°C to 55°C with no icing	
Ambient humidity		Operating:95% max.	
Weight		Approx. 370 g (D4NL-IAFA-B)	

Note: 1. The above values are initial values.

2. 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 penetrate through the key hole on the head, otherwise Switch damage or malfunctioning may occur.

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

4. If the ambient temperature is greater than 35°C, do not pass the 3-A, 250-VAC load through more than 2 circuits.

5. These figures are minimum requirements for safe operation.

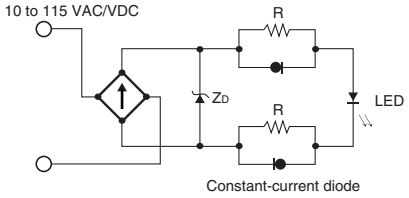
6. This figure is based on the GS-ET-19 evaluation method.

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

Connections

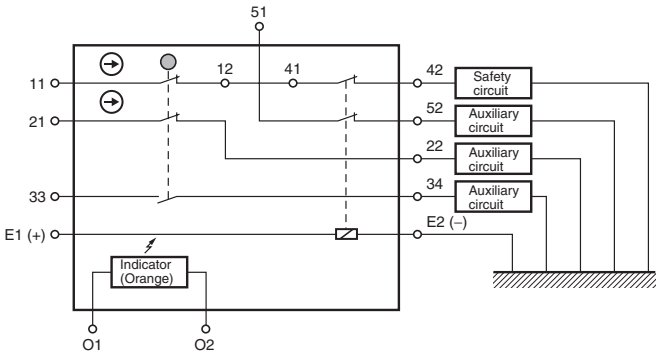
Indicator

Internal Circuit Diagram



Circuit Connection Example

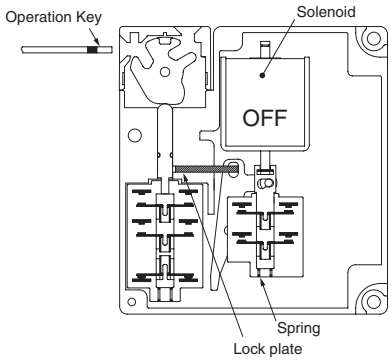
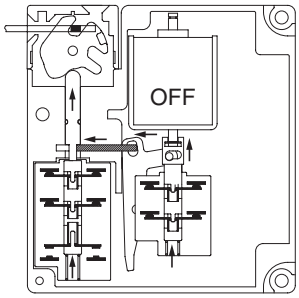
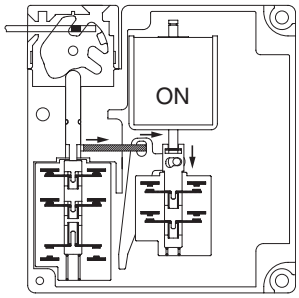
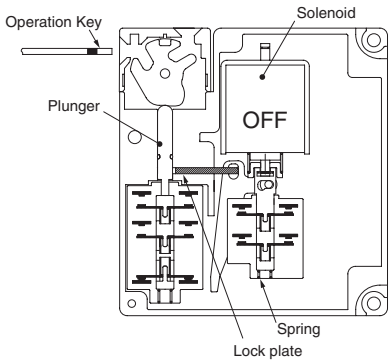
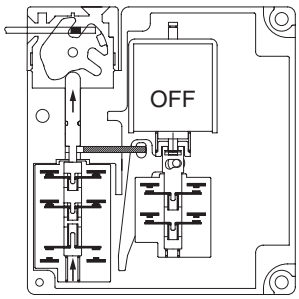
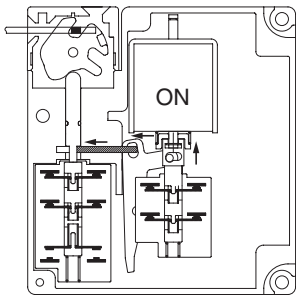
- Terminals 12 and 41 are connected internally and so connect terminals 11 and 42 for safety-circuit input. (GS-ET-19)
- Connect terminals 21 and 22 and terminals 51 and 52 in series when using as safety-circuit input (redundancy circuit for terminals 11 and 12 and terminals 41 and 42 above). Connect the terminals individually when using as auxiliary-circuit input (e.g., terminals 21 and 22 for safety-door open/closed monitoring and terminals 51 and 52 for monitoring the lock status).
- In the connection example on the right, terminals 21 and 22 and terminals 51 and 52 are used as auxiliary-circuit input.



- Direct opening contacts used as safety-circuit input are indicated with the ⊖ mark. Terminals 11 and 12 and terminals 21 and 22 are direct opening contacts.
- Connect the indicators in parallel to the auxiliary circuits or terminals E1 and E2.
  If an indicator is connected in parallel to a direct opening contact, when the indicator breaks, a short-circuit current will be generated, possibly resulting in an installation malfunction.
- Do not switch standard loads for more than 2 circuits at the same time. Otherwise, the level of insulation may decrease.
- The 24-VDC solenoid has polarity. Be sure to connect terminals with the correct polarity.

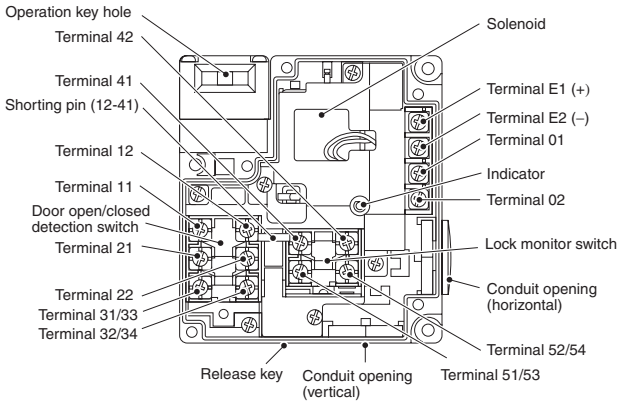
Operation Method

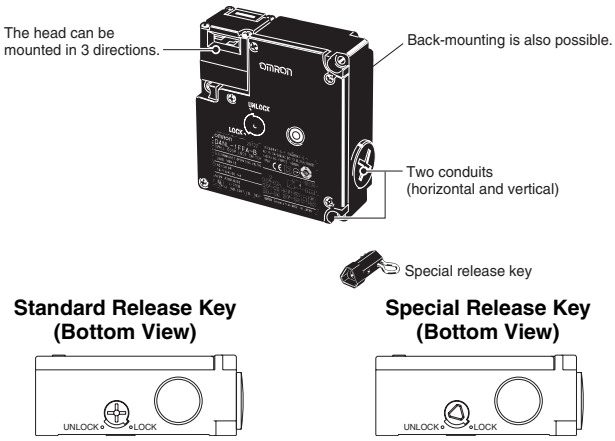
Operation Principles

Mechanical lock models		 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.	 The solenoid is released only when the lock is turned ON.
Solenoid lock models		 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 work-pieces or parts.	 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 sys-tems that would maintain a hazardous state (e.g., systems requiring toxic gases, high temperatures, or gears that would continue to turn due to inertia).

Nomenclature

Structure

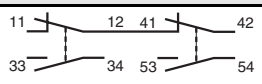
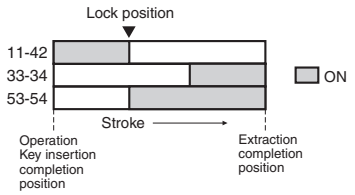
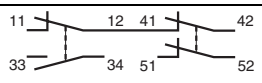
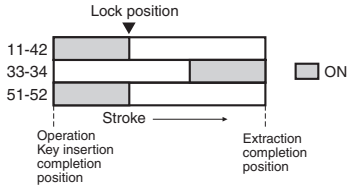
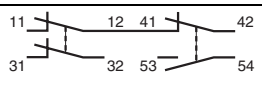
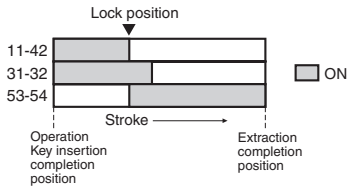
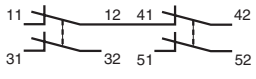
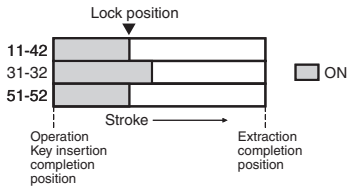
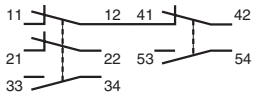
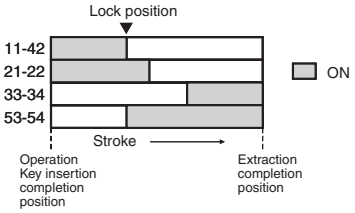
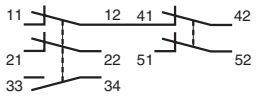
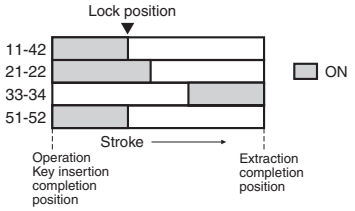
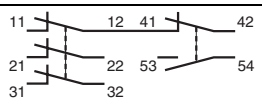
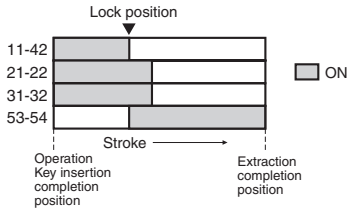
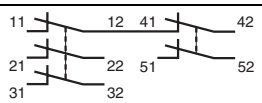
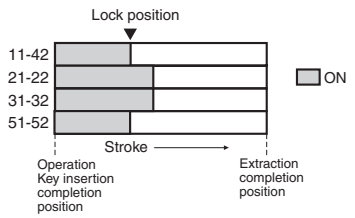




Note: Terminal numbers vary with the model.

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).

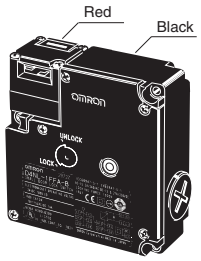
Model	Contact	Contact form	Operating pattern	Remarks
D4NL-□AF□-□	1NC/1NO + 1NC/1NO			Only NC contacts 11-12 and 41-42 have an approved direct opening mechanism. ⊖ The terminals 11-42, 33-34, and 53-54 can be used as unlike poles.
D4NL-□BF□-□	1NC/1NO + 2NC			Only NC contacts 11-12, 41-42, and 51-52 have an approved 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, 31-32, and 41-42 have an approved 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, 31-32, 41-42, and 51-52 have an approved 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, 21-22, and 41-42 have an approved 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, 21-22, 41-42, and 51-52 have an approved 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, 31-32, and 41-42 have an approved 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, 31-32, 41-42 and 51-52 have an approved direct opening mechanism. ⊖ The terminals 11-42, 21-22, 31-32, and 51-52 can be used as unlike poles.

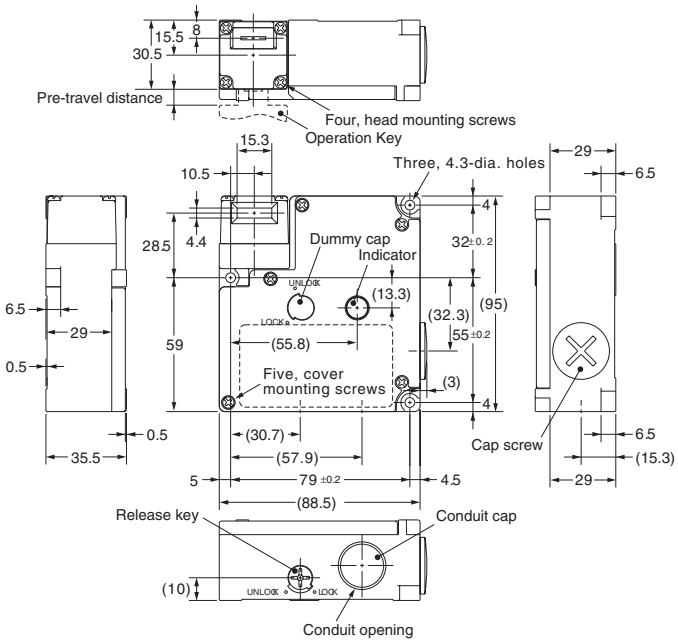
Dimensions

Note: All units are in millimeters unless otherwise indicated

Switches

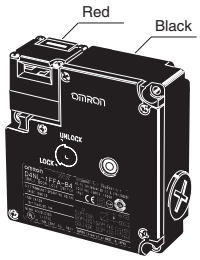
D4NL-□□□□-B

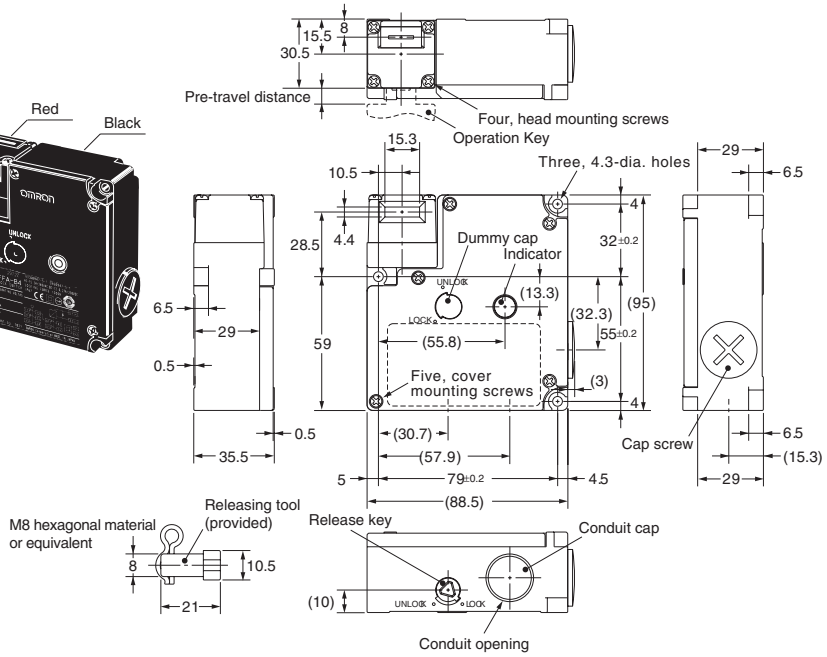




Operating characteristics	D4NL-□□□□-B
Key insertion force Key extraction force	15 N max. 30 N max.
Pre-travel distance	9 mm max.
Movement before being locked	3 mm min.

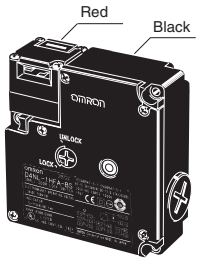
D4NL-□□□□-B4

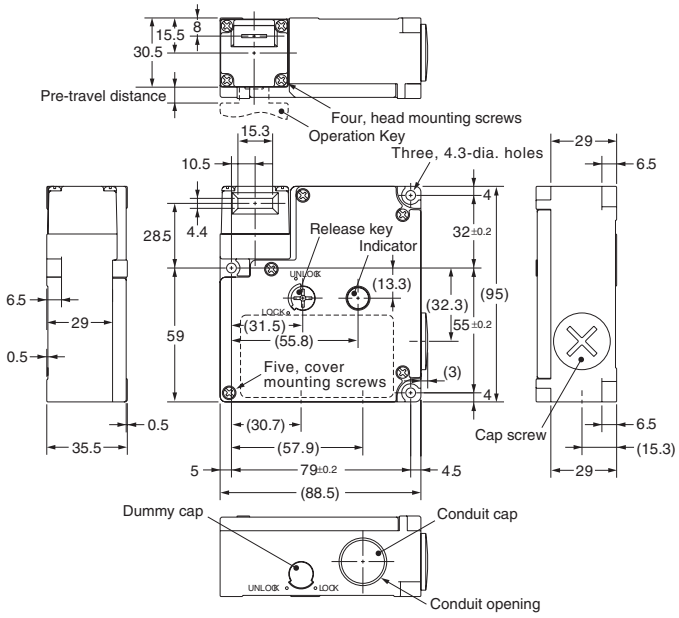




Operating characteristics	D4NL-□□□□-B4
Key insertion force Key extraction force	15 N max. 30 N max.
Pre-travel distance	9 mm max.
Movement before being locked	3 mm min.

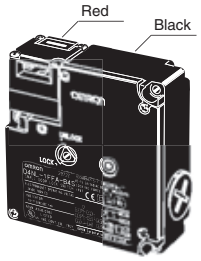
D4NL-□□□□-BS

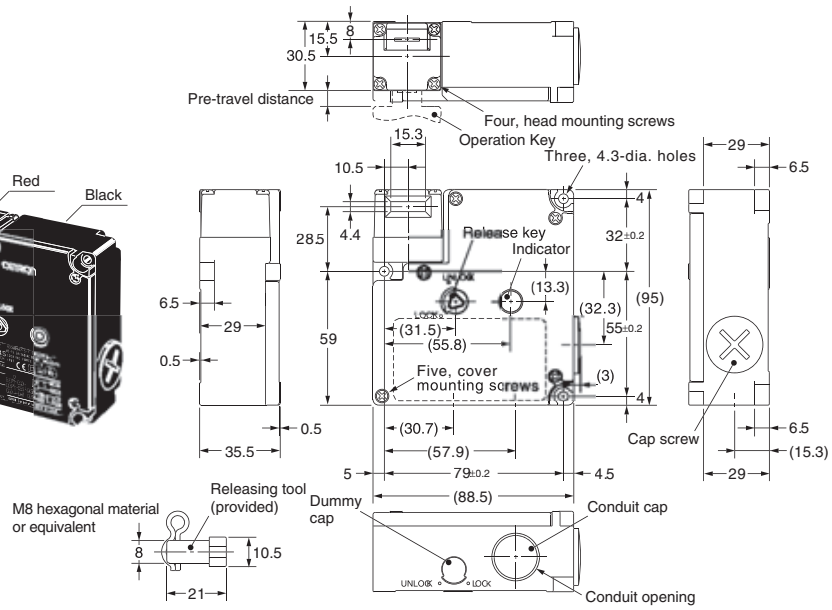




Operating characteristics	D4NL-□□□□-BS
Key insertion force Key extraction force	15 N max. 30 N max.
Pre-travel distance	9 mm max.
Movement before being locked	3 mm min.

D4NL-□□□□-B4S



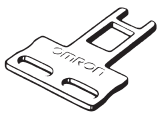


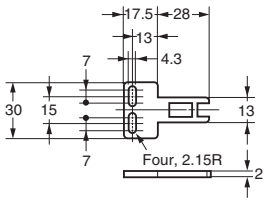
Operating characteristics	D4NL-□□□□-B4S
Key insertion force Key extraction force	15 N max. 30 N max.
Pre-travel distance	9 mm max.
Movement before being locked	3 mm min.

Operation Keys

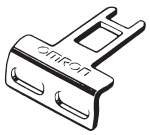
Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

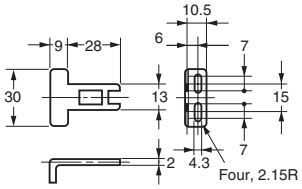
D4DS-K1



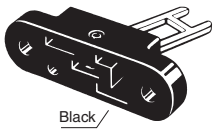


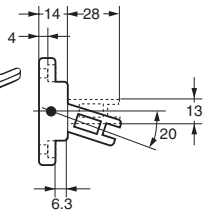
D4DS-K2

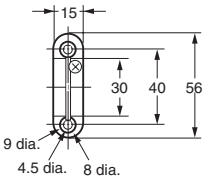




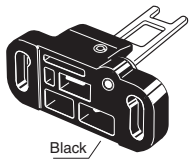
D4DS-K3

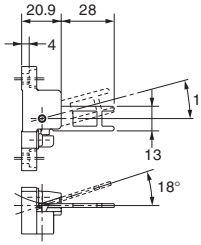


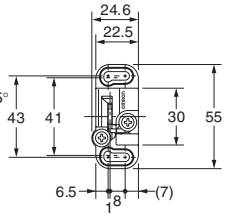




D4DS-K5

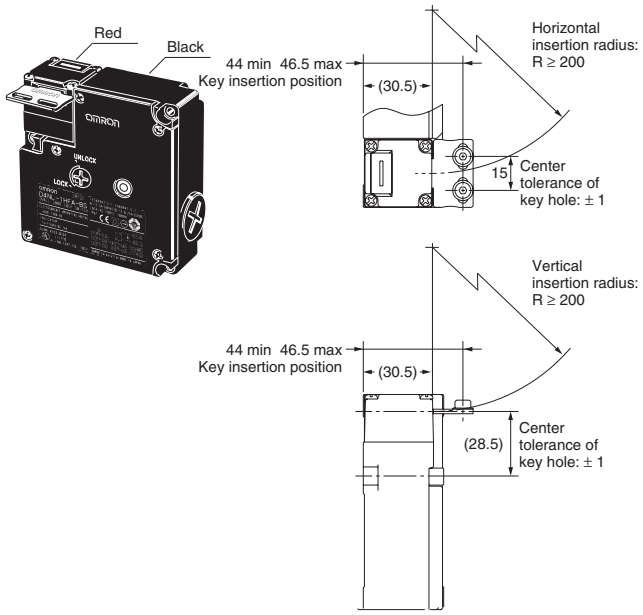




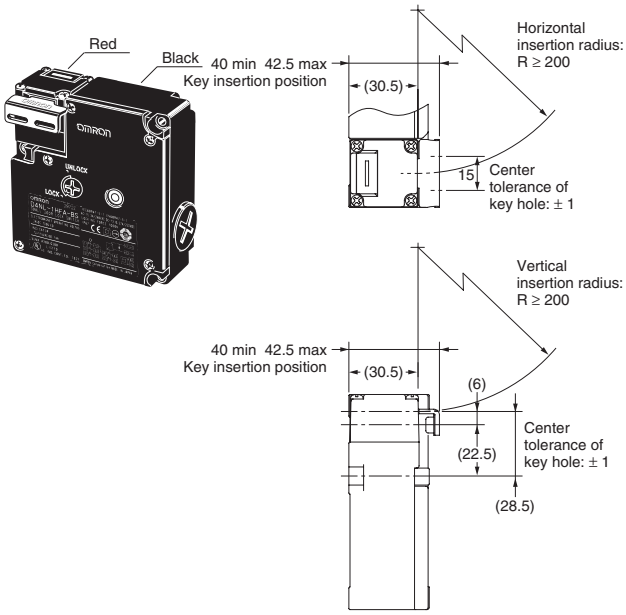


With Operation Key Inserted

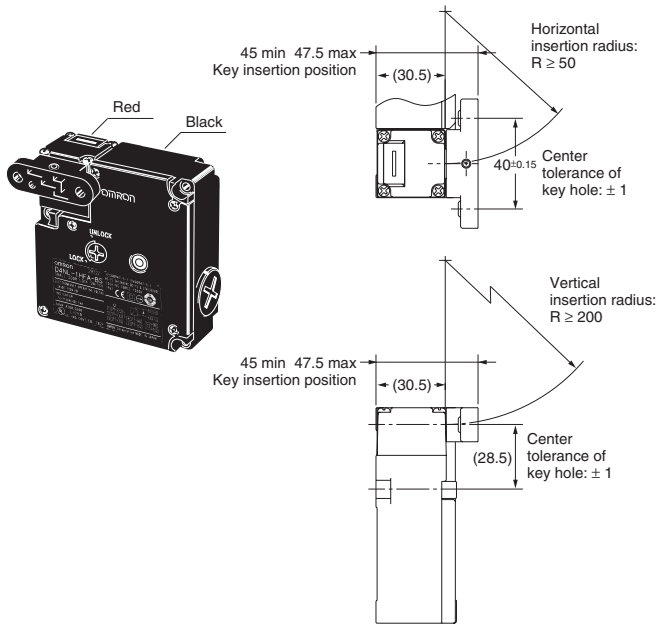
D4NL + D4DS-K1



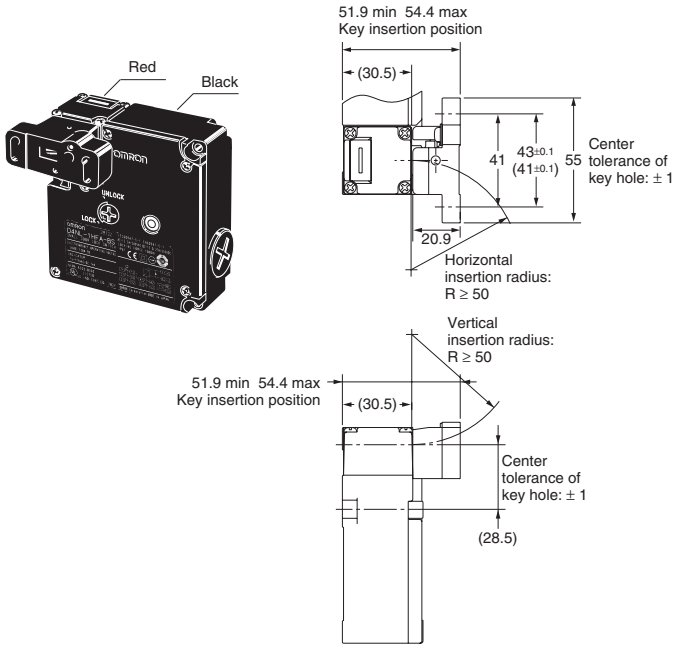
D4NL + D4DS-K2



D4NL + D4DS-K3

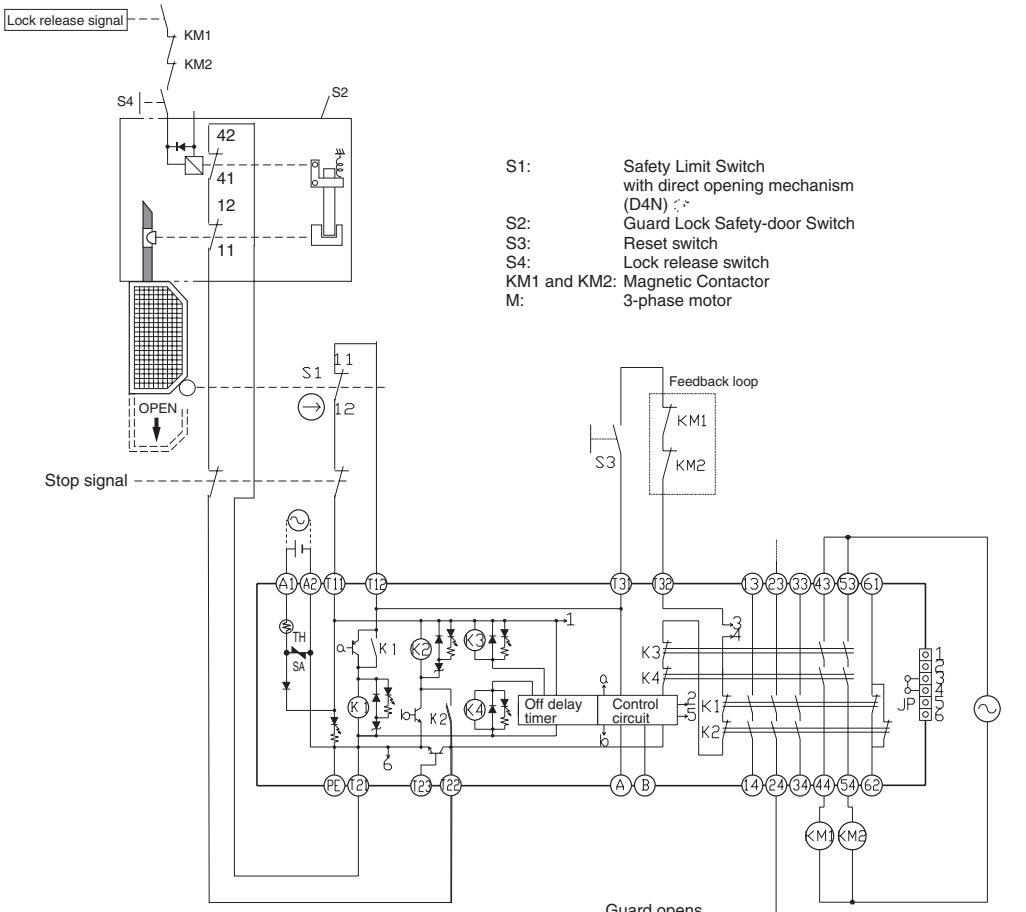


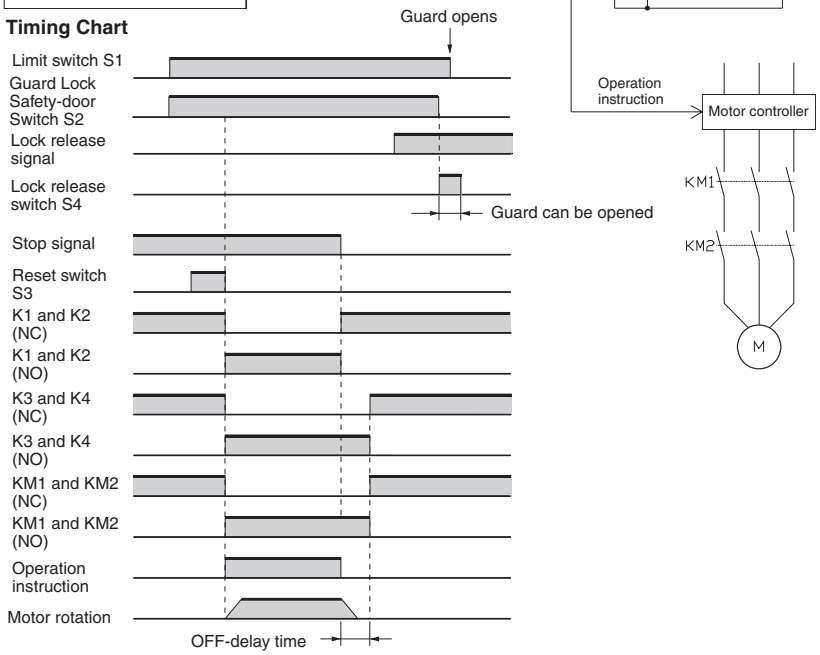
D4NL + D4DS-K5



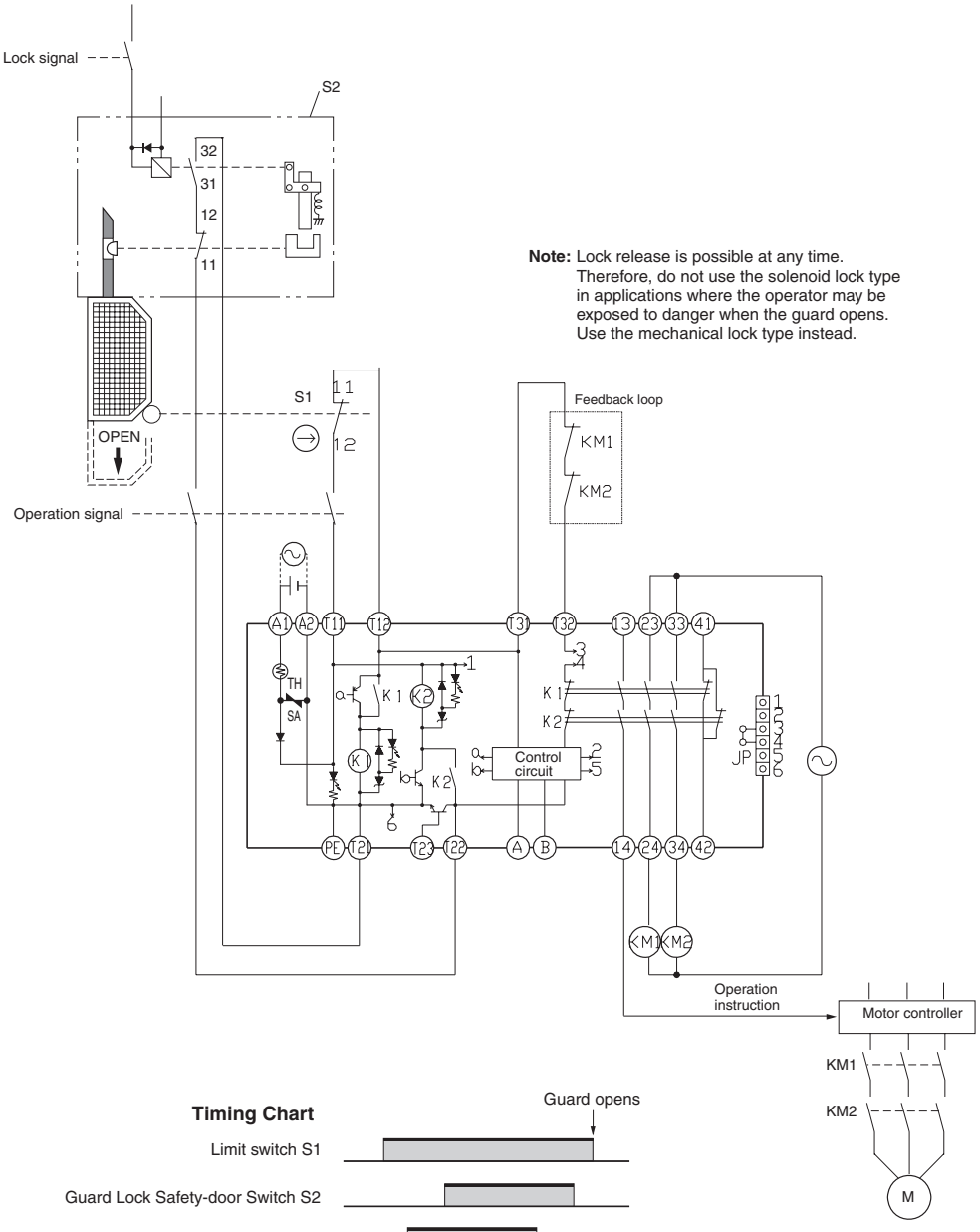
Application Examples

G9SA-321-T□ (24 VAC/VDC) + D4NL-□□□A-□, □□□B-□, □□□C-□ (Mechanical Lock Type) + D4D-□520N Circuit Diagram



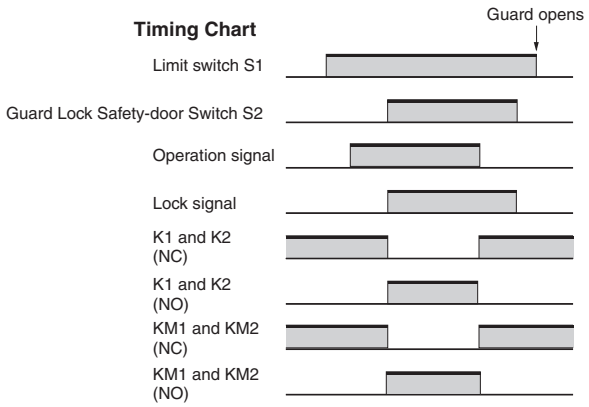


G9SA-301 (24 VAC/VDC) + D4NL-□□□G-□, □□□H-□, □□□J-□ (Solenoid Lock Type) + D4D-□520N Circuit Diagram



Note: Lock release is possible at any time. Therefore, do not use the solenoid lock type in applications where the operator may be exposed to danger when the guard opens. Use the mechanical lock type instead.

Timing Chart



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

Precautions

⚠ Caution

Do not insert the Operation Key with the door open. The machine may operate and damage may result.

⚠ Caution

Do not use metal connectors or conduits with this switch. Damage to the broken conduit hole may cause electric shock.

⚠ Caution

Change the head direction after changing the release key to the UNLOCK position. Do not change the head direction with the cover removed. Failure to observe these points may result in Switch malfunction or damage.

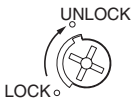
Holding Force

- Do not apply a force exceeding the specified holding force. Doing so may break the Switch and the machine may continue to operate.
- Either install another locking component (e.g., a stop) in addition to the Switch, or use a warning sticker or an indicator showing the lock status so that a force exceeding the specified holding force is not applied.

Safety Precautions

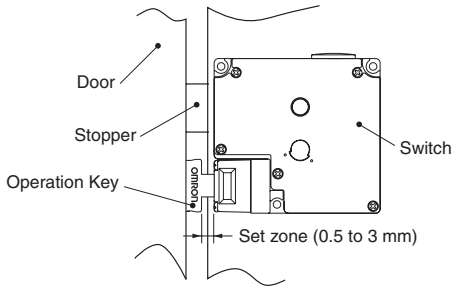
- The Switch contacts can be used for either standard loads or microloads. Once a contact has been used to switch a standard load, however, it cannot be used for a load of a smaller capacity. Doing so may result in roughening of the contact surface and contact reliability may be lost.
- Turn OFF the power before disassembling the Switch or touching any internal parts. Not doing so may result in electric shock.
- Mount the Operation Key in a location where it will not come in contact with users when the door is opened or closed. Otherwise, injury may result.
- Do not impose excessive force on the Operation Key when it is inserted into the Switch or drop the Switch with the Operation Key inserted. Otherwise, the Operation Key may be deformed or the Switch may be broken.
- Observe the specified insertion radius for the Operation Key and insert it in a direction perpendicular to the key hole.
- Do not use the Switch in starting circuits. (Use for safety confirmation signals.)
- When using the Switch in emergency-stop circuits or other safety circuits that have a direct impact on human lives, operate the NC contacts that have a direct opening mechanism in direct opening mode. For safety purposes, prevent easy removal by, for example, mounting the Switch and Operation Key with one-way screws or attaching a protective cover and warning label.
- In order to prevent short-circuit damage to the Switch, connect a fuse to the Switch in series. Use a fuse with a breaking current of 1.5 to 2 times the rated current. To conform to EN ratings, use a IEC269-compliant 10-A fuse type gI or gG.
- Turn the power OFF when wiring. After wiring is completed, be sure to mount the cover before use.
- In order to prevent burning due to overvoltage, insert a protective fuse in the solenoid circuits.
- Do not use the Switch where explosive gas, flammable gas, or any other dangerous gas may be present.
- Ensure that the load current does not exceed the rated current.
- Be sure to wire the terminals correctly.
- Be sure to evaluate the Switch under actual operating conditions after installation.
- Do not drop the package or the product. Do not disassemble internal parts.

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 using an appropriate tool, the lock will be released and the safety door can be opened (mechanical lock models only).
- After setting the release key to UNLOCK in order to, for example, change the head direction or perform maintenance, be sure to return it to LOCK setting before resuming operation.
- When the Switch is used for the door of a machine room to ensure the safety of people performing adjustment work inside, if the 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.
- 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 operated properly.
- To prevent the release key from being used by unauthorized personnel, set it to LOCK and seal it with seal wax.

Mounting



- Do not use the Switch as a stopper. To prevent the door from coming into contact with the flange of the Operation Key, be sure to mount the Switch with a stopper as shown above.
- 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, if an attempt is made to open the door beyond the lock position, the force imposed will be much larger than for locations far from the hinged side, and the lock may be damaged.

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.

Correct Use

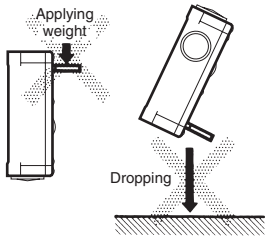
Operating Environment

- This Switch is for indoor use only. Do not use it outdoors. Otherwise, it may malfunction.
- Do not use the Switch in the following locations:
  - •Locations subject to severe temperature changes
  - •Locations subject to high humidity levels or condensation
  - •Locations subject to severe shocks or vibrations
  - •Locations where the Switch may come in contact with metal dust, oil, or chemicals
  - •Locations subject to thinner, detergent, or other solvents.
- Although the Switch itself is protected from dust or water penetration, ensure that foreign material does not penetrate through the key hole on the head, otherwise Switch damage or malfunctioning may occur.
- 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 interior. (The IP67 degree of protection specification for the Switch pertains to the amount of water penetration after the Switch is submerged in water for a certain period of time.)

Life Expectancy

The life expectancy of the Switch will vary with the switching conditions. Before applying the Switch, test it under actual operating conditions and be sure to use it at a switching frequency that will not lower its performance.

Operation Key



- Use the designated OMRON Operation Key with the Switch. Using another Operation Key may result in Switch damage.
- Do not impose excessive force on the Operation Key when it is inserted into the Switch or drop the Switch with the Operation Key inserted. Otherwise, the Operation Key may be deformed or the Switch may be broken.

Mounting

Tightening Torque

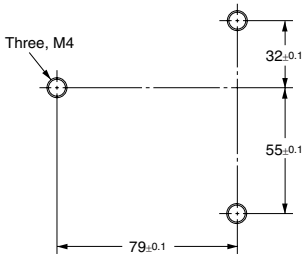
Be sure to tighten each screw of the Switch properly. Loose screws may result in malfunction.

Type	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

Switch and Operation Key Mounting

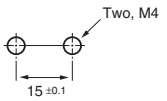
- Mount the Switch and Operation Key securely to the applicable tightening torque with M4 screws.

Mounting Hole Dimensions for Switch

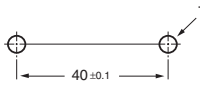


Mounting Hole Dimensions for Operation Key

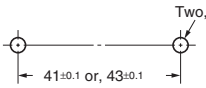
D4DS-K1/-K2 (horizontal/vertical mounting)



D4DS-K3 (adjustable mounting: horizontal)



D4DS-K5 (adjustable mounting: vertical)



- If the Switch is back-mounted, the release key can only be operated from the bottom and the indicator cannot be used.
- Use the designated OMRON Operation Key with the Switch. Using another Operation Key may result in Switch damage.
- Ensure that the alignment offset between the Operation Key and the key hole does not exceed ±1 mm.

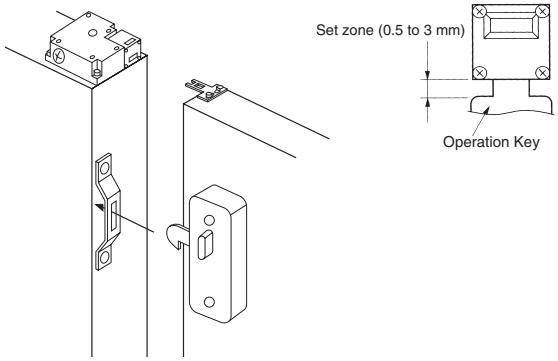
Head Direction

By removing the four screws of the head, the mounting direction of the head can be changed. The head can be mounted in four directions.

Ensure that no foreign matter penetrates the interior of the Switch.

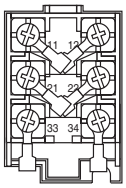
Securing the Door

When the door is closed (with the Operation Key inserted), it may be pulled beyond the set zone because of, for example, the door's weight, or the door cushion rubber. Also, if a load is applied to the Operation Key, the door may fail to unlock properly. Use hooks to ensure that the door stays within the set zone (0.5 to 3 mm).



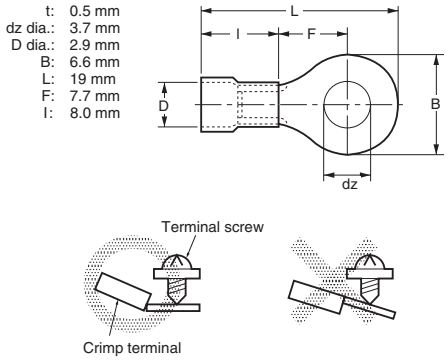
Wiring

Wiring Precautions



- 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 0.75mm^2).
- When connecting lead wires directly to terminals, perform wiring securely so that there are no loose wire strands.
- Do not push crimp terminals into gaps in the case interior. Doing so may cause damage or deformation of the case.
- Use lead wires of an appropriate length. Not doing so may cause the cover to rise.
- Use crimp terminals not more than 0.5 mm in thickness. Otherwise, they will interfere with other components inside the case. The crimp terminals shown below are not more than 0.5 mm thick.

Manufacturer	Model
J.S.T.	FV0.5-3.7



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 an excessive tightening torque is applied.
- In order to ensure IP67 degree of protection, wrap sealing tape around the conduit end of the connector.
- Be sure that the outer diameter of the cable connected to the connector is correct.
- Attach and tighten a conduit cap to the unused conduit opening when wiring. 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
G$^1/_2$	LAPP	ST-PF1/2 5380-1002	6.0 to 12.0 mm
	Ohm Denki	OA-W1609	7.0 to 9.0 mm
		OA-W1611	9.0 to 11.0 mm
Pg13.5	LAPP	S-13.5 5301-5030	5.0 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 with the applicable torque. Seal packing is sold separately.

Maintenance and Repairs

The user must not perform repairs or maintenance. Contact the machine manufacturer if repairs or maintenance are required.

Storage

Do not store the Switch in locations where harmful gases (e.g., H_2S, SO_2, NH_3, HNO_3, or Cl_2) or dust are present, or in locations subject to high humidity levels.

Miscellaneous

- Do not touch the solenoid. The temperature of the solenoid increases when current is passed.
- In conditions requiring greater rigidity, sealing performance, and oil resistance, use OMRON's D4BL.
- Perform regular inspections.

Production Termination

Following the release of the D4NL, production of the D4DL will be terminated.

Date of Production Termination

Production of the D4DL Series will be terminated in November 2003.

Date of Substitute Product Release

Sale of the D4NL Series commenced in October 2002.

Product Replacement

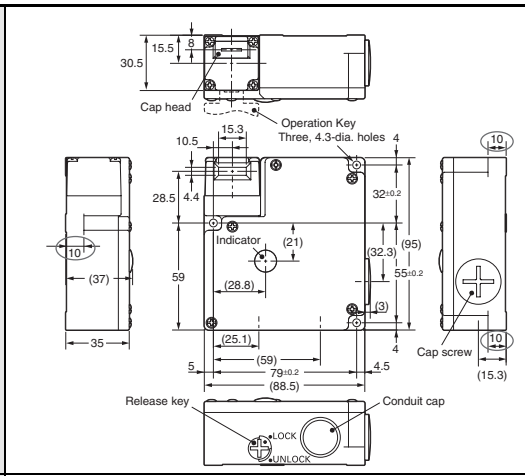
The D4DL and D4NL have basically the same structure, and use the same mounting method and Operation Keys. There are differences, however, in the external appearance and the mounting sections.

Comparison of the D4DL and Substitute Products

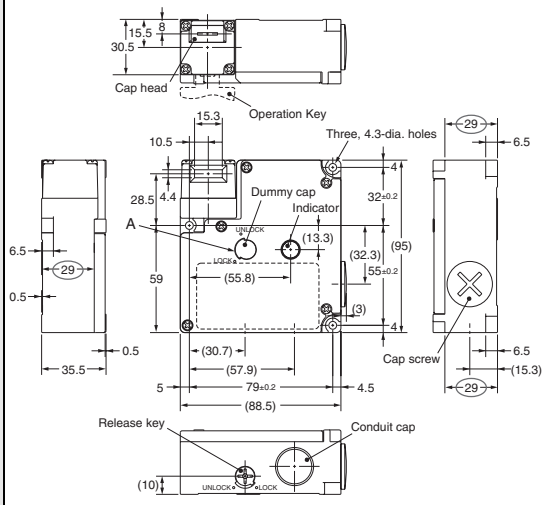
Model	D4NL-□
Switch color	Very similar
Dimensions	Very similar
Wiring/connection	Significantly different
Mounting method	Very similar
Ratings/performance	Very similar
Operating characteristics	Very similar
Operating method	Completely compatible

Dimensions

Discontinued Model (D4DL)



Replacement products (D4NL Series)



The above diagram is for Switches with the release key on the bottom. For Switches with the release key on the front, interchange the positions of the release key and dummy cap (A).

Differences: The depth of the M4 mounting screw holes is 29 mm for the D4NL, as opposed to 10 mm for the D4DL. Therefore, when replacing the D4DL with the D4NL, use M4 screws that are 19 mm longer than the ones used before.

List of Recommended Substitute Products

Switch

D4DL product	Recommended substitute product	Substitute with M20 conduit
D4DL-1CFA-B	D4NL-1AFA-B, D4NL-1BFA-B	D4NL-4AFA-B, D4NL-4BFA-B
D4DL-2CFA-B	D4NL-2AFA-B, D4NL-2BFA-B	
D4DL-1DFA-B	D4NL-1CFA-B, D4NL-1DFA-B	D4NL-4CFA-B, D4NL-4DFA-B
D4DL-2DFA-B	D4NL-2CFA-B, D4NL-2DFA-B	
D4DL-1CFG-B	D4NL-1AFG-B, D4NL-1BFG-B	D4NL-4AFG-B, D4NL-4BFG-B
D4DL-2CFG-B	D4NL-2AFG-B, D4NL-2BFG-B	
D4DL-1DFG-B	D4NL-1CFG-B, D4NL-1DFG-B	D4NL-4CFG-B, D4NL-4DFG-B
D4DL-2DFG-B	D4NL-2CFG-B, D4NL-2DFG-B	
D4DL-1CFB-B	D4NL-1AFB-B, D4NL-1BFB-B	D4NL-4AFB-B, D4NL-4BFB-B
D4DL-2CFB-B	D4NL-2AFB-B, D4NL-2BFB-B	
D4DL-1DFB-B	D4NL-1CFB-B, D4NL-1DFB-B	D4NL-4CFB-B, D4NL-4DFB-B
D4DL-2DFB-B	D4NL-2CFB-B, D4NL-2DFB-B	
D4DL-1CFH-B	D4NL-1AFH-B, D4NL-1BFH-B	D4NL-4AFH-B, D4NL-4BFH-B
D4DL-2CFH-B	D4NL-2AFH-B, D4NL-2BFH-B	
D4DL-1DFH-B	D4NL-1CFH-B, D4NL-1DFH-B	D4NL-4CFH-B, D4NL-4DFH-B
D4DL-2DFH-B	D4NL-2CFH-B, D4NL-2DFH-B	
D4DL-1CFC-EW	D4NL-1AFC-E, D4NL-1BFC-E	D4NL-4AFC-E, D4NL-4BFC-E
D4DL-2CFC-EW	D4NL-2AFC-E, D4NL-2BFC-E	
D4DL-1DFC-EW	D4NL-1CFC-E, D4NL-1DFC-E	D4NL-4CFC-E, D4NL-4DFC-E
D4DL-2DFC-EW	D4NL-2CFC-E, D4NL-2DFC-E	
D4DL-1CFJ-EW	D4NL-1AFJ-E, D4NL-1BFJ-E	D4NL-4AFJ-E, D4NL-4BFJ-E
D4DL-2CFJ-EW	D4NL-2AFJ-E, D4NL-2BFJ-E	
D4DL-1DFJ-EW	D4NL-1CFJ-E, D4NL-1DFJ-E	D4NL-4CFJ-E, D4NL-4DFJ-E
D4DL-2DFJ-EW	D4NL-2CFJ-E, D4NL-2DFJ-E	
D4DL-1CFA-B-HT	D4NL-1AFA-B4, D4NL-1BFA-B4	D4NL-4AFA-B4, D4NL-4BFA-B4
D4DL-2CFA-B-HT	D4NL-2AFA-B4, D4NL-2BFA-B4	
D4DL-1DFA-B-HT	D4NL-1CFA-B4, D4NL-1DFA-B4	D4NL-4CFA-B4, D4NL-4DFA-B4
D4DL-2DFA-B-HT	D4NL-2CFA-B4, D4NL-2DFA-B4	
D4DL-1CFG-B-HT	D4NL-1AFG-B4, D4NL-1BFG-B4	D4NL-4AFG-B4, D4NL-4BFG-B4
D4DL-2CFG-B-HT	D4NL-2AFG-B4, D4NL-2BFG-B4	
D4DL-1DFG-B-HT	D4NL-1CFG-B4, D4NL-1DFG-B4	D4NL-4CFG-B4, D4NL-4DFG-B4
D4DL-2DFG-B-HT	D4NL-2CFG-B4, D4NL-2DFG-B4	

Note: With standard products, terminals 12 and 41 are connected with a shorting pin. In cases where D4DL terminals 11 and 12 and terminals 41 and 42 are currently being used independently, remove the shorting pin.

Note: Operation Key

- D4DS-K1
- D4DS-K2
- D4DS-K3
- D4DS-K5

All of the above Operation Keys can be used with the D4NL.

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

Cat. No. C126-E2-01-X In the interest of product improvement, specifications are subject to change without notice.

Guard Lock Safety-door Switch

D4GL

Environment-friendly Switch with Direct Opening Contacts

- Contains no harmful substances, such as lead or cadmium, reducing the burden on the environment.
- Slim safety-door switch with an electromagnetic lock or unlock mechanism.
- Models with 4-contact and 5-contact built-in switches are available.
- Capable of a holding force of 1,000 N min.
- Can be used for either standard loads or microloads.
- Lineup includes models with a conduit size of M20.
- Patent and industrial design approval pending.

Model Number Structure

Model Number Legend

Switch

D4GL-□□□□-□□
1 2 3 4 5 6

1. **Conduit Size**
   - 1: Pg13.5
   - 2: G1/2
   - 4: M20
2. **Built-in Switch (with Door Open/Closed Detection Switch and Lock Monitor Switch Contacts)**
   - A: 1NC/1NO slow-action contacts plus 1NC/1NO slow-action contacts
   - B: 1NC/1NO slow-action contacts plus 2NC slow-action contacts
   - C: 2NC slow-action contacts plus 1NC/1NO slow-action contacts
   - D: 2NC slow-action contacts plus 2NC slow-action contacts
   - E: 2NC/1NO slow-action contacts plus 1NC/1NO slow-action contacts
   - F: 2NC/1NO slow-action contacts plus 2NC slow-action contacts
   - G: 3NC slow-action contacts plus 1NC/1NO slow-action contacts
   - H: 3NC slow-action contacts plus 2NC slow-action contacts
3. **Head Mounting Direction and Material**
   - F: Four mounting directions possible (Front-side mounting at time of delivery)/plastic
4. **Door Lock and Release**
   - A: Mechanical lock/24-VDC solenoid release
   - G: 24-VDC solenoid lock/mechanical release
5. **Indicator**
   - B: 24 VDC (orange/green LED indicator)
6. **Release Key Type**
   - Blank: Standard release key
   - 4: Special release key

Operation Key

D4DS-K□
1

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

Ordering Information

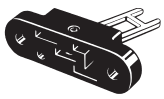
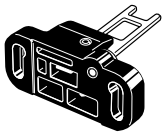
List of Models

Switches (Operation Keys are sold separately.)

: Models with approved direct opening contacts. **Prefered stock item***

Head material	Release key type	Solenoid voltage/ indicator	Lock and release types	Contact configuration (door open/closed detection switch and lock monitor switch contacts) (slow-action) Approved direct opening NC contact	Conduit size	Model
Plastic	Standard	Solenoid: 24 VDC Orange/green LED: 24 VDC	Mechanical lock Solenoid release	1NC/1NO+1NC/1NO	Pg13.5	**D4GL-1AFA-A***
					G1/2	D4GL-2AFA-A
					M20	**D4GL-4AFA-A***
				1NC/1NO+2NC	Pg13.5	D4GL-1BFA-A
					G1/2	D4GL-2BFA-A
					M20	D4GL-4BFA-A
				2NC+1NC/1NO	Pg13.5	**D4GL-1CFA-A***
					G1/2	D4GL-2CFA-A
					M20	**D4GL-4CFA-A***
				2NC+2NC	Pg13.5	D4GL-1DFA-A
					G1/2	D4GL-2DFA-A
					M20	D4GL-4DFA-A
				2NC/1NO+1NC/1NO	Pg13.5	D4GL-1EFA-A
					G1/2	D4GL-2EFA-A
					M20	**D4GL-4EFA-A***
				2NC/1NO+2NC	Pg13.5	D4GL-1FFA-A
					G1/2	D4GL-2FFA-A
					M20	D4GL-4FFA-A
				3NC+1NC/1NO	Pg13.5	D4GL-1GFA-A
					G1/2	D4GL-2GFA-A
					M20	D4GL-4GFA-A
				3NC+2NC	Pg13.5	D4GL-1HFA-A
					G1/2	D4GL-2HFA-A
					M20	D4GL-4HFA-A
			Solenoid lock Mechanical release	1NC/1NO+1NC/1NO	Pg13.5	**D4GL-1AFG-A***
					G1/2	D4GL-2AFG-A
					M20	**D4GL-4AFG-A***
				1NC/1NO+2NC	Pg13.5	D4GL-1BFG-A
					G1/2	D4GL-2BFG-A
					M20	D4GL-4BFG-A
				2NC+1NC/1NO	Pg13.5	**D4GL-1CFG-A***
					G1/2	D4GL-2CFG-A
					M20	**D4GL-4CFG-A***
				2NC+2NC	Pg13.5	D4GL-1DFG-A
					G1/2	D4GL-2DFG-A
					M20	D4GL-4DFG-A
				2NC/1NO+1NC/1NO	Pg13.5	D4GL-1EFG-A
					G1/2	D4GL-2EFG-A
					M20	**D4GL-4EFG-A***
				2NC/1NO+2NC	Pg13.5	D4GL-1FFG-A
					G1/2	D4GL-2FFG-A
					M20	D4GL-4FFG-A
				3NC+1NC/1NO	Pg13.5	D4GL-1GFG-A
					G1/2	D4GL-2GFG-A
					M20	D4GL-4GFG-A
				3NC+2NC	Pg13.5	D4GL-1HFG-A
					G1/2	D4GL-2HFG-A
					M20	D4GL-4HFG-A

Operation Keys (Order Separately)

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

Specifications

Standards and EC Directives

Applicable EC Directives and Standards

- Machinery Directive
- Low Voltage Directive
- EN1088
- EN60204-1
- GS-ET-19

Approved Standards

Agency	Standard	File No.
TÜV Product Service	EN60947-5-1 (approved direct opening)	(See note 1.)
UL (See note 2.)	UL508, CSA C22.2 No.14	E76675

Note: 1. Consult your OMRON representative for details.
2. Approval for CSA C22.2 No. 14 is authorized by the UL mark.

Approved Standard Ratings

TÜV (EN60947-5-1)

Item / Utilization category	AC-15	DC-13
Rated operating current (I_e)	0.75 A	0.27 A
Rated operating voltage (U_e)	240 V	250 V

Note: Use a 10-A fuse type gI or gG that conforms to IEC269 as a short-circuit protection device.

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

C300

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
120 VAC	2.5 A	15 A	1.5 A	1,800 VA	180 VA
240 VAC		7.5 A	0.75 A		

Q300

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

Solenoid Coil Characteristics

Item	24 VDC
Rated operating voltage (100% ED)	24 VDC ±10%
Current consumption	Approx. 200 mA
Insulation	Class F (130°C max.)

Indicator Characteristics

Item	LED
Rated voltage	24 VDC
Current leakage	Approx. 3 mA
Color (LED)	Orange/Green

Characteristics

Degree of protection (See note 2.)		IP67 (EN60947-5-1) (This applies for the Switch only. The degree of protection for the key hole is IP00.)	
Durability (See note 3.)	**Mechanical**	1,000,000 operations min.	
	Electrical	500,000 operations min. for a resistive load of 4 mA at 24 VDC; 150,000 operations min. for a resistive load of 1 A at 125 VAC in 2 circuits and 4 mA at 24 VDC in 2 circuits (See note 4.)	
Operating speed		0.05 to 0.5 m/s	
Operating frequency		30 operations/minute max.	
Rated frequency		50/60 Hz	
Contact gap		2 x 2 mm min.	
Direct opening force (See note 5.)		60 N min. (EN60947-5-1)	
Direct opening travel (See note 5.)		10 mm min. (EN60947-5-1)	
Holding force (See note 6.)		1,000 N min.	
Insulation resistance		100 MΩ min. (at 500 VDC)	
Minimum applicable load (See note 7.)		Resistive load of 4 mA at 24 VDC (N-level reference value)	
Rated insulation voltage (U_i)		300 V (EN60947-5-1)	
Conventional enclosed thermal current (I_{the})		2.5 A (EN60947-5-1)	
Impulse withstand voltage (EN60947-5-1)		Between terminals of the same polarity	2.5 kV
		Between terminals of different polarities	4 kV
		Between the solenoid and uncharged metallic parts and between the solenoid and ground	---
		24-VDC solenoid	0.8 kV
		Between other terminals and uncharged metallic parts and between other terminals and ground	4 kV
Conditional short-circuit current		100 A (EN60947-5-1)	
Pollution degree (operating environment)		3 (EN60947-5-1)	
Protection against electric shock		Class II (double insulation)	
Closed-circuit counterelectromotive force		1,500 V max. (EN60947-5-1)	
Contact resistance		25 mΩ max. (initial value)	
Vibration resistance	**Malfunction**	10 to 55 Hz, 0.75-mm single amplitude	
Shock resistance	**Destruction**	1,000 m/s^2 min.	
	Malfunction	300 m/s^2 min.	
Ambient temperature		Operating: −10°C to 55°C with no icing	
Ambient humidity		Operating: 95% max.	
Weight		Approx. 400 g (D4GL-1AFA-A)	

Note: 1. The above values are initial values.

2. 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 D4GL in places where foreign material may penetrate through the key hole on the head, otherwise Switch damage or malfunctioning may occur.

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

4. If the ambient temperature is greater than 35°C, do not pass the 1-A, 125-VAC load through more than 2 circuits.

5. These figures are minimum requirements for safe operation.

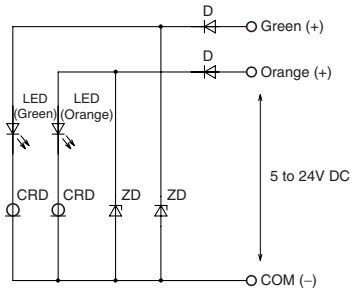
6. This figure is based on the GS-ET-19 evaluation method.

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

Connections

Indicator

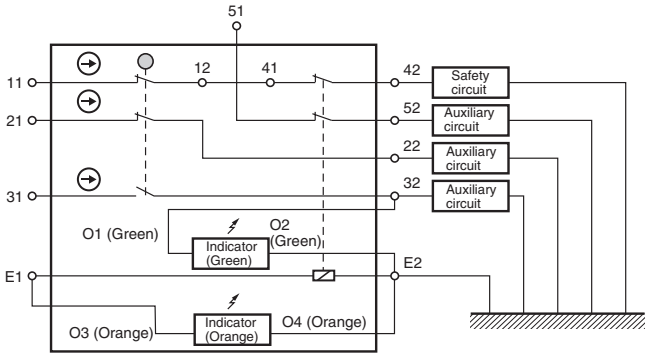
Internal Circuit Diagram



Circuit Connection Example

- Terminals 12 and 41 are connected internally and so connect terminals 11 and 42 for safety-circuit input. (BIA GS-ET-19)
- Connect terminals 21 and 22 and terminals 51 and 52 in series when using as safety-circuit input (redundancy circuit for terminals 11 and 12 and terminals 41 and 42 above). Connect the terminals individually when using as auxiliary-circuit input (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 input.

Connection Example for D4GL-1HFA-A



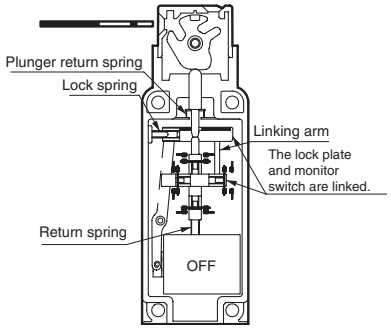
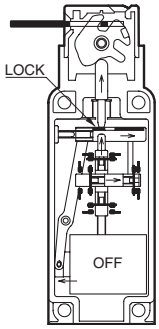
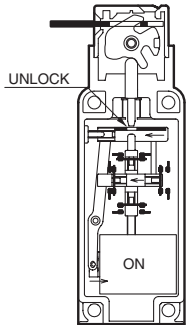
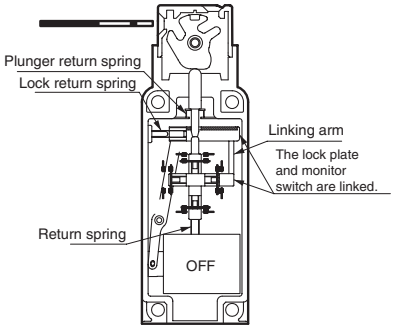
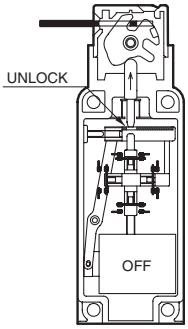
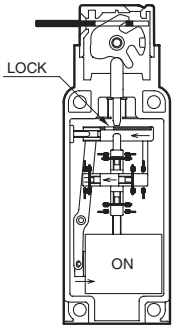
- Direct opening contacts used as safety-circuit input are indicated with the ⊖ mark. Terminals 11 and 12 and terminals 21 and 22 are direct opening contacts.
- Connect the indicators in parallel to the auxiliary circuits or terminals E1 and E2.
- Although the 3 lines are connected at the time of delivery, rewire them as necessary for the application.
- The following table shows the connection configuration required to make the green indicator light when the door is closed and the orange indicator light when the solenoid turns ON.

Indicator	Terminal number	Lead wire color	Connected terminal number
Green indicator	O1	Green	32
Orange indicator	O2	Orange	E1
Common	O3	Black	E2

- If an indicator is connected in parallel to a direct opening contact, when the indicator breaks, a short-circuit current will be generated, possibly resulting in an installation malfunction.
- Do not switch standard loads for more than 2 circuits at the same time. Otherwise, the level of insulation may decrease.
- The solenoid has polarity. Be sure to connect terminals with the correct polarity.

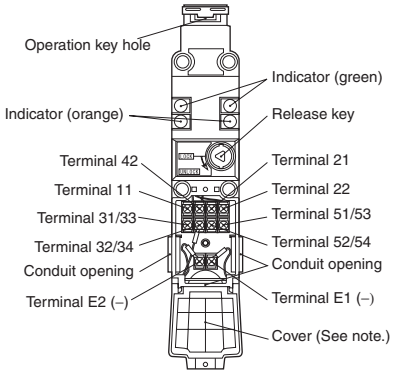
Operation Method

Operation Principles

Mechanical lock models		 When the door is closed, it is locked by the lock spring. The door will stay locked even if there is a power interruption.	 The solenoid is released only when the lock is turned ON.
Solenoid lock models		 If the solenoid is OFF, the door will not be locked when it is closed. This means that the door can be opened and closed easily when replacing workpieces or parts.	 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).

Nomenclature

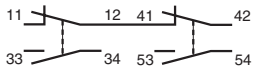
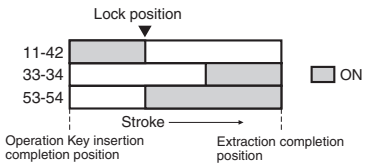
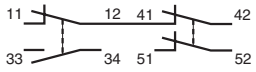
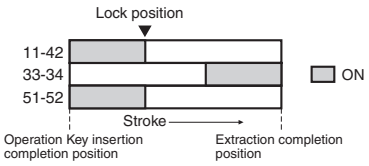
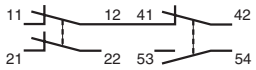
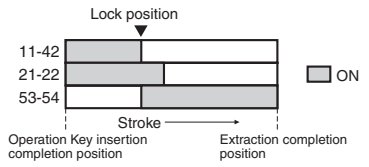
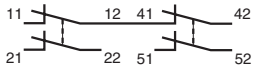
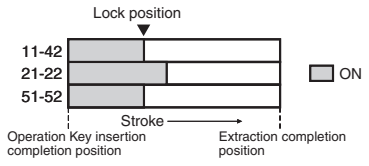
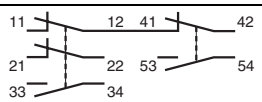
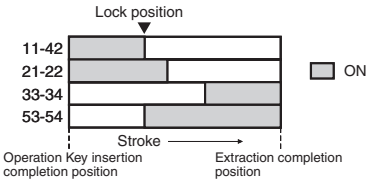
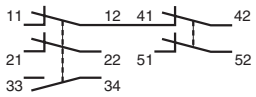
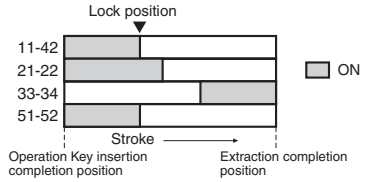
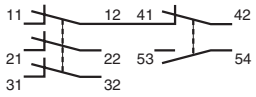
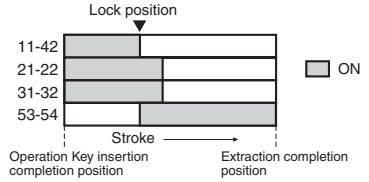
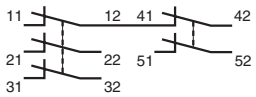
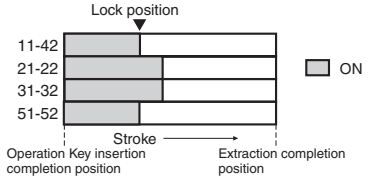
Structure



Note: Terminal numbers vary with the model. Confirm terminal numbers by referring to the cover on the back of the Switch.

Contact Form

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

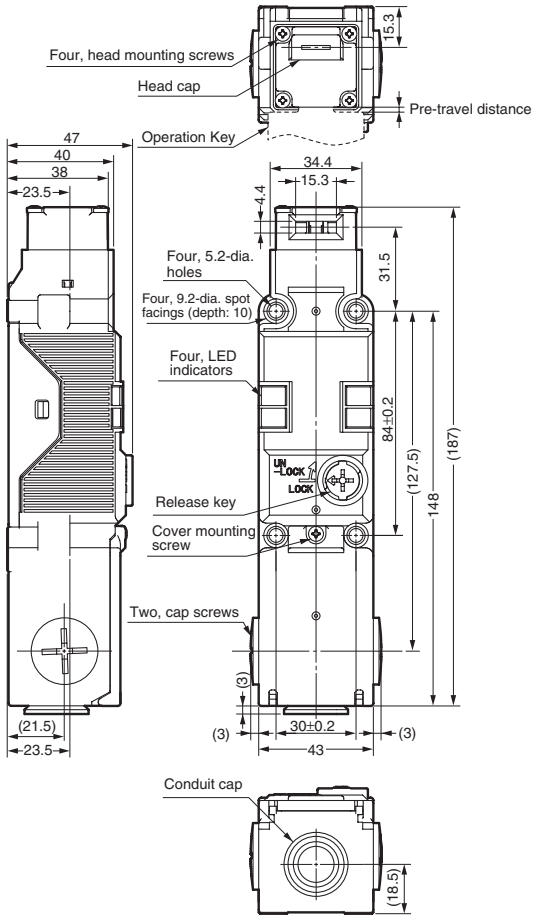
Model	Contact	Contact form (door open/closed detection switch and lock monitor switch contacts)	Operating pattern	Remarks
D4GL-□AF□-□	1NC/1NO + 1NC/1NO			Only NC contact 11-12 has an approved direct opening mechanism. ⊖ The terminals 11-42, 33-34, and 53-54 can be used as unlike poles.
D4GL-□BF□-□	1NC/1NO + 2NC			Only NC contact 11-12, has an approved direct opening mechanism. ⊖ The terminals 11-42, 33-34, and 51-52 can be used as unlike poles.
D4GL-□CF□-□	2NC + 1NC/1NO			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. ⊖ The terminals 11-42, 21-22, and 53-54 can be used as unlike poles.
D4GL-□DF□-□	2NC + 2NC			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. ⊖ The terminals 11-42, 21-22, and 51-52 can be used as unlike poles.
D4GL-□EF□-□	2NC/1NO + 1NC/1NO			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. ⊖ The terminals 11-42, 21-22, 33-34, and 53-54 can be used as unlike poles.
D4GL-□FF□-□	2NC/1NO + 2NC			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. ⊖ The terminals 11-42, 21-22, 33-34, and 51-52 can be used as unlike poles.
D4GL-□GF□-□	3NC + 1NC/1NO			Only NC contacts 11-12, 21-22, and 31-32 have an approved direct opening mechanism. ⊖ The terminals 11-42, 21-22, 31-32, and 53-54 can be used as unlike poles.
D4GL-□HF□-□	3NC + 2NC			Only NC contacts 11-12, 21-22, and 31-32 have an approved direct opening mechanism. ⊖ The terminals 11-42, 21-22, 31-32, and 51-52 can be used as unlike poles.

Dimensions

Note: All units are in millimeters unless otherwise indicated.

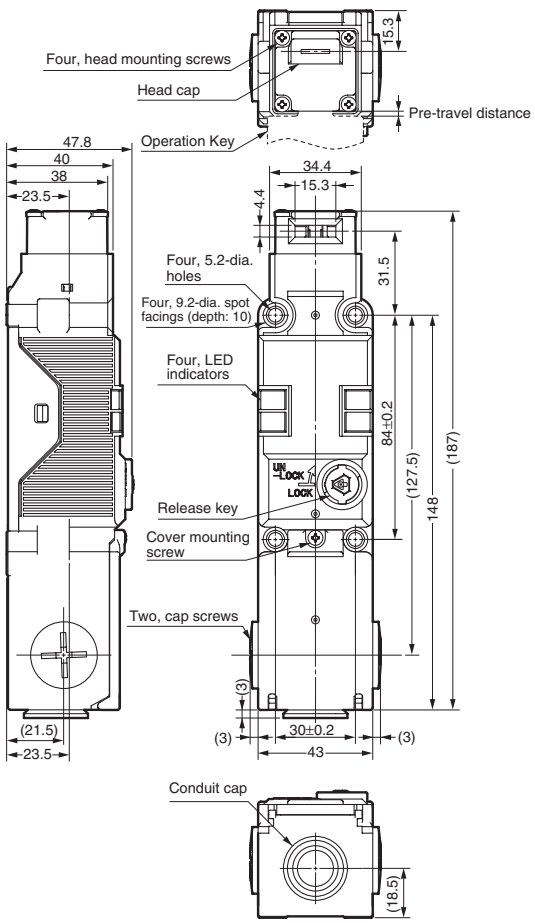
Switches

D4GL-□□□□-A



Operating characteristics	D4GL-□□□□-A
Key insertion force Key extraction force	15 N max. 40 N max.
Pre-travel distance	10 mm max.
Movement before being locked	4 mm min.

D4GL-□□□□-A4

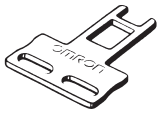


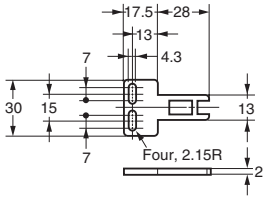
Operating characteristics	D4GL-□□□□-A4
Key insertion force Key extraction force	15 N max. 40 N max.
Pre-travel distance	10 mm max.
Movement before being locked	4 mm min.

Operation Keys

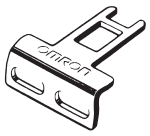
Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

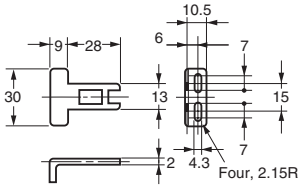
D4DS-K1



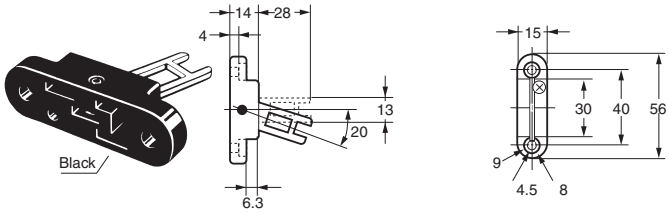


D4DS-K2

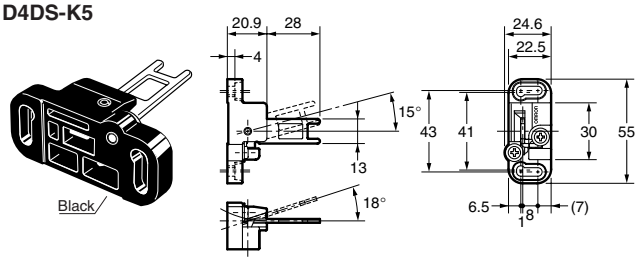




D4DS-K3

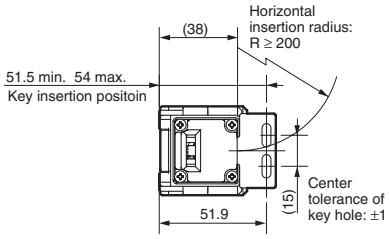


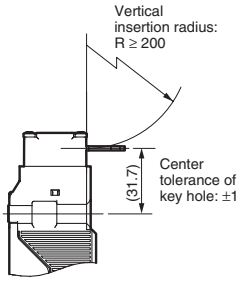
D4DS-K5



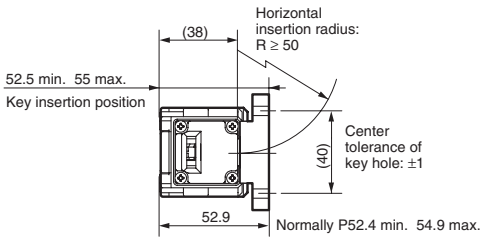
With Operation Key Inserted

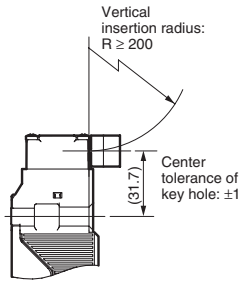
D4GL + D4DS-K1



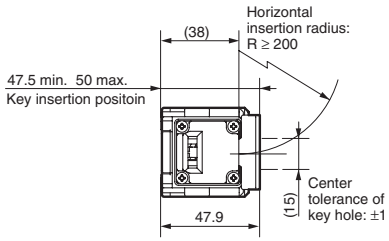


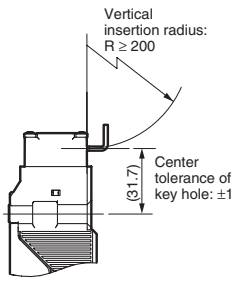
D4GL + D4DS-K3



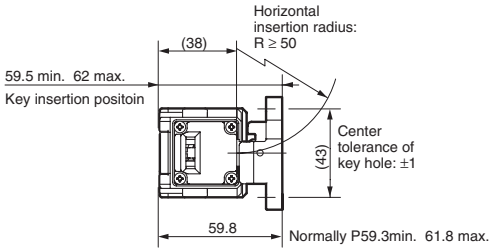


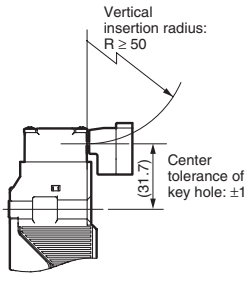
D4GL + D4DS-K2





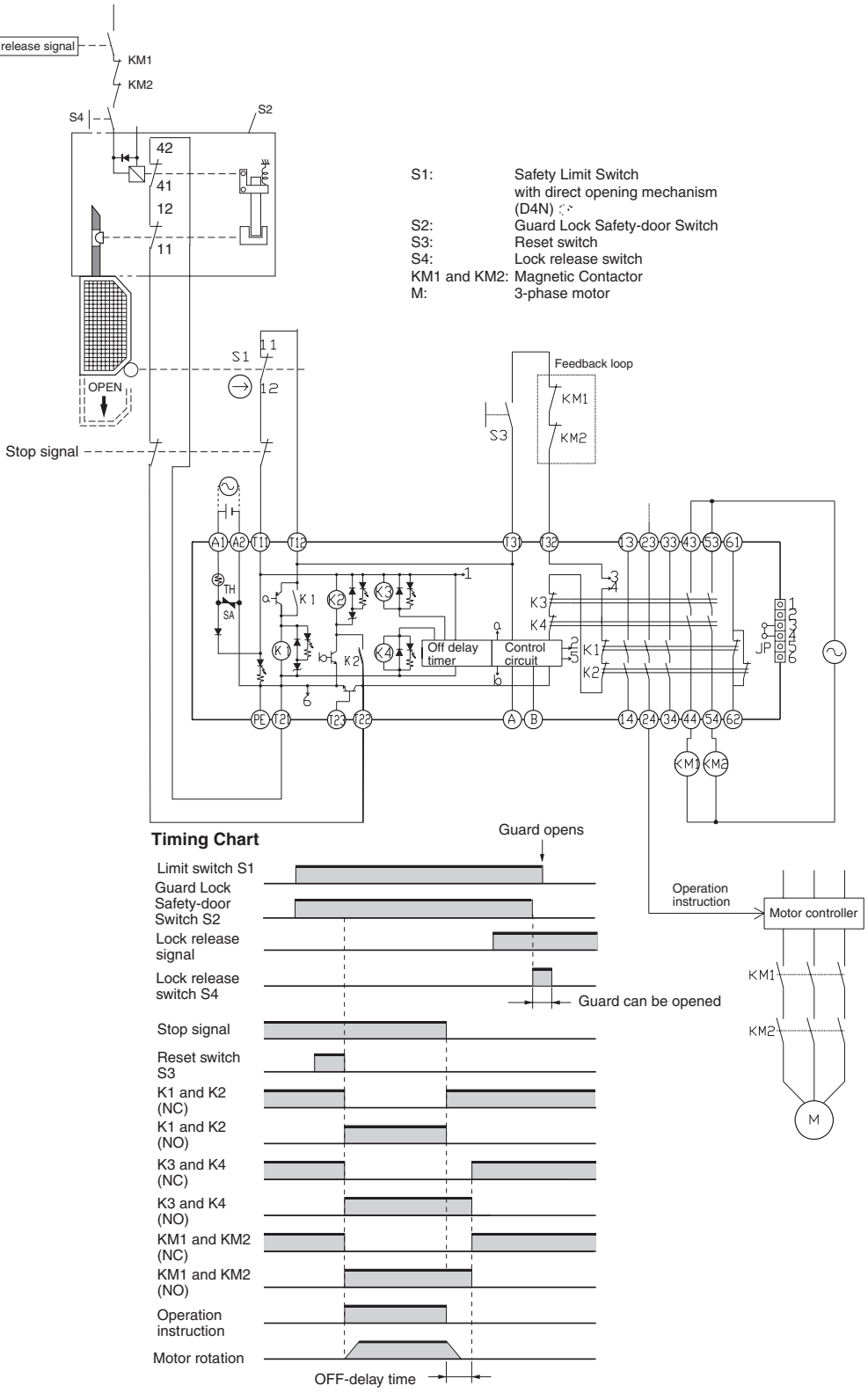
D4GL + D4DS-K5



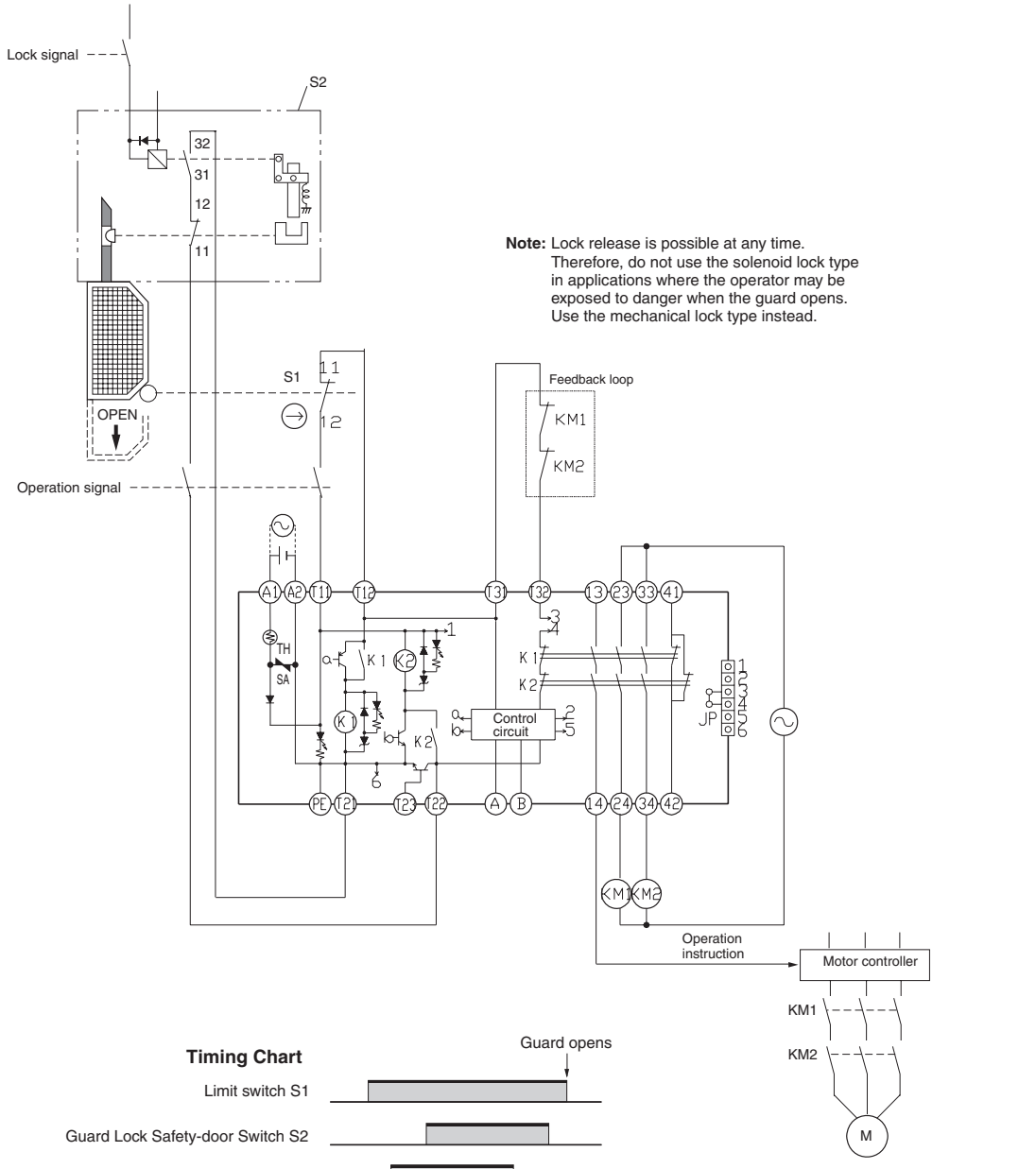


Application Examples

G9SA-321-T□ (24 VAC/VDC) + D4GL-□□□A-□ (Mechanical Lock Type) + D4D-□520N Circuit Diagram

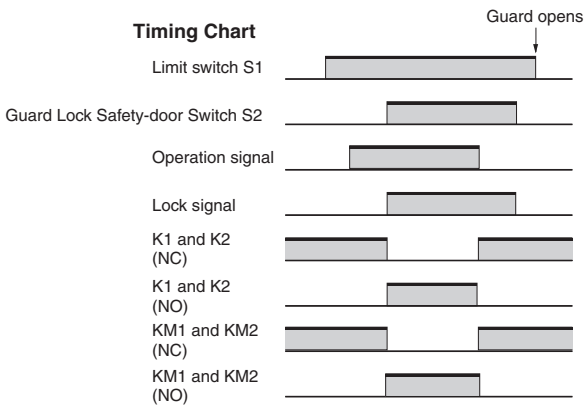


G9SA-301 (24 VAC/VDC) + D4GL-□□□G-□ (Solenoid Lock Type) + D4D-□520N Circuit Diagram



Note: Lock release is possible at any time. Therefore, do not use the solenoid lock type in applications where the operator may be exposed to danger when the guard opens. Use the mechanical lock type instead.

Timing Chart



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

Precautions

⚠ Caution

Do not insert the Operation Key with the door open. The machine may operate and damage may result.

⚠ Caution

Do not use metal connectors or conduits with this switch. Damage to the broken conduit hole may cause electric shock.

⚠ Caution

Change the head direction after inserting the Operation Key or changing the release key to the UNLOCK position. Otherwise, the switch may malfunction and damage may result.

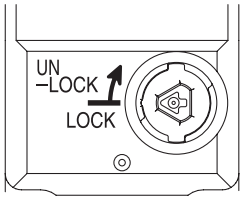
Holding Force

- Do not apply a force exceeding the specified holding force. Doing so may break the Switch and the machine may continue to operate.
- Either install another locking component (e.g., a stop) in addition to the Switch, or use a warning sticker or an indicator showing the lock status so that a force exceeding the specified holding force is not applied.

Safety Precautions

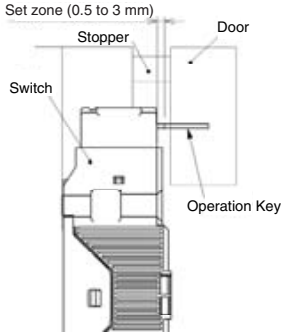
- Turn OFF the power before disassembling the Switch or touching any internal parts. Not doing so may result in electric shock.
- Mount the Operation Key in a location where it will not come in contact with users when the door is opened or closed. Otherwise, injury may result.
- Do not impose excessive force on the Operation Key when it is inserted into the Switch or drop the Switch with the Operation Key inserted. Otherwise, the Operation Key may be deformed or the Switch may be broken.
- Observe the specified insertion radius for the Operation Key and insert it in a direction perpendicular to the key hole.
- Do not use the Switch in starting circuits. (Use for safety confirmation signals.)
- When using the Switch in emergency-stop circuits or other safety circuits that have a direct impact on human lives, operate the NC contacts that have a direct opening mechanism in direct opening mode. For safety purposes, prevent easy removal by, for example, mounting the Switch and Operation Key with one-way screws or attaching a protective cover and warning label.
- In order to prevent short-circuit damage to the Switch, connect a fuse to the Switch in series. Use a fuse with a breaking current of 1.5 to 2 times the rated current. To conform to EN ratings, use a IEC269-compliant 10-A fuse type gI or gG.
- Turn the power OFF when wiring. After wiring is completed, be sure to mount the cover before use.
- In order to prevent burning due to overvoltage, insert a protective fuse in the solenoid circuits.
- Do not use the Switch where explosive gas, flammable gas, or any other dangerous gas may be present.
- Ensure that the load current does not exceed the rated current.
- Be sure to wire the terminals correctly.
- Be sure to evaluate the Switch under actual operating conditions after installation.
- Do not drop the package or the product. Do not disassemble internal parts.

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 using an appropriate tool, the lock will be released and the safety door can be opened (mechanical lock models only).
- After setting the release key to UNLOCK in order to, for example, change the head direction or perform maintenance, be sure to return it to LOCK setting before resuming operation.
- When the Switch is used for the door of a machine room to ensure the safety of people performing adjustment work inside, if the 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.
- Do not use the release key to start or stop machines.
- The auxiliary lock must only be released by authorized personnel.
- Do not impose excessive force on the release key screws. The release key may be damaged and may not operated properly.
- To prevent easy release of the auxiliary lock by unauthorized personnel, set it to LOCK and seal it with seal wax.

Mounting



- Do not use the Switch as a stopper. To prevent the door from coming into contact with the flange of the Operation Key, be sure to mount the Switch with a stopper as shown above.
- 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, if an attempt is made to open the door beyond the lock position, the force imposed will be much larger than for locations far from the hinged side, and the lock may be damaged.

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.

Correct Use

Operating Environment

- This Switch is for indoor use only. Do not use it outdoors. Otherwise, it may malfunction.
- Do not use the Switch in the following locations:
  - •Locations subject to severe temperature changes
  - •Locations subject to high humidity levels or condensation
  - •Locations subject to severe vibration
  - •Locations where the Switch may come in contact with metal dust, oil, or chemicals
  - •Locations subject to thinner, detergent, or other solvents
- Although the switch itself is protected from dust or water penetration, ensure that foreign material does not penetrate through the key hole on the head, otherwise Switch damage or malfunctioning may occur.
- 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 interior. (The IP67 degree of protection specification for the Switch pertains to the amount of water penetration after the Switch is submerged in water for a certain period of time.)

Life Expectancy

The life expectancy of the Switch will vary with the switching conditions. Before applying the Switch, test it under actual operating conditions and be sure to use it at a switching frequency that will not lower its performance.

Mounting

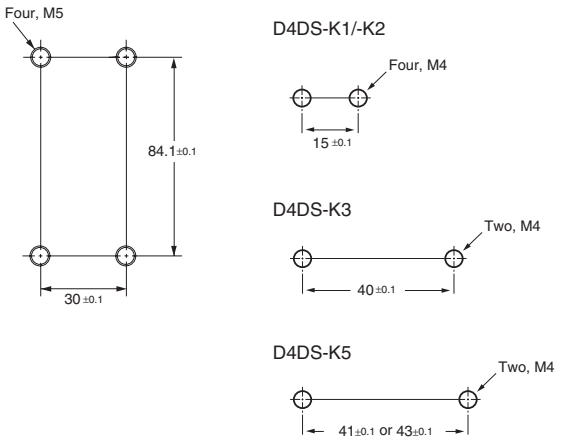
Tightening Torque

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

Terminal screw	0.4 to 0.5 N·m
Cover mounting screw	0.5 to 0.7 N·m
Head mounting screw	0.5 to 0.6 N·m
Operation Key mounting screw	2.4 to 2.8 N·m
Switch mounting screw	1.3 to 1.5 N·m
Connector	1.8 to 2.1 N·m
Cap screw	1.3 to 1.7 N·m

Switch and Operation Key Mounting

- Mount the Switch and Operation Key securely to the applicable tightening torque with M5 screws.

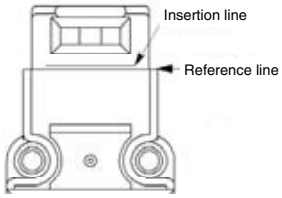


- Use the designated OMRON Operation Key with the Switch. Using another Operation Key may result in Switch damage.
- Ensure that the alignment offset between the Operation Key and the key hole does not exceed ±1 mm.

Head Direction

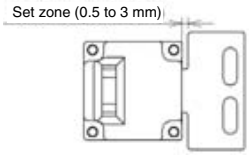
By removing the four screws of the head, the mounting direction of the head can be changed. The head can be mounted in four directions.

Ensure that no foreign matter penetrates the interior of the Switch. Also, insert the head until the insertion line engraved on the head is hidden by the reference line on the Switch, as shown in the following diagram.



Securing the Door

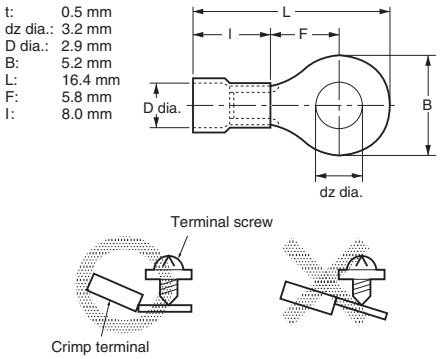
When the door is closed (with the Operation Key inserted), it may be pulled beyond the set zone because of, for example, the door's weight, or the door cushion rubber. Also, if a load is applied to the Operation Key, the door may fail to unlock properly. Use hooks to ensure that the door stays within the set zone.



Wiring

Wiring Precautions

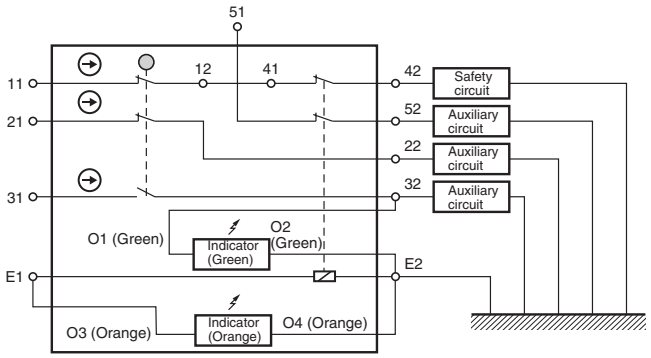
- Applicable lead wire size: AWG22 to AWG24.
- When connecting lead wires directly to terminals, perform wiring securely so that there are no loose wire strands.
- Do not push crimp terminals into gaps in the case interior. Doing so may cause damage or deformation of the case.
- Use lead wires of an appropriate length. Not doing so may cause the cover to rise.
- Use crimp terminals not more than 0.5 mm in thickness. Otherwise, they will interfere with other components inside the case.



Circuit Connection Example

- Terminals 12 and 41 are connected internally and so connect terminals 11 and 42 for safety-circuit input. (BIA GS-ET-19)
- Connect terminals 21 and 22 and terminals 51 and 52 in series when using as safety-circuit input (redundancy circuit for terminals 11 and 12 and terminals 41 and 42 above). Connect the terminals individually when using as auxiliary-circuit input (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 input.

Connection Example for D4GL-1HFA-A



- Direct opening contacts used as safety-circuit input are indicated with the ⊖ mark. Terminals 11 and 12, terminals 21 and 22, and terminals 31 and 32 are direct opening contacts.
- Connect the indicators in parallel to the auxiliary circuits or terminals E1 and E2.
- Although the 3 lines are connected at the time of delivery, rewire them as necessary for the application.
- The following table shows the connection configuration required to make the green indicator light when the door is closed and the orange indicator light when the solenoid turns ON.

Indicator	Terminal number	Lead wire color	Connected terminal number
Green indicator	O1	Green	32
Orange indicator	O2	Orange	E1
Common	O3	Black	E2

- If an indicator is connected in parallel to a direct opening contact, when the indicator breaks, a short-circuit current will be generated, possibly resulting in an installation malfunction.
- Do not switch standard loads for more than 2 circuits at the same time. Otherwise, the level of insulation may decrease.
- The solenoid has polarity. Be sure to connect terminals with the correct polarity.

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 an excessive tightening torque is applied.
- In order to ensure IP67 degree of protection, wrap sealing tape around the conduit end of the connector.
- Be sure that the outer diameter of the cable connected to the connector is correct.
- Attach and tighten a conduit cap to the unused conduit opening when wiring. The conduit cap is provided with the Switch.

Recommended Connectors

Use a connector with a screw section not exceeding 10 mm, otherwise the screws will protrude into the case interior. The connectors given in the following table have connectors with screw sections not exceeding 10 mm.

Size	Manufacturer	Model	Applicable cable diameter
$G^1/_2$	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	S-13.5 5301-5030	5.0 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 with the applicable torque. Seal packing is sold separately.

Maintenance and Repairs

The user must not perform repairs or maintenance. Contact the machine manufacturer if repairs or maintenance are required.

Storage

Do not store the Switch in locations where harmful gases (e.g., H_2S, SO_2, NH_3, HNO_3, or Cl_2) or dust are present, or in locations subject to high humidity levels.

Miscellaneous

- In conditions requiring greater rigidity, sealing performance, and oil resistance, use OMRON's D4BL.
- Perform regular inspections.

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

Cat. No. C125-E2-01-X In the interest of product improvement, specifications are subject to change without notice.

Guard Lock Safety-door Switch

D4BL

Protective Doors Are Locked Until Machines Completely Stop Operating

- A mechanical lock is applied automatically when the Operation Key is inserted. A high level of safety is achieved using a mechanism where the lock is only released when voltage is applied to the solenoid.
- Conforms to EN (TÜV) standards corresponding to the CE marking.
- Approved by UL, CSA, BIA, and SUVA standards.
- The switch contact is opened by a direct opening mechanism (NC contacts only) when the protective cover is opened. Direct opening mechanism that is EN-approved is indicated by ⊖ on the switch.
- Auxiliary release key ensures easy maintenance and unlocks the door in the case of a power failure.
- Tough aluminum die-cast body incorporating a switch box with degree of protection satisfying IP67, UL, and CSA TYPE6P, 13.
- Equipped with a horizontal and vertical conduit opening.
- Models incorporating easy-to-see indicators for monitoring and those using an adjustable Operation Key for a double door are available.
- The mounting direction of the head can be changed to allow the Operation Key to be inserted from four directions.
- Metric conduit types available

Model Number Structure

Model Number Legend

Switch

D4BL -□ □ □ □ -□
1 2 3 4 5

1. Conduit Size (2-conduit)
1: PG13.5
2: G1/2
3: 1/2-14NPT
4: M20

2. Built-in Switch (with Safety Switch and Lock Monitor Switch Contacts)
C: 1NC/1NO (slow-action) + 1NC (slow-action)
D: 2NC (slow-action) + 1NC (slow-action)

3. Head Mounting Direction
R: Four mounting directions possible (right-side mounting at shipping)

4. Door Lock and Release (Auxiliary Release Key is Incorporated by All Models)
A: Mechanical lock/24-VDC solenoid release
B: Mechanical lock/110-VAC solenoid release
G: 24-VDC Solenoid lock/Mechanical release

5. Indicator
Blank: Without indicator
A: 10 to 115 VAC or VDC driving (with orange and green LED indicator unit)

Operation Key (Order Separately)

D4BL - K□
1

1. Operation Key Type
1: Horizontal mounting
2: Vertical mounting
3: Adjustable mounting (Horizontal)

Ordering Information

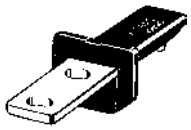
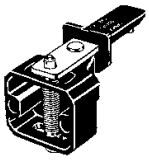
List of Models

Switches

Lock method	Conduit size	Voltage for solenoid	Without indicator 1NC/1NO+ 1NC (Slow-action)	With LED indicator 1NC/1NO+ 1NC (Slow-action)	Without indicator 2NC+ 1NC (Slow-action)	With LED indicator 2NC+ 1NC (Slow-action)
Mechanical lock	PG13.5	24 VDC	D4BL-1CRA	D4BL-1CRA-A	D4BL-1DRA	D4BL-1DRA-A
		110 VAC	D4BL-1CRB	D4BL-1CRB-A	D4BL-1DRB	D4BL-1DRB-A
	G1/2	24 VDC	D4BL-2CRA	D4BL-2CRA-A	D4BL-2DRA	D4BL-2DRA-A
		110 VAC	D4BL-2CRB	D4BL-2CRB-A	D4BL-2DRB	D4BL-2DRB-A
	M20	24 VDC	D4BL-4CRA	D4BL-4CRA-A	D4BL-4DRA	D4BL-4DRA-A
		110 VAC	D4BL-4CRB	D4BL-4CRB-A		
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
	M20	24 VDC		D4BL-4CRG-A		

Prefered model

Operation Keys (Order Separately)

Mounting type	Model
Horizontal mounting 	D4BL-K1
Vertical mounting 	D4BL-K2
Adjustable mounting (Horizontal) 	D4BL-K3

Specifications

Approved Standards

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

Standards and EC Directives

Conforms to the following EC Directives:
Machinery Directive
Low Voltage Directive
EN1088

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

Use a 10-A fuse type gI or gG that conforms to IEC269 as a short-circuit protection device.

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

A300

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

Note: The UL/CSA approved rating for products with indicators (-A) is 6 A/115 VAC.

Characteristics

Degree of protection	IP67 (See note 2.)
Durability (See note 3.)	Mechanical:1,000,000 operations min. Electrical:500,000 operations min. (10-A resistive load at 250 VAC)
Operating speed	0.05 to 0.5 m/s
Operating frequency	30 operations/min max.
Rated frequency	50/60 Hz
Operating characteristics	Direct opening force:19.61 N min. (EN60947-5-1) Direct opening travel:20 mm min. (EN60947-5-1) All stroke:23 mm min.
Holding force	700 N min. (GS-ET-19)
Insulation resistance	100 MΩ min. (at 500 VDC)
Rated insulation voltage (U_i)	300 V (EN60947-5-1)
Conventional enclosed thermal current (I_{the})	10 A (EN60947-5-1)
Dielectric strength (U_{imp})	Impulse dielectric strength (U_{imp}) 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 (EN60947-5-1)
Conditional short-circuit current	100 V (EN60947-5-1)
Pollution degree (operating environment)	3 (EN60947-5-1)
Protection against electric shock	Class I (with ground terminal)
Switching overvoltage	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
Shock resistance	Destruction:1,000 m/s^2 min. (IEC68-2-27) Malfunction:300 m/s^2 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 above values are initial values.

2. Although the switch box is protected from dust, oil or water penetration, do not use the D4BL in places where dust, oil, water, or chemicals may penetrate through the key hole on the head, otherwise Switch damage or malfunctioning may occur.

3. The durability is for an ambient temperature of 5°C to 35°C and an ambient humidity of 40% to 70%.

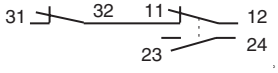
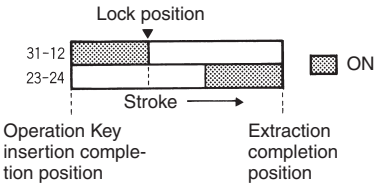
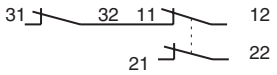
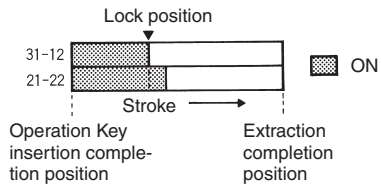
Solenoid Coil Characteristics

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 F (130°C or less)		

Indicator Characteristics

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

Contact Form (Diagrams Show State with Key Inserted and Lock Engaged)

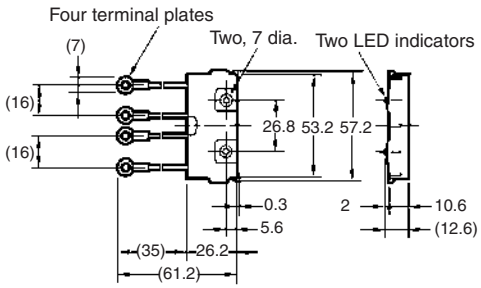
Model	Contact		Diagram	Remarks
D4BL-□C□□-□	1NC/ 1NO+1NC			Only NC contacts 11-12 and 31-32 have an approved direct opening mechanism. ⊖ The terminals 11-12 and 23-24 can be used as unlike poles.
D4BL-□D□□-□	2NC+1NC			NC contacts 11-12, 21-22, and 31-32 have an approved direct opening mechanism. ⊖ The terminals 11-12 and 21-22 can be used as unlike poles.

Note: The EN-approved direct opening mechanism is indicated by ⊖ on the switch.

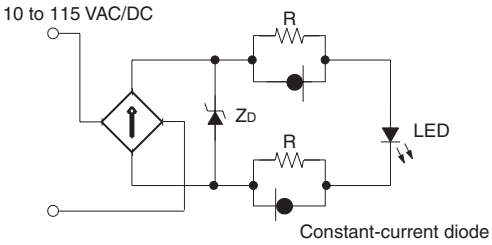
Connections

Indicator Unit

Dimensions



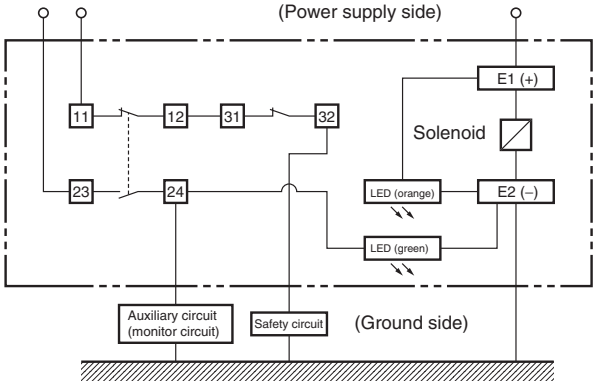
Internal Circuit



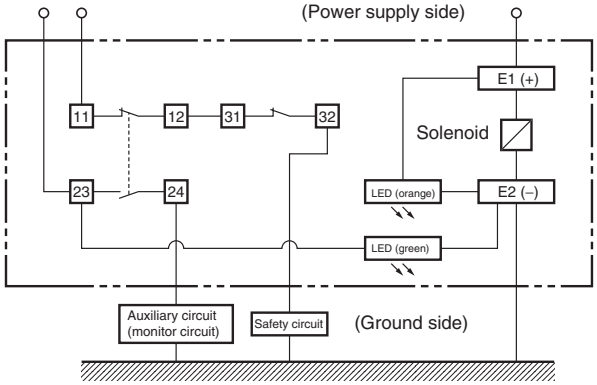
Circuit Connection Example

- Do not connect the indicators to the safety contact terminals (11-12-31-32) or the safety circuit side.
- When using indicators, connect them to the auxiliary circuit side (monitor circuit) or the solenoid input terminals as shown below.
- The indicators can be used to confirm the open/closed status of the door, the ON/OFF status of the power supply, and the ON/OFF status of the solenoid.
- Do not connect the indicators in parallel with the direct opening contact. If the indicators are broken, a short-circuit current may flow, causing equipment to malfunction.
- The 24-VDC solenoid terminals have polarity. Confirm the polarity before wiring.
- Be sure to use a special pushbutton switch to stop and start machinery and release locks.

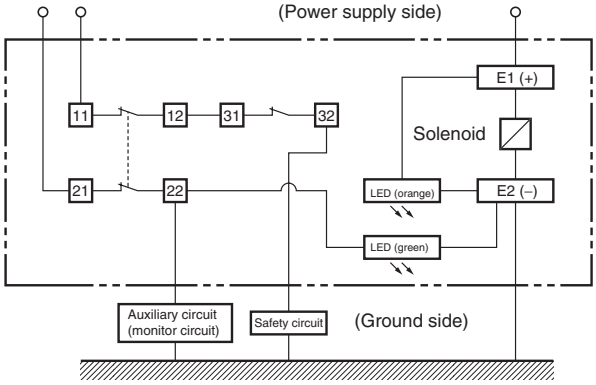
1. Orange: Lights when the solenoid turns ON.
Green: Lights when the door opens.



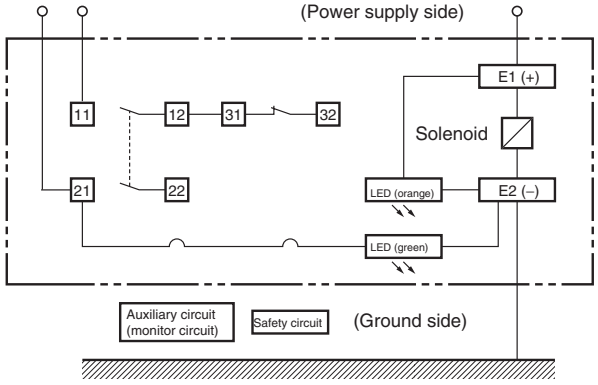
2. Orange: Lights when the solenoid turns ON.
Green: Lights when power turns ON.



3. Orange: Lights when the solenoid turns ON.
Green: Lights when door closes.

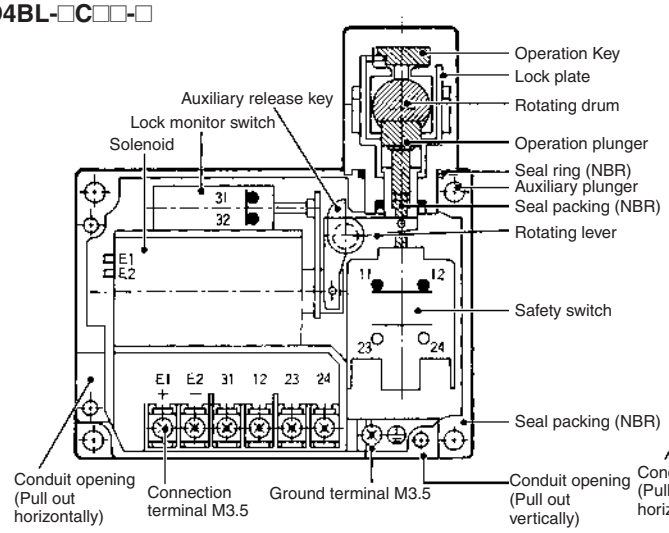


4. Orange: Lights when the solenoid turns ON.
Green: Lights when power turns ON.

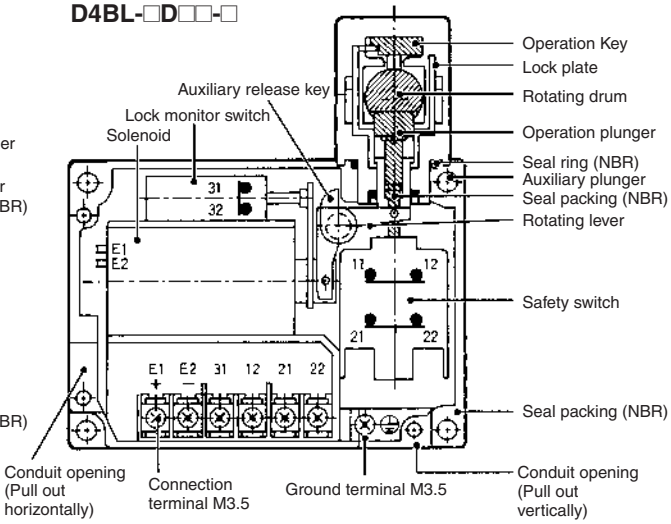


Nomenclature

D4BL-□C□□-□



D4BL-□D□□-□

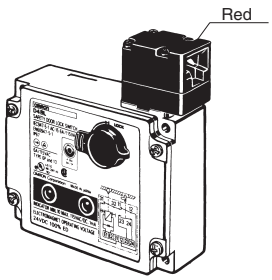


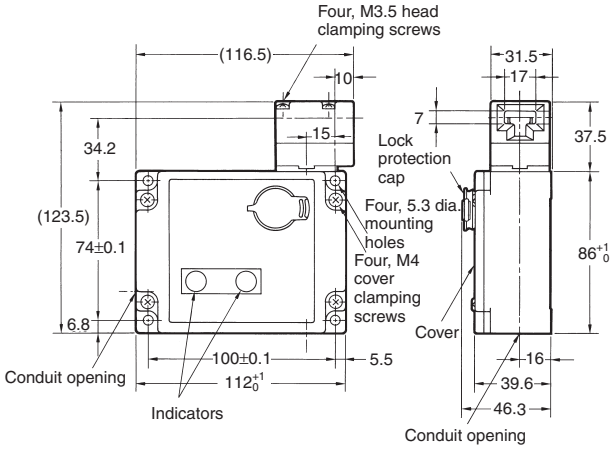
Dimensions

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

Switches

D4BL-□□□□-□



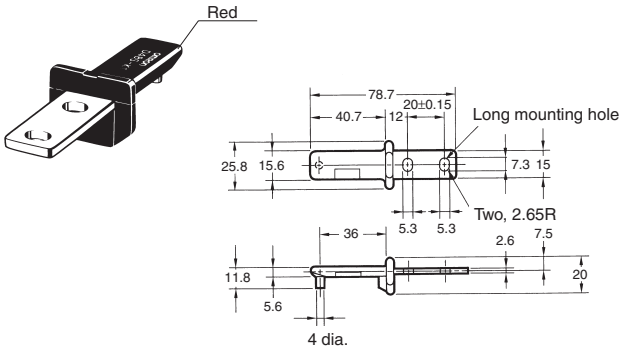


Operating Characteristics	D4BL-□□□□
Key insertion force Key extraction force	19.61 N max. 19.61 N max.
Movement before being locked	15 mm max.

Operation Keys

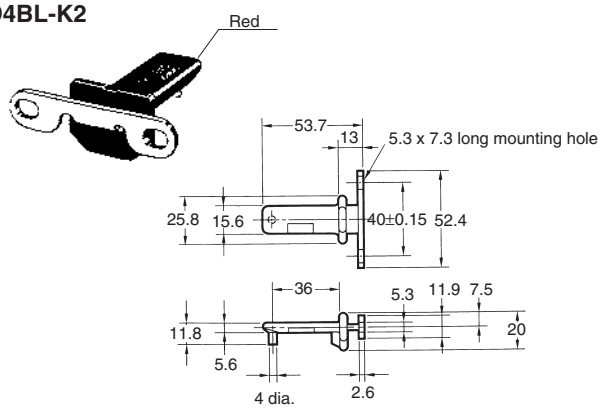
Horizontal Mounting

D4BL-K1



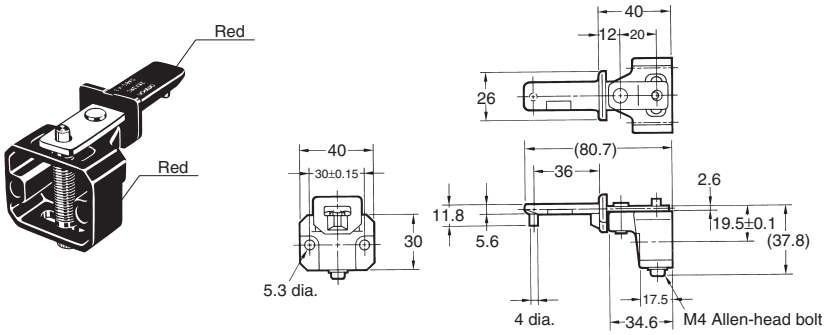
Vertical Mounting

D4BL-K2



Adjustable Mounting (Horizontal)

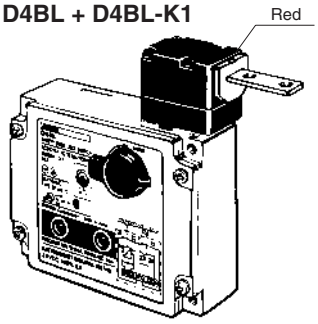
D4BL-K3

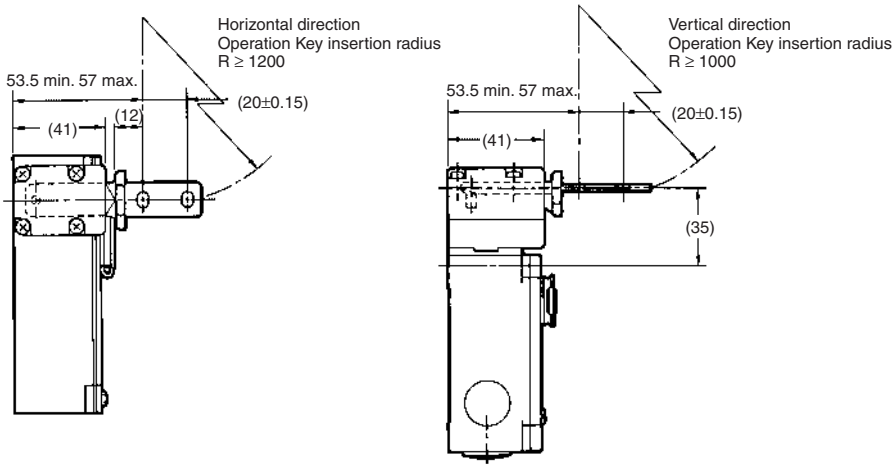


With Operation Key Inserted

Horizontal Mounting

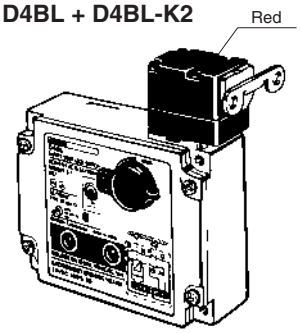
D4BL + D4BL-K1

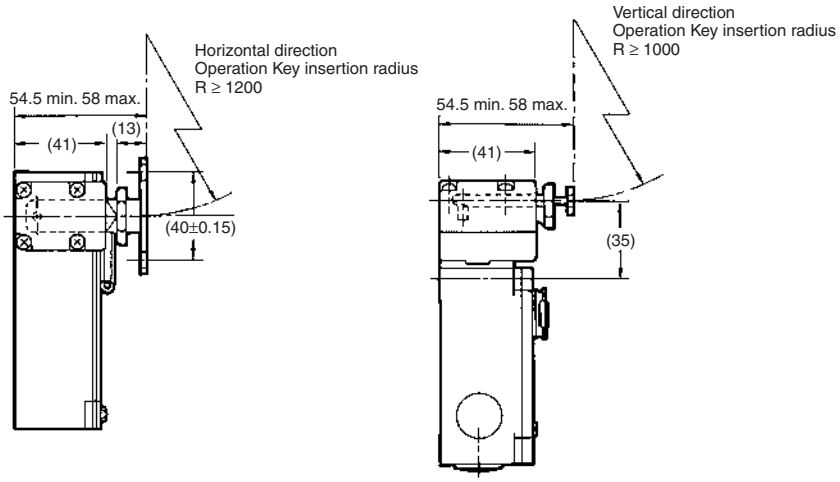




Vertical Mounting

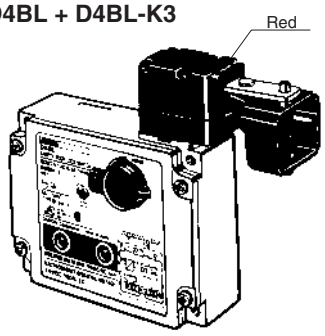
D4BL + D4BL-K2

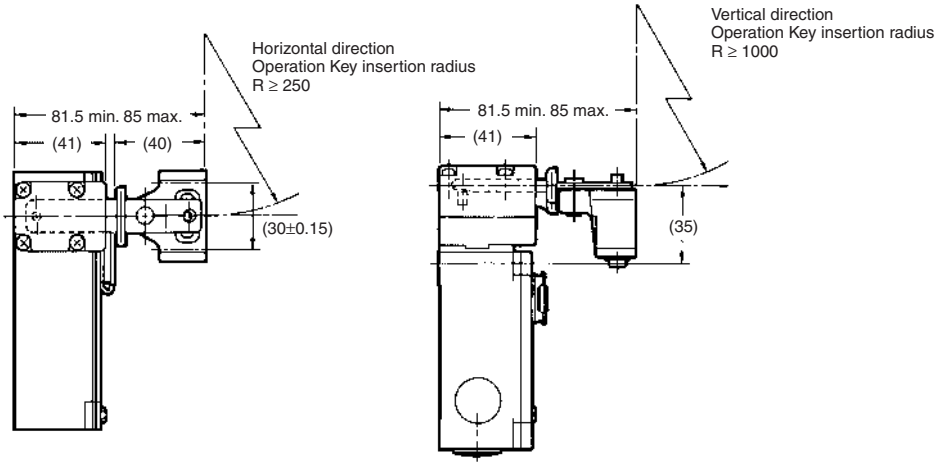




Adjustable Mounting (Horizontal)

D4BL + D4BL-K3





Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

2. In the above diagrams, the Operation Key is inserted from the front.

Precautions

Do not insert the Operation Key to the Switch with the door open. Before using the machine, be sure to remove the shock-absorbing damper, which is provided before shipping. Otherwise the machine may start operating and injury may be caused.

Mount the Operation Key at a location where it will not come in contact with users when the door is opened or closed.

When operating the D4BL as a part of a safety circuit or an emergency stop circuit to prevent injury, operate the NC contacts that have a direct opening mechanism in direct opening mode. For safety purposes, tighten the switch body and Operation Key with one-way screws or equivalents or install a switch protection cover and warning label for safety purposes to prevent easy removal of the D4BL.

Connect the fuse to the D4BL in series to prevent it from short-circuit damage. The value of the breaking current of the fuse must be calculated by multiplying rated current by 150% to 200%.

When using the D4BL with EN ratings, use 10-A fuse Type gI or gG that complies with IEC60269.

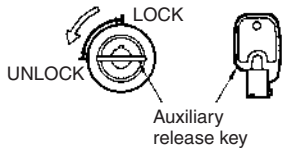
In order to prevent the D4BL from burning due to overvoltage, insert a protection fuse into the solenoid circuit.

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 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.

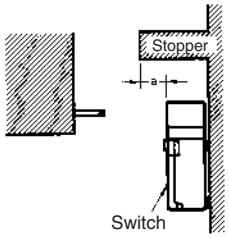
Do not use the auxiliary release key to start or stop machines.

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.

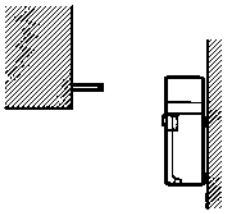
Make sure that the auxiliary release key is kept with the person in charge.

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

Stopper



Do not use the Switch as a stopper. When mounting the Switch, be sure to locate a stopper as shown in the following illustration to prevent the top of the Operation Key from hitting the switch head.



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.

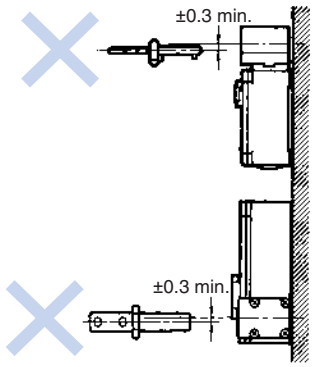
Do not use the D4BL in the following locations.

- Locations subject to severe temperature changes
- Locations subject to high temperatures or condensation
- Locations subject to severe vibration
- Locations where the product may come in contact with metal dust, oil, or chemicals

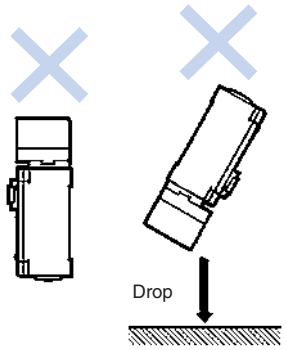
Operation Key

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 ±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.



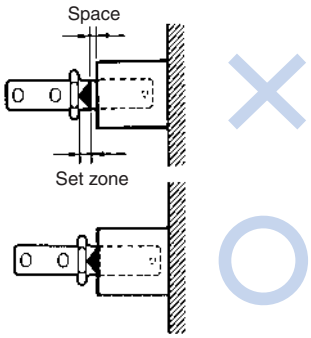
The head is constructed so that it cannot be operated with tools such as screwdrivers. Always use OMRON's Operation Key to operate the head in order to ensure the safety of the machine and protect the D4BL from damage.

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

Mount the Operation Key and secure it with one-way screws or equivalents to prevent easy removal of the D4BL.

Securing the Door

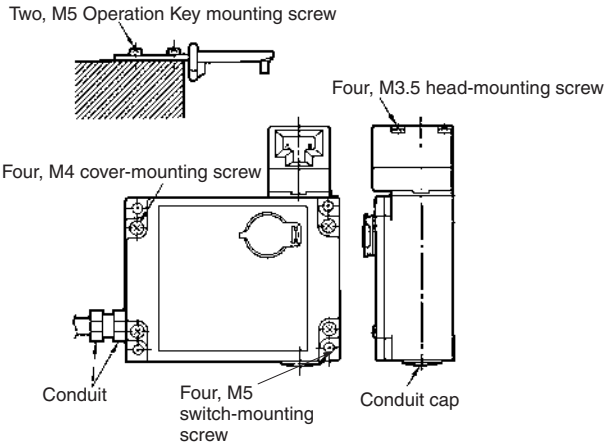
If the Operation Key on the closed door is pulled outside the set zone by a force caused by vibration, the door's weight, or the door cushion rubber, the D4BL may be damaged. Secure the door with hooks so that it will remain within the set zone.



Tightening Torque

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

	Type	Torque
1	M3.5 terminal screw (including terminal screw)	0.59 to 0.78 N·m
2	Cover mounting screw	1.18 to 1.37 N·m
3	Head mounting screw	0.78 to 0.98 N·m
4	M5 body mounting screw	4.90 to 5.88 N·m
5	Operation Key mounting screw	2.35 to 2.75 N·m
6	Connector	1.77 to 2.16 N·m
7	Cap screw	1.27 to 1.67 N·m

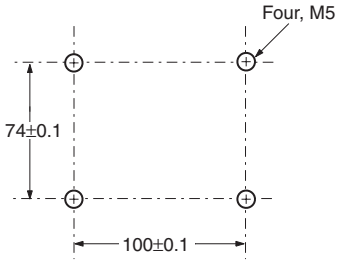


Switch and Operation Key Mounting

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

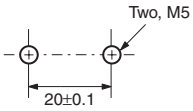
Mounting Dimensions

Switch Mounting Dimensions

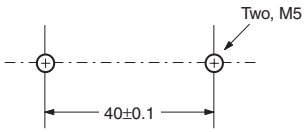


Operation Key Mounting Holes

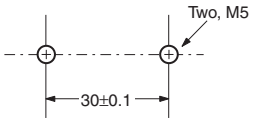
- Horizontal Mounting
  D4BL-K1



- Vertical Mounting
  D4BL-K2



- Adjustable Mounting (Horizontal)
  D4BL-K3

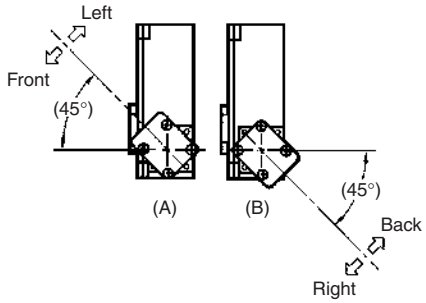


Head Directions

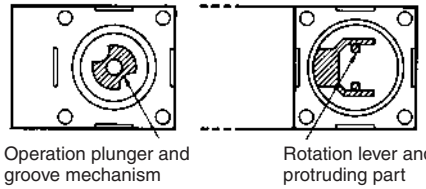
The head can be mounted in four directions. To remove the head, turn the head by 45° as shown in figures A and B below.

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.

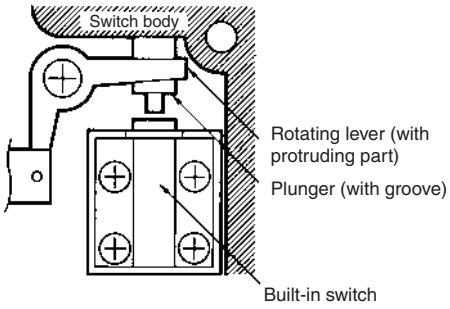
Head Direction Changes



Head Bottom View **Switch Top View**



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.

Mounting the Cover

When tightening the cover, first check the specified torque, and then tighten each screw to the that torque. Also, make sure that no foreign matter has entered the switch.

When mounting the cover, make sure that the cover and switch box are properly aligned.

Processing and Connecting Cable/Conduit

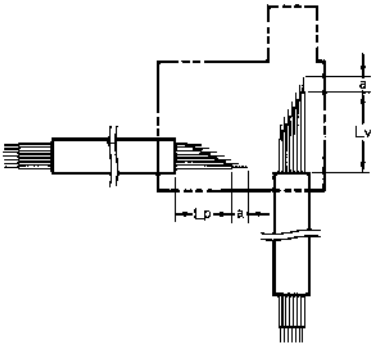
The following procedures are recommended for mounting and wiring the indicator unit securely.

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^2) 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.

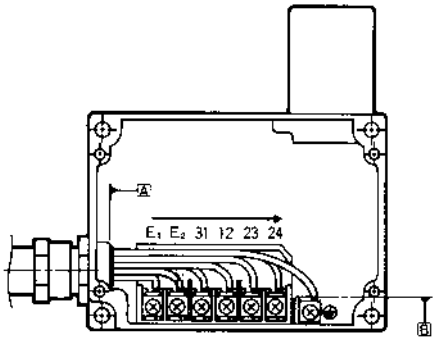


Terminal no.	Lp (mm)	Lv (mm)	a (mm)
E_1	30±2	80±2	8±1
E_2	35±2	75±2	
31	45±2	60±2	
12	55±2	50±2	
23 (21)	65±2	45±2	
24 (22)	70±2	35±2	
⏚	90±2	50±2	

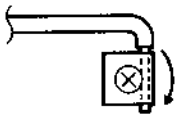
Properly attach and securely tighten the provided conduit cap to the unused conduit opening when wiring the D4BL.

Cable Connection Example

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

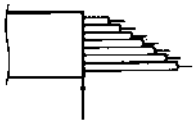


Tighten each wired terminal clockwise to a torque of 0.59 to 0.78 N·m.



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.



Insulation sheath edge

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.

Cat. No. C100-E2-03A-X In the interest of product improvement, specifications are subject to change without notice.

Compact Non-contact Door Switch

D40B

Detects the open/ closed state of doors without making contact and has high resistance to the environment.

- Detects the open/closed state of doors without making contact by combining a special magnetic actuator and switch. The switching mechanism is not easily disabled.
- The non-contact operation prevents the creation of particles due to abrasion.
- The actuator and switch can be washed in water. There are no keyholes where dirt can accumulate, making it easy to keep machinery clean.
- Small distortions in the door and mechanical discrepancies can be absorbed in the allowable operating range of the magnetic actuator and switch.
- Conforms to Category 3.

Model Number Structure

Model Number Legend

Sensor

D40B-□□□□
1 2 3 4

1. **Type**
   1: Standard Sensor
   2: Elongated Sensor
   3: High-temperature Type Sensor
2. **Auxiliary Output**
   B: None
   D: 1 NC
   E: 1 NO
3. **Cable Length**
   3: 3 m
   5: 5 m
   10: 10 m
4. **Wiring Method**
   None: Pre-wired
   C: Connector (switch side only)

Controller

D40B-J□
1

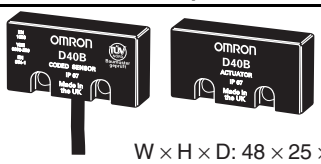
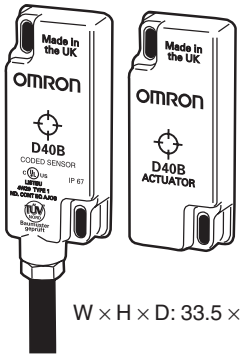
1. **Type**
   1: One main contact + one auxiliary contact (See note.)
   2: Two main contacts + one auxiliary contact (See note.)

Note: The auxiliary contacts use non-safety output.

Ordering Information

List of Models

Sensors (Switches/Actuators)

Classification	Shape	Auxiliary output	Cable length	Model
Standard Sensor	 W × H × D: 48 × 25 × 12	None	3 m	D40B-1B3
			10 m	D40B-1B10
		1 NC	3 m	D40B-1D3
			10 m	D40B-1D10
Elongated Sensor	 W × H × D: 19 × 82 × 19	None	3 m	D40B-2B3
			10 m	D40B-2B10
		1 NC	3 m	D40B-2D3
			10 m	D40B-2D10
High-temperature Type Sensor	 W × H × D: 33.5 × 78.5 × 16	1 NC	5 m	D40B-3D5C
		1 NO		D40B-3E5C

Note: A Sensor used in combination with a Controller is classified Category 3.

Controllers

Safety contacts	Auxiliary contacts/output (See note 2.)	Rated voltage	Model
1 NO	1 NC (See note 1.)	24 VAC/VDC	D40B-J1
2 NO	1 NC	24 VAC/VDC 110/230 VAC	D40B-J2

Note: 1. MOS output.

2. Non-safety output.

Accessories

Classification	Model
Fuse	D9M-P1

Specifications

Sensor (Switch/Actuator)

Item / Type	Standard Sensor	Elongated Sensor	High-temperature Type Sensor
Switching distance (See note 1.) (nominal value)	OFF→ON: 5 mm ON→OFF: 15 mm		OFF→ON: 9 mm ON→OFF: 17 mm
Actuator approach speed (See note 2.)	17 mm/s min.		
Operating temperature	−10 to +55°C		−25 to +125°C
Operating humidity	90% at +50°C		
Degree of protection	IP67		
Material	ABS		Stainless steel
Mounting method	M4 screws		
Mounting screw tightening torque	1 N·m		

Note: 1. These values represent the distances at which OFF changes to ON (approaching) or ON changes to OFF (separating) when the switch and actuator's target marks are aligned and the sensing surfaces have the same orientation.

2. If the approach speed is less than the specified value, the Controller's safety contact output may not turn ON, even if the distance is less than the switching distance.

Controller

Ratings

Power Supply

Item / Type	D40B-J1	D40B-J2
Power supply voltage	24 VAC/DC	24 VAC/DC or 110/230 VAC (selectable)
Allowable voltage range	Power supply voltage ±15%	
Power consumption	2.0 VA max.	4.0 VA max.

Switch

Item	Type	D40B-J1	D40B-J2
Rated load	**Safety contacts**	250 VAC, 4 A, cosϕ = 1 30 VDC, 2 A, cosϕ = 1	
	Auxiliary contacts/output (See note.)	230 VAC, 100 mA, cosϕ = 1 24 VDC, 100 mA, cosϕ = 1	250 VAC, 4 A, cosϕ = 1 30 VDC, 2 A, cosϕ = 1

Note: D40B-J1: MOS output; D40B-J2: Contact output.

Characteristics

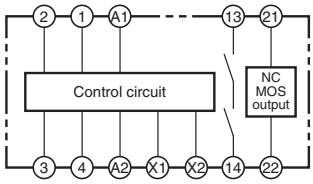
Item	Type	D40B-J1	D40B-J2
Contact resistance		100 mΩ (not including auxiliary output)	100 mΩ
Auxiliary output ON resistance		36 Ω (nominal value)	---
Response time		25 ms max.	
Insulation resistance		100 MΩ (at 500 VDC)	
Dielectric strength	**Between output poles**	1,500 VAC 1 min.	
	Between inputs and outputs		
	Between power supply and outputs		
Vibration resistance		10 to 55 Hz, 1-mm single amplitude, IEC68-2-6	
Shock resistance		30G, 11 ms, IEC68-2-27	
Durability	**Mechanical**	1,000,000 operations min.	
	Electrical	100,000 operation min. (at the rated load)	
Minimum rated current for safety contacts		10 VAC/VDC, 10 mA (reference values)	
Operating temperature		−10 to +55 °C	
Operating humidity		90% at +50 °C.	
Mounting method		35 mm DIN Track (Screw mounting is not possible.)	
Terminal screw tightening torque		1 N·m	
Weight		147 g	590 g

Approved Standards

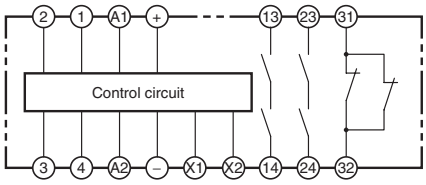
- EN standards certified by TÜV Nord
  EN954-1
  EN/IEC60204-1
  EN/IEC60947-5-3
- UL508, CSA C22.2 No. 14
- EN1088 conformance

Internal Connection Diagram

D40B-J1



D40B-J2



Note: 1. If a 100/230 VAC power supply is used, connect it to the A1 and A2 terminals. Do not connect the power supply to the + and –terminals.

2. If a 24 VDC power supply is used, connect it to the + and – terminals. Do not connect the power supply to the A1 and A2 terminals.

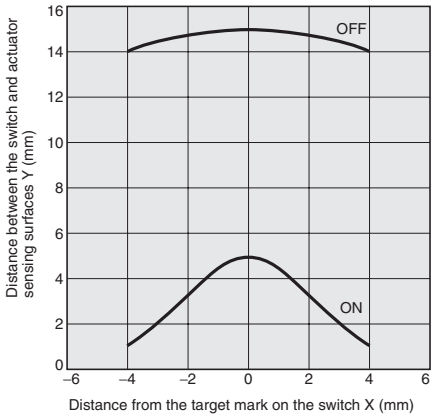
⚠ WARNING

Do not connect a 100/230 VAC power supply to the + and –terminals.
Doing so may result in electric shock.

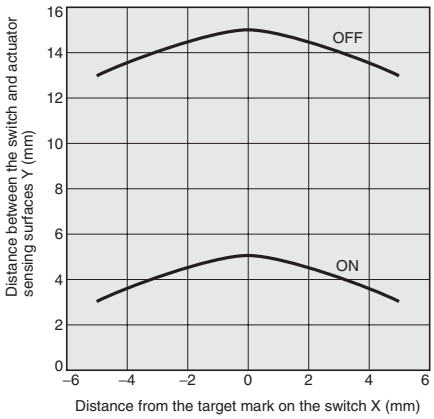
Engineering Data

Detection Ranges

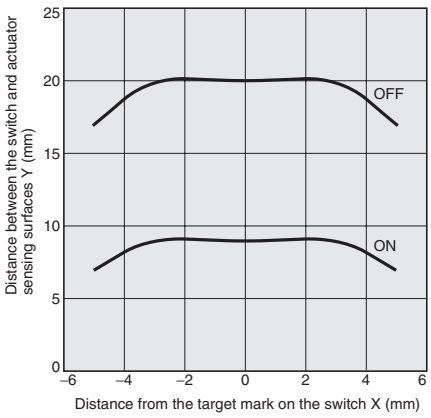
Standard Sensor



Elongated Sensor



High-temperature Type Sensor



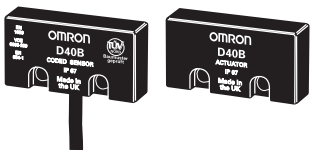
Dimensions

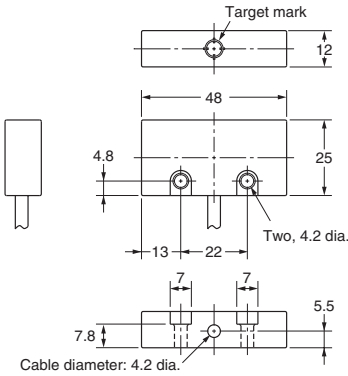
Note: All units are in millimeters unless otherwise indicated.

Sensor (Switch/Actuator)

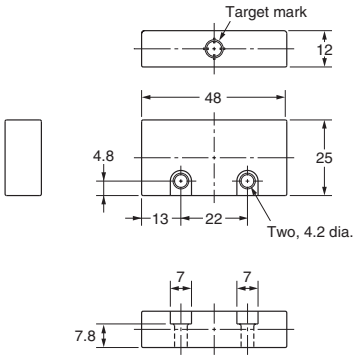
Standard Sensor

D40B-1B3
D40B-1B10
D40B-1D3
D40B-1D10





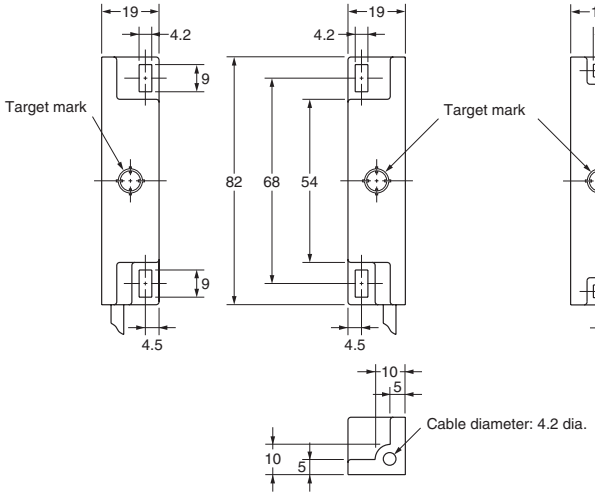
(Switch)



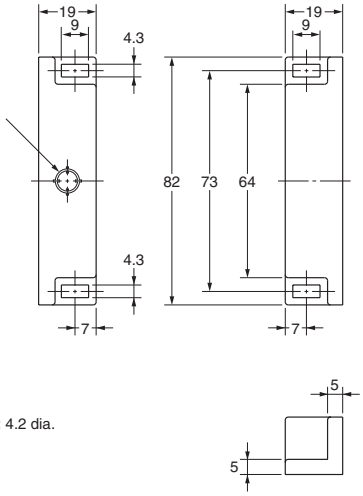
(Actuator)

Elongated Sensor

D40B-2B3
D40B-2B10
D40B-2D3
D40B-2D10



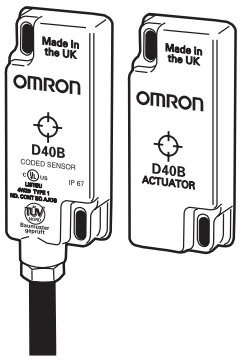
(Switch)



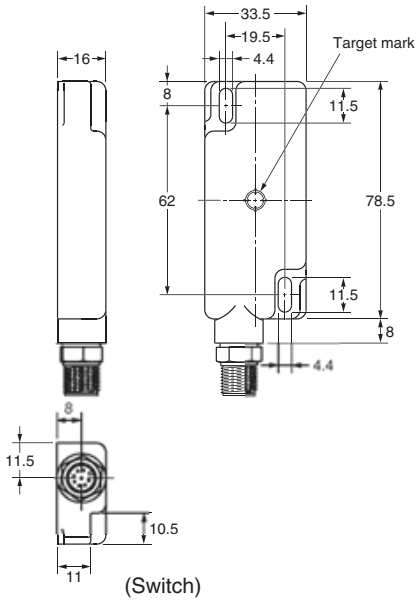
(Actuator)

High-temperature Type Sensor

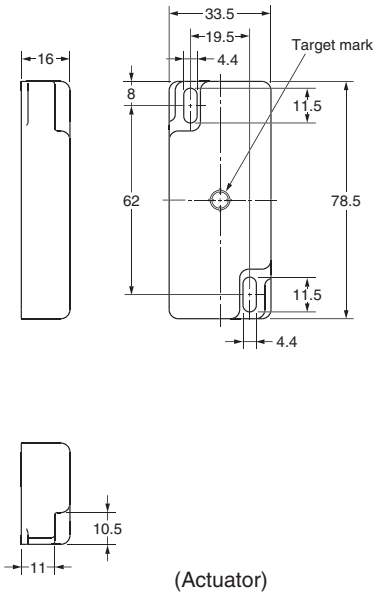
D40B-3D5C
D40B-3E5C



Note: A cable with connectors is included.



(Switch)

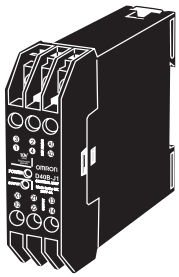


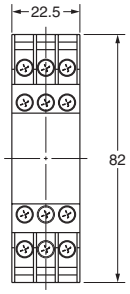
(Actuator)

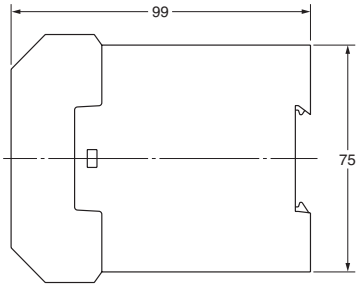
Controller

1-pole Controller

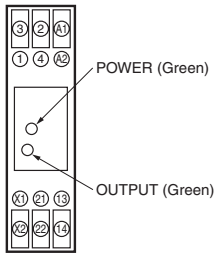
D40B-J1





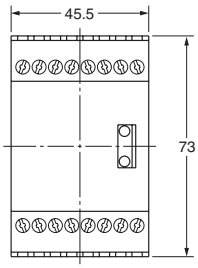


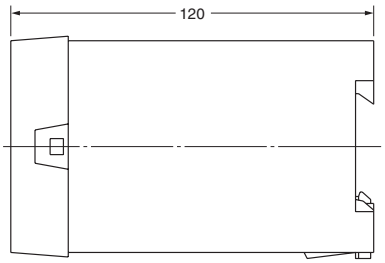
Terminal Arrangement



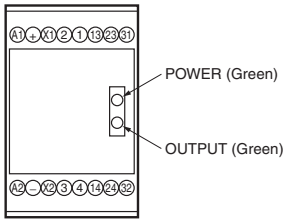
2-pole Controller

D40B-J2





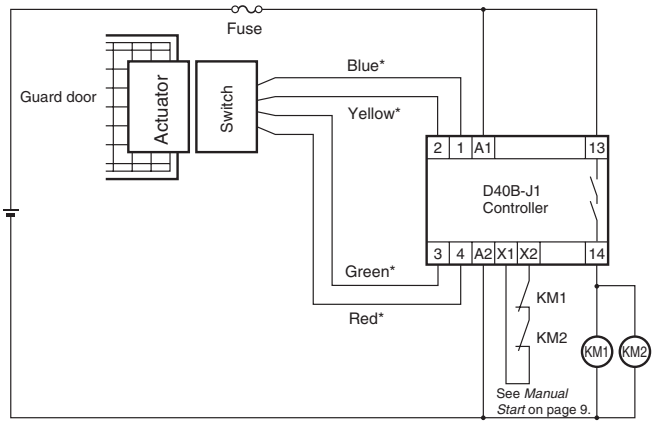
Terminal Arrangement

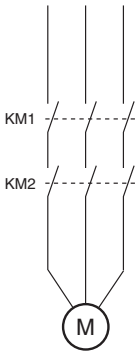


Application Examples

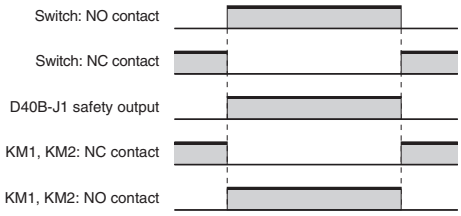
Wiring Example for 1 Sensor and 2 Contactors (with D40B-J1): Auto-reset

The configuration in this example is for auto-reset and contactor monitoring.





Operation Flowchart

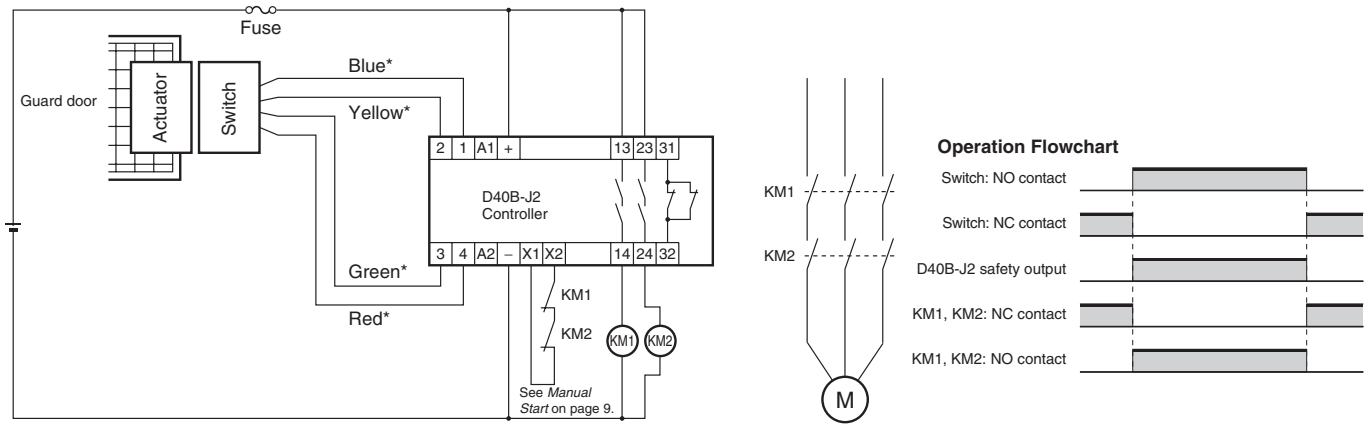


Note: The circuit in this example is equivalent to a Category 3 circuit.

*This example applies to Standard or Elongated Sensors. The wire colors for the High-temperature Type Sensors are different. Refer to *Sensor and Controller Connection Examples* on page 10.

Wiring Example for 1 Sensor and 2 Contactors (with D40B-J2): Auto-reset

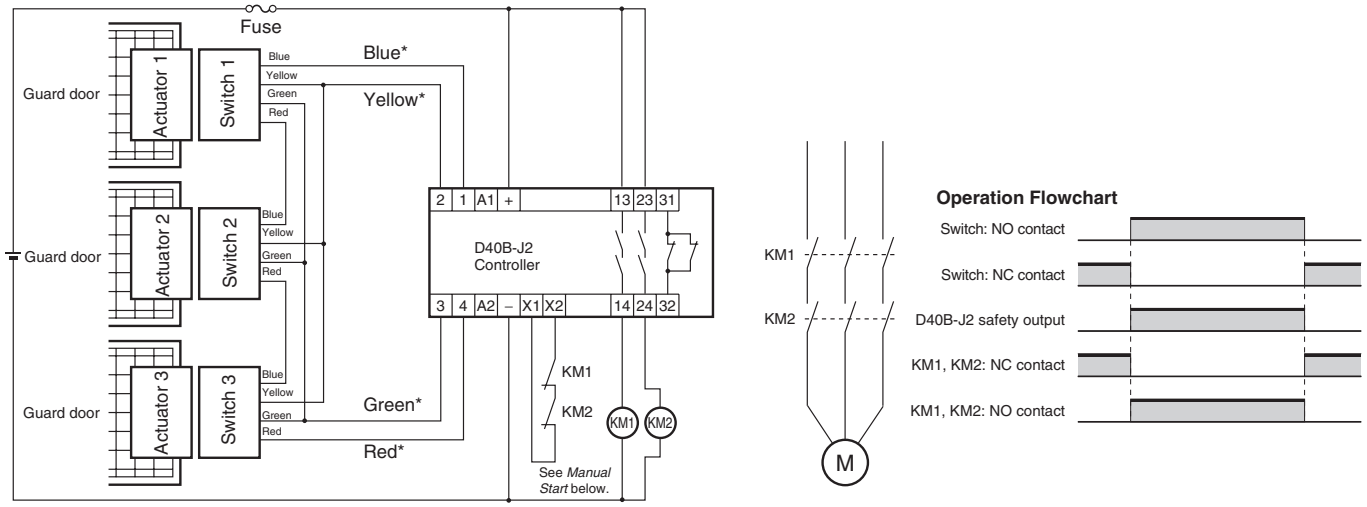
The configuration in this example is for auto-reset and contactor monitoring.



Note: The circuit in this example is equivalent to a Category 3 circuit.
*This example applies to Standard or Elongated Sensors. The wire colors for the High-temperature Type Sensors are different. Refer to *Sensor and Controller Connection Examples* on page 10.

Wiring Example for 3 Sensors and 2 Contactors (with D40B-J2): Auto-reset

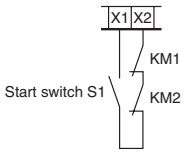
The configuration in this example is for auto-reset and contactor monitoring.



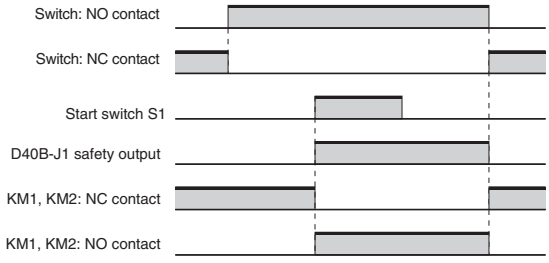
Note 1: The circuit in this example is equivalent to a Category 3 circuit.
Note 2: If two or more Sensors are connected to one Controller, all of the guard doors must open and close independently. If two or more doors open and close at the same time, it is possible that a fault may not be detected.
Note 3: Up to six Sensors can be connected to a single Controller.
*This example applies to Standard or Elongated Sensors. The wire colors for the High-temperature Type Sensors are different. Refer to *Sensor and Controller Connection Examples* on page 10.

Manual Start

If manual start is required, insert start switch S1 between X1 and X2 as shown below. Monitored start is not possible.

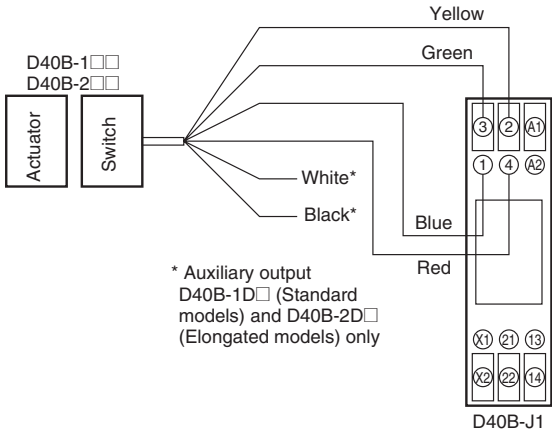


Operation Flowchart

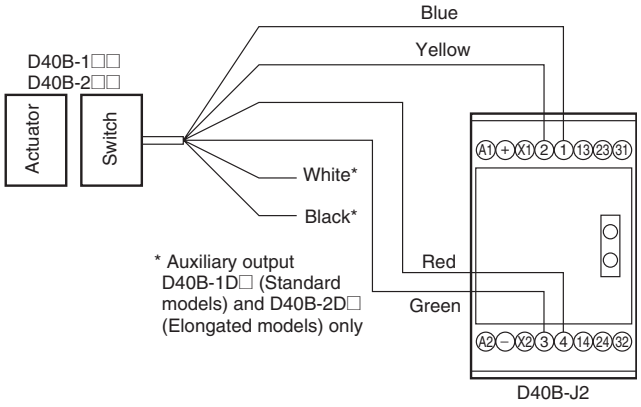


Sensor and Controller Connection Examples

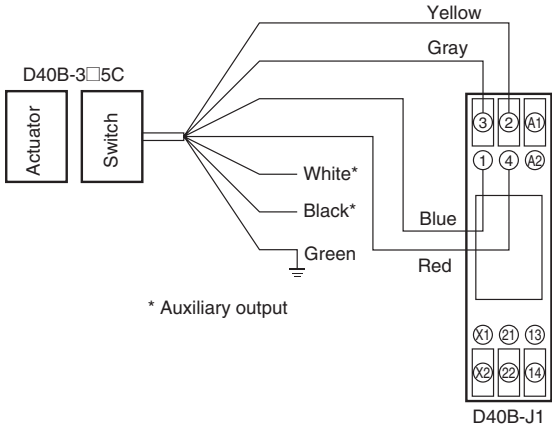
Connection between Standard or Elongated Sensor and 1-pole Controller



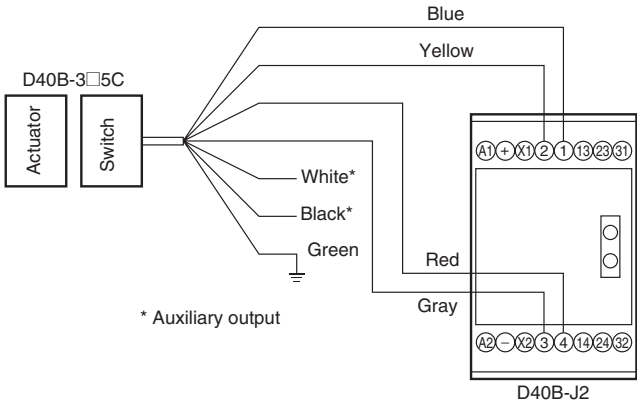
Connection between Standard or Elongated Sensor and 2-pole Controller



Connection between High-temperature Type Sensor and 1-pole Controller



Connection between High-temperature Type Sensor and 2-pole Controller



Safety Precautions

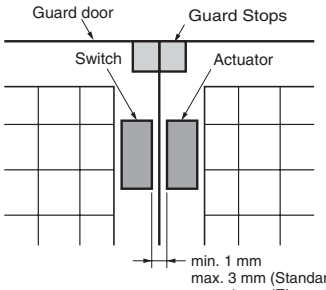
⚠ WARNING

Be sure to turn OFF the power before performing wiring. Do not touch charge parts (e.g., terminals) while power is ON. Doing so may result in electric shock.

Do not allow the actuator to come close to the switch with the door open. Doing so may cause machinery to start operating and may result in injury.

⚠ CAUTION

Use guard stops in the way shown below to ensure that the switch and actuator do not make contact when the guard door is closed.



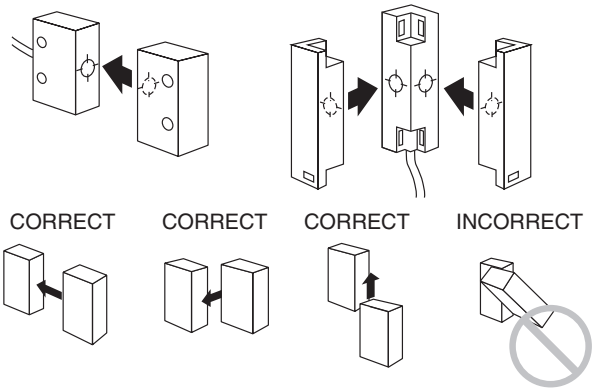
Application Precautions

- Do not use the product in locations subject to explosive or flammable gases.
- Do not use load currents exceeding the rated value.
- Be sure to wire each conductor correctly.
- Be sure to confirm correct operation after completing mounting and adjustment.
- Do not drop or attempt to disassemble the product.
- Be sure to use the correct combination of switch and actuator.
- Use a power supply of the specified voltage. Do not use power supplies with large ripples or power supplies that intermittently generate incorrect voltages.
- Capacitors are consumable and require regular maintenance and inspection.

Precautions for Safe Use

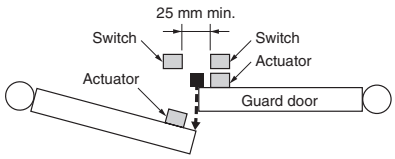
Mounting Direction of Switch and Actuator

The Sensor will not operate properly if the switch and actuator come towards each other diagonally. The Sensor will, however, operate properly if the switch and actuator come towards each other head-on, horizontally or vertically (as long as the faces have the same orientation).



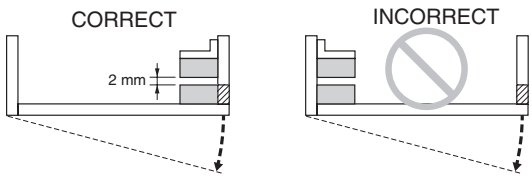
Mutual Interference

If the switch and actuator are mounted in parallel, be sure to separate them by at least 25 mm, as shown below.



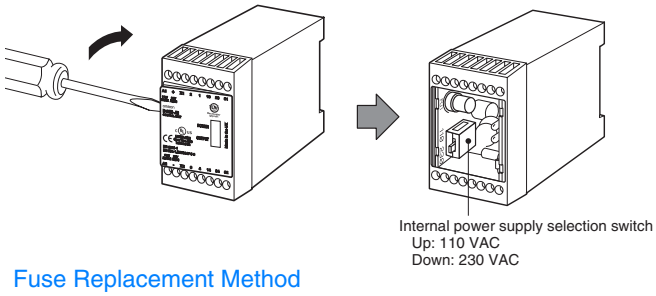
Using for Hinged Doors

On hinged doors, install the Sensor at an opening edge as shown below.



Switching Power Supply Voltage (D40B-J2 Only)

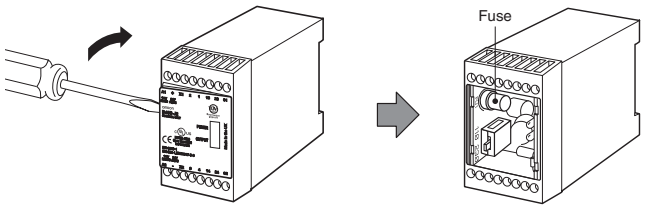
- Turn OFF the power to the Controller.
- Open the Controller's front cover with a flat-bladed screwdriver.
- Change the power supply voltage as required with the internal power supply selection switch. The switch is factory-set to 230 VAC.



Fuse Replacement Method (D40B-J2 Only)

Note: The D40B-J1 has an automatic recovery mechanism and so fuse replacement is not necessary.

- Turn OFF the power to the Controller.
- Open the Controller's front cover with a flat-bladed screwdriver.
- Replace the fuse (D9M-P1). (See page 198.)



Applicable Safety Category (EN954-1)

This product can be used in environments classified as Safety Category 3 according to the requirements of European standard EN954-1. This evaluation, however, is based on circuit configuration examples proposed by OMRON. The standard may not apply in some operating conditions.

The applicable safety category is determined from the whole safety control system. Make sure that the whole safety control system meets EN954-1 requirements.

Handling

Do not drop the product or subject it to excessive shocks or vibration. Doing so may result in faults or malfunctions.

Solvents

Ensure that solvents, such as alcohol, thinner, trichloroethane, or gasoline do not adhere to the product. Solvents may cause markings to fade and components to deteriorate.

Installation Location

Do not install the product in the following locations. Doing so may result in product failure or malfunction.

- Locations subject to direct sunlight.
- Locations subject to temperatures outside the range 25 to 55 °C.
- Locations subject to humidity levels outside the range 35% to 85% or subject to condensation due to extreme temperature changes.
- Locations subject to corrosive or flammable gases.
- Locations subject to shocks or vibration in excess of the product ratings.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to dust (including iron dust) or salts.

Take appropriate and sufficient countermeasures when using the product in the following locations.

- Locations subject to static electricity or other forms of noise.
- Locations subject to possible exposure to radioactivity.
- Locations close to power supply lines.

Wiring

Perform wiring using wire with the following dimensions.
Stranded wire: 2.5 mm^2
Solid wire: 4.0 mm^2

Tighten the terminal screws with the specified torque. Not doing so may result in malfunction or abnormal heat generation.
Terminal screw tightening torque: 1 N·m

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

Cat. No. C127-E2-02-X

Miniature Safety-door Hinge Switch

D4NH

New series Safety-door Hinge Switch Designed for sace saving guaring in Machines and safety Equipment

- Lineup includes three contact models with 2NC/1NO and 3NC contacts in addition to the 1NC/1NO, and 2NC versions. Version with MBB contacts meet applications for avdanced requirements.
- M12-connector models are available, saving on labor and simplifying maintenance.
- Standardized gold-clad contacts provide high contact reliability Can be used with both standard loads and micro-loads.
- Free of lead, cadmium, and hexavalent chrome, reducing the burden on the environment.

Be sure to read the “Safety Precautions” on page G-214.

Note: Contact your sales representative for details on models with safety standard certification.

Model Number Structure

D4NH-□□□
1 2 3

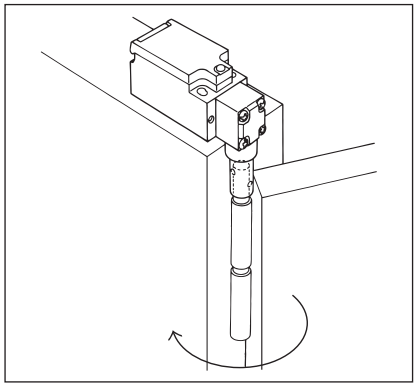
1. Conduit/Connector size
1: Pg13.5 (1-conduit)
2: G1/2 (1-conduit)
3: 1/2-14NPT (1-conduit)
4: M20 (1-conduit)
5: Pg13.5 (2-conduit)
6: G1/2 (2-conduit)
7: 1/2-14NPT (2-conduit)
8: M20 (2-conduit)
9: M12 connector (1-conduit)

2. Built-in Switch
A: 1NC/1NO (slow-action)
B: 2NC (slow-action)
C: 2NC/1NO (slow-action)
D: 3NC (slow-action)
E: 1NC/1NO (MBB contact) (slow-action)
F: 2NC/1NO (MBB contact) (slow-action)

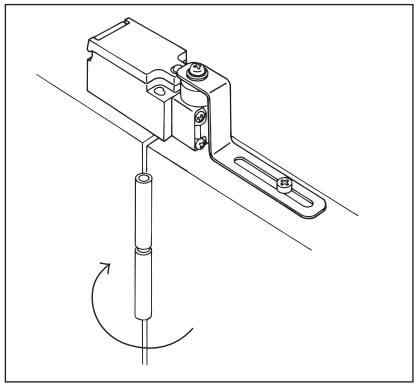
3. Actuator
AS: Shaft
BC: Arm lever

Application Examples (Protective Door Safety Measures)

Shaft Actuator



Arm Lever Actuator



Ordering Information

List of Models

Switches

Actuator	Conduit size		Built-in switch mechanism		
			1NC/1NO (Slow-action)	2NC (Slow-action)	2NC/1NO (Slow-action)
Shaft	1-conduit	Pg13.5	D4NH-1AAS	D4NH-1BAS	D4NH-1CAS
		G1/2	D4NH-2AAS	D4NH-2BAS	D4NH-2CAS
		1/2-14NPT	D4NH-3AAS	D4NH-3BAS	D4NH-3CAS
		M20	D4NH-4AAS	D4NH-4BAS	D4NH-4CAS
		M12 connector	D4NH-9AAS	D4NH-9BAS	---
	2-conduit	Pg13.5	D4NH-5AAS	D4NH-5BAS	D4NH-5CAS
		G1/2	D4NH-6AAS	D4NH-6BAS	D4NH-6CAS
		1/2-14NPT (See note 3.)	D4NH-7AAS	D4NH-7BAS	D4NH-7CAS
		M20	D4NH-8AAS	D4NH-8BAS	D4NH-8CAS
Arm lever	1-conduit	Pg13.5	D4NH-1ABC	D4NH-1BBC	D4NH-1CBC
		G1/2	D4NH-2ABC	D4NH-2BBC	D4NH-2CBC
		1/2-14NPT	D4NH-3ABC	D4NH-3BBC	D4NH-3CBC
		M20	D4NH-4ABC	D4NH-4BBC	D4NH-4CBC
		M12 connector	D4NH-9ABC	D4NH-9BBC	---
	2-conduit	Pg13.5	D4NH-5ABC	D4NH-5BBC	D4NH-5CBC
		G1/2	D4NH-6ABC	D4NH-6BBC	D4NH-6CBC
		1/2-14NPT (See note 3.)	D4NH-7ABC	D4NH-7BBC	D4NH-7CBC
		M20	D4NH-8ABC	D4NH-8BBC	D4NH-8CBC

Actuator	Conduit size		Built-in switch mechanism		
			3NC (Slow-action)	1NC/1NO MBB (Slow-action)	2NC/1NO MBB (Slow-action)
Shaft	1-conduit	Pg13.5	D4NH-1DAS	D4NH-1EAS	D4NH-1FAS
		G1/2	D4NH-2DAS	D4NH-2EAS	D4NH-2FAS
		1/2-14NPT	D4NH-3DAS	D4NH-3EAS	D4NH-3FAS
		M20	D4NH-4DAS	D4NH-4EAS	D4NH-4FAS
		M12 connector	---	D4NH-9EAS	---
	2-conduit	Pg13.5	D4NH-5DAS	D4NH-5EAS	D4NH-5FAS
		G1/2	D4NH-6DAS	D4NH-6EAS	D4NH-6FAS
		1/2-14NPT (See note 3.)	D4NH-7DAS	D4NH-7EAS	D4NH-7FAS
		M20	D4NH-8DAS	D4NH-8EAS	D4NH-8FAS
Arm lever	1-conduit	Pg13.5	D4NH-1DBC	D4NH-1EBC	D4NH-1FBC
		G1/2	D4NH-2DBC	D4NH-2EBC	D4NH-2FBC
		1/2-14NPT	D4NH-3DBC	D4NH-3EBC	D4NH-3FBC
		M20	D4NH-4DBC	D4NH-4EBC	D4NH-4FBC
		M12 connector	---	D4NH-9EBC	---
	2-conduit	Pg13.5	D4NH-5DBC	D4NH-5EBC	D4NH-5FBC
		G1/2	D4NH-6DBC	D4NH-6EBC	D4NH-6FBC
		1/2-14NPT (See note 3.)	D4NH-7DBC	D4NH-7EBC	D4NH-7FBC
		M20	D4NH-8DBC	D4NH-8EBC	D4NH-8FBC

Prefered types

Note: 1. It is recommended that M20 be used for Switches to be exported to Europe and 1/2-14NPT be used for Switches to be exported to North American countries.

2. All models have slow-action contacts with approved direct opening mechanisms on NC contacts only.

3. The 1/2-14NPT 2-conduit models include an M20-to-1/2-14NPT changing adaptor.

Specifications

Standards and EC Directives

- Conforms to the following EC Directives:
  Machinery Directive
  Low Voltage Directive
  EN50047
  EN1088
  GS-ET-15

Approved Standards

Agency	Standard	File No.
TÜV Product Service	EN60947-5-1 (approved direct opening)	B03 11 39656 061
UL (See note.)	UL508, CSA C22.2 No.14	E76675

Note: Approval for CSA C22.2 No. 14 is authorized by the UL mark.

CCC (China Compulsory Certification) Mark

Agency	Standard	File No.
CQC	GB14048.5	Under application

Approved Standard Ratings

TÜV (EN60947-5-1)

Item / Utilization category	AC-15	DC-13
Rated operating current (I_e)	3 A	0.27 A
Rated operating voltage (U_e)	240 V	250 V

Note: Use a 10-A fuse type gI or gG that conforms to IEC269 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		Volt-amperes	
		Make	Break	Make	Break
120 VAC	10 A	60 A	6 A	7,200 VA	720 VA
240 VAC		30 A	3 A		

Q300

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

Characteristics

Degree of protection (See note 3.)		IP67 (EN60947-5-1)
Durability (See note 4.)	**Mechanical**	1,000,000 operations min.
	Electrical	500,000 operations min. for a resistive load of 3 A at 250 VAC (See note 5.) 300,000 operations min. for a resistive load of 10 A at 250 VAC
Operating speed		2 to 360°/s (See note 6.)
Operating frequency		30 operations/minute max.
Contact resistance		25 mΩ max.
Minimum applicable load (See note 7.)		Resistive load of 1 mA at 5 VDC (N-level reference value)
Rated insulation voltage (U_i)		300 V
Protection against electric shock		Class II (double insulation)
Pollution degree (operating environment)		Level 3 (EN60947-5-1)
Impulse withstand voltage (EN60947-5-1)		Between terminals of the same polarity: 2.5 kV
		Between terminals of different polarities: 4 kV
		Between other terminals and uncharged metallic parts: 6 kV
Insulation resistance		100 MΩ min.
Contact gap		Snap-action: 2 x 9.5 mm min Slow-action: 2 x 2 mm min
Vibration resistance	**Malfunction**	10 to 55 Hz, 0.75-mm single amplitude
Shock resistance	**Destruction**	1,000 m/s^2
	Malfunction	300 m/s^2
Conditional short-circuit current		100 A (EN60947-5-1)
Rated open thermal current (I_{th})		10 A (EN60947-5-1)
Ambient temperature		Operating: −30°C to 70°C with no icing
Ambient humidity		Operating: 95% max.
Weight		Approx. 87 g (D4NH-1AAS) Approx. 97 g (D4NH-1ABC)

Note: 1. The values in the table on the previous page are initial values.

2. Once a contact has been used to switch a standard load, it cannot be used for a load of a smaller capacity. Doing so may result in roughening of the contact surface and contact reliability may be lost.

3. 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 D4NH in places where foreign material such as dust, dirt, oil, water, or chemicals may penetrate through the head. Otherwise, premature wear, Switch damage or malfunctioning may occur.

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

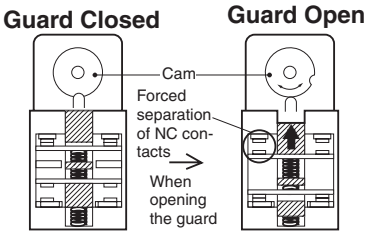
5. If the ambient temperature is greater than 35°C, do not pass the 3-A, 250-VAC load through more than 2 circuits.

6. For safe use, make sure that the allowable operating speed is not exceeded.

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

Structure, Names, and Functions

Structure (D4NH-□□BC)

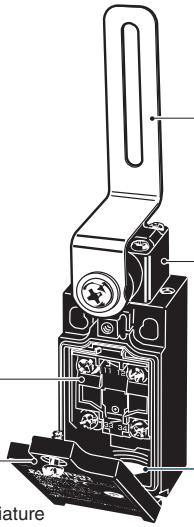


When the guard is opened, the cam that is directly coupled to the shaft rotates to press the Switch in the direction shown by the (vertical) arrow. This action separates the contacts to stop the machine.

Built-in Switch
The built-in switch has a direct opening mechanism that forcibly separates the NC contact even when there is contact deposit.

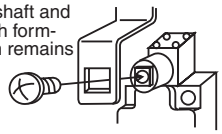
Cover
The cover, with a hinge on its lower part, can be opened by removing the screw of the cover, which ensures ease of maintenance and wiring.

* The housing and head of the D4NH are made of resin. Use D4BS Miniature Electromagnetic Lock Safety Door Limit Switches for applications requiring safety door switches of tough, high-sealing, or oil-resistant construction.



Arm Lever
The arm lever is mounted upwards in the center position before shipping. To change the position, loosen the arm lever mounting screw, dismount the arm lever, and mount the arm lever in the left or right position.

The joint between the shaft and arm lever is formed with form-lock construction which remains secure even when the screw becomes loose.



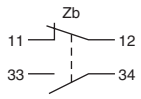
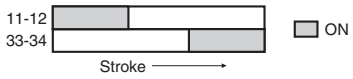
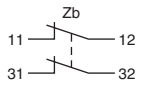
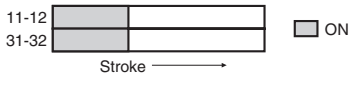
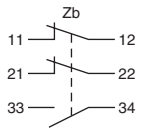
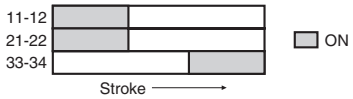
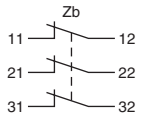
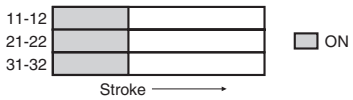
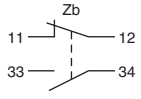
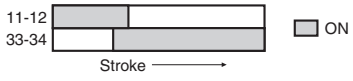
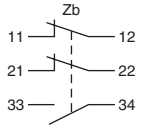
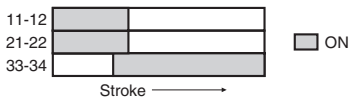
Head
The head can be mounted in four directions.

Conduit
A wide variety of conduits is available.

Size	1-conduit	2-conduit
Pg13.5	Yes	Yes
G1/2	Yes	Yes
1/2-14NPT	Yes	Yes
M20	Yes	Yes
M12 Connector	Yes	---

Note: M12 connector types are not available for Switches with three contacts.

Contact Form

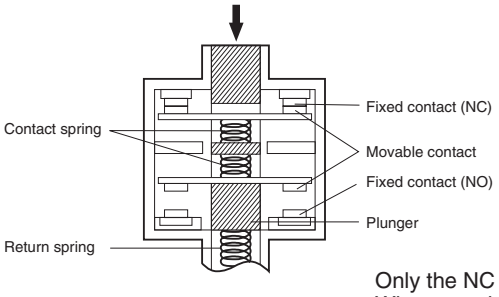
Model	Contact	Contact form	Operating pattern	Remarks
D4NH-□A□	1NC/1NO			Only NC contacts 11-12 have an approved direct opening mechanism. (→) The terminals 11-12 and 33-34 can be used as unlike poles.
D4NH-□B□	2NC			Only NC contacts 11-12 and 31-32 have an approved direct opening mechanism. (→) The terminals 11-12 and 31-32 can be used as unlike poles.
D4NH-□C□	2NC/1NO			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. (→) The terminals 11-12, 21-22, and 33-34 can be used as unlike poles.
D4NH-□D□	3NC			Only NC contacts 11-12, 21-22, and 31-32 have an approved direct opening mechanism. (→) The terminals 11-12, 21-22, and 31-32 can be used as unlike poles.
D4NH-□E□	1NC/1NO MBB			Only NC contacts 11-12 have an approved direct opening mechanism. (→) The terminals 11-12 and 33-34 can be used as unlike poles.
D4NH-□F□	2NC/1NO MBB			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. (→) The terminals 11-12, 21-22 and 33-34 can be used as unlike poles.

Note: 1. Terminals are numbered according to EN50013. Contact forms are according to EN60947-5-1.

2. MBB (Make Before Break) contacts have an overlapping structure, so that before the normally closed contact (NC) opens, the normally open contact (NO) closes.

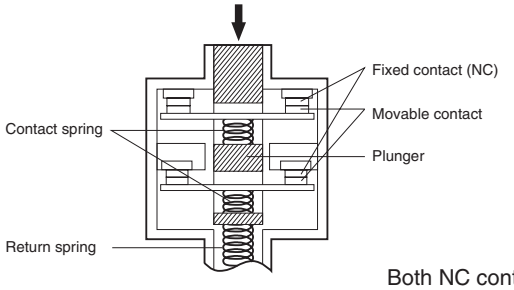
Direct Opening Mechanism

1NC/1NO Contact (Slow-action)



Only the NC contact side has a direct opening mechanism.
When metal deposition occurs, the contacts are separated from each other by the plunger being pushed in.
(Conforms to EN60947-5-1 Direct Opening Operation.)

2NC Contact (Slow-action)



Both NC contacts have a direct opening mechanism.
When metal deposition occurs, the contacts are separated from each other by the plunger being pushed in.
(Conforms to EN60947-5-1 Direct Opening Operation.)

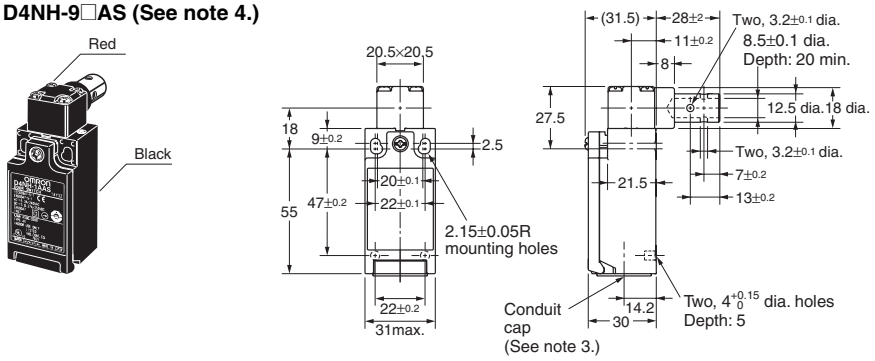
Dimensions

Switches

Note: All units are in millimeters unless otherwise indicated.

Shaft Type with 1 Conduit

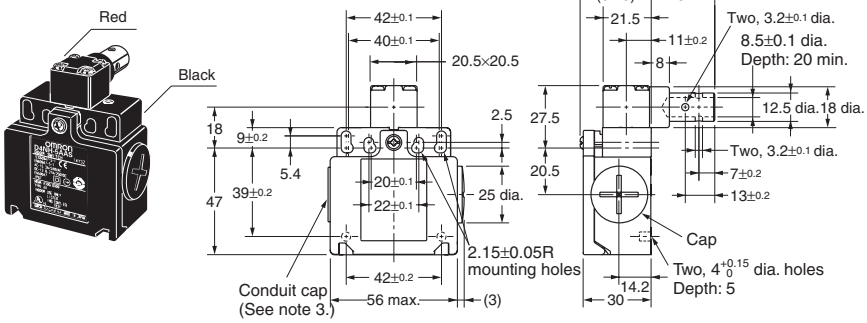
D4NH-1□AS D4NH-2□AS
D4NH-3□AS D4NH-4□AS
D4NH-9□AS (See note 4.)



OF max.	0.15 N·m
PT 1 (NC) **PT 2 (NO)**	(7°) (MBB: 10°) (19°) (MBB: 5°)
DOT min. **DOF min.**	18° 1 N·m

Shaft Type with 2 Conduits

D4NH-5□AS D4NH-6□AS
D4NH-7□AS D4NH-8□AS

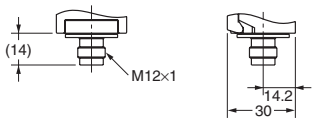


OF max.	0.15 N·m
PT 1 (NC) **PT 2 (NO)**	(7°) (MBB: 10°) (19°) (MBB: 5°)
DOT min. **DOF min.**	18° 1 N·m

Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
3. There are a minimum of five turns of the screw thread for a Pg13.5 conduit opening and four turns minimum for a G 1/2 conduit opening.
4. Refer to the following diagram for details on M12 connectors.

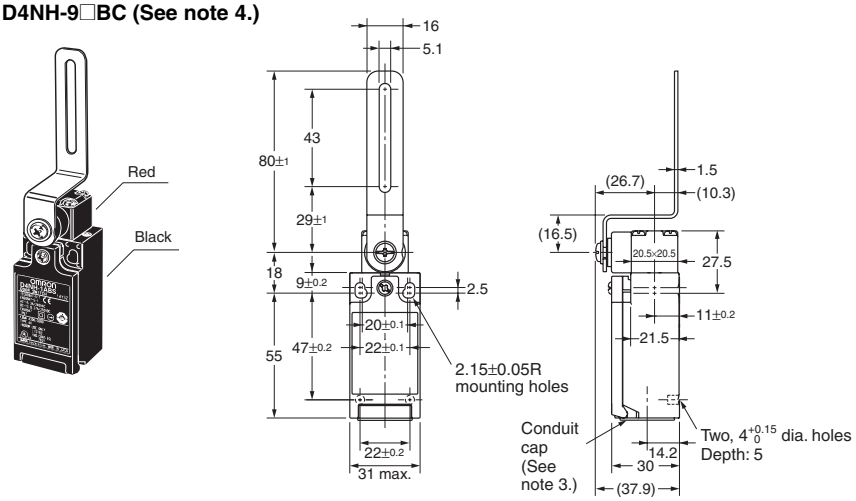
1-conduit M12 Connector

D4NH-9□□□



Arm Lever Type with 1 Conduit

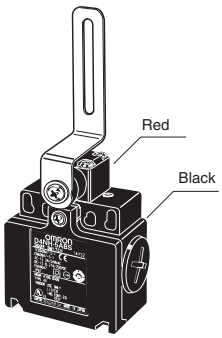
D4NH-1□BC D4NH-2□BC
D4NH-3□BC D4NH-4□BC
D4NH-9□BC (See note 4.)

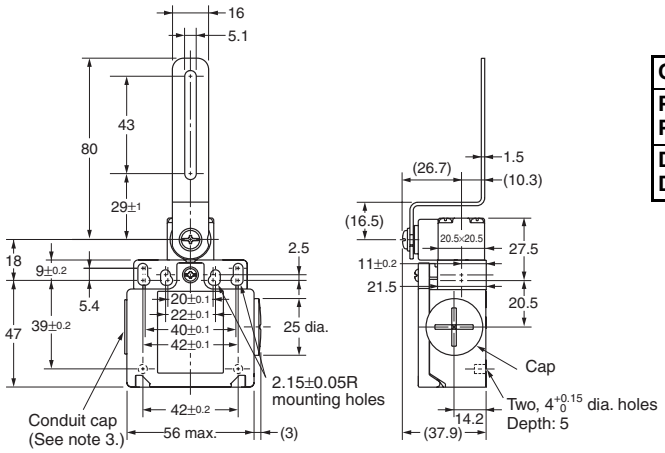


OF max.	0.15 N·m
PT 1 (NC) **PT 2 (NO)**	(7°) (MBB: 10°) (19°) (MBB: 5°)
DOT min. **DOF min.**	18° 1 N·m

Arm Lever Type with 2 Conduits

D4NH-5□BC D4NH-6□BC
D4NH-7□BC D4NH-8□BC



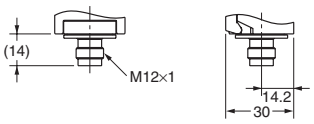


OF max.	0.15 N·m
PT 1 (NC) **PT 2 (NO)**	(7°) (MBB: 10°) (19°) (MBB: 5°)
DOT min. **DOF min.**	18° 1 N·m

Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
3. There are a minimum of five turns of the screw thread for a Pg13.5 conduit opening and four turns minimum for a G 1/2 conduit opening.
4. Refer to the following diagram for details on M12 connectors.

1-conduit M12 Connector

D4NH-9□□□

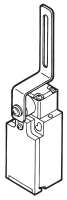


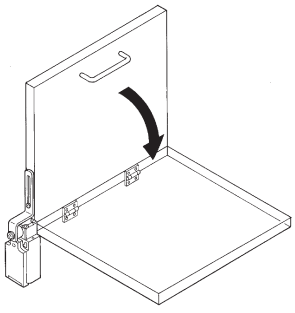
Application Examples of Arm Lever Use

Note: Be sure to evaluate the Switch under actual working conditions after installation.

When Installing at the Center

The arm lever is set for center installation at the time of shipment.

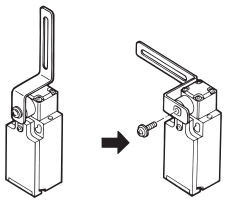


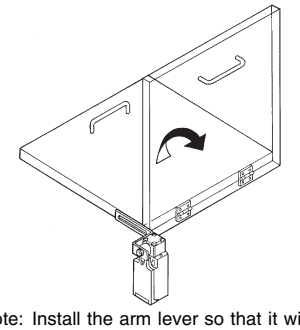


Note: Install the arm lever so that it will not rotate more than 90°.

When Installing to the Left

Remove the screw and arm lever, position the arm lever to the left, and then secure it with the screw.

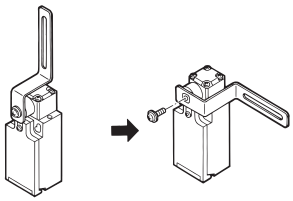


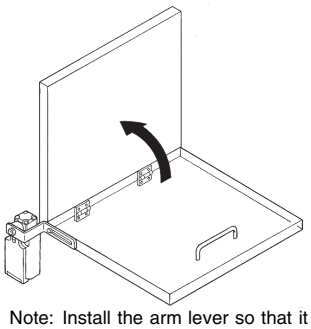


Note: Install the arm lever so that it will not rotate more than 180°.

When Installing to the Right

Remove the screw and arm lever, position the arm lever to the right, and then secure it with the screw.





Note: Install the arm lever so that it will not rotate more than 180°.

Safety Precautions

Refer to *OMRON SAFETY COMPONENTS SERIES (Y106)* for common precautions for Switches and Safety Limit Switches.

⚠ CAUTION

Do not use metal connectors or metal conduits with this Switch. Doing so may occasionally result in electric shock.

Precautions for Safe Use

- Do not drop the Switch. Doing so may result in the Switch not performing to its full capacity.
- Do not attempt to disassemble or modify the Switch. Doing so may cause the Switch to malfunction.
- Do not use the Switch where explosive gas, flammable gas, or any other hazardous gas may be present.
- Install the Switch in a location away from close body contact. Not doing so may result in malfunction.
- 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 interior. (The IP67 degree of protection specification for the Switch refers to water penetration while the Switch is submersed in water for a specified period of time.)
- Protect the head from foreign material. Subjecting the head to foreign material may result in premature wear or damage to the Switch. Although the switch body is protected from penetration by dust or water, the head is not protected from penetration by minute particles or water.
- Turn the power OFF before wiring. Doing so may result in electric shock.
- Install a cover after wiring. Not doing so may result in electric shock.
- Connect a fuse to the Switch in series to protect the Switch from short-circuit damage. Use a fuse with a breaking current 1.5 to 2 times larger than the rated current. To conform to EN ratings, use an IEC60269-compliant 10-A fuse type gI or gG.
- Do not switch circuits for two or more standard loads (250 VAC, 3 A) at the same time. Doing so may adversely affect insulation performance.
- The durability of the Switch is greatly affected by operating conditions. Evaluate the Switch under actual working conditions before permanent installation and use within a number of switching operations that will not adversely affect the Switch's performance.
- Be sure to indicate in the machine manufacturer's instruction manual that the user must not attempt to repair or maintain the Switch and must contact the machine manufacturer for any repairs or maintenance.
- If the Switch is to be used in an emergency stop circuit or in a safety circuit for preventing accidents resulting in injuries or deaths, use a model that has an NC contact equipped with a direct opening mechanism and make sure that the Switch operates in the direct opening mode.

Precautions for Correct Use

Environment

- The Switch is intended for indoor use only.
- Do not use the Switch outdoors. Doing so may cause the Switch to malfunction.
- Do not use the Switch where hazardous gases (e.g., H_2S, SO_2, NH_3, HNO_3, Cl_2) are present or in locations subject to high temperature and humidity. Doing so may result in damage to the Switch caused by contact failure or corrosion.
- Do not use the Switch under any of the following conditions.
  - Locations subject to extreme temperature changes.
  - Locations where high humidity or condensation may occur.
  - Locations subject to excessive vibration.
  - Locations where metal dust, processing waste, oil, or chemicals may penetrate through the protective door.
  - Locations subject to detergents, thinner, or other solvents.

Mounting Method

Mounting Screw Tightening Torque

Tighten each of the screws to the specified torque. Loose screws may result in malfunction of the Switch within a short time.

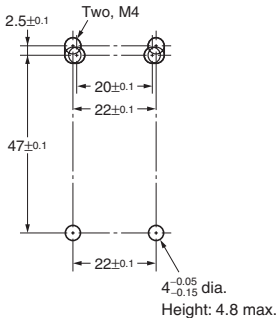
Terminal screw	0.6 to 0.8 N·m
Cover clamping screw	0.5 to 0.7 N·m
Head clamping screw	0.5 to 0.6 N·m
Arm lever clamping screw	1.6 to 1.8 N·m
Body clamping screw	0.5 to 0.7 N·m
Conduit mounting connection, M12 adaptor	1.8 to 2.2 N·m
	1.4 to 1.8 N·m (1/2-14NPT)
Cap screw	1.3 to 1.7 N·m

Switch Mounting

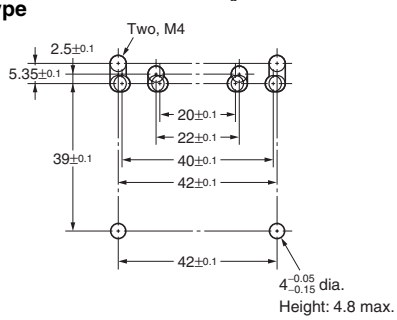
- Mount the Switch using M4 screws and washers and tighten the screws to the specified torque.
- For safety, use screws that cannot be easily removed, or use an equivalent measure to ensure that the Switch is secure.
- Secure the Switch with two M4 bolts and washers. Provide studs with a diameter of $4^{-0.05}_{-0.15}$ and a height of 4.8 mm max. at two places, inserting into the holes at the bottom of the Switch as shown below so that the Switch is firmly fixed at four points.

Switch Mounting Holes

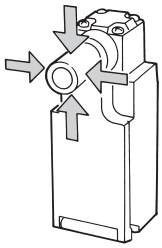
One-conduit Type



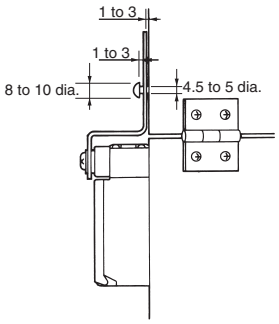
Two-conduit Type



- Mount the shaft or arm lever securely with a one-way screw, or an equivalent so that the shaft or arm lever cannot be easily removed.
- Align the rotational center of the shaft with the door, so that the switch shaft and head will not be subjected to mechanical stress when the door opens or closes.
  Do not impose a force of 50 N or more on the shaft.



Be sure that the arm lever and door are mounted as shown in the following diagram so that the arm lever and head are not subjected to mechanical stress when the door opens or closes.



Changing the Head Direction

By removing the four screws of the head, the mounting direction of the head can be changed. The head can be mounted in four directions. Be sure that no foreign material will enter the head during a change in direction.

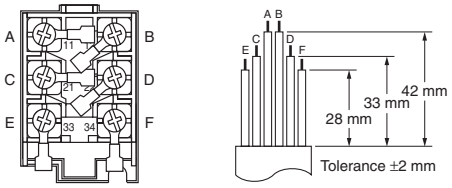
Arm Lever Mounting Position

The arm lever is mounted upwards in the center position before shipping. To change the position, loosen the arm lever mounting screw, dismount the arm lever, and mount the arm lever in the left or right position.

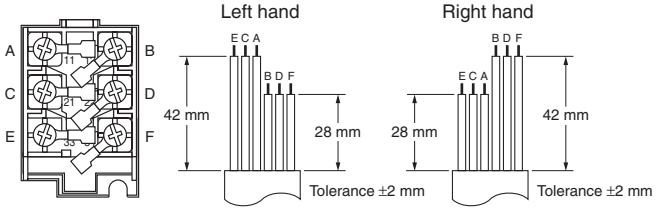
Wiring

- When connecting to the terminals via insulating tube and M3.5 crimp terminals, arrange the crimp terminals as shown below 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^2).
  Use lead wires of an appropriate length, as shown below. Not doing so may result in excess length causing the cover to rise and not fit properly.

One-conduit Type (3 Poles)



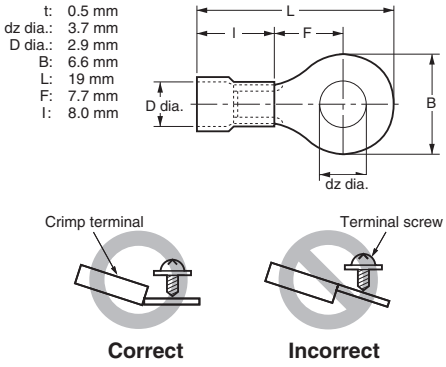
Two-conduit Type (3 Poles)



- Do not push crimp terminals into gaps in the case interior. Doing so may cause damage or deformation of the case.
- Use crimp terminals not more than 0.5 mm in thickness. Otherwise, they will interfere with other components inside the case. The crimp terminals shown below are not more than 0.5 mm thick.

Manufacture	Type	Wire size
J.S.T.	FV0.5-3.7 (F type) V0.5-3.7 (straight type)	AWG20 (0.5 mm^2)

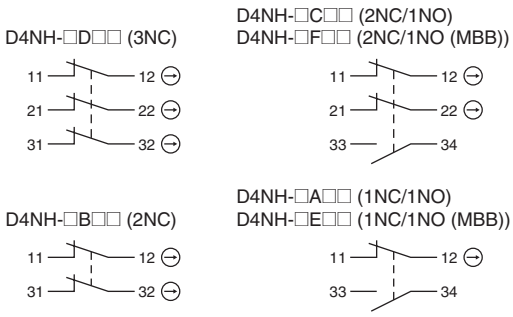
J.S.T is a Japanese manufacturer.



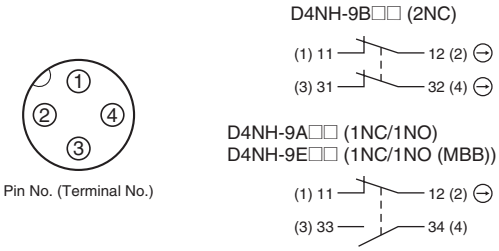
Contact Arrangement

- The following diagrams show the contact arrangements used for screw terminal types and connector types.

Screw Terminal Type



Connector Type



- Applicable socket: XS2F (OMRON).
- Refer to the G010 *Connector Catalog* for details on socket pin numbers and lead wire colors.

Socket Tightening (Connector Type)

- Turn the socket connector screws by hand and tighten until no space remains between the socket and the plug.
- Make sure that the socket connector is tightened securely. Otherwise, the rated degree of protection (IP67) may not be maintained and vibration may loosen the socket connector.

Conduit Opening

- Connect a recommended connector to the opening of the conduit and tighten the connector to the specified torque. The case may be damaged if an excessive tightening torque is applied.
- When using 1/2-14NPT, wind sealing tape around the joint between the connector and conduit opening so that the enclosure will conform to IP67.
- Use a cable with a suitable diameter for the connector.
- Attach and tighten a conduit cap to the unused conduit opening when wiring. Tighten the conduit cap to the specified torque. The conduit cap is provided with the Switch (2-conduit types).

Recommended Connectors

Use connectors with screws not exceeding 9 mm, otherwise the screws will protrude into the case interior, interfering with other components in the case. The connectors listed in the following table have connectors with thread sections not exceeding 9 mm. Use the recommended 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 Denki	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
1/2-14NPT	LAPP	ST-NPT1/2 5301-6030	6.0 to 12.0 mm
M12	LAPP	ST-M12 × 1.5 5311-1000	3.5 to 7.0 mm

Use LAPP connectors together with seal packing (JPK-16, GP-13.5, GPM20, or GPM12), and tighten to the specified tightening torque. Seal packing is sold separately.

LAPP is a German manufacturer. Ohm Denki is a Japanese manufacturer.

Before using an M12 type, attaching the provided changing adaptor to the Switch and then connect the recommended connector.

Before using a 2-conduit 1/2-14NPT type, attach the provided changing adaptor to the Switch and then connect the recommended connector.

Storage

Do not store the Switch in locations where hazardous gases (e.g., H_2S, SO_2, NH_3, HNO_3, Cl_2) or dust is present, or in locations subject to high temperatures and humidity.

Others

- Do not allow the load current to exceed the rated value.
- Confirm that the seal rubber has no defects before use. If the seal rubber is displaced or raised, or has foreign particles adhered to it, the sealing capability of the seal rubber will be adversely affected.
- Use the correct cover mounting screws only, or the sealing capability of the seal rubber will deteriorate.
- Inspect the Switch regularly.
- Use the following recommended countermeasures to prevent telegraphing when using adjustable or long levers.

1. Make the rear edge of the dog smooth with an angle of 15° to 30° or make it in the shape of a quadratic curve.
2. Design the circuit so that no error signal will be generated.
3. Use or set a Switch that is operated in one direction only.

Production Termination

Following the release of the D4NH, production of the D4DH will be terminated.

Date of Production Termination

Production of the D4DH Series will be terminated in March 2006.

Product Replacement

1. Dimensions
   The D4DH and D4NH use the same mounting method, and mounting hole. The multi-contact structure and the extra 4 mm in length, however, are different.
2. Terminal Numbers
   For the 2-contact model, the terminals 21, 22, 23, and 24 on the D4DH are 31, 32, 33, and 34 on the D4NH.
3. Recommended Terminals
   If the recommended terminals are not used, the Switch may not be compatible. Make sure that the Switch is compatible with the terminals.

Comparison of the D4DH and Substitute Products

Model	D4NH
Switch color	Very similar
Dimensions	Very similar
Wiring/connection	Significantly different
Mounting method	Completely compatible
Ratings/performance	Very similar
Operating characteristics	Very similar
Operating method	Completely compatible

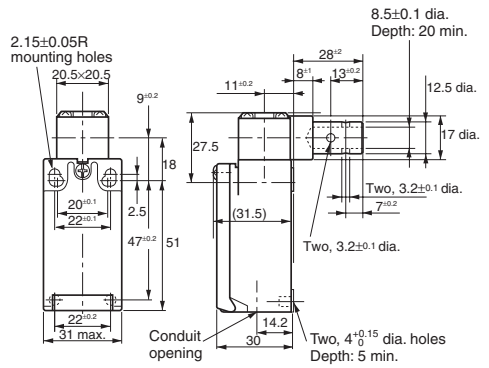
List of Recommended Substitute Products

Using M screws is recommended to comply with European standards. Therefore, the M20 conduit model is recommended for use in new designs.

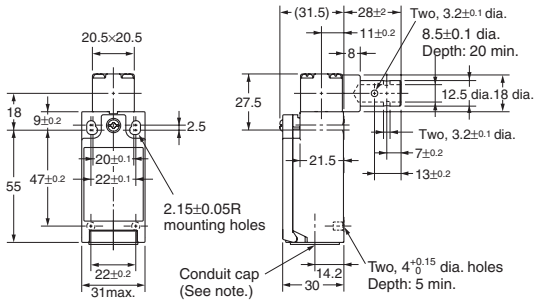
D4DH product to be discontinued	Recommended substitute product	D4DH product to be discontinued	Recommended substitute product
D4DH-15AS	D4NH-1AAS	D4DH-1AAS	D4NH-1BAS
D4DH-25AS	D4NH-2AAS	D4DH-2AAS	D4NH-2BAS
D4DH-35AS	D4NH-3AAS	D4DH-3AAS	D4NH-3BAS
D4DH-55AS	D4NH-5AAS	D4DH-5AAS	D4NH-5BAS
D4DH-65AS	D4NH-6AAS	D4DH-6AAS	D4NH-6BAS
D4DH-15BC	D4NH-1ABC	D4DH-1ABC	D4NH-1BBC
D4DH-25BC	D4NH-2ABC	D4DH-2ABC	D4NH-2BBC
D4DH-35BC	D4NH-3ABC	D4DH-3ABC	D4NH-3BBC
D4DH-55BC	D4NH-5ABC	D4DH-5ABC	D4NH-5BBC
D4DH-65BC	D4NH-6ABC	D4DH-6ABC	D4NH-6BBC

Dimensions (Unit: mm)

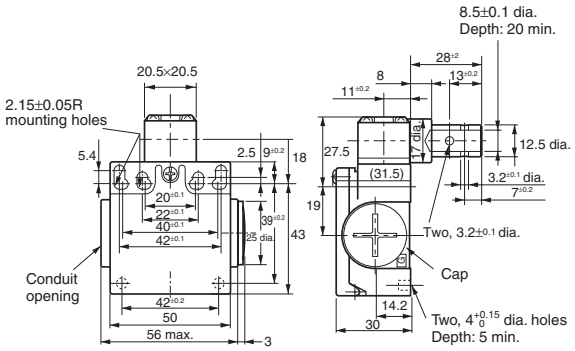
Discontinued Models (1-conduit D4DH)



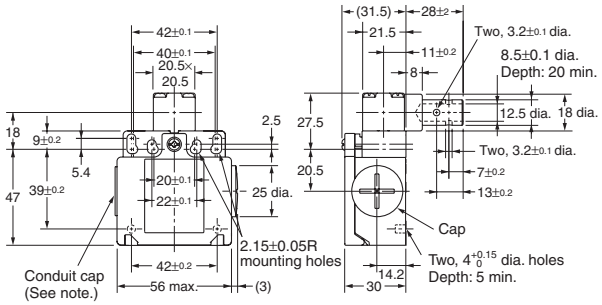
Replacement Products (1-conduit D4NH)



Discontinued Models (2-conduit D4DH)



Replacement Products (2-conduit D4NH)



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

Cat. No. C131-E2-01A-X In the interest of product improvement, specifications are subject to change without notice.

Miniature Safety Limit Switch

D4N

Safety Limit Switches compatible to the Popular D4D, Providing a Full Lineup Conforming to International Standards

- Lineup includes three contact models with 2NC/1NO and 3NC in addition to the 1NC/1NO, and 2NC contact models. Models with MBB contacts are available too.
- M12-connector models are available, saving on labor and simplifying maintenance.
- Standardized gold-clad contacts provide high contact reliability.
  Can be used with both standard loads and microloads.
- Free of lead, cadmium, and hexavalent chrome, reducing the burden on the environment.
- Conforms to EN115 and EN81-1.
- Lineup includes both slow-action and snap-action models with Zb contacts.

Be sure to read the *Safety Precautions* on page G-237.

Note: Contact your sales representative for details on models with safety standard certification.

Model Number Structure

Model Number Legend

D4N-□□□□
1 2 3

1. Conduit/Connector size
- 1: Pg13.5 (1-conduit)
- 2: G1/2 (1-conduit)
- 3: 1/2-14NPT (1-conduit)
- 4: M20 (1-conduit)
- 5: Pg13.5 (2-conduit)
- 6: G1/2 (2-conduit)
- 7: 1/2-14NPT (2-conduit)
- 8: M20 (2-conduit)
- 9: M12 connector (1-conduit)

2. Built-in Switch
- 1: 1NC/1NO (snap-action)
- 2: 2NC (snap-action)
- A: 1NC/1NO (slow-action)
- B: 2NC (slow-action)
- C: 2NC/1NO (slow-action)
- D: 3NC (slow-action)
- E: 1NC/1NO (MBB contact-/-slow-action)
- F: 2NC/1NO (MBB contact-/-slow-action)

3. Head and Actuator
- 20: Roller lever (resin lever, resin roller)
- 22: Roller lever (metal lever, resin roller)
- 25: Roller lever (metal lever, metal roller)
- 26: Roller lever (metal lever, bearing roller)
- 2G: Adjustable roller lever, form lock (metal lever, resin roller)
- 2H: Adjustable roller lever, form lock (metal lever, rubber roller)
- 31: Top plunger
- 32: Top roller plunger
- 62: One-way roller arm lever (horizontal)
- 72: One-way roller arm lever (vertical)
- 80: Cat whisker
- 87: Plastic rod
- RE: Fork lever lock (right operation)
- LE: Fork lever lock (left operation)

Ordering Information

List of Models

Switches with Two Contacts

Actuator	Conduit size		Built-in switch mechanism							
			1NC/1NO (Snap-action)		2NC (Snap-action)		1NC/1NO (Slow-action)		2NC (Slow-action)	
			Direct opening	Model	Direct opening	Model	Direct opening	Model	Direct opening	Model
Roller lever (resin lever, resin roller) 	1-conduit	Pg13.5	⊖	D4N-1120	⊖	D4N-1220	⊖	D4N-1A20	⊖	D4N-1B20
		G1/2		D4N-2120		D4N-2220		D4N-2A20		D4N-2B20
		1/2-14NPT		D4N-3120		D4N-3220		D4N-3A20		D4N-3B20
		M20		D4N-4120		D4N-4220		D4N-4A20		D4N-4B20
		M12 connector		D4N-9120		D4N-9220		D4N-9A20		D4N-9B20
	2-conduit	Pg13.5	⊖	D4N-5120	⊖	D4N-5220	⊖	D4N-5A20	⊖	D4N-5B20
		G1/2		D4N-6120		D4N-6220		D4N-6A20		D4N-6B20
		M20		D4N-8120		D4N-8220		D4N-8A20		D4N-8B20
Roller lever (metal lever, resin roller) 	1-conduit	Pg13.5	⊖	D4N-1122	⊖	D4N-1222	⊖	D4N-1A22	⊖	D4N-1B22
		G1/2		D4N-2122		D4N-2222		D4N-2A22		D4N-2B22
		1/2-14NPT		D4N-3122		D4N-3222		D4N-3A22		D4N-3B22
		M20		D4N-4122		D4N-4222		D4N-4A22		D4N-4B22
		M12 connector		D4N-9122		D4N-9222		D4N-9A22		D4N-9B22
	2-conduit	Pg13.5	⊖	D4N-5122	⊖	D4N-5222	⊖	D4N-5A22	⊖	D4N-5B22
		G1/2		D4N-6122		D4N-6222		D4N-6A22		D4N-6B22
		M20		D4N-8122		D4N-8222		D4N-8A22		D4N-8B22
Roller lever (metal lever, metal roller) 	1-conduit	Pg13.5	⊖	D4N-1125	⊖	D4N-1225	⊖	D4N-1A25	⊖	D4N-1B25
		G1/2		D4N-2125		D4N-2225		D4N-2A25		D4N-2B25
		1/2-14NPT		D4N-3125		D4N-3225		D4N-3A25		D4N-3B25
		M20		D4N-4125		D4N-4225		D4N-4A25		D4N-4B25
		M12 connector		D4N-9125		D4N-9225		D4N-9A25		D4N-9B25
Roller lever (metal lever, bearing roller) 	1-conduit	Pg13.5	⊖	D4N-1126	⊖	D4N-1226	⊖	D4N-1A26	⊖	D4N-1B26
		G1/2		D4N-2126		D4N-2226		D4N-2A26		D4N-2B26
		1/2-14NPT		D4N-3126		D4N-3226		D4N-3A26		D4N-3B26
		M20		D4N-4126		D4N-4226		D4N-4A26		D4N-4B26
		M12 connector		D4N-9126		D4N-9226		D4N-9A26		D4N-9B26
Plunger 	1-conduit	Pg13.5	⊖	D4N-1131	⊖	D4N-1231	⊖	D4N-1A31	⊖	D4N-1B31
		G1/2		D4N-2131		D4N-2231		D4N-2A31		D4N-2B31
		1/2-14NPT		D4N-3131		D4N-3231		D4N-3A31		D4N-3B31
		M20		D4N-4131		D4N-4231		D4N-4A31		D4N-4B31
		M12 connector		D4N-9131		D4N-9231		D4N-9A31		D4N-9B31
	2-conduit	Pg13.5	⊖	D4N-5131	⊖	D4N-5231	⊖	D4N-5A31	⊖	D4N-5B31
		G1/2		D4N-6131		D4N-6231		D4N-6A31		D4N-6B31
		M20		D4N-8131		D4N-8231		D4N-8A31		D4N-8B31
Roller plunger 	1-conduit	Pg13.5	⊖	D4N-1132	⊖	D4N-1232	⊖	D4N-1A32	⊖	D4N-1B32
		G1/2		D4N-2132		D4N-2232		D4N-2A32		D4N-2B32
		1/2-14NPT		D4N-3132		D4N-3232		D4N-3A32		D4N-3B32
		M20		D4N-4132		D4N-4232		D4N-4A32		D4N-4B32
		M12 connector		D4N-9132		D4N-9232		D4N-9A32		D4N-9B32
	2-conduit	Pg13.5	⊖	D4N-5132	⊖	D4N-5232	⊖	D4N-5A32	⊖	D4N-5B32
		G1/2		D4N-6132		D4N-6232		D4N-6A32		D4N-6B32
		M20		D4N-8132		D4N-8232		D4N-8A32		D4N-8B32
One-way roller arm lever (horizontal) 	1-conduit	Pg13.5	⊖	D4N-1162	⊖	D4N-1262	⊖	D4N-1A62	⊖	D4N-1B62
		G1/2		D4N-2162		D4N-2262		D4N-2A62		D4N-2B62
		1/2-14NPT		D4N-3162		D4N-3262		D4N-3A62		D4N-3B62
		M20		D4N-4162		D4N-4262		D4N-4A62		D4N-4B62
		M12 connector		D4N-9162		D4N-9262		D4N-9A62		D4N-9B62
	2-conduit	Pg13.5	⊖	D4N-5162	⊖	D4N-5262	⊖	D4N-5A62	⊖	D4N-5B62
		G1/2		D4N-6162		D4N-6262		D4N-6A62		D4N-6B62
		M20		D4N-8162		D4N-8262		D4N-8A62		D4N-8B62

Prefered types

Actuator	Conduit size		Built-in switch mechanism							
			1NC/1NO (Snap-action)		2NC (Snap-action)		1NC/1NO (Slow-action)		2NC (Slow-action)	
			Direct opening	Model	Direct opening	Model	Direct opening	Model	Direct opening	Model
One-way roller arm lever (vertical) 	1-conduit	Pg13.5	⊖	D4N-1172	⊖	D4N-1272	⊖	D4N-1A72	⊖	D4N-1B72
		G1/2		D4N-2172		D4N-2272		D4N-2A72		D4N-2B72
		1/2-14NPT		D4N-3172		D4N-3272		D4N-3A72		D4N-3B72
		M20		D4N-4172		D4N-4272		D4N-4A72		D4N-4B72
		M12 connector		D4N-9172		D4N-9272		D4N-9A72		D4N-9B72
	2-conduit	Pg13.5	⊖	D4N-5172	⊖	D4N-5272	⊖	D4N-5A72	⊖	D4N-5B72
		G1/2		D4N-6172		D4N-6272		D4N-6A72		D4N-6B72
		M20		D4N-8172		D4N-8272		D4N-8A72		D4N-8B72
Adjustable roller lever, form lock (metal lever, resin roller) 	1-conduit	Pg13.5	⊖	D4N-112G	⊖	D4N-122G	⊖	D4N-1A2G	⊖	D4N-1B2G
		G1/2		D4N-212G		D4N-222G		D4N-2A2G		D4N-2B2G
		1/2-14NPT		D4N-312G		D4N-322G		D4N-3A2G		D4N-3B2G
		M20		D4N-412G		D4N-422G		D4N-4A2G		D4N-4B2G
		M12 connector		D4N-912G		D4N-922G		D4N-9A2G		D4N-9B2G
	2-conduit	G1/2	⊖	D4N-612G	⊖	D4N-622G	⊖	D4N-6A2G	⊖	D4N-6B2G
		M20		D4N-812G		D4N-822G		D4N-8A2G		D4N-8B2G
Adjustable roller lever, form lock (metal lever, rubber roller) 	1-conduit	Pg13.5	⊖	D4N-112H	⊖	D4N-122H	⊖	D4N-1A2H	⊖	D4N-1B2H
		G1/2		D4N-212H		D4N-222H		D4N-2A2H		D4N-2B2H
		1/2-14NPT		D4N-312H		D4N-322H		D4N-3A2H		D4N-3B2H
		M20		D4N-412H		D4N-422H		D4N-4A2H		D4N-4B2H
		M12 connector		D4N-912H		D4N-922H		D4N-9A2H		D4N-9B2H
	2-conduit	G1/2	⊖	D4N-612H	⊖	D4N-622H	⊖	D4N-6A2H	⊖	D4N-6B2H
		M20		D4N-812H		D4N-822H		D4N-8A2H		D4N-8B2H

Prefered types

Note: It is recommended that M20 be used for Switches to be exported to Europe and 1/2-14NPT be used for Switches to be exported to North American countries.

Switches with Three Contacts and MBB Contacts

Actuator	Conduit size		Built-in switch mechanism							
			2NC/1NO (Snap-action)		3NC (Snap-action)		1NC/1NO MBB (Slow-action)		2NC/1NO MBB (Slow-action)	
			Direct opening	Model	Direct opening	Model	Direct opening	Model	Direct opening	Model
Roller lever (resin lever, resin roller) 	1-conduit	Pg13.5	⊖	D4N-1C20	⊖	D4N-1D20	⊖	D4N-1E20	⊖	D4N-1F20
		G1/2		D4N-2C20		D4N-2D20		D4N-2E20		D4N-2F20
		1/2-14NPT		D4N-3C20		D4N-3D20		D4N-3E20		D4N-3F20
		M20		D4N-4C20		D4N-4D20		D4N-4E20		D4N-4F20
		M12 connector		---		---		D4N-9E20		---
	2-conduit	Pg13.5	⊖	D4N-5C20	⊖	D4N-5D20	⊖	D4N-5E20	⊖	D4N-5F20
		G1/2		D4N-6C20		D4N-6D20		D4N-6E20		D4N-6F20
		M20		D4N-8C20		D4N-8D20		D4N-8E20		D4N-8F20
Roller lever (metal lever, resin roller) 	1-conduit	Pg13.5	⊖	D4N-1C22	⊖	D4N-1D22	⊖	D4N-1E22	⊖	D4N-1F22
		G1/2		D4N-2C22		D4N-2D22		D4N-2E22		D4N-2F22
		1/2-14NPT		D4N-3C22		D4N-3D22		D4N-3E22		D4N-3F22
		M20		D4N-4C22		D4N-4D22		D4N-4E22		D4N-4F22
		M12 connector		---		---		D4N-9E22		---
	2-conduit	Pg13.5	⊖	D4N-5C22	⊖	D4N-5D22	⊖	D4N-5E22	⊖	D4N-5F22
		G1/2		D4N-6C22		D4N-6D22		D4N-6E22		D4N-6F22
		M20		D4N-8C22		D4N-8D22		D4N-8E22		D4N-8F22
Roller lever (metal lever, metal roller) 	1-conduit	Pg13.5	⊖	D4N-1C25	⊖	D4N-1D25	⊖	D4N-1E25	⊖	D4N-1F25
		G1/2		D4N-2C25		D4N-2D25		D4N-2E25		D4N-2F25
		1/2-14NPT		D4N-3C25		D4N-3D25		D4N-3E25		D4N-3F25
		M20		D4N-4C25		D4N-4D25		D4N-4E25		D4N-4F25
		M12 connector		---		---		D4N-9E25		---

Prefered types

Actuator	Conduit size		Built-in switch mechanism							
			2NC/1NO (Snap-action)		3NC (Snap-action)		1NC/1NO MBB (Slow-action)		2NC/1NO MBB (Slow-action)	
			Direct opening	Model	Direct opening	Model	Direct opening	Model	Direct opening	Model
Roller lever (metal lever, bearing roller) 	1-conduit	Pg13.5	⊖	D4N-1C26	⊖	D4N-1D26	⊖	D4N-1E26	⊖	D4N-1F26
		G1/2		D4N-2C26		D4N-2D26		D4N-2E26		D4N-2F26
		1/2-14NPT		D4N-3C26		D4N-3D26		D4N-3E26		D4N-3F26
		M20		D4N-4C26		D4N-4D26		D4N-4E26		D4N-4F26
		M12 connector		---		---		D4N-9E26		---
Plunger 	1-conduit	Pg13.5	⊖	D4N-1C31	⊖	D4N-1D31	⊖	D4N-1E31	⊖	D4N-1F31
		G1/2		D4N-2C31		D4N-2D31		D4N-2E31		D4N-2F31
		1/2-14NPT		D4N-3C31		D4N-3D31		D4N-3E31		D4N-3F31
		M20		D4N-4C31		D4N-4D31		D4N-4E31		D4N-4F31
		M12 connector		---		---		D4N-9E31		---
	2-conduit	Pg13.5	⊖	D4N-5C31	⊖	D4N-5D31	⊖	D4N-5E31	⊖	D4N-5F31
		G1/2		D4N-6C31		D4N-6D31		D4N-6E31		D4N-6F31
		M20		D4N-8C31		D4N-8D31		D4N-8E31		D4N-8F31
Roller plunger 	1-conduit	Pg13.5	⊖	D4N-1C32	⊖	D4N-1D32	⊖	D4N-1E32	⊖	D4N-1F32
		G1/2		D4N-2C32		D4N-2D32		D4N-2E32		D4N-2F32
		1/2-14NPT		D4N-3C32		D4N-3D32		D4N-3E32		D4N-3F32
		M20		D4N-4C32		D4N-4D32		D4N-4E32		D4N-4F32
		M12 connector		---		---		D4N-9E32		---
	2-conduit	Pg13.5	⊖	D4N-5C32	⊖	D4N-5D32	⊖	D4N-5E32	⊖	D4N-5F32
		G1/2		D4N-6C32		D4N-6D32		D4N-6E32		D4N-6F32
		M20		D4N-8C32		D4N-8D32		D4N-8E32		D4N-8F32
One-way roller arm lever (horizontal) 	1-conduit	Pg13.5	⊖	D4N-1C62	⊖	D4N-1D62	⊖	D4N-1E62	⊖	D4N-1F62
		G1/2		D4N-2C62		D4N-2D62		D4N-2E62		D4N-2F62
		1/2-14NPT		D4N-3C62		D4N-3D62		D4N-3E62		D4N-3F62
		M20		D4N-4C62		D4N-4D62		D4N-4E62		D4N-4F62
		M12 connector		---		---		D4N-9E62		----
	2-conduit	Pg13.5	⊖	D4N-5C62	⊖	D4N-5D62	⊖	D4N-5E62	⊖	D4N-5F62
		G1/2		D4N-6C62		D4N-6D62		D4N-6E62		D4N-6F62
		M20		D4N-8C62		D4N-8D62		D4N-8E62		D4N-8F62
One-way roller arm lever (vertical) 	1-conduit	Pg13.5	⊖	D4N-1C72	⊖	D4N-1D72	⊖	D4N-1E72	⊖	D4N-1F72
		G1/2		D4N-2C72		D4N-2D72		D4N-2E72		D4N-2F72
		1/2-14NPT		D4N-3C72		D4N-3D72		D4N-3E72		D4N-3F72
		M20		D4N-4C72		D4N-4D72		D4N-4E72		D4N-4F72
		M12 connector		---		---		D4N-9E72		---
	2-conduit	Pg13.5	⊖	D4N-5C72	⊖	D4N-5D72	⊖	D4N-5E72	⊖	D4N-5F72
		G1/2		D4N-6C72		D4N-6D72		D4N-6E72		D4N-6F72
		M20		D4N-8C72		D4N-8D72		D4N-8E72		D4N-8F72
Adjustable roller lever, form lock (metal lever, resin roller) 	1-conduit	Pg13.5	⊖	D4N-1C2G	⊖	D4N-1D2G	⊖	D4N-1E2G	⊖	D4N-1F2G
		G1/2		D4N-2C2G		D4N-2D2G		D4N-2E2G		D4N-2F2G
		1/2-14NPT		D4N-3C2G		D4N-3D2G		D4N-3E2G		D4N-3F2G
		M20		D4N-4C2G		D4N-4D2G		D4N-4E2G		D4N-4F2G
		M12 connector		---		---		D4N-9E2G		---
	2-conduit	G1/2	⊖	D4N-6C2G	⊖	D4N-6D2G	⊖	D4N-6E2G	⊖	D4N-6F2G
		M20		D4N-8C2G		D4N-8D2G		D4N-8E2G		D4N-8F2G
Adjustable roller lever, form lock (metal lever, rubber roller) 	1-conduit	Pg13.5	⊖	D4N-1C2H	⊖	D4N-1D2H	⊖	D4N-1E2H	⊖	D4N-1F2H
		G1/2		D4N-2C2H		D4N-2D2H		D4N-2E2H		D4N-2F2H
		1/2-14NPT		D4N-3C2H		D4N-3D2H		D4N-3E2H		D4N-3F2H
		M20		D4N-4C2H		D4N-4D2H		D4N-4E2H		D4N-4F2H
		M12 connector		---		---		D4N-9E2H		---
	2-conduit	G1/2	⊖	D4N-6C2H	⊖	D4N-6D2H	⊖	D4N-6E2H	⊖	D4N-6F2H
		M20		D4N-8C2H		D4N-8D2H		D4N-8E2H		D4N-8F2H

Prefered types

Note: It is recommended that M20 be used for Switches to be exported to Europe and 1/2-14NPT be used for Switches to be exported to North American countries.

General-purpose Switches with Two Contacts

Actuator	Conduit size		Built-in switch mechanism							
			1NC/1NO (Snap-action)		2NC (Snap-action)		1NC/1NO (Slow-action)		2NC (Slow-action)	
			Direct opening	Model	Direct opening	Model	Direct opening	Model	Direct opening	Model
Fork lever lock (right operation) 	1-conduit	G1/2	---	---	---	---	---	D4N-2ARE	---	D4N-2BRE
		1/2-14NPT						D4N-3ARE		D4N-3BRE
		M20						D4N-4ARE		D4N-4BRE
	2-conduit	G1/2	---		---		---	D4N-6ARE	---	D4N-6BRE
		M20						D4N-8ARE		D4N-8BRE
Fork lever lock (left operation) 	1-conduit	G1/2	---		---		---	D4N-2ALE	---	D4N-2BLE
		1/2-14NPT						D4N-3ALE		D4N-3BLE
		M20						D4N-4ALE		D4N-4BLE
	2-conduit	G1/2	---		---		---	D4N-6ALE	---	D4N-6BLE
		M20						D4N-8ALE		D4N-8BLE
Cat whisker 	1-conduit	G1/2	---	D4N-2180	---	D4N-2280	---	---	---	D4N-2B80
		1/2-14NPT		D4N-3180		D4N-3280				D4N-3B80
		M20		D4N-4180		D4N-4280				D4N-4B80
	2-conduit	G1/2	---	D4N-6180	---	D4N-6280	---		---	D4N-6B80
		M20		D4N-8180		D4N-8280				D4N-8B80
Plastic rod 	1-conduit	G1/2	---	D4N-2187	---	D4N-2287	---		---	D4N-2B87
		1/2-14NPT		D4N-3187		D4N-3287				D4N-3B87
		M20		D4N-4187		D4N-4287				D4N-4B87
	2-conduit	G1/2	---	D4N-6187	---	D4N-6287	---		---	D4N-6B87
		M20		D4N-8187		D4N-8287				D4N-8B87

Prefered types

Note: 1. It is recommended that M20 be used for Switches to be exported to Europe and 1/2-14NPT be used for Switches to be exported to North American countries.

2. Mechanically speaking, these models are basic limit switches.

⚠ WARNING

Do not use general purpose switch models for applications that require form lock for safety reasons

General-purpose Switches with Three Contacts and MBB Contacts

Actuator	Conduit size		Built-in switch mechanism							
			Direct opening	2NC/1NO (Slow-action)	Direct opening	3NC (Slow-action)	Direct opening	1NC/1NO MBB (Slow-action)	Direct opening	2NC/1NO MBB (Slow-action)
Fork lever lock (right operation) 	1-conduit	G1/2	---	D4N-2CRE	---	D4N-2DRE	---	D4N-2ERE	---	D4N-2FRE
		1/2-14NPT		D4N-3CRE		D4N-3DRE		D4N-3ERE		D4N-3FRE
		M20		D4N-4CRE		D4N-4DRE		D4N-4ERE		D4N-4FRE
	2-conduit	G1/2	---	D4N-6CRE	---	D4N-6DRE	---	D4N-6ERE	---	D4N-6FRE
		M20		D4N-8CRE		D4N-8DRE		D4N-8ERE		D4N-8FRE
Fork lever lock (left operation) 	1-conduit	G1/2	---	D4N-2CLE	---	D4N-2DLE	---	D4N-2ELE	---	D4N-2FLE
		1/2-14NPT		D4N-3CLE		D4N-3DLE		D4N-3ELE		D4N-3FLE
		M20		D4N-4CLE		D4N-4DLE		D4N-4ELE		D4N-4FLE
	2-conduit	G1/2	---	D4N-6CLE	---	D4N-6DLE	---	D4N-6ELE	---	D4N-6FLE
		M20		D4N-8CLE		D4N-8DLE		D4N-8ELE		D4N-8FLE
Cat whisker 	1-conduit	G1/2	---	---	---	D4N-2D80	---	---	---	---
		1/2-14NPT				D4N-3D80				
		M20				D4N-4D80				
	2-conduit	G1/2	---		---	D4N-6D80	---		---	
		M20				D4N-8D80				
Plastic rod 	1-conduit	G1/2	---		---	D4N-2D87	---		---	
		1/2-14NPT				D4N-3D87				
		M20				D4N-4D87				
	2-conduit	G1/2	---		---	D4N-6D87	---		---	
		M20				D4N-8D87				

Note: 1. It is recommended that M20 be used for Switches to be exported to Europe and 1/2-14NPT be used for Switches to be exported to North American countries.

2. Mechanically speaking, these models are basic limit switches.

⚠ WARNING

Do not use general purpose switch models for applications that require form lock for safety reasons

Specifications

Standards and EC Directives

- Conforms to the following EC Directives:
  Machinery Directive
  Low Voltage Directive
  EN50047
  EN1088 (slow-action models only)
  GS-ET-15

Approved Standards

Agency	Standard	File No.
TÜV Product Service	EN60947-5-1 (approved direct opening)	B03 11 39656 061
UL (See note.)	UL508, CSA C22.2 No.14	E76675

Note: Approval for CSA C22.2 No. 14 is authorized by the UL mark.

CCC (China Compulsory Certification) Mark

Agency	Standard	File No.
CQC	GB14048.5	Under application

Approved Standard Ratings

TÜV (EN60947-5-1)

Item / Utilization category	AC-15	DC-13
Rated operating current (I_e)	3 A	0.27 A
Rated operating voltage (U_e)	240 V	250 V

Note: Use a 10-A fuse type gI or gG that conforms to IEC269 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		Volt-amperes	
		Make	Break	Make	Break
120 VAC	10 A	60 A	6 A	7,200 VA	720 VA
240 VAC		30 A	3 A		

Q300

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

Characteristics

Degree of protection (See note 3.)		IP67 (EN60947-5-1)
Durability (See note 4.)	**Mechanical**	15,000,000 operations min. (See note 7.)
	Electrical	500,000 operations min. for a resistive load of 3 A at 250 VAC (See note 5.) 300,000 operations min. for a resistive load of 10 A at 250 VAC
Operating speed		1 mm/s to 0.5 m/s (D4-1120)
Operating frequency		30 operations/minute max.
Contact resistance		25 mΩ max.
Minimum applicable load (See note 6.)		Resistive load of 1 mA at 5 VDC (N-level reference value)
Rated insulation voltage (U_i)		300 V
Protection against electric shock		Class II (double insulation)
Pollution degree (operating environment)		Level 3 (EN60947-5-1)
Impulse withstand voltage (EN60947-5-1)		Between terminals of the same polarity: 2.5 kV
		Between terminals of different polarities: 4 kV
		Between other terminals and uncharged metallic parts : 6 kV
Insulation resistance		100 MΩ min.
Contact gap		Snap-action: 2 x 0.5 mm min Slow-action: 2 x 2 mm min
Vibration resistance	**Malfunction**	10 to 55 Hz, 0.75-mm single amplitude
Shock resistance	**Destruction**	1,000 m/s^2 min.
	Malfunction	300 m/s^2 min.
Conditional short-circuit current		100 A (EN60947-5-1)
Rated open thermal current (I_{th})		10 A (EN60947-5-1)
Ambient temperature		Operating: −30°C to 70°C with no icing
Ambient humidity		Operating: 95% max.
Weight		Approx. 82 g (D4N-1120) Approx. 99 g (D4N-5120)

Note: 1. The above values are initial values.

2. Once a contact has been used to switch a standard load, it cannot be used for a load of a smaller capacity. Doing so may result in roughening of the contact surface and contact reliability may be lost.

3. 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 D4N in places where foreign material such as dust, dirt, oil, water, or chemicals may penetrate through the head. Otherwise, premature wear, Switch damage or malfunctioning may occur.

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

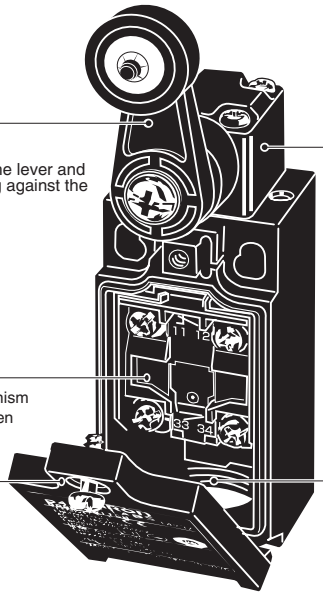
5. If the ambient temperature is greater than 35°C, do not pass the 3-A, 250-VAC load through more than 2 circuits.

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

7. The mechanical durability of fork lever lock models is 10,000,000 operations min.

Structure, Names, and Functions

Structure



Safety-oriented Lever Setting (Form-lock construction)
Grooves which engage the lever are cut in the lever and rotary shaft to prevent the lever from slipping against the rotary shaft.
There are resin-lever and metal-lever types.

Head
The direction of the switch head can be varied to any of the four directions. (Roller plunger models can be mounted in either of two directions at a 90° angle.)

Built-in Switch
The built-in switch has a direct opening mechanism that forcibly separates the NC contact even when there is contact deposit.

Cover
The cover, with a hinge on its lower part, can be opened by removing the screw of the cover, which ensures ease of maintenance and wiring.

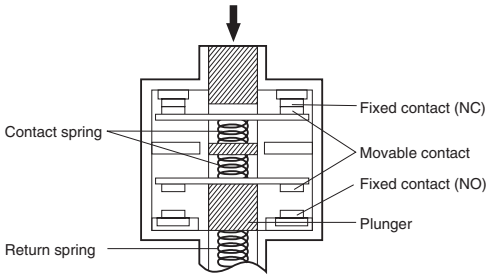
Conduit Opening
A wide variety of conduits is available.

Size	1-conduit	2-conduit
Pg13.5	Yes	Yes
G1/2	Yes	Yes
1/2-14NPT	Yes	Yes
M20	Yes	Yes
M12 connector	Yes	---

Note: M12 connector types are not available for Switches with three contacts.

Direct Opening Mechanism

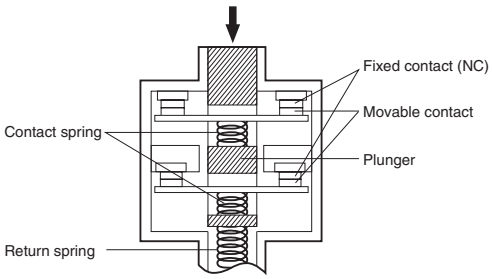
1NC/1NO Contact (Slow-action)



Conforms to EN60947-5-1 Direct Opening Operation ⊖

(Only the NC contact side has a direct opening mechanism.)
When metal deposition occurs, the contacts are separated from each other by the plunger being pushed in.

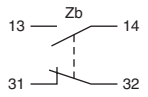
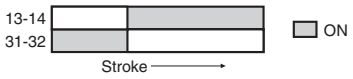
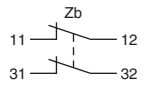
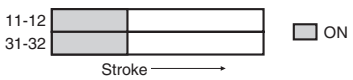
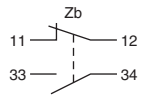
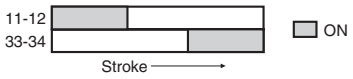
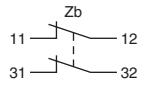
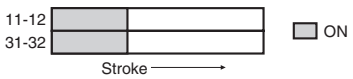
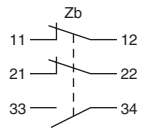
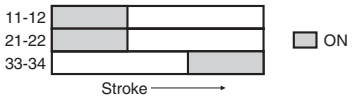
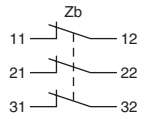
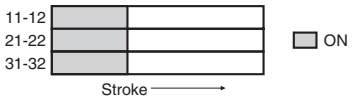
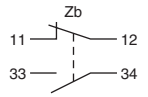
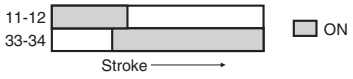
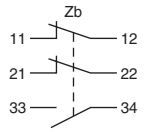
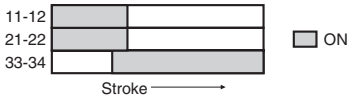
2NC Contact (Slow-action)



Conforms to EN60947-5-1 Direct Opening Operation ⊖

(Both NC contacts have a direct opening mechanism.)

Contact Form

Model	Contact	Contact form	Operating pattern	Remarks
D4N-□1□	1NC/1NO (Snap-action)			Only NC contacts 31-32 have an approved direct opening mechanism. ⊖ The terminals 13-14 and 31-32 can be used as unlike poles.
D4N-□2□	2NC (Snap-action)			Only NC contacts 11-12 and 31-32 have an approved direct opening mechanism. ⊖ The terminals 11-12 and 31-32 can be used as unlike poles.
D4N-□A□	1NC/1NO (Slow-action)			Only NC contacts 11-12 have an approved direct opening mechanism. ⊖ The terminals 11-12 and 33-34 can be used as unlike poles.
D4N-□B□	2NC (Slow-action)			Only NC contacts 11-12 and 31-32 have an approved direct opening mechanism. ⊖ The terminals 11-12 and 31-32 can be used as unlike poles.
D4N-□C□	2NC/1NO (Slow-action)			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. ⊖ The terminals 11-12, 21-22, and 33-34 can be used as unlike poles.
D4N-□D□	3NC (Slow-action)			Only NC contacts 11-12, 21-22, and 31-32 have an approved direct opening mechanism. ⊖ The terminals 11-12, 21-22, and 31-32 can be used as unlike poles.
D4N-□E□	1NC/1NO MBB (Slow-action)			Only NC contacts 11-12 have an approved direct opening mechanism. ⊖ The terminals 11-12 and 33-34 can be used as unlike poles.
D4N-□F□	2NC/1NO MBB (Slow-action)			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. ⊖ The terminals 11-12, 21-22 and 33-34 can be used as unlike poles.

Note: 1. Terminals are numbered according to EN50013 and the contact forms are according to IEC947-5-1.

2. MBB (Make Before Break) contacts have an overlapping structure, so that before the normally closed contact (NC) opens, the normally open contact (NO) closes.

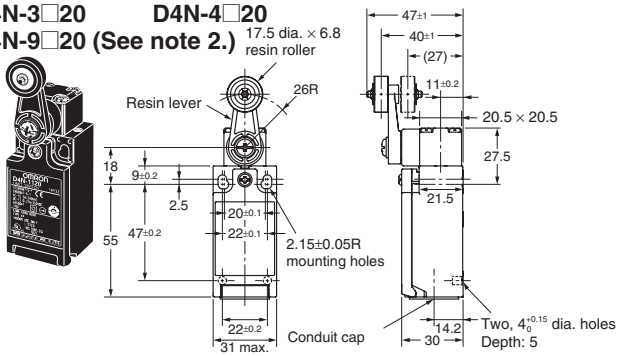
Dimensions

Switches

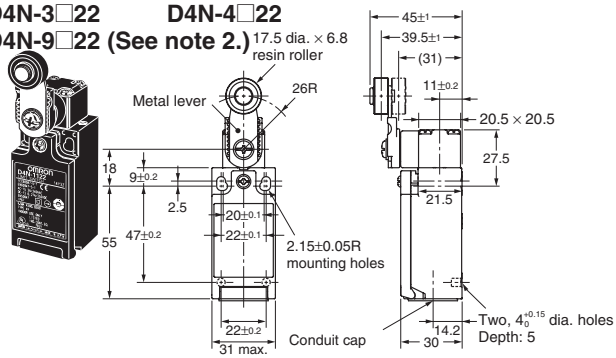
Note: All units are in millimeters unless otherwise indicated.

1-conduit Models

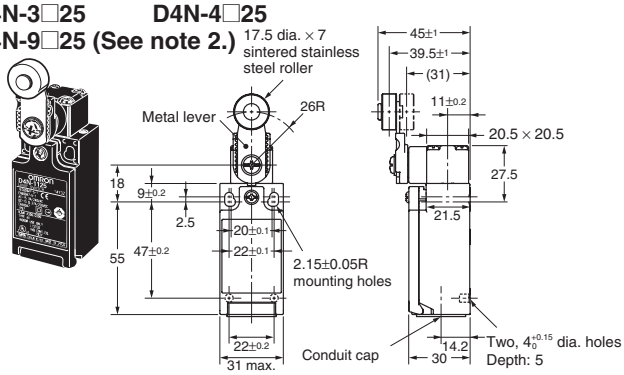
Roller Lever (Resin Lever, Resin Roller)
D4N-1□20 D4N-2□20
D4N-3□20 D4N-4□20
D4N-9□20 (See note 2.)



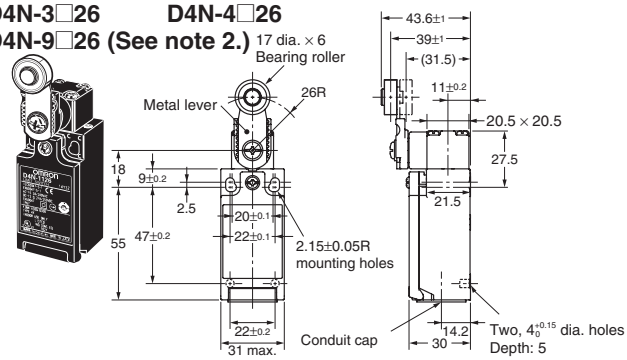
Roller Lever (Metal Lever, Resin Roller)
D4N-1□22 D4N-2□22
D4N-3□22 D4N-4□22
D4N-9□22 (See note 2.)



Roller Lever (Metal Lever, Metal Roller)
D4N-1□25 D4N-2□25
D4N-3□25 D4N-4□25
D4N-9□25 (See note 2.)



Roller Lever (Metal Lever, Bearing Roller)
D4N-1□26 D4N-2□26
D4N-3□26 D4N-4□26
D4N-9□26 (See note 2.)



Note: **1.** Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Refer to page G-231 for details on M12 connectors.

Snap-action (1NC/1NO) (2NC), Slow-action (2NC) (3NC)

Model	D4N-□120 D4N-□220 D4N-□B20 D4N-□D20	D4N-□122 D4N-□222 D4N-□B22 D4N-□D22	D4N-□125 D4N-□225 D4N-□B25 D4N-□D25	D4N-□126 D4N-□226 D4N-□B26 D4N-□D26
OF max.	5.0 N			
RF min.	0.5 N			
PT	18° to 27°			
OT min.	40°			
MD max. **(See note 2.)**	14°			
OP	---			
TT **(See note 3.)**	(80°)			
DOT min. **(See note 4.)**	50°			
DOF min. **(See note 4.)**	20 N			

Note: **1.** Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
2. Only for snap-action models.
3. Reference value.
4. ⚠ Only for slow-action models. For safe use, always make sure that the minimum values or greater are provided.

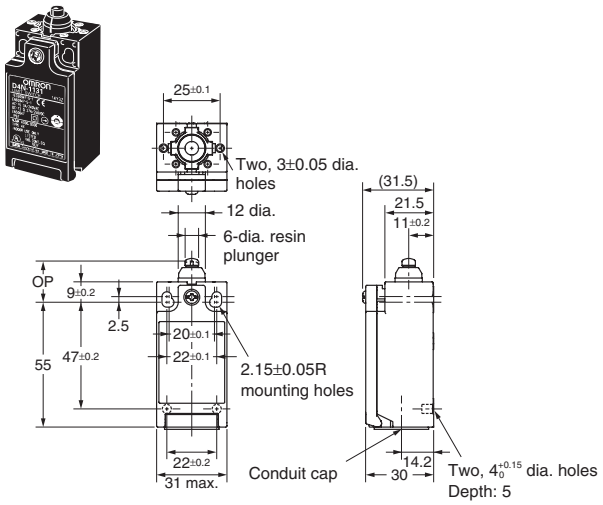
Slow-action (1NC/1NO) (2NC/1NO)

Model	D4N-□A20 D4N-□C20 D4N-□E20 D4N-□F20	D4N-□A22 D4N-□C22 D4N-□E22 D4N-□F22	D4N-□A25 D4N-□C25 D4N-□E25 D4N-□F25	D4N-□A26 D4N-□C26 D4N-□E26 D4N-□F26
OF max.	5.0 N			
RF min.	0.5 N			
PT **(See note 1.)**	18° to 27°			
PT (2nd) **(See note 2.)**	(44°)			
PT (See note 3.)	27.5° to 36.5°			
PT (2nd) **(See note 4.)**	(18°)			
OT min.	40°			
OP	---			
TT (See note 5.)	(80°)			
DOT min. (See note 6.)	50°			
DOF min. (See note 6.)	20 N			

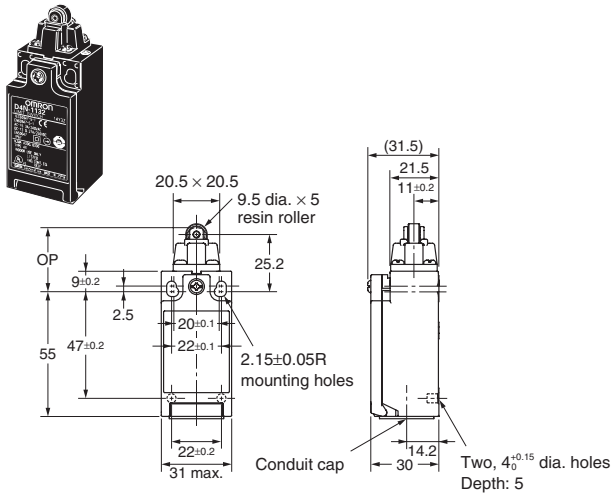
Note: **1.** These PT values are possible when the NC contacts are open (OFF).
2. These PT values are possible when the NO contacts are closed (ON).
3. Only for MBB models.
4. Reference values for MBB models only.
5. Reference values.
6. ⚠ For safe use, always make sure that the minimum values or greater are provided.

1-conduit Models

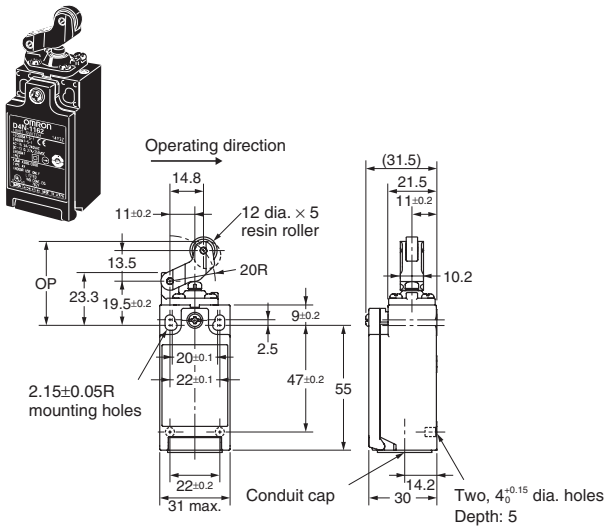
Plunger
D4N-1□31 D4N-2□31
D4N-3□31 D4N-4□31
D4N-9□31 (See note 2.)



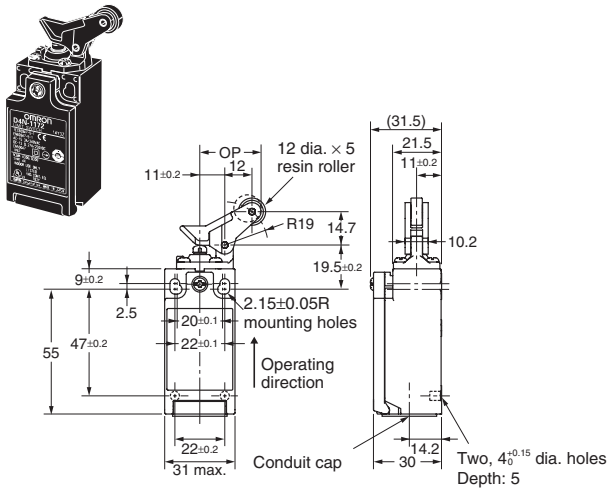
Roller Plunger
D4N-1□32 D4N-2□32
D4N-3□32 D4N-4□32
D4N-9□32 (See note 2.)



One-way Roller Arm Lever (Horizontal)
D4N-1□62 D4N-2□62
D4N-3□62 D4N-4□62
D4N-9□62 (See note 2.)



One-way Roller Arm Lever (Vertical)
D4N-1□72 D4N-2□72
D4N-3□72 D4N-4□72
D4N-9□72 (See note 2.)



Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Refer to page G-231 for details on M12 connectors.

Snap-action (1NC/1NO) (2NC), Slow-action (2NC) (3NC)

Model	D4N-□131 D4N-□231 D4N-□B31 D4N-□D31	D4N-□132 D4N-□232 D4N-□B32 D4N-□D32	D4N-□162 D4N-□262 D4N-□B62 D4N-□D62	D4N-□172 D4N-□272 D4N-□B72 D4N-□D72
OF max.	6.5 N	6.5 N	5.0 N	5.0 N
RF min.	1.5 N	1.5 N	0.8 N	0.8 N
PT max.	2 mm	2 mm	4 mm	4 mm
OT min.	4 mm	4 mm	5 mm	5 mm
MD max. (See note 2.)	1 mm	1 mm	1.5 mm	1.5 mm
OP	18.2 ±0.5 mm	28.6 ±0.8 mm	37 ±0.8 mm	27 ±0.8 mm
TT (See note 3.)	(6 mm)	(6 mm)	(9 mm)	(9 mm)
DOT min. (See note 4.)	3.2 mm	3.2 mm	5.8 mm	4.8 mm
DOF min. (See note 4.)	20 N	20 N	20 N	20 N

Note: 1. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
2. Only for snap-action models.
3. Reference value.
4. ⚠ Only for slow-action models. For safe use, always make sure that the minimum values or greater are provided.

Slow-action (1NC/1NO) (2NC/1NO)

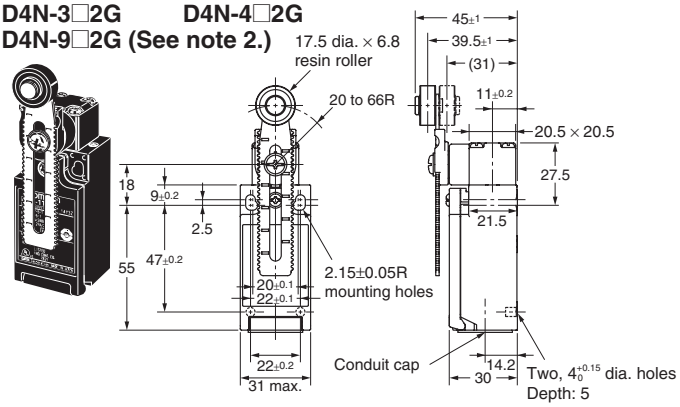
Model	D4N-□A31 D4N-□C31 D4N-□E31 D4N-□F31	D4N-□A32 D4N-□C32 D4N-□E32 D4N-□F32	D4N-□A62 D4N-□C62 D4N-□E62 D4N-□F62	D4N-□A72 D4N-□C72 D4N-□E72 D4N-□F72
OF max.	6.5 N	6.5 N	5.0 N	5.0 N
RF min.	1.5 N	1.5 N	0.8 N	0.8 N
PT max. (See note 1.)	2 mm	2 mm	4 mm	4 mm
PT (2nd) (See note 2.)	(2.9 mm)	(2.9 mm)	(5.2 mm)	(4.3 mm)
PT max. (See note 3.)	2.8 mm	2.8 mm	4 mm	4 mm
PT (2nd) (See note 4.)	(1 mm)	(1 mm)	(1.5 mm)	(1.5 mm)
OT min.	4 mm	4 mm	5 mm	5 mm
OP	18.2 ±0.5 mm	28.6 ±0.8 mm	37 ±0.8 mm	27 ±0.8 mm
OP (See note 5.)	17.4 ±0.5 mm	28 ±0.8 mm	36 ±0.8 mm	26.1 ±0.8 mm
TT (See note 6.)	(6 mm)	(6 mm)	(9 mm)	(9 mm)
DOT min. (See note 7.)	3.2 mm	3.2 mm	5.8 mm	4.8 mm
DOF min. (See note 7.)	20 N	20 N	20 N	20 N

Note: 1. These PT values are possible when the NC contacts are open (OFF).
2. These PT values are possible when the NO contacts are closed (ON).
3. Only for MBB models.
4. Reference values for MBB models.
5. Only for MBB models.
6. Reference value.
7. ⚠ For safe use, always make sure that the minimum values or greater are provided.

1-conduit Models

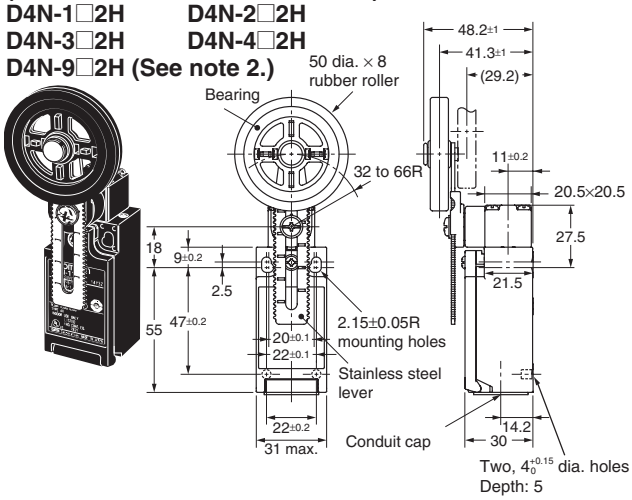
Adjustable Roller Lever, Form Lock (with Metal Lever, Resin Roller)

D4N-1□2G D4N-2□2G
D4N-3□2G D4N-4□2G
D4N-9□2G (See note 2.)



Adjustable Roller Lever, Form Lock (with Metal Lever, Rubber Roller)

D4N-1□2H D4N-2□2H
D4N-3□2H D4N-4□2H
D4N-9□2H (See note 2.)



Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Refer to following diagrams for details on M12 connectors.

Snap-action (1NC/1NO) (2NC), Slow-action (2NC) (3NC)

Model	D4N-□12H D4N-□22H D4N-□B2H D4N-□D2H	D4N-□12G D4N-□22G D4N-□B2G D4N-□D2G (See note 2.)
OF max.	4.5 N	
RF min.	0.4 N	
PT	18° to 27°	
OT min.	40°	
MD max. (See note 3.)	14°	
OP	---	
TT (See note 4.)	(80°)	
DOT min. (See note 5.)	50°	
DOF min. (See note 5.)	20 N	

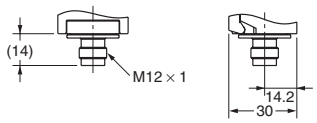
Note: 1. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
2. The operating characteristics of these Switches were measured with the roller lever set at 32 mm.
3. Only for snap-action models.
4. Reference value.
5. ⚠ Only for slow-action models. For safe use, always make sure that the minimum values or greater are provided.

Slow-action (1NC/1NO) (2NC/1NO)

Model	D4N-□A2H D4N-□C2H D4N-□E2H D4N-□F2H	D4N-□A2G D4N-□C2G D4N-□E2G D4N-□F2G (See note 1.)
OF max.	4.5 N	
RF min.	0.4 N	
PT (See note 2.)	18° to 27°	
PT (2nd) (See note 3.)	(44°)	
PT (See note 4.)	27.5° to 36.5°	
PT (2nd) (See note 5.)	(18°)	
OT min.	40°	
OP	---	
TT (See note 6.)	(80°)	
DOT min.	50°	
DOF min. (See note 7.)	20 N	

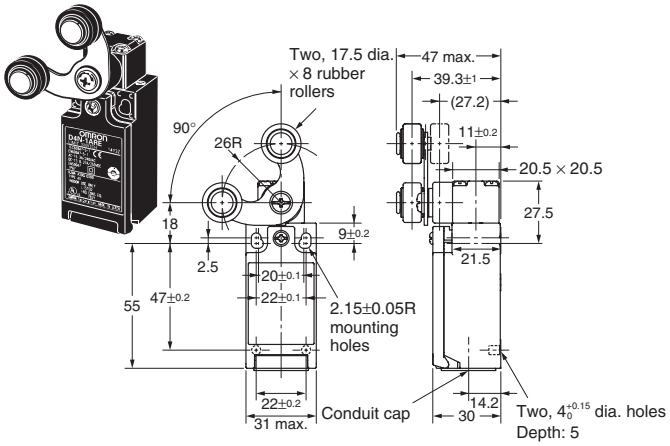
Note: 1. The operating characteristics of these Switches were measured with the roller lever set at 32 mm.
2. This PT value is possible when the NC contacts are open (OFF).
3. This PT value is possible when the NO contacts are closed (ON).
4. Only for MBB models.
5. Reference value for MBB models only.
6. Reference value.
7. ⚠ For safe use, always make sure that the minimum values or greater are provided.

1-conduit M12 Connector
D4N-9□□□

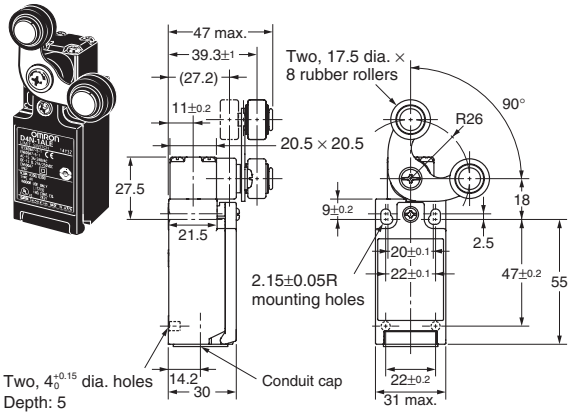


1-conduit Models

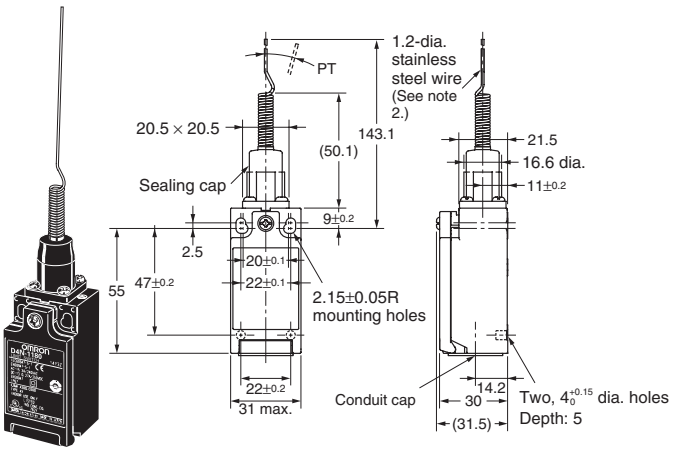
Fork Lever Lock (Right Operation)
D4N-1□RE D4N-2□RE
D4N-3□RE D4N-4□RE



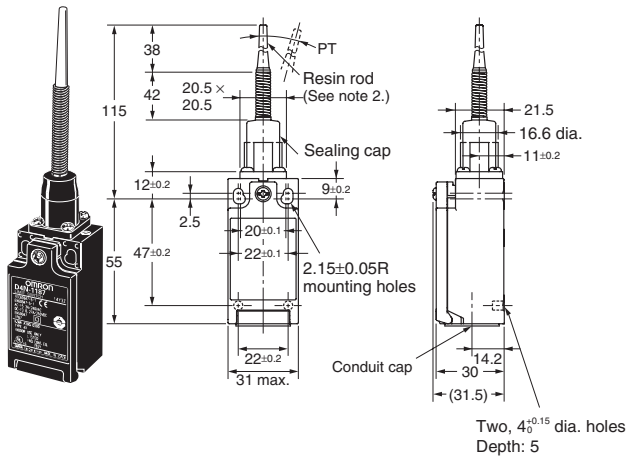
Fork Lever Lock (Left Operation)
D4N-1□LE D4N-2□LE
D4N-3□LE D4N-4□LE



Cat Whisker
D4N-1□80 D4N-2□80
D4N-3□80 D4N-4□80



Plastic Rod
D4N-1□87 D4N-2□87
D4N-3□87 D4N-4□87



Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Use the dog within 35 mm of the tip of the actuator and keep the total travel to 70 mm or less.

Slow-action (1NC/1NO) (2NC/1NO) (2NC) (3NC)

Model	D4N-□□RE	D4N-□□LE
Force necessary to reverse the direction of the lever: max.	6.4 N	6.4 N
Movement until the lever reverses	55 ±10°	55 ±10°
Movement until switch operation (NC)	6.5° (MBB: 10°)	6.5° (MBB: 10°)
Movement until switch operation (NO)	18.5° (MBB: 5°)	18.5° (MBB: 5°)

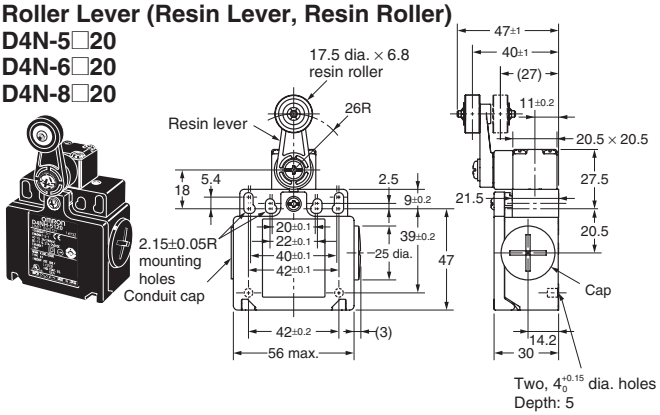
Note: Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.

Snap-action (1NC/1NO) (2NC), Slow-action (2NC) (3NC)

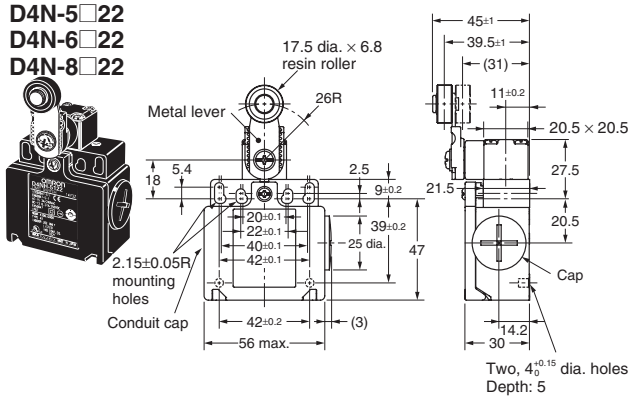
Model	D4N-□□80	D4N-□□87
OF max.	1.5 N	1.5 N
PT max.	15°	15°

2-conduit Models

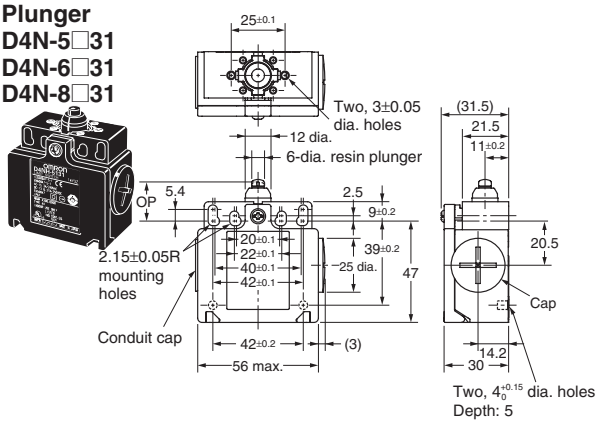
Roller Lever (Resin Lever, Resin Roller)
D4N-5□20
D4N-6□20
D4N-8□20



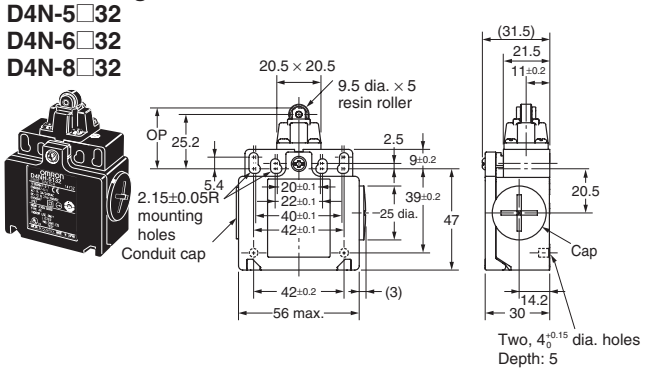
Roller Lever (Metal Lever, Resin Roller)
D4N-5□22
D4N-6□22
D4N-8□22



Plunger
D4N-5□31
D4N-6□31
D4N-8□31



Roller Plunger
D4N-5□32
D4N-6□32
D4N-8□32



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

Snap-action (1NC/1NO) (2NC), Slow-action (2NC) (3NC)

Model	D4N-□120 D4N-□220 D4N-□B20 D4N-□D20	D4N-□122 D4N-□222 D4N-□B22 D4N-□D22	D4N-□131 D4N-□231 D4N-□B31 D4N-□D31	D4N-□132 D4N-□232 D4N-□B32 D4N-□D32
OF max.	5 N	5 N	6.5 N	6.5 N
RF min.	0.5 N	0.5 N	1.5 N	1.5 N
PT	18° to 27°	18° to 27°	2 mm	2 mm
OT min.	40°	40°	4 mm	4 mm
MD max. **(See note 2.)**	14°	14°	1 mm	1 mm
OP	---	---	18 ±0.5 mm	28.2 ±0.8 mm
TT **(See note 3.)**	(80°)	(80°)	(6 mm)	(6 mm)
DOT min. **(See note 4.)**	50°	50°	3.2 mm	3.2 mm
DOF min. **(See note 4.)**	20 N	20 N	20 N	20 N

Note: **1.** Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
2. Only for snap-action models.
3. Reference value.
4. ⚠ Only for slow-action models. For safe use, always make sure that the minimum values or greater are provided.

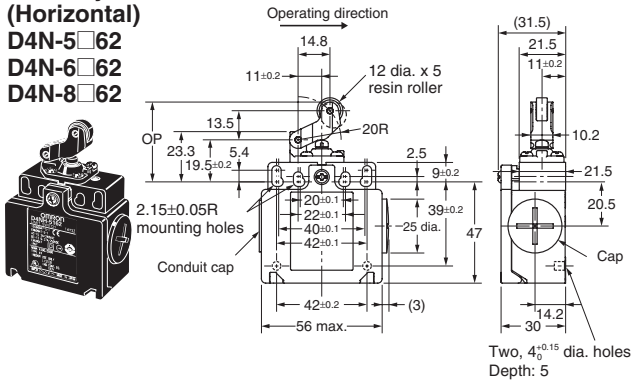
Slow-action (1NC/1NO) (2NC/1NO)

Model	D4N-□A20 D4N-□C20 D4N-□E20 D4N-□F20	D4N-□A22 D4N-□C22 D4N-□E22 D4N-□F22	D4N-□A31 D4N-□C31 D4N-□E31 D4N-□F31	D4N-□A32 D4N-□C32 D4N-□E32 D4N-□F32
OF max.	5 N	5 N	6.5 N	6.5 N
RF min.	0.5 N	0.5 N	1.5 N	1.5 N
PT **(See note 1.)**	18° to 27°	18° to 27°	2 mm	2 mm
PT (2nd) **(See note 2.)**	(44°)	(44°)	(2.9 mm)	(2.9 mm)
PT **(See note 3.)**	27.5° to 36.5°	27.5° to 36.5°	2.8 mm	2.8 mm
PT (2nd) **(See note 4.)**	(18°)	(18°)	(1 mm)	(1 mm)
OT min.	40°	40°	4 mm	4 mm
OP	---	---	18 ±0.5 mm	28.2 ±0.8 mm
OP **(See note 5.)**	---	---	17.4 ±0.5 mm	28 ±0.8 mm
TT **(See note 6.)**	(80°)	(80°)	(6 mm)	(6 mm)
DOT min. **(See note 7.)**	50°	50°	3.2 mm	3.2 mm
DOF min. **(See note 7.)**	20 N	20 N	20 N	20 N

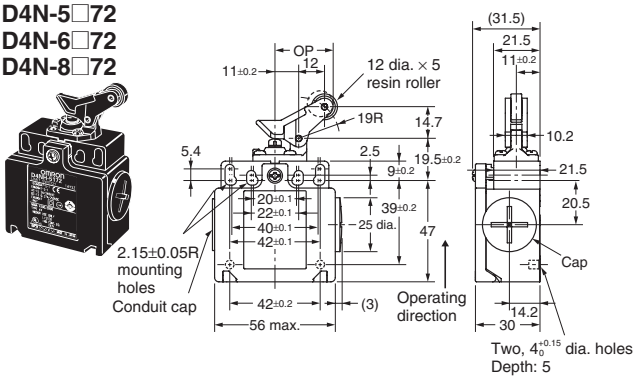
Note: **1.** This PT value is possible when the NC contacts are open (OFF).
2. This PT value is possible when the NO contacts are closed (ON).
3. Only for MBB models.
4. Reference value for MBB models.
5. Only for MBB models.
6. Reference value.
7. ⚠ For safe use, always make sure that the minimum values or greater are provided.

2-conduit Models

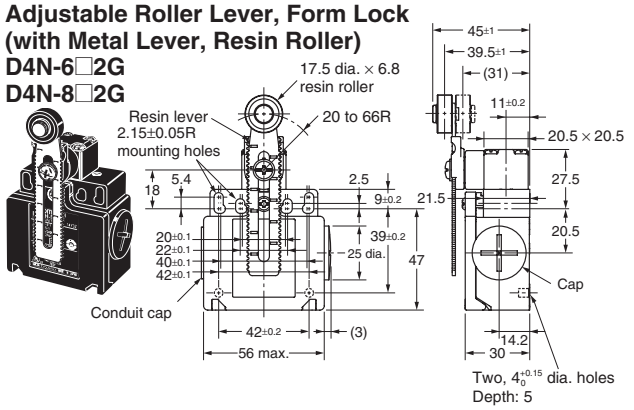
One-way Roller Arm Lever (Horizontal)
D4N-5□62
D4N-6□62
D4N-8□62



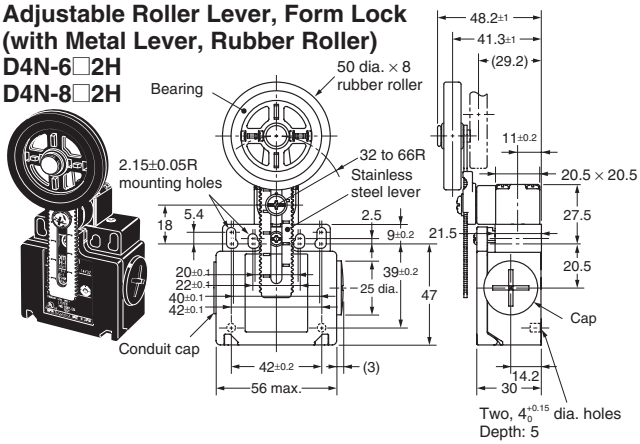
One-way Roller Arm Lever (Vertical)
D4N-5□72
D4N-6□72
D4N-8□72



Adjustable Roller Lever, Form Lock (with Metal Lever, Resin Roller)
D4N-6□2G
D4N-8□2G



Adjustable Roller Lever, Form Lock (with Metal Lever, Rubber Roller)
D4N-6□2H
D4N-8□2H



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

Snap-action (1NC/1NO) (2NC), Slow-action (2NC) (3NC)

Model	D4N-□162 D4N-□262 D4N-□B62 D4N-□D62	D4N-□172 D4N-□272 D4N-□B72 D4N-□D72	D4N-□12G D4N-□22G D4N-□B2G D4N-□D2G (See note 2.)	D4N-□12H D4N-□22H D4N-□B2H D4N-□D2H (See note 3.)
OF max.	5.0 N	5.0 N	4.5 N	4.5 N
RF min.	0.8 N	0.8 N	0.4 N	0.4 N
PT max.	4 mm	4 mm	18° to 27°	18° to 27°
OT min.	5 mm	5 mm	40°	40°
MD max. (See note 4.)	1.5 mm	1.5 mm	14°	14°
OP	37 ±0.8 mm	27 ±0.8 mm	---	---
TT (See note 5.)	(9 mm)	(9 mm)	(70°)	(70°)
DOT min. (See note 6.)	5.8 mm	4.8 mm	50°	50°
DOF min. (See note 6.)	20 N	20 N	20 N	20 N

Note:
1. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
2. The operating characteristics of these Switches were measured with the roller lever set at 30 mm.
3. The operating characteristics of these Switches were measured with the roller lever set at 31 mm.
4. Only for snap-action models.
5. Reference value.
6. ⚠ Only for slow-action models. For safe use, always make sure that the minimum values or greater are provided.

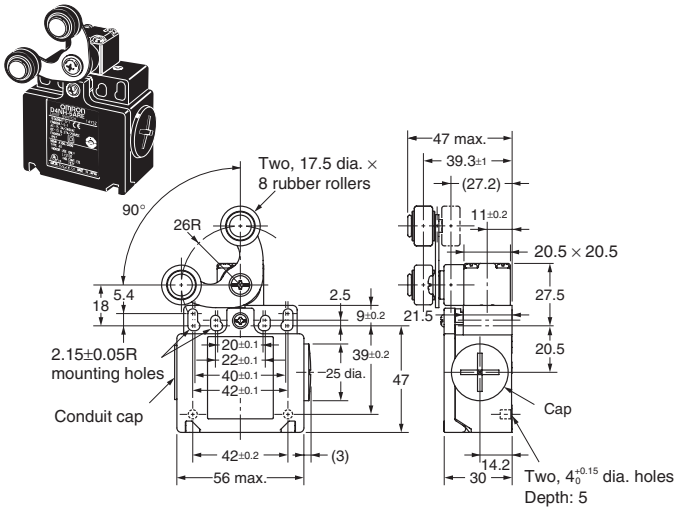
Slow-action (1NC/1NO) (2NC/1NO)

Model	D4N-□A62 D4N-□C62 D4N-□E62 D4N-□F62	D4N-□A72 D4N-□C72 D4N-□E72 D4N-□F72	D4N-□A2G D4N-□C2G D4N-□E2G D4N-□F2G (See note 1.)	D4N-□A2H D4N-□C2H D4N-□E2H D4N-□F2H (See note 2.)
OF max.	5.0 N	5.0 N	4.5 N	4.5 N
RF min.	0.8 N	0.8 N	0.4 N	0.4 N
PT max. (See note 3.)	4 mm	4 mm	18° to 27°	18° to 27°
PT (2nd) (See note 4.)	(5.2 mm)	(4.3 mm)	(44°)	(44°)
PT max. (See note 5.)	4 mm	4 mm	27.5° to 36.5°	27.5° to 36.5°
PT (2nd) (See note 6.)	(1.5 mm)	(1.5 mm)	(18°)	(18°)
OT min.	5 mm	5 mm	40°	40°
OP	37 ±0.8 mm	27 ±0.8 mm	---	---
OP (See note 7.)	36 ±0.8 mm	26.1 ±0.8 mm	---	---
TT (See note 8.)	(9 mm)	(9 mm)	(70°)	(70°)
DOT min. (See note 9.)	5.8 mm	4.8 mm	50°	50°
DOF min. (See note 9.)	20 N	20 N	20 N	20 N

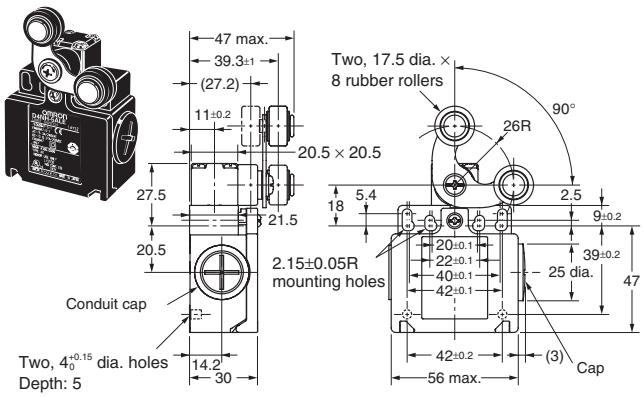
Note:
1. The operating characteristics of these Switches were measured with the roller lever set at 30 mm.
2. The operating characteristics of these Switches were measured with the roller lever set at 31 mm.
3. This PT value is possible when the NC contacts are open (OFF).
4. This PT value is possible when the NO contacts are closed (ON).
5. Only for MBB models.
6. Reference value for MBB models only.
7. Only for MBB models.
8. Reference value.
9. ⚠ For safe use, always make sure that the minimum values or greater are provided.

2-conduit Models

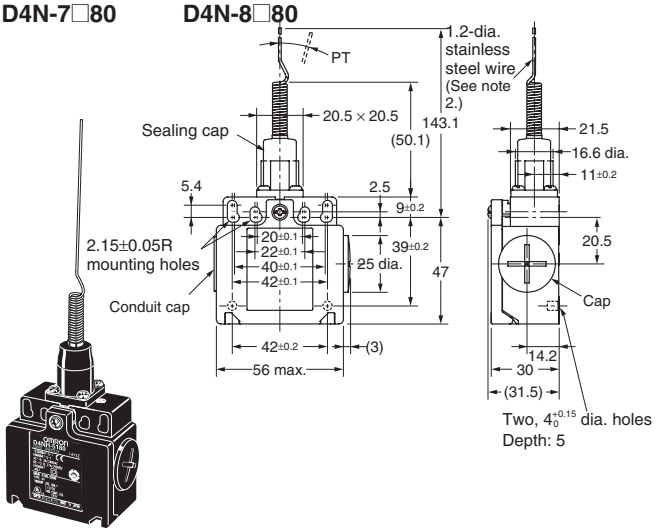
Fork Lever Lock (Right Operation)
D4N-5□RE D4N-6□RE
D4N-7□RE D4N-8□RE



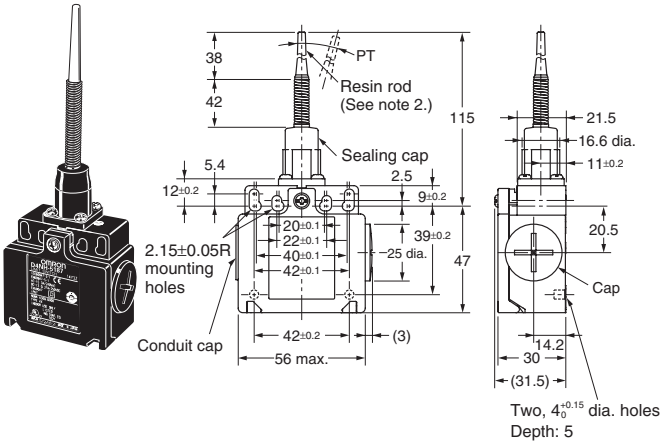
Fork Lever Lock (Left Operation)
D4N-5□LE D4N-6□LE
D4N-7□LE D4N-8□LE



Cat Whisker
D4N-5□80 D4N-6□80
D4N-7□80 D4N-8□80



Plastic Rod
D4N-5□87 D4N-6□87
D4N-7□87 D4N-8□87



Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Use the dog within 35 mm of the tip of the actuator and keep the total travel to 70 mm or less.
3. The usable range of the moving part is 1/3 or less of the entire spring length from the end of the spring.

Slow-action (1NC/1NO) (2NC), Slow-action (2NC) (3NC)

Model	D4N-□□RE	D4N-□□LE
Force necessary to reverse the direction of the lever: max.	6.4 N	6.4 N
Movement until the lever reverses	55 ±10°	55 ±10°
Movement until switch operation (NC)	(6.5°)	(6.5°) (MBB: 10°)
Movement until switch operation (NO)	(18.5°)	(18.5°) (MBB: 5°)

Note: Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.

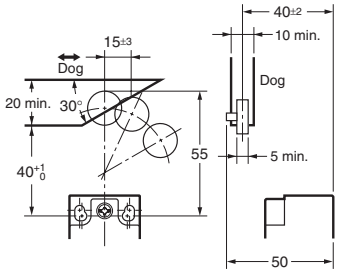
Snap-action (1NC/1NO), Slow-action (2NC) (3NC)

Model	D4N-□□80	D4N-□□87
OF max.	1.5 N	1.5 N
PT max.	15°	15°

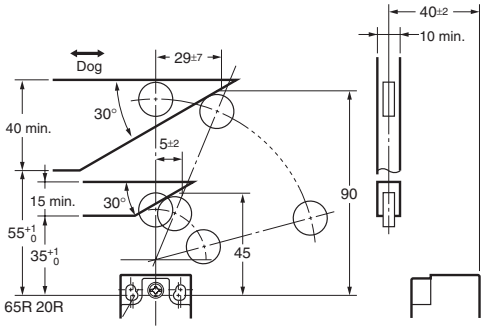
Levers

Refer to the following for the angles and positions of the watchdogs (source: EN50047.)

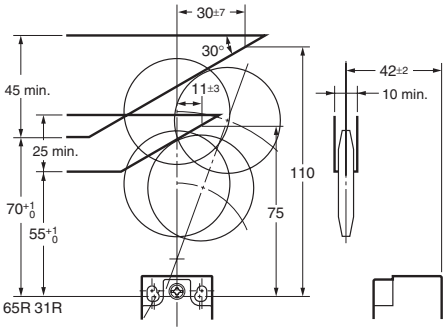
Roller Lever (D4N-□□20)



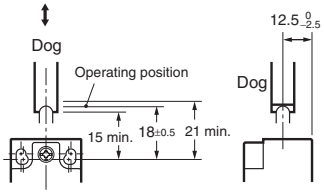
Adjustable Roller Lever, Form Lock (with Metal Lever, Resin Roller) (D4N-□□2G) (Reference Values)



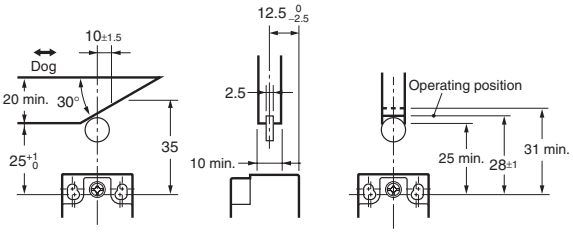
Adjustable Roller Lever, Form Lock (with Metal Lever, Rubber Roller) (D4N-□□2H) (Reference Values)



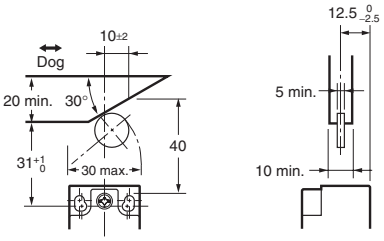
Sealed Plunger (D4N-□□31)



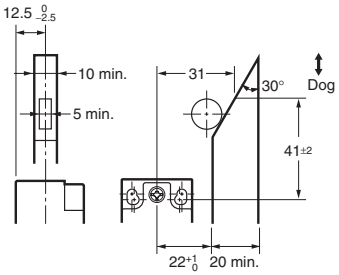
Roller Plunger (D4N-□□32)



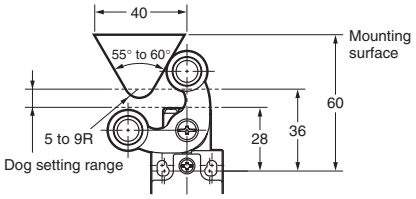
One-way Roller Arm Lever (Horizontal) (D4N-□□62)



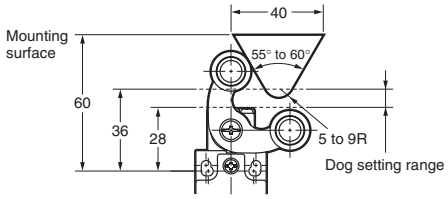
One-way Roller Arm Lever (Vertical) (Reference Values) (D4N-□□72)



Fork Lever Lock (Right Operation) (D4N-□□RE)



Fork Lever Lock (Left Operation) (D4N-□□LE)



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

Safety Precautions

Refer to *OMRON SAFETY COMPONENTS SERIES (Y106)* for common precautions for Switches and Safety Limit Switches.

⚠ CAUTION

Do not use metal connectors or metal conduits with this Switch. Doing so may occasionally result in electric shock.

Precautions for Safe Use

- Do not drop the Switch. Doing so may result in the Switch not performing to its full capacity.
- Do not attempt to disassemble or modify the Switch. Doing so may cause the Switch to malfunction.
- Do not use the Switch where explosive gas, flammable gas, or any other hazardous gas may be present.
- 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 interior. (The IP67 degree of protection specification for the Switch refers to water penetration while the Switch is submersed in water for a specified period of time.)
- Protect the head from foreign material. Subjecting the head to foreign material may result in premature wear or damage to the Switch. Although the switch body is protected from penetration by dust or water, the head is not protected from penetration by minute particles or water.
- Turn the power OFF before wiring. Doing so may result in electric shock.
- Install the cover after wiring. Not doing so may result in electric shock.
- Connect a fuse to the Switch in series to protect the Switch from short-circuit damage. Use a fuse with a breaking current 1.5 to 2 times larger than the rated current. To conform to EN ratings, use an IEC60269-compliant 10-A fuse type gI or gG.
- Do not switch circuits for two or more standard loads (250 VAC, 3 A) at the same time. Doing so may adversely affect insulation performance.
- The durability of the Switch is greatly affected by operating conditions. Evaluate the Switch under actual working conditions before permanent installation and use within a number of switching operations that will not adversely affect the Switch's performance.
- Be sure to indicate in the machine manufacturer's instruction manual that the user must not attempt to repair or maintain the Switch and must contact the machine manufacturer for any repairs or maintenance.
- Check the Switches before use and inspect regularly, replacing them when necessary. If a Switch is kept pressed for an extended period of time, the components may deteriorate quickly, and the Switch may not release.

Precautions for Correct Use

Environment

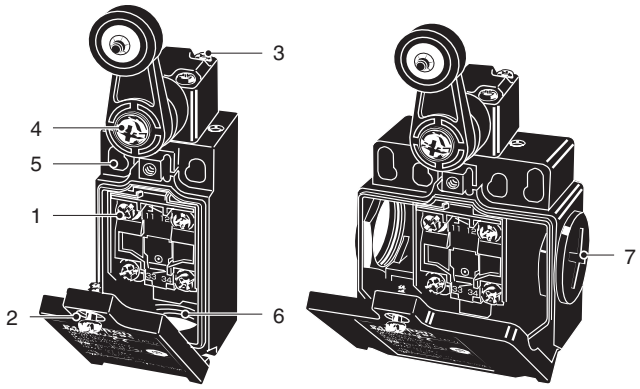
- The Switch is intended for indoor use only.
- Do not use the Switch outdoors. Doing so may cause the Switch to malfunction.
- Do not use the Switch where hazardous gases (e.g., H_2S, SO_2, NH_3, HNO_3, Cl_2) are present or in locations subject to high temperature and humidity. Doing so may result in damage to the Switch caused by contact failure or corrosion.
- Do not use the Switch under any of the following conditions.
  - Locations subject to extreme temperature changes.
  - Locations where high humidity or condensation may occur.
  - Locations subject to excessive vibration.
  - Locations where metal dust, processing waste, oil, or chemicals may penetrate through the protective door.
  - Locations subject to detergents, thinner, or other solvents.

Mounting Method

Mounting Screw Tightening Torque

Tighten each of the screws to the specified torque. Loose screws may result in malfunction of the Switch within a short time.

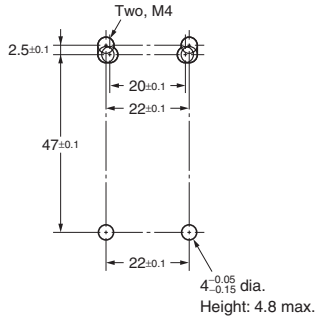
1	Terminal screw	0.6 to 0.8 N·m
2	Cover clamping screw	0.5 to 0.7 N·m
3	Head clamping screw	0.5 to 0.6 N·m
4	Lever clamping screw	1.6 to 1.8 N·m
5	Body clamping screw	0.5 to 0.7 N·m
6	Conduit mounting connection, M12 adaptor	1.8 to 2.2 N·m (except 1/2-14NPT)
		1.4 to 1.8 N·m (1/2-14NPT)
7	Cap screw	1.3 to 1.7 N·m



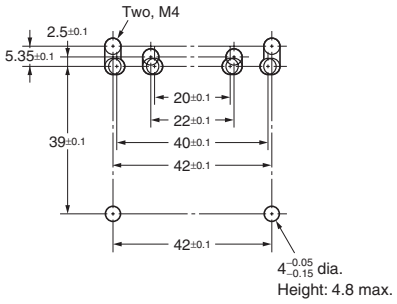
Switch Mounting

- Mount the Switch using M4 screws and washers and tighten the screws to the specified torque.
- For safety, use screws that cannot be easily removed, or use an equivalent measure to ensure that the Switch is secure.
- Secure the Switch with two M4 bolts and washers. Provide studs with a diameter of $4^{-0.05}/_{-0.15}$ and a height of 4.8 mm max. at two places, inserting into the holes at the bottom of the Switch as shown below so that the Switch is firmly fixed at four points.

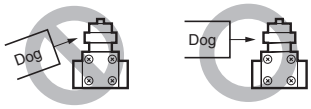
Switch Mounting Holes One-conduit Type



Two-conduit Type



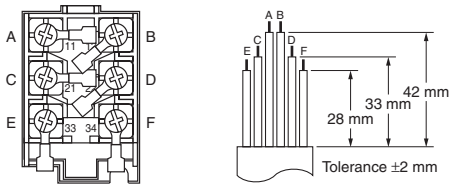
- Make sure that the dog contacts the actuator at a right angle. Applying a load to the switch actuator (roller) on a slant may result in deformation or damage of the actuator or rotary shaft.



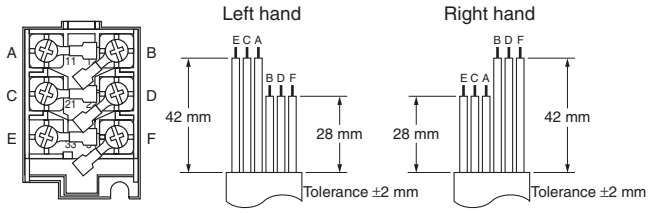
Wiring

- When connecting to the terminals via insulating tube and M3.5 crimp terminals, arrange the crimp terminals as shown below 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^2).
  Use lead wires of an appropriate length, as shown below. Not doing so may result in excess length causing the cover to rise and not fit properly.

One-conduit Type (3 Poles)



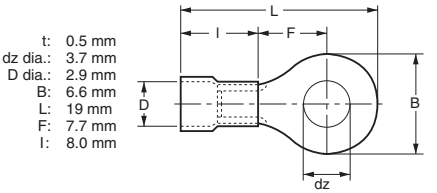
Two-conduit Type (3 Poles)

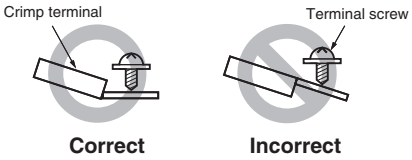


- Do not push crimp terminals into gaps in the case interior. Doing so may cause damage or deformation of the case.
- Use crimp terminals not more than 0.5 mm in thickness. Otherwise, they will interfere with other components inside the case. The crimp terminals shown below are not more than 0.5 mm thick.

Manufacture	Type	Wire size
J.S.T.	FV0.5-3.7 (F type) V0.5-3.7 (straight type)	AWG20 (0.5 mm^2)

J.S.T is a Japanese manufacturer.



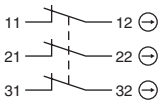


Contact Arrangement

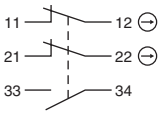
- The following diagrams show the contact arrangements used for screw terminal types and connector types.

Screw Terminal Type

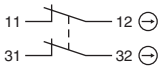
D4N-□D□□ (3NC)



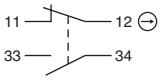
D4N-□C□□ (2NC/1NO)
D4N-□F□□ (2NC/1NO (MBB))



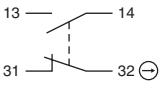
D4N-□B□□ (2NC)
D4N-□2□□ (2NC (SNAP))



D4N-□A□□ (1NC/1NO)
D4N-□E□□ (1NC/1NO (MBB))

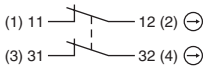


D4N-□1□□ (1NC/1NO (SNAP))

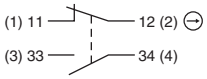


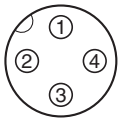
Connector Type

D4N-9B□□ (2NC)
D4N-92□□ (2NC (SNAP))



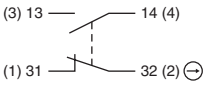
D4N-9A□□ (1NC/1NO)
D4N-9E□□ (1NC/1NO (MBB))





Pin No. (Terminal No.)

D4N-91□□ (1NC/1NO (SNAP))



- Applicable socket: XS2F (OMRON).
- Refer to the G010 *Connector Catalog* for details on socket pin numbers and lead wire colors.

Socket Tightening (Connector Type)

- Turn the socket connector screws by hand and tighten until no space remains between the socket and the plug.
- Make sure that the socket connector is tightened securely. Otherwise, the rated degree of protection (IP67) may not be maintained and vibration may loosen the socket connector.

Conduit Opening

- Connect a recommended connector to the opening of the conduit and tighten the connector to the specified torque. The case may be damaged if an excessive tightening torque is applied.
- When using 1/2-14NPT, wind sealing tape around the joint between the connector and conduit opening so that the enclosure will conform to IP67.
- Use a cable with a suitable diameter for the connector.
- Attach and tighten a conduit cap to the unused conduit opening when wiring. Tighten the conduit cap to the specified torque. The conduit cap is provided with the Switch (2-conduit types).

Changing the Lever

The lever mounting screws can be used to set the lever position to any position in a 360° angle at 7.5° increments. Grooves are incised on the lever and rotary shaft that engage to prevent the lever from slipping against the rotary shaft. The screws on adjustable roller lever models can also loosened to change the length of the lever.

Remove the screws from the front of the lever before mounting the lever in reverse (front/back), and set the level so that operation will be completed before exceeding a range of 180° on the horizontal.

Recommended Connectors

Use connectors with screws not exceeding 9 mm, otherwise the screws will protrude into the case interior, interfering with other components in the case. The connectors listed in the following table have connectors with thread sections not exceeding 9 mm. Use the recommended 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 Denki	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
1/2-14NPT	LAPP	ST-NPT1/2 5301-6030	6.0 to 12.0 mm
M12	LAPP	ST-M12 × 1.5 5311-1000	3.5 to 7.0 mm

Use LAPP connectors together with seal packing (JPK-16, GP-13.5, GPM20, or GPM12), and tighten to the specified tightening torque. Seal packing is sold separately.

LAPP is a German manufacturer. Ohm Denki is a Japanese manufacturer.

Before using an M12 type, attaching the provided changing adaptor to the Switch and then connect the recommended connector.

Before using a 2-conduit 1/2-14NPT type, attach the provided changing adaptor to the Switch and then connect the recommended connector.

Storage

Do not store the Switch in locations where hazardous gases (e.g., H_2S, SO_2, NH_3, HNO_3, Cl_2) or dust is present, or in locations subject to high temperatures and humidity.

Others

- Do not allow the load current to exceed the rated value.
- Confirm that the seal rubber has no defects before use. If the seal rubber is displaced or raised, or has foreign particles adhered to it, the sealing capability of the seal rubber will be adversely affected.
- Use the correct cover mounting screws only, or the sealing capability of the seal rubber will deteriorate.
- Inspect the Switch regularly.
- Make sure that foreign particles do not enter the head when removing the screws from the four corners to change the head position in any of the four directions.
- Use the following recommended countermeasures to prevent telegraphing when using adjustable or long levers.

1. Make the rear edge of the dog smooth with an angle of 15° to 30° or make it in the shape of a quadratic curve.
2. Design the circuit so that no error signal will be generated.
3. Use or set a Switch that is operated in one direction only.

Production Termination

Following the release of the D4N, production of the D4D-N will be terminated.

Date of Production Termination

Production of the D4D-N Series will be terminated in March 2006.

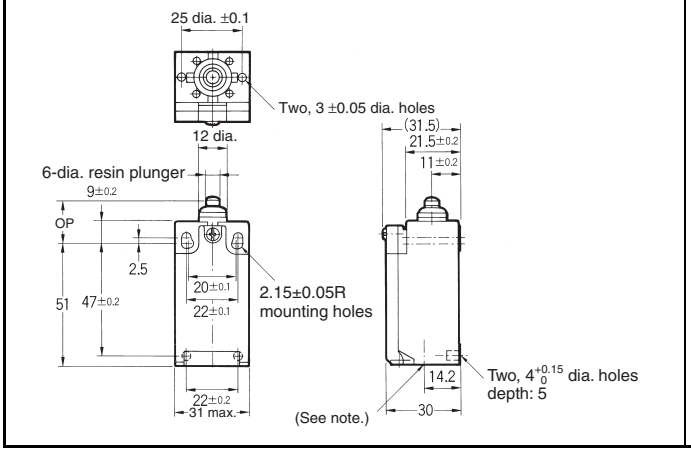
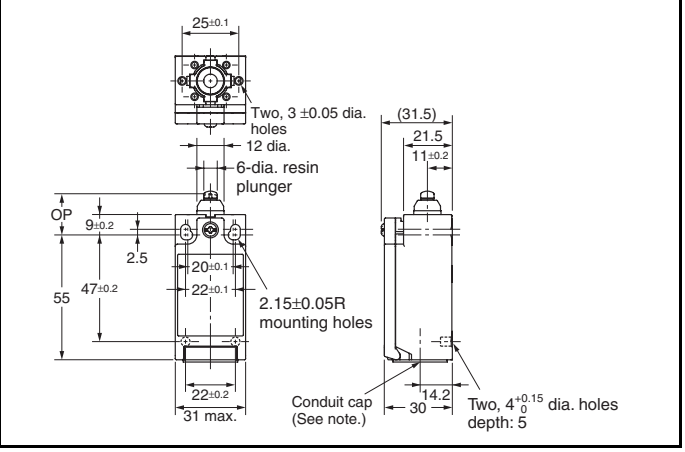
Product Replacement

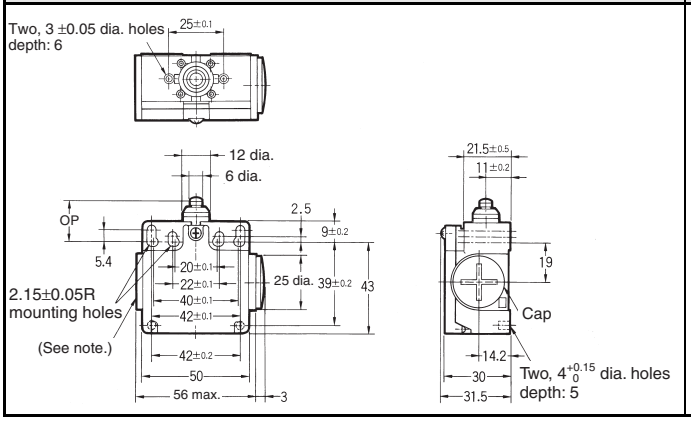
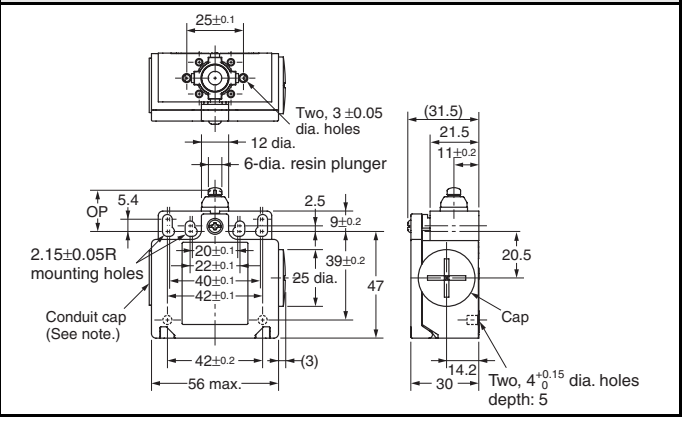
1. Dimensions
   The D4D-N and D4N use the same mounting method, and mounting hole. The multi-contact structure and the extra 4 mm in length, however, are different.
2. Terminal Numbers
   For the 2-contact slow-action model, the terminals 21, 22, 23, and 24 on the D4D-N are 31, 32, 33, and 34 on the D4N.
3. Recommended Terminals
   If the recommended terminals are not used, the Switch may not be compatible. Make sure that the Switch is compatible with the terminals.

Comparison of the D4D-N and Substitute Products

Model	D4N
Switch color	Very similar
Dimensions	Very similar
Wiring/connection	Significantly different
Mounting method	Completely compatible
Ratings/performance	Very similar
Operating characteristics	Very similar
Operating method	Completely compatible

Dimensions (Unit: mm)

Discontinued Models (1-conduit Plunger-type D4D-N)	Replacement Products (1-conduit Plunger-type D4N)
	

Discontinued Models (2-conduit Plunger-type D4D-N)	Replacement Products (2-conduit Plunger-type D4N)
	

List of Recommended Substitute Products

: The actuator on the D4D-N is a non-safety type. The D4N is recommended for safety applications (form lock type). Be sure to mount it correctly.

: M screws are recommended to comply with European standards. Therefore, the M20 type is recommended as a substitute when the PG13.5 conduit-type is not available in a D4N model.

Safety Limit Switches

D4D-N product to be discontinued	Recommended substitute product	D4D-N product to be discontinued	Recommended substitute product	D4D-N product to be discontinued	Recommended substitute product
D4D-1120N	D4N-1120	D4D-1520N	D4N-1A20	D4D-1A20N	D4N-1B20
D4D-2120N	D4N-2120	D4D-2520N	D4N-2A20	D4D-2A20N	D4N-2B20
D4D-3120N	D4N-3120	D4D-3520N	D4N-3A20	D4D-3A20N	D4N-3B20
D4D-5120N	D4N-5120	D4D-5520N	D4N-5A20	D4D-5A20N	D4N-5B20
D4D-6120N	D4N-6120	D4D-6520N	D4N-6A20	D4D-6A20N	D4N-6B20
D4D-1122N	D4N-1122	D4D-1522N	D4N-1A22	D4D-1A22N	D4N-1B22
D4D-2122N	D4N-2122	D4D-2522N	D4N-2A22	D4D-2A22N	D4N-2B22
D4D-3122N	D4N-3122	D4D-3522N	D4N-3A22	D4D-3A22N	D4N-3B22
D4D-5122N	D4N-5122	D4D-5522N	D4N-5A22	D4D-5A22N	D4N-5B22
D4D-6122N	D4N-6122	D4D-6522N	D4N-6A22	D4D-6A22N	D4N-6B22
D4D-1125N	D4N-1125	D4D-1525N	D4N-1A25	D4D-1A25N	D4N-1B25
D4D-2125N	D4N-2125	D4D-2525N	D4N-2A25	D4D-2A25N	D4N-2B25
D4D-3125N	D4N-3125	D4D-3525N	D4N-3A25	D4D-3A25N	D4N-3B25
D4D-1131N	D4N-1131	D4D-1531N	D4N-1A31	D4D-1A31N	D4N-1B31
D4D-2131N	D4N-2131	D4D-2531N	D4N-2A31	D4D-2A31N	D4N-2B31
D4D-3131N	D4N-3131	D4D-3531N	D4N-3A31	D4D-3A31N	D4N-3B31
D4D-5131N	D4N-5131	D4D-5531N	D4N-5A31	D4D-5A31N	D4N-5B31
D4D-6131N	D4N-6131	D4D-6531N	D4N-6A31	D4D-6A31N	D4N-6B31
D4D-1132N	D4N-1132	D4D-1532N	D4N-1A32	D4D-1A32N	D4N-1B32
D4D-2132N	D4N-2132	D4D-2532N	D4N-2A32	D4D-2A32N	D4N-2B32

D4D-N product to be discontinued	Recommended substitute product	D4D-N product to be discontinued	Recommended substitute product	D4D-N product to be discontinued	Recommended substitute product
D4D-3132N	D4N-3132	D4D-3532N	D4N-3A32	D4D-3A32N	D4N-3B32
D4D-5132N	D4N-5132	D4D-5532N	D4N-5A32	D4D-5A32N	D4N-5B32
D4D-6132N	D4N-6132	D4D-6532N	D4N-6A32	D4D-6A32N	D4N-6B32
D4D-1162N	D4N-1162	D4D-1562N	D4N-1A62	D4D-1A62N	D4N-1B62
D4D-2162N	D4N-2162	D4D-2562N	D4N-2A62	D4D-2A62N	D4N-2B62
D4D-3162N	D4N-3162	D4D-3562N	D4N-3A62	D4D-3A62N	D4N-3B62
D4D-5162N	D4N-5162	D4D-5562N	D4N-5A62	D4D-5A62N	D4N-5B62
D4D-6162N	D4N-6162	D4D-6562N	D4N-6A62	D4D-6A62N	D4N-6B62
D4D-1172N	D4N-1172	D4D-1572N	D4N-1A72	D4D-1A72N	D4N-1B72
D4D-2172N	D4N-2172	D4D-2572N	D4N-2A72	D4D-2A72N	D4N-2B72
D4D-3172N	D4N-3172	D4D-3572N	D4N-3A72	D4D-3A72N	D4N-3B72
D4D-5172N	D4N-5172	D4D-5572N	D4N-5A72	D4D-5A72N	D4N-5B72
D4D-6172N	D4N-6172	D4D-6572N	D4N-6A72	D4D-6A72N	D4N-6B72
D4D-112HN	D4N-112H	D4D-152HN	D4N-1A2H	D4D-1A2HN	D4N-1B2H
D4D-212HN	D4N-212H	D4D-252HN	D4N-2A2H	D4D-2A2HN	D4N-2B2H
D4D-312HN	D4N-312H	D4D-352HN	D4N-3A2H	D4D-3A2HN	D4N-3B2H

General-purpose Limit Switches

D4D-N product to be discontinued	Recommended substitute product	D4D-N product to be discontinued	Recommended substitute product	D4D-N product to be discontinued	Recommended substitute product
D4D-1121N	D4N-112G	D4D-15REN	D4N-1ARE	D4D-1AREN	D4N-1BRE
D4D-2121N	D4N-212G	D4D-25REN	D4N-2ARE	D4D-2AREN	D4N-2BRE
D4D-3121N	D4N-312G	D4D-35REN	D4N-3ARE	D4D-3AREN	D4N-3BRE
D4D-5121N	D4N-512G	D4D-55REN	D4N-5ARE	D4D-5AREN	D4N-5BRE
D4D-6121N	D4N-612G	D4D-65REN	D4N-6ARE	D4D-6AREN	D4N-6BRE
D4D-1127N	D4N-112H	D4D-15LEN	D4N-1ALE	D4D-1ALEN	D4N-1BLE
D4D-2127N	D4N-212H	D4D-25LEN	D4N-2ALE	D4D-2ALEN	D4N-2BLE
D4D-3127N	D4N-312H	D4D-35LEN	D4N-3ALE	D4D-3ALEN	D4N-3BLE
D4D-5127N	D4N-512H	D4D-55LEN	D4N-5ALE	D4D-5ALEN	D4N-5BLE
D4D-6127N	D4N-612H	D4D-65LEN	D4N-6ALE	D4D-6ALEN	D4N-6BLE
D4D-1180N	D4N-4180	D4D-1521N	D4N-1A2G	D4D-1A21N	D4N-1B2G
D4D-2180N	D4N-2180	D4D-2521N	D4N-2A2G	D4D-2A21N	D4N-2B2G
D4D-3180N	D4N-3180	D4D-3521N	D4N-3A2G	D4D-3A21N	D4N-3B2G
D4D-5180N	D4N-8180	D4D-5521N	D4N-5A2G	D4D-5A21N	D4N-5B2G
D4D-6180N	D4N-6180	D4D-6521N	D4N-6A2G	D4D-6A21N	D4N-6B2G
D4D-1187N	D4N-4187	D4D-1527N	D4N-1A2H	D4D-1A27N	D4N-1B2H
D4D-2187N	D4N-2187	D4D-2527N	D4N-2A2H	D4D-2A27N	D4N-2B2H
D4D-3187N	D4N-3187	D4D-3527N	D4N-3A2H	D4D-3A27N	D4N-3B2H
D4D-5187N	D4N-8187	D4D-5527N	D4N-5A2H	D4D-5A27N	D4N-5B2H
D4D-6187N	D4N-6187	D4D-6527N	D4N-6A2H	D4D-6A27N	D4N-6B2H
				D4D-1A80N	D4N-4B80
				D4D-2A80N	D4N-2B80
				D4D-3A80N	D4N-3B80
				D4D-5A80N	D4N-8B80
				D4D-6A80N	D4N-6B80
				D4D-1A87N	D4N-4B87
				D4D-2A87N	D4N-2B87
				D4D-3A87N	D4N-3B87
				D4D-5A87N	D4N-8B87
				D4D-6A87N	D4N-6B87

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

Cat. No. C130-E2-01-X

Safety Limit Switch

D4B-□N

- Snap-action or slow-action contact for accurate switching with safe operation via a direct opening mechanism with metal deposition between mating contacts.
- Two sets of contacts: one (NC) for safety category circuit and the other (NO) for control circuit.
- Contacts opened by direct opening mechanism (NC contacts only), thus preventing faulty operation due to factors such as metal deposition.
- Wide standard operating temperature range:
  –40°C to 80°C (standard type).
- Safety of lever settings ensured using a mechanism that engages a gear between the operating position indicator plate and the lever.
- Equipped with a mechanism that indicates the applicable operating zone, as well as push-button switching to control left and right motion.
- Conforms to EN (TÜV) standards corresponding to the CE marking.
- 3-conduit switches are available.
- Metric conduit types available.

Model Number Structure

Model Number Legend

D4B-□□□□N
1 2 3

1. Conduit
- 1: PG13.5 (1-conduit)
- 2: G1/2 (PF1/2) (1-conduit)
- 3: 1/2-14NPT (1-conduit)
- 4: M20
- 5: PG13.5 (3-conduit)
- 6: G1/2 (PF1/2) (3-conduit)
- 7: 1/2-14NPT (3-conduit)
- 8: M20 (3-conduit)

2. Built-in Switch
- 1: 1NC/1NO (snap-action)
- 3: 1NC/1NO (slow-action) gold-plated contacts
- 5: 1NC/1NO (slow-action) (see note)
- A: 2NC (slow-action)
- B: 2NC (slow-action) gold-plated contacts

Note: Excluding D4B-□□81N and D4B-□□87N models.

3. Actuator
- 00: Switch box (without head)
- 11: Roller lever (standard)
- 16: Adjustable roller lever
- 17: Adjustable rod lever
- 1R: Roller lever (conventional D4B-compatible)
- 70: Top plunger
- 71: Top roller plunger
- 81: Coil spring
- 87: Plastic rod

Ordering Information

List of Models

Safety limit switch, mechanical form lock

Switches (EN50041)

Actuator		Conduit size								
		PG13.5 (see note 2)			G1/2			M20		
		1NC/1NO (Snap-action)	1NC/1NO (Slow-action)	2NC (Slow-action)	1NC/1NO (Snap-action)	1NC/1NO (Slow-action)	2NC (Slow-action)	1NC/1NO (Snap-action)	1NC/1NO (Slow-action)	2NC (Slow-action)
Side rotary	Roller lever (form A)	D4B-1111N	D4B-1511N	D4B-1A11N	D4B-2111N	D4B-2511N	D4B-2A11N	D4B-4111N	D4B-4511N	D4B-4A11N
	Adjustable roller lever (see note 1)	D4B-1116N	D4B-1516N	D4B-1A16N	D4B-2116N	D4B-2516N	D4B-2A16N	D4B-4116N	D4B-4516N	D4B-4A16N
	Adjustable rod lever (form D) (see note 1)	D4B-1117N	D4B-1517N	D4B-1A17N	D4B-2117N	D4B-2517N	D4B-2A17N	D4B-4117N	D4B-4517N	D4B-4A17N
Top plunger	Plain (form B)	D4B-1170N	D4B-1570N	D4B-1A70N	D4B-2170N	D4B-2570N	D4B-2A70N	D4B-4170N	D4B-4570N	D4B-4A70N
	Roller (form C)	D4B-1171N	D4B-1571N	D4B-1A71N	D4B-2171N	D4B-2571N	D4B-2A71N	D4B-4171N	D4B-4571N	D4B-4A71N
Wobble lever (see note 1)	Coil spring	D4B-1181N	---	D4B-1A81N	D4B-2181N	---	D4B-2A81N	D4B-4181N	---	
	Plastic rod	D4B-1187N	---	D4B-1A87N	D4B-2187N	---	D4B-2A87N	D4B-4187N	---	

Note: 1. Mechanically speaking, these models are basic limit switches.
2. The D4B-□N is a Limit Switch conforming to European standards, and PG13.5 is commonly used in Europe.

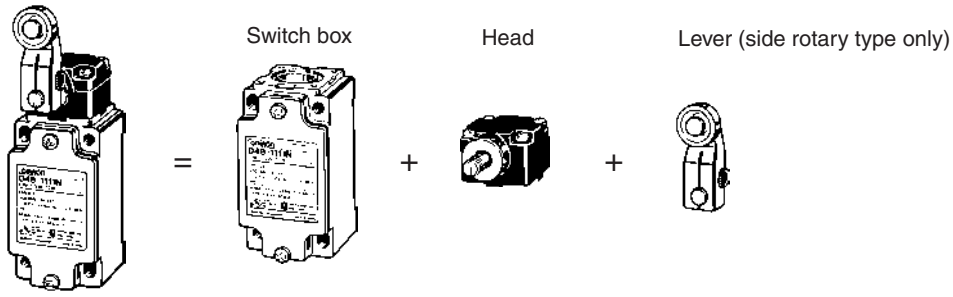
3-conduit Switch

Actuator		Conduit size								
		PG13.5 (see note 2)			G1/2			M20		
		1NC/1NO (Snap-action)	1NC/1NO (Slow-action)	2NC (Slow-action)	1NC/1NO (Snap-action)	1NC/1NO (Slow-action)	2NC (Slow-action)	1NC/1NO (Snap-action)	1NC/1NO (Slow-action)	2NC (Slow-action)
Side rotary	Roller lever (form A)	D4B-5111N	D4B-5511N	D4B-5A11N	D4B-6111N	D4B-6511N	D4B-6A11N	D4B-8111N	---	---
	Adjustable roller lever (see note 1)	D4B-5116N	D4B-5516N	D4B-5A16N	D4B-6116N	D4B-6516N	D4B-6A16N	D4B-8116N	---	---
	Adjustable rod lever (form D) (see note 1)	D4B-5117N	D4B-5517N	D4B-5A17N	D4B-6117N	D4B-6517N	D4B-6A17N	D4B-8117N	---	---
Top plunger	Plain (form B)	D4B-5170N	D4B-5570N	D4B-5A70N	D4B-6170N	D4B-6570N	D4B-6A70N	---	---	---
	Roller (form C)	D4B-5171N	D4B-5571N	D4B-5A71N	D4B-6171N	D4B-6571N	D4B-6A71N	D4B-8171N	---	D4B-8A71N
Wobble lever (see note 1)	Coil spring	D4B-5181N	---	D4B-5A81N	D4B-6181N	---	D4B-6A81N	---	---	---
	Plastic rod	D4B-5187N	---	D4B-5A87N	D4B-6187N	---	D4B-6A87N	---	---	---

Note: 1. Mechanically speaking, these models are basic limit switches.
2. The D4B-□N is a Limit Switch conforming to European standards, and M20/PG13.5 is commonly used in Europe.
3. The wobble lever models are ordinary limit switches and are not approved under EN, GS, and SUVA's Direct Opening Certificate.

Replacement Part

Because the D4B-□N employs a block mounting construction, the switch box, operating head, and lever (side rotary type only) may be ordered as a complete assembly or individually as replacement parts. (Replacement parts are not available as a switch box and head assembly or as a head and lever assembly.)



ex. D4B-2111N = D4B-2100N + D4B-0010N + D4B-0001N

Switch Box

	EN50041			3-conduit type		
	PG13.5	G1/2	1/2-14NPT	PG13.5	G1/2	1/2-14NPT
1NC/1NO (Snap-action)	D4B-1100N	D4B-2100N	D4B-3100N	D4B-5100N	D4B-6100N	D4B-7100N
1NC/1NO (Slow-action)	D4B-1500N	D4B-2500N	D4B-3500N	D4B-5500N	D4B-6500N	D4B-7500N
2NC (Slow-action)	D4B-1A00N	D4B-2A00N	D4B-3A00N	D4B-5A00N	D4B-6A00N	D4B-7A00N

Operating Heads

Actuator	Type	Model
Side rotary	Standard	D4B-0010N
Top plunger	Plain	D4B-0070N
	Roller	D4B-0071N
Wobble lever	Coil spring	D4B-0081N
	Plastic rod	D4B-0087N

Levers (for Side Rotary Switches)

Actuator	Length	Diameter of roller	Model
Standard	31.5	17.5 dia.	D4B-0001N
Adjustable roller lever	25 to 89	19 dia.	D4B-0006N
Adjustable rod lever	145 max.	---	D4B-0007N
Interchangeable with D4B-0001	33.7	19 dia.	D4B-000RN

Note: Other types of lever are also available.

Specifications

Approved Standards

Snap-action Models

Agency	Standard	File No.
TÜV Rheinland	EN60947-5-1	R9851083 (Direct opening: approved) R9151372 (Direct opening: approval pending) (See note 1.)
UL	UL508	E76675
CSA	C22.2 No. 14	LR45746
BIA (See note 2.)	GS-ET-15	1-conduit: 9202158 3-conduit: 9309655

Note: 1. Adjustable roller lever, adjustable rod lever, coil spring, and plastic rod models only.

2. Not including adjustable roller lever, adjustable rod lever, coil spring, and plastic rod models.

Slow-action Models

Agency	Standard	File No.
TÜV Rheinland	EN60947-5-1	R9151643 (Direct opening: approved) (See note)
UL	UL508	E76675
CSA	C22.2 No. 14	LR45746
BIA (See note.)	GS-ET-15	1-conduit: 9202158 3-conduit: 9309655
SUVA (See note.)	SUVA	1-conduit: E6188/1.d 3-conduit: E6189/1.d

Note: Not including adjustable roller lever, adjustable rod lever, coil spring, and plastic rod models.

Standards and EC Directives

- Conforms to the following EC Directives:
  Machinery Directive
  Low Voltage Directive
  EN1088
  EN50041

Approved Standard Ratings

TÜV Rheinland: EN60947-5-1

Utilization category	AC-15
Rated operating current (I_e)	2 A
Rated operating voltage (U_e)	400 V

Note: As protection against short-circuiting, use either a gI-type or gG-type 10-A fuse that conforms to IEC269.

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

A600

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
120 VAC 240 VAC 480 VAC 600 VAC	10 A	60 A 30 A 15 A 12 A	6 A 3 A 1.5 A 1.2 A	7,200 VA	720 VA

Characteristics

Item		Snap-action	Slow-action
Durability (see note 3)	Mechanical	30,000,000 operations min.	10,000,000 operations min.
	Electrical	500,000 operations min. (at a 250 VAC, 10-A resistive load)	
Operating speed		1 mm/s to 0.5 m/s	
Operating frequency		Mechanical:120 operations/min Electrical:30 operations/min	
Rated frequency		50/60 Hz	
Insulation resistance		100 MΩ min. (at 500 VDC) between terminals of the same polarity and between each terminal and non-current-carrying part	
Contact resistance		25 mΩ max. (initial value)	
Dielectric strength (U_{imp})			
	Between terminals of same polarity	U_{imp} 2.5 kV	U_{imp} 4 kV
	Between terminals of different polarity	---	U_{imp} 4 kV
	Between current-carrying metal parts and ground	U_{imp} 4 kV	U_{imp} 4 kV
	Between each terminal and non-current-carrying parts	U_{imp} 4 kV	U_{imp} 4 kV
Rated insulation voltage (U_i)		600 VAC (EN60947-5-1)	
Counter electromotive voltage at switching		1,500 VAC max. (EN60947-5-1)	
Operating environmental pollution level		3 (EN60947-5-1)	
Conditional short-circuit current		100 A (EN60947-5-1)	
Conventional enclosed thermal current (I_{the})		20 A (EN60947-5-1)	
Electric shock protection class		Class I (with ground terminal)	
Vibration resistance		Malfunction:10 to 55 Hz, 0.75 mm single amplitude	
Shock resistance		Destruction:1,000 m/s^2 min. Malfunction:300 m/s^2 min.	
Ambient temperature		Operating:–40°C to 80°C (with no icing) (see note 4)	
Ambient humidity		Operating:95% max.	
Degree of protection		IP67 (EN60947-5-1)	
Weight		Approx. 250 g	

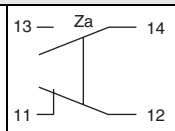
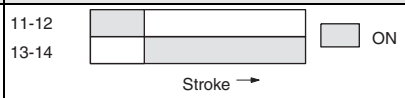
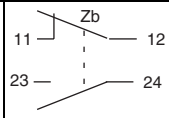
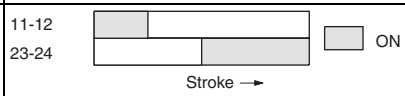
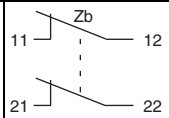
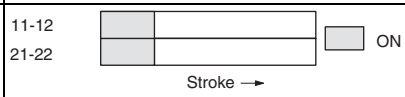
Note: 1. The above values are initial values.
2. The above values may vary depending on the model. Consult your OMRON sales representative for details.
3. The durability is for an ambient temperature of 5°C to 35°C and ambient humidity of 40% to 70%. For further conditions, consult your OMRON sales representative.
4. –25°C to 80°C for the flexible-rod type.

Operating Characteristics

Model	D4B-□□11N	D4B-□□16N (see note 1)	D4B-□□17N (see note 2)	D4B-□□70N	D4B-□□71N	D4B-□□81N	D4B-□□87N
OF max.	9.41 N		2.12 N	18.63 N		1.47 N	
RF min.	1.47 N		0.29 N	1.96 N		---	
PT	21±3°			2.0 mm max.		15° max.	
PT (2nd) (see note 3)	(45°)			(3.0 mm)		---	
OT min.	50°			5.0 mm		---	
MD max. (see note 4)	12°			1.0 mm		---	
DOT min.	35° (Slow-action models) 55° (Snap-action models)			3.2 mm		---	
DOF min.	19.61 N			49.03 N		---	
TT	(75°)			7.0 mm		---	
FP max.	---			38 mm	51 mm	---	
OP	---			35±1 mm	48±1 mm	---	

Note: 1. The operating characteristics of these Switches were measured with the roller lever set at 31.5 mm.
2. The operating characteristics of these Switches were measured with the rod lever set at 140 mm.
3. Only for slow-action models.
4. Only for snap-action models.

Contact Form (EN50013)

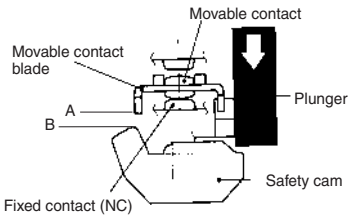
Model	Contact		Diagrams	Explanation
D4B-□1□N	1NC/1NO (Snap-action)			Only NC contact 11-12 has an approved direct opening mechanism. ⊖ Terminal numbers 11-12 and 13-14 cannot be used as unlike poles.
D4B-□5□N	1NC/1NO (Slow-action)			Only NC contact 11-12 has an approved direct opening mechanism. ⊖ Terminal numbers 11-12 or 23-24 can be used as unlike poles.
D4B-□A□N	2NC (Slow-action)			Both NC contacts 11-12 and 21-22 have an approved direct opening mechanism. ⊖ Terminal numbers 11-12 and 21-22 can be used as unlike poles.

Direct Opening Mechanism

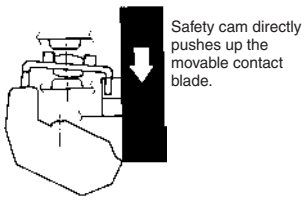
1NO/1NC Contact (Snap-action)

If metal deposition between mating contacts occurs on the NC contact side, they can be pulled apart by the shearing force and tensile force generated when part B of the safety cam or plunger engages part A of the movable contact blade. When the safety cam or plunger is moved in the direction of the arrow, the Limit Switch releases.

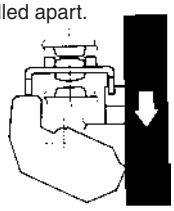
1. When metal deposition occurs.



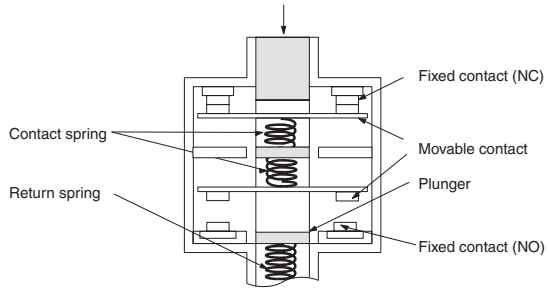
2. When contacts are being pulled apart.



3. When contacts are completely pulled apart.



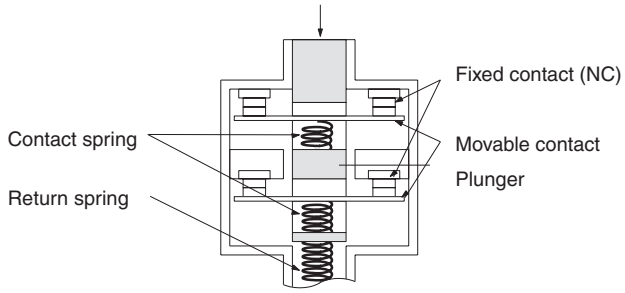
1NC/1NO Contact (Slow-action)



Conforms to EN60947-5-1 Direct Opening ⊖

When metal deposition occurs, the contacts are separated from each other by the plunger being pushed in.

2NC Contact (Slow-action)



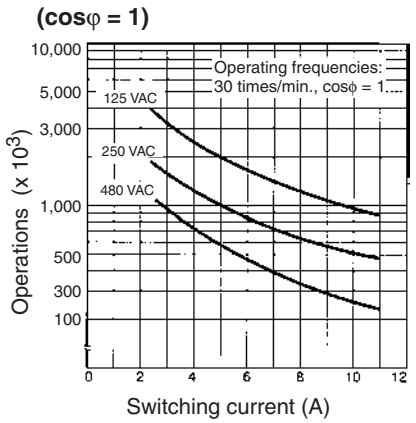
Conforms to EN60947-5-1 ⊖

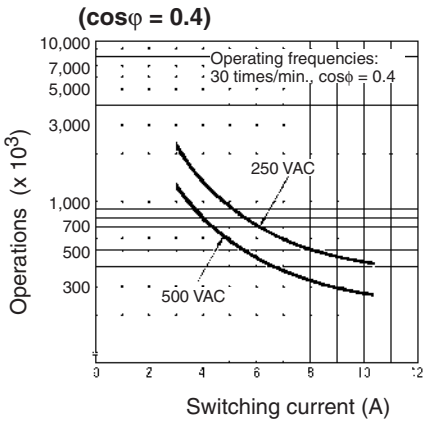
When metal deposition occurs, the contacts are separated from each other by the plunger being pushed in.

⊖ is marked on the product to indicate approval of direct opening.

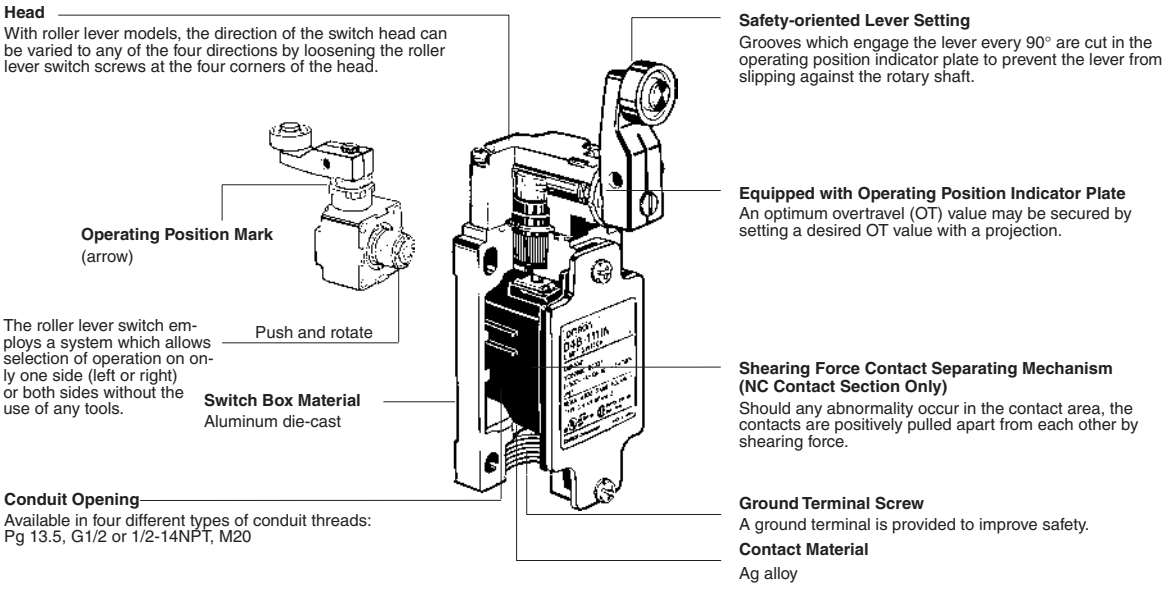
Engineering Data

Electrical Durability (Snap-action)





Nomenclature



Dimensions

Note: 1. All units are in millimeters unless otherwise indicated.

2. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

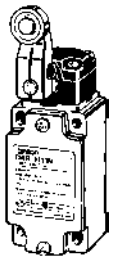
3. When placing your order, specify the conduit type by adding a code from the list below to the blank box of the following model numbers as shown below.

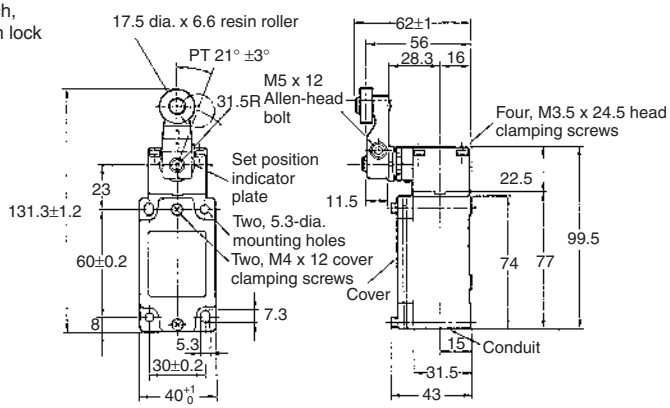
Standard Switches	3-conduit Switches
1: PG 13.5	5: PG 13.5
2: G 1/2	6: G 1/2
3: 1/2-14NPT	7: 1/2-14NPT
4: M20	8: M20

Switches

Roller Lever safety limit switch, mechanical form lock

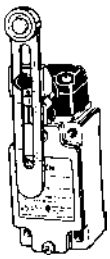
D4B-□□11N

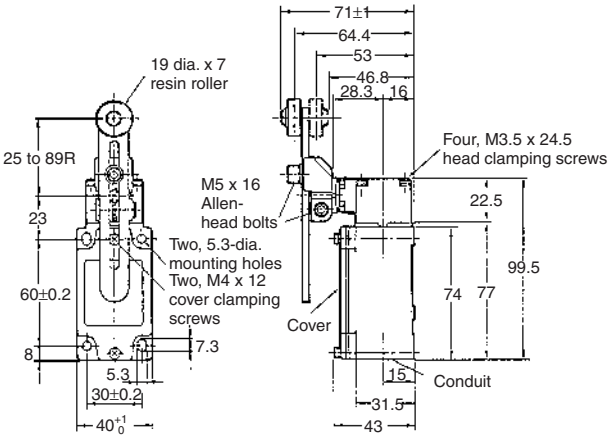




Adjustable Roller Lever

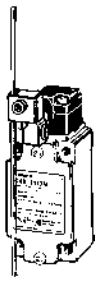
D4B-□□16N

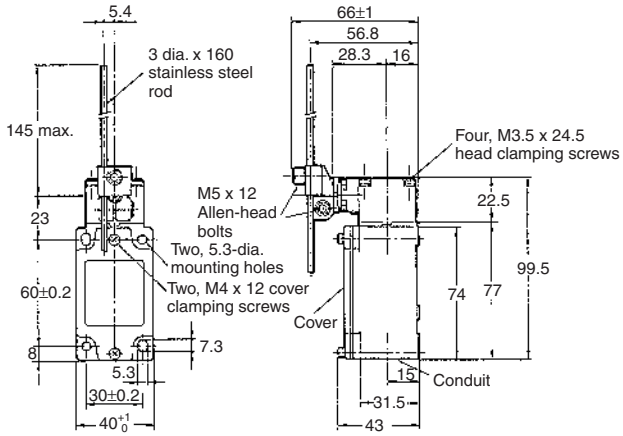




Adjustable Rod Lever

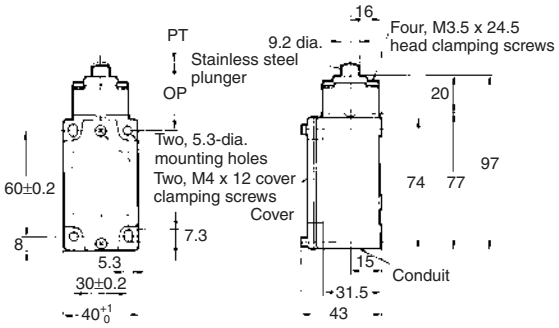
D4B-□□17N





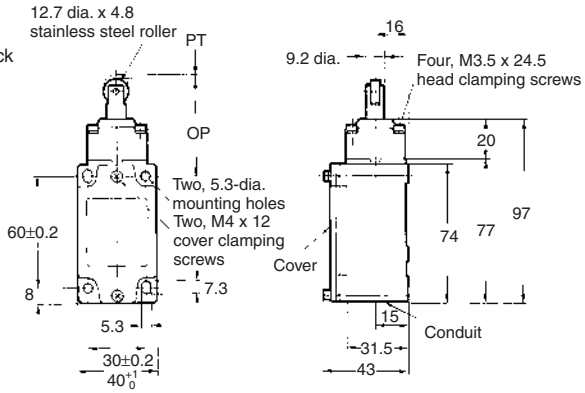
Top Plunger
D4B-□□70N

safety limit switch, mechanical form lock

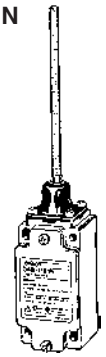


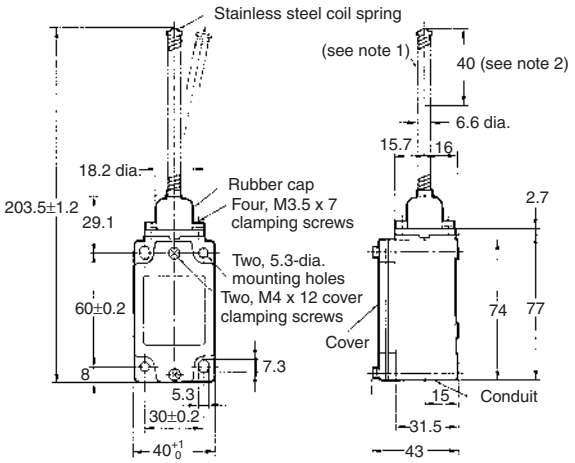
Top Roller Plunger
D4B-□□71N

safety limit switch, mechanical form lock



Coil Spring
D4B-□□81N

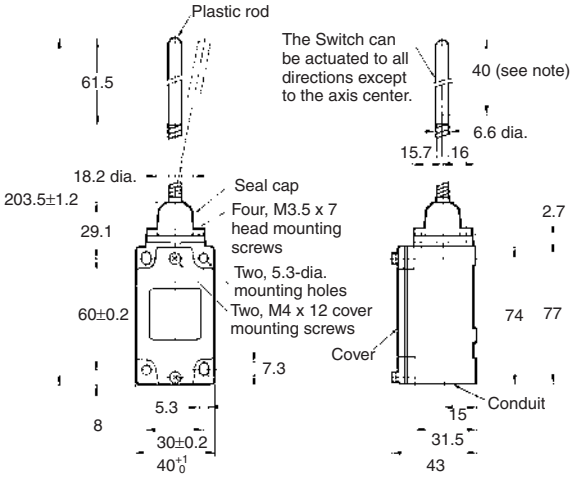




Note: 1. The coil spring may be operated from any directions except axial directions (↓).

2. Be sure to adjust the dog to within 40 mm from the top end of the coil spring.

Plastic Rod
D4B-□□87N



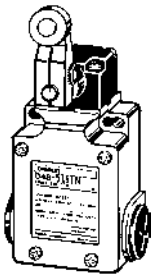
Note: Be sure to adjust the dog to within 40 mm from the top end of the plastic rod.

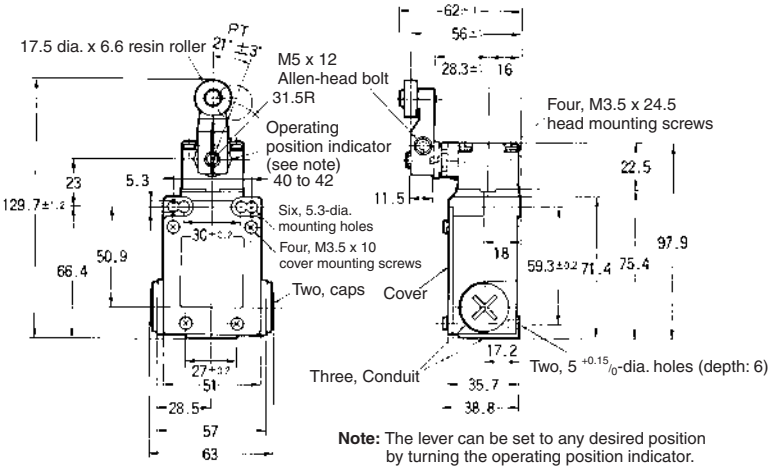
3-conduit Switches

Roller Lever

safety limit switch, mechanical form lock

D4B-□□11N

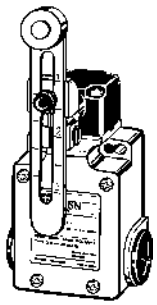


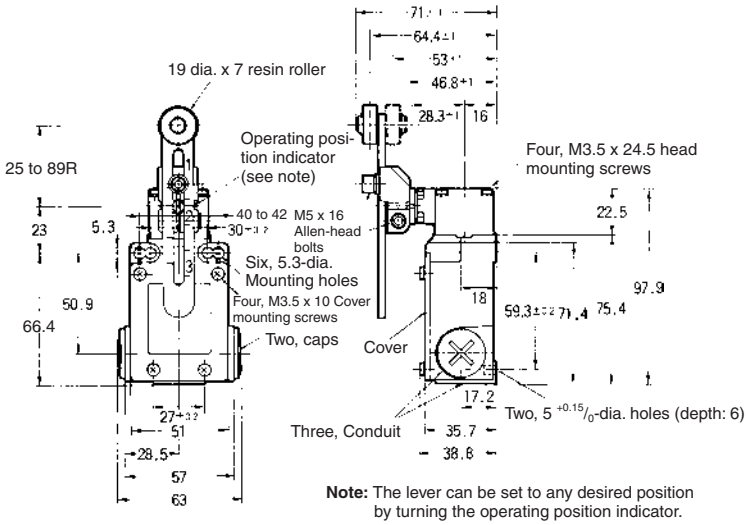


Note: The lever can be set to any desired position by turning the operating position indicator.

Adjustable Roller Lever

D4B-□□16N

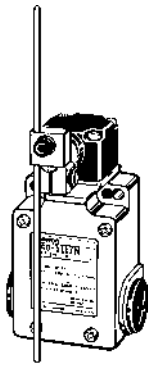


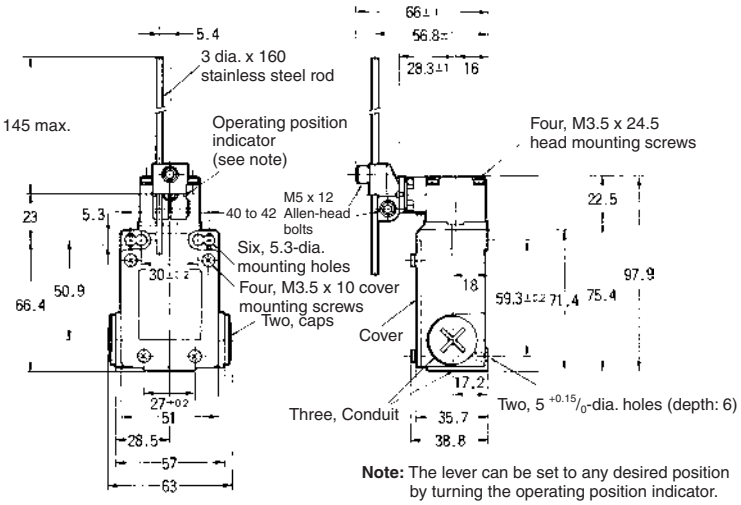


Note: The lever can be set to any desired position by turning the operating position indicator.

Adjustable Rod Lever

D4B-□□17N

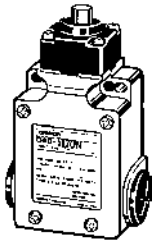


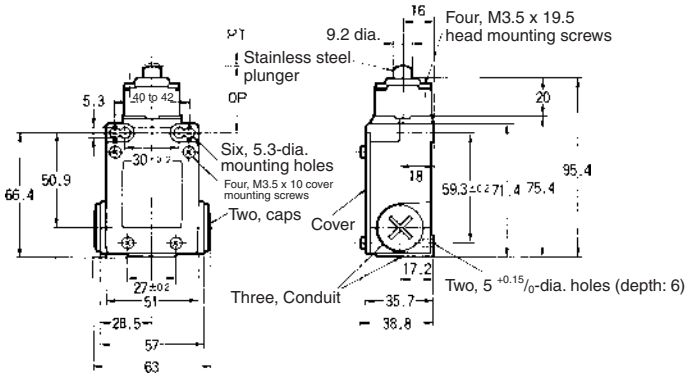


Note: The lever can be set to any desired position by turning the operating position indicator.

Top Plunger
safety limit switch, mechanical form lock

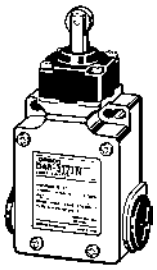
D4B-□□70N

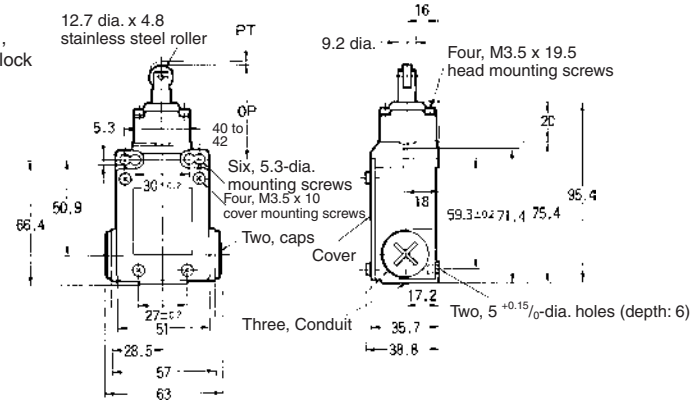




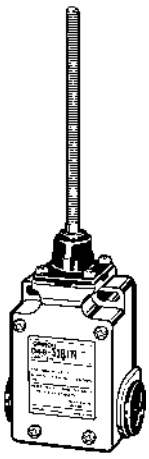
Top Roller Plunger
safety limit switch, mechanical form lock

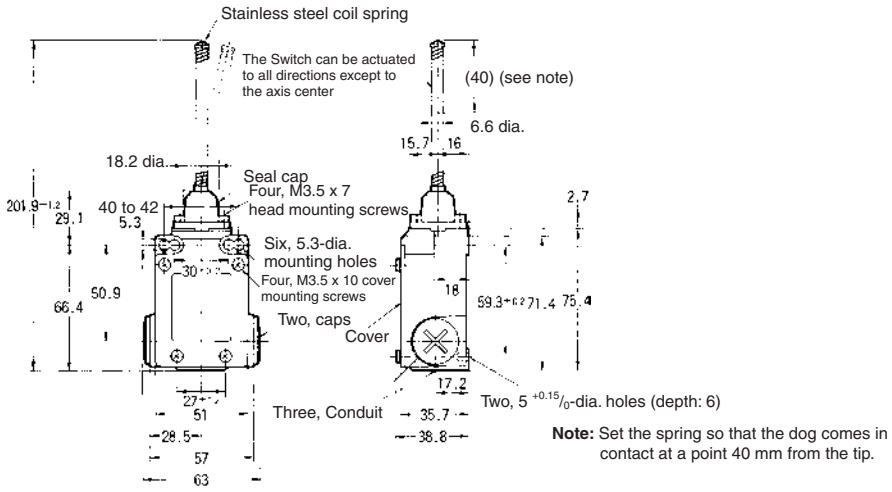
D4B-□□71N





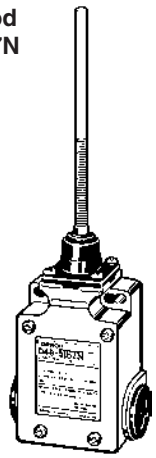
Coil Spring
D4B-□□81N

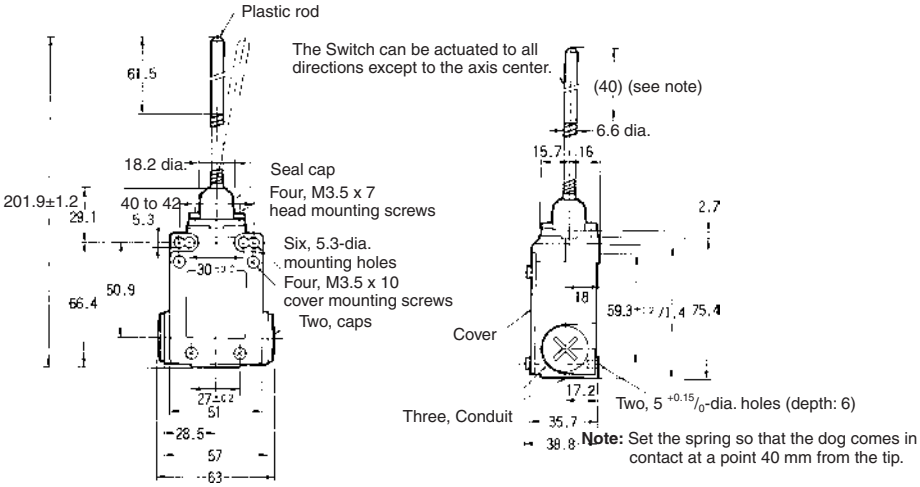




Note: Set the spring so that the dog comes in contact at a point 40 mm from the tip.

Plastic Rod
D4B-□□87N



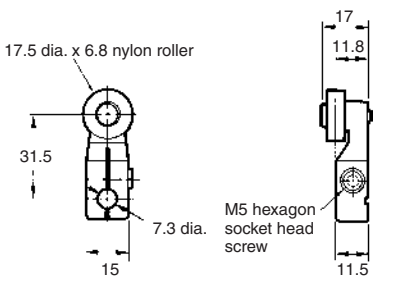


Note: Set the spring so that the dog comes in contact at a point 40 mm from the tip.

Levers

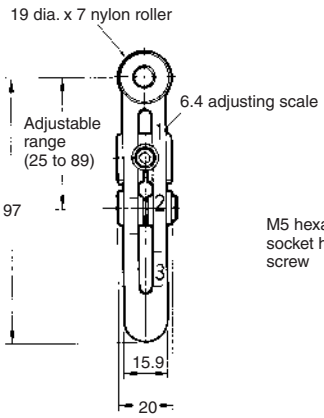
Roller Lever
mechanical form lock

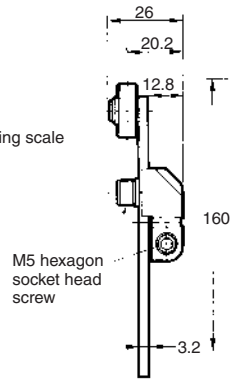
D4B-0001N



Adjustable Roller Lever

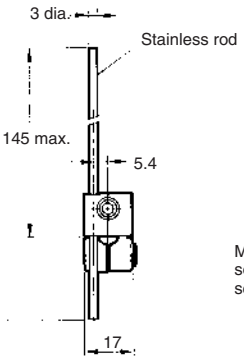
D4B-0006N

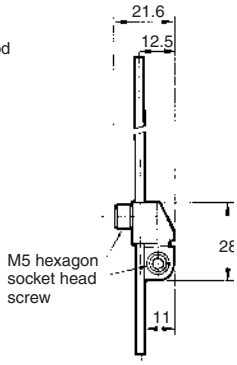




Adjustable Rod Lever

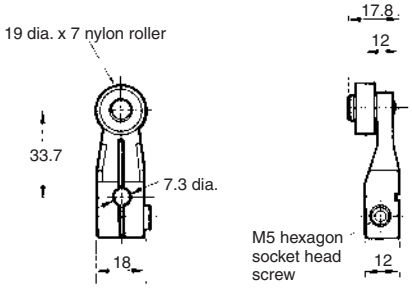
D4B-0007N





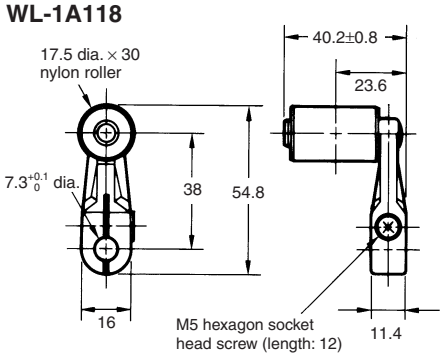
Roller Lever (compatible with previous D4B model)
mechanical form lock

D4B-000RN



Roller Lever

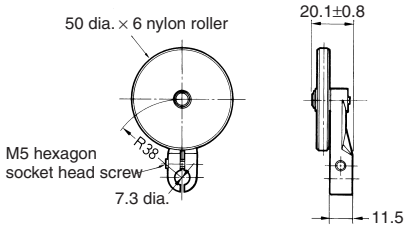
WL-1A118



Note: Reverse the indicator plate when mounting.

Roller Lever

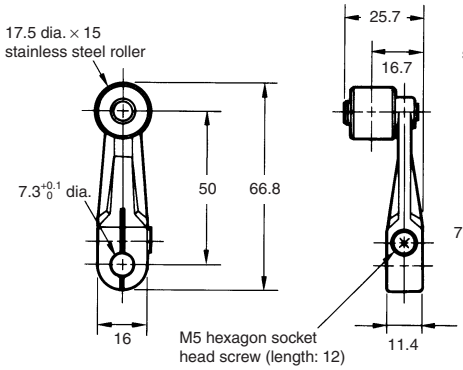
WL-1A106



Note: Reverse the indicator plate when mounting.

Roller Lever
mechanical form lock

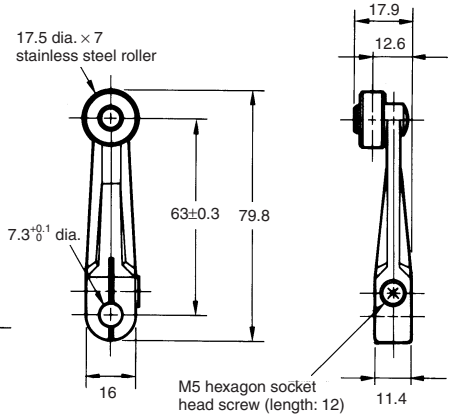
WL-1A206



Note: Reverse the indicator plate when mounting.

Roller Lever

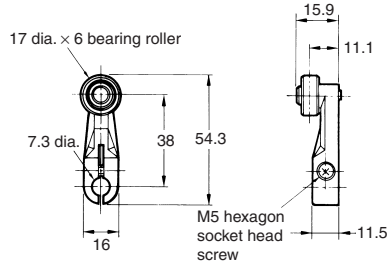
WL-1A300



Note: Reverse the indicator plate when mounting.

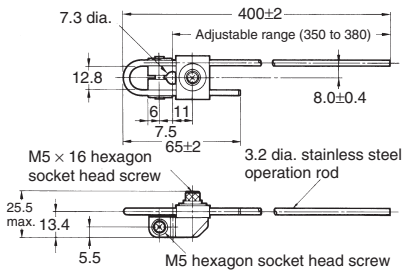
Roller Lever

WL-1A400



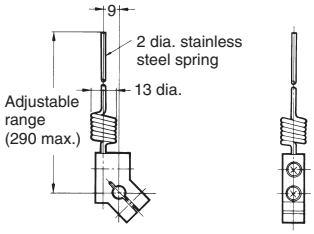
Note: Reverse the indicator plate when mounting.

Adjustable Rod Lever
WL-3A100



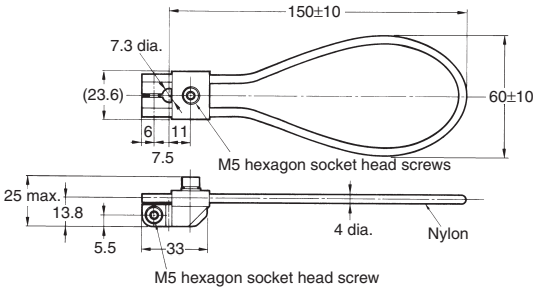
Note: Reverse the indicator plate when mounting.

Spring Rod Lever
WL-4A201



Note: Reverse the indicator plate when mounting.

Resin Loop Lever
D4A-F00



Note: Reverse the indicator plate when mounting.

Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

2. Safety Limit Switch specifications are satisfied with D4B-□□□□AN Levers only.

Precautions

If the D4B-□N is applied to a safety category circuit for prevention of injury, use the D4B-□N model that has an NC contact equipped with a direct opening mechanism, and make sure that the D4B-□N operates in the direct opening mode. Furthermore, secure the D4B-□N with screws or equivalent parts that are tightened in a single direction so that the D4B-□N cannot be easily removed. Then provide a protection cover for the D4B-□N and post a warning label near the D4B-□N.

In order to protect the D4B-□N 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 D4B-□N.

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

Do not apply the D4B-□N to the door without applying a stopper to the door.

If the D4B-□N is used with the actuator normally pressed, the D4B-□N may malfunction or may soon have reset failures. Be sure to check and replace the D4B-□N regularly.

Correct Use

Operating Environment

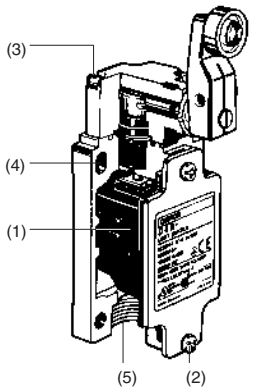
The D4B-□N is for indoor use. The D4B-□N may malfunction if the D4B-□N is used outdoors. Be sure to use a model with a lever-type actuator for outdoor use instead.

Do not use the D4B-□N in the following locations:

- Locations subject to severe temperature changes
- Locations subject to high temperatures or condensation
- Locations subject to severe vibration
- Locations where the product may come in contact with metal dust, oil, or chemicals

Tightening Torque

Be sure to tighten each screw of the D4B-□N properly, otherwise the D4B-□N may malfunction.



	Type	Torque
1	M3.5 terminal screw	0.59 to 0.78 N·m
2	Cover-mounting screw (see note)	1.18 to 1.37 N·m
3	Head mounting screw	0.78 to 0.98 N·m
4	M5 body mounting screw	4.90 to 5.88 N·m
5	Connector	1.77 to 2.16 N·m
6	Cap screw (for three-conduit models)	1.27 to 1.67 N·m

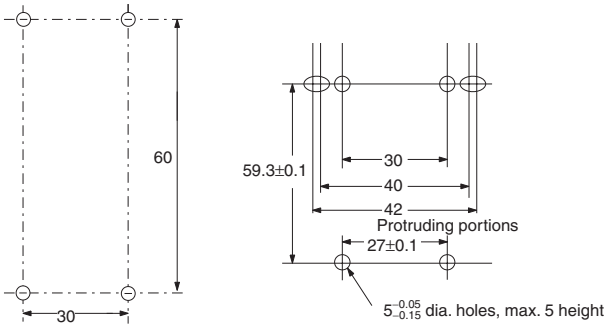
Note: Apply a tightening torque of 0.78 to 0.88 N·m to conduit models.

Mounting

Use four M5 screws with washers to mount the standard model. Be sure to apply the proper torque to tighten each screw. The D4B-□N can be mounted more securely by using the four screws plus two $5\ ^{-0.05}/_{-0.15}$-mm protruding parts, each of which has a maximum height of 4.8 mm as shown below.

Mounting Dimensions (M5)

Standard Model **3-conduit Model**



Changes in Actuator Mounting Position

To change the angle of the lever, loosen the Allen-head bolts on the side of the lever.

The operating position indicator plate has protruding parts which engage with the lever, thus allowing changes to the lever position by 90°.

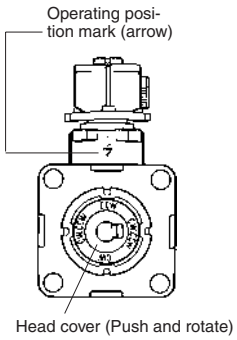
The back of the operating position indicator plate has no protruding parts. The lever can be set at any angle by attaching the operating position indicator plate to the Switch so that this side will face the lever. In this case, however, the D4B-□N will not be approved by SUVA or BIA. Make sure that the lever engages with the operating position indicator plate securely so that the lever will not slip.

Changes in Head Mounting Position

By removing the screws on the four corners of the head, the head can be reset in any of four directions. Make sure that no foreign materials will penetrate through the head.

CW, CCW or Two-way Operation

The head of Side Rotary Switches can be converted in seconds to CW, CCW, or two-way operation. The conversion procedure follows.



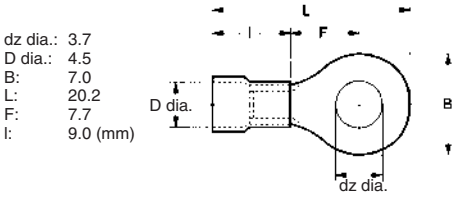
Procedure

1. Dismount the head by loosening the four screws that secure it.
2. Turn over the head to set the desired operation (CW, CCW, or both). The desired operation can be selected by setting the mode selector knob shown in the figure. This knob is factory set to the "CW + CCW" (two-way operation) position.
3. Set the CW hole on the head at the operation position mark (arrow) for clockwise operation or set the CCW hole right at the arrow for counterclockwise operation. In either case, be sure to set the hole position exactly at the arrow point.

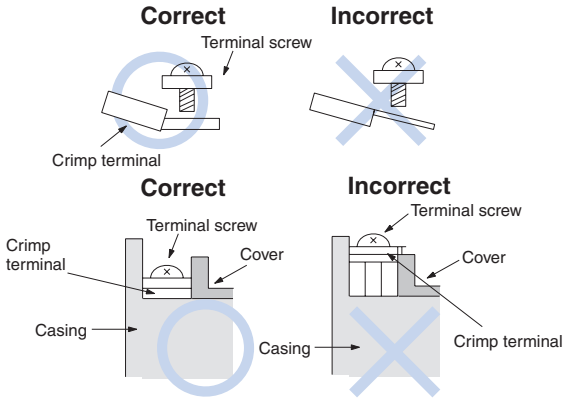
Wiring

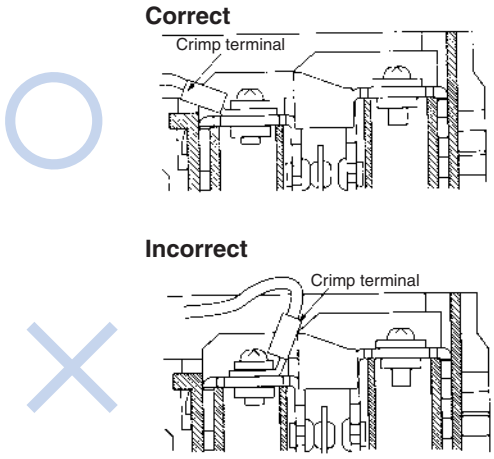
Do not connect the bare lead wires directly to the terminals but be sure to connect each of them by using an insulation tube and M3.5 round crimp terminals and tighten each terminal screw within the specified torque range.

The proper lead wire is 20 to 14 AWG (0.5 to 2.5 mm^2) in size.



Make sure that all crimp terminals come into contact with the casing or cover as shown below, otherwise the cover may not be mounted properly or the D4B-□N may malfunction.





Connector

Make sure that each connector is tightened within the specified torque range. The casing may be damaged if the connector is tightened excessively.

If the 1/2-14NPT is used, cover the cable and conduit end with sealing tape in order to ensure IP67.

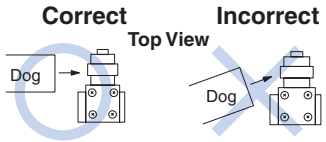
The Pg13.5 connector must be Nippon Flex's ABS-08Pg13.5 or ABS-12 Pg13.5.

Use OMRON's SC-series connector which is suited to the cable in diameter.

Properly attach the provided conduit cap to the unused conduit opening and securely tighten the cap screw within the specified torque when wiring the D4B-□N.

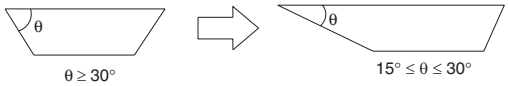
Others

The load for the actuator (roller) of the Switch must be imposed on the actuator in the horizontal direction, otherwise the actuator or the rotating axis may be deformed or damaged.



When using a long lever model like the D4B-□□16N or D4B-□□17N, the Switch may telegraph. To avoid telegraphing, take the following precautions.

1. Set the lever to operate in one direction. For details, see page G-257, *CW, CCW or Two-way Operation*.
2. Modify the rear end of the dog to an angle of 15° to 30° as shown below or to a secondary-degree curve.



3. Modify the circuit so as not to detect the wrong operating signals.

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

Cat. No. C005-E2-09A-X In the interest of product improvement, specifications are subject to change without notice.

Small Safety Limit Switch

D4F

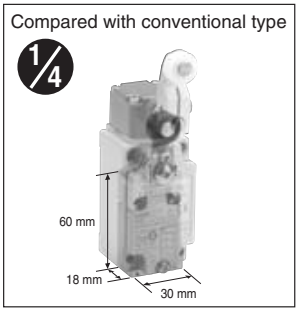
A Smaller Limit Switch than Ever Previously Produced. Ideal for Applications to Small-scale Machinery and Equipment

- A noticeable reduction to 1/4 the size of OMRON's conventional model.
- High-sensitivity safety limit switch.
- Built-in switches with two- or four-contact construction are available.
- Degree of protection: IP67 (EN60947-5-1)
- Patent and design pending.

Features

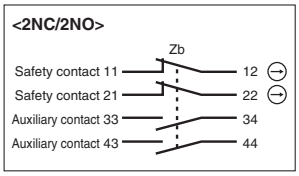
A Dramatic Reduction in Size

The volume is reduced to one quarter of the volume of our company's conventional types of limit switches (30 (W) × 18 (L) × 60 mm (H)). Optimal for the downsizing of machinery and equipment.



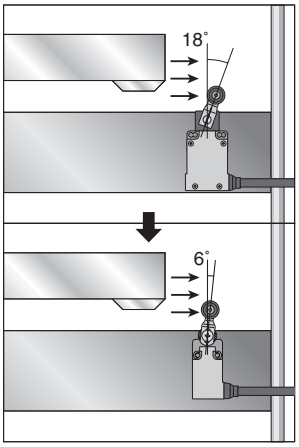
Four-contact Construction is Available

D4F models of two-contact construction (1NC/1NO and 2NC) and those of four-contact construction (2NC/2NO and 4NC) are available. The auxiliary contact can be used for monitoring input of control circuits and indicator lighting.



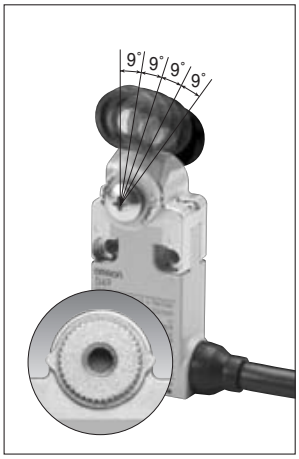
High-sensitivity and Space-saving

The conventional types of limit switches with a direct opening mechanism required 18 degrees for a movement until operation because its direct opening point is long (Our company's conventional types of limit switches).
The D4F requires 6 degrees to respond.
On the table that allows machine tools etc. to move at an increasing speed, the moment the dog pushes the actuator, the D4F responds.
With the development of smaller versions of machines, the D4F saves space and fits in a smaller space.



Positioning in Steps of 9 Degrees

For a roller lever type of switch, grooves are incised on the body and the cam of the actuator, to allow positioning in steps of 9 degrees.



Standards and EC Directives

- Conforms to the following EC Directives:
  Machinery Directive
  Low Voltage Directive
  EN60204-1
  EN1088
  EN50047
  EN81
  EN115
  GS-ET-15
  JIS C 8201-5-1

Approved Standards

Agency	Standards	File No.
TÜV Product service	EN60947-5-1 (Direct opening: approved)	(See note 1.)
UL (See note 2.)	UL508 CSA C22.2 No.14	E76675

Note: 1. Contact your Omron sales representative.
2. Approval has been obtained for CSA C22.2 No. 14 under UL.

Ordering Information

Model Number Legend

D4F-□□-□□
1 2 3 4

1. **Built-in Switch**
   1: 1NC/1NO (slow-action)
   2: 2NC (slow-action)
   3: 2NC/2NO (slow-action)
   4: 4NC (slow-action)
2. **Actuator**
   02: Roller plunger (Metallic roller)
   20: Roller lever (Metallic lever, resin roller)
3. **Cable Length**
   1: 1 m
   3: 3 m
   5: 5 m
4. **Pull-outing direction of cable**
   R: Horizontal
   D: Vertical

List of Models

Actuator	Cable length	Cable direction	Built-in switch			
			1NC/1NO (slow-action)	2NC (slow-action)	2NC/2NO (slow-action)	4NC (slow-action)
Roller lever (Metallic lever, resin roller) 	1 m	Horizontal	D4F-120-1R	D4F-220-1R	D4F-320-1R	D4F-420-1R
		Vertical	D4F-120-1D	D4F-220-1D	D4F-320-1D	D4F-420-1D
	3 m	Horizontal	D4F-120-3R	D4F-220-3R	D4F-320-3R	D4F-420-3R
		Vertical	D4F-120-3D	D4F-220-3D	D4F-320-3D	D4F-420-3D
	5 m	Horizontal	D4F-120-5R	D4F-220-5R	D4F-320-5R	D4F-420-5R
		Vertical	D4F-120-5D	D4F-220-5D	D4F-320-5D	D4F-420-5D
Roller plunger (Metallic roller) 	1 m	Horizontal	D4F-102-1R	D4F-202-1R	D4F-302-1R	D4F-402-1R
		Vertical	D4F-102-1D	D4F-202-1D	D4F-302-1D	D4F-402-1D
	3 m	Horizontal	D4F-102-3R	D4F-202-3R	D4F-302-3R	D4F-402-3R
		Vertical	D4F-102-3D	D4F-202-3D	D4F-302-3D	D4F-402-3D
	5 m	Horizontal	D4F-102-5R	D4F-202-5R	D4F-302-5R	D4F-402-5R
		Vertical	D4F-102-5D	D4F-202-5D	D4F-302-5D	D4F-402-5D

Prefered items

Specifications

Approved Standard Ratings

TÜV (EN60947-5-1)

Item / Utilization category	AC-15	DC-13
Rated operating current (Ie)	0.75 A	0.27 A
Rated operating voltage (Ue)	240 V	250 V

Note: Use a 10-A fuse type gI or gG that conforms to IEC269 as a short-circuit protection device.

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

C300

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
120 VAC	2.5 A	15 A	1.5 A	1,800 VA	180 VA
240 VAC		7.5 A	0.75 A		

Q300

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

Characteristics

Degree of protection (See note 1.)		IP67 (EN60947-5-1)
Durability (See note 2.)		Mechanical: 10,000,000 times min. Electrical: 1,000,000 times min. (4-mA resistive load at 24 VDC, 4 circuits) 150,000 times min. (1-A resistive load at 125 VAC, 2 circuits / 4-mA resistive load at 24 VDC, 2 circuits) (See note 3.)
Operating speed		1 mm/s to 0.5 m/s
Operating frequency		Mechanical: 120 operations/minute Electrical: 30 operations/minute
Insulation resistance		100 MΩ min. (at 500 VDC) between terminals of the same polarities, between terminals of different polarities, between current-carrying metal parts and grounds, and between each terminal and non-current carrying metal parts
Minimum applicable load (See note 4.)		4-mA resistive load at 24 VDC, 4 circuits (Level N reference value)
Contact resistance (See note 5.)		300 mΩ max. (initial value with 1-m cable), 500 mΩ max. (initial value with 3-m cable), 700 mΩ max. (initial value with 5-m cable)
Dielectric strength		Between terminals of same polarities: Uimp 2.5 kV (EN60947-5-1) Between terminals of different polarities: Uimp 4 kV (EN60947-5-1) Between current-carrying metal parts and grounds: Uimp 4 kV (EN60947-5-1) Between each terminal and non-current carrying metal parts: Uimp 4 kV (EN60947-5-1)
Conditional short-circuit current		100 A (EN60947-5-1)
Pollution degree (operating environment)		3 (EN60947-5-1)
Conventional free air thermal current (Ith)		2.5 A (EN60947-5-1)
Protection against electric shock		Class I (with a ground wire)
Vibration resistance	**Malfunction**	10 to 55 Hz, 0.75-mm single amplitude
Shock resistance	**Destruction**	1,000 m/s^2 min.
	Malfunction	300 m/s^2 min.
Ambient temperature		Operating: -30°C to 70°C (with no icing)
Ambient humidity		Operating: 95% max.
Cable		UL2464 No. 22 AWG, finishing O.D.: 8.3 mm
Weight		Approx. 190 g (D4F-102-1R, with 1-m cable) Approx. 220 g (D4F-120-1R, with 1-m cable)

Note:
1. The degree of protection shown above is based on the test method specified in EN60947-5-1. Be sure to confirm in advance the sealing performance under the actual operating environment and conditions.
2. Durability values are calculated at an operating temperature of 5°C to 35°C, and an operating humidity of 40% to 70%. Contact your OMRON sales representative for more detailed information on other operating environments.
3. When the ambient temperature is 35°C or higher, do not apply 1 A at 125 VAC to more than two circuits.
4. The value will vary depending on factors such as the switching frequency, the ambient environment, and the reliability level. Be sure to confirm correct operation with the actual load before application.
5. The contact resistance was measured with 0.1 A at 5 to 8 VDC with a fall-of-potential method.

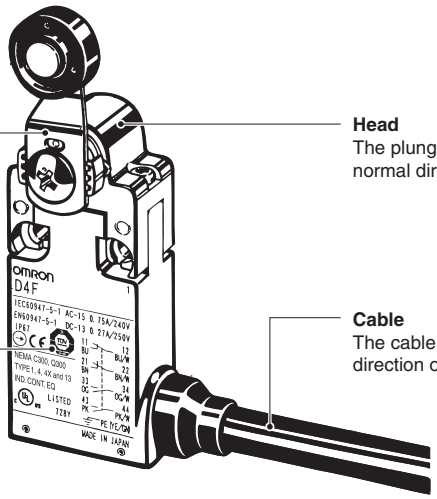
Operating Characteristics

Slow-action (1NC/1NO, 2NC, 2NC/2NO, and 4NC)

Model **Operating Characteristics**	**D4F-□20-□R** **D4F-□20-□D**	**D4F-□02-□R** **D4F-□02-□D**
Operating force max.: OF (See note 1.)	5 N	12 N
Release force min.: RF (See note 2.)	0.5 N	1.5 N
Pretravel: PT1 (11-12 and 21-22)	6±3° (NC)	1 mm max. (NC)
: PT1 (31-32 and 41-42)	9±3° (NC)	1.3 mm max. (NC)
: PT2 (See note 3.)	(12°) (NO)	(1.2 mm) (NO)
Overtravel min.: OT	40°	3.2 mm
Operating position: OP (11-12 and 21-22)	——	29.4±1 mm
: OP (31-32 and 41-42)	——	29±1 mm
Total travel: TT (See note 3.)	(55°)	(4.5 mm)
Min. direct opening travel: DOT (See note 4.)	18°	1.8 mm
Min. direct opening force: DOF	20 N	20 N

Note:
1. The OF value is the maximum load that opens an NC contact (11-12, 21-22, 31-32, 41-42).
2. The RF value is the minimum load that closes an NC contact (11-12, 21-22, 31-32, 41-42).
3. The PT2 and TT values are reference values.
4. The D4F is used in accordance with EN81 and EN115 at a minimum DOT of 30° and 2.8 mm.

Nomenclature



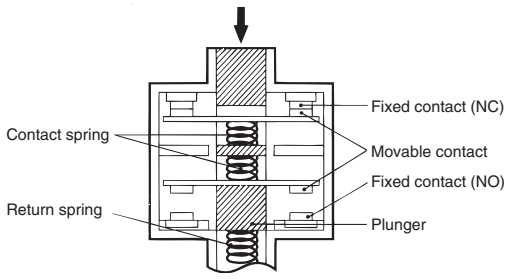
Operation

Contact Form

Model	Contact		Diagram	Remarks
D4F-1□-□□	1NC/1NO (slow-action)	Zb: 11–12, 33–34	11-12, 33-34; ON; Stroke	Only NC contact 11-12 has an approved direct opening mechanism. ⊖ The terminals 11-12 and 33-34 can be used as unlike poles.
D4F-2□-□□	2NC (slow-action)	Zb: 11–12, 21–22	11-12, 21-22; ON; Stroke	NC contacts 11-12 and 21-22 have an approved direct opening mechanism. ⊖ The terminals 11-12 and 21-22 can be used as unlike poles.
D4F-3□-□□	2NC/2NO (slow-action)	Zb: 11–12, 21–22, 33–34, 43–44	11-12, 21-22, 33-34, 43-44; ON; Stroke	NC contacts 11-12 and 21-22 have an approved direct opening mechanism. ⊖ The terminals 11-12, 21-22, 33-34 and 43-44 can be used as unlike poles.
D4F-4□-□□	4NC (slow-action)	Zb: 11–12, 21–22, 31–32, 41–42	11-12, 21-22, 31-32, 41-42; ON; Stroke	NC contacts 11-12, 21-22, 31-32 and 41-42 have an approved direct opening mechanism. ⊖ The terminals 11-12, 21-22, 31-32 and 41-42 can be used as unlike poles.

Direct Opening Mechanism

1NC/1NO Contact (slow-action)

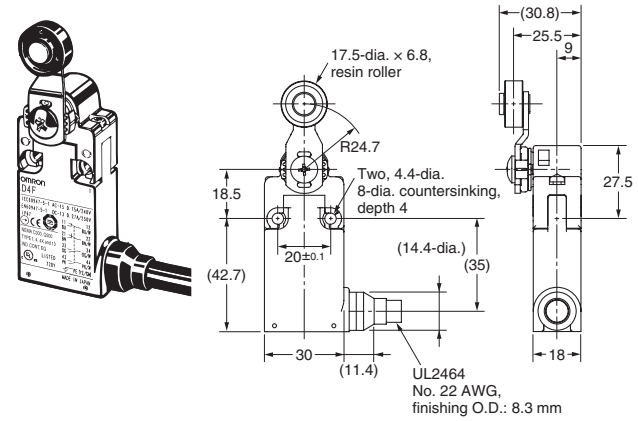


Conforms to EN60947-5-1 Direct Opening ⊖.
(Only the NC contacts have a direct opening function.)
When metal weld occurs, the NC contacts are separated from each other by pushing in the plunger.

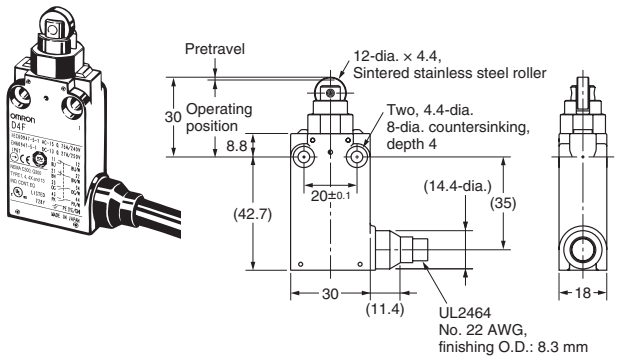
Dimensions

Note: 1. All units are in millimeters unless otherwise indicated.
2. Each dimension has a tolerance of 0.4 mm unless otherwise specified.

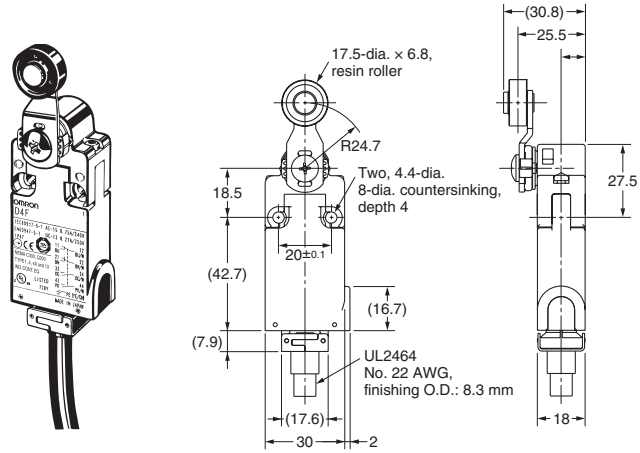
Roller lever (Metallic lever, resin roller)
D4F-□20-□R



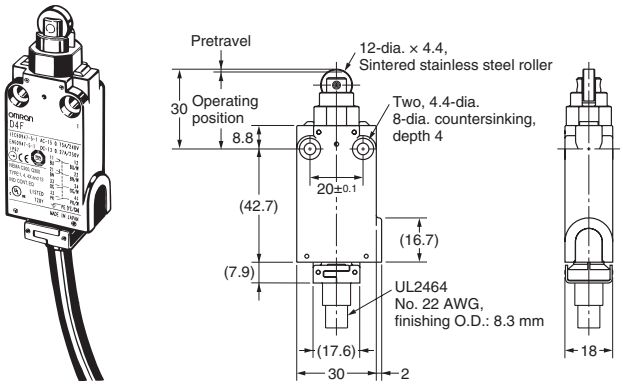
Roller plunger (Metallic roller)
D4F-□02-□R



Roller lever (Metallic lever, resin roller)
D4F-□20-□D



Roller plunger (Metallic roller)
D4F-□02-□D



Precautions

NOTICE

Be sure to connect a ground line, otherwise an electric shock may occur.

If the D4F is to be used as a switch in an emergency stop circuit or in a safety circuit for preventing accidents resulting in injuries or deaths, use NC contacts with a forced release mechanism and set the D4F so that it will operate in direct opening mode.
For safety, install the Switch using one-way rotational screws or other similar means to prevent it from easily coming off. Protect the D4F with an appropriate cover and post a warning sign near the D4F in order to ensure the safety.

To prevent the D4F from damage due to circuit short-circuiting, connect a fuse with a breaking current 1.5 to 2 times larger than the rated current of the D4F in series to the D4F.

If the D4F is used under EN-approved conditions, use a gI or gG 10-A fuse approved by IEC269.

Actuation of the Switch over a long time may deteriorate parts of the Switch and a return failure may result. Be sure to check the condition of the Switch regularly.

Do not supply electric power when wiring.

Do not use the Switch where explosive gas, flammable gas, or any other dangerous gas may be present.

Keep the electrical load below the rated value.

Never wire to a wrong terminal.

Be sure to evaluate the Switch under actual working conditions after installation.

Do not drop or disassemble the D4F.

Do not use in closely contacted mounting.

Do not use the Switch as a stopper.

Conduct periodic inspections.

Do not use it in an activating circuit. (Use it as a safety signal.)

Contacts of the D4F can be used both for ordinary load and microload; however, once the contact is opened or closed with an ordinary load, it cannot be used for a load smaller than that. The contact surface may be rough, which impairs the reliability of contacting.

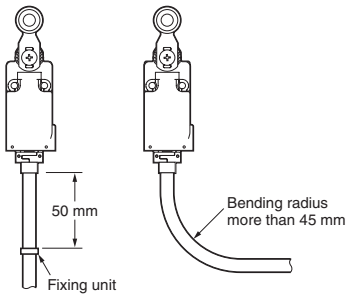
Handling of cables

Cables cannot be flexed repeatedly.

The cable is fixed with sealing materials on the bottom of the switch. When excessive force may be imposed on the cable, fasten the cable with a fixing unit at a distance of 50 mm from the bottom of the switch as shown.

Do not pull or press the cable at an excessive force (50 N max.).

When bending the cable, secure the cable with more than 45-mm bending radius so as not to cause damage to the insulator or sheath of the cable. Doing so may result in current leakage or burning.



When wiring, be sure to prevent penetration of a liquid such as water or oil through the cable end.

Operating Environment

Keep the D4F away from oil and water, as these may enter the casing. (Though the switch construction complies with IP67 and prevents immersion of water even when held in water for a specified time, its use is not guaranteed when it is immersed in a liquid.)

Make sure in advance that the environment is suitable, with the presence of oil, water, or chemicals, as these may cause the seal to deteriorate, resulting in faulty contact, faulty isolation, current leakage, or burning.

Do not use the D4F in the following locations:

- Locations subject to corrosive gas
- Locations with severe changes in temperature
- Locations with excessive humidity that may cause condensation
- Locations with excessive vibration
- Locations that may be covered with processing chips or dust
- Locations subject to high temperature or excessive humidity

Correct Use

Operating Environment

The D4F is for indoor use only.
Do not use the D4F outdoors. Otherwise, the D4F may malfunction.

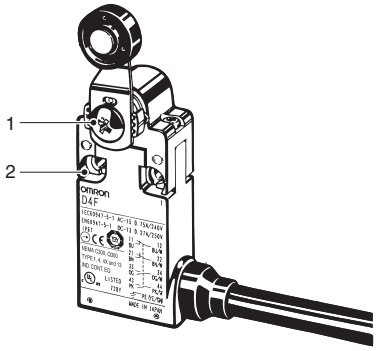
Durability

The life of the D4F will vary with the switching conditions. Before applying the D4F, test the D4F under actual operating conditions and be sure to use the D4F in actual operation within switching times that will not lower the performance of the D4F.

Tightening Torque

Be sure to tighten each screw of the D4F properly, otherwise the D4F may soon malfunction.

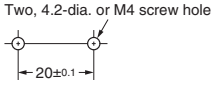
No.	Type	Proper tightening torque
1	Lever mounting screw (M5)	2.4 to 2.8 N·m
2	Body mounting screw (M4)	1.18 to 1.37 N·m



Mounting

Use two M4 screws and washers to mount the D4F securely. The D4F can be mounted more securely with proper tightening torque.

Mounting Holes (Unit: mm)



Changing the lever angle

Unfasten the screw that holds the lever to set the position of the lever at any angle through 360° (in steps of 9°).

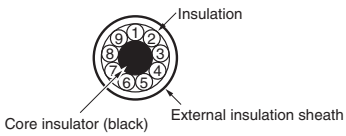
After unfastening the screws that hold the lever, mount the lever the other way (normal side or reverse side). Set an angle of the lever to complete adjustment within a range in which the lever does not touch the switch body.

Wiring

Identifying Wires

Identify wires according to the color (with or without white lines) of the insulation on the wire.

Cross section



Wire Colors

No.	Color of insulation	No.	Color of insulation
1	Blue/white	6	Brown
2	Orange /white	7	Pink
3	Pink/white	8	Orange
4	Brown/white	9	Blue
5	Green/yellow		

Note: "Blue/white, orange/white, pink/white, or brown/white" means that the cover is blue, orange, pink, or brown with a white line.

Terminal Numbers

Identify terminal numbers based on the color (with or without white lines) of the insulation on the wire.

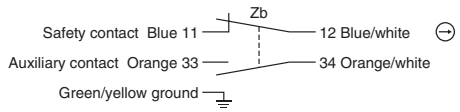
The safety and auxiliary contacts of D4F models of four-terminal contact construction and those of two-terminal contact construction are described below.

The safety contacts are direct-opening NC contacts (11-12 and 21-22); they are used for safety circuits, and each of them is indicated with the appropriate mark ⊖.

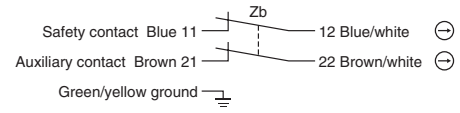
Auxiliary contacts are used to check (to monitor) the operating state of the switch, which are equivalent to NO contacts (33-34 and 43-44) or NC contacts (31-32 and 41-42).

The NC contacts 31-32 and 41-42 of auxiliary contacts (orange or pink) can be used as safety contacts.

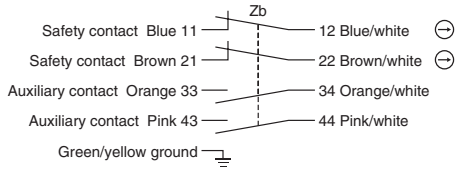
<1NC/1NO>



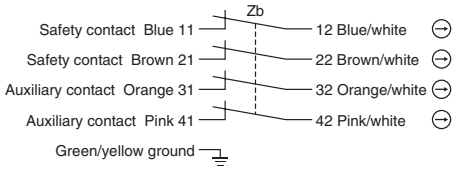
<2NC>



<2NC/2NO>



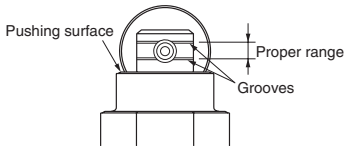
<4NC>



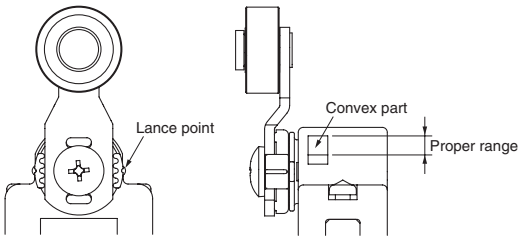
Cut the black core insulator and all unused wires at the end of the external insulation sheath when wiring the cable.

Operating

To set the plunger stroke correctly, press-fit the plunger until the top of the pushing surface comes between two grooves on the plunger.

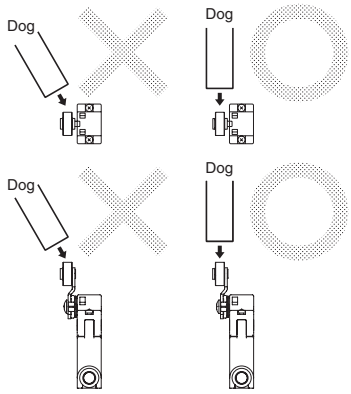


To set the roller lever stroke correctly, push the dog and cam until the the lance point comes within the range of the convex part that is the correct setting position.



Others

Actuating the switch from an angle other than 90 degrees to the switch face may deform or damage the actuator, or deform or damage the rotary spindle, so make sure that the dog is straight.



Do not remove the head. Otherwise, a failure may occur.

To avoid telegraphing, take the following precautions.

1. Set the switch to operate in one direction.
2. Modify the rear end of the dog to an angle of 15° to 30° as shown below or to a secondary-degree curve.

3. Modify the circuit so as not to detect the wrong operating signals.

SI Units Conversion Table

To fully comply with international standards, this catalogue is based on the International System of Units (SI).

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

Cat. No. C124-E2-01-X

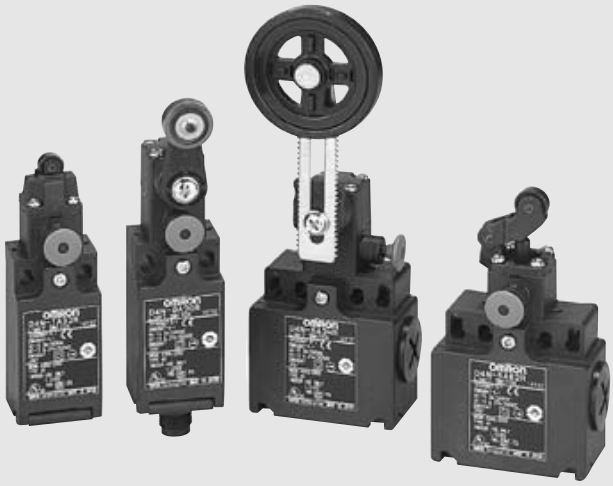
Miniature Manual Reset Limit Switch

D4N-□R

New Series of manual-reset Limit Switch

- Lineup includes three contact models with 2NC/1NO and 3NC contacts in addition to the 1NC/ 1NO, and 2NC version. Version with MBB contacts meet applications for avdanced requirements.
- M12-connector models are available, saving on labor and simplifying maintenance.
- Standardized gold-clad contacts provide high contact reliability. Can be used with both standard loads and micro-loads.
- Free of lead, cadmium, and hexavalent chrome, reducing the burden on the environment.
- Conforms to EN115 and EN81-1.

Be sure to read the “Safety Precautions” on page G-277.



Note: Contact your sales representative for details on models with safety standard certification.

Model Number Structure

D4N-□□□□R
1 2 3

1. Conduit/Connector size
1: Pg13.5 (1-conduit)
2: G1/2 (1-conduit)
3: 1/2-14NPT (1-conduit)
4: M20 (1-conduit)
5: Pg13.5 (2-conduit)
6: G1/2 (2-conduit)
7: 1/2-14NPT (M20 2-conduit with 1/2-14NPT changing adaptor included)
8: M20 (2-conduit)
9: M12 connector (1-conduit)

2. Built-in Switch
A: 1NC/1NO (slow-action)
B: 2NC (slow-action)
C: 2NC/1NO (slow-action)
D: 3NC (slow-action)

3. Head and Actuator
20:Roller lever (resin lever, resin roller)
2G:Adjustable roller lever, form lock (metal lever, resin roller)
2H:Adjustable roller lever, form lock (metal lever. rubber roller)
31:Top plunger
32:Top roller plunger
62:One-way roller arm lever (horizontal)
72:One-way roller arm lever (vertical)

Ordering Information

List of Models

Actuator	Conduit size		Built-in switch mechanism			
			1NC/1NO (Slow-action)	2NC (Slow-action)	2NC/1NO (Slow-action)	3NC (Slow-action)
Roller lever (resin lever, resin roller) 	1-conduit	Pg13.5	D4N-1A20R	D4N-1B20R	D4N-1C20R	D4N-1D20R
		G1/2	D4N-2A20R	D4N-2B20R	D4N-2C20R	D4N-2D20R
		1/2-14NPT	D4N-3A20R	D4N-3B20R	D4N-3C20R	D4N-3D20R
		M20	D4N-4A20R	D4N-4B20R	D4N-4C20R	D4N-4D20R
		M12 connector	D4N-9A20R	D4N-9B20R	---	---
	2-conduit	Pg13.5	D4N-5A20R	D4N-5B20R	D4N-5C20R	D4N-5D20R
		G1/2	D4N-6A20R	D4N-6B20R	D4N-6C20R	D4N-6D20R
		1/2-14NPT (See note 2.)	D4N-7A20R	D4N-7B20R	D4N-7C20R	D4N-7D20R
		M20	D4N-8A20R	D4N-8B20R	D4N-8C20R	D4N-8D20R
Adjustable roller lever, form lock (metal lever, resin roller) 	1-conduit	Pg13.5	D4N-1A2GR	D4N-1B2GR	D4N-1C2GR	D4N-1D2GR
		G1/2	D4N-2A2GR	D4N-2B2GR	D4N-2C2GR	D4N-2D2GR
		1/2-14NPT	D4N-3A2GR	D4N-3B2GR	D4N-3C2GR	D4N-3D2GR
		M20	D4N-4A2GR	D4N-4B2GR	D4N-4C2GR	D4N-4D2GR
		M12 connector	D4N-9A2GR	D4N-9B2GR	---	---
	2-conduit	Pg13.5	D4N-5A2GR	D4N-5B2GR	D4N-5C2GR	D4N-5D2GR
		G1/2	D4N-6A2GR	D4N-6B2GR	D4N-6C2GR	D4N-6D2GR
		1/2-14NPT (See note 2.)	D4N-7A2GR	D4N-7B2GR	D4N-7C2GR	D4N-7D2GR
		M20	D4N-8A2GR	D4N-8B2GR	D4N-8C2GR	D4N-8D2GR
Adjustable roller lever, form lock (metal lever, rubber roller) 	1-conduit	Pg13.5	D4N-1A2HR	D4N-1B2HR	D4N-1C2HR	D4N-1D2HR
		G1/2	D4N-2A2HR	D4N-2B2HR	D4N-2C2HR	D4N-2D2HR
		1/2-14NPT	D4N-3A2HR	D4N-3B2HR	D4N-3C2HR	D4N-3D2HR
		M20	D4N-4A2HR	D4N-4B2HR	D4N-4C2HR	D4N-4D2HR
		M12 connector	D4N-9A2HR	D4N-9B2HR	---	---
	2-conduit	Pg13.5	D4N-5A2HR	D4N-5B2HR	D4N-5C2HR	D4N-5D2HR
		G1/2	D4N-6A2HR	D4N-6B2HR	D4N-6C2HR	D4N-6D2HR
		1/2-14NPT (See note 2.)	D4N-7A2HR	D4N-7B2HR	D4N-7C2HR	D4N-7D2HR
		M20	D4N-8A2HR	D4N-8B2HR	D4N-8C2HR	D4N-8D2HR
Plunger 	1-conduit	Pg13.5	D4N-1A31R	D4N-1B31R	D4N-1C31R	D4N-1D31R
		G1/2	D4N-2A31R	D4N-2B31R	D4N-2C31R	D4N-2D31R
		1/2-14NPT	D4N-3A31R	D4N-3B31R	D4N-3C31R	D4N-3D31R
		M20	D4N-4A31R	D4N-4B31R	D4N-4C31R	D4N-4D31R
		M12 connector	D4N-9A31R	D4N-9B31R	---	---
	2-conduit	Pg13.5	D4N-5A31R	D4N-5B31R	D4N-5C31R	D4N-5D31R
		G1/2	D4N-6A31R	D4N-6B31R	D4N-6C31R	D4N-6D31R
		1/2-14NPT (See note 2.)	D4N-7A31R	D4N-7B31R	D4N-7C31R	D4N-7D31R
		M20	D4N-8A31R	D4N-8B31R	D4N-8C31R	D4N-8D31R
Roller plunger 	1-conduit	Pg13.5	D4N-1A32R	D4N-1B32R	D4N-1C32R	D4N-1D32R
		G1/2	D4N-2A32R	D4N-2B32R	D4N-2C32R	D4N-2D32R
		1/2-14NPT	D4N-3A32R	D4N-3B32R	D4N-3C32R	D4N-3D32R
		M20	D4N-4A32R	D4N-4B32R	D4N-4C32R	D4N-4D32R
		M12 connector	D4N-9A32R	D4N-9B32R	---	---
	2-conduit	Pg13.5	D4N-5A32R	D4N-5B32R	D4N-5C32R	D4N-5D32R
		G1/2	D4N-6A32R	D4N-6B32R	D4N-6C32R	D4N-6D32R
		1/2-14NPT (See note 2.)	D4N-7A32R	D4N-7B32R	D4N-7C32R	D4N-7D32R
		M20	D4N-8A32R	D4N-8B32R	D4N-8C32R	D4N-8D32R

Prefered types

Actuator	Conduit size		Built-in switch mechanism			
			1NC/1NO (Slow-action)	2NC (Slow-action)	2NC/1NO (Slow-action)	3NC (Slow-action)
One-way roller arm lever (horizontal) 	1-conduit	Pg13.5	D4N-1A62R	D4N-1B62R	D4N-1C62R	D4N-1D62R
		G1/2	D4N-2A62R	D4N-2B62R	D4N-2C62R	D4N-2D62R
		1/2-14NPT	D4N-3A62R	D4N-3B62R	D4N-3C62R	D4N-3D62R
		M20	D4N-4A62R	D4N-4B62R	D4N-4C62R	D4N-4D62R
		M12 connector	D4N-9A62R	D4N-9B62R	---	---
	2-conduit	Pg13.5	D4N-5A62R	D4N-5B62R	D4N-5C62R	D4N-5D62R
		G1/2	D4N-6A62R	D4N-6B62R	D4N-6C62R	D4N-6D62R
		1/2-14NPT (See note 2.)	D4N-7A62R	D4N-7B62R	D4N-7C62R	D4N-7D62R
		M20	D4N-8A62R	D4N-8B62R	D4N-8C62R	D4N-8D62R
One-way roller arm lever (vertical) 	1-conduit	Pg13.5	D4N-1A72R	D4N-1B72R	D4N-1C72R	D4N-1D72R
		G1/2	D4N-2A72R	D4N-2B72R	D4N-2C72R	D4N-2D72R
		1/2-14NPT	D4N-3A72R	D4N-3B72R	D4N-3C72R	D4N-3D72R
		M20	D4N-4A72R	D4N-4B72R	D4N-4C72R	D4N-4D72R
		M12 connector	D4N-9A72R	D4N-9B72R	---	---
	2-conduit	Pg13.5	D4N-5A72R	D4N-5B72R	D4N-5C72R	D4N-5D72R
		G1/2	D4N-6A72R	D4N-6B72R	D4N-6C72R	D4N-6D72R
		1/2-14NPT (See note 2.)	D4N-7A72R	D4N-7B72R	D4N-7C72R	D4N-7D72R
		M20	D4N-8A72R	D4N-8B72R	D4N-8C72R	D4N-8D72R

Note: 1. It is recommended that M20 be used for Switches to be exported to Europe and 1/2-14NPT be used for Switches to be exported to North American countries.

2. The 1/2-14NPT 2-conduit models include an M20-to-1/2-14NPT changing adaptor.

Specifications

Standards and EC Directives

- Conforms to the following EC Directives:
  Machinery Directive
  Low Voltage Directive
  EN50047
  EN1088
  GS-ET-15

Approved Standards

Agency	Standard	File No.
TÜV Product Service	EN60947-5-1 (approved direct opening)	B03 11 39656 061
UL (See note.)	UL508, CSA C22.2 No.14	E76675

Note: Approval for CSA C22.2 No. 14 is authorized by the UL mark.

CCC (China Compulsory Certification) Mark

Agency	Standard	File No.
CQC	GB14048.5	Under application

Approved Standard Ratings

TÜV (EN60947-5-1)

Item / Utilization category	AC-15	DC-13
Rated operating current (I_e)	3 A	0.27 A
Rated operating voltage (U_e)	240 V	250 V

Note: Use a 10-A fuse type gI or gG that conforms to IEC269 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		Volt-amperes	
		Make	Break	Make	Break
120 VAC	10 A	60 A	6 A	7,200 VA	720 VA
240 VAC		30 A	3 A		

Q300

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

Characteristics

Degree of protection (See note 3.)		IP67 (EN60947-5-1)
Durability (See note 4.)	**Mechanical**	1,000,000 operations min.
	Electrical	500,000 operations min. for a resistive load of 3 A at 250 VAC (See note 5.) 300,000 operations min. for a resistive load of 10 A at 250 VAC
Operating speed		1 mm/s to 0.5 m/s (D4N-1A20R)
Operating frequency		30 operations/minute max.
Contact resistance		25 mΩ max.
Minimum applicable load (See note 6.)		Resistive load of 1 mA at 5 VDC (N-level reference value)
Rated insulation voltage (U_i)		300 V
Protection against electric shock		Class II (double insulation)
Pollution degree (operating environment)		Level 3 (EN60947-5-1)
Impulse withstand voltage (EN60947-5-1)		Between terminals of the same polarity: 2.5 kV
		Between terminals of different polarities: 4 kV
		Between other terminals and uncharged metallic parts: 6 kV
Insulation resistance		100 MΩ min.
Contact gap		Snap-action: 2 x 0.5 mm min Slow-action: 2 x 2 mm min
Vibration resistance	**Malfunction**	10 to 55 Hz, 0.75-mm single amplitude
Shock resistance	**Destruction**	1,000 m/s^2
	Malfunction	300 m/s^2
Conditional short-circuit current		100 A (EN60947-5-1)
Rated open thermal current (I_{th})		10 A (EN60947-5-1)
Ambient temperature		Operating: -30°C to 70°C with no icing
Ambient humidity		Operating: 95% max.
Weight		Approx. 92 g (D4N-1A20R)

Note: 1. The above values are initial values.

2. Once a contact has been used to switch a standard load, it cannot be used for a load of a smaller capacity. Doing so may result in roughening of the contact surface and contact reliability may be lost.

3. 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 D4N-□R in places where foreign material such as dust, dirt, oil, water, or chemicals may penetrate through the head. Otherwise, premature wear, Switch damage or malfunctioning may occur.

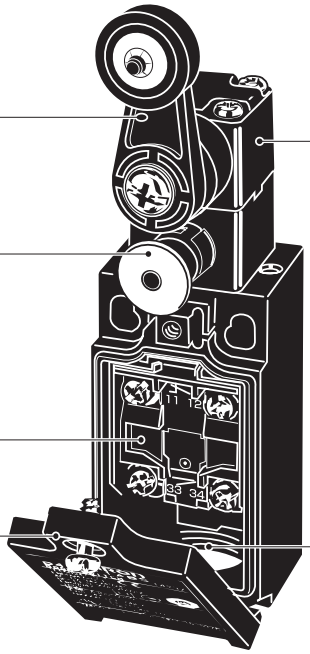
4. The durability is for an ambient temperature of 5°C to 35°C and an ambient humidity of 40% to 70%. For more details, consult your OMRON representative.

5. If the ambient temperature is greater than 35°C, do not pass the 3-A, 250-VAC load through more than 2 circuits.

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

Structure, Names, and Functions

Structure



Safety-oriented Lever Setting
Grooves which engage the lever are cut in the lever and rotary shaft to prevent the lever from slipping against the rotary shaft. The actuator locks (self-holding) when it moves to the lock position.

Reset Head (Blue)
The direction of the reset head can be adjusted to any of the four directions.

Built-in Switch
The built-in switch has a direct opening mechanism that forcibly separates the NC contact even when there is contact deposit.

Cover
The cover, with a hinge on its lower part, can be opened by removing the screw of the cover, which ensures ease of maintenance and wiring.

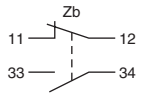
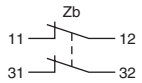
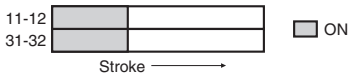
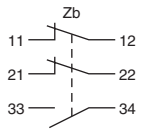
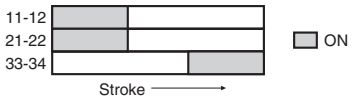
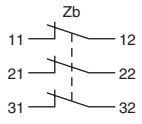
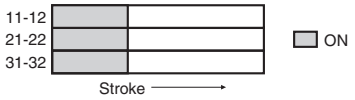
Head
With roller lever models, the direction of the switch head can be adjusted to any of the four directions by loosening the roller lever switch screws at the four corners of the head.

Conduit
A wide variety of conduits is available.

Size / Box	1-conduit model	2-conduit model
Pg13.5	Yes	Yes
G1/2	Yes	Yes
1/2-14NPT	Yes	Yes
M20	Yes	Yes
M12 connector	Yes	---

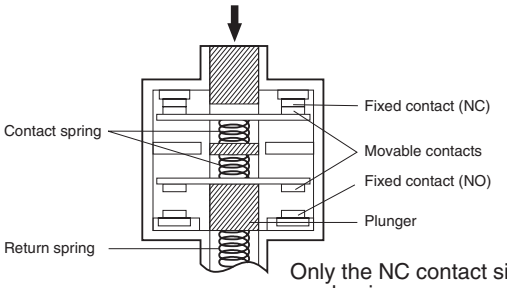
Note: M12 connector types are not available for Switches with three contacts.

Contact Form

Model	Contact	Contact form	Operating pattern	Remarks
D4N-□A□R	1NC/1NO			Only NC contacts 11-12 have an approved direct opening mechanism. ⊖ The terminals 11-12 and 33-34 can be used as unlike poles.
D4N-□B□R	2NC			Only NC contacts 11-12 and 31-32 have an approved direct opening mechanism. ⊖ The terminals 11-12 and 31-32 can be used as unlike poles.
D4N-□C□R	2NC/1NO			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. ⊖ The terminals 11-12, 21-22, and 33-34 can be used as unlike poles.
D4N-□D□R	3NC			Only NC contacts 11-12, 21-22, and 31-32 have an approved direct opening mechanism. ⊖ The terminals 11-12, 21-22, and 31-32 can be used as unlike poles.

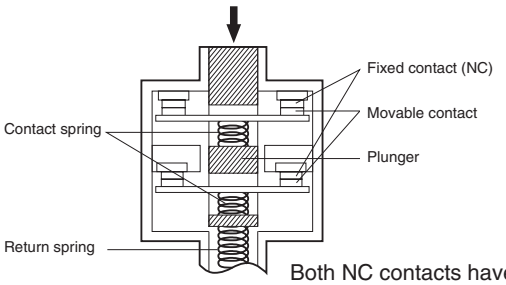
Direct Opening Mechanism

1NC/1NO Contact (Slow-action)



Only the NC contact side has a direct opening mechanism.
When metal deposition occurs, the contacts are separated from each other by the plunger being pushed in.
(Conforms to EN60947-5-1 Direct Opening Operation.)

2NC Contact (Slow-action)



Both NC contacts have a direct opening mechanism.
When metal deposition occurs, the contacts are separated from each other by the plunger being pushed in.
(Conforms to EN60947-5-1 Direct Opening Operation.)

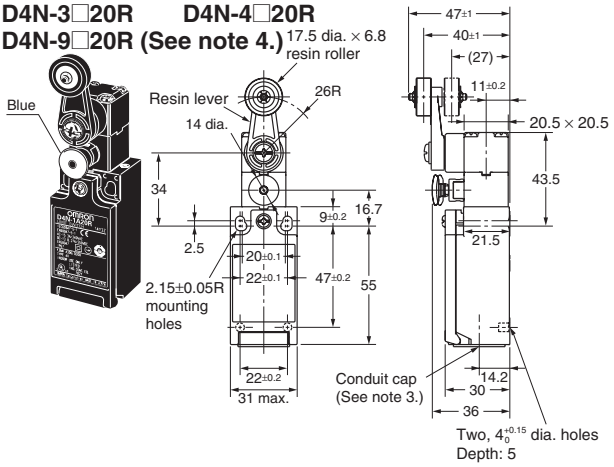
Dimensions

Switches

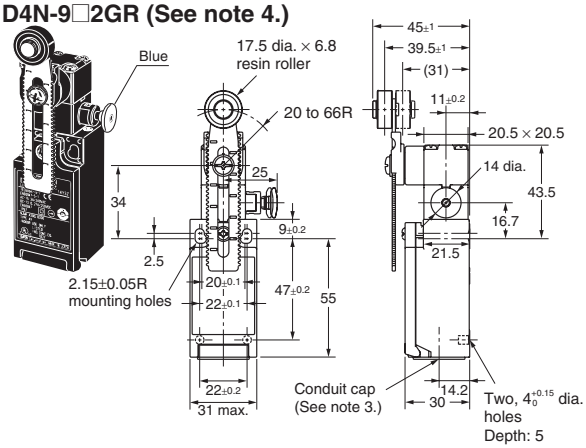
Note: All units are in millimeters unless otherwise indicated.

1-conduit Models

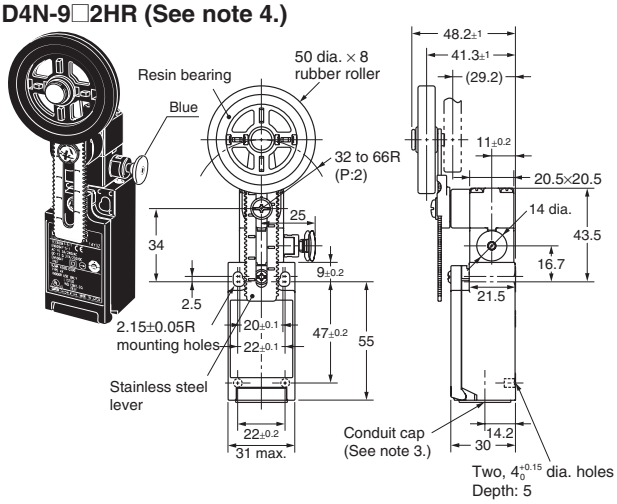
Roller Lever (Resin Lever, Resin Roller)
D4N-1□20R D4N-2□20R
D4N-3□20R D4N-4□20R
D4N-9□20R (See note 4.)



Adjustable Roller Lever, Form Lock (with Metal Lever, Resin Roller)
D4N-1□2GR D4N-2□2GR
D4N-3□2GR D4N-4□2GR
D4N-9□2GR (See note 4.)



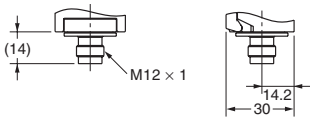
Adjustable Roller Lever, Form Lock (with Metal Lever, Rubber Roller)
D4N-1□2HR D4N-2□2HR
D4N-3□2HR D4N-4□2HR
D4N-9□2HR (See note 4.)



Model	D4N-□□20R	D4N-□□2GR (See note 2.)	D4N-□□2HR
LF max.	6.4 N	5.6 N	5.4 N
LT max.	55°	55°	55°
PT 1 (See note 3.)	18 to 27°	18 to 27°	18 to 27°
(PT 2) (See note 4.)	(44°)	(44°)	(44°)
(TT) (See note 5.)	80°	80°	80°
DOF min. (See note 6.)	20 N	20 N	20 N
DOT min. (See note 6.)	50°	50°	50°

1-conduit M12 Connectors

D4N-9□□□R

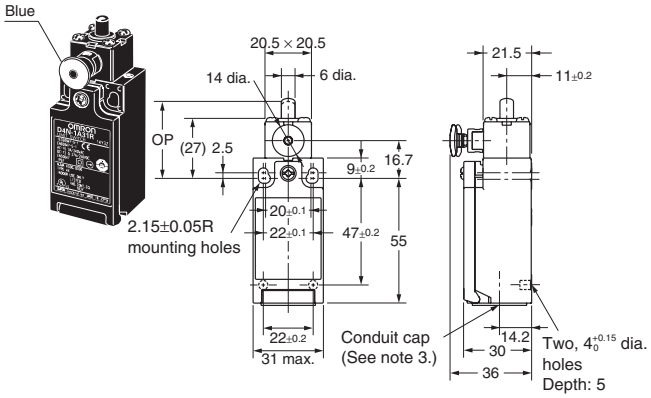


Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
3. There are a minimum of five turns of the screw thread for a Pg13.5 conduit opening and four turns minimum for a G 1/2 conduit opening.
4. Refer to the following diagram for details on M12 connectors.

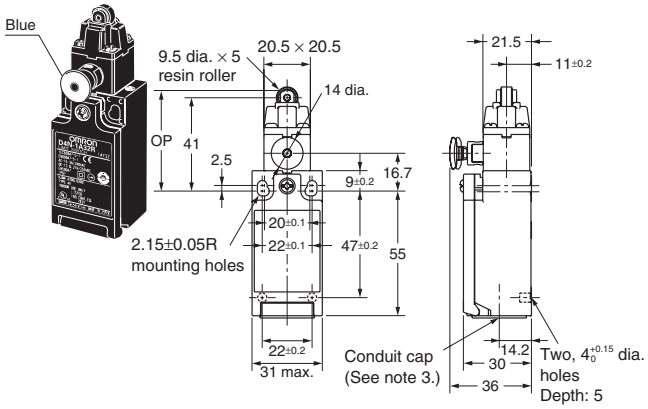
Note: 1. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
2. The operating characteristics of these Switches were measured with the roller lever set at 32 mm.
3. These PT values are possible when the NC contacts are open (OFF).
4. These PT values are nominal values possible when the NO contacts are closed (ON). (1NC/1NO models only)
5. Nominal value.
6. Load and stroke values for the direct opening mechanism. For safe use, always make sure that the minimum values or greater are provided.

1-conduit Models

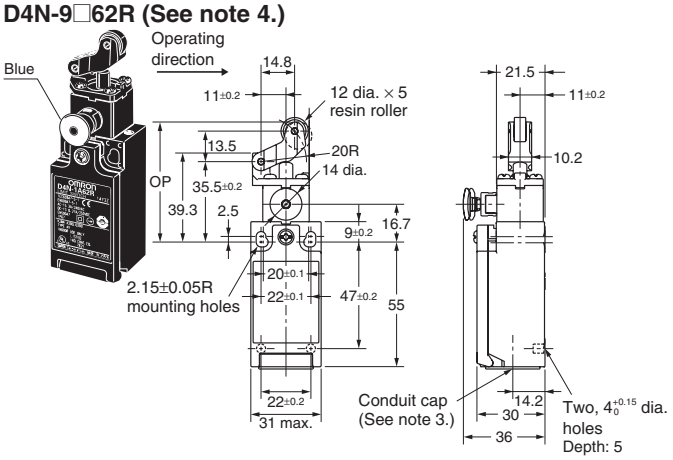
Plunger
D4N-1□31R D4N-2□31R
D4N-3□31R D4N-4□31R
D4N-9□31R (See note 4.)



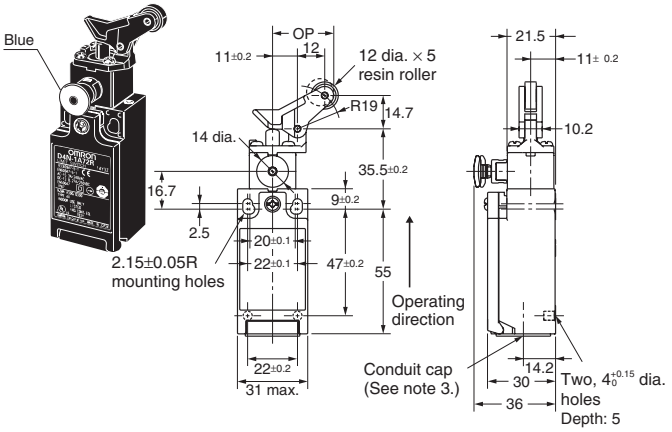
Roller Plunger
D4N-1□32R D4N-2□32R
D4N-3□32R D4N-4□32R
D4N-9□32R (See note 4.)



One-way Roller Arm Lever (Horizontal)
D4N-1□62R D4N-2□62R
D4N-3□62R D4N-4□62R
D4N-9□62R (See note 4.)



One-way Roller Arm Lever (Vertical)
D4N-1□72R D4N-2□72R
D4N-3□72R D4N-4□72R
D4N-9□7R2 (See note 4.)



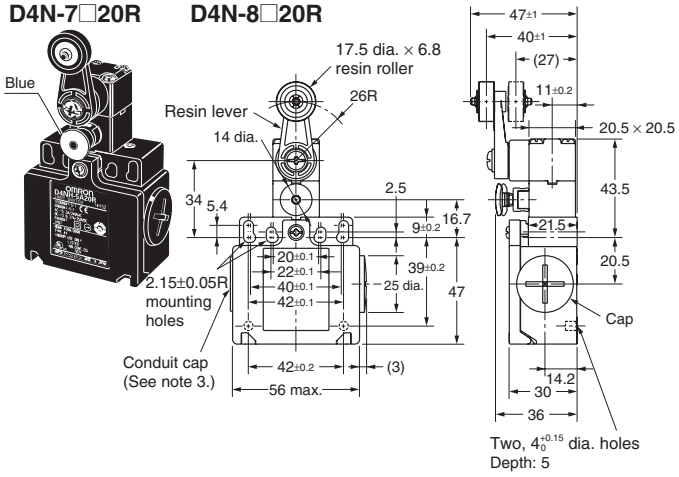
Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Variation occurs in the simultaneity of contact opening/closing operations of 2NC and 3NC contacts. Check contact operation.
3. There are a minimum of five turns of the screw thread for a Pg13.5 conduit opening and four turns minimum for a G 1/2 conduit opening.
4. Refer to page 273 for details on M12 connectors.

Model	D4N-□□31R	D4N-□□32R	D4N-□□62R	D4N-□□72R
LF max.	10.8 N	10.8N	7.5 N	7.9 N
LT max.	4.5 mm	4.5 mm	7 mm	7 mm
PT 1 (See note 2.)	2 mm	2 mm	4 mm	4 mm
(PT 2) (See note 3.)	(2.9 mm)	(2.9 mm)	(5.2 mm)	(4.3 mm)
OP	34 ±0.5 mm	44.4 ±0.8 mm	53 ±0.8 mm	27 ±0.8 mm
(TT) (See note 4.)	(6 mm)	(6 mm)	(9 mm)	(9 mm)
DOF min. (See note 5.)	20 N	20 N	20 N	20 N
DOT min. (See note 5.)	3.2 mm	3.2 mm	5.8 mm	4.8 mm

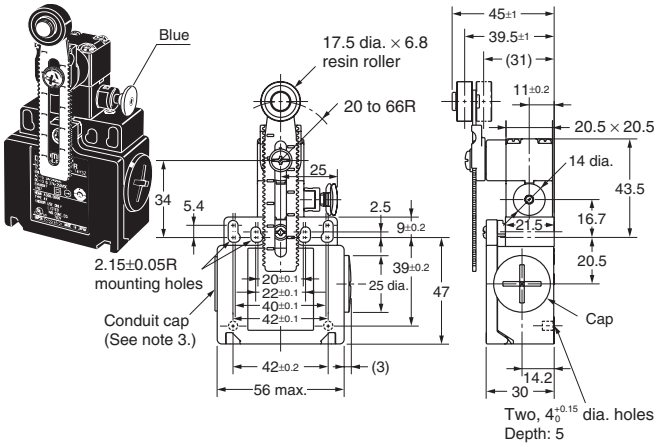
Note: 1. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
2. These PT values are possible when the NC contacts are open (OFF).
3. These PT values are nominal values possible when the NO contacts are closed (ON). (1NC/1NO models only)
4. Nominal value.
5. Load and stroke values for the direct opening mechanism. For safe use, always make sure that the minimum values or greater are provided.

2-conduits Models

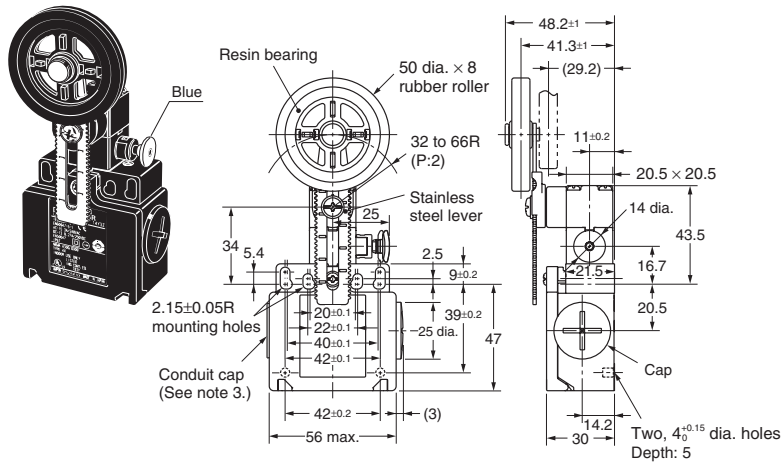
Roller Lever (Resin Lever, Resin Roller)
D4N-5□20R D4N-6□20R
D4N-7□20R D4N-8□20R



Adjustable Roller Lever, Form Lock (with Metal Lever, Resin Roller)
D4N-5□2GR D4N-6□2GR
D4N-7□2GR D4N-8□2GR



Adjustable Roller Lever, Form Lock (with Metal Lever, Rubber Roller)
D4N-5□2HR D4N-6□2HR
D4N-7□2HR D4N-8□2HR



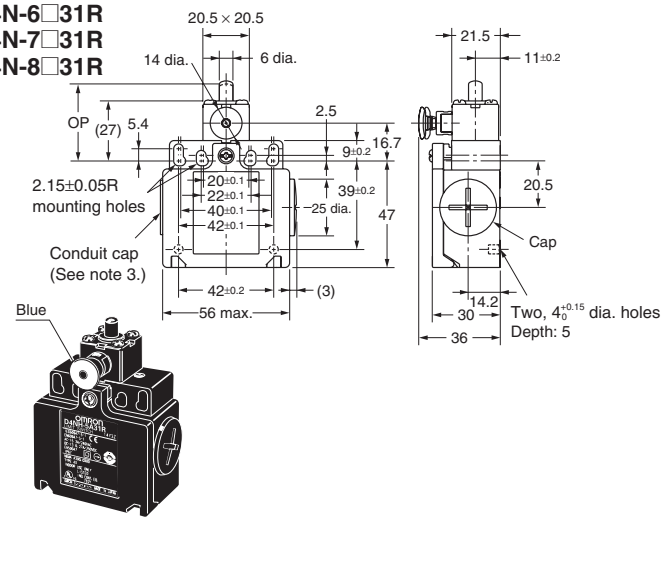
Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Variation occurs in the simultaneity of contact opening/closing operations of 2NC and 3NC contacts. Check contact operation.
3. There are a minimum of five turns of the screw thread for a Pg13.5 conduit opening and four turns minimum for a G 1/2 conduit opening.

Model	D4N-□□20R	D4N-□□2GR	D4N-□□2HR
LF max.	6.4 N	5.6 N	5.4 N
LT max.	55°	55°	55°
PT 1 (See note 2.)	18° to 27°	18° to 27°	18° to 27°
(PT 2) (See note 3.)	(44°)	(44°)	(44°)
(TT) (See note 4.)	80°	80°	80°
DOF min. (See note 5.)	20 N	20 N	20 N
DOT min. (See note 5.)	50°	50°	50°

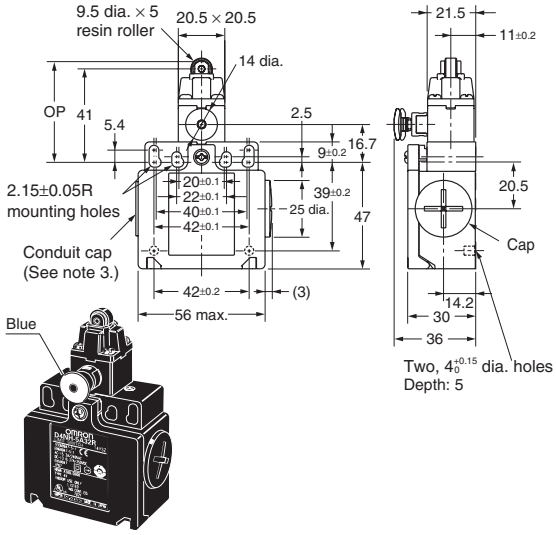
Note: 1. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
2. These PT values are possible when the NC contacts are open (OFF).
3. These PT values are nominal values possible when the NO contacts are closed (ON). (1NC/1NO models only)
4. Nominal value.
5. Load and stroke values for the direct opening mechanism. For safe use, always make sure that the minimum values or greater are provided.

2-conduits Models

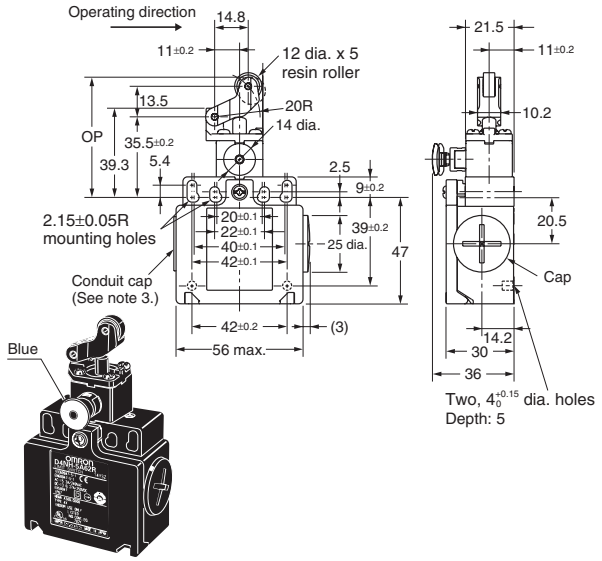
Plunger
D4N-5□31R
D4N-6□31R
D4N-7□31R
D4N-8□31R



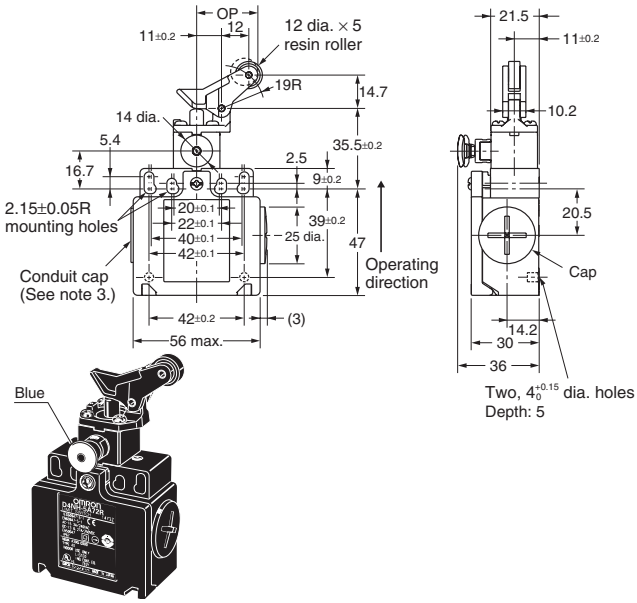
Roller Plunger
D4N-5□32R **D4N-6□32R**
D4N-7□32R **D4N-8□32R**



One-way Roller Arm Lever (Horizontal)
D4N-5□62R **D4N-6□62R**
D4N-7□62R **D4N-8□62R**



One-way Roller Arm Lever (Vertical)
D4N-5□72R **D4N-6□72R**
D4N-7□72R **D4N-8□72R**



Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Variation occurs in the simultaneity of contact opening/closing operations of 2NC and 3NC contacts. Check contact operation.
3. There are a minimum of five turns of the screw thread for a Pg13.5 conduit opening and four turns minimum for a G 1/2 conduit opening.

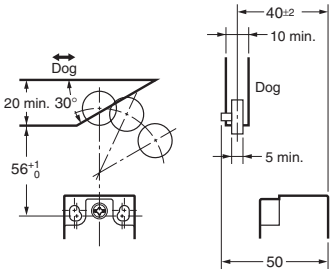
Model	D4N-□□31R	D4N-□□32R	D4N-□□62R	D4N-□□72R
LF max.	10.8 N	10.8N	7.5 N	7.9 N
LT max.	4.5 mm	4.5 mm	7 mm	7 mm
PT 1 max. (See note 2.)	2 mm	2 mm	4 mm	4 mm
(PT 2) (See note 3.)	(2.9 mm)	(2.9 mm)	(5.2 mm)	(4.3 mm)
OP	34 ±0.5 mm	44.4 ±0.8 mm	53 ±0.8 mm	27 ±0.8 mm
(TT) (See note 4.)	(6 mm)	(6 mm)	(9 mm)	(9 mm)
DOF min. (See note 5.)	20 N	20 N	20 N	20 N
DOT min. (See note 5.)	3.2 mm	3.2 mm	5.8 mm	4.8 mm

Note: 1. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
2. These PT values are possible when the NC contacts are open (OFF).
3. These PT values are nominal values possible when the NO contacts are closed (ON). (1NC/1NO models only)
4. Nominal value.
5. Load and stroke values for the direct opening mechanism. For safe use, always make sure that the minimum values or greater are provided.

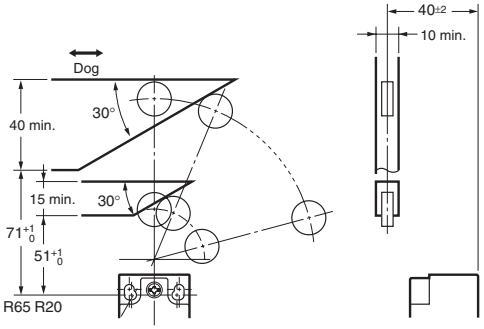
Levers

Refer to the following diagrams for the angles and positions of the dogs.

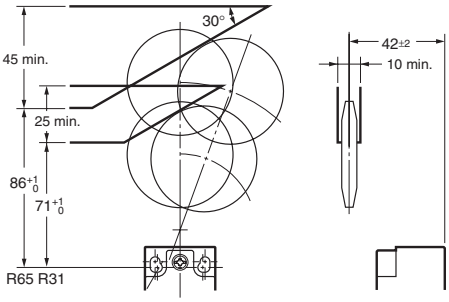
Roller Lever (D4N-□□20R)



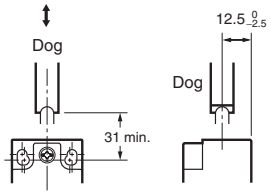
Adjustable Roller Lever, Form Lock (with Metal Lever, Resin Roller) (D4N-□□2GR)



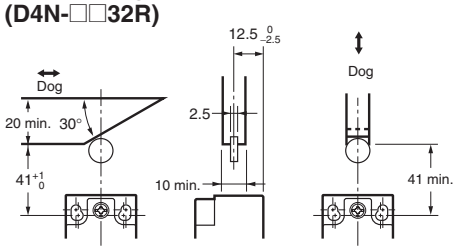
Adjustable Roller Lever, Form Lock (with Metal Lever, Rubber Roller) (D4N-□□2HR)



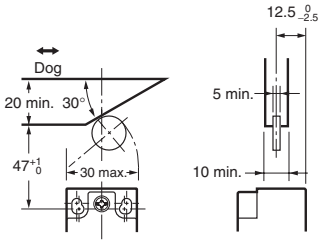
Sealed Plunger (D4N-□□31R)



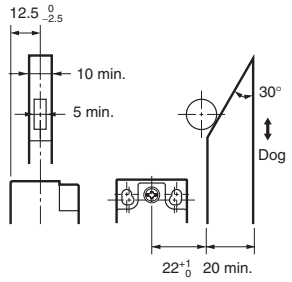
Roller Plunger (D4N-□□32R)



One-way Roller Arm Lever (Horizontal) (D4N-□□62R)



One-way Roller Arm Lever (Vertical) (D4N-□□72R)



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

Safety Precautions

Refer to *OMRON SAFETY COMPONENTS SERIES (Y106)* for common precautions for Switches and Safety Limit Switches.

⚠ CAUTION

Do not use metal connectors or metal conduits with this Switch. Doing so may occasionally result in electric shock.

Precautions for Safe Use

- Do not drop the Switch. Doing so may result in the Switch not performing to its full capacity.
- Do not attempt to disassemble or modify the Switch. Doing so may cause the Switch to malfunction.
- Do not use the Switch where explosive gas, flammable gas, or any other hazardous gas may be present.
- Install the Switch in a location away from close body contact. Not doing so may result in malfunction.
- 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 interior. (The IP67 degree of protection specification for the Switch refers to water penetration while the Switch is submersed in water for a specified period of time.)
- Protect the head from foreign material. Subjecting the head to foreign material may result in premature wear or damage to the Switch. Although the switch body is protected from penetration by dust or water, the head is not protected from penetration by minute particles or water.
- Turn the power OFF before wiring. Doing so may result in electric shock.
- Install the cover after wiring. Not doing so may result in electric shock.
- Connect a fuse to the Switch in series to protect the Switch from short-circuit damage. Use a fuse with a breaking current 1.5 to 2 times larger than the rated current. To conform to EN ratings, use an IEC60269-compliant 10-A fuse type gI or gG.
- Do not switch circuits for two or more standard loads (250 VAC, 3 A) at the same time. Doing so may adversely affect insulation performance.
- The durability of the Switch is greatly affected by operating conditions. Evaluate the Switch under actual working conditions, before permanent installation and use within a number of switching operations that will not adversely affect the Switch's performance.
- Be sure to indicate in the machine manufacturer's instruction manual that the user must not attempt to repair or maintain the Switch and must contact the machine manufacturer for any repairs or maintenance.

- If the Switch is to be used in an emergency stop circuit or in a safety circuit for preventing accidents resulting in injuries or deaths, use a model that has an NC contact equipped with a direct opening mechanism and make sure that the Switch operates in the direct opening mode. Furthermore, secure the Switch with screws or equivalent parts that are tightened in a single direction so that the Switch cannot be easily removed. Then provide a protection cover for the Switch and post a warning label near the Switch.
- Make sure that the actuator is pushed into the lock position. Not doing so may result in the actuator becoming unlocked, causing an accident.
- Always reset the Switch manually. Not doing so may result in damage to the reset function.
- When the Switch locks due to a fault in the system, be sure to reset the Switch manually before resupplying power after confirming the safety of the system.
- Check the Switches before use and inspect regularly, replacing them when necessary. If a Switch is kept pressed for an extended period of time, the components may deteriorate quickly, and the Switch may not release.
- When using the Switch as a safety component, be sure to check the system design for both operational and circuit safety.

Precautions for Correct Use

Environment

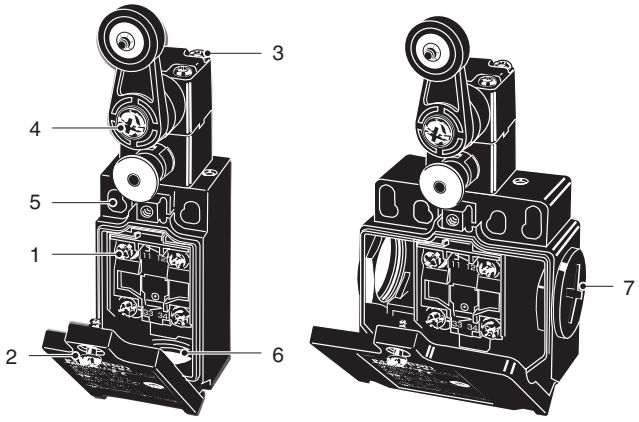
- The Switch is intended for indoor use only.
- Do not use the Switch outdoors. Doing so may cause the Switch to malfunction.
- Do not use the Switch where hazardous gases (e.g., H_2S, SO_2, NH_3, HNO_3, Cl_2) are present or in locations subject to high temperature and humidity. Doing so may result in damage to the Switch caused by contact failure or corrosion.
- Do not use the Switch under any of the following conditions.
  - Locations subject to extreme temperature changes.
  - Locations where high humidity or condensation may occur.
  - Locations subject to excessive vibration.
  - Locations where metal dust, processing waste, oil, or chemicals may penetrate through the protective door.
  - Locations subject to detergents, thinner, or other solvents.

Mounting Method

Mounting Screw Tightening Torque

Tighten each of the screws to the specified torque. Loose screws may result in malfunction of the Switch within a short time.

1	Terminal screw	0.6 to 0.8 N·m
2	Cover clamping screw	0.5 to 0.7 N·m
3	Head clamping screw	0.5 to 0.6 N·m
4	Lever clamping screw	1.6 to 1.8 N·m
5	Body clamping screw	0.5 to 0.7 N·m
6	Conduit mounting connection, M12 adaptor	1.8 to 2.2 N·m (except 1/2-14NPT)
		1.4 to 1.8 N·m (1/2-14NPT)
7	Cap screw	1.3 to 1.7 N·m

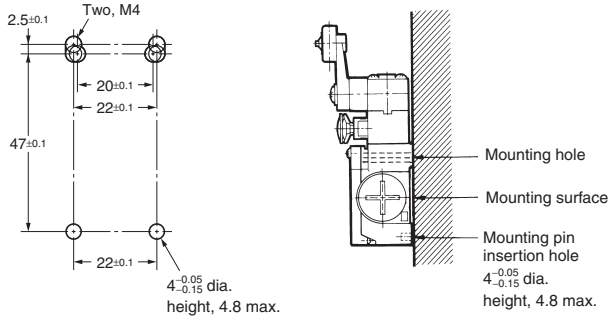


Switch Mounting

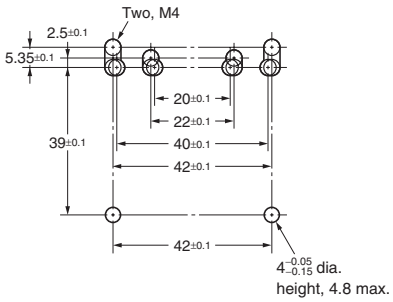
- Mount the Switch using M4 screws and washers and tighten the screws to the specified torque.
- For safety, use screws that cannot be easily removed, or use an equivalent measure to ensure that the Switch is secure.
- Secure the Switch with two M4 bolts and washers. Provide studs with a diameter of 4 $^{0.05}/_{0.15}$ and a height of 4.8 mm max. at two places, inserting into the holes at the bottom of the Switch as shown below so that the Switch is firmly fixed at four points.

Switch Mounting Holes

One-conduit Type



Two-conduit Type



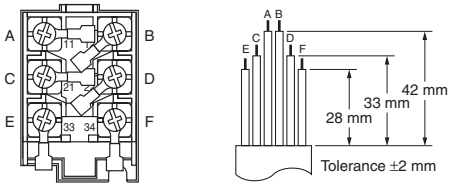
Changing the Head Direction

By removing the four screws of the head, the mounting direction of the head can be changed. The head can be mounted in four directions. Be sure that no foreign material will enter the head during a change in direction.

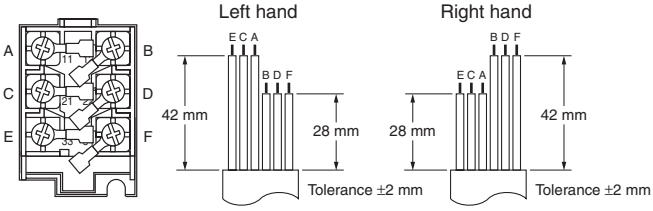
Wiring

- When connecting to the terminals via insulating tube and M3.5 crimp terminals, arrange the crimp terminals as shown below 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^2).
  Use lead wires of an appropriate length, as shown below. Not doing so may result in excess length causing the cover to rise and not fit properly.

One-conduit Type (3 Poles)



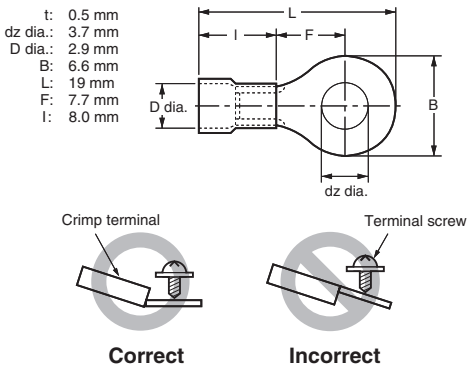
Two-conduit Type (3 Poles)



- Do not push crimp terminals into gaps in the case interior. Doing so may cause damage or deformation of the case.
- Use crimp terminals not more than 0.5 mm in thickness. Otherwise, they will interfere with other components inside the case. The crimp terminals shown below are not more than 0.5 mm thick.

Manufacture	Type	Wire size
J.S.T.	FV0.5-3.7 (F type) V0.5-3.7 (straight type)	AWG20 (0.5 mm^2)

J.S.T is a Japanese manufacturer.

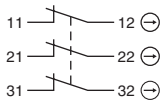


Contact Arrangement

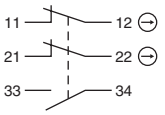
- The following diagrams show the contact arrangements used for screw terminal types and connector types.

Screw Terminal Type

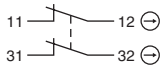
D4N-□D□□R (3NC)



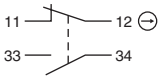
D4N-□C□□R (2NC/1NO)



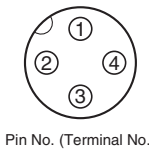
D4N-□B□□R (2NC)



D4N-□A□□R (1NC/1NO)

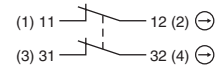


Connector Type

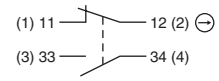


Pin No. (Terminal No.)

D4N-9B□□R (2NC)



D4N-9A□□R (1NC/1NO)



- Applicable socket: XS2F (OMRON).
- Refer to the G010 *Connector Catalog* for details on socket pin numbers and lead wire colors.

Socket Tightening (Connector Type)

- Turn the socket connector screws by hand and tighten until no space remains between the socket and the plug.
- Make sure that the socket connector is tightened securely. Otherwise, the rated degree of protection (IP67) may not be maintained and vibration may loosen the socket connector.

Conduit Opening

- Connect a recommended connector to the opening of the conduit and tighten the connector to the specified torque. The case may be damaged if an excessive tightening torque is applied.
- When using 1/2-14NPT, wind sealing tape around the joint between the connector and conduit opening so that the enclosure will conform to IP67.
- Use a cable with a suitable diameter for the connector.
- Attach and tighten a conduit cap to the unused conduit opening when wiring. Tighten the conduit cap to the specified torque. The conduit cap is provided with the Switch (2-conduit types).

Recommended Connectors

Use connectors with screws not exceeding 9 mm, otherwise the screws will protrude into the case interior, interfering with other components in the case. The connectors listed in the following table have connectors with thread sections not exceeding 9 mm. Use the recommended 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 Denki	OA-W1609	7.0 to 9.0 mm
		OA-W1611	9.0 to 11.0 mm
Pg13.5	LAPP	S-13.5 5301-5030	6.0 to 12.0 mm
M20	LAPP	ST-M20 × 1.5 5311-1020	7.0 to 13.0 mm
1/2-14NPT	LAPP	ST-NPT1/2 5301-6030	6.0 to 12.0 mm
M12	LAPP	ST-M12 × 1.5 5301-1000	3.5 to 7.0 mm

Use LAPP connectors together with seal packing (JPK-16, GP-13.5, GPM20, or GPM12), and tighten to the specified tightening torque. Seal packing is sold separately.

LAPP is a German manufacturer. Ohm Denki is a Japanese manufacturer.

Before using an M12 type, attaching the provided changing adaptor to the Switch and then connect the recommended connector.

Before using a 2-conduit 1/2-14NPT type, attach the provided changing adaptor to the Switch and then connect the recommended connector.

Storage

Do not store the Switch in locations where hazardous gases (e.g., H_2S, SO_2, NH_3, HNO_3, Cl_2) or dust is present, or in locations subject to high temperatures and humidity.

Others

- Do not allow the load current to exceed the rated value.
- Confirm that the seal rubber has no defects before use. If the seal rubber is displaced or raised, or has foreign particles adhered to it, the sealing capability of the seal rubber will be adversely affected.
- Use the correct cover mounting screws only, or the sealing capability of the seal rubber will deteriorate.
- Inspect the Switch regularly.
- With rubber roller lever models, the rubber roller may turn white over time, but this will not affect the quality of operation.
- Use the following recommended countermeasures to prevent telegraphing when using adjustable or long levers.

1. Make the rear edge of the dog smooth with an angle of 15° to 30° or make it in the shape of a quadratic curve.
2. Design the circuit so that no error signal will be generated.
3. Use or set a Switch that is operated in one direction only.

Production Termination

Following the release of the D4N-R, production of the D4D-R will be terminated.

Date of Production Termination

Production of the D4D-R Series will be terminated in March 2006.

Product Replacement

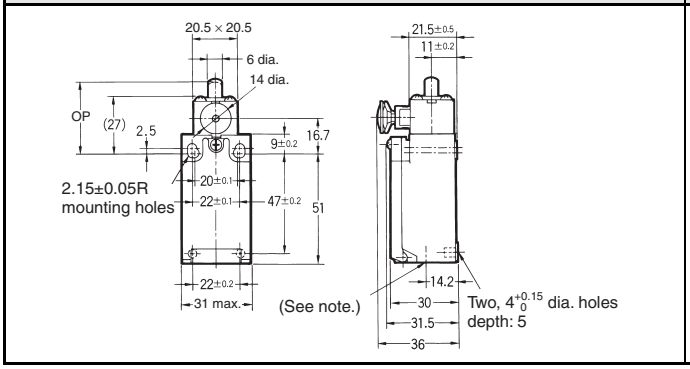
1. Dimensions
   The D4D-R and D4N-R use the same mounting method, and mounting hole. The multi-contact structure and the extra 4 mm in length, however, are different.
2. Terminal Numbers
   For the 2-contact model, the terminals 21, 22, 23, and 24 on the D4D-R are 31, 32, 33, and 34 on the D4N-R.
3. Recommended Terminals
   If the recommended terminals are not used, the Switch may not be compatible. Make sure that the Switch is compatible with the terminals.

Comparison of the D4D-R and Substitute Products

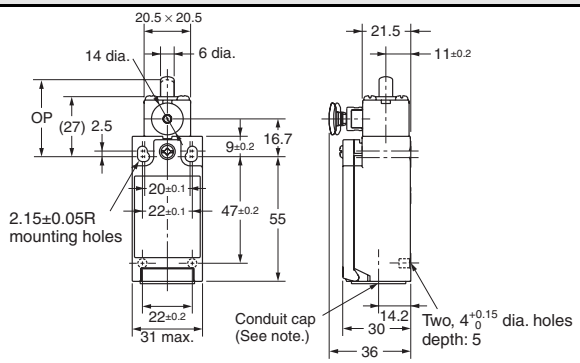
Model	D4N-R
Switch color	Very similar
Dimensions	Very similar
Wiring/connection	Significantly different
Mounting method	Completely compatible
Ratings/performance	Very similar
Operating characteristics	Very similar
Operating method	Completely compatible

Dimensions (Unit: mm)

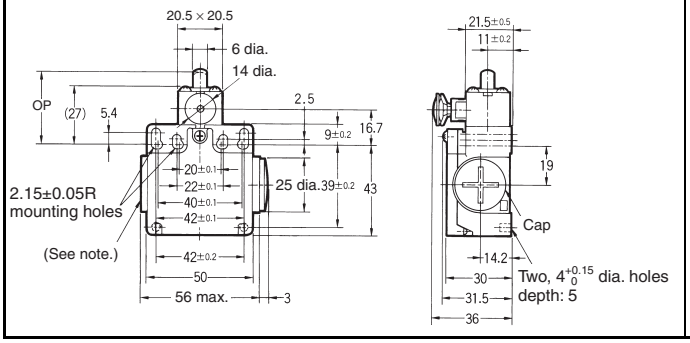
Discontinued Models (1-conduit Plunger-type D4D-R)



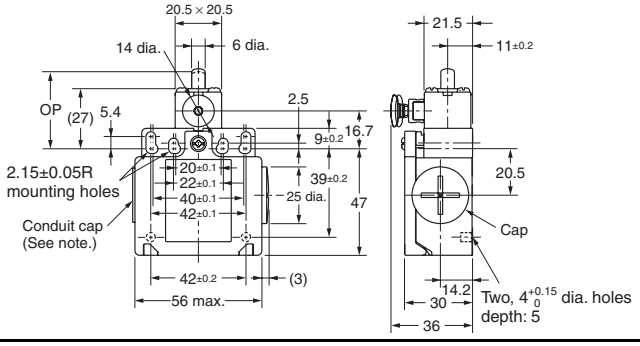
Replacement Products (1-conduit Plunger-type D4N-R)



Discontinued Models (2-conduit Plunger Type D4D-R)



Replacement Products (2-conduit Plunger Type D4N-R)



List of Recommended Substitute Products

: The actuator on the D4D-R is a non-safety type. The D4N-R is recommended for safety applications (form lock type). Be sure to mount it correctly. Using M screws is recommended to comply with European standards. Therefore, the M20 conduit model is recommended for use in new designs.

Safety Limit Switch

D4D-R product to be discontinued	Recommended substitute product
D4D-1520R	D4N-1A20R
D4D-2520R	D4N-2A20R
D4D-3520R	D4N-3A20R
D4D-5520R	D4N-5A20R
D4D-6520R	D4N-6A20R
D4D-1531R	D4N-1A31R
D4D-2531R	D4N-2A31R
D4D-3531R	D4N-3A31R
D4D-5531R	D4N-5A31R
D4D-6531R	D4N-6A31R
D4D-1532R	D4N-1A32R
D4D-2532R	D4N-2A32R
D4D-3532R	D4N-3A32R
D4D-5532R	D4N-5A32R
D4D-6532R	D4N-6A32R
D4D-1562R	D4N-1A62R
D4D-2562R	D4N-2A62R
D4D-3562R	D4N-3A62R
D4D-5562R	D4N-5A62R
D4D-6562R	D4N-6A62R
D4D-1572R	D4N-1A72R
D4D-2572R	D4N-2A72R
D4D-3572R	D4N-3A72R
D4D-5572R	D4N-5A72R
D4D-6572R	D4N-6A72R
D4D-152HR	D4N-1A2HR
D4D-252HR	D4N-2A2HR
D4D-352HR	D4N-3A2HR
D4D-1521R	D4N-1A2GR
D4D-2521R	D4N-2A2GR
D4D-3521R	D4N-3A2GR
D4D-5521R	D4N-5A2GR
D4D-6521R	D4N-6A2GR
D4D-1527R	D4N-1A2HR
D4D-2527R	D4N-2A2HR
D4D-3527R	D4N-3A2HR
D4D-5527R	D4N-5A2HR
D4D-6527R	D4N-6A2HR

D4D-R product to be discontinued	Recommended substitute product
D4D-1A20R	D4N-1B20R
D4D-2A20R	D4N-2B20R
D4D-3A20R	D4N-3B20R
D4D-5A20R	D4N-5B20R
D4D-6A20R	D4N-6B20R
D4D-1A31R	D4N-1B31R
D4D-2A31R	D4N-2B31R
D4D-3A31R	D4N-3B31R
D4D-5A31R	D4N-5B31R
D4D-6A31R	D4N-6B31R
D4D-1A32R	D4N-1B32R
D4D-2A32R	D4N-2B32R
D4D-3A32R	D4N-3B32R
D4D-5A32R	D4N-5B32R
D4D-6A32R	D4N-6B32R
D4D-1A62R	D4N-1B62R
D4D-2A62R	D4N-2B62R
D4D-3A62R	D4N-3B62R
D4D-5A62R	D4N-5B62R
D4D-6A62R	D4N-6B62R
D4D-1A72R	D4N-1B72R
D4D-2A72R	D4N-2B72R
D4D-3A72R	D4N-3B72R
D4D-5A72R	D4N-5B72R
D4D-6A72R	D4N-6B72R
D4D-1A2HR	D4N-1B2HR
D4D-2A2HR	D4N-2B2HR
D4D-3A2HR	D4N-3B2HR
D4D-1A21R	D4N-1B2GR
D4D-2A21R	D4N-2B2GR
D4D-3A21R	D4N-3B2GR
D4D-5A21R	D4N-5B2GR
D4D-6A21R	D4N-6B2GR
D4D-1A27R	D4N-1B2HR
D4D-2A27R	D4N-2B2HR
D4D-3A27R	D4N-3B2HR
D4D-5A27R	D4N-5B2HR
D4D-6A27R	D4N-6B2HR

Warranty and Application Considerations

Read and Understand this Catalog

Please read and understand this catalog before purchasing the products. Please consult your OMRON representative if you have any questions or comments.

Warranty and Limitations of Liability

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS, OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

Application Considerations

SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

Take all necessary steps to determine the suitability of the product for the systems, machines, and equipment with which it will be used.

Know and observe all prohibitions of use applicable to this product.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

Disclaimers

PERFORMANCE DATA

Performance data given in this catalog is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON *Warranty and Limitations of Liability.*

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons. Consult with your OMRON representative at any time to confirm actual specifications of purchased product.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. C132-E2-01-X

In the interest of product improvement, specifications are subject to change without notice.

Emergency Stop Switch

A165E

Mounting Aperture of 16 mm

- Modular construction, easy installation
- Direct opening mechanism with minimum contact separation of 3 mm in accordance with EN60947-5-1, ⊖. (only for NC contacts)
- Conforms to EN418, EN60947-5-1.
- Includes a safety lock to prevent misuse.
- Features separate construction that allows the Switch to be separated for easier wiring and one-piece-like construction that allows easier handling.
- High reliability, IP65
- Short mounting depth, less than 28.5 mm below panel
- Quick and easy assembly, snap-in Switch.
- A165E is identifiable, clearly visible and will stop a dangerous process, without creating additional hazards.

Model Number Structure

Model Number Legend

A165E-□□-□-□
1 2 3 4

1. Lighted/Non-lighted
None: Non-lighted
L: Lighted

2. Head Size
S: 30 mm dia.
M: 40 mm dia.

3. Illumination (Operation Voltage/Rated Voltage)
None: Non-lighted
24D: LED (24 VDC)

4. Contacts
01: SPST (NC)
02: DPST (NC)
03U: TPST (NC)
One-body, non-lighted models only

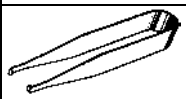
Ordering Information

List of Models

Illumination	Rated voltage	Pushbutton color	Pushbutton size	Terminal	Contact	Standard load (125 VAC at 5 A, 250 VAC at 3 A, 30 VDC at 3 A)
LED	24 VDC	Red	30 dia.	Solder terminal	SPST-NC	A165E-LS-24D-01
					DPST-NC	A165E-LS-24D-02
None	---				SPST-NC	A165E-S-01
					DPST-NC	A165E-S-02
					TPST-NC	A165E-S-03U
LED	24 VDC		40 dia.		SPST-NC	A165E-LM-24D-01
					DPST-NC	A165E-LM-24D-02
None	---				SPST-NC	A165E-M-01
					DPST-NC	A165E-M-02
					TPST-NC	A165E-M-03U

Note: The above models have a surface indication of “RESET.” Models with “STOP” indication are also available. For further information, contact your OMRON representative.

Accessories (Order Separately)

Item	Appearance	Type	Model	Precautions
Yellow Plate		Yellow, 45 dia.	A16Z-5070	Use this as an emergency stop nameplate.
Panel Plug		Rectangular	A16ZJ-3003	Used for covering the panel cutouts for future panel expansion.
		Square	A16ZA-3003	
		Round	A16ZT-3003	
Tightening Tool		---	A16Z-3004	Useful for repetitive mounting. Be careful not to tighten excessively.
Extractor		---	A16Z-5080	Convenient for extracting the Switch and Lamp.

Specifications

Approved Standards

Recognized Organization	Standards	File No.
UL, cUL (see note)	UL508	E41515
AZCO	EN60947-5-1	C9805501

Note: UL: UL508, cUL: CSA C22 No. 14

Approved Standard Ratings

UL, cUL

Rated voltage	Rated current	
	A165E series	A165E-U series
125 VAC	5 A (General use)	1 A (General use)
250 VAC	3 A (General use)	0.5 A (General use)
30 VDC	3 A (Resistive)	1 A (Resistive)

Ratings

Switch Ratings

Rated voltage	Resistive load	
	A165E series	A165E□-U series
125 VAC 250 VAC 30 VDC	5 A 3 A 3 A	1 A 0.5 A 1 A
Minimum applicable load	150 mA at 5 VDC	1 mA at 5 VDC

Characteristics

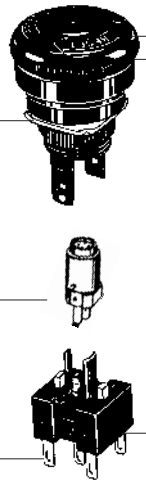
Item		Emergency Stop Switch
Allowable operating frequency	Mechanical	20 operations/minute max.
	Electrical	10 operations/minute max.
Insulation resistance		100 MΩ min. (at 500 VDC)
Dielectric strength		1,000 VAC, 50/60 Hz for 1 min between terminals of same polarity 2,000 VAC, 50/60 Hz for 1 min between terminals of different polarity and also between each terminal and ground 1,000 VAC, 50/60 Hz for 1 min between lamp terminals (see note)
Vibration resistance	Malfunction	10 to 55 Hz, 1.5-mm double amplitude (malfunction within 1 ms)
Shock resistance	Destruction	500 m/s^2
	Malfunction	300 m/s^2 max. (malfunction within 1 ms), 150 m/s^2 max. In case of A165E□U series
Durability	Mechanical	100,000 operations min.
	Electrical	100,000 operations min.
Ambient temperature		Operating:-10°C to 55°C (with no icing or condensation) Storage:-25°C to 65°C (with no icing or condensation)
Ambient humidity		Operating:35% to 85%
Electric shock protection class		Class II
PTI (tracking characteristic)		175
Degree of contamination		3
Weight		Approx. 16 g (in case of DPDT Switches)

Note: LED not mounted. Test them with the LED removed.

Operating Characteristics

Features	Characteristics
Operating force (OF) max.	14.7 N
Releasing force (RF) min.	0.1 N·m
Pretravel (PT)	3.5±0.5 mm (3±0.5 mm In case of A165E□U series)

Nomenclature



Illumination Colors
- LED Illumination
  Red
- Non-lighted
  Red

Illumination Method
- LED

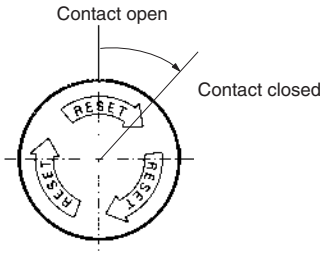
Protective Structure and Terminal Type
- **Protective Structure**
  Oil-resistant IP65
- **Terminal Type**
  Solder terminals
  (tab terminals #110)

Lamp
- LED lamp

Switch Specifications
- **Standard Loads**
  5 A at 125 VAC
  3 A at 250 VAC
  3 A at 30 VDC

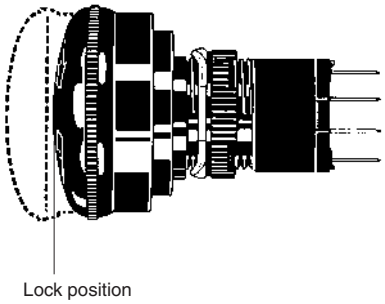
Note: A165E Emergency Stop Switch must be ordered as a set.
No LED is installed for the non-lighted model.

Push-lock, Turn-reset System Prevents Misuse



Safety Lock Prevents Misuse

Even if an object or person touches the pushbutton by mistake, the contact will not be released unless the pushbutton reaches the lock position.

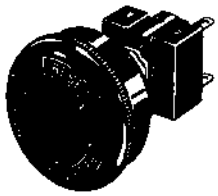


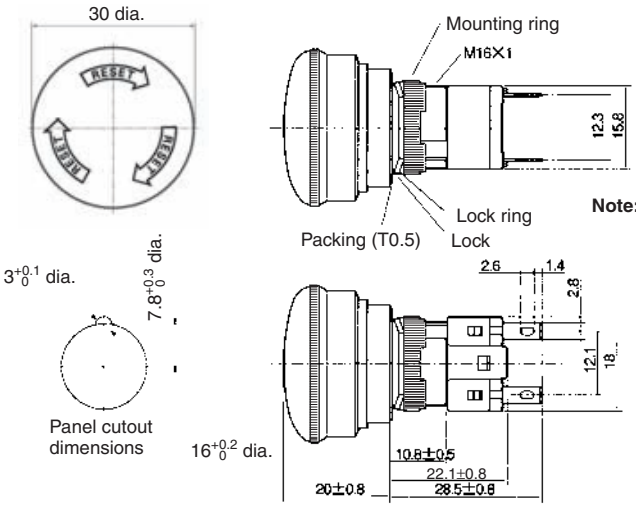
Dimensions

Note: All units are in millimeters unless otherwise indicated.

A165E

Non-lighted models
30 mm diameter



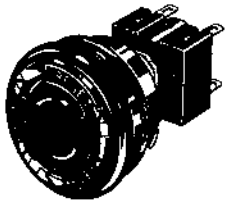


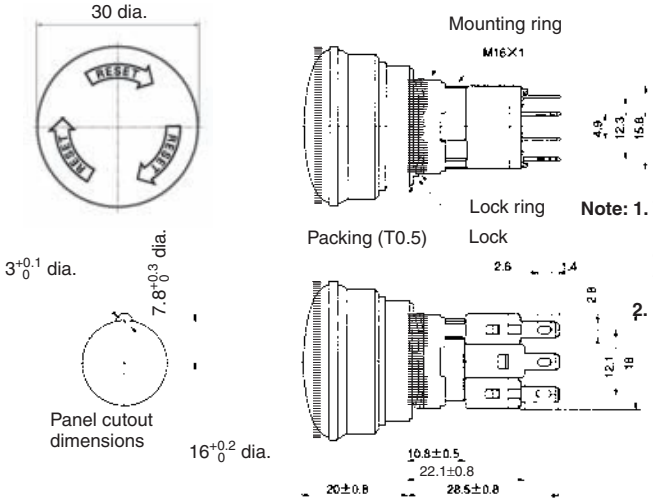
Note: 1. When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.

2. Recommended panel thickness: 0.5 to 3.2 mm.

A165E

Lighted models
30 mm diameter



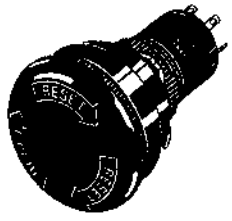


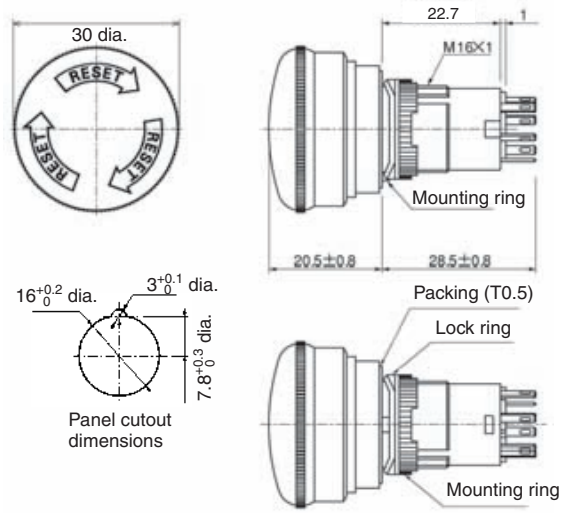
Note: 1. When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.

2. Recommended panel thickness: 0.5 to 3.2 mm.

A165E□U

One-body models
30 mm diameter



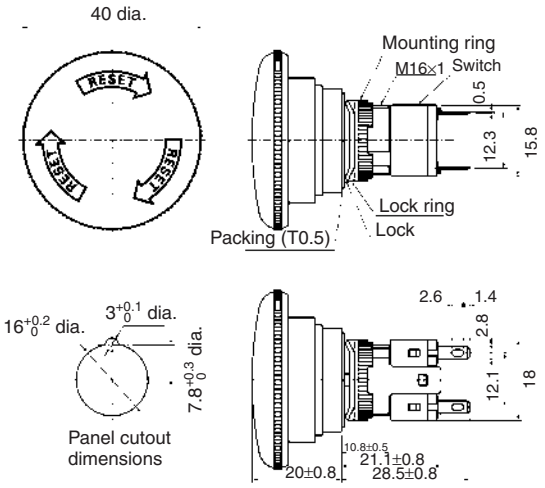


Note: 1. When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.

2. Recommended panel thickness: 0.5 to 3.2 mm.

A165E

Non-lighted models
40 mm diameter

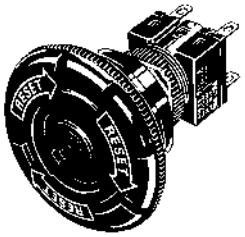


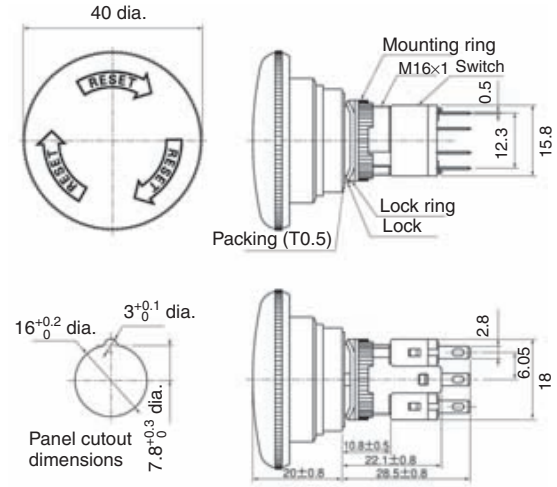
Note: 1. When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.

2. Recommended panel thickness: 0.5 to 3.2 mm.

A165E

Lighted models
40 mm diameter



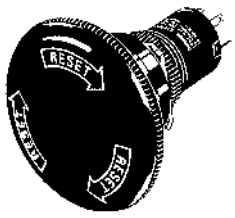


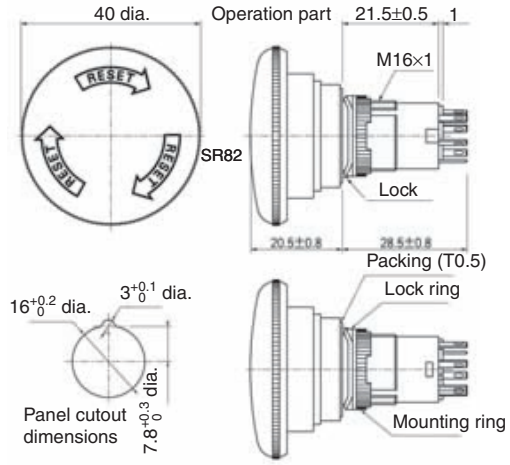
Note: 1. When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.

2. Recommended panel thickness: 0.5 to 3.2 mm.

A165E□U

Non-lighted,
one-body models
40 mm diameter





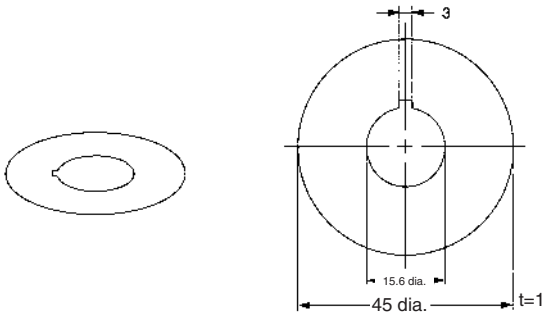
Note: 1. When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.

2. Recommended panel thickness: 0.5 to 3.2 mm.

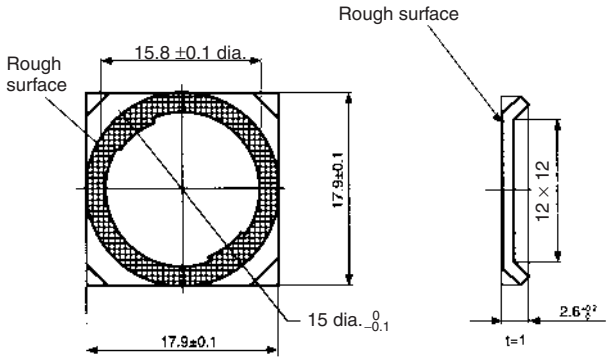
Accessories

Yellow Plate (Vinyl Chloride)

A16Z-5070

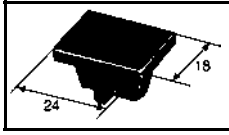
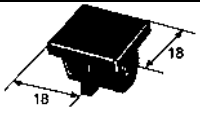
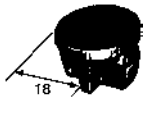


Lock Ring



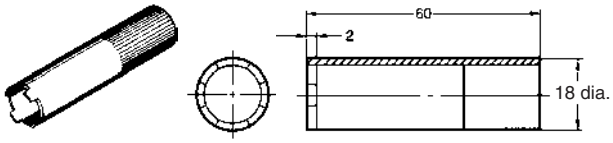
Panel Plugs

Select an appropriate Panel Plug according to the panel design and mount from the front side of the panel. Panel cutout dimensions are the same as those for the Switch.

Rectangular	Square	Round
		

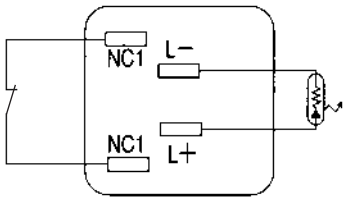
Screw Fitting

A16Z-3004

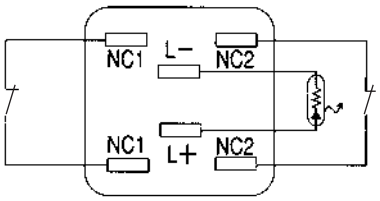


Terminal Arrangement

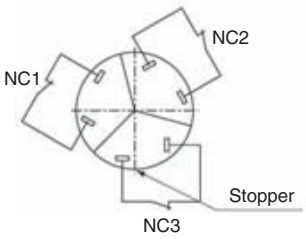
SPST Switches



DPST Switches



TPST Switches



Note: The L+ and L− terminals are not available with the non-lighted models.

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

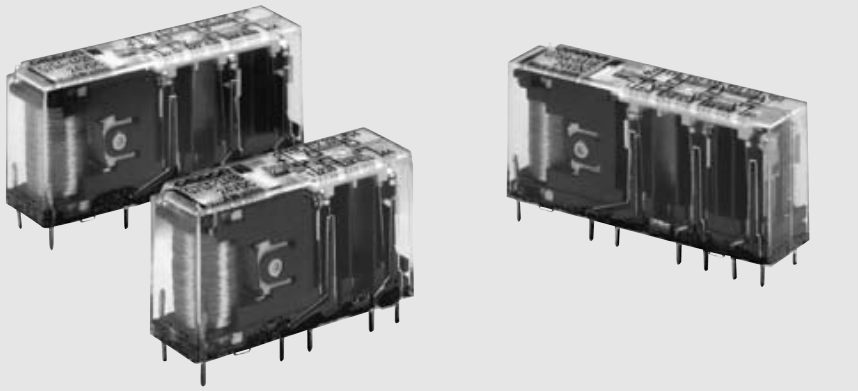
Cat. No. A120-E2-03A-X In the interest of product improvement, specifications are subject to change without notice.

Relays with Forcibly Guided Contacts

G7SA

Slim Relays with Forcibly Guided Contacts Conforming to EN Standards

- EN50205 Class A, approved by VDE.
- Ideal for use in safety circuits in production machinery.
- Four-pole and six-pole Relays are available.
- The Relay's terminal arrangement simplifies PCB pattern design.
- Reinforced insulation between inputs and outputs.
  Reinforced insulation between poles.
- UL, CSA approval.



Ordering Information

Relays with Forcibly Guided Contacts

Type	Sealing	Poles	Contacts	Rated voltage	Model
Standard	Flux-tight	4 poles	3PST-NO, SPST-NC	24 VDC*1	G7SA-3A1B
			DPST-NO, DPST-NC		G7SA-2A2B
		6 poles	5PST-NO, SPST-NC		G7SA-5A1B
			4PST-NO, DPST-NC		G7SA-4A2B
			3PST-NO, 3PST-NC		G7SA-3A3B

*1 12 VDC, 21 VDC, 48 VDC are available on request.

Sockets

Type		LED indicator	Poles	Rated voltage	Model
Track-mounting	Track mounting and screw mounting possible	No	4 poles	---	P7SA-10F
			6 poles		P7SA-14F
		Yes	4 poles	24 VDC	P7SA-10F-ND
			6 poles		P7SA-14F-ND
Back-mounting	PCB terminals	No	4 poles	---	P7SA-10P
			6 poles		P7SA-14P

Model Number Legend

G7SA-□A□B
1 2

1. NO Contact Poles
- 2: DPST-NO
- 3: 3PST-NO
- 4: 4PST-NO
- 5: 5PST-NO

2. NC Contact Poles
- 1: SPST-NC
- 2: DPST-NC
- 3: 3PST-NC

Specifications

Ratings

Coil

Rated voltage	Rated current	Coil resistance	Must-operate voltage	Must-release voltage	Max. voltage	Power consumption
24 VDC	4 poles: 15 mA 6 poles: 20.8 mA	4 poles: 1,600 Ω 6 poles: 1,152 Ω	75% max. (V)	10% min. (V)	110% (V)	4 poles: Approx. 360 mW 6 poles: Approx. 500 mW

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with tolerances of ±15%.

2. Performance characteristics are based on a coil temperature of 23°C.

3. The value given for the maximum voltage is for voltages applied instantaneously to the Relay coil (at an ambient temperature of 23°C) and not continuously.

Contacts

Load	Resistive load (cos φ =1)
Rated load	6 A at 250 VAC, 6 A at 30 VDC
Rated carry current	6 A
Max. switching voltage	250 VAC, 125 VDC
Max. switching current	6 A
Max. switching capacity (reference value)	1,500 VA, 180 W

Characteristics

Sockets

Model	Continuous current	Dielectric strength	Insulation resistance
P7SA-14□	6 A (see note 1)	2,500 VAC for 1 min. between poles	100 MΩ min. (see note 2)

Note: 1. If the P7SA-1□F is used between 55 and 85°C, reduce the continuous current (from 6 A) by 0.1 A for every degree.
2. Measurement conditions: Measurement of the same points as for the dielectric strength at 500 VDC.
3. When using the P7SA-1□F-ND at 24 VDC, use at an ambient operating temperature from -25 to 55°C.

Relays with Forcibly Guided Contacts

Contact resistance		100 mΩ max. (The contact resistance was measured with 1 A at 5 VDC using the voltage-drop method.)
Operating time (see note 2)		20 ms max.
Response time (see note 2)		10 ms max. (The response time is the time it takes for the normally open contacts to open after the coil voltage is turned OFF.)
Release time (see note 2)		20 ms max.
Maximum operating frequency	Mechanical	36,000 operations/hr
	Rated load	1,800 operations/hr
Insulation resistance		100 MΩ min. (at 500 VDC) (The insulation resistance was measured with a 500-VDC megger at the same places that the dielectric strength was measured.)
Dielectric strength (see notes 3, 4)		Between coil contacts/different poles: 4,000 VAC, 50/60 Hz for 1 min (2,500 VAC between poles 3-4 in 4-pole Relays or poles 3-5, 4-6, and 5-6 in 6-pole Relays.) Between contacts of same polarity: 1,500 VAC, 50/60 Hz for 1 min
Vibration resistance		10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Destruction	1,000 m/s^2
	Malfunction	100 m/s^2
Durability	Mechanical	10,000,000 operations min. (at approx. 36,000 operations/hr)
	Electrical	100,000 operations min. (at the rated load and approx. 1,800 operations/hr)
Min. permissible load (see note 5) (reference value)		5 VDC, 1 mA
Ambient temperature (see note 6)		Operating:-40°C to 85°C (with no icing or condensation) Storage:-40°C to 85°C (with no icing or condensation)
Ambient humidity		Operating:35% to 85% Storage:35% to 85%
Weight		4 poles: Approx. 22 g 6 poles: Approx. 25 g
Approved standards		EN61810-1 (IEC61810-1), EN50205, UL508, CSA22.2 No. 14

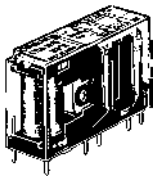
Note: 1. The values listed above are initial values.
2. These times were measured at the rated voltage and an ambient temperature of 23°C. Contact bounce time is not included.
3. Pole 3 refers to terminals 31-32 or 33-34, pole 4 refers to terminals 43-44, pole 5 refers to terminals 53-54, and pole 6 refers to terminals 63-64.
4. When using a P7SA Socket, the dielectric strength between coil contacts/different poles is 2,500 VAC, 50/60 Hz for 1 min.
5. Min. permissible load is for a switching frequency of 300 operations/min.
6. When operating at a temperature between 70°C and 85°C, reduce the rated carry current (6 A at 70°C or less) by 0.1 A for each degree above 70°C.

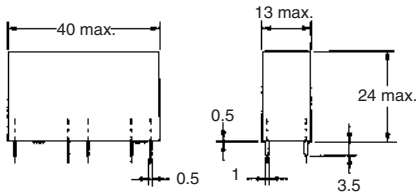
Dimensions

Note: All units are in millimeters unless otherwise indicated. The diagrams are drawn in perspective.

Relays with Forcibly Guided Contacts

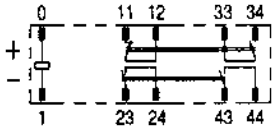
G7SA-3A1B
G7SA-2A2B



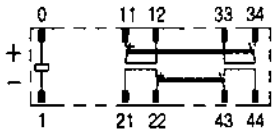


Terminal Arrangement/ Internal Connection Diagram (Bottom View)

G7SA-3A1B

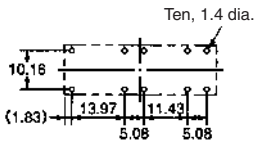


G7SA-2A2B



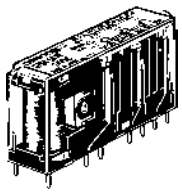
Printed Circuit Board Design Diagram (Bottom View)

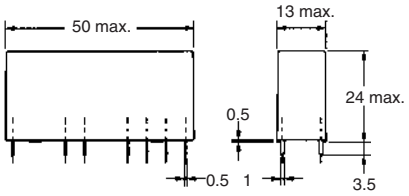
(±0.1 tolerance)



Note: Terminals 23-24, 33-34, and 43-44 are normally open. Terminals 11-12 and 21-22 are normally closed.

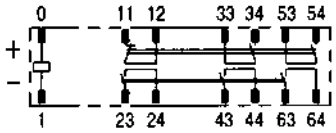
G7SA-5A1B
G7SA-4A2B
G7SA-3A3B



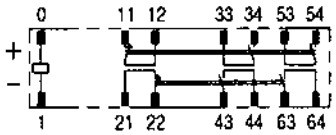


Terminal Arrangement/ Internal Connection Diagram (Bottom View)

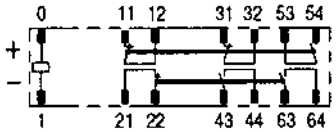
G7SA-5A1B



G7SA-4A2B

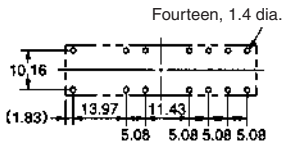


G7SA-3A3B



Printed Circuit Board Design Diagram (Bottom View)

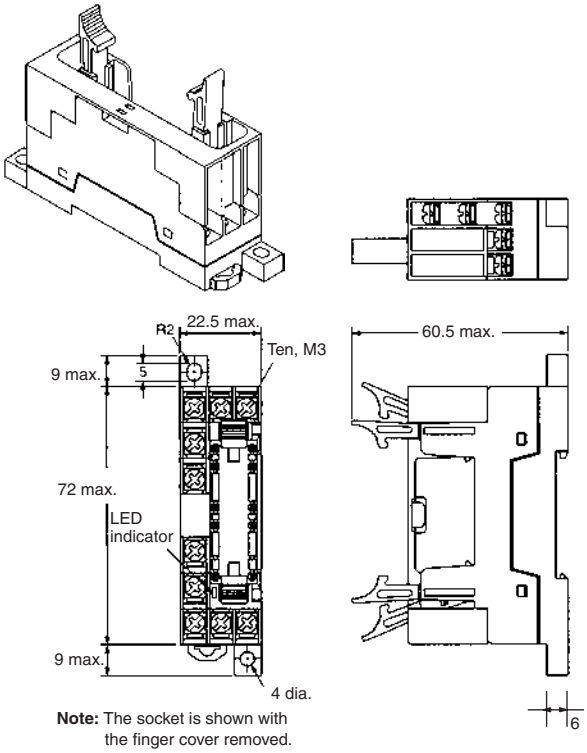
(±0.1 tolerance)



Note: Terminals 23-24, 33-34, 53-54, and 63-64 are normally open. Terminals 11-12, 21-22, and 31-32 are normally closed.

Track-mounting Socket

P7SA-10F, P7SA-10F-ND

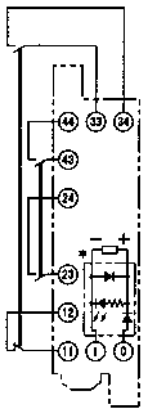


Note: The socket is shown with the finger cover removed.

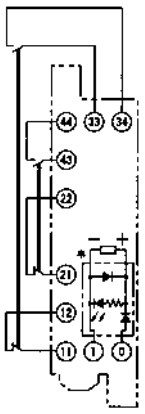
Note: Only the -ND Sockets have LED indicators.

Terminal Installation/Internal Connection Diagram (Top View)

G7SA-3A1B Mounted



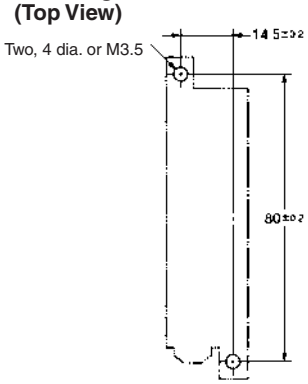
G7SA-2A2B Mounted



* This display circuit is available only for "-ND" models.

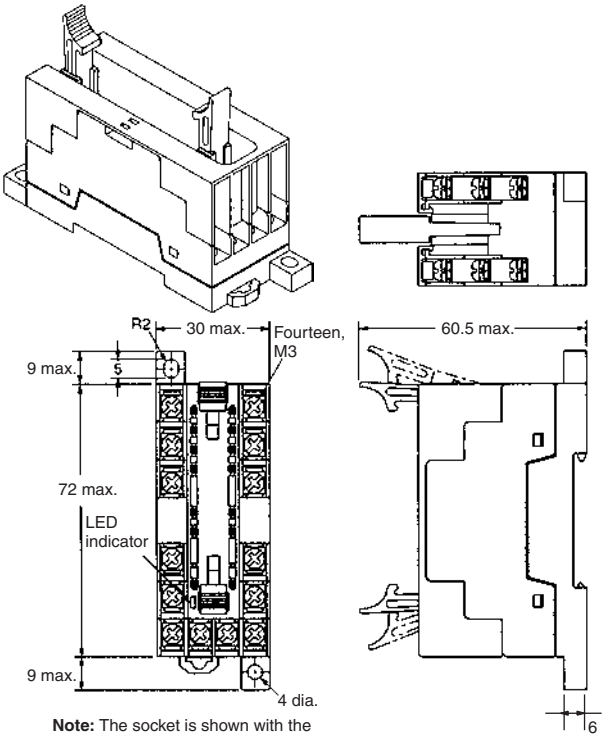
Note: Terminals 23-24, 33-34, and 43-44 are normally open. Terminals 11-12 and 21-22 are normally closed.

Mounting Hole Placement Diagram (Top View)



Track-mounting Socket

P7SA-14F, P7SA-14F-ND

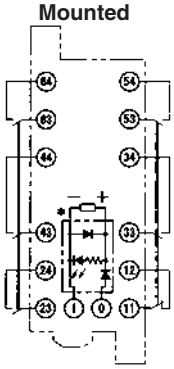


Note: The socket is shown with the finger cover removed.

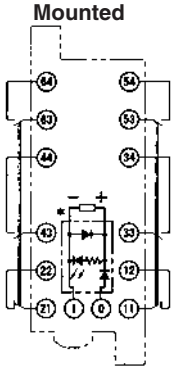
Note: Only the -ND Sockets have LED indicators.

Terminal Arrangement/Internal Connection Diagram (Top View)

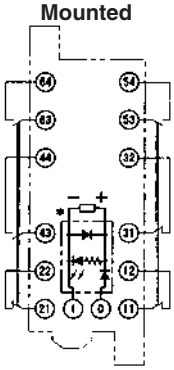
G7SA-5A1B Mounted



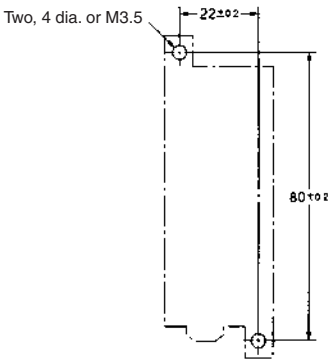
G7SA-4A2B Mounted



G7SA-3A3B Mounted



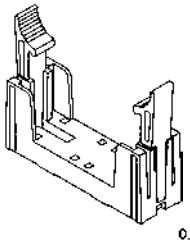
Mounting Hole Placement Diagram (Top View)

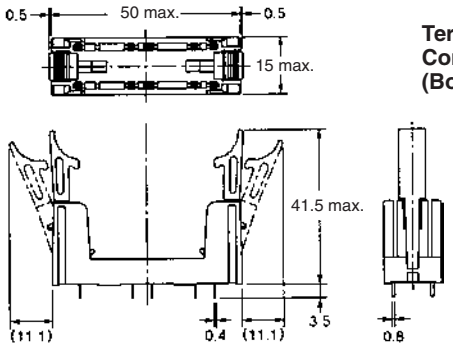


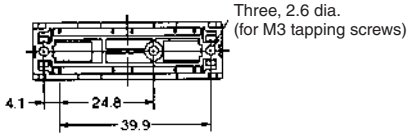
* This display circuit is available only for "-ND" models.

Note: Terminals 23-24, 33-34, 43-44, 53-54, and 63-64 are normally open. Terminals 11-12, 21-22, and 31-32 are normally closed.

P7SA-10P Back-mounting Socket (for PCB)







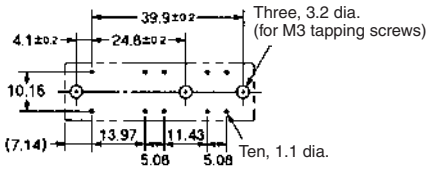
Terminal Arrangement/Internal Connection Diagram (Bottom View)

G7SA-3A1B Mounted

G7SA-2A2B Mounted

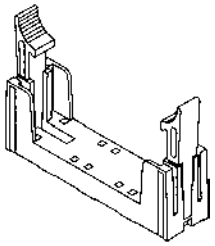
Mounting Hole Placement (Bottom View)

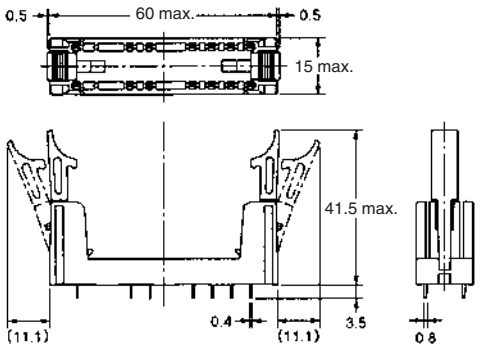
(±0.1 tolerance)

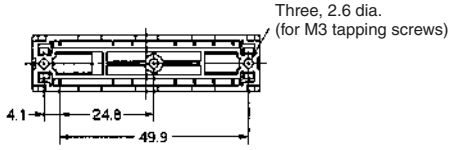


Note: Terminals 23-24, 33-34, and 43-44 are normally open. Terminals 11-12 and 21-22 are normally closed.

P7SA-14P Back-mounting Socket (for PCB)

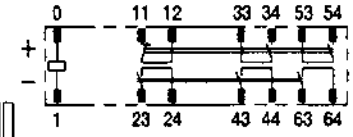




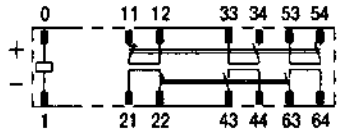


Terminal Arrangement/Internal Connection Diagram (Bottom View)

G7SA-5A1B Mounted



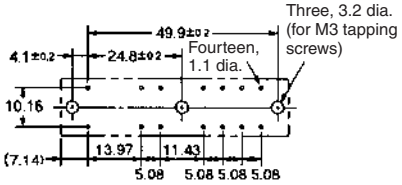
G7SA-4A2B Mounted



G7SA-3A3B Mounted

Mounting Hole Placement (Bottom View)

(±0.1 tolerance)



Note: Terminals 23-24, 33-34, 43-44, 53-54, and 63-64 are normally open. Terminals 11-12, 21-22, and 31-32 are normally closed.

Precautions

Do not touch the terminal area of the Relays or the socket terminal area (charged area) while power is ON. Electric shock will result.

Relays with Forcibly Guided Contacts

A Relay with Forcibly Guided Contacts is a Relay with which a safety category circuit can be configured.

Wiring

Use one of the following wires to connect to the P7SA-10F/10F-ND/14F/14F-ND.
Stranded wire:0.75 to 1.5 mm^2
Solid wire:1.0 to 1.5 mm^2

Tighten each screw of the P7SA-10F/10F-ND/14F/14F-ND to a torque of 0.98 N·m securely.

Wire the terminals correctly with no mistakes in coil polarity, otherwise the G7SA will not operate.

Cleaning

The G7SA is not of enclosed construction. Therefore, do not wash the G7SA with water or detergent.

Forcibly Guided Contacts (from EN50205)

If an NO contact becomes welded, all NC contacts will maintain a minimum distance of 0.5 mm when the coil is not energized. Likewise if an NC contact becomes welded, all NO contacts will maintain a minimum distance of 0.5 mm when the coil is energized.

Correct Use

Relays with Forcibly Guided Contacts

While the Relay with Forcibly Guided Contacts has the previously described forcibly guided contact structure, it is basically the same as an ordinary relay in other respects. Rather than serving to prevent malfunctions, the forcibly guided contact structure enables another circuit to detect the condition following a contact weld or other malfunction. Accordingly, when a contact weld occurs in a Relay with Forcibly Guided Contacts, depending on the circuit configuration, the power may not be interrupted, leaving the Relay in a potentially dangerous condition (as shown in Fig. 1.)
To configure the power control circuit to interrupt the power when a contact weld or other malfunction occurs, and to prevent restarting until the problem has been eliminated, add another Relay with Forcibly Guided Contacts or similar Relay in combination to provide redundancy and a self-monitoring function to the circuit (as shown in Fig. 2).
The G9S/G9SA Safety Relay Unit, which combines Relays such as the Relay with Forcibly Guided Contacts in order to provide the above-described functions, is available for this purpose. By connecting a contactor with appropriate input and output to the Safety Relay Unit, the circuit can be equipped with redundancy and a self-monitoring function.

Fig 1

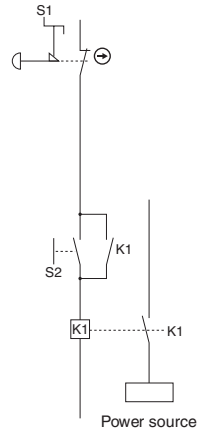
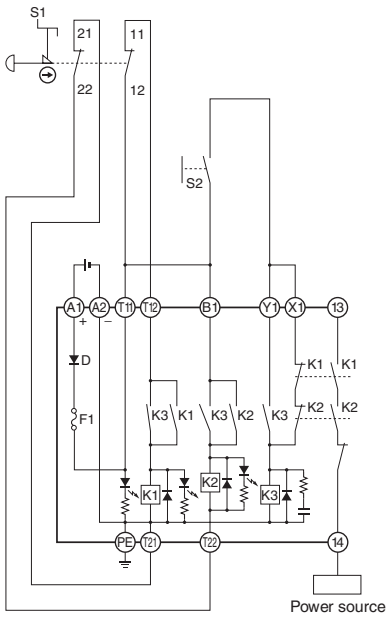


Fig 2



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

Cat. No. J120-E2-02A-X In the interest of product improvement, specifications are subject to change without notice.

Enabling Switch

A4E

3-position Enabling Switch for Safer Robot Operation

- Clicking feel.
- Conforms to U.S. standards (ANSI/RIA R15.06-1999) for 3-position switches.
- Can be mounted in two directions.

Model Number Structure

Model Number Legend

A4E-□□□□□□

1 2 3 4 5 6

1. Total output number
- B: Two outputs
- C: Four outputs

2. Enable outputs
- 2: Two contact outputs

3. Release monitor outputs
- 0: None
- 1: One contact output

4. Grip monitor outputs
- 0: None
- 1: One contact output

5. Mounting bracket
- S: No mounting bracket
- H: Horizontal mounting bracket
- V: Vertical mounting bracket

6. Cover
- S: No cover
- A: Rubber cover

Ordering Information

List of Models

Model	Specification
A4E-B200SS	Two outputs, no mounting bracket, no rubber seal
A4E-B200HS	Two outputs, horizontal mounting, no rubber seal
A4E-B200VS	Two outputs, vertical mounting, no rubber seal
A4E-B200VA	Two outputs, vertical mounting, with rubber seal
A4E-C211SS	Four outputs, no mounting bracket, no rubber seal
A4E-C211HS	Four outputs, horizontal mounting, no rubber seal
A4E-C211VS	Four outputs, vertical mounting, no rubber seal
A4E-C211VA	Four outputs, vertical mounting, with rubber seal

Approved Standards

EN 60947-5-1

UL 508

CSA C22.2 No. 14

Specifications

Ratings

Rated insulation voltage	250 V
Rated ON current	2.5 A
Rated load	24 VDC, 300 mA (inductive load) 125 VAC, 1 A (resistive load)
Minimum applicable load	24 VDC, 4 mA
Impulse withstand voltage	4.0 kV between terminals of different polarity, 2.5 kV between terminals of same polarity
Ambient temperature	-10°C to 55°C (with no icing)
Ambient humidity	35% to 85% (with no condensation)
Storage temperature	-25°C to 65°C

Structure

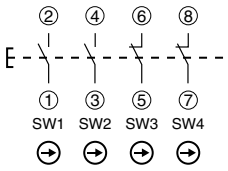
Contact form	4-contact type:2NO (enable output) 1NC (release output) 1NC (grip output) Direct opening for all contacts (See note)
	2-contact type:2NO (enable output) Direct opening for all contacts (See note)
Operating pattern	During operation: OFF-ON-OFF During reset: OFF-OFF momentary 3-position operation
Terminal shape	Solder terminals

Note: Direct opening only during grip.

Characteristics

Insulation resistance	100 M min. (at 500 VDC)
Contact resistance	100 m max. (initial value)
Vibration resistance	10 to 55 Hz, 0.75-mm single amplitude min.
Shock resistance	150 m/s^2
Mechanical durability	OFF-ON: 1,000,000 operations min. OFF-ON-OFF (direct opening): 100,000 operations min.
Electrical durability	100,000 operations min.
Degree of protection	IP65 (rubber seal type only)

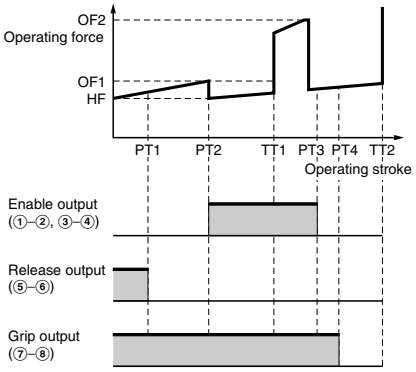
Contact form



SW1, SW2: Enable output
SW3: Release output
SW4: Grip output

Note: SW3 and SW4 are for 4-contact types only.

Operating Characteristics



Operating stroke

Symbol	Name	A4E-B200□S	A4E-B200VA (See note.)	A4E-C211□S	A4E-C211VA (See note.)
PT1	Release output (ON)	---	---	1 mm max.	1.2 mm max.
PT2	Enable output (ON)	3.2 mm max.	3.4 mm max.	3.2 mm max.	3.4 mm max.
TT1	Max. enable holding position	Approx. 4 mm	Approx. 4.2 mm	Approx. 4 mm	Approx. 4.2 mm
PT3	Enable direct opening position	5.4 mm max.	5.6 mm max.	5.4 mm max.	5.6 mm max.
PT4	Grip output (ON)	---	---	5.4 mm min.	5.4 mm min.
TT2	Max. stroke	Approx. 6.5 mm	Approx. 6.7 mm	Approx. 6.5 mm	Approx. 6.7 mm

Note:Not including the rise of the rubber cover (0.5 mm max.).

Operating force (reference values)

Symbol	Name	A4E-B200□S	A4E-B200VA	A4E-C211□S	A4E-C211VA
OF1	Enable operating force	7 N max.	14 N max.	7 N max.	14 N max.
HF (See note)	Enable holding force	Approx. 5.5 N	Approx. 8 N	Approx. 5.5 N	Approx. 8 N
OF2	Grip operating force	35 N max.	40 N max.	35 N max.	40 N max.

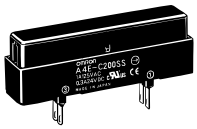
Note: HF indicates “holding force”.

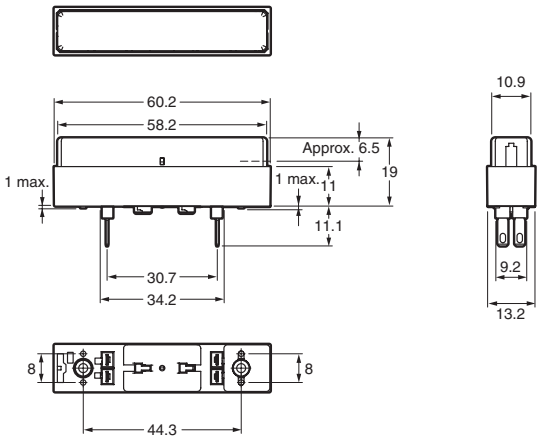
Dimensions

Note: All units are in millimeters unless otherwise indicated.

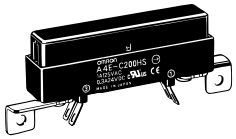
2-contact type

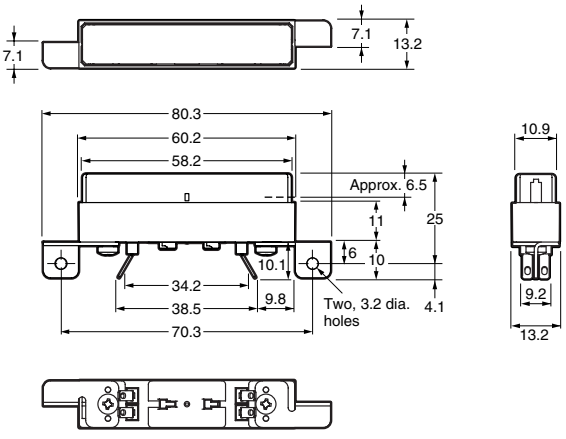
No mounting bracket
A4E-B200SS





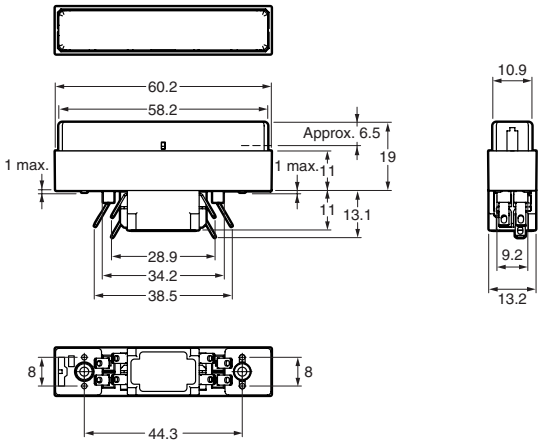
Horizontal mounting
A4E-B200HS



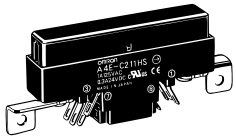


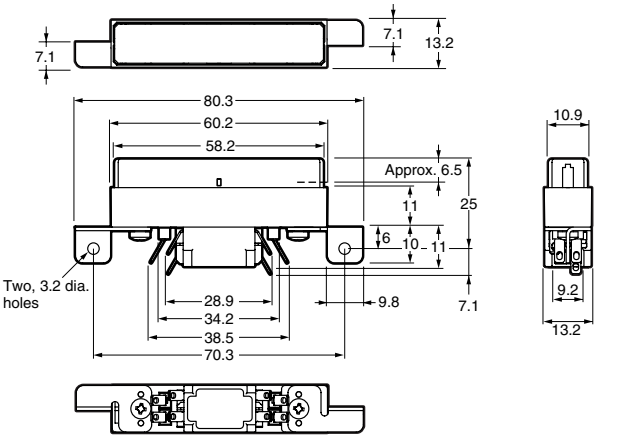
4-contact type

No mounting bracket
A4E-C211SS

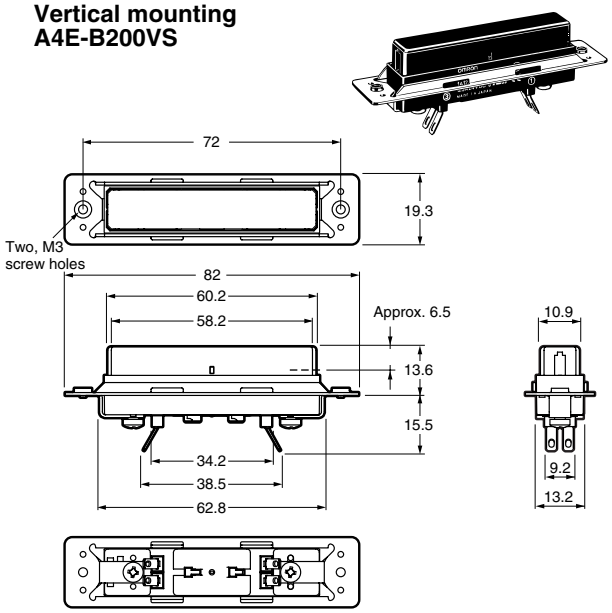


Horizontal mounting
A4E-C211HS

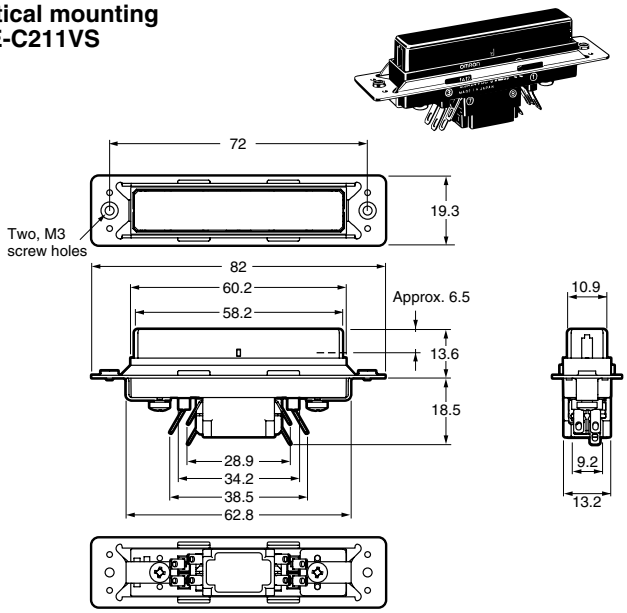




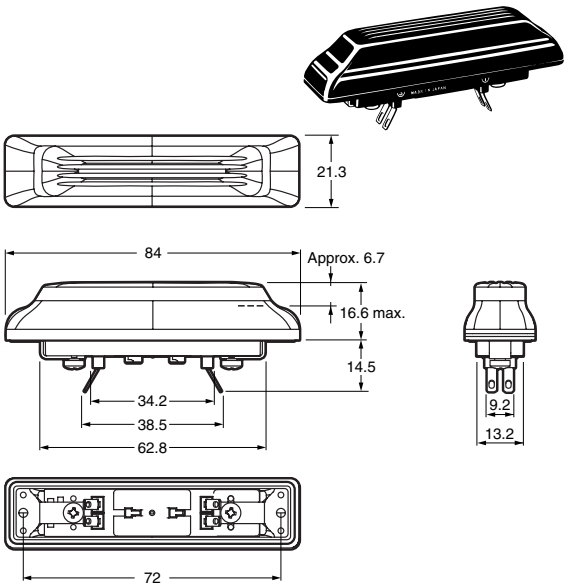
Vertical mounting
A4E-B200VS



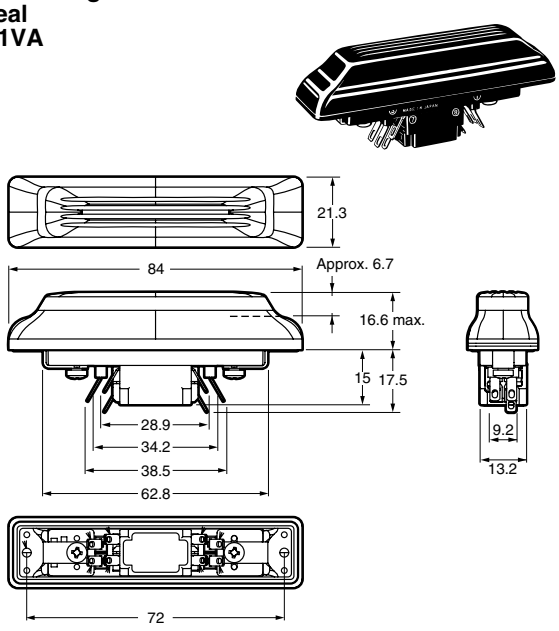
Vertical mounting
A4E-C211VS



Vertical mounting with rubber seal
A4E-B200VA



Vertical mounting with rubber seal
A4E-C211VA



Precautions

WARNING

Do not wire the Switch or touch any terminal of the Switch while power is being supplied. Doing so may result in electric shock.

WARNING

Always use the Switch in a system that is operated directly by hand. Do not operate the Switch with a mechanical actuator. Insufficient Switch strength may result in damage to the Switch, electric shock, or fire.

CAUTION

Design a safe system for using the Switch, based on a risk assessment that takes into account all reasonably foreseeable malfunctions.

CAUTION

Determine the Switch mounting direction and structural design only after thorough risk assessment. For example, in a structure where the Switch protrudes from the pendant perimeter, the weight of the pendant itself could place the Switch into the enable condition and operate the machine. Likewise, in a buried structure where the Switch lies below the surface of the pendant, the Switch may not enter the grip condition when pressed and thus fail to stop the machine.

CAUTION

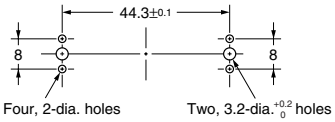
Configure the system so that the machine operates only when the Switch is in the enable position.

Correct Use

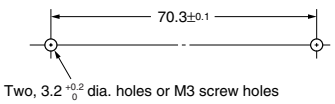
Mounting

Use M3 screws and flat washers or spring washers to mount the Switch securely. Use a tightening torque of 0.39 to 0.59 Nm.

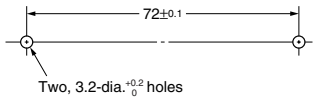
No-mounting-bracket type



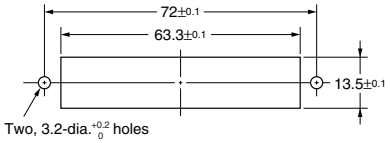
Horizontal mounting type



Vertical mounting type



Vertical mounting type with rubber seal



Wiring

- Use an appropriate wire size (0.5 to 0.75 mm^2) for the applied voltage and carry current.
- Do not use a #110 tab receptacle.
- Wire according to the terminal numbers. Mistaken wiring may damage the Switch and result in fire.
- Wire according to the terminal arrangement.
- Use good-quality 6:4 (tin:lead) solder.
- Use a resin flux cored solder.
- Do not use a liquid or chlorine type flux.
- Perform soldering within 3 s using a 30-W max. soldering iron (temperature at the tip of the soldering iron: 350°C max.). Insulate with an insulation tube.
- Do not move the terminal for at least one minute after soldering.
- Do not apply a force that would deform the terminal when wiring.

Operating Environment

Prior to using the Switch in places that are subject to contact by oil spray or chemicals, check the effect of those substances on the Switch.

Some types of oil spray and chemicals will degrade the sealing capability, which may result in faulty contact, defective insulation, ground fault, or burning damage.

Improper Operating Environment

- Do not use the Switch in places that are subject to sudden temperature change.
- Do not use the Switch in places that are subject to high temperatures and condensation.
- Do not use the Switch in places that are subject to strong vibration.
- Do not use the Switch in places that are subject to direct contact with machine filings or dust.

Storage

- Do not store the Switch in places with hydrogen sulfide or other corrosive gas or sea breeze.
- Do not store the Switch in places where the level of dust is high enough to be visible.
- Do not store the Switch in direct sunlight.
- Do not impose excessive force on the Switch during storage. Otherwise, the Switch may deform.

Handling

- Do not drop the Switch. Otherwise, the Switch may malfunction.
- Do not apply strong vibration or shock to the Switch. Otherwise, the Switch may malfunction or be damaged.
  Do not contact the Switch with sharp objects. Otherwise, the Switch may be scratched. Scratches on the operating portion of the Switch may result in problems both in appearance and operation.

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

Cat. No. C123-E2-01-X