GENERAL CATALOGUE 2004/2005

Sensing & Safety





- Photoelectric Sensors
- Displacement Sensors
- Vision Systems
- Safety Sensors
- Safety Switches
- Safety Relays
- Proximity Sensors
- Rotary Encoders
- Pressure Sensors

Advanced Industrial Automation

Cat.No. F502-EN2-03A SEN

OMRON

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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".

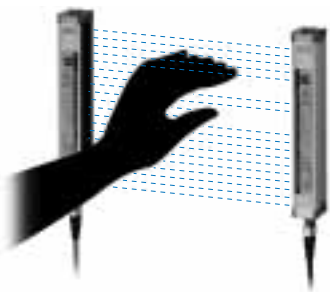
Finger protection

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



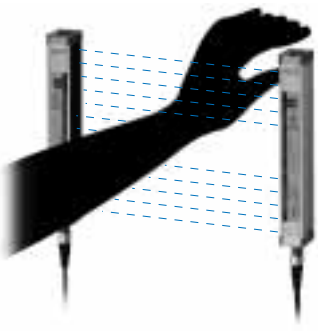
Hand protection

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.)

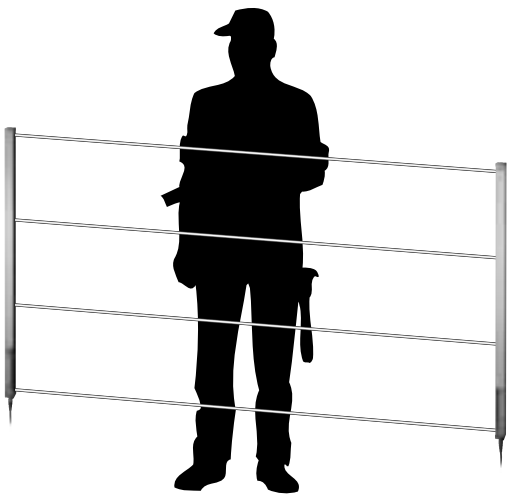
Body protection

Multi-beam safety curtain

F3SH-A09P03

Sensing distance : 10 m

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

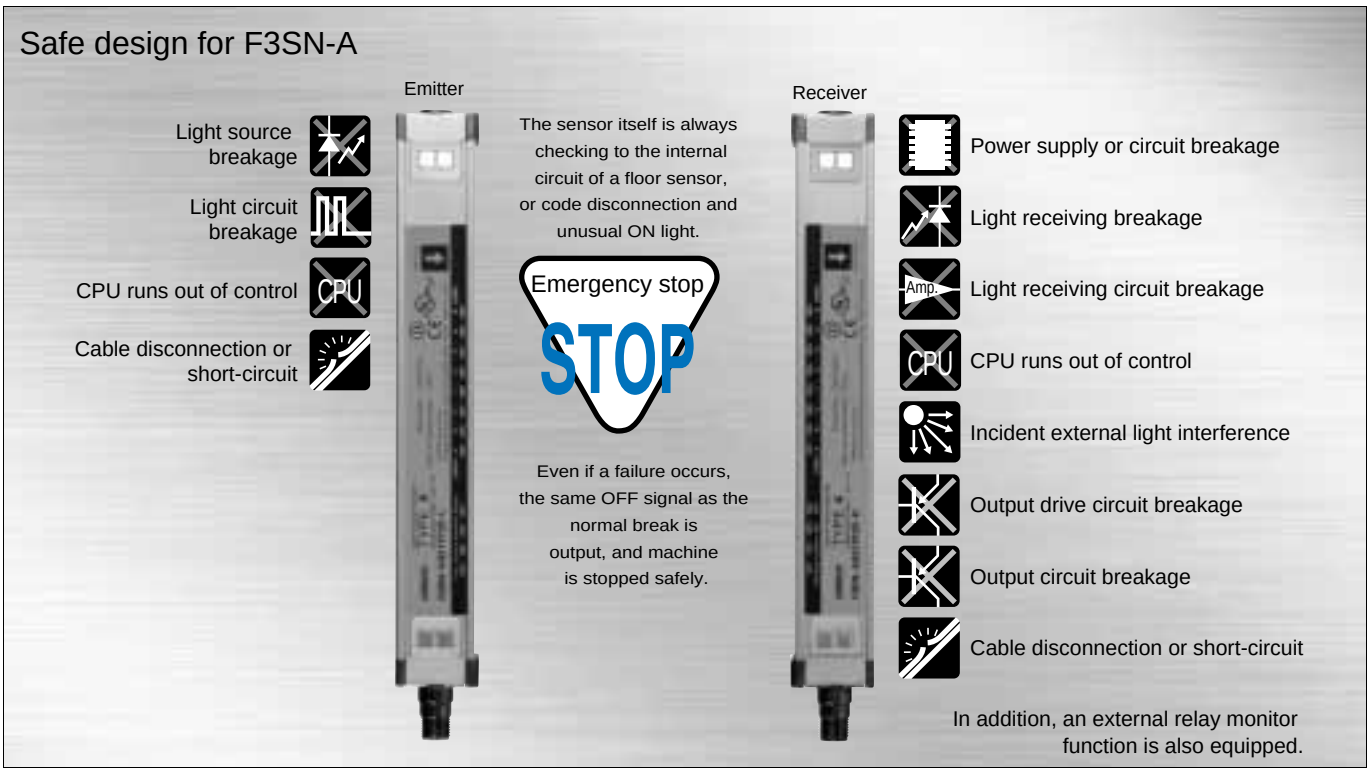


Features

A superior standard of safety design prevents machine accidents.

Wide-range implementation of fail-safe design.

Self-failure diagnosis triggers output shut off.

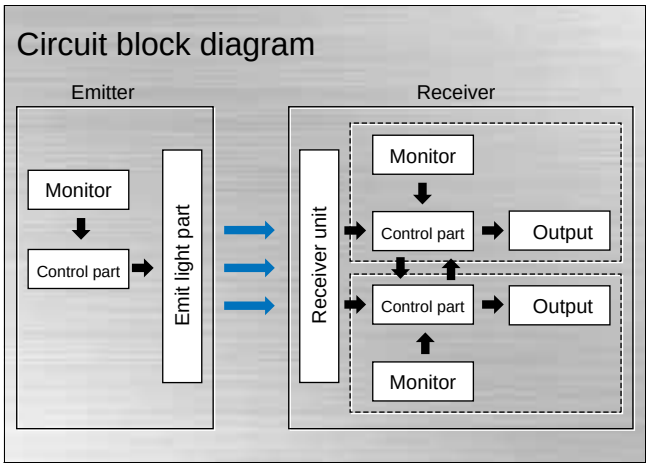


Technology-supported safety design

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.

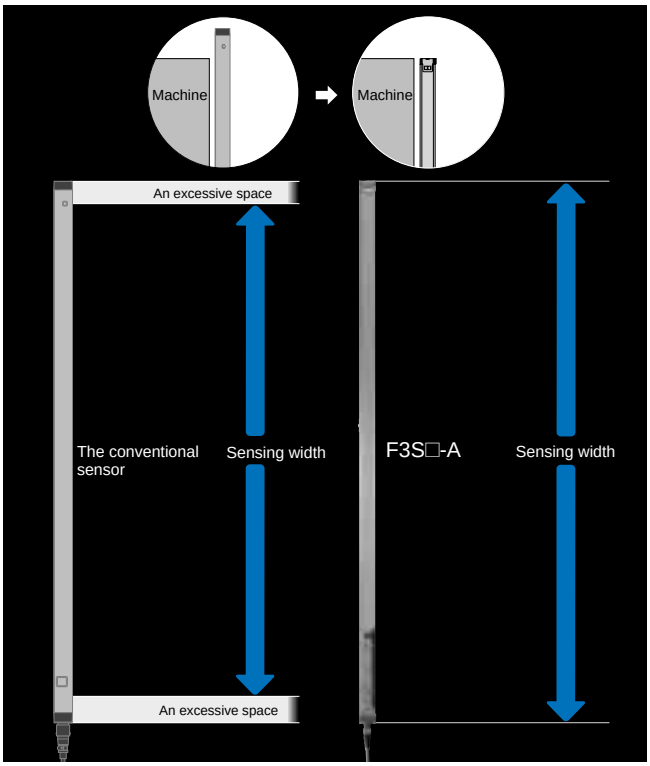
UL CE IEC61496-1 IEC61496-2 Type 4

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.

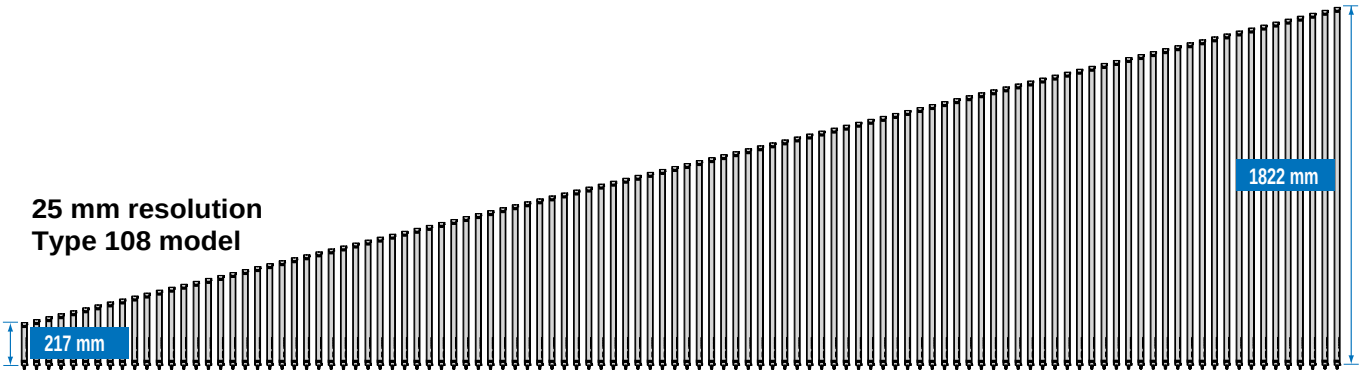


Up to 3 sets can be connected in series. Mutual interference can be prevented.

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

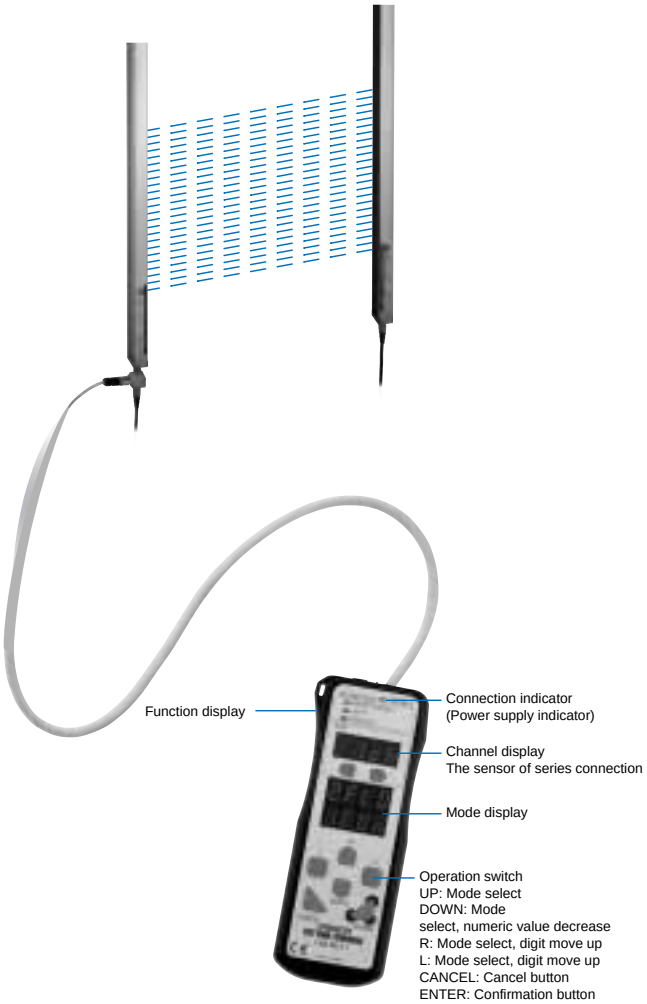
Note: When you order for a series connection type, please place an order with model-code F3SN-A□□□□P□□ -01.

Select the optimum length



Features

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



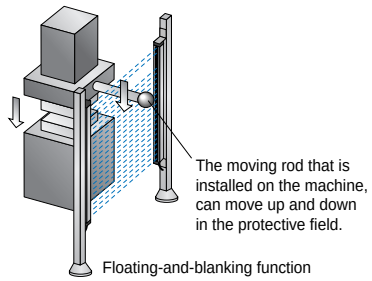
Includes two types of blanking functions

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.

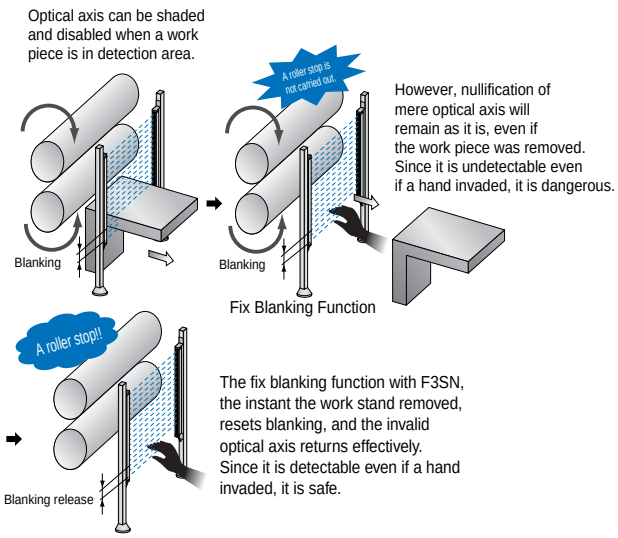
(Example of floating blanking function)



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

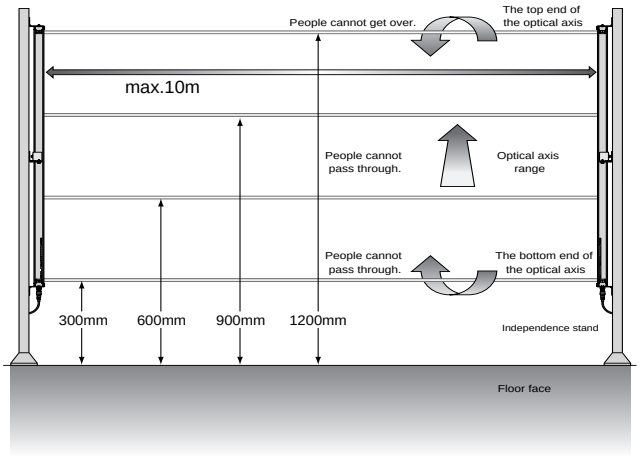
Recommended dimensions of EN standard for F3SH-A (4-optical axis multi-beam)
Human body detection achieved

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

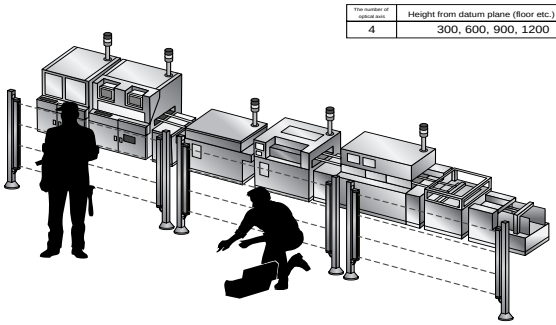
In EN Standard EN999 (machine safety: positioning of protective devices in relation to the approach speed of human body parts), the values in the following table are recommended as the most effective regarding the height from the reference surface (floor, etc.) of each optical axis of the 4 optical axis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

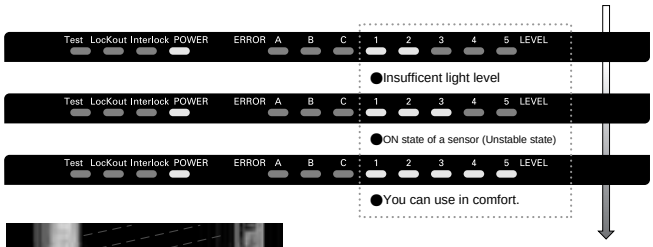
Various safety functions are implemented. Can be adapted to various safety circuit system configurations.

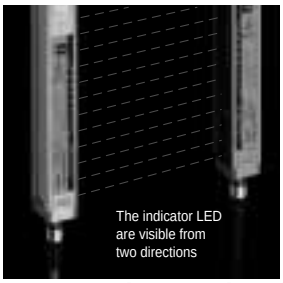
- Interlock function
- Auto reset / manual reset can be selected
- External device monitoring function

Equipped with LED bar for easy use.

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

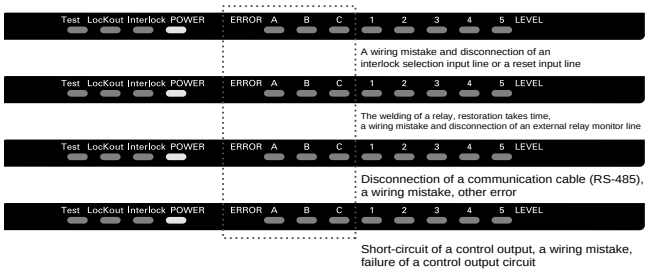
- Optical axis adjustment indicator (green only)





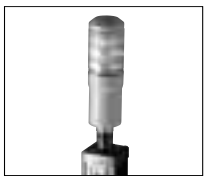
Error modes can be clearly indicated to provide a safety backup.

Error display example (red only)



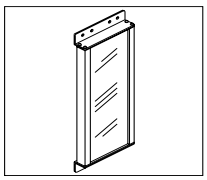
Full lineup of accessories (optional)

●Large-sized display indicator F39-A



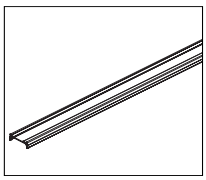
When connecting, a series connection model (model end number -01) is required.The setting console can select the kind of signal.

●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



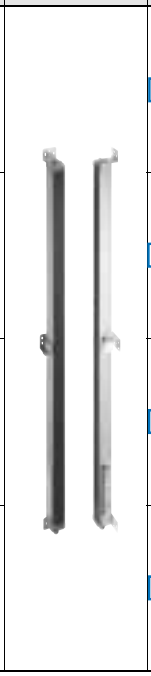
- Protective tube
- Slit cover
- Free location brackets
- Muting controller
- PSDI controller

Ordering information

Sensors

Safety light curtain

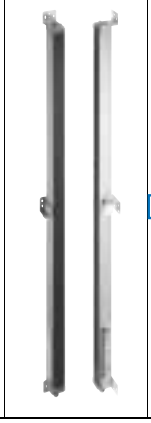
Infrared ray

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.

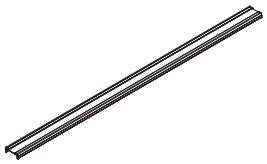
2. When two or more cables have to be used for connection with the G9SA-300-SC, connect the necessary number of F39-JC□B cables to one F39-JC□C cable.
(Example) When a 35 m long cable is required, connect two F39-JC□B cables to one F39-JC□C.

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

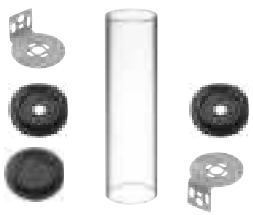
Note: □□□□ in the model name indicates the 4-digit sensor detection width (in sensor models).

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
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
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)				

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
	Series con-nection	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	

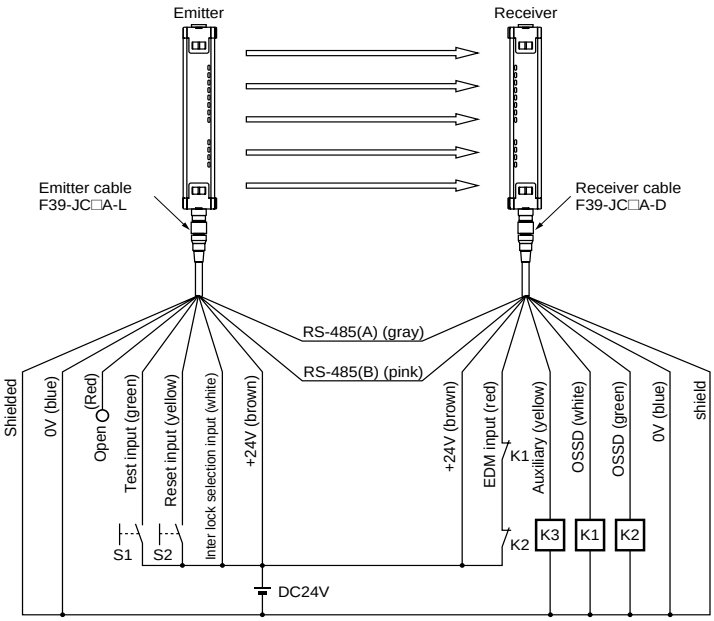
Environment-resistant Enclosure

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	

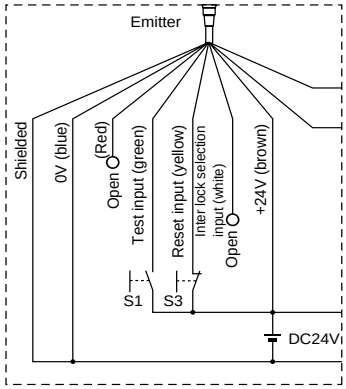
Note: To conform to IP67, tighten the screws according to the “Cautions for Use” as described in the manual packaged together with the product.

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)

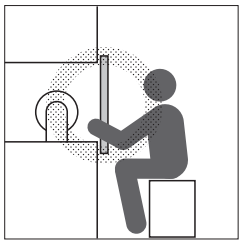
Detection zone and intrusion path

F3SN-A Safety Light Curtain

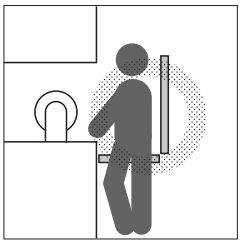
Install protective structures around the machine so that you must pass through the detection zone of the F3SN-A to reach a hazardous part of the machine.
Install the F3SN-A so that some part of the operator's body remains in the detection zone at all times when the operator works in a hazardous area.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

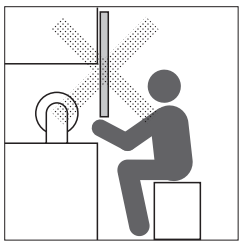


Some part of the operator's body remains in the detection zone while they are working.

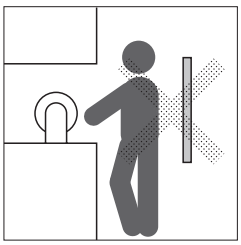


Incorrect Installation

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.

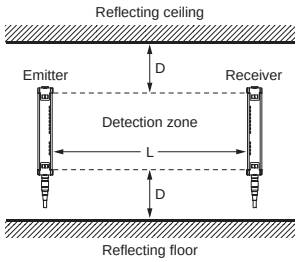
Use of the fixed blanking function (F3SN-A only)

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.

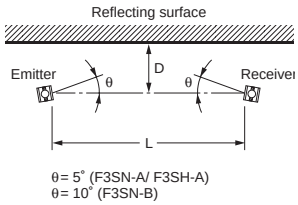
Distances from reflective surfaces

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 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)

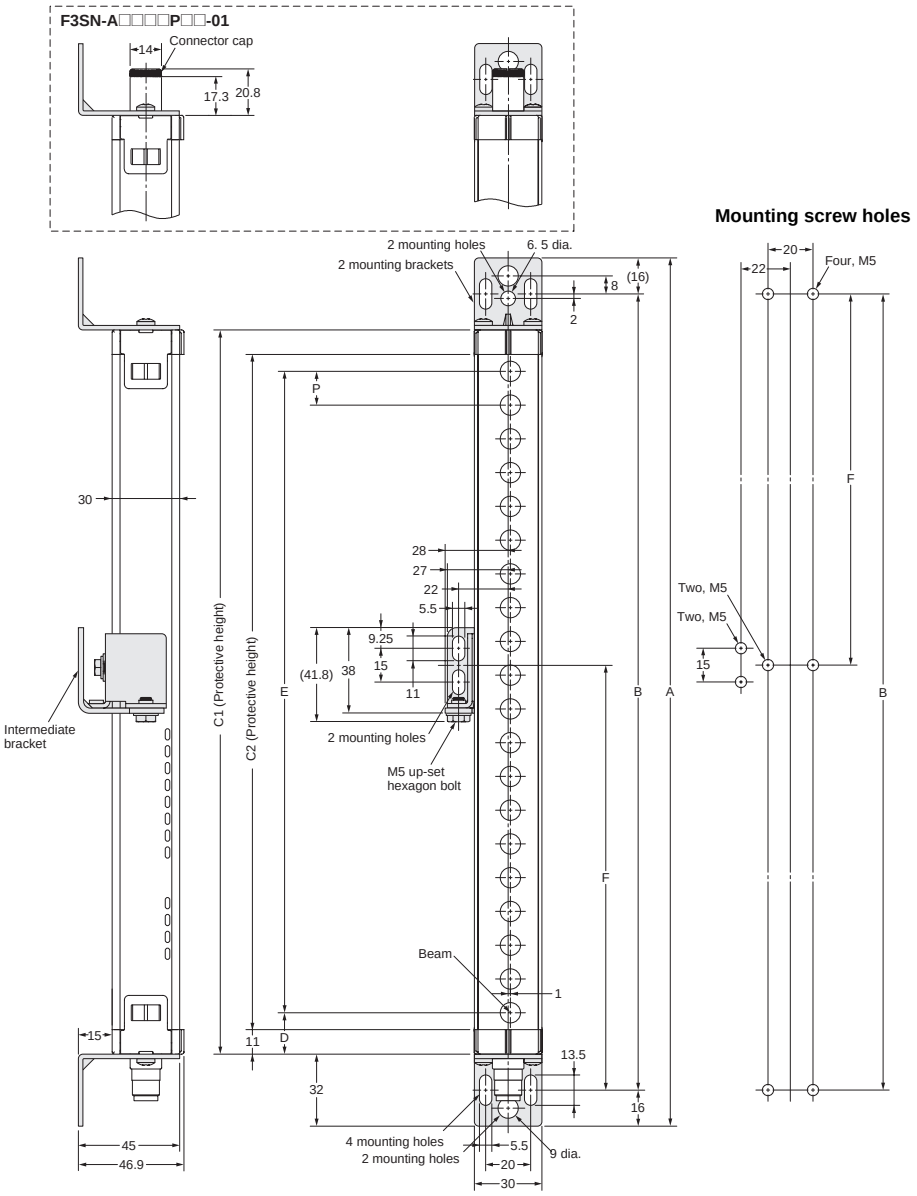
The safety distance varies with national standards and individual machine standards. The equation is also different if the direction of intrusion is not perpendicular to the detection zone of the light curtain. Be sure to refer to related standards.

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

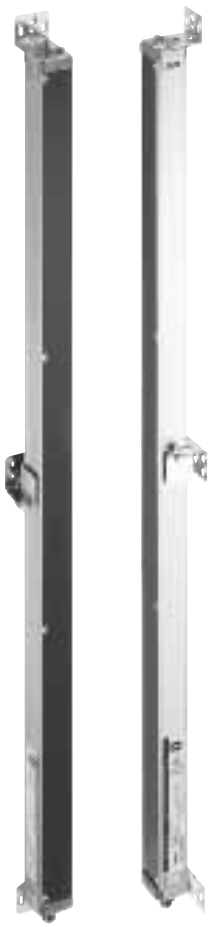
Dimension C1 (protective height): 4 digits in the model name
Dimension A = C1 + 64
Dimension B = C1 + 32
Dimension D = 18.5
Dimension E = C1 – 37
Dimension F: See the table below.

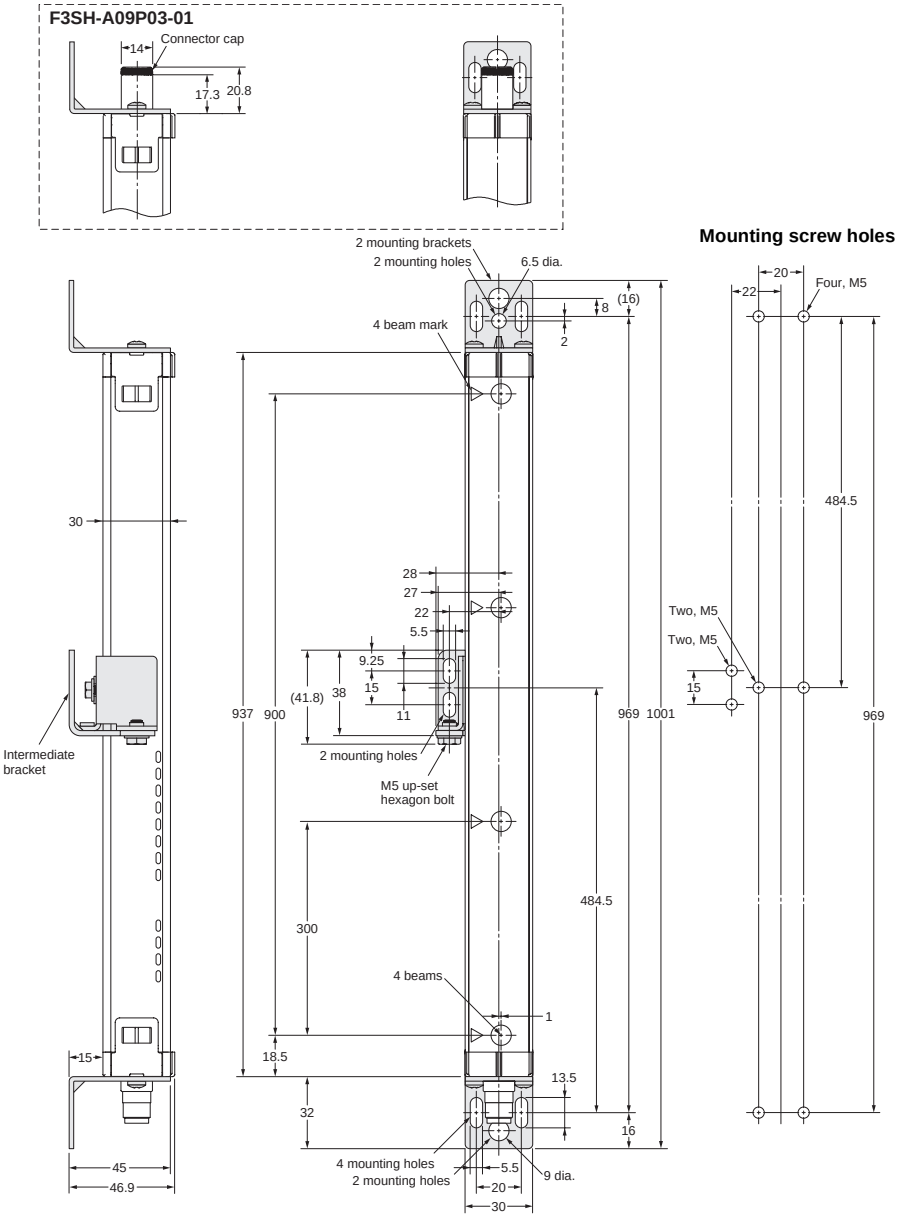
C1 (protective height)	Number of intermediate mounting bracket	Dimension F (see note)
to 0640	0	——
0641 to 1280	1	F = B/2
1281 to 1822	2	F = B/3

Dimension P: See the table below

Detection capability	Dimension P
25	15
40	30
70	60

F3SH-A09P03
F3SH-A09P03-01

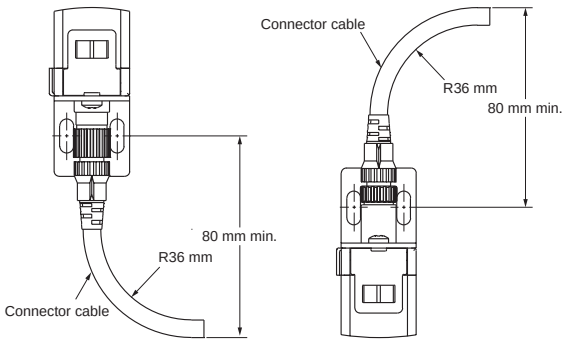




Mounting Precautions

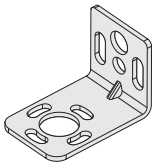
Note: 1 . The mounting bracket (3) (see Mounting brackets (intermediate)) is shown on the left-hand side of the sensor as an example. If the mounting bracket (3) is on the right-hand side of the sensor then the mounting holes must also be on the right-hand side.

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



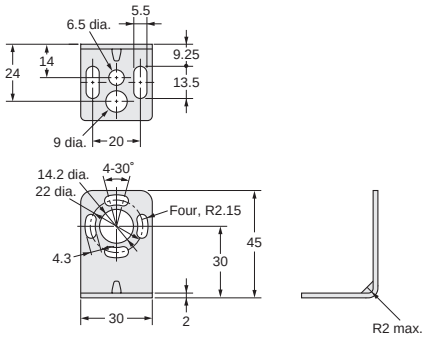
Accessories

Mounting bracket (top and bottom)

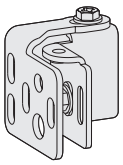


Material: Iron (zinc plating)

Note: Provided with the product.

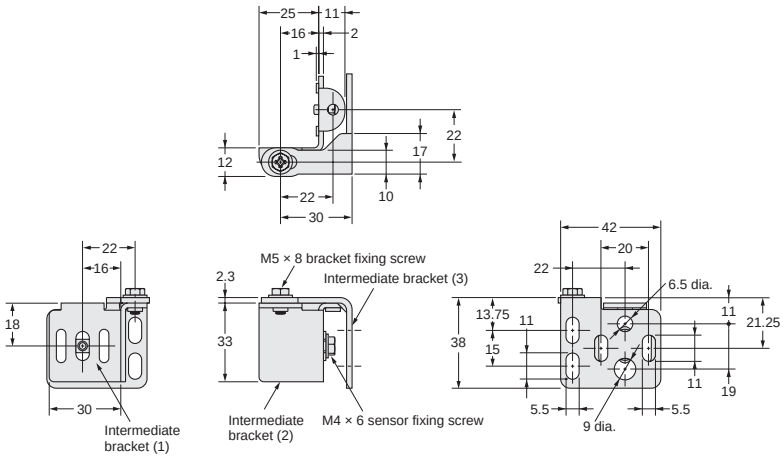


Mounting brackets (intermediate)



Material: Iron (zinc plating)

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

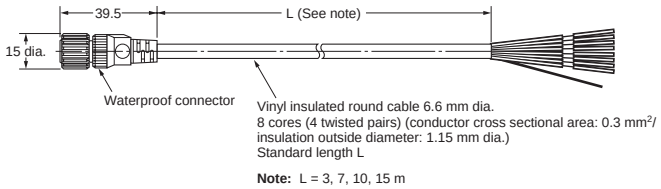


Accessories (Optional)

Single-ended connector cable

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

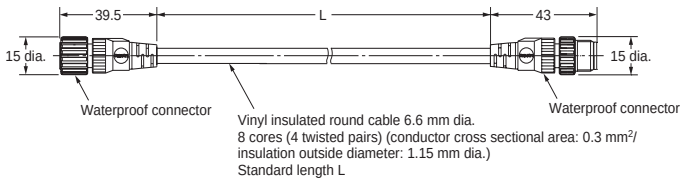
Color: Emitter (gray)
Receiver (black)



Double-ended connector cable

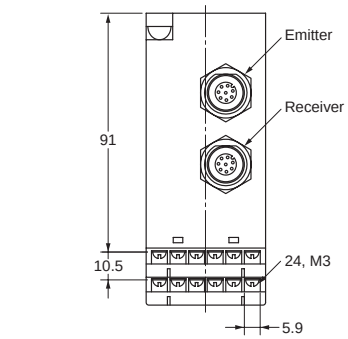
F39-JCR2B (L = 0.2 m)
F39-JCR5B (L = 0.5 m)
F39-JC3B (L = 3 m)
F39-JC5B (L = 5 m)
F39-JC7B (L = 7 m)
F39-JC10B (L = 10 m)
F39-JC15B (L = 15 m)
F39-JC20B (L = 20 m)
F39-JCR2C (L = 0.2 m)
F39-JC1C (L = 1 m)
F39-JC3C (L = 3 m)
F39-JC7C (L = 7 m)
F39-JC10C (L = 10 m)
F39-JC15C (L = 15 m)

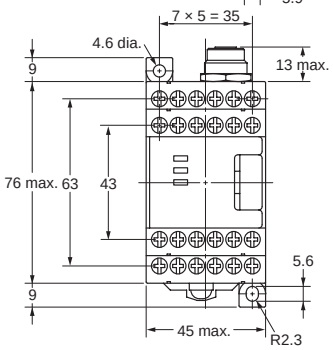
Color: Emitter (gray)
Receiver (black)

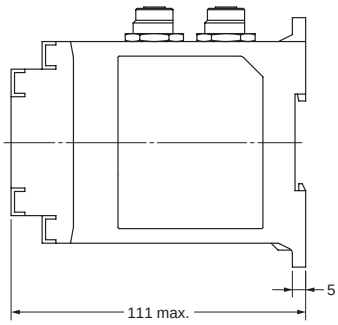


Control unit

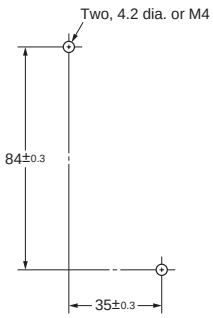
F3SP-B1P





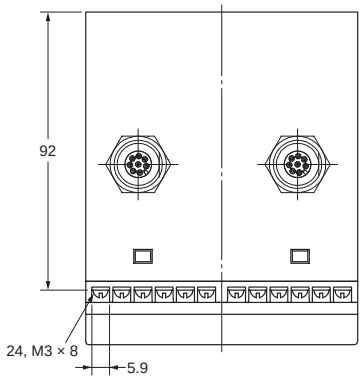


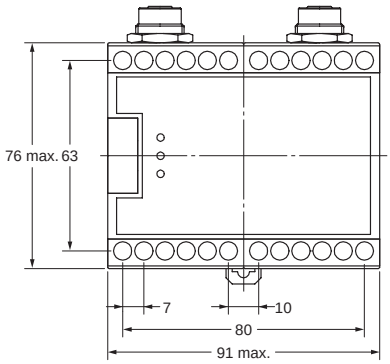
Mounting screw holes

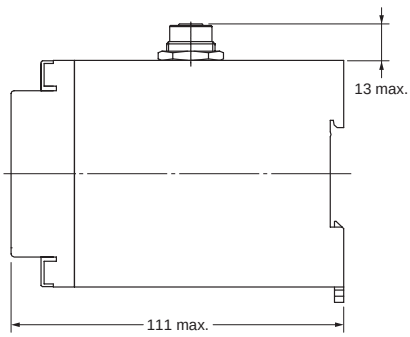


Safety relay unit

G9SA-300-SC

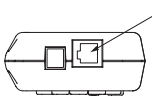


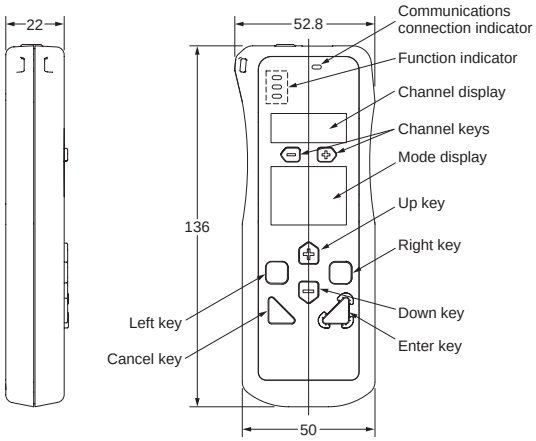




Setting console

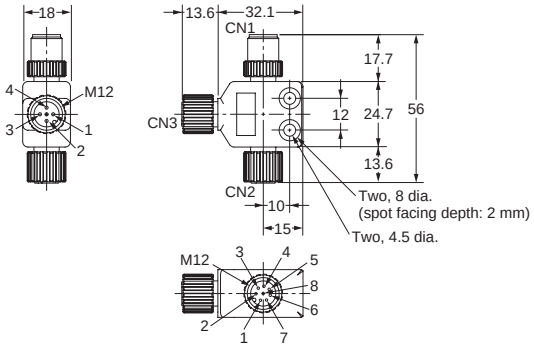
F39-MC11





Branching connector (supplied with F39-MC11)

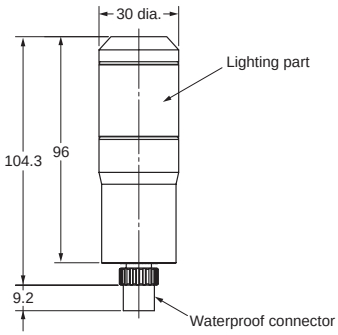
F39-CN1



CN1	Connector cable
CN2	Sensor
CN3	Setting console

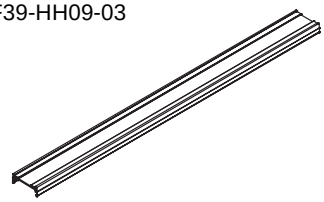
External indicator

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

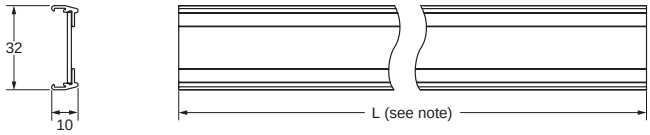


Spatter protection cover

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



Protection cover

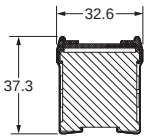


Note: L is as follows.

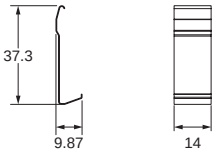
F39-HN□□□□-14	L = □□□□ mm
F39-HN□□□□-25	L = □□□□ – 22 mm
F39-HH09-03	L = 915 mm

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

Mounting dimensions



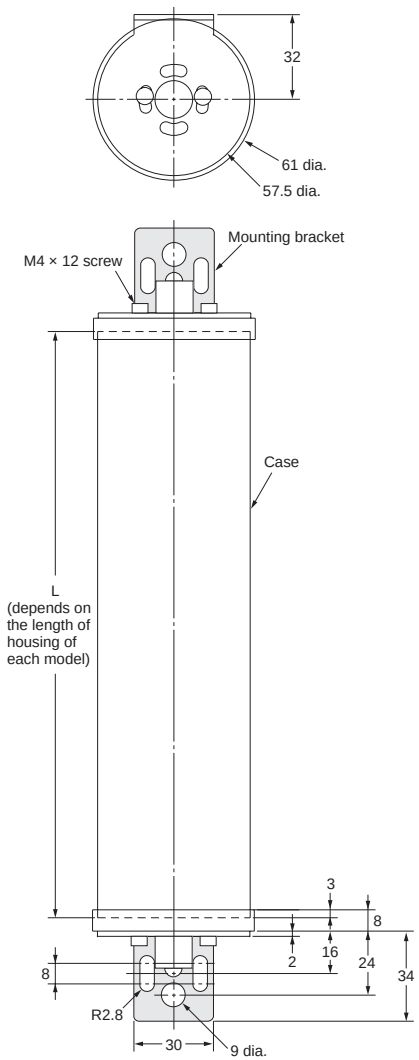
Fixing bracket



Materials: SUS

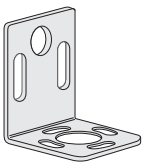
Environment-resistant enclosure

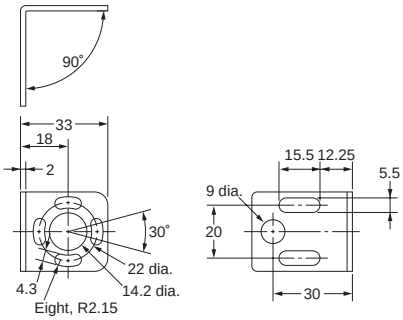
F39-HP□□□□-14
F39-HP□□□□-25
F39-HPH09-03



Wall mounting bracket

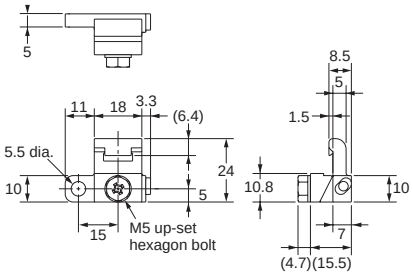
F39-L18



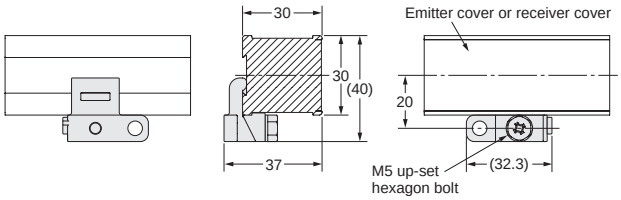


Free-location bracket

F39-L19

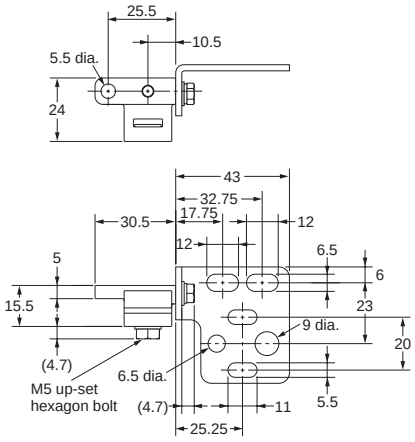


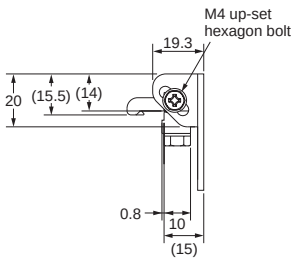
Mounting



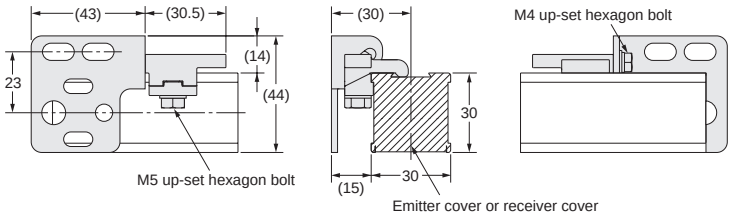
Free-location bracket

F39-L20

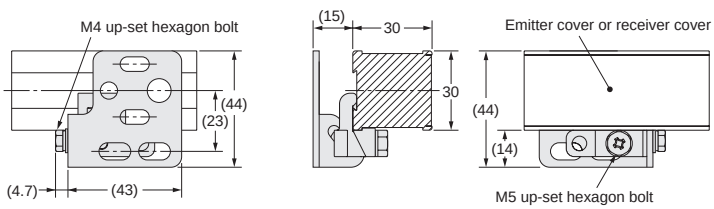




Side mounting



Back mounting



MEMO

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.

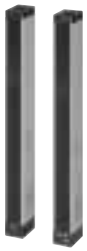
Features

- 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 D-92)	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 D-106)	G9SB series

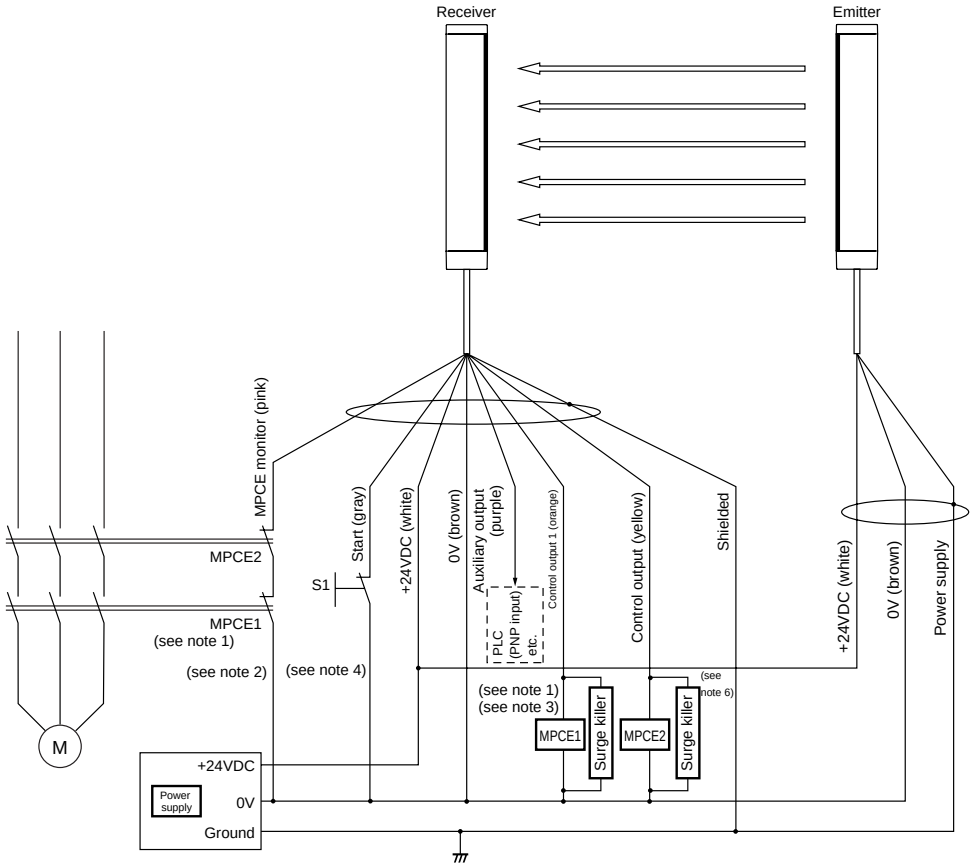
Rating/performance

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.

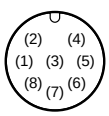


M: Mechanical drive unit including 3-phase motor
S1: Start switch for interlock reset (NC contact)
MPCE1, MPCE2: Contactor or safety relay with compulsory guide mechanism (G7SA is recommended)

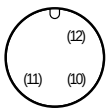
Note: 1 . Please use a safety relay with forcibly guided contacts (such as the G7SA) for MPCE1 and MPCE2, which are relays that perform ultimate control of the machine.
2 . If you do not intend to use the MPCE monitor function, short the MPCE monitor line (pink) to power supply 0 V.
3 . If a load is 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

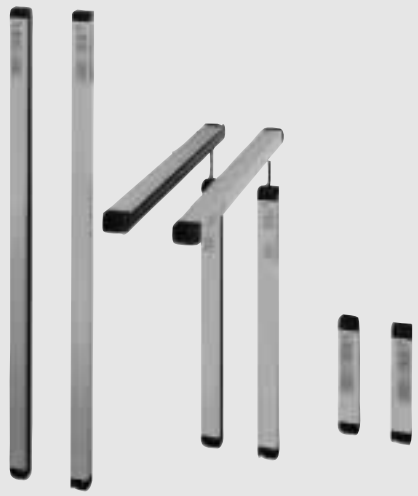
Note: Please order one each for the emitter and the receiver.

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 (1997) (Type 2 AOPD), EN 61496-1 (06/98) (Type 2 ESPE) standards and EC Directive: No. 98/336/EEC, No. 98/37/EC.
- 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]

blank	Stand-alone
M	Master unit for series connection
S	Slave unit for series connection
36	No. of optical axis (4-66)
2	25 mm optical pitch
5	50 mm optical pitch
7	75 mm optical pitch
blank	Slave unit
P	PNP outputs

blank	Complete set of emitter and receiver
L	Emitter unit only
D	Receiver unit only
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

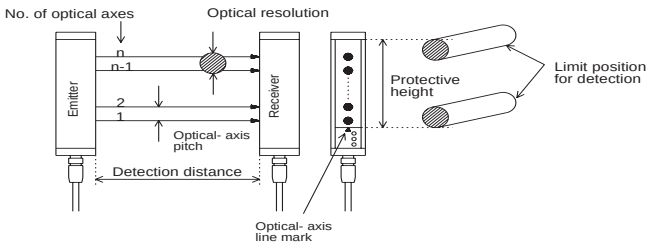
Nomenclature

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”.

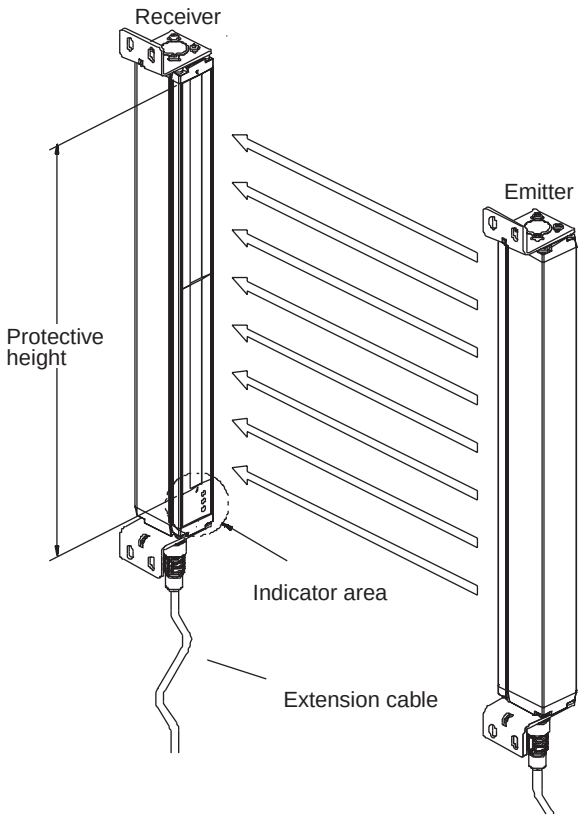
Optical-axis line mark

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.



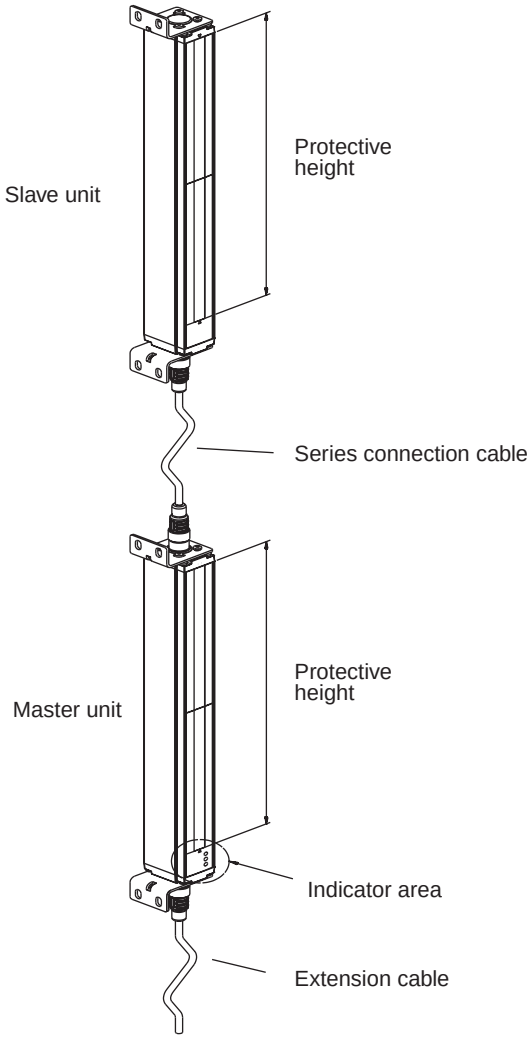
Series connection types

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.

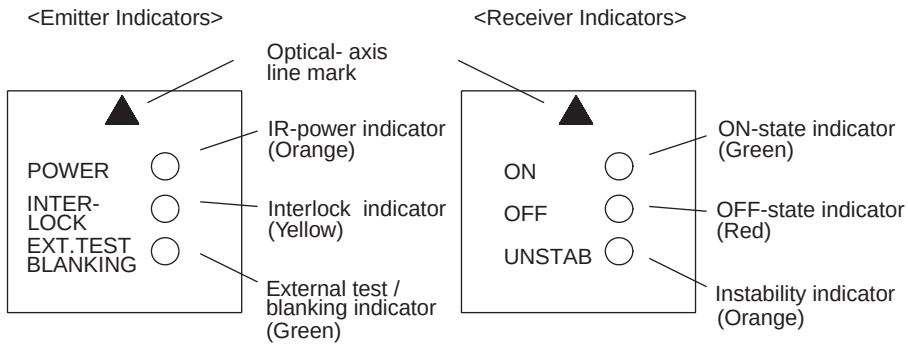
Rating and Performance

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								
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								

Type	F3S-B□□□P[*1] Stand-alone	F3S-BM□□□P□□ [*1] Master unit for series connection	F3S-BS□□□[*1] Slave unit for series connection
Materials	Case: Aluminum Front cover: PMMA (acrylic resin) End caps: PA6		
Size (cross section)	30 x 40 mm		
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:	Lit when emitting.
	Interlock indicator:	Lit during start/restart interlock or start interlock.
	External test/ blanking indicator:	Lit during external test. / Flashing when using blanking function.
Receiver	ON-state indicator:	Lit when receiving light.
	OFF-state indicator:	Lit with interrupted light. Flashing during connection with F39-E1 or with failure.
	Instability indicator:	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

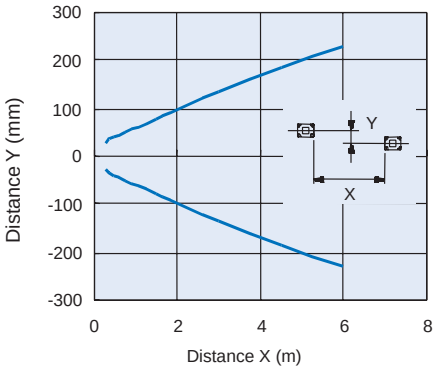
	Response time [ms]			
Slave unit F3S- Master unit	BS065	BS095	BS125	BS155
F3S-BM065P□□	20	20	20	21
F3S-BM095P□□	20	20	21	22
F3S-BM125P□□	20	21	22	24
F3S-BM155P□□	21	22	24	26
F3S-BM185P□□	22	24	26	28
F3S-BM215P□□	24	26	28	30
F3S-BM245P□□	26	28	30	32
F3S-BM275P□□	28	30	32	34
F3S-BM305P□□	30	32	34	35
F3S-BM335P□□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

Characteristic data

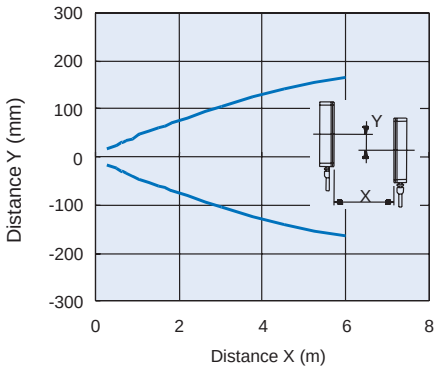
Operating Range

F3S-B122P

Parapendicular to Center Line of Lenses

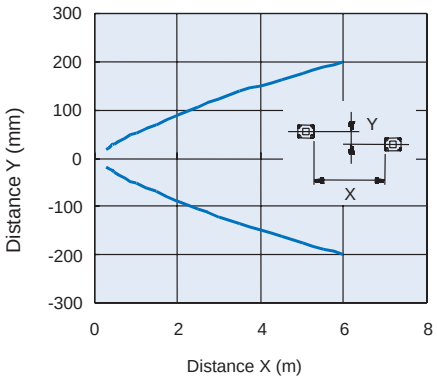


Parallel to Center Line of Lenses

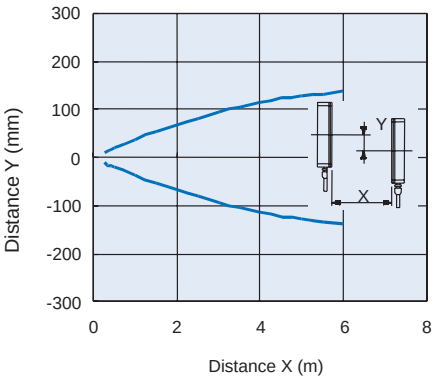


F3S-B662P

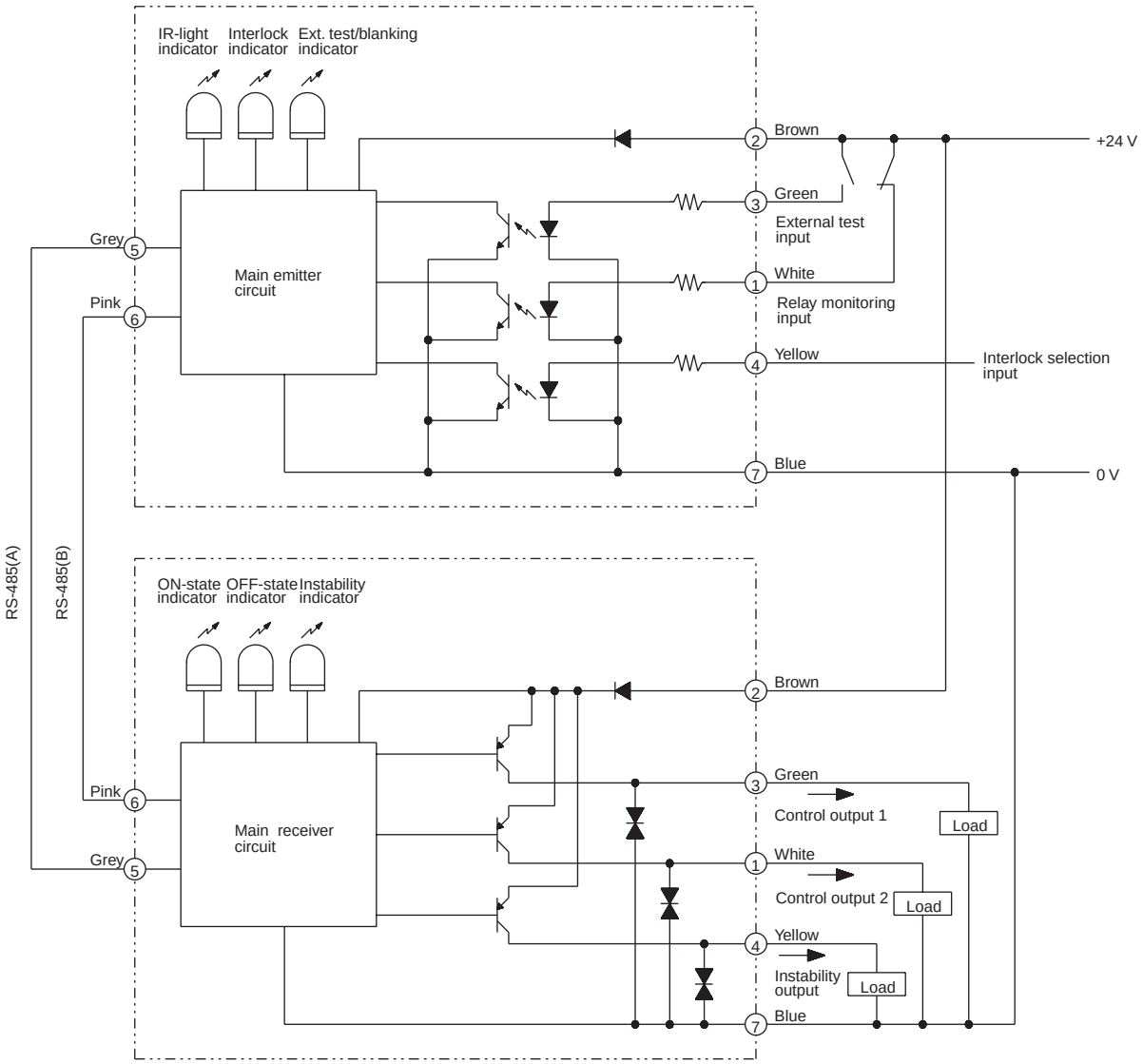
Parapendicular to Center Line of Lenses



Parallel to Center Line of Lenses



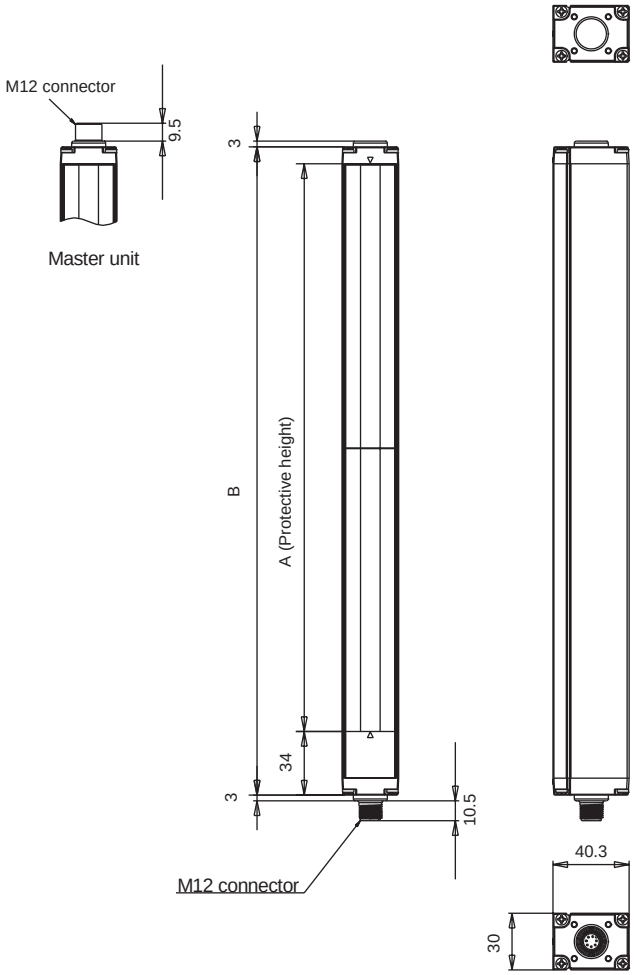
I/O Circuit Diagram



Dimensions

Safety Light Curtain

F3S-B

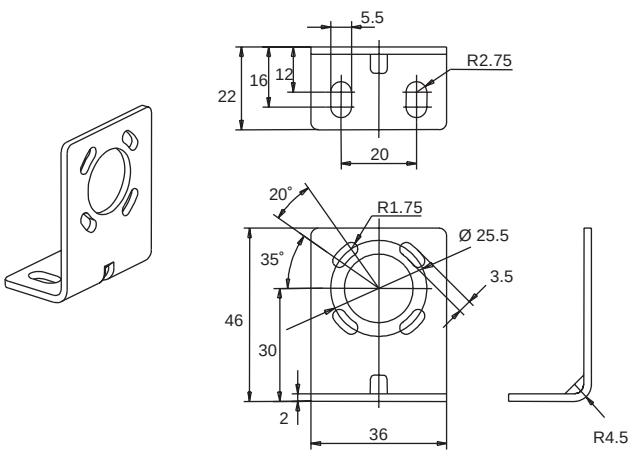


Type	**A** Protective height	**B** Full length
F3S-B122, -B065, -B047	300	343
F3S-B182, -B095, -B067	450	493
F3S-B242, -B125, -B087	600	643
F3S-B302, -B155, -B107	750	793
F3S-B362, -B185, -B127	900	943
F3S-B422, -B215, -B147	1050	1093
F3S-B482, -B245, -B167	1200	1243
F3S-B542, -B275, -B187	1350	1393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

Note:All units are in Millimeters unless otherwise indicated.

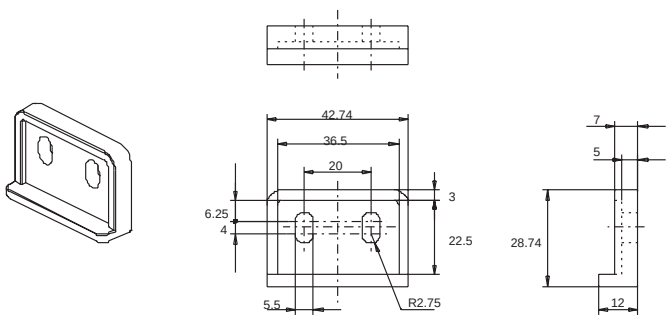
Accessoires

Mounting Bracket (Top and Bottom)



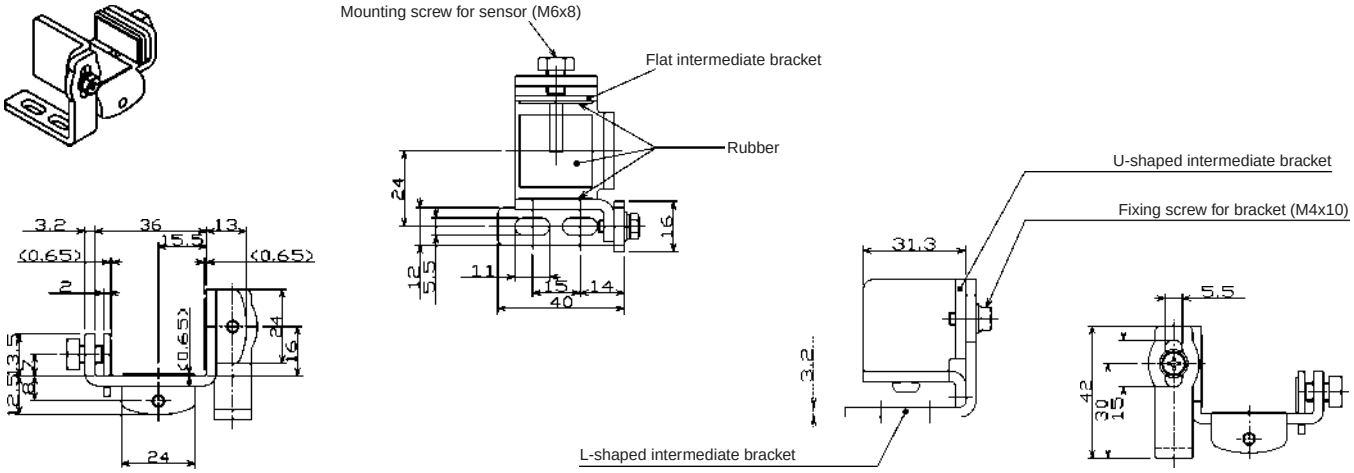
Mounting Plate

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

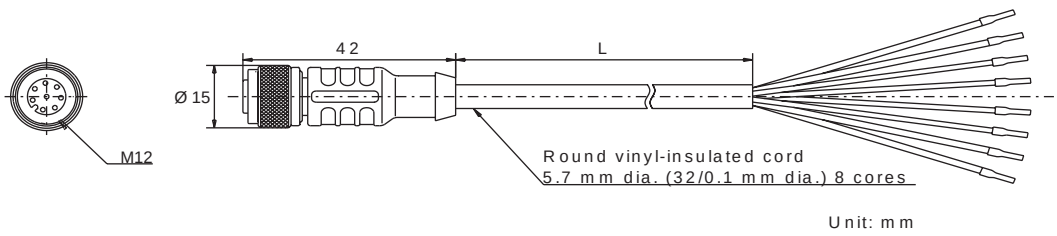


Options (Order Separately)

Extension Cable

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

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

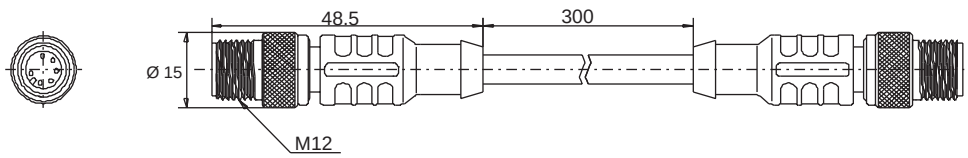


Unit: mm

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.

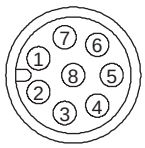
Installation

Wiring

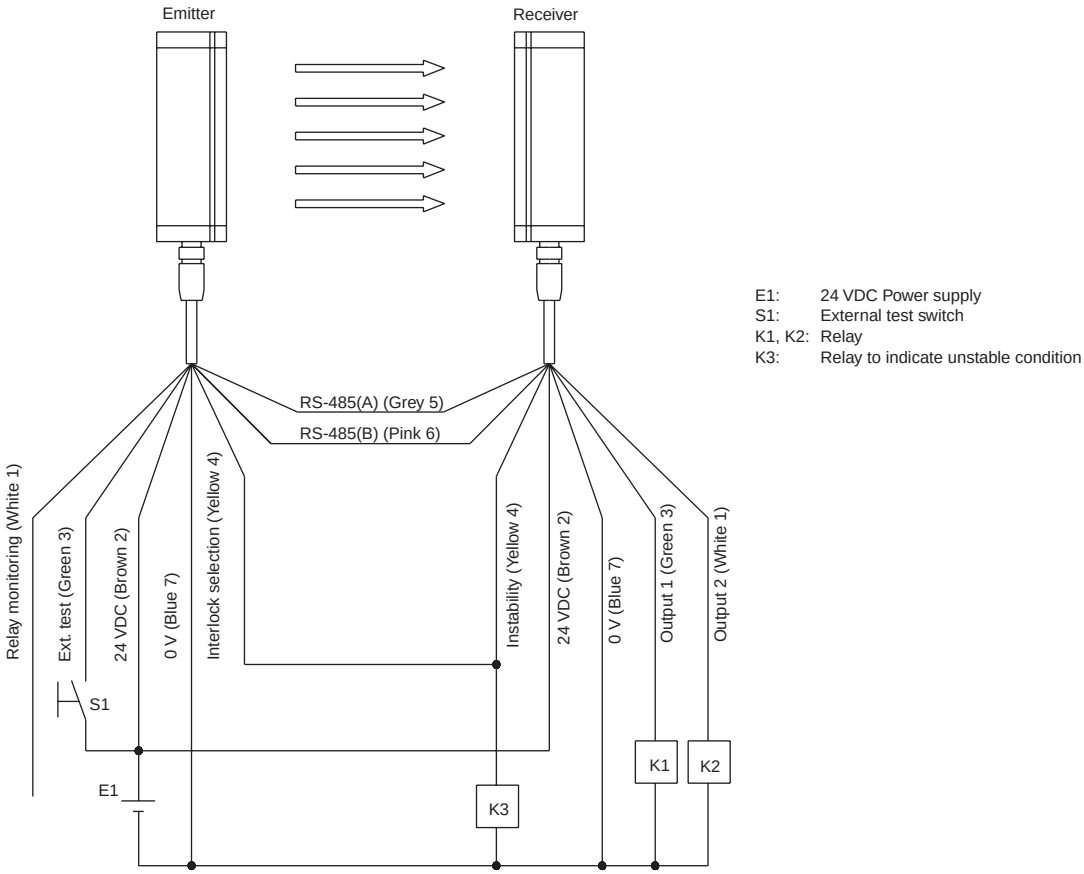
Disconnect all sources of power before wiring the F3S-B to a machine.

- 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).

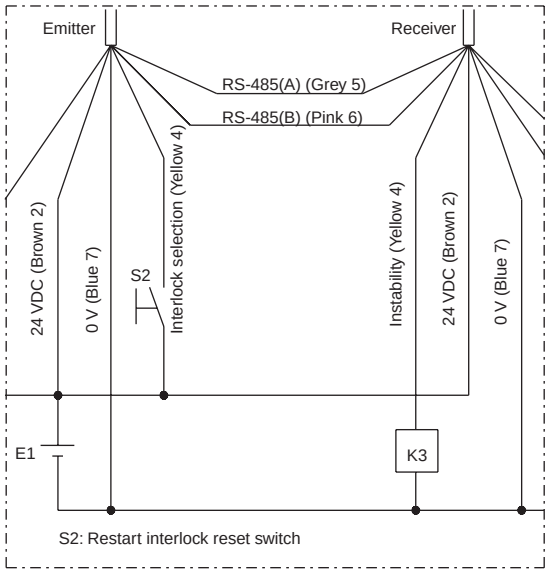
Note: Note:Be sure to wire correctly. Failure to do so may damage the F3S-B.

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

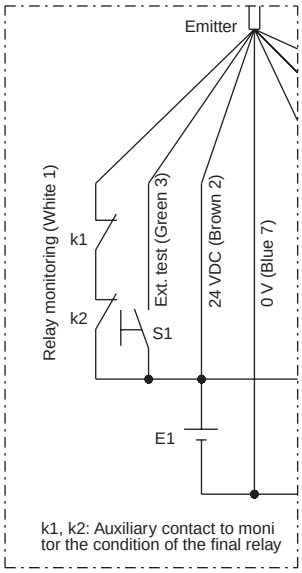
*1. N.C. / reserved: do not connect



When using START/RESTART FUNCTION



When using optional RELAY MONITORING FUNCTION



Details of F39-EU1E Optional Function Kit

1. Installation

1.1 Preparation

⚠WARNING

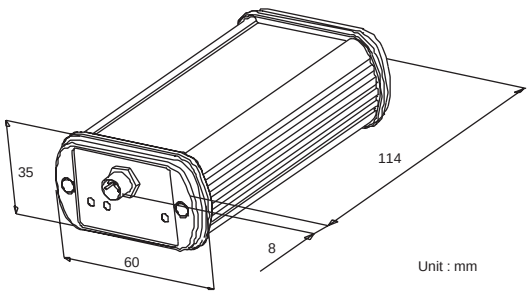
Perform the installation check and the periodical inspection described in the F3S-B manual.

Do not disassemble, repair or modify the F39-E1.

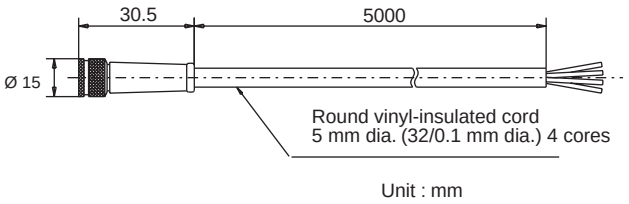
Do not use the F39-E1 in flammable or explosive environments.

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

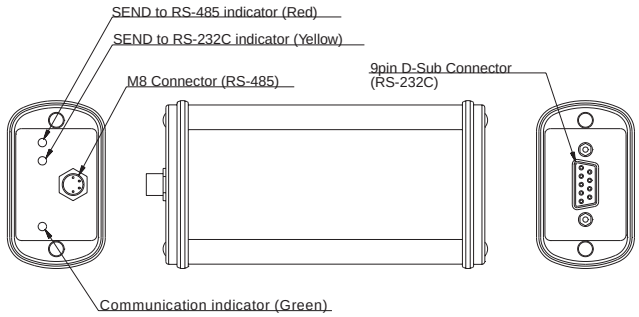


- F39-JB1C Interface cable 5 m cable length, M8 connector (4 pins)



- 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)

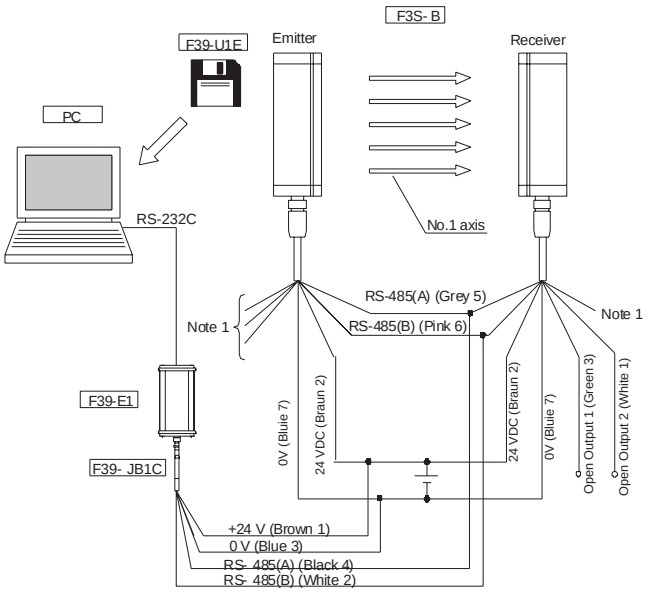
Flashing during communication between the F3S-B and the F39-E1.

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

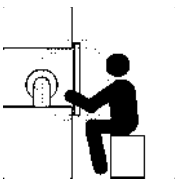
Type	F39-E1 Interface unit
Supply voltage	24 VDC ± 20% (including 5 Vp-p ripple)
Current Consumption	120 mA max.
Interface	RS-232C interface, RS-485 interface
Indicator	See 1-2
Connection method	RS-485: 4pins, M 8 connector
	RS-232C: D-SUB connector, 9 pins
Protection circuit	RS 485 protection against 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

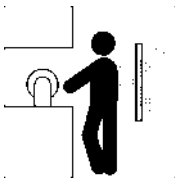


A hazardous part of a machine can be reached only by passing through the sensor detection zone.

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.

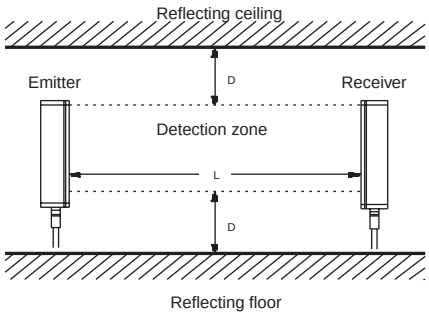


A worker is between the sensor detection zone and a hazardous part of a machine.

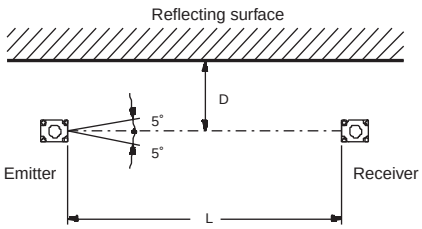
⚠WARNING

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>



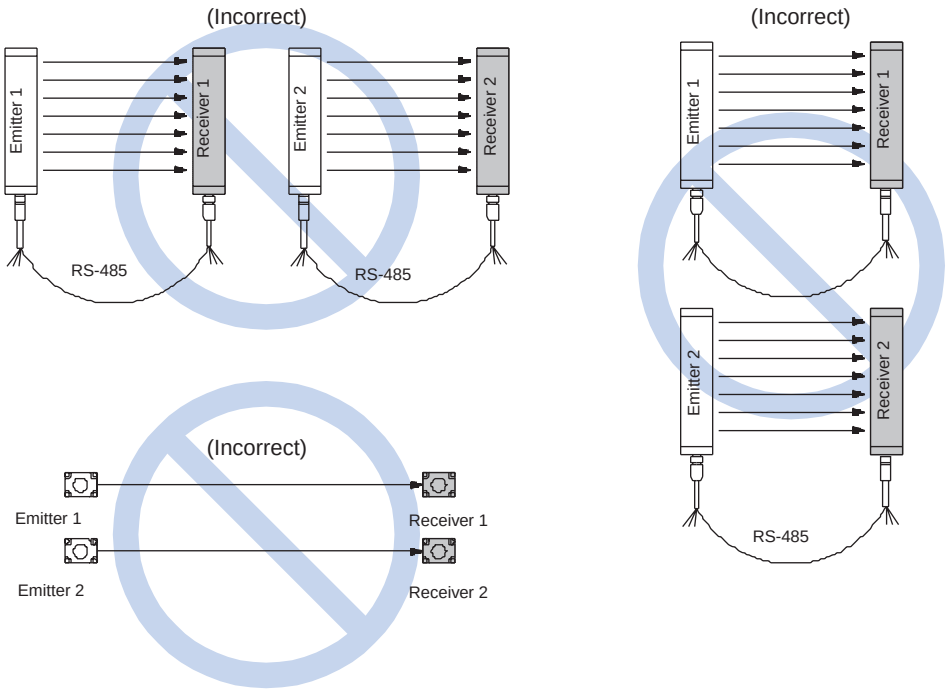
<Top View>



Distance between emitter and receiver (detection distance L)	Minimum installation distance D
0.3 to 3 m	0.27 m
3 to 5 m	L x tan 5° = L x 0.087 (m)

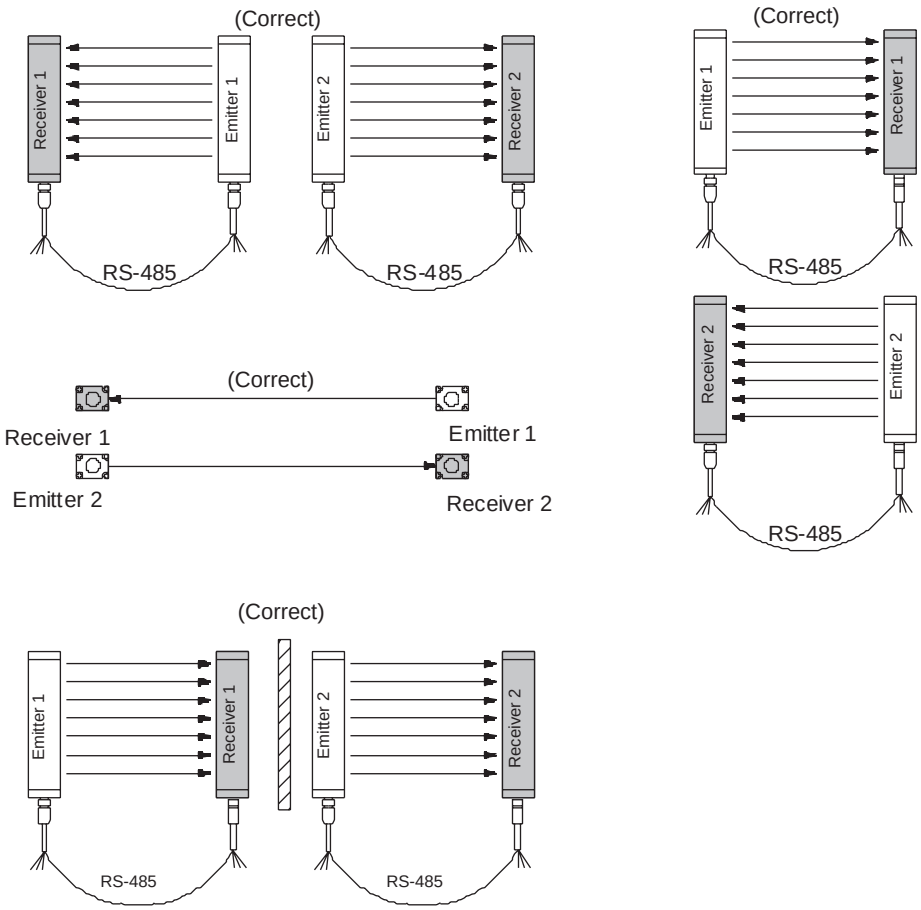
⚠WARNING

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



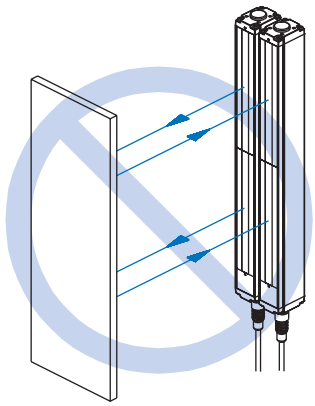
Alternate emitters and receivers

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.



MEMO

Safety Sensor for perimetrical guarding

F3S-TGR-SB

For perimeter guarding

- **Compact dimensions (45 x 35).**
- **Safety category 2 and 4.**
- **No additional controller required.**
- **Automatic/manual reset.**
- **Functions of muting/override/ partial muting integrated.**
- **Safety PNP-outputs.**
- **Easy muting application by using the T/L muting actuator.**
- **TÜV approved**
- **Easy wiring and set up**

List of Models

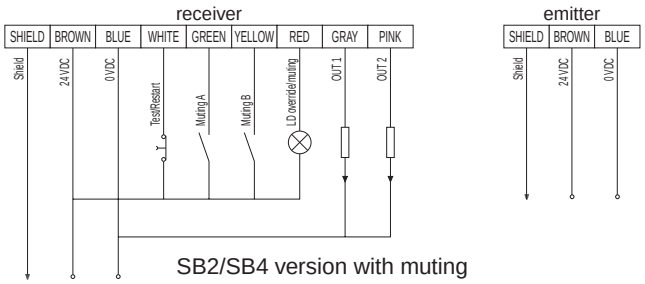
Safety category	Beams	Protective height	Model[*1]
Type 2	2	500 mm	F3S-TGR-SB2-K2-500 (MTL)
	3	800 mm	F3S-TGR-SB2-K3-800 (MTL)
	4	900 mm	F3S-TGR-SB2-K4-900 (MTL)
Type 4	2	500 mm	F3S-TGR-SB4-K2-500 (MTL)
	3	800 mm	F3S-TGR-SB4-K3-800 (MTL)
	4	900 mm	F3S-TGR-SB4-K4-900 (MTL)

*1. Add "MTL" to the model if you need a configuration with L-shape muting actuator F39-TGR-MSB-L

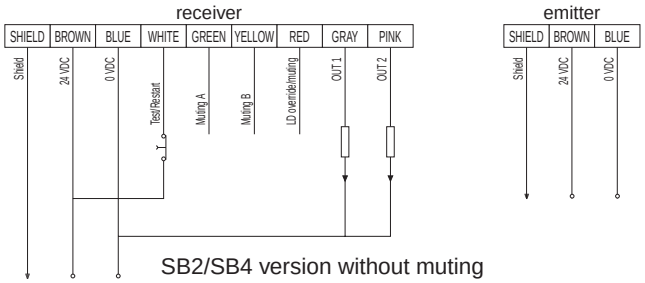
Rating / performance

		F3S-TGR-SB2-K□-□□□ (MTL)	F3S-TGR-SB4-K□-□□□ (MTL)
Power supply voltage		24 VDC ± 20%	
Power consumption		10 W max	
Outputs		PNP	
Max. load		500 mA (overload c.c protection)	
Protection degree		IP65	
Connector	receiver	M12, 8 poles	
	transmitter	M12, 5 poles	
Response time		14 ms max.	
Operating temperature		-10 to +55 °C	
LEDS	receiver	5 LED yellow, 1st optical beam centred yellow, last optical beam centred green, power on green, guard red, break	
	transmitter	2 LED yellow, status OK green, power on	
Case		Aluminium extrusion, painted yellow	
Light source		Infrared 950 nm	
Optical beam pitch		500 mm / 400 mm / 300 mm	
Range		0,5 - 50 m	4 - 50 m
Optical beam		2 SB2-K2-500 3 SB2-K3-800 4 SB2-K4-900	2 SB4-K2-500 3 SB4-K3-800 4 SB4-K4-900

Connections

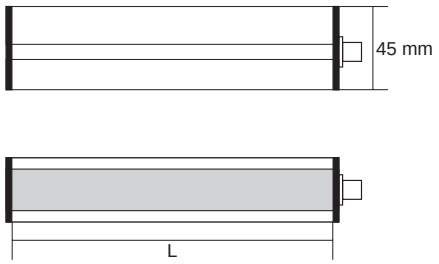


SB2/SB4 version with muting



SB2/SB4 version without muting

Dimensions



Model	Controlled height (mm)	Total height (mm)	Reponse time (ms)
SB2-K2-500 / SB4-K2-500	515	545	14
SB2-K3-800 / SB4-K3-800	810	840	14
SB2-K4-900 / SB4-K4-900	930	960	14

Accessories

Description	Model
Muting lamp	F39-A11
Connection cables (□ = 2, 5 and 10 m)	F39-TGR-SB4-CVLB□E/R*1
Reflection mirror, □□□ = 607.907	F39-MDG□□□
Muting actuator L shape	F39-TGR-MSB-L*2
Muting actuator T shape	F39-TGR-MSB-T
Additional mounting brackets	F39-TGR-ST/SB

*1. Order cables for transmitter (E) and receiver (R) seperatly. 1 cable each is required per safety sensor.
*2. Order a F39-TGR-SB□-K□-□00-MTL Guard for use with the L-muting actuator (F39-TGR-MSB-L), refer to supplemental manual.

Safety Laser Scanner

F3G-C

- Protective field 6 m
- Warning field 7.5 m
- Scanning angle range 3oo degrees
- Type 3 / Category 3
- BIA approval
- Safety relay outputs
- Simple connection and setup

Flexible safeguarding of areas and advanced warning functionality for 300 degree angle.

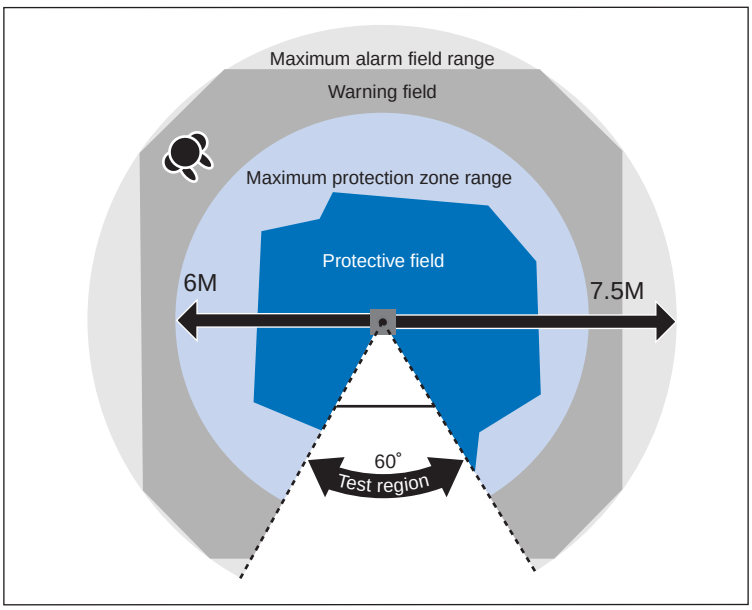
Features

Wider Scan Area

Sensing Range

Long range sensing is provided up to a 6 m radius for the protective field and a 7.5 m radius for the warning field.

The zone dimensions and shape settings are defined by the user with the software provided with the sensor.



Scanning Angle

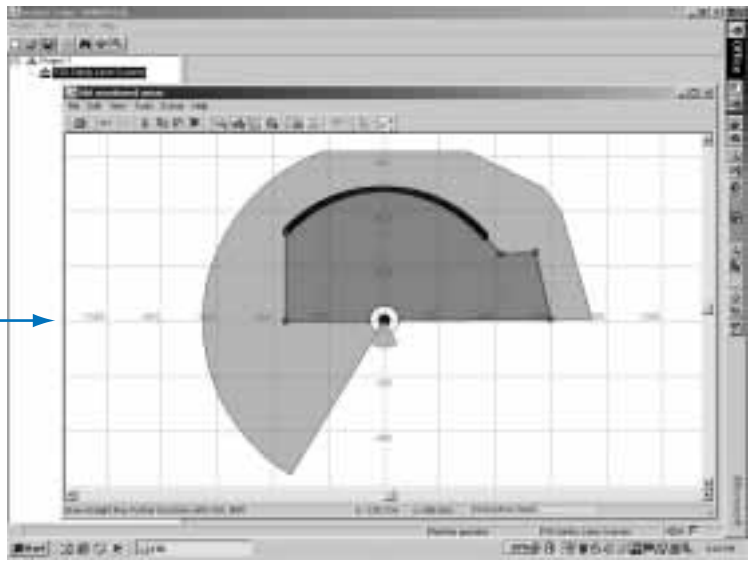
Generally, safety laser scanners have a scanning angle of 180° to 190°, but the F3G-C can sense movement within 300° range.

For example, normally two scanners would be required to monitor two surfaces of a large machine, but only one F3G-C Scanner is required if it is installed at the corner of the machine.

Easy Setup

The protective field and warning field can be easily set up from a personal computer using the CSL Setup Sotware provided with the scanner

Settings can be protected from changes by using a password preventing unintentional changes.



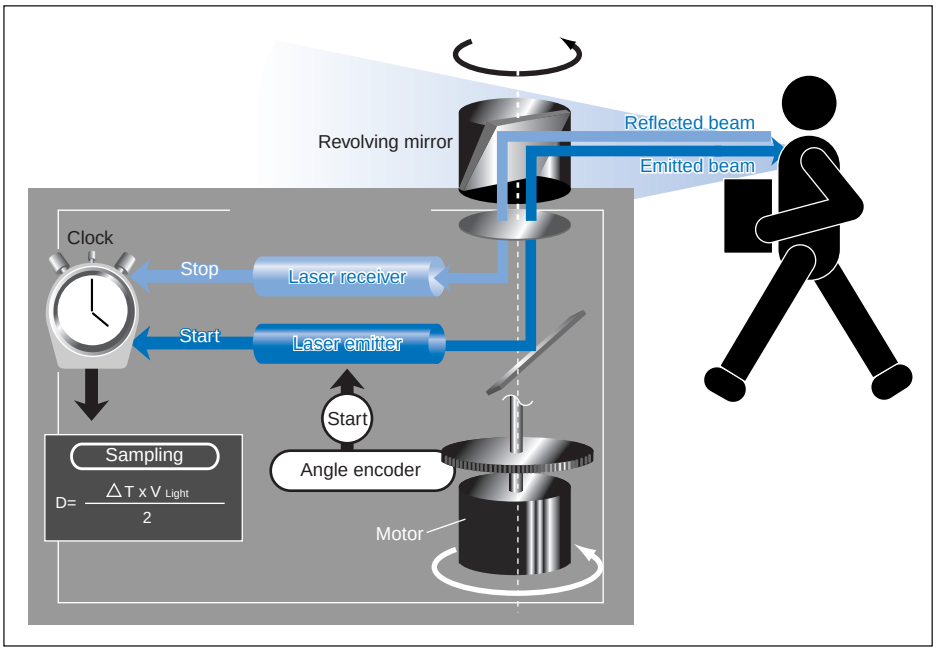
The system requirements for running CSL Setup Software are as follows:
- CPU: Intel Pentium PC, 233 MHz or higher
- RAM: 64 MB or higher
- RS-232C: Serial interface*

* The software may not function properly if a USB/RS-232C Serial Conversion Adapter is used, ask your OMRON representative

- OS: Microsoft Windows 95, 98, NT 4.0, ME, 2000 Professional or XP
- CD-ROM Drive

Principle of Operation

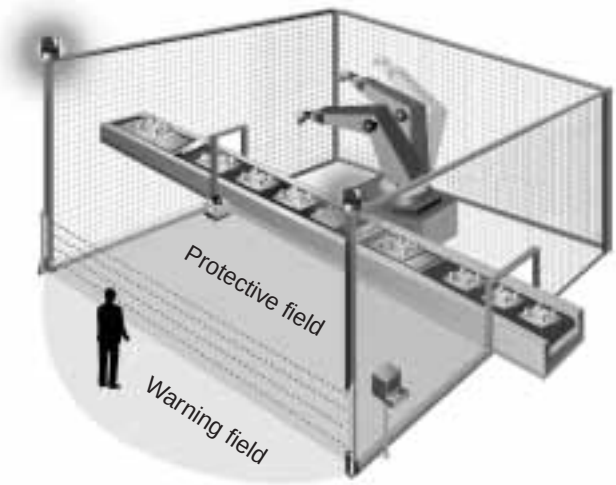
The F3G-C1R70 Safety Laser Scanner emits a pulse laser beam in all directions over a 360° range using a revolving mirror. The laser pulses are reflected of surrounding objects and the sensor receives reflected light through a photodiode. The distance to the object is calculated according to the time from when the laser emits the beam until the sensor receives the light. The direction of the measurement beam ist determined by the angle encoder. Of the total scanning range of 360°, the actual scanning angle is 300° after subtracting 60° due to reflection from the base target.



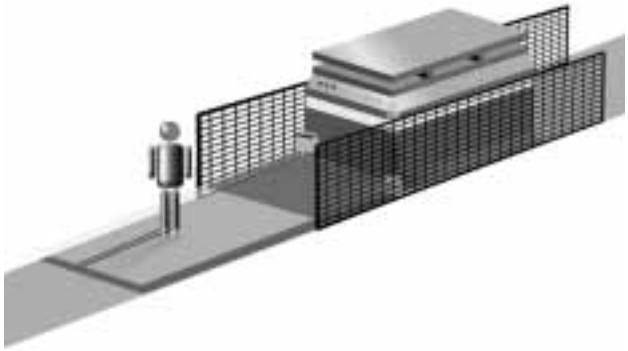
Application

Safety laser scanner guards and protects the hazardous area of a handling robot.

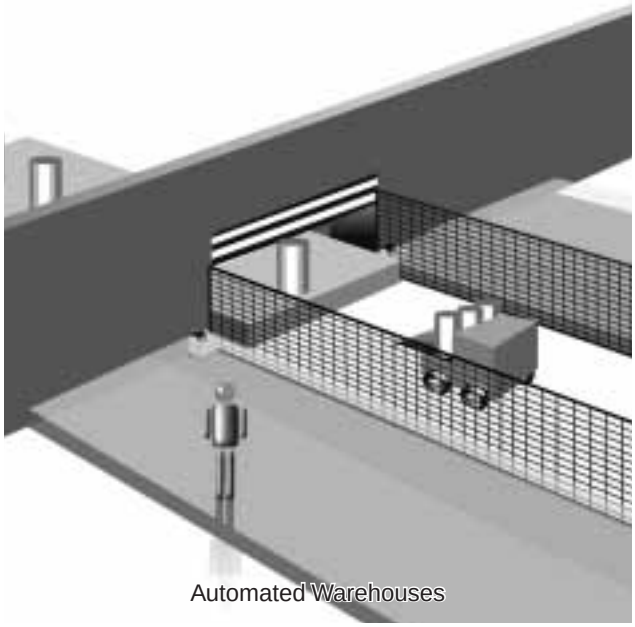
The safety laser scanner monitors the warning and protective field between the robot and the safe area. If a person intrudes the warning field a signal is generated and the person has the possibility to turn without shutting down the machine. If the person is entering the protective field he is to close to the hazard, the machine shut down to a safe status. As soon as the protective field is free , the machine can be restarted safely.



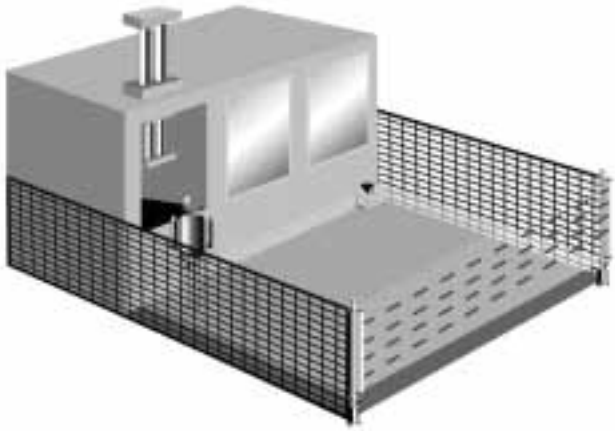
Robots



AGV pathways



Automated Warehouses



Automated machinery

List of Models

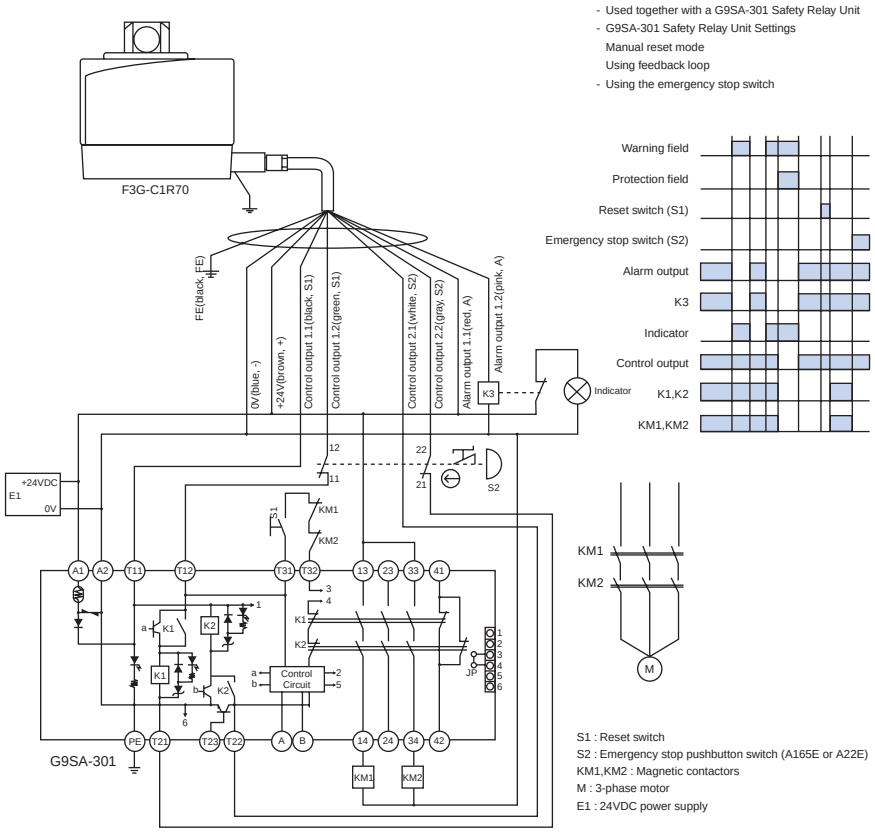
Appearance	Product Name	Model	Remarks
	Safety laser scanner	F3G-C1R70	Includes setup software CD
	Power supply cable	F39-JG5A	One cable required for each sensor
	Communications cable	F39-JG5R	Required for setup only

Ratings and Performance

Item	Model	F3G-C1R70
Safety category		Conforms to Type 3 ESPE EN/IEC 61496-1
Sensing range (includes area of permitted deviation)		Protective field: 0 to 6 m Warning field: 0 to 7.5 m
Scanning angle		300°
Detection capability		Non-transparent, 70 mm in diameter (reflective rate of 1.8% min.)
Response time		280 ms max.
Reactivation time		200 to 5,000 ms (adjustable)
Supply voltage		24 VDC ±25% (ripple: 5 V p-p max, except for voltage drop due to cable extension
Power consumption		24 W
Light source		Infrared laser diode (wavelength: 905 nm)
Laser protection class		Laser class 1 product conforms to following standards: EN 60825-1, IEC 825-1, JIS C 6802, and 21 CFR 1040.10
Control output (output signal switching device)		Relay output: SPST-NO contact x 2 outputs, 30 V, 2 A (cosϕ=1) max. Switch life expectancy: 2,000,000 operations
Warning output (non-safety output)		Relay output: SPST-NO contact, 30 V, 2 A (cosϕ=1) max. Switch life expectancy: 2,000,000 operations
Protection		Control circuit: 3.15 A fuse (medium slow blow) Output: 2 A self resetting fuse
Connection method		Power supply, output 8-pin round connector (manufactured by Binder, 423 Series) Computer connection: 14-pin round connector (manufactured by Binder, 423 Series)
Communication method with computer		RS-232C
Ambient temperature		Operating 0 to 50 °C, Storage -20 to 70 °C
Ambient humidity		Operating/Storage: 5% to 95% (with no condensation)
Vibration resistance (malfunction)		10 to 55 Hz with a 0.7 mm double amplitude, 20 sweeps each in X, Y, and Z directions
Shock resistance		100 m/s², 1,000 times each in X, Y, and Z directions
Degree of protection		IP65 (IEC 60529)
Cable (sold separately)	Power supply, output	0.5 mm², 8-wire, mesh shield; maximum extension length: 20 m; allowable bending radius: 90 mm
	Connection to computer	Maximum extension length: 5 m; allowable bending radius: 112 mm
Materials		Case: Aluminium; Optical surface, display: Glass
Weight		Sensor only: Approximately 3,0 kg; In packaging: Approximately 4.4 kg
Accessories		Instruction manual, CSL Setup Software (CD-ROM), and mounting screws (four M4x10)

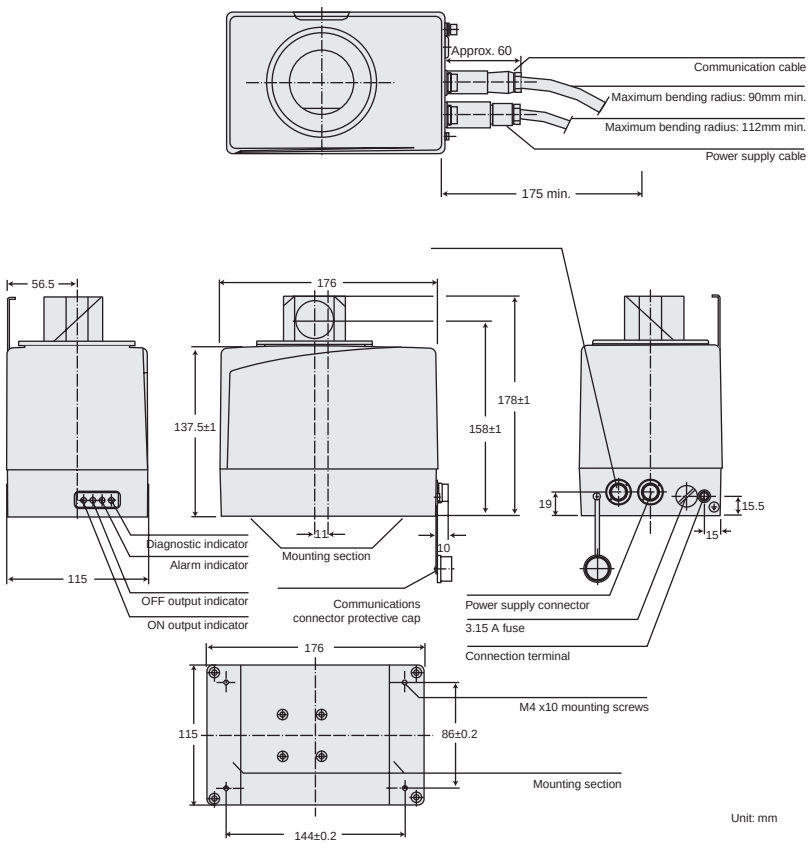
Connection Example (Category 3)

Connection with a G9SA-301 Safety relay Unit



Dimensions

F3G-C1R70



MEMO

Single beam safety sensor for long distance detection

F3SS

60-m long-distance detection. Single beam safety sensor for personnel detection (type 4) is ideal for perimeter protection or multi-sided detection of intrusion into large machines.

Features

- Mutual interference protection function for up to four sets.
- Complies with IEC standards and North American standards (received IEC61496-1, -2, and UL/CSA certification). 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.
- The emitter lens and receiver lens are equipped with heaters for worry-free operation even in environments where condensation is an issue.
- Optional glass and stainless steel mirrors are available.

Ordering Information

Sensors

Infrared ray

Sensor type	Shape	Sensing distance	Minimum detectable object (mm)	Operating mode	Model
Through-beam		0.3 to 60m	31-mm dia.	Light ON	F3SS-AT60P

Note: Emitter: F3SS-AT60P-L, receiver F3SS-AT60P-D Can also be ordered as single units.

Accessories (Order Separately)

Item	Model
Laser alignment kit (for optical axis adjustment)	F39-LLK
Glass mirror	F39-MSG
Stainless steel mirror	F39-MSS
45Ω mirror clamp	F39-LM45
Mirror clamp for wall mounting	F39-LA
Sensor clamp for 42-mm dia. column stand	F39-LSP

Note: Wiring is based on a built-in terminal block. Please purchase a 4-mm to 7-mm (dia.) cable separately.

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 D-92)	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 D-106)	G9SB series

Rating/performance

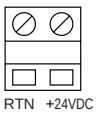
Item	Model	F3SS-AT60P
Sensing distance		0.3 to 60 m
Number of optical axes		1 (single beam)
Beam diameter		31 mm
Min. sensing object		Opaque object, 31-mm dia. or greater
Orientation angle		emitter/receiver: ±2.5° or less each (based on IEC61496-2 at detection distance of 3 m or greater)
Light source (wave length)		Infrared LED (880 nm)
Power supply voltage		24 V DC ±10%, ripple (p-p) 5% or less
After power is turned on Startup time		4 s or less
Current consumption		Emitter: 170 mA or less, receiver: 800 mA or less (including load output current)
Operating mode		Auto start mode, start interlock mode, and start/restart interlock mode can all be selected using a switch in the receiver.
Control output		PNP transistor outputs x 2 outputs, load current 250 mA or less (residual voltage 1 V or less) (excluding voltage drop due to cable extension), Light ON
Protective circuits		Output load short circuit and power supply reverse connection protection
Response time (ON→OFF)		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		Malfunction/durability: 100 m/s2, 1,000 times each in X, Y, and Z directions
Protective structure		IEC60529 Standard IP65
Connection method		Connect to terminal block on internal board
Weight (Packed state)		2.5 kg
Materi-al	Case	Aluminum
	Cap	Aluminum
Accessories		Set of mounting brackets, operation manual, caps for unused conduits
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)

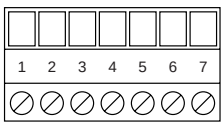
Wiring

Wire the F3SS only after all power has been turned off.

Emitter

Terminal block number	Terminal name	Functions	Terminal block assignments
J3	+24 VDC	+DC24V	 RTN +24VDC
	RTN	0V (GND)	

Receiver

Terminal block number	Terminal name	Functions	Terminal block assignments
J5	1	Control out-put 1 (+)	 1 2 3 4 5 6 7
	2	For control out-put 1/2 COM (-)	
	3	Control output 2 (+)	
	4	START(-)	
	5	START(+)	
	6	+DC24V	
	7	0V (GND)	

Note: Ground the emitter and receiver to the ground terminal inside the case.

MEMO

Safety Photoelectric Switch

E3FS

Safety design for category 2. Suitable for detecting human bodies in hazardous area.

Main features

- The E3FS is a Type 2 Safety Single Beam intended to be used with the control unit F3SP-U1P-TGR, F3SP-U3P-TGR and F3SP-U5P-TGR for the control system of a machine to category 2, 1 or B as defined in the European standard EN 954-1.
- Compliance with Machinery directive: No. 98/37/EC, EMC Directive: No. 89/336/EEC, EN 61496-1 and IEC61496-2 .
- Approved by TÜV Product Service (Notified Body) as Type 2 ESPE, Type 2 AOPD and CE marking.
- Pursuing safety with high level of safety design and FMEA.
- System configuration of up to four units is possible.
- With the control unit F3SP-U1P-TGR and F3SP-U5P-TGR two different muting functions can be selected for each set of E3FS separately.
- Compact and space-saving (M18 DIN-sized threaded cylindrical housing, axial type)
- Housing materials: plastic and nickel brass
- Connection: Pre-wired and M12 plug
- High enclosure ratings (IP67)
- Sensing distance 10m

Selection guide

DC-Switching Models

		Plastic		Nickel Brass (-M)	
		Cable Type	Plug Type	Cable Type	Plug Type
Method of detection		Single beam	Single beam	Single beam	Single beam
Rated sensing distance		10m	10m	10m	10m
Light-ON/Dark-ON (selectable)	PNP	E3FS-10B4	E3FS-10B4-P1	E3FS-10B4-M	E3FS-10B4-M1-M

Accessories (Order Separately)

Name		Model
Mounting bracket		Y92E-B18
Muting control unit	4 sensors	F3SP-U1P-TGR, F3SP-U5P-TGR
	2 sensors	F3SP-U3P-TGR

For detailed information about the mounting bracket, refer to the main chapter “Accessories” at the end of the document.
For detailed information about the muting control unit, refer to pages D-70, D-74 and D-76.

Connectors (Order Separately)

Cord	Appearance		Cord length	Model
Standard	Straight (4 conductor)		2 m	XS2F-D421-D80-A
			5 m	XS2F-D421-G80-A
	L-shape (4 conductor)		2 m	XS2F-D422-D80-A
			5 m	XS2F-D422-G80-A

Ordering Information: type list

DC-Switching Models, plastic

Pos.	Code	Sensing method, sensing distance	Connection (cable-length)	Output/ Input config.	Enclo-sure ratings	Comments
1	E3FS-10B4 2M	Through beam, 10 m	Pre-wired (2 m)*	PNP	IP67	Receiver and Emitter
2	E3FS-10B4-P1	Through beam, 10 m	Connector	PNP	IP67	Receiver and Emitter

* Other cable lengths available by special order

DC-Switching Models, metal

Pos.	Code	Sensing method, sensing range	Connection (cable-length)	Output/ Input config.	Enclo-sure ratings	Comments
1	E3FS-10B4-M 2M	Through beam, 10 m	Pre-wired (2 m)*	PNP	IP67	Receiver and Emitter
2	E3FS-10B4-M1-M	Through beam, 10 m	Connector	PNP	IP67	Receiver and Emitter

* Other cable lengths available by special order

Remarks to enclosure ratings:

The enclosure ratings IP67 of OMRON internal standard correspond to a higher test requirements than the official standard IEC 60 529 :

- The sensors rated IP67 have special enclosure protection. In this case, the sensors have passed the OMRON-internal heat shock test before the IP67-test of IEC 60 529 (1m water height for 1 hour). Afterwards the sensors have been tested according to the OMRON-internal water-proof-test.

Heat shock:

Alternating, fast temperature changes between –25°C and +55°C are executed for 5 cycles and 1 hour for each temperature. Functioning and isolation is checked afterwards.

Water proof:

After the heat shock test, the sensors are exposed alternating under water of +2°C and +55°C executing 20 cycles and 1 hour for each temperature. Functioning, water tightness and electrical isolation is checked afterwards.

Specification of the E3FS types

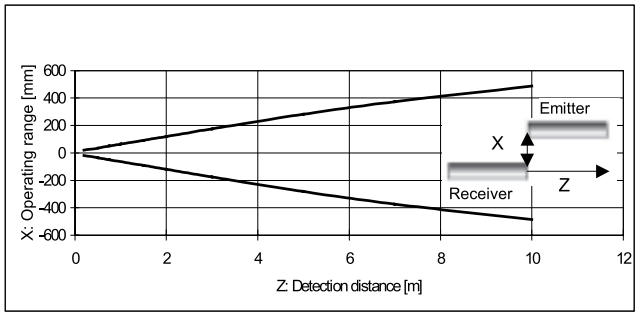
DC Switching Models

Item		Emitter E3FS-10LB...	Receiver E3FS-10DB4...
Method of detection		Single beam	
Power supply voltage		12 to 24V DC +/- 10% (ripple (p-p) 10%)	
Current consumption (max.)		50 mA	25 mA
Rated sensing distance		10 m (Function reserve: +20%)	
Standard object		Opaque 11 mm min.	
Operation angle		+/- 5° (at 3 m)	
Response time		2.0 ms	
Control output		Transistor output PNP 100 mA max residual voltage: 2 V max at 100 mA	
Test input (Emitter)	E3FS-10B___ (PNP)	Vcc to Vcc-2,5 V : Emitting OFF (Sink current: 3 mA max.) Open or 0 to 2,5 V: Emitting ON (Leakage current: 0,1 mA max.)	
Mode selection input (Receiver)		Connection to Vcc: Light ON (ON when incident) Connection to 0 V: Dark ON (ON when interrupt)	
Power reset time		100 ms	
Ambient illumination		Incandescent lamp: 3000 lx max. Sunlight: 10000 lx max.	
Ambient temperature [9]		Operating: -25 to 55°C; Storage: -30 to 70°C	
Ambient humidity		Operating: 35% to 95%; Storage: 35% to 95%	
Insulation resistance		20 MΩ min. at 500 V DC between current carrying parts and case	
Dielectric strength		1000 V AC, 50/60 Hz for 1 min between current carrying parts and case	
Vibration resistance	Durability	10 to 55 Hz, 1.5 mm double amplitude, each X, Y, Z direction 2 hours	
	Operation limit	10 to 55 Hz, 0,7 mm double amplitude, each X, Y, Z direction 50 min	
Shock resistance	Durability	500 m/s² (approx. 50 g) each X, Y, Z directions for 3 times	
	Operation limit	100 m/s² (approx. 10 g) each X, Y, Z directions for 1,000 times	
Enclosure ratings		IP67	
Light source		Infrared	
Indicators		Emitter: Orange / Light emission Receiver: Green / ON-state, Red / OFF-state	
Sensitivity adjustment		Fixed	
Connection method		2 m pre-wired cable or connector	
Operation mode		Light-ON or Dark-ON selectable by wiring	
Weight for set Plastic case Metal case		Pre-wired cable models: Approx. 150 g Approx. 205 g	Connector models: Approx. 55 g Approx. 125 g
Circuit protection		Output short-circuit and power supply reverse polarity	
Housing materials		Plastic, Nickel brass	

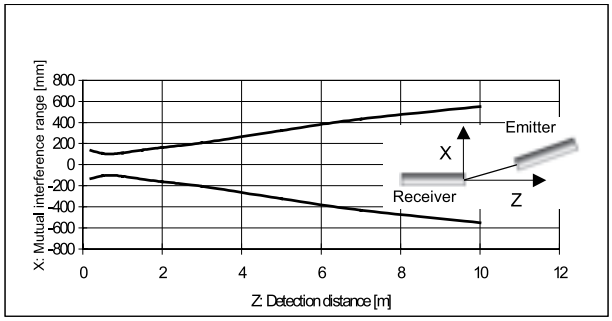
Engineering Data – Sensing Range

Through-beam type (E3FS-10B4-)

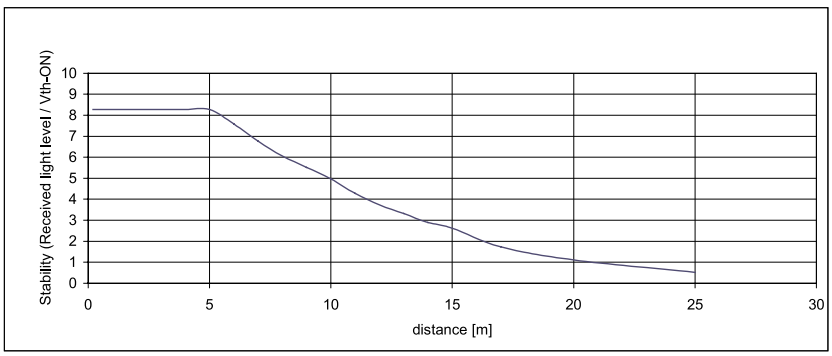
Sensing range



Mutual interference range

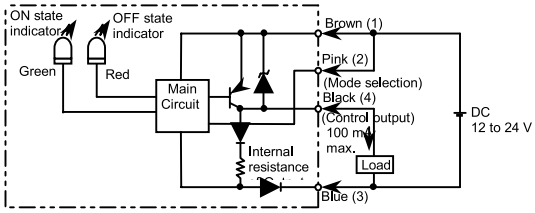
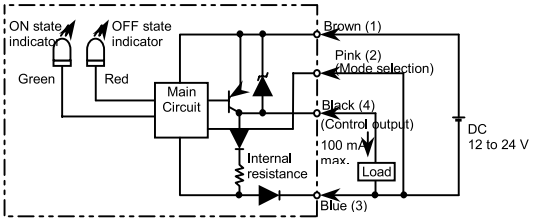
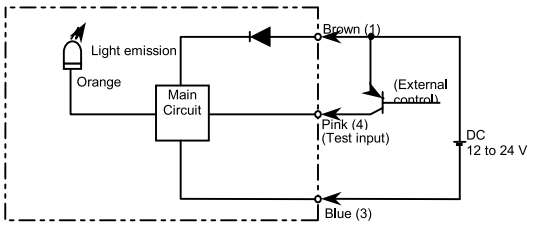


Excess gain ratio



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 (Light-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

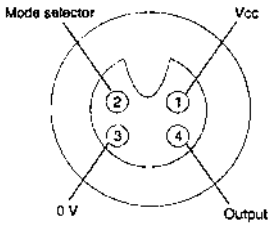
Receiver connection	Connect Pink (2) to Brown(1)	Connect Pink (2) to Blue (3)
Mode of output	ON when Incident (Light ON)	ON when interrupted (Dark ON)
Light Incident Light interrupted		
Indicator Green Red		
Control output ON OFF		
Load (Relay) ON OFF		

Emitting timing chart

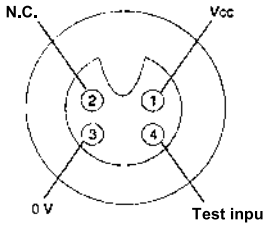
	Timing chart
Test input ON OFF	
Light emission ON OFF	
Indicator ON OFF	

Terminals/Connections

Receiver



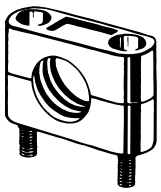
Emitter

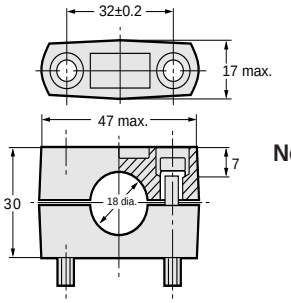


Accessories (order separately)

Mounting tools

Y92E-B18 Mounting Bracket





Note: Hexagonal bolt: M5 x 32 mm
Material: plastic

Dimensions

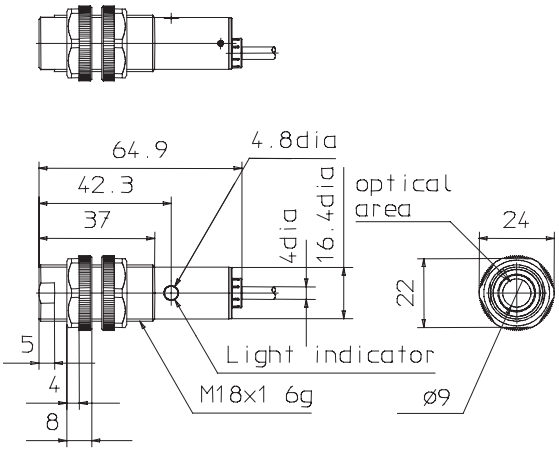
Note: All units are in millimeters unless otherwise indicated

Plastic housing

Cable type:

E3FS-10LB

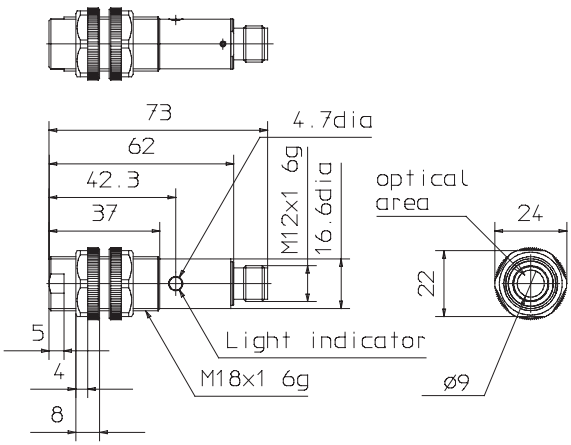
E3FS-10DB4



Connector type:

E3FS-10LB-P1

E3FS-10DB4-P1

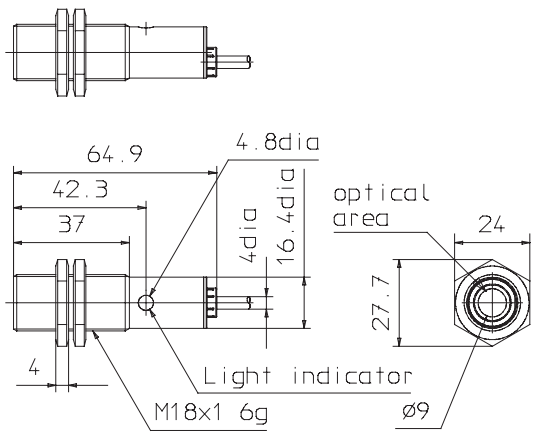


Metallic housing

Cable type:

E3FS-10LB-M

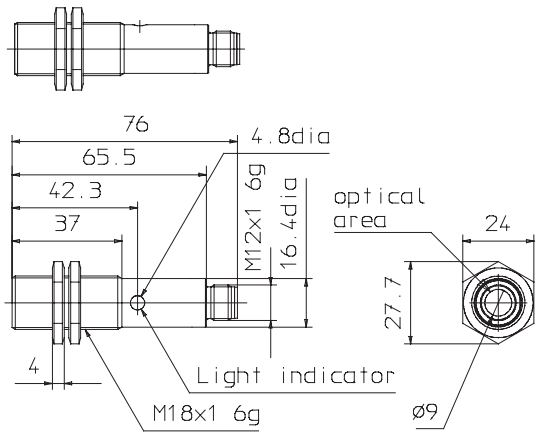
E3FS-10DB4-M



Connector type:

E3FS-10LB-M1-M

E3FS-10DB4-M1-M



Precautions

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Indicates prohibited actions.

WARNING

When the E3FS is used without a safety control unit, do not use the E3FS as a safety device nor a part of safety systems for ensuring safety of persons.

When the E3FS is used without a safety control unit like the F3SP-U1/3/5P-TGR, it is in accordance with the requirements of the safety related control system to category B as defined in the European standard EN954-1.

The E3FS is in accordance with the requirements of the safety related control system to category 2 only when it is connected with a specified control unit.

E3FS-10B (PNP):
Type F3SP-U1/3/5P-TGR safety control unit must be used.
The F3SP-U1/3/5P-TGR executes a periodic test every 27 ms.

WARNING

Make sure that personnel operating the E3FS are knowledgeable about the machine on which it is installed.
Read this manual and the control unit manual completely.
Be sure the information provided is understood before attempting to operate the E3FS.
Multiple E3FSs must be sufficiently far from each other to avoid mutual interference.
Regarding the calculation of the safety distance, obey the control unit manual and related standards, e.g. EN999, EN61496-1 when the E3FS is used as a safety device.
Regarding the avoidance of malfunction caused by shiny surface, obey the control unit manual when the E3FS is used as a safety device.
Use an opaque test piece with 11 mm in diameter and 200 mm or greater in effective length to check the detection capability.
Do not connect the E3FS to an AC or DC power supply with higher voltage than nominal 24 VDC. Otherwise the sensor may explode, burn, or cause electric shock.
The power supply must conform to regulatory requirements and standards, regarding EMC and electrical equipment safety, of the country where the E3FS is installed. For example, the power supply must fulfil EN60742 requirements for double insulation and must conform to EMC Directive and Low Voltage Directive in EU.

NOTICE

A load must not be shorted.
A load must not be used with current higher than the rating.
Do not apply the reversed supplied voltage.
Be sure to route the E3FS cable separated from high-potential power line or through an exclusive conduit.
E3FS must not be used in water.
The E3FS is ready to operate 100ms after the E3FS is turned ON. If the load and E3FS are connected to independent power supplies respectively, be sure to turn ON the sensor before turning the load ON.
To extend the cable, use a wire of 0.3mm^2 or more. However do not extend it more than 50m.
Do not use the E3FS in explosive or flammable gas.
Do not disassemble, repair, and modify the E3FS.
Do not exceed a torque of 2.0N·m (20Kgf·cm) when tightening mounting nuts for plastic models
20.0N·m (200Kgf·cm) when tightening mounting nuts for metal models.
For connector type of E3FS, make sure the cable connector is rated IP54 or higher.
Be sure to connect or disconnect the connector after turning OFF the E3FS.
Hold the connector cover to connect or disconnect the connector.
Secure the connector cover by hand. Do not use any pliers.
The proper tightening torque range should be checked according to connector specification. Be sure to tighten the connector securely.

Muting Controller for Safety Single Beam

F3SP-U1P

Muting controller for one, two, three or four Safety Single Beam.

- **High functionality (two independent muting functions, override function, automatic and manual reset).**
- **Category 2.**
- **Muting lamp included.**
- **Double output safety relay.**
- **7 segment display for status of the control unit and trouble shooting.**
- **Easy to install.**

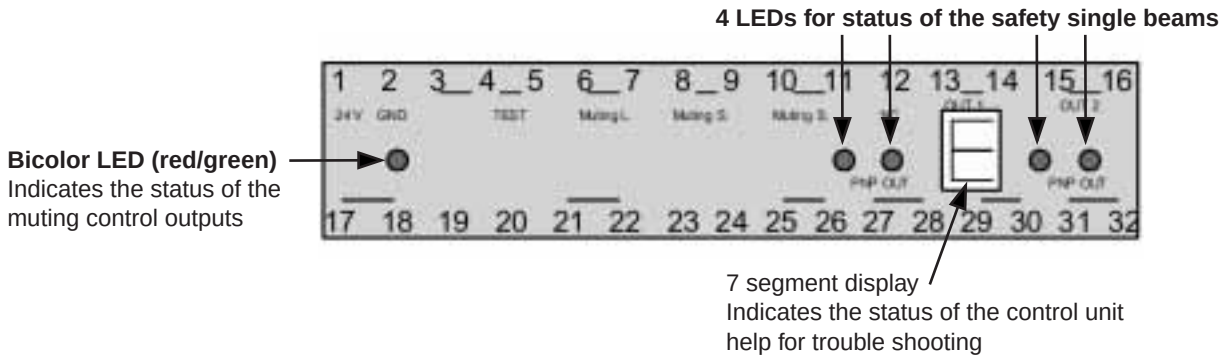
List of Models

Description	Model
Muting Controller for Safety Single Beam E3FS	F3SP-U1P-TGR

Rating / performance

	F3SP-U1P-TGR
Power supply voltage	24 VDC ±10%
Power consumption	8 W max. (incl. muting lamp, excl. E3FS)
Output contacts	2 NO 3,15 A (protected by fuses)
Indicators	7 segment display for status of the control unit and trouble shooting, 4 LEDs for status of the single beams, one bicolor LED for the status of the control output.
Enclosure rating	IP20
Terminal	32 screw terminals (2,5 mm²)
Response time	≤ 30 ms
Ambient temperature	Operating: -10 °C + 55 °C
Housing material	Polycarbonate (UL V-0)
Weight	0,6 kg

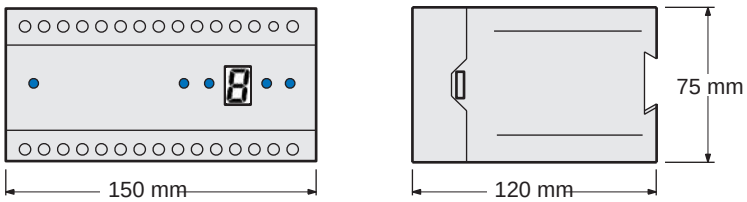
Description Front Panel



Function

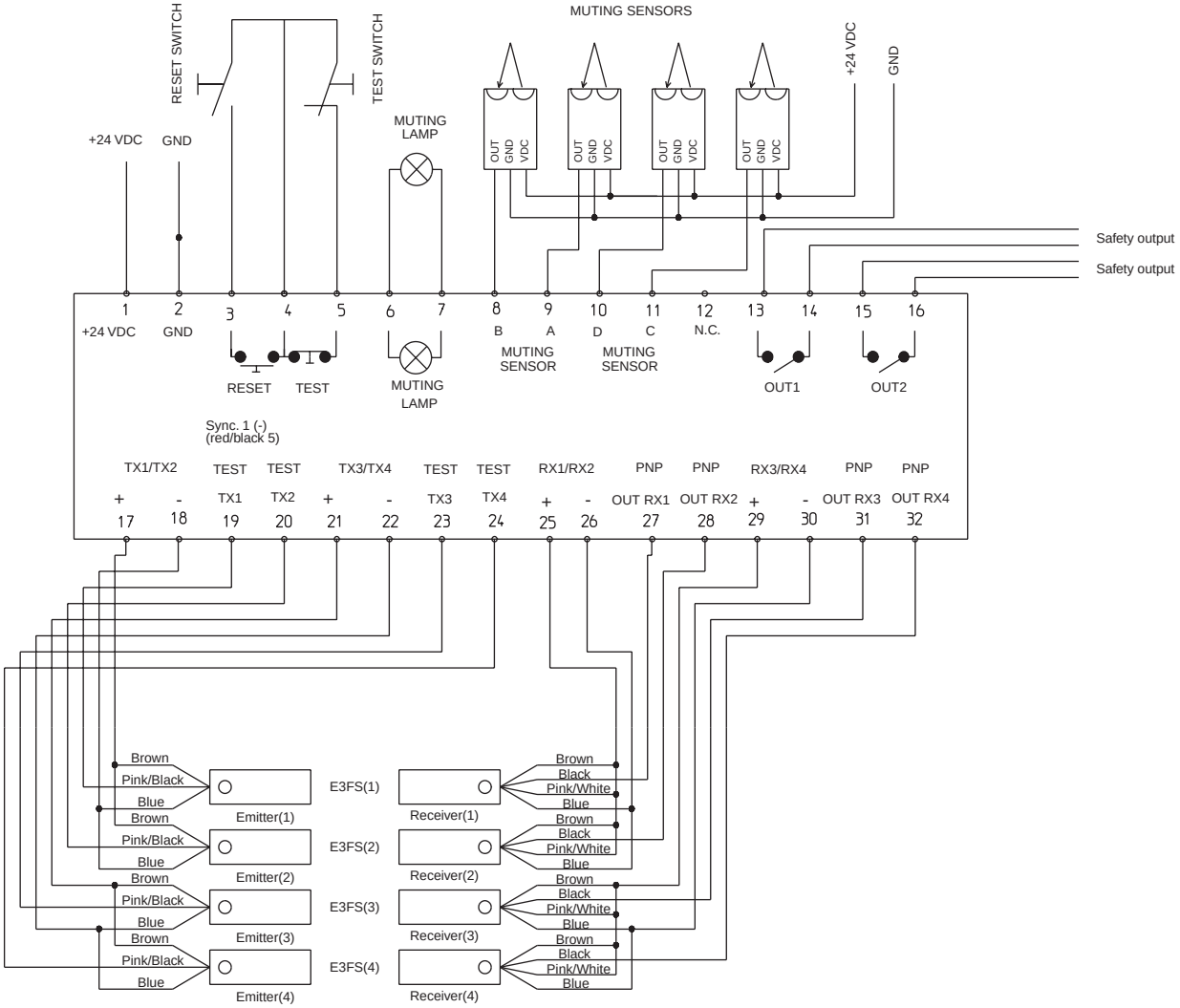
To use the E3FS as a safety device category 2 the single beam need to be connected to the control unit F3SP-U1P-TGR. F3SP-U1P-TGR performs periodic tests every 27 ms. It will manage the operation of up to four sets of E3FS to produce an intelligent, adaptable and safety protective circuit with an optical resolution as the application requires. It can be used to mute all or some of the safety device light beams for a controlled period of time.

Dimensions



Connections

with four safety single beam E3FS



Note: Before connecting this unit please read carefully precautions in the instruction manual.

MEMO

Muting Controller for Safety Single Beam

F3SP-U3P-TGR

Muting controller for one or two Safety Single Beam.

- **High functionality (two independent muting functions, override function, automatic and manual reset).**
- **Category 2.**
- **Only 22,2 mm width**
- **Double output safety relay.**
- **6 LED for status and diagnostics.**
- **Detachable terminals for easy installation.**
- **Controlls 1 or 2 safety sensors.**
- **TÜV approved.**

List of Models

Controller

Description	Model
 Muting Controller for Safety Single Beam E3FS	F3SP-U3P-TGR

Accessories

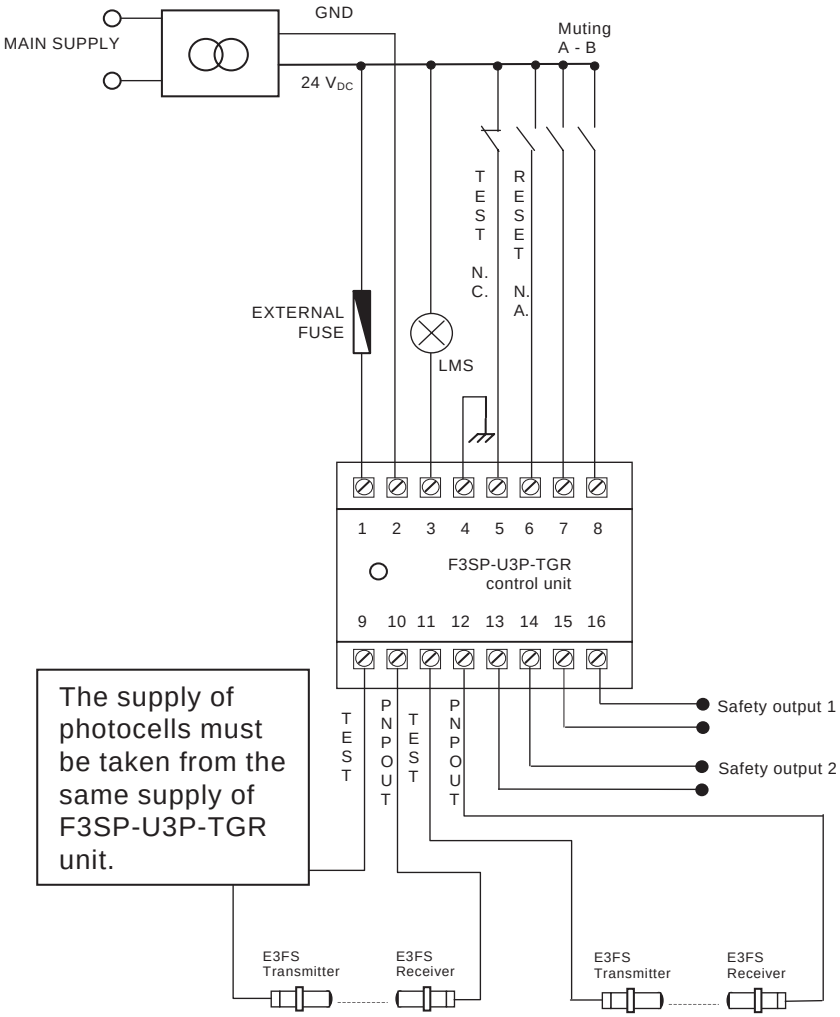
Description	Model
 Muting lamp	F39-A11

Rating / performance

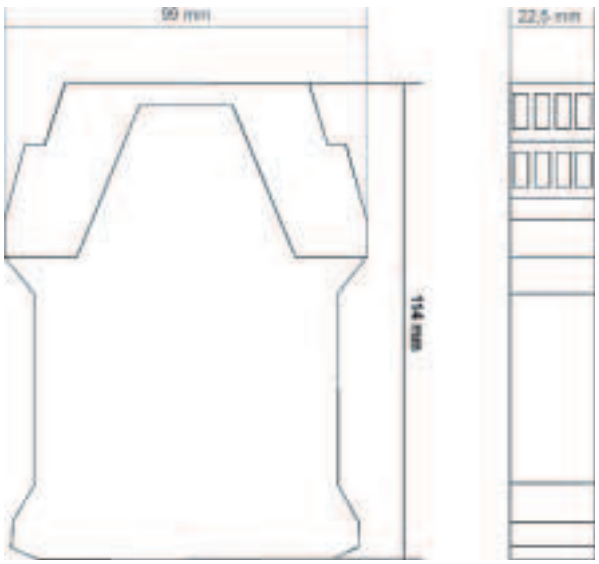
	F3SP-U3P-TGR
Power supply voltage	24 VDC ±10%
Power consumption	420 mA max.
Output contacts	2 NO 2.5 A (protected by fuse), 115 V AC max.
Indicators	6 LED for status and diagnostics
Enclosure rating	IP20
Terminal	16 screw terminals, detachable blocks with '4' screws each
Response time	≤ 30 ms
Ambient temperature	Operating: -10 °C + 55 °C
Housing material	Plastic, DIN rail mounting
Weight	0,3 kg

Wiring Example

Connection of 2 safety PES to the control unit.



Dimensions



Muting Controller for Safety Single Beam

F3SP-U5P-TGR

Muting controller for one, two, three or four Safety Single Beam.

- **High functionality (two independent muting functions, override function, automatic and manual reset).**
- **Category 2.**
- **Only 45 mm width**
- **Double output safety relay.**
- **6 LED for status and diagnostics.**
- **Detachable terminals for easy installation.**
- **Controlls 1, 2, 3 or 4 E3FS sensors**
- **TÜV approved**

List of Models

Controller

Description	Model
 Muting Controller for Safety Single Beam E3FS	F3SP-U5P-TGR

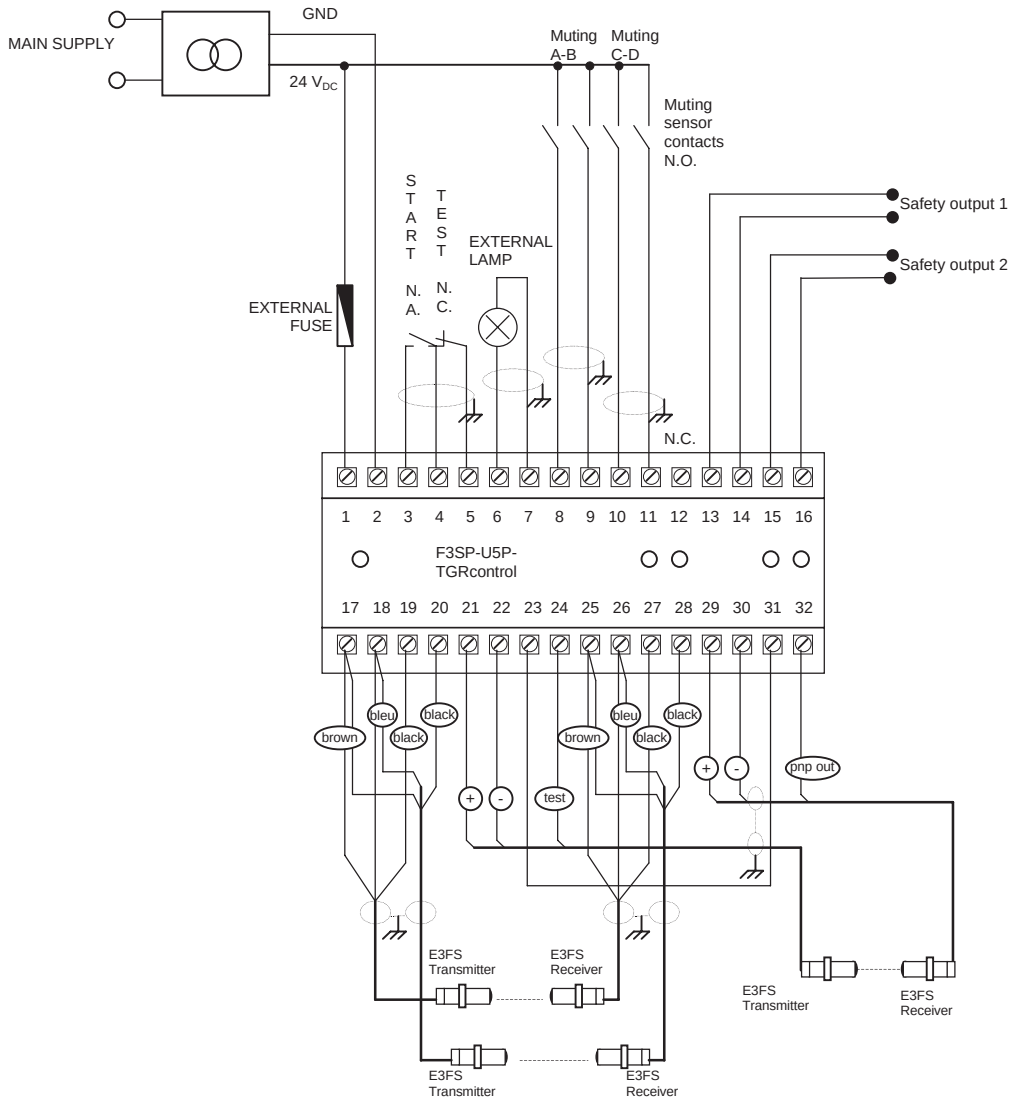
Accessories

Description	Model
 Muting lamp	F39-A11

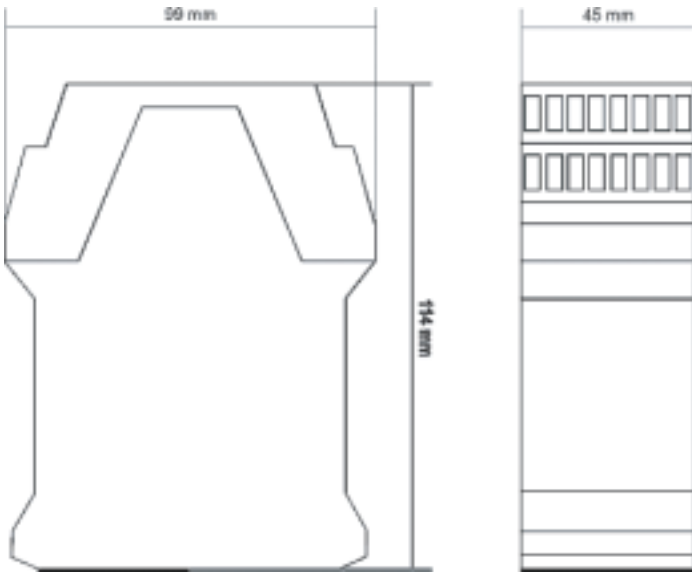
Rating / performance

	F3SP-U5P-TGR
Power supply voltage	24 V DC ±10%
Power consumption	420 mA max.
Output contacts	2 NO 2.5 A (protected by fuse), 250 V AC max.
Indicators	6 LED 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	0,3 kg

Wiring Example



Dimensions



Muting Controller for Safety Light Curtain

F3SP-U2P

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.**
- **Muting lamp included.**
- **Double output safety relay.**
- **7 segment display for status of the control unit and trouble shooting.**
- **Easy to install.**

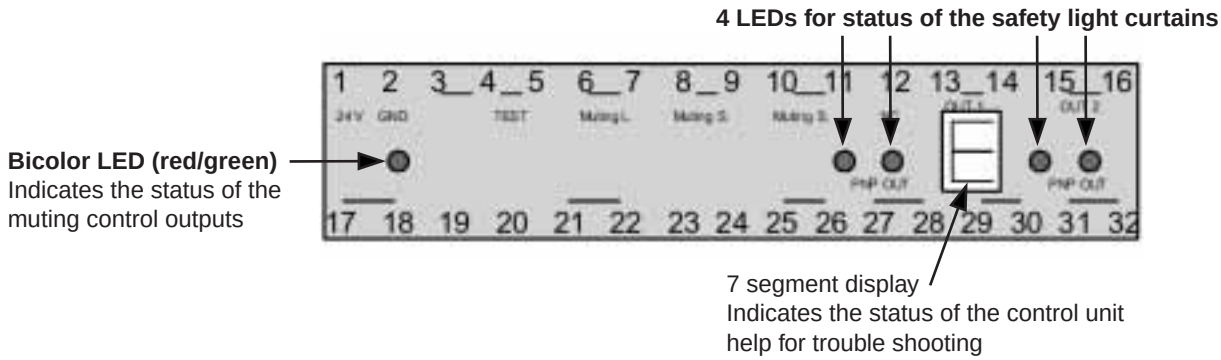
List of Models

Description	Model
Muting Controller for Safety Light Curtain F3S-B, F3SN and F3SH	F3SP-U2P-TGR

Rating / performance

	F3SP-U2P-TGR
Power supply voltage	24 VDC ±10%
Power consumption	8 W max. (incl. muting lamp, excl. safety light curtains)
Output contacts	2 NO 3,15 A (protected by fuses)
Indicators	7 segment display for status of the control unit and trouble shooting, 4 LEDs for status of the single beams, one bicolor LED for the status of the control output.
Enclosure rating	IP20
Terminal	32 screw terminals (2,5 mm²)
Response time	≤ 18 ms
Ambient temperature	Operating: -10 °C + 55 °C
Housing material	Polycarbonate (UL V-0)
Weight	0,6 kg

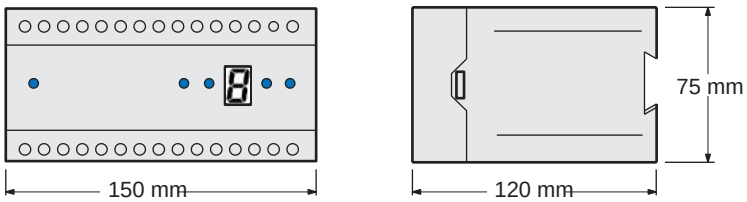
Description Front Panel



Function

The muting control unit F3SP-U2P-TGR complies with all category 4 safety requirements, conforming to IEC 61496-1. It can be connected to one or two OMRON safety light curtains F3SN-A and F3SH-A (type 4) or F3S-B (type 2) to realise the muting function. This function enables a product passing the safety light curtain to enter into or exit from a hazardous zone. But prevents a person to enter into this zone. In addition this control unit offers the double muting function with two independent safety light curtains. This enables a product to enter and to exit a hazardous area. An override function can be used to force the system, if an object need to be removed, which has gathered in front of the safety light curtain.

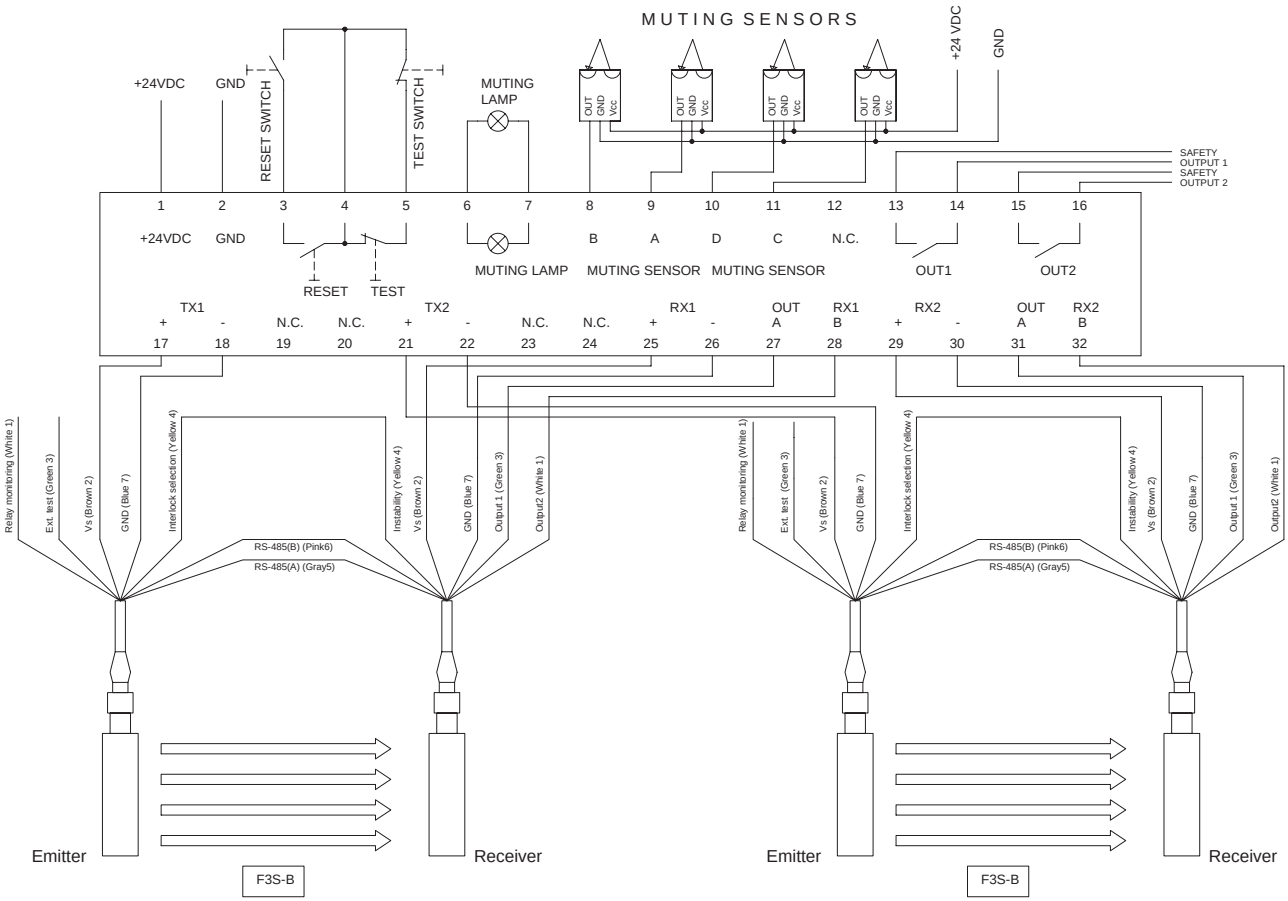
Dimensions



Connections

F3S-B and F3SP-U2P-TGR

Wiring diagram with 2 F3S-B



Note:
For use with 1 F3S-B safety light curtain connect terminal 29 to 31 and 32

Connections

F3SN-A and F3SP-U2P-TGR, Muting application

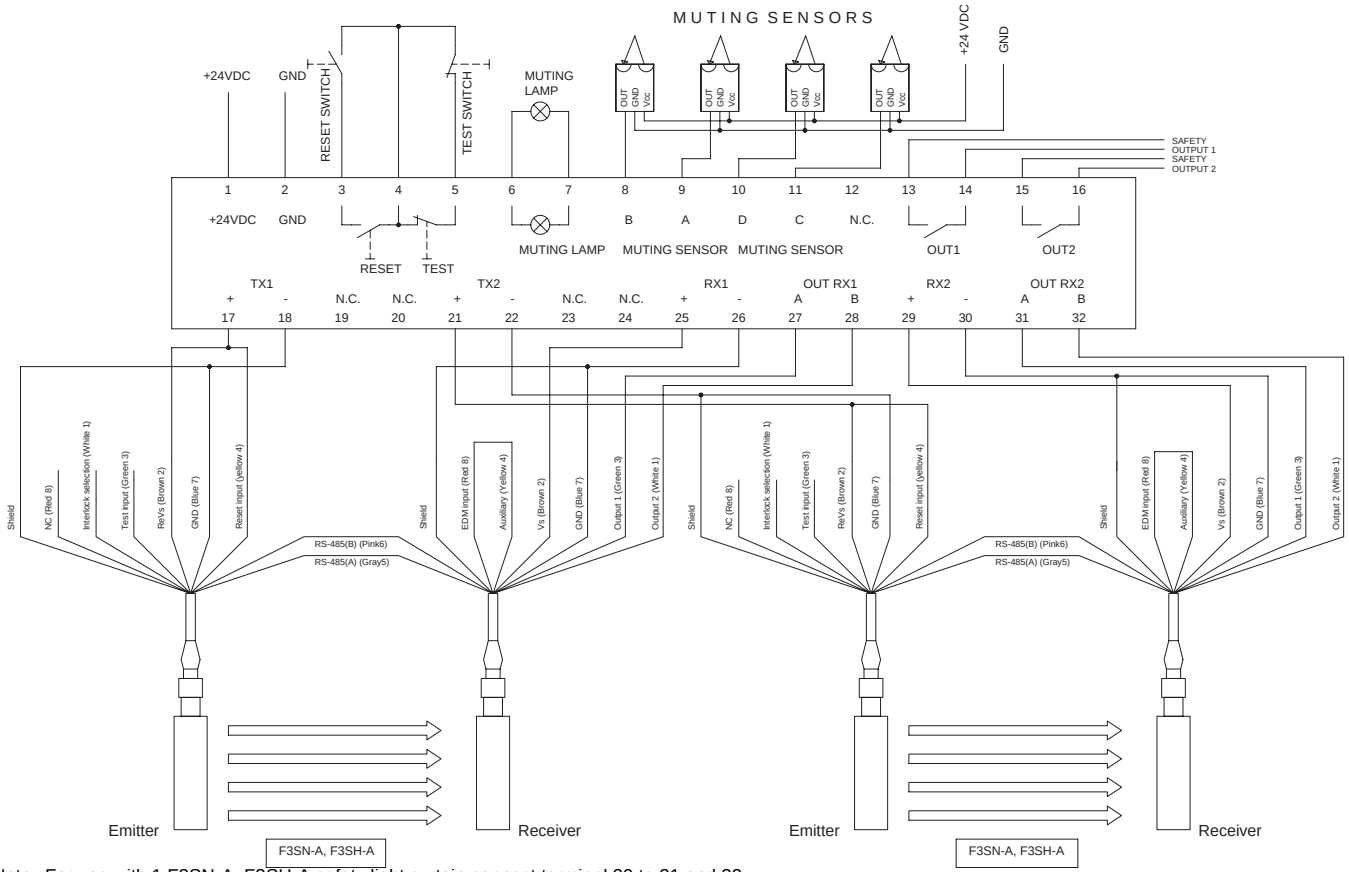
Connection of two F3SN-A light curtains or two F3SH-A multi-beam sensors to the control unit F3SP-U2P-TGR with four muting sensors.

F3SN-A, F3SH-A function mode

Automatic reset

No external device monitoring

No lockout reset



Note: For use with 1 F3SN-A, F3SH-A safety light curtain connect terminal 29 to 31 and 32.

Muting Controller for Safety Light Curtain

F3SP-U4P

- **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**

Muting controller for one or two Safety Light Curtain.

List of Models

Controller

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

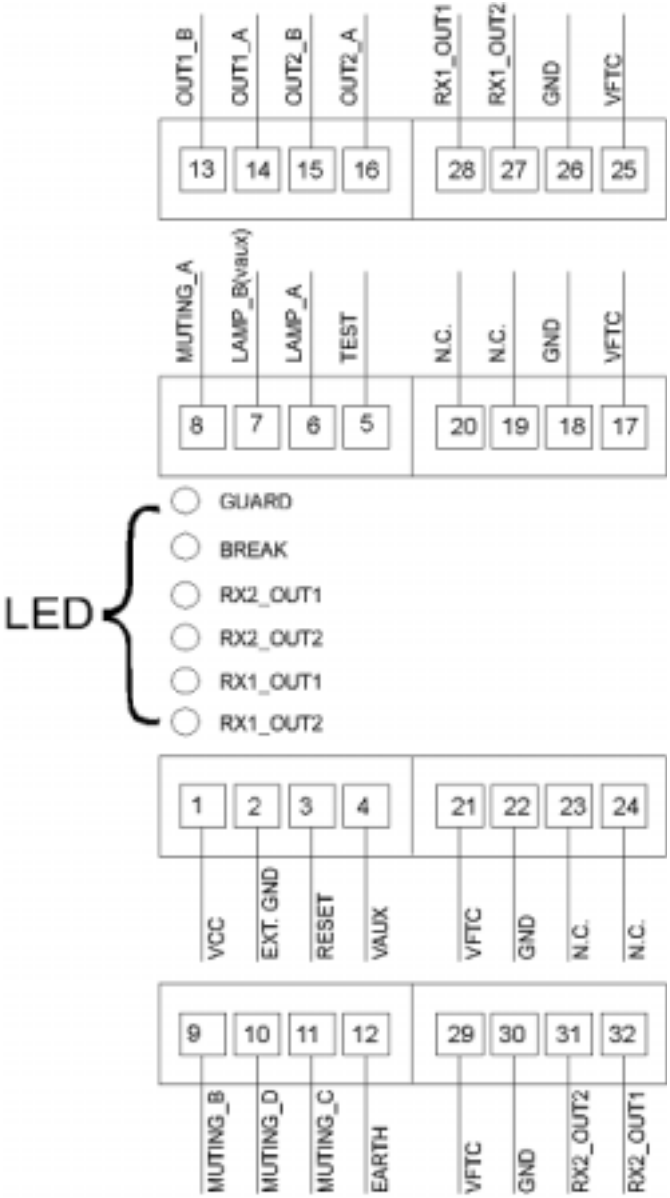
Accessories

Description	Model
 Muting lamp	F39-A11

Rating / performance

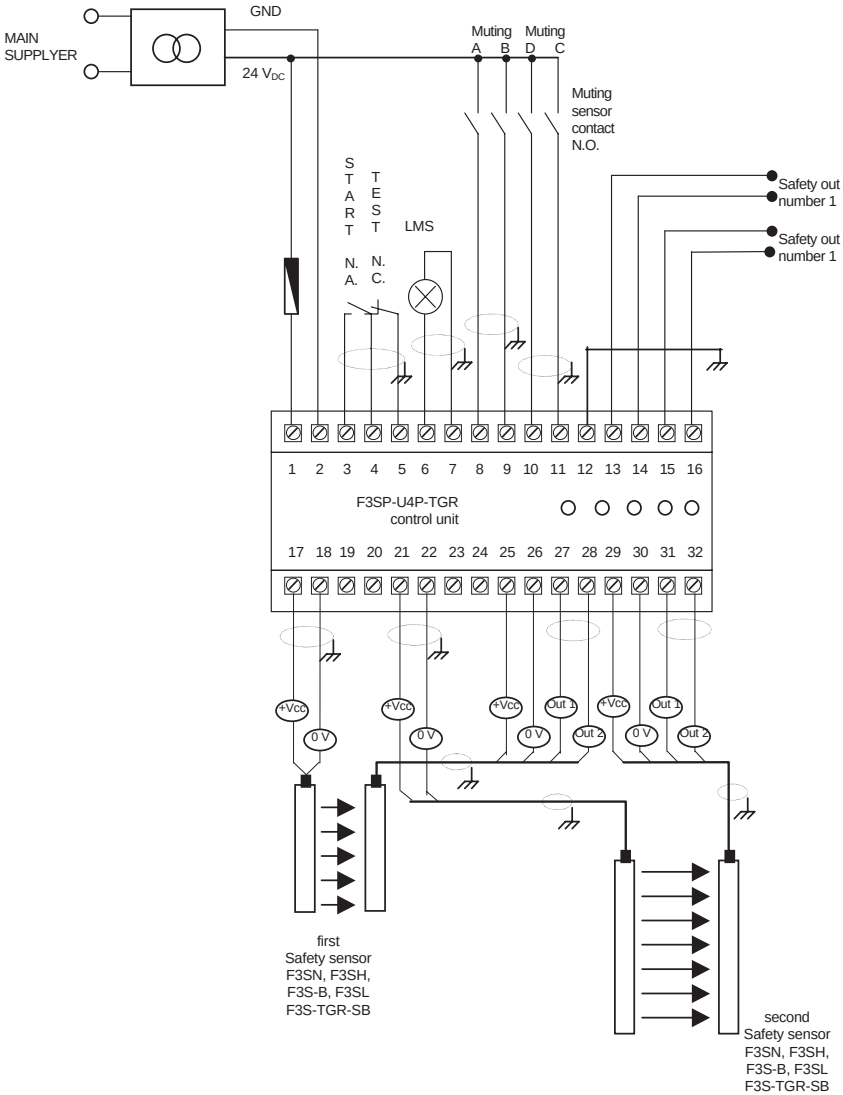
	F3SP-U4P-TGR
Power supply voltage	24 VDC ±10%
Power consumption	420 mA max. (excl. SLC power consumption)
Output contacts	2 NO 2,5 A (protected by fuse)
Indicators	6 LEDs for status and diagnostics.
Enclosure rating	IP20
Terminal	32 screw terminals (1,5 mm²), detachable blocks with 4 screws each
Response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

Pin Overview

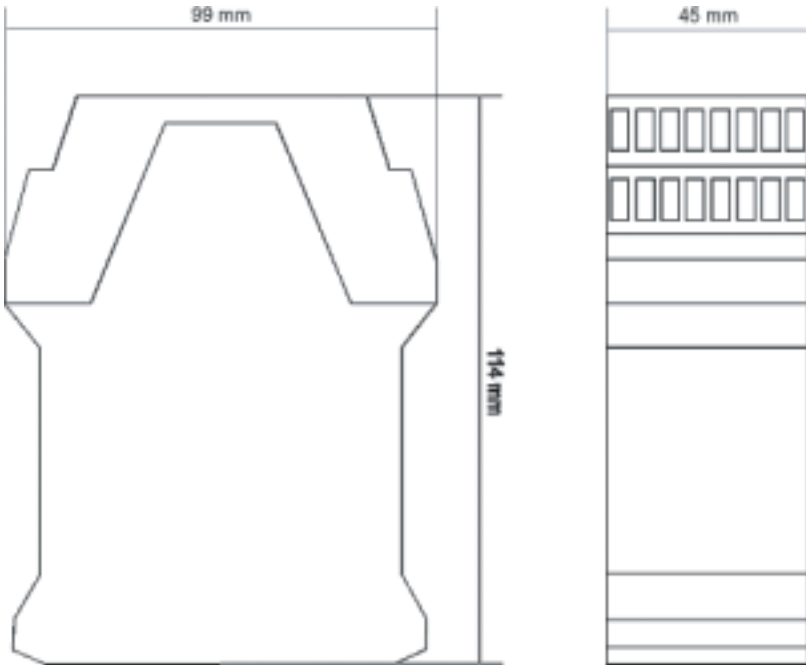


Wiring Example

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



Dimensions

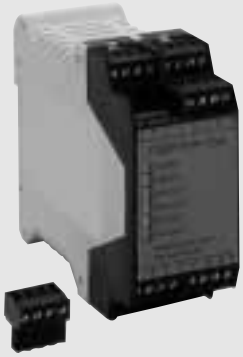


PSDI Controller for Safety Light Curtain

F3SP-P1P-TGR

Single/Double break controller (PSDI) for safety light curtain.

- **High functionality (4 operating modes: single break, double break, guard mode and manual reset).**
- **Suitable for automatic reinitiation by a safety light curtain**
- **Category 4.**
- **Double output safety relay.**
- **6 LED for status and diagnostics.**
- **45 mm width**
- **Mode select by Input.**
- **Detachable terminals for easy installation**
- **TÜV approved**



List of Models

Description	Model
PSDI Controller for Safety Light Curtain F3SN, F3S-B, F3S-TGR and F3SL	F3SP-P1P-TGR

Rating / performance

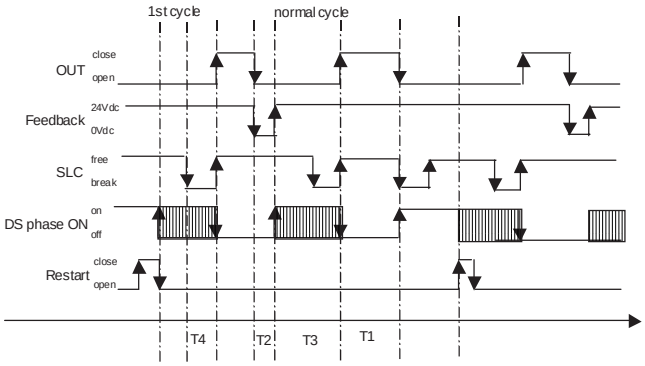
	F3SP-P1P-TGR
Power supply voltage	24 VDC ±10%
Power consumption	420 mA max. (excl. SLC power consumption)
Output contacts	2 NO 2,5 A (protected by fuses)
Auxiliary output	50 mA, 24 VDC, PNP for system status (DS ON)
Indicators	6 LEDs for status and diagnostics.
Enclosure rating	IP20
Terminal	32 screw terminals (1,5 mm²), detachable blocks with 4
Response time	≤ 30 ms
Ambient temperature	Operating: -10 °C + 55 °C
Housing material	Plastic, DIN rail mounting
Weight	0,6 kg

Operation

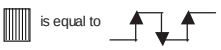
The control electronic system is fitted inside the control unit. The 'core' of the device is made up of two microprocessors forming - as required by the standards - a system having "two independent channels". By means of the suitable hardware, they continuously control and check the connected SLC.
The system is designed to realize application using the safety light curtain for reinitialisation of the machine.
By using 2 setting inputs the unit can operate in

Single Break function

After initialisation the system will start a cycle of the machine after the sensor has been intruded once. The system monitors a feedback signal to identify the completion of the machine cycle and will wait for a time of 30s for the next intrusion. If this time is exceeded the system requires a new reset signal to restart the reinitialisation

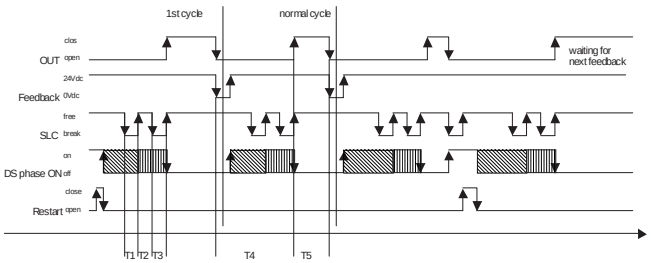


T1: waiting status (in normal cycle this time is used to make works)
T2: Feedback input signal; must be T2 > 100ms
T3: Wait for single SLC break time; must be < 30 sec
T4: Break Time; it dipends on how long the SLC are intercepted but T4 must be always > 300 msec

N.B.  is equal to one flashing

Double Break function

After initialisation the system will start a cycle of the machine after the sensor has been intruded twice in a dedicated time period. The system monitors a feedback signal to identify the completion of the machine cycle and will wait for a time of 30s for the next intrusion. If this time is exceeded the system requires a new reset signal to restart the reinitialisation



T1: First interruption of SLC must be > 300ms
T2: Spacing between two interruption must be > 150ms
T3: Second interruption must be > 300ms
T4: Timeout of DB function (at least 30 sec).
T5: Output close time; it depends on the controlled machine cycle;
T4 + T5 represents the total time of the complete working cycle of the machine.

N.B. indicate a double flasching of DS phase out , is a single flashing.

Auto reset guard function

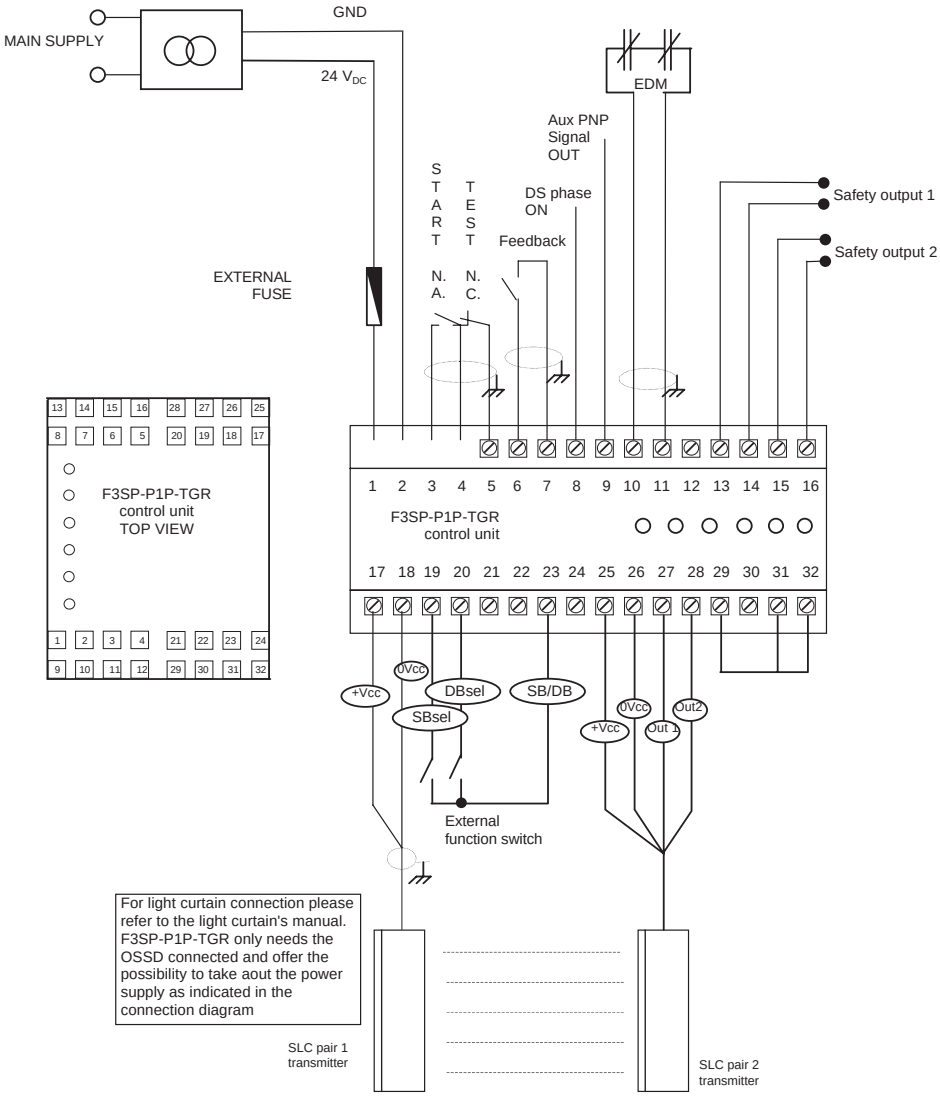
The system operates as a standard SLC controller in auto reset mode. A reinitialisation function is not obtained by the system.

Manual reset guard function

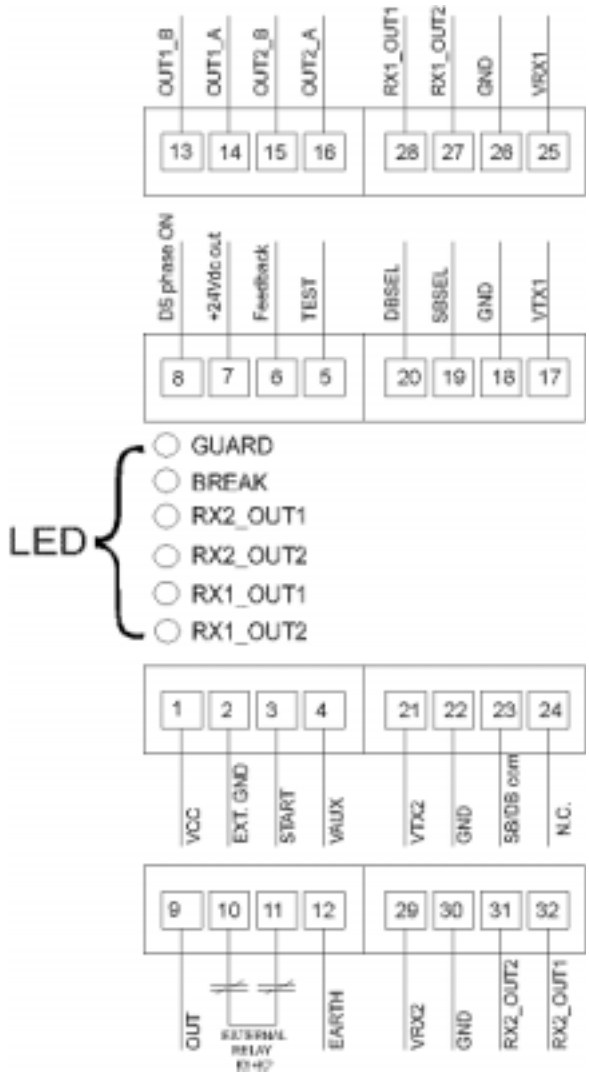
The system operates as a standard SLC controller in manual reset mode. A reinitialisation function is not obtained by the system.

Wiring Example

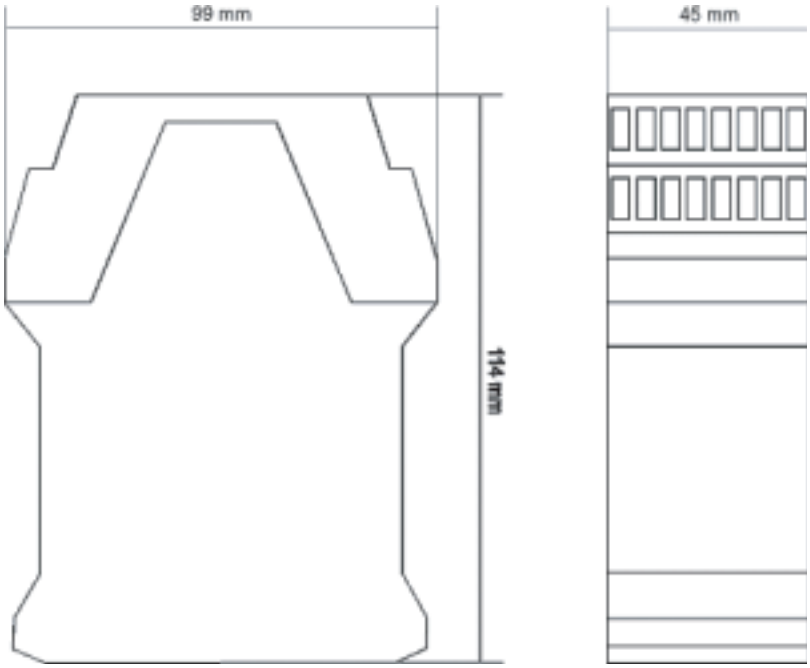
Control unit F3SP-P1P-TGR" in a configuration that allowes the use of several OMRON safety light curtains.



Pin Overview



Dimensions

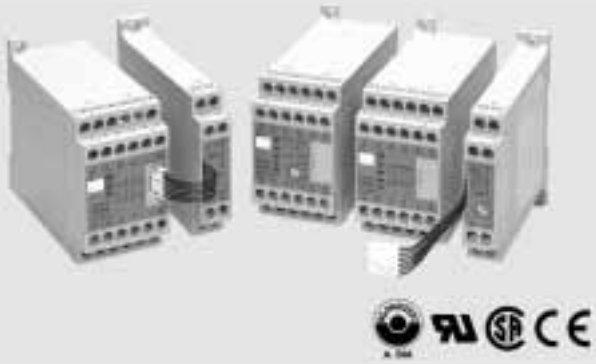


MEMO

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.

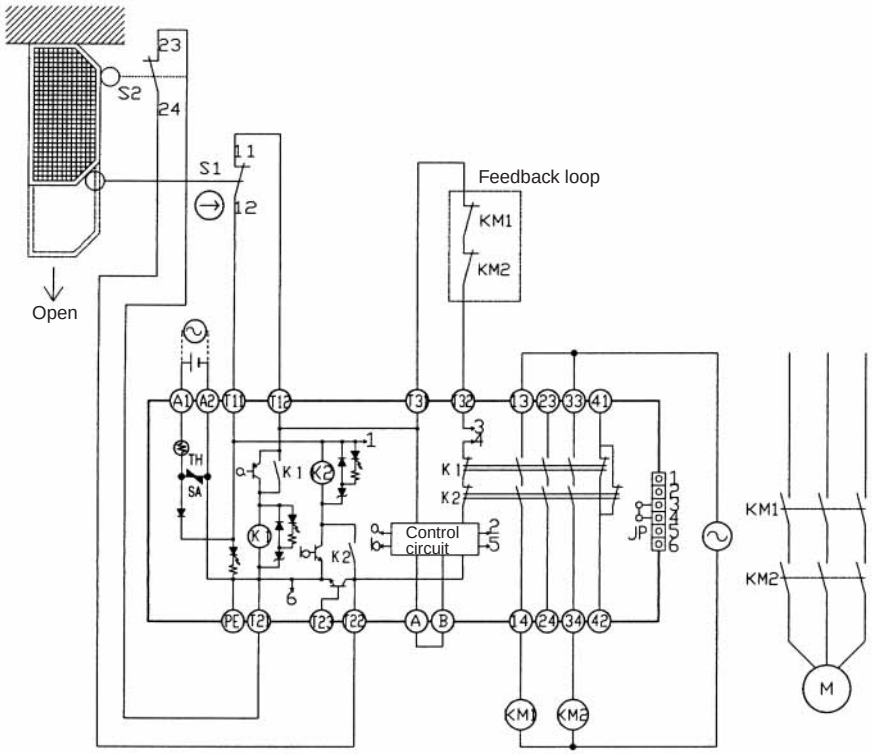
2. The response time is the time it takes for the main contact to open after the input is turned OFF.

3. The insulation resistance was measured with 500 VDC at the same places that the dielectric strength was checked.

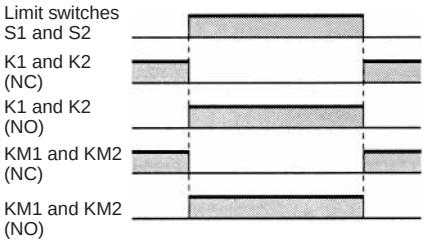
4. Weight shown is for 24-VAC/VDC type. For 100 to 240-VAC type, add approximately 20 g.

Application Examples

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



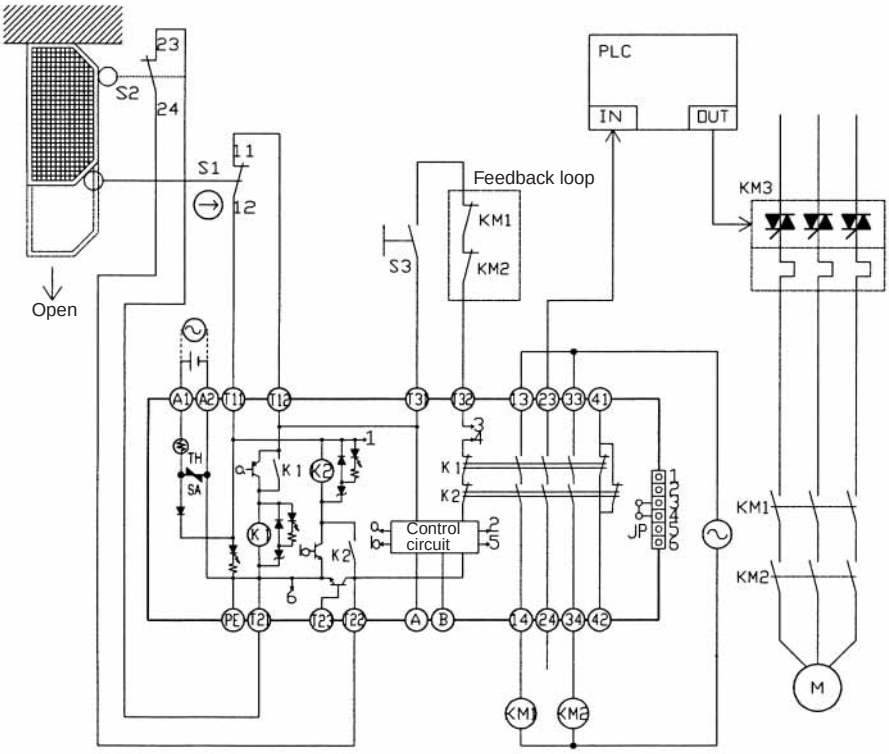
Timing Chart



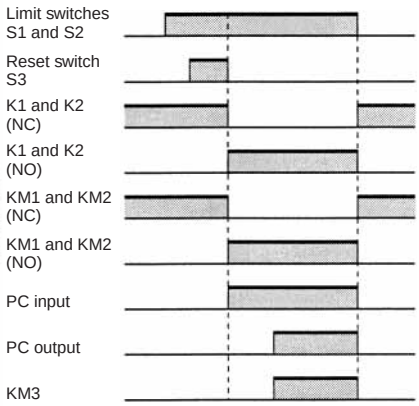
S1:	Safety Limit Switch with direct opening mechanism (D4D or D4B)
S2:	Limit switch
KM1 and KM2:	Magnetic Contactor
M:	3-phase motor

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

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



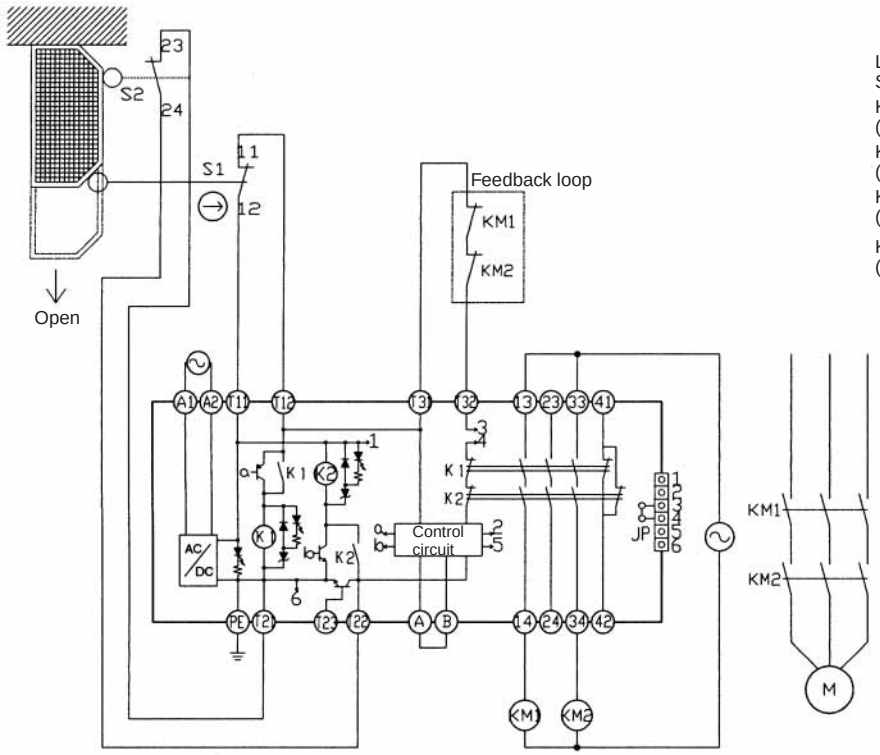
Timing Chart



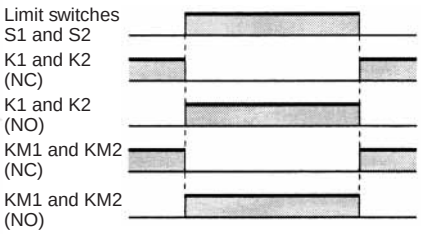
S1:	Safety Limit Switch with direct opening mechanism (D4D or D4B)
S2:	Limit switch
S3:	Reset switch
KM1 and KM2:	Magnetic Contactor
KM3:	G3J Solid-state Contactor (G3J)
M:	3-phase motor

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

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



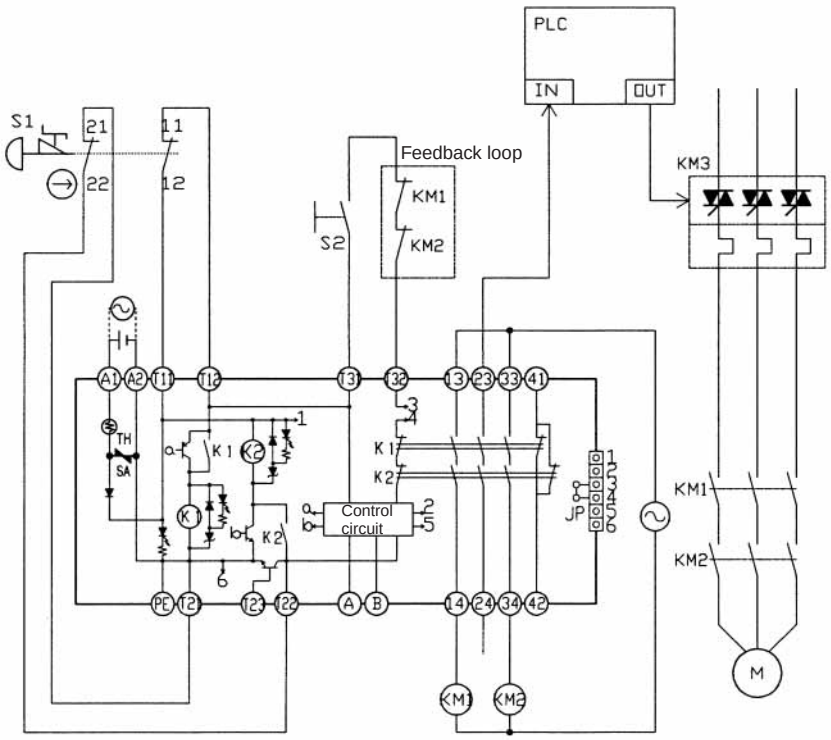
Timing Chart



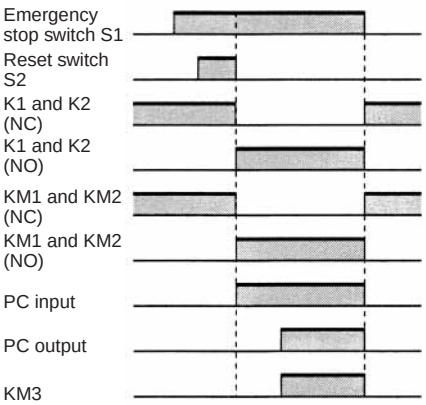
S1: Safety Limit Switch with direct opening mechanism (D4D or D4B) ⊖
S2: Limit switch
KM1 and KM2: Magnetic Contactor
M: 3-phase motor

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

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



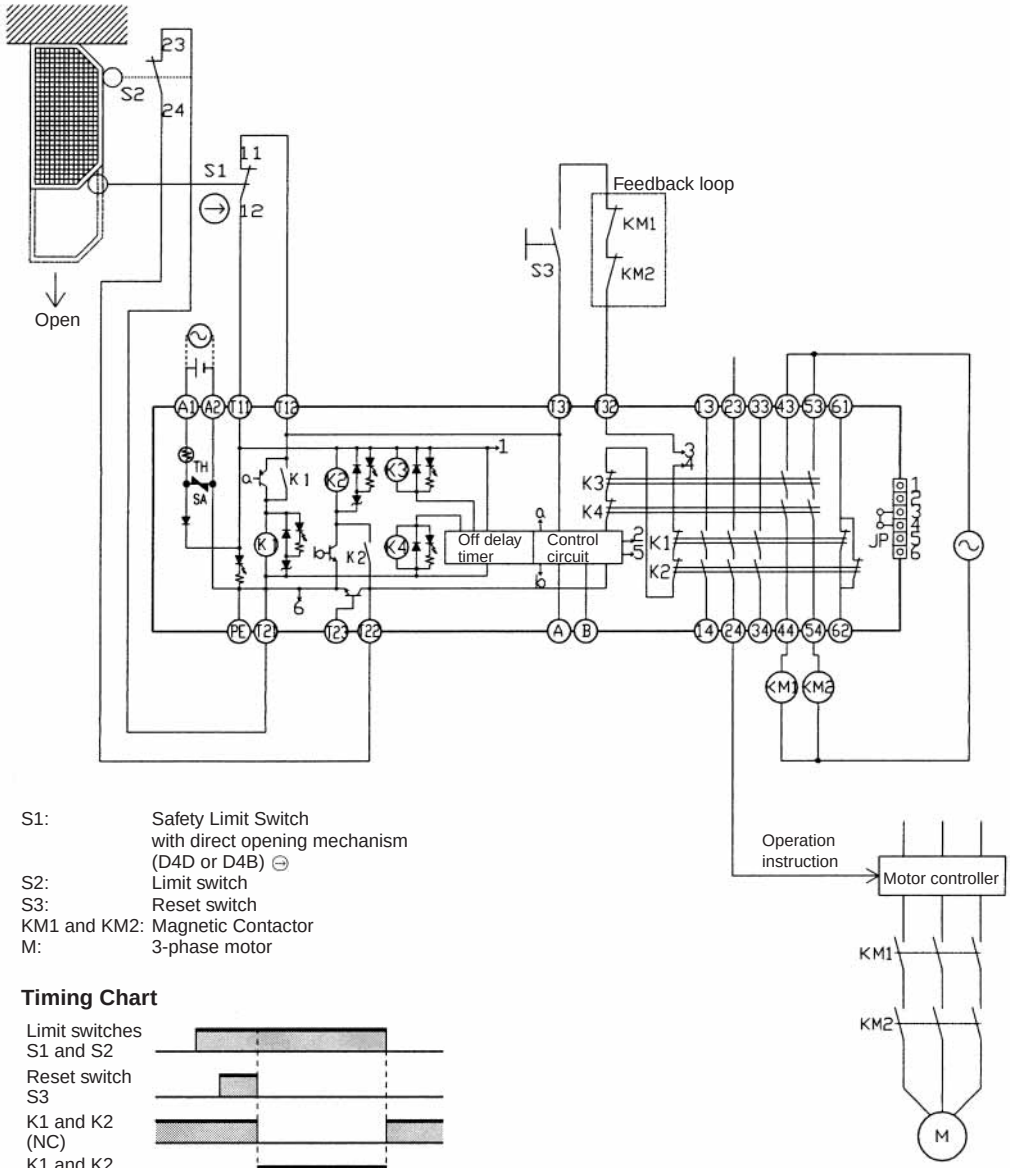
Timing Chart



S1: Emergency stop switch with direct opening mechanism (A165E or A22E) ⊖
S2: Reset switch
KM1 and KM2: Magnetic Contactor
KM3: G3J Solid-state Contactor (G3J)
M: 3-phase motor

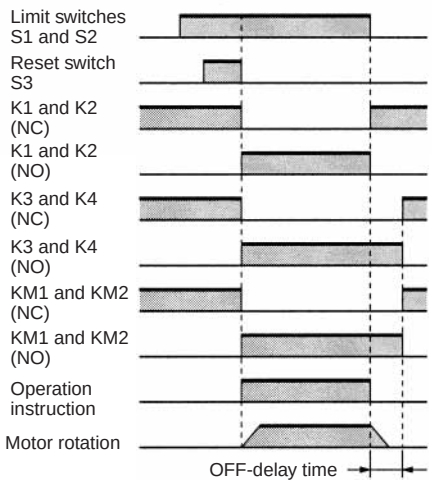
Note: This circuit achieves EN954-1 Safety Category 4.

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



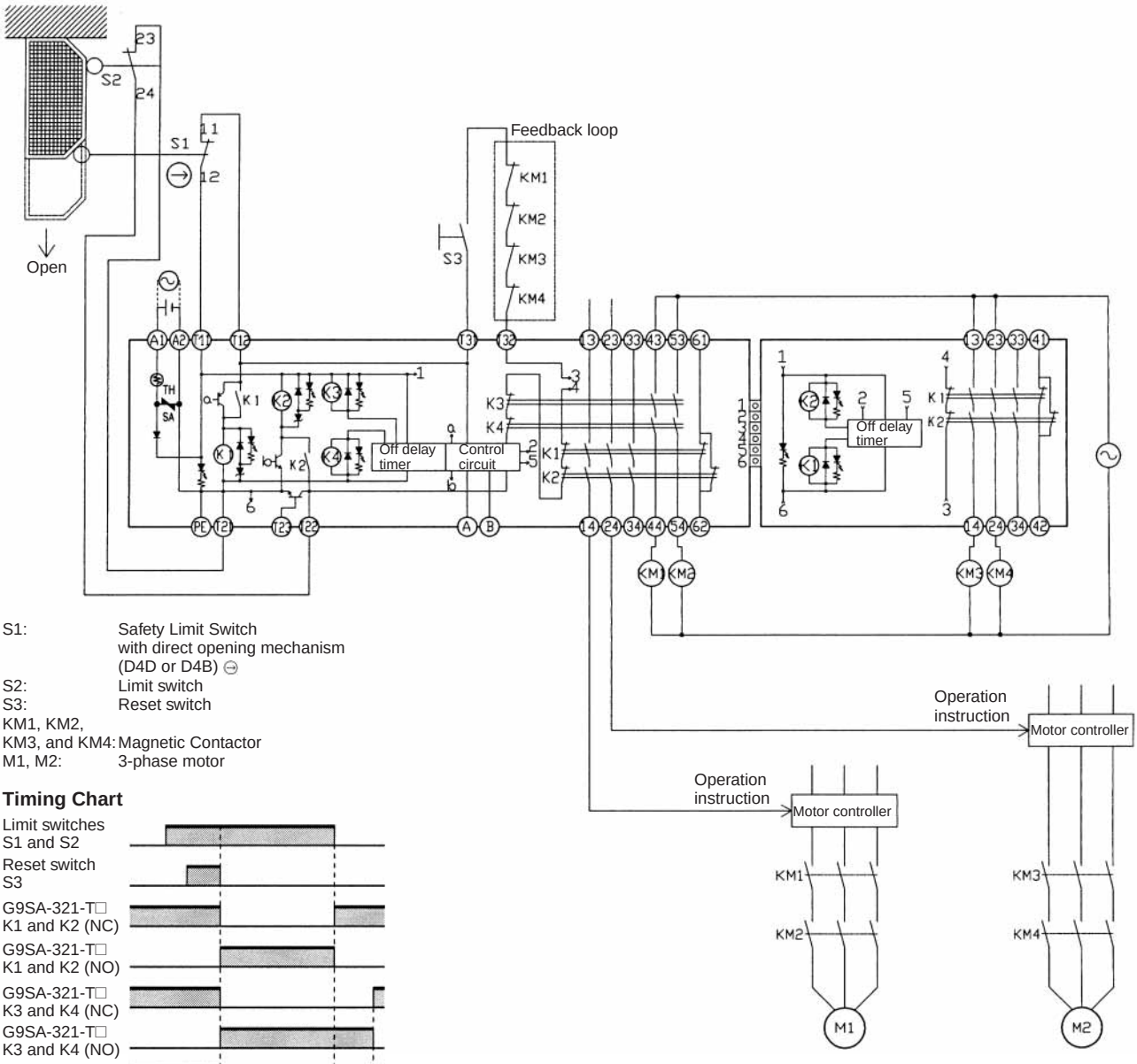
S1: Safety Limit Switch with direct opening mechanism (D4D or D4B) ⊖
S2: Limit switch
S3: Reset switch
KM1 and KM2: Magnetic Contactor
M: 3-phase motor

Timing Chart



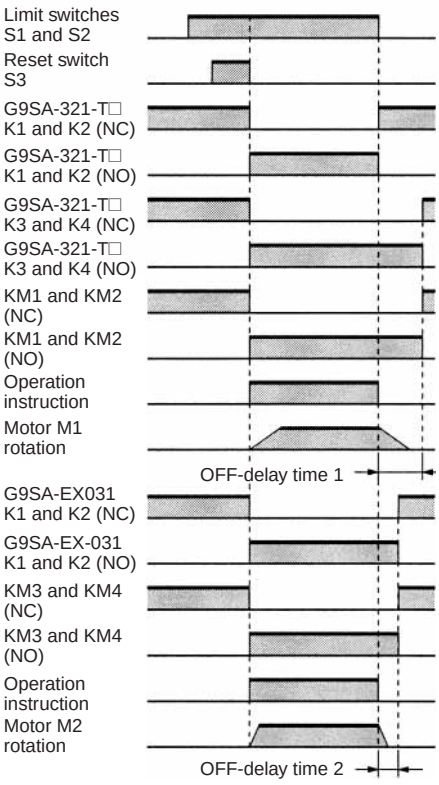
Note: This circuit achieves EN954-1 Safety Category 4. The OFF-delay output, however, achieves EN954-1 Safety Category 3.

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



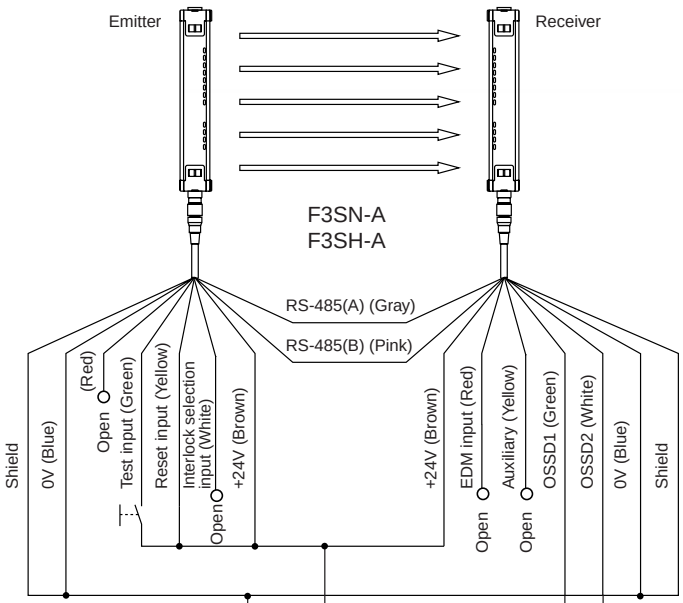
S1: Safety Limit Switch with direct opening mechanism (D4D or D4B) ⊖
S2: Limit switch
S3: Reset switch
KM1, KM2, KM3, and KM4: Magnetic Contactor
M1, M2: 3-phase motor

Timing Chart

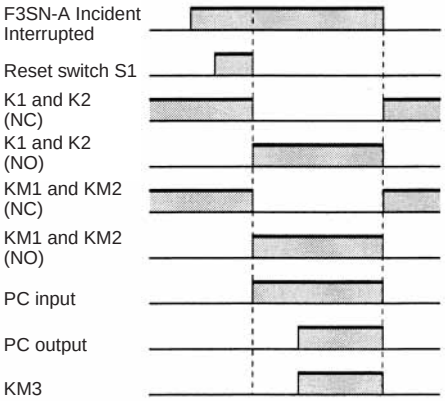


Note: This circuit achieves EN954-1 Safety Category 4. The OFF-delay output, however, achieves EN954-1 Safety Category 3.

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

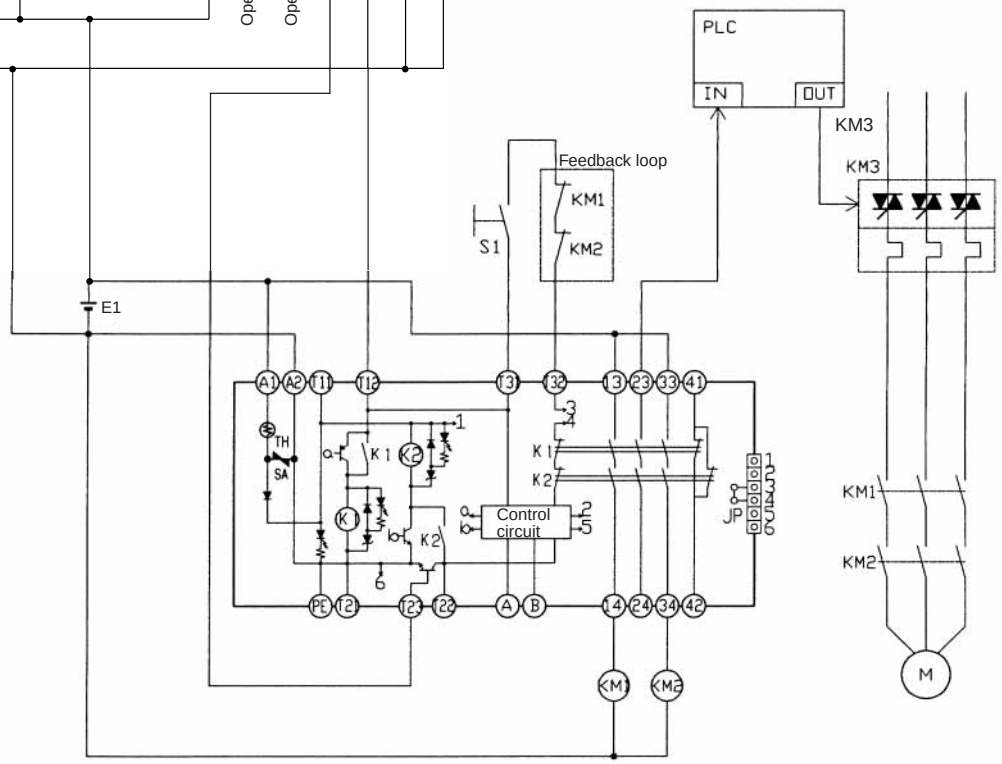


Timing Chart

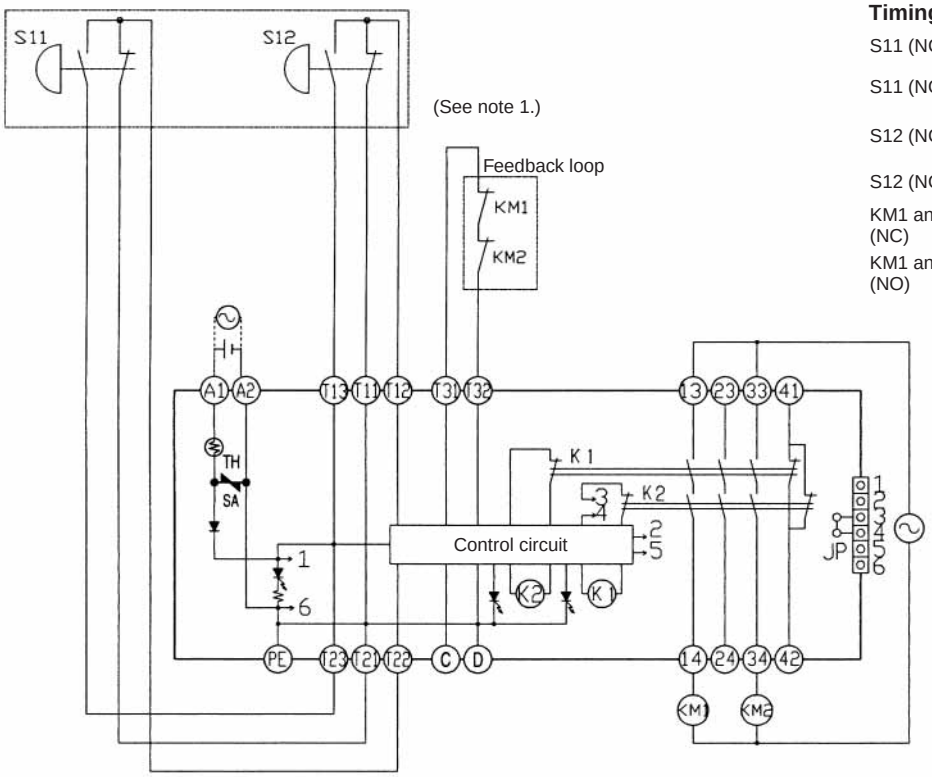


F3SN-A: Safety area sensor
S1: Reset switch
KM1 and KM2: Magnetic Contactor
KM3: G3J Solid-state Contactor (G3J)
M: 3-phase motor
E1: 24-VDC Power Supply

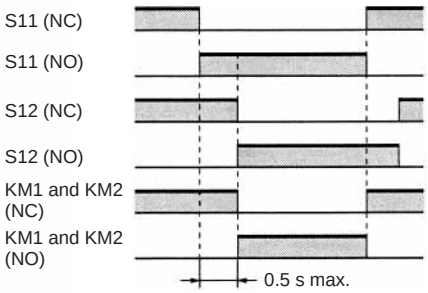
Note: This circuit achieves EN954-1 Safety Category 4.



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



Timing Chart



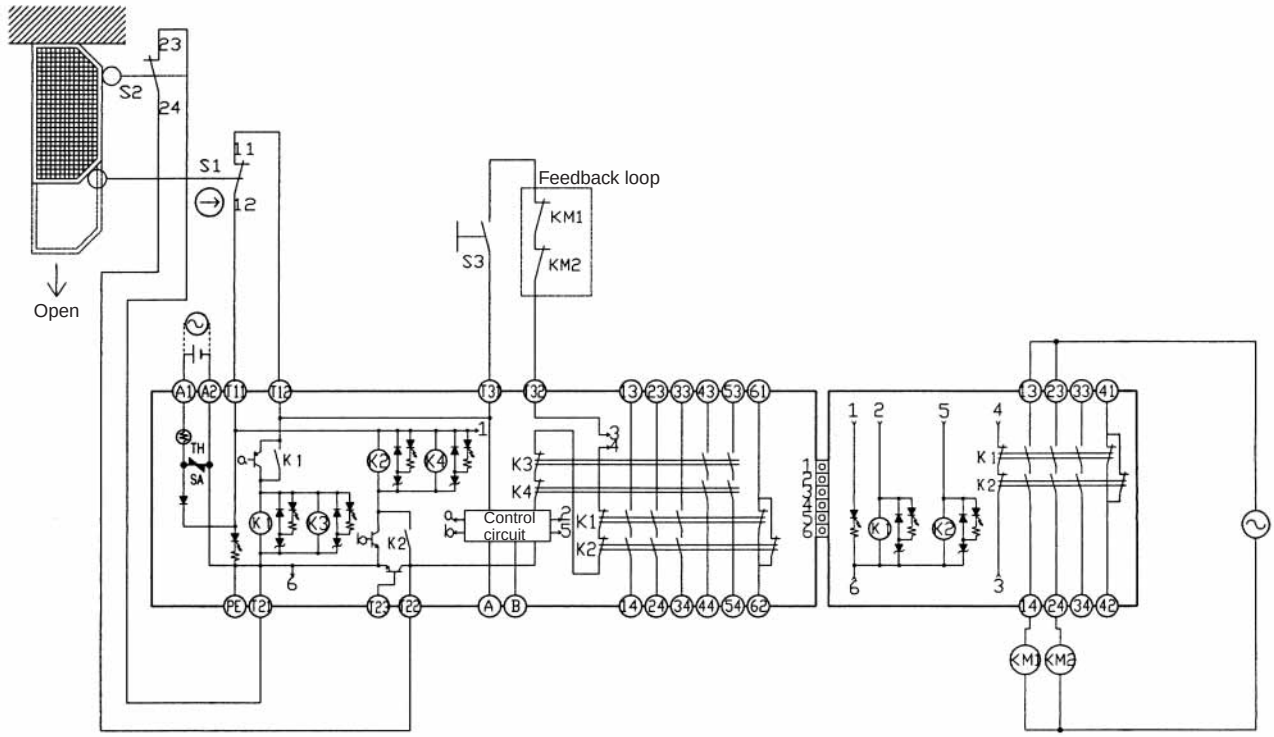
Input time difference operates only when the difference is 0.5 s max.

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

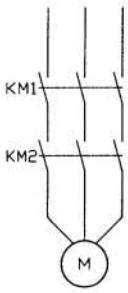
Note: 1. Use a 1NC+1NO switch for S11 and S12.

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

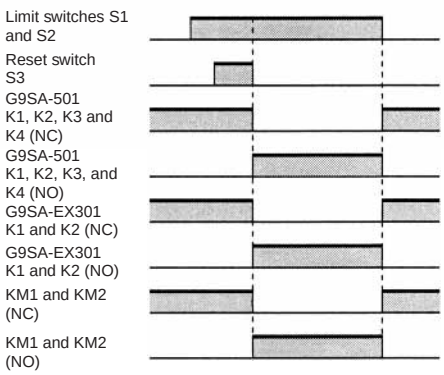
G9SA-501 (24 VAC/VDC) and G9SA-EX301 with 2-channel Limit Switch Input/Manual-reset



S1:	Safety Limit Switch with direct opening mechanism (D4D or D4B) ⊖
S2:	Limit switch
S3:	Reset switch
KM1 and KM2:	Magnetic Contactor
M:	3-phase motor



Timing Chart

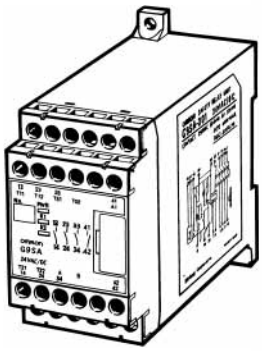


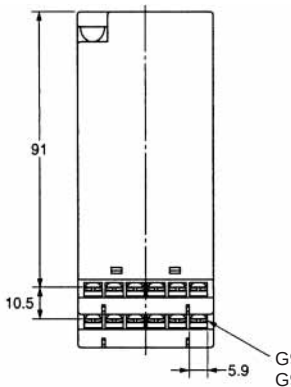
Note: This circuit achieves EN954-1 Safety Category 4.

Dimensions

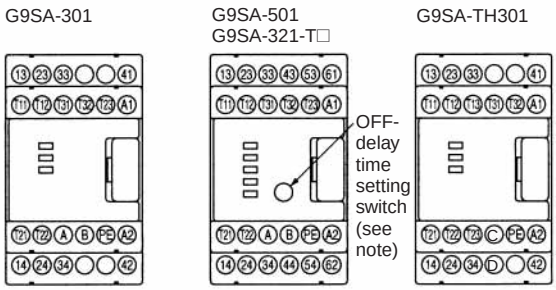
Note: All units are in millimeters unless otherwise indicated. The diagrams are drawn in perspective.

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

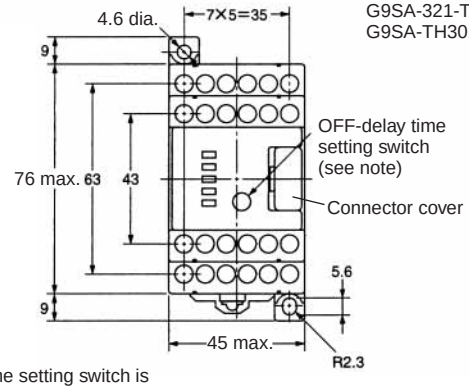


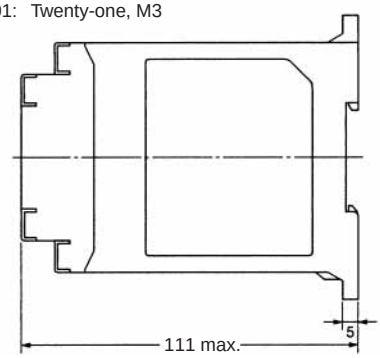


Terminal Arrangement



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

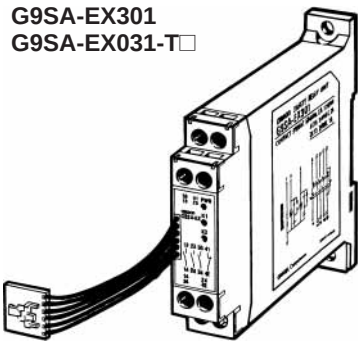


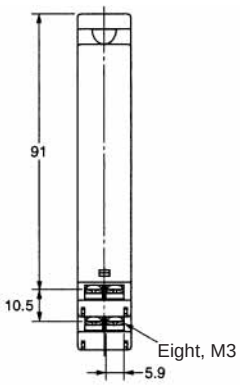


Mounting Holes

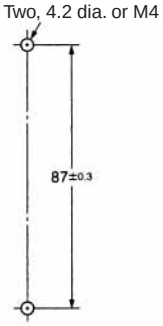
Note: The OFF-delay time setting switch is found on the G9SA-321-T□ only.

G9SA-EX301
G9SA-EX031-T□



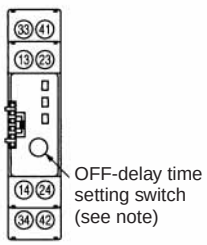


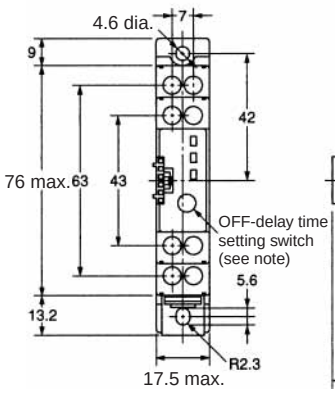
Mounting Holes

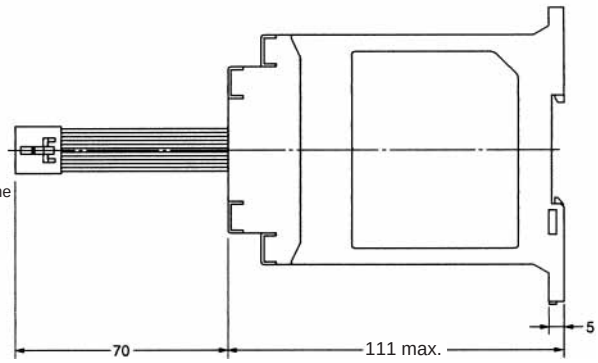


Terminal Arrangement

G9SA-EX301
G9SA-EX031-T□





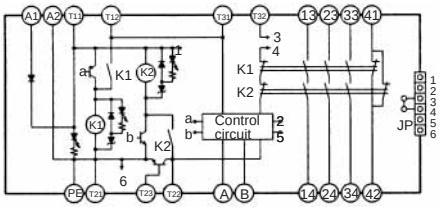


Note: The OFF-delay time setting switch is found on the G9SA-EX031-T□ only.

Installation

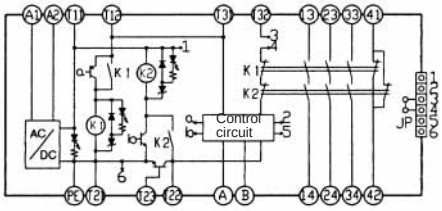
Internal Connections

G9SA-301 (24 VAC/VDC)



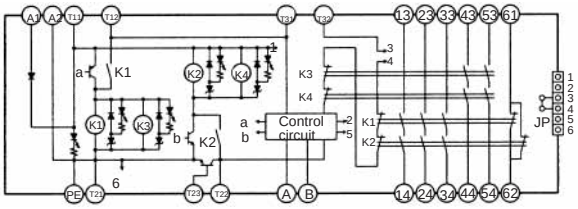
(See note 3.) (See note 1.)

G9SA-301 (100 to 240 VAC)



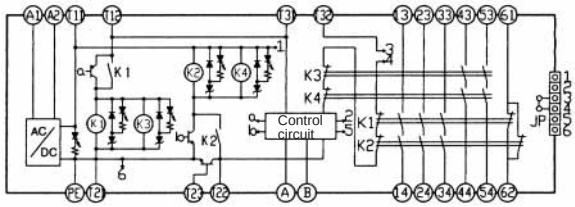
(See note 3.)(See note 1.)

G9SA-501 (24 VAC/VDC)



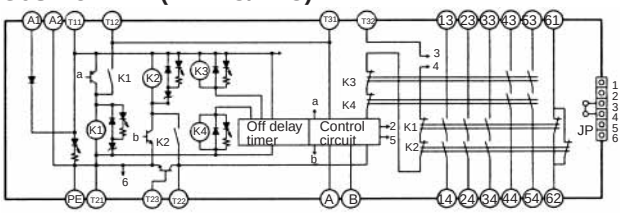
(See note 3.) (See note 1.)

G9SA-501 (100 to 240 VAC)



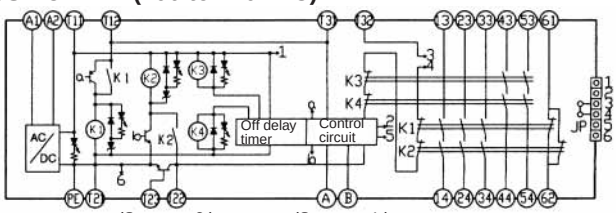
(See note 3.)(See note 1.)

G9SA-321-T□ (24 VAC/VDC)



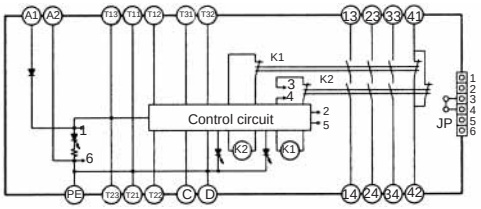
(See note 3.) (See note 1.)

G9SA-321-T□ (100 to 240 VAC)



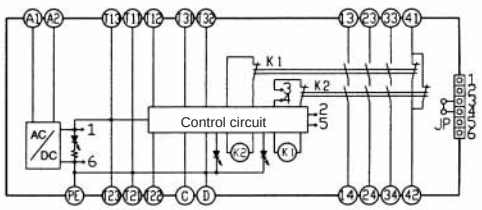
(See note 3.) (See note 1.)

G9SA-TH301 (24 VAC/VDC)



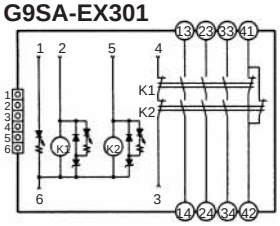
(See note 2.)

G9SA-TH301 (100 to 240 VAC)

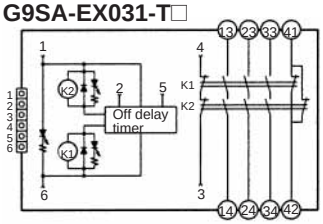


(See note 2.)

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.

⚠ Caution

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.

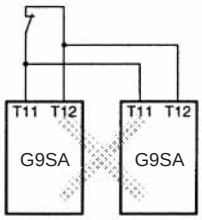
The applicable safety category is determined from the whole safety control system. Make sure that the whole safety control system meets EN954-1 requirements.

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.

MEMO

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

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 (cosφ=1)		
Rated load	250 VAC, 5 A		
Rated carry current	5 A		

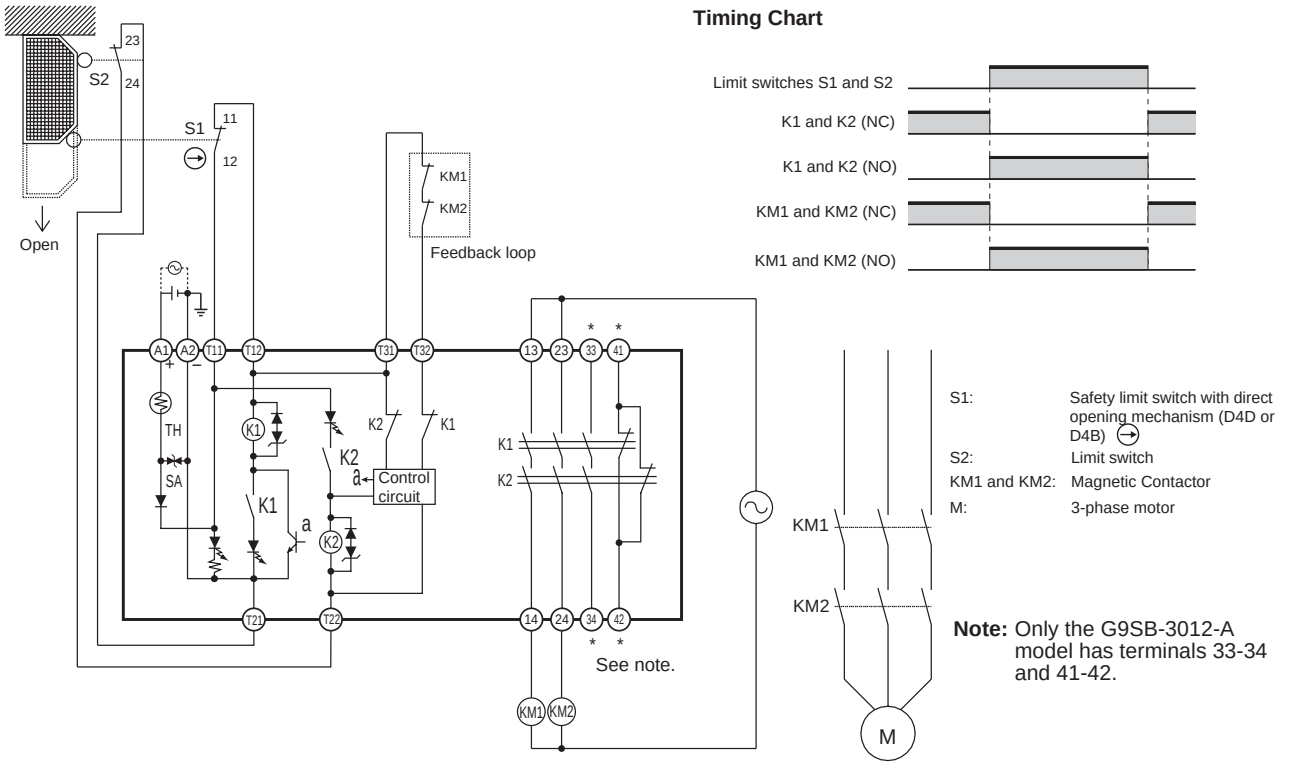
Characteristics

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.

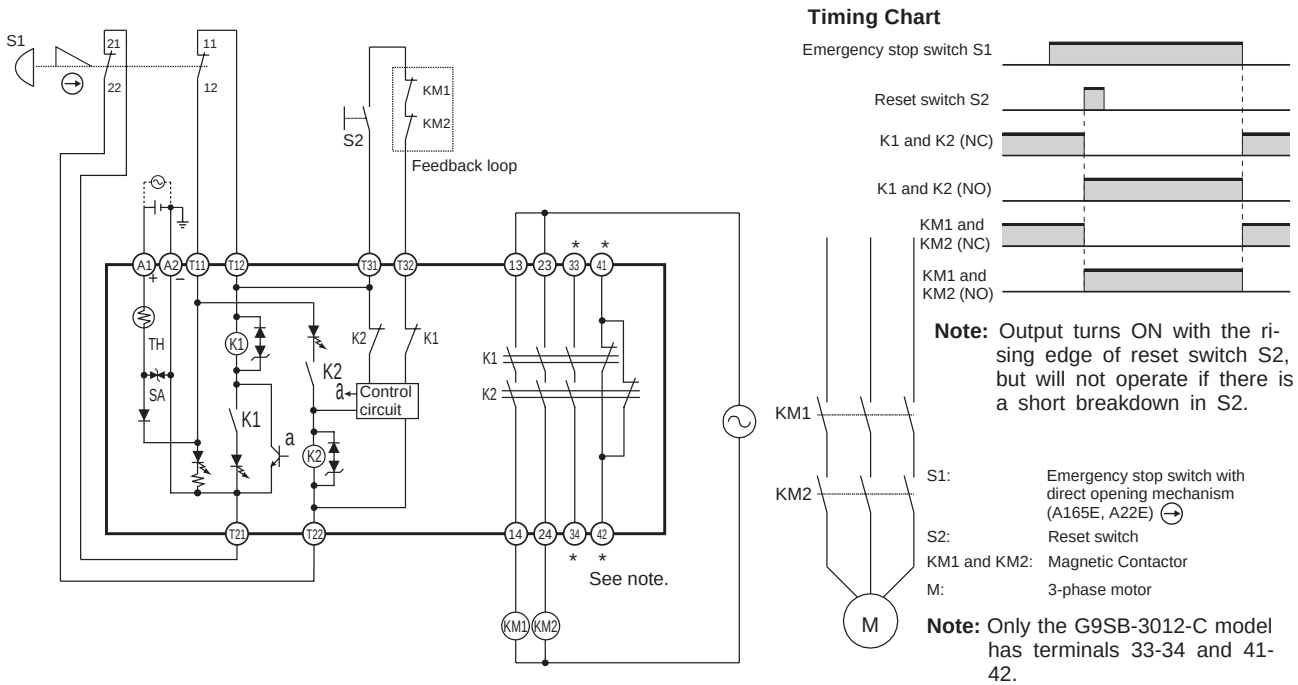
Application Examples

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



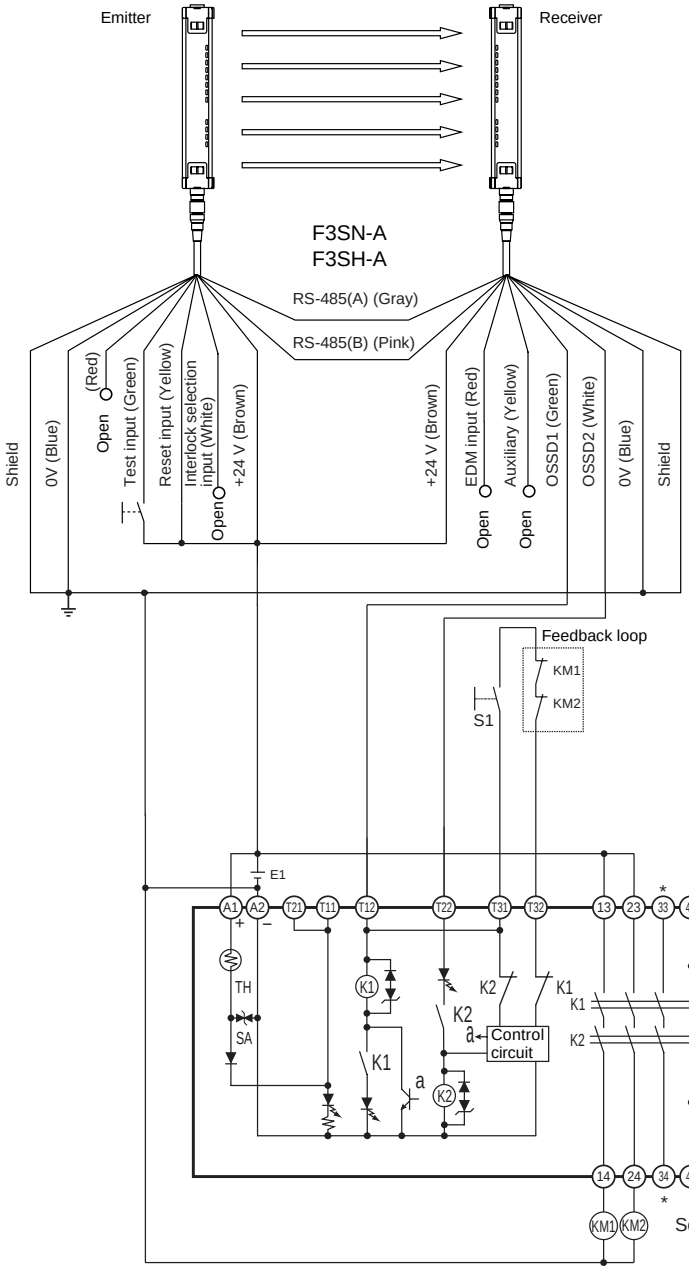
Note: 1. External connections and timing charts for G9SB-200-B/301-B models are the same as those for G9SB-2002-A/3012-A models.
2. This circuit conforms to EN954-1 Safety Category 4.

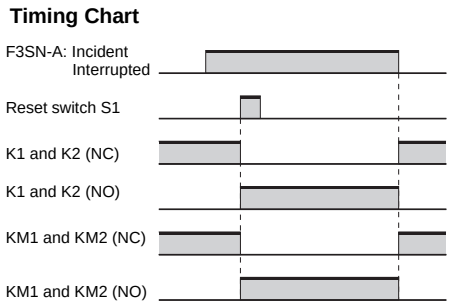
G9SB-2002-C (24 VAC/VDC) or G9SB-3012-C (24 VAC/VDC) with 2-channel Emergency Stop Switch Input/Manual-reset



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.

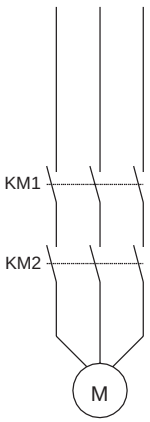
G9SB-200-D (24 VAC/VDC) or G9SB-301-D (24 VAC/VDC) with 2-channel Safety Area Sensor/Manual-reset





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

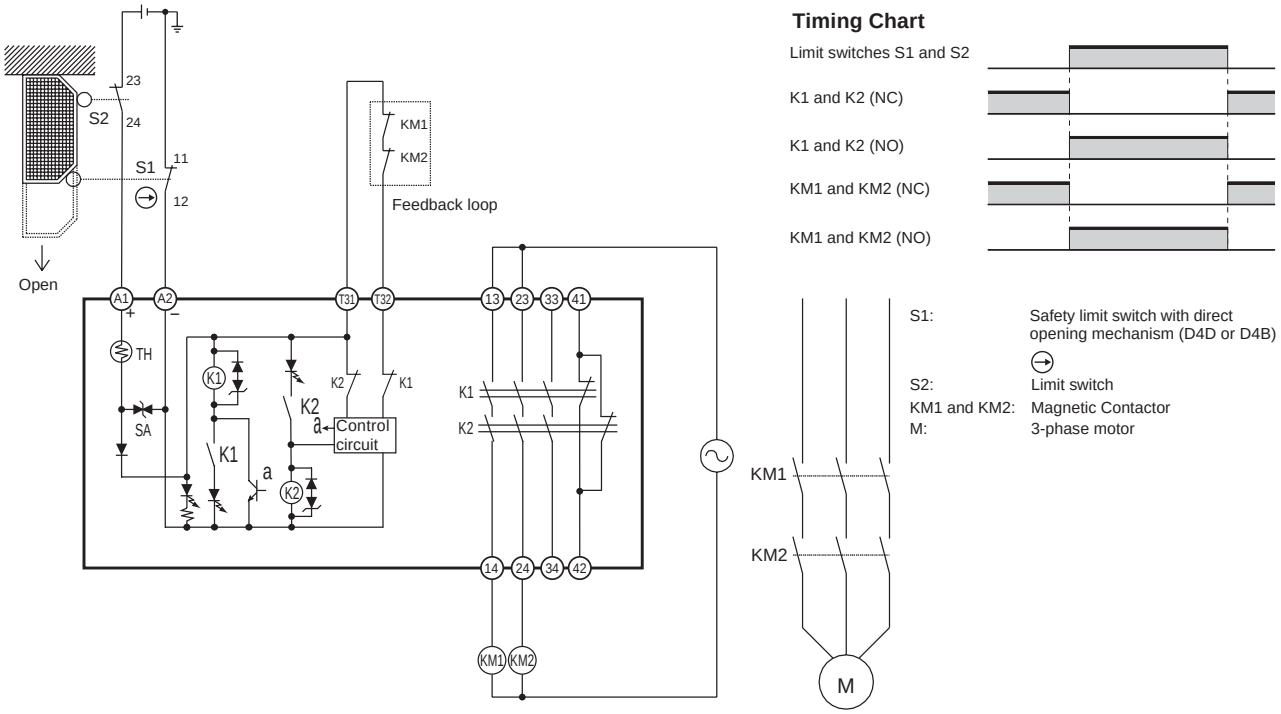
F3SN-A:	Safety Area Sensor
S1:	Reset switch
KM1 and KM2:	Magnetic Contactor
M:	3-phase motor
E1:	24-VDC power supply



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

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

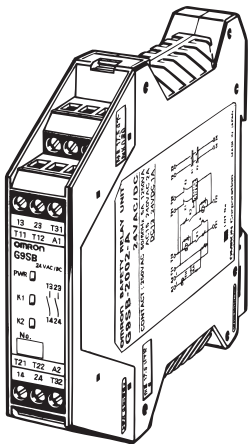
G9SB-3010 (24 VDC) with 2-channel Limit Switch Input/Auto-reset

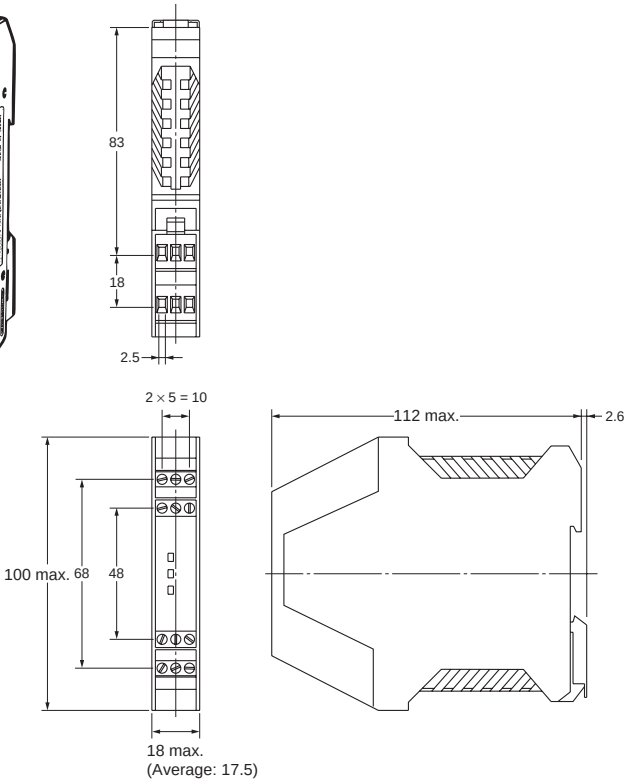


Note: This circuit conforms to EN954-1 Safety Category 3.

Dimensions

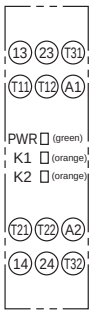
G9SB-200□-□
G9SB-3010



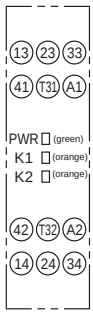


Terminal Arrangement

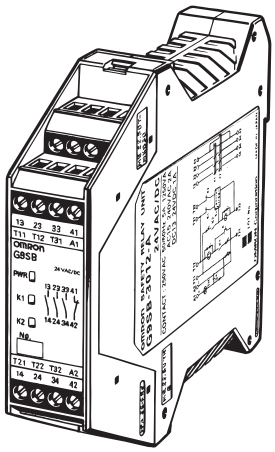
G9SB-200□-□

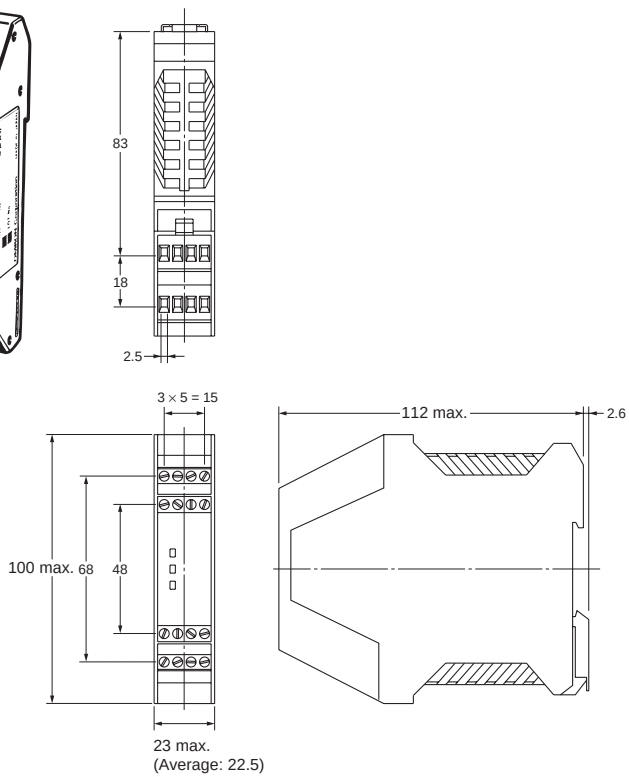


G9SB-3010



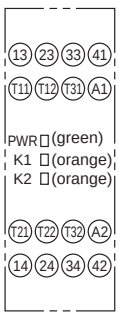
G9SB-301-□





Terminal Arrangement

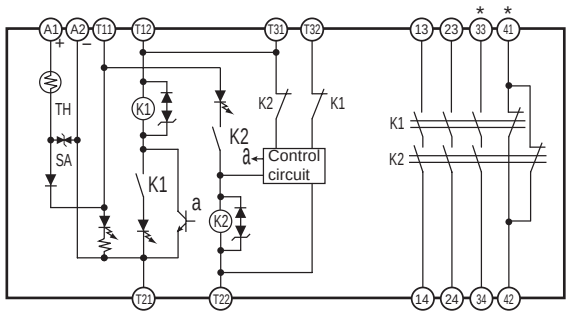
G9SB-200□-□



Installation

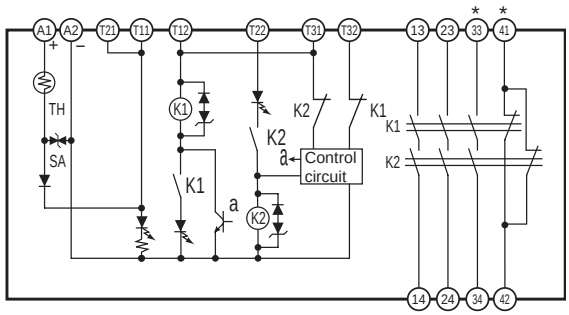
Internal connections

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



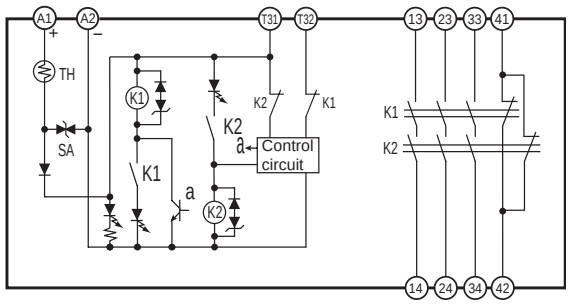
See note 2.

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

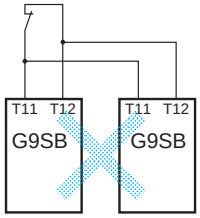
G9SB-200□-□/301□-□ meet the requirements of Safety Category 4 of the EN954-1 standards when they are used as shown in the examples provided by OMRON. Relays may not meet the standards in some operating conditions. The G9SB-3010 can be applied to Safety Category 3 of the EN954-1 using double breaking. 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.

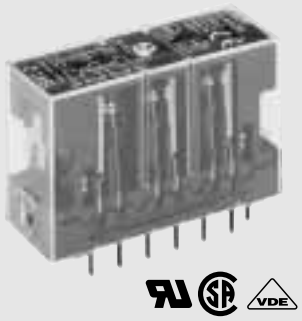
Safety Relay

G7S

Safety Relay conforming to EN standard

- Conforms to EN50205.
- A minimum of 0.5 mm between contacts even when one contact is welded. (prEN50205 Class A)
- Forcibly guided contacts.
- The G7S contributes to the protection of machinery when used as part of an interlocking circuit.
- Most suitable for safety circuits in press machinery, machine tools, and other production machinery.
- Track–mounting and Back–mounting Sockets are available.

Note: Be sure to refer to the page D-119.



Ordering Information

Model Number Legend

G7S-□A□B
1 2

1. NO Contact Poles
- 4: 4PST–NO
- 3: 3PST–NO

2. NC Contact Poles
- 2: DPST–NC
- 3: 3PST–NC

Safety Relays

Type	Poles	Contact form	Rated voltage (V)	Model
Standard	6 poles	4PST-NO, DPST-NC	24 VDC	G7S-4A2B
		3PST-NO, 3PST-NC		G7S-3A3B

Accessories

Safety Relay Sockets

Type		Model
Track-mounting	Common for track mounting and screw mounting	P7S-14F
Back-mounting	Solder terminals	P7S-14A
	PCB terminals	P7S-14P

Socket Mounting Plate

Applicable Socket	Quantity	Model
P7S-14A	10	P7A-A10

Relay Removal Tool

Applicable Socket	Model
P7S-14F P7S-14A P7S-14P	P7S-B

Specifications

Ratings

Operation Coil

Rated voltage	Rated current	Coil resistance	Must operate voltage	Must release voltage	Max. voltage	Power consumption
24 VDC	30 mA	800 Ω	80% max. (V)	10% min. (V)	1110% (V)	Approx. 0.8 W

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 maximum voltage is based on an ambient operating temperature of 23°C maximum.

Switching Section (Contact Ratings)

Load	Resistive load (cos ϕ =1)	Inductive load (cos ϕ = 0.4, L/R = 7 ms)
Rated load	240 VAC: 3 A, 24 VDC: 3 A	240 VAC: 3 A, 24 VDC: 1 A
Rated carry current	6 A	
Maximum switching voltage	250 VAC, 24 VDC	
Maximum switching current	6 A	
Maximum switching capacity (reference value)	1,440 VA, 144 W	
Min. permissible load (See note.)	5 VDC, 10 mA	
Contact material	Ag) Au	

Note: The above values are based on an operating frequency of 60 operations/min.

Characteristics

Contact resistance (See note 2.)		100 mΩ max.
Operate time (See note 3.)		50 ms max.
Release time (See note 3.)		50 ms max.
Maximum operating frequency	Mechanical	18,000 operations/hr
	Rated load	1,800 operations/hr
Insulation resistance		100 MΩ min. (at 500 VDC)
Dielectric strength		2,500 VAC, 50/60 Hz for 1 min (1,500 VAC between contacts of same polarity)
Vibration	Destruction	10 to 55 Hz, 1.5–mm double amplitude
	Malfunction	10 to 55 Hz, 0.75–mm double amplitude
Shock	Destruction	1,000 m/s^2 (approx. 100G)
	Malfunction	100 m/s^2 (approx. 10G)
Life expectancy	Mechanical	10,000,000 operations min. (at approx. 18,000 operations/hr)
	Electrical	100,000 operations min. (at the rated load and approx. 1,800 operations/hr)
Ambient operating temperature		-10°C to 70°C (no icing)
Ambient operating humidity		35% to 85% RH
Ambient storage temperature		-25°C to 70°C (no icing)
Ambient storage humidity		35% to 85% RH
Weight		Approx. 65 g

Note: 1. The values given above are initial values.
Note: 2. Measurement conditions: 5 VDC, 10 mA, voltage drops.
Note: 3. Measurement conditions: Rated voltage operation
Ambient operating temperature: 23°C
Does not include bounce time.

Characteristics of Safety Relay Socket

Model	Continuous current	Dielectric strength	Insulation resistance
P7S–14□	6 A	2000 VAC for 1 min. between terminals	1000MΩ min (see note)

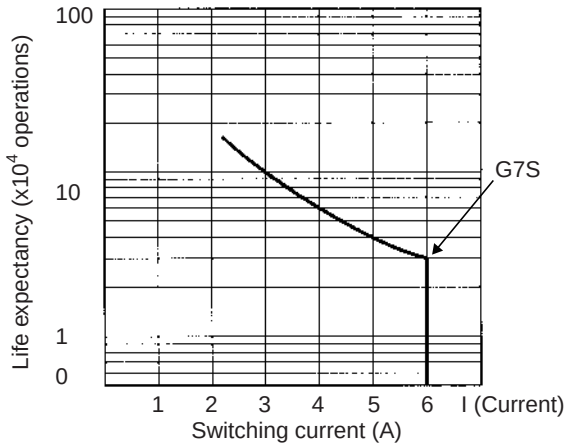
Note: Measurement conditions: Measurement of the same points as for the dielectric strength at 500 VDC.

Approved Standards

VDE0435 (Electrical Relays);Approved by VDE
IEC255 (Electrical Relays); Approved by VDE
EN50205 (Electrical Relays); Approved by VDE
UL508 (Industrial Control Device)
CSA22.2 No.14 (Industrial Control Device)

Engineering Data

Life Expectancy (240 VAC; cosφ=0.4, cosφ=1)



Life Expectancy (AC15, DC13 IEC947–5–1/Table 4)

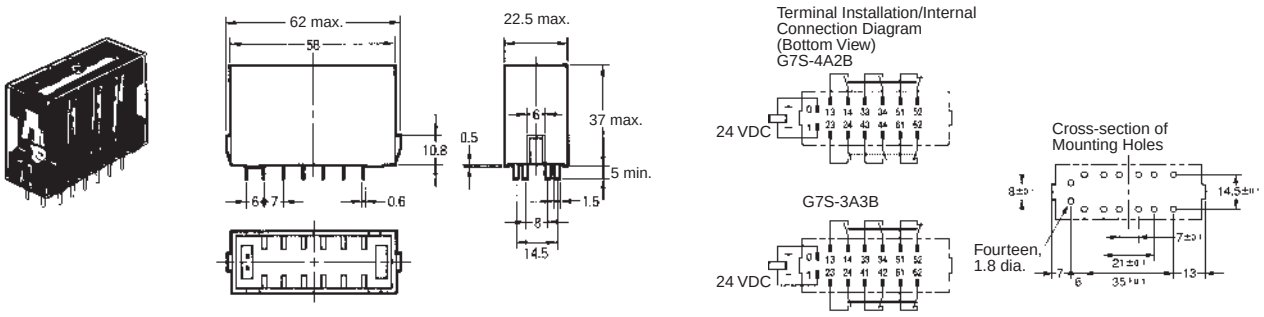
6,050 operations min. (AC15, 240 VAC, 3 A, cosϕ=0.3)
6,050 operations min. (DC13, 24 VDC, 1 A, L/R 100 ms)
VDE approved.

Dimension

Note: All units are in millimeters unless otherwise indicated.

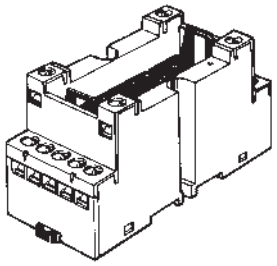
Safety Relays

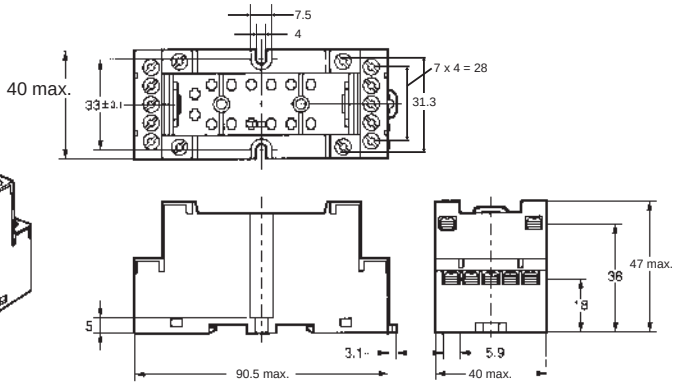
G7S-4A2B
G7S-3A3B



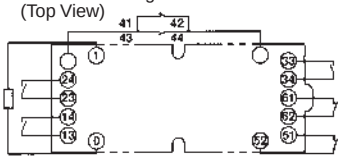
Safety Relay Sockets

P7S-14F Track-mounting Socket

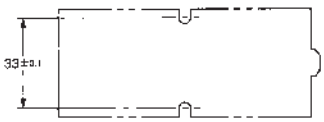




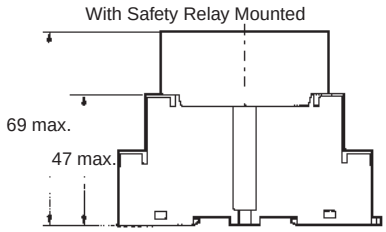
Terminal Installation/Internal Connection Diagram (Top View)



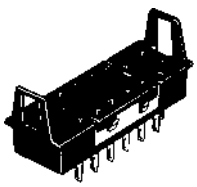
Cross-section of Mounting Holes

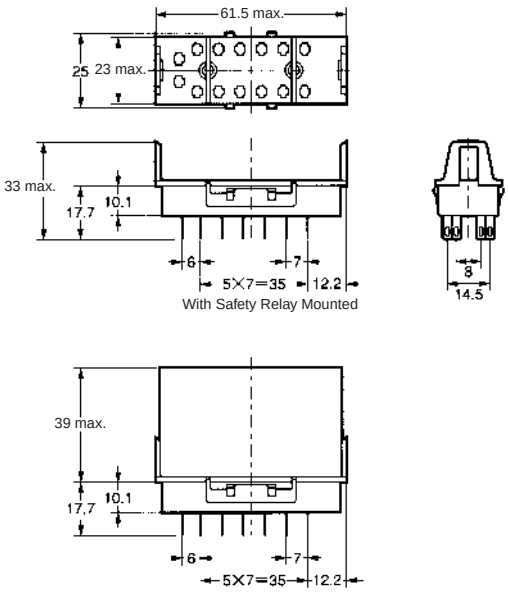


With Safety Relay Mounted

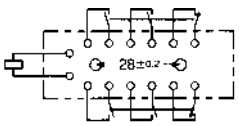


P7S-14A Back-mounting Socket (Solder Terminals)

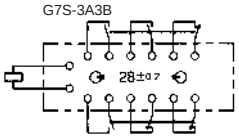




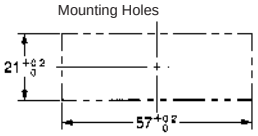
Terminal Installation/Internal Connection Diagram (Bottom View)
G7S-4A2B



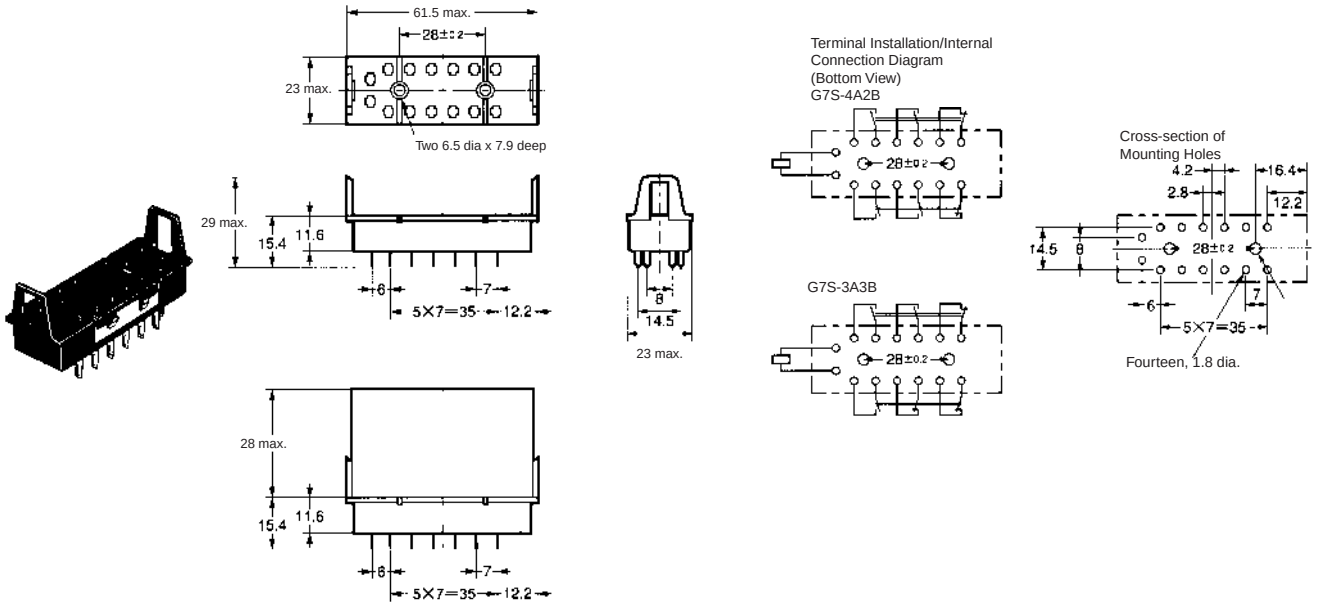
G7S-3A3B



Cross-section of Mounting Holes

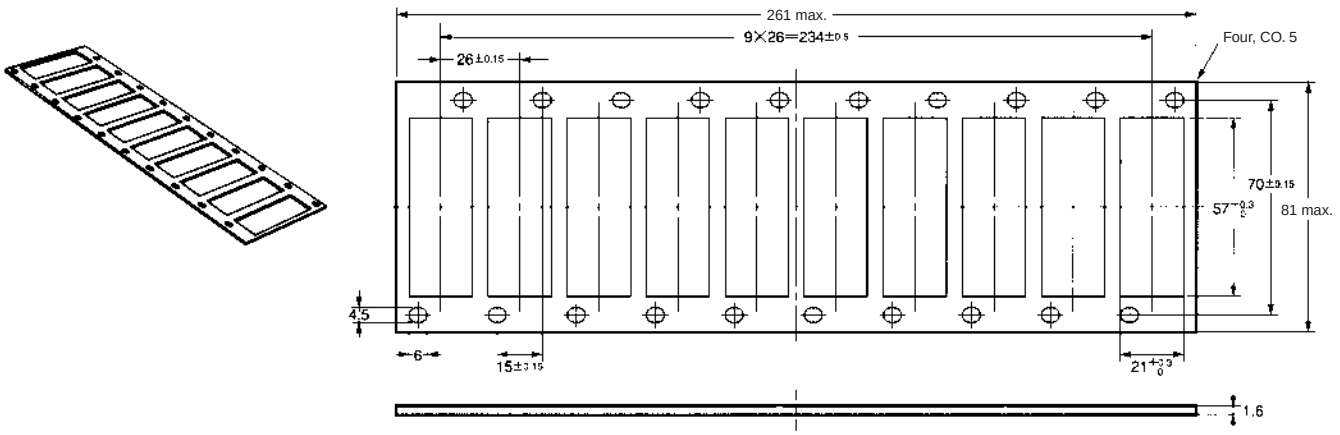


P7S-14P Back-mounting Socket (PCB Terminals)



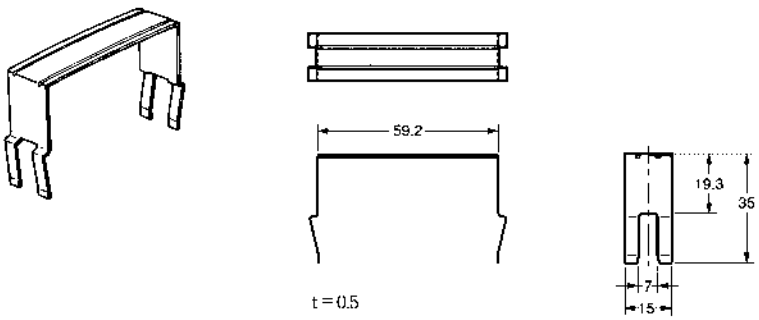
Socket Mounting Plate

P7S-A10 (Special Mounting Plate for P7S-14A)



Relay Removal Tool

P7S-B



Precautions

Forcibly Guided Contacts

When NO contacts are welded, the coil will be non-energized so all NC contacts will maintain a distance between the contacts of 0.5 mm minimum. Likewise if NC contacts are welded, the coil will be energize so all contacts will maintain between each other of 0.5 mm minimum.

Application

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

Safety Relays

A Safety Relay is a Relay with which a safety circuit can be configured. For common precautions when using and handling Relays, refer to OMRON's Relay Catalog.

Contacts

The coil terminals have polarity (positive and negative). Operation is not possible if there are connected in reverse.

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	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

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

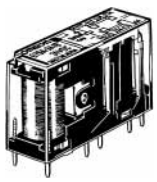
Note: 1. The values listed above are initial values.
2. These times were measured at the rated voltage and an ambient temperature of 23°C. Contact bounce time is not included.
3. Pole 3 refers to terminals 31-32 or 33-34, pole 4 refers to terminals 43-44, pole 5 refers to terminals 53-54, and pole 6 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.

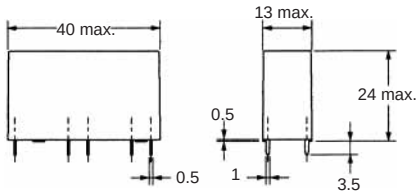
Dimensions

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

Relays with Forcibly Guided Contacts

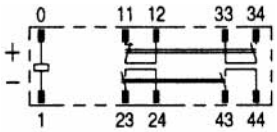
G7SA-3A1B
G7SA-2A2B



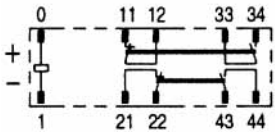


Terminal Arrangement/ Internal Connection Diagram (Bottom View)

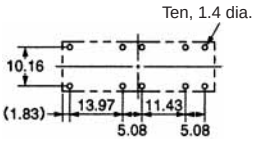
G7SA-3A1B



G7SA-2A2B

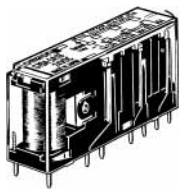


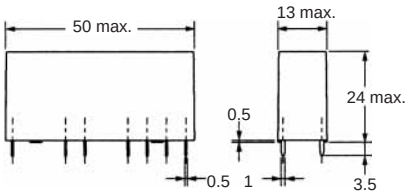
Printed Circuit Board Design Diagram (Bottom View)
(±0.1 tolerance)



Note: Terminals 23-24, 33-34, and 43-44 are normally open. Terminals 11-12 and 21-22 are normally closed.

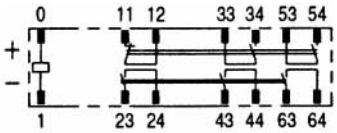
G7SA-5A1B
G7SA-4A2B
G7SA-3A3B



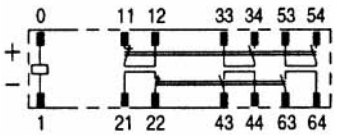


Terminal Arrangement/ Internal Connection Diagram (Bottom View)

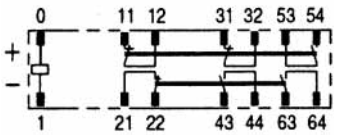
G7SA-5A1B



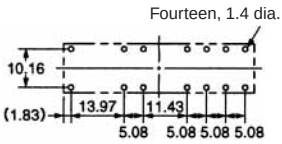
G7SA-4A2B



G7SA-3A3B



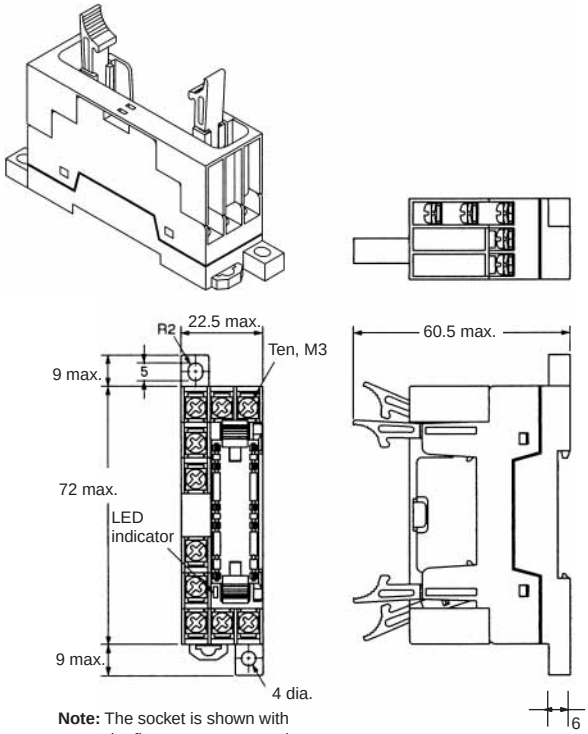
Printed Circuit Board Design Diagram (Bottom View)
(±0.1 tolerance)



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

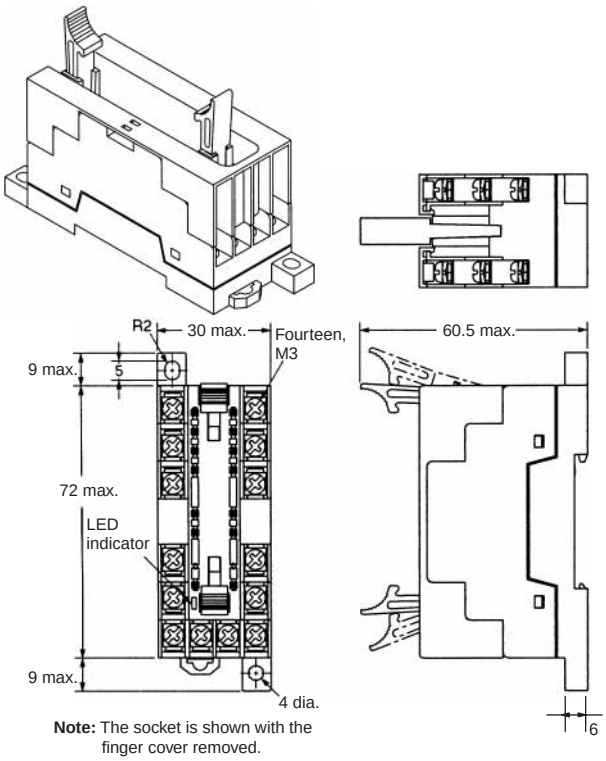


Note: The socket is shown with the finger cover removed.

Note: Only the -ND Sockets have LED indicators.

Track-mounting Socket

P7SA-14F, P7SA-14F-ND

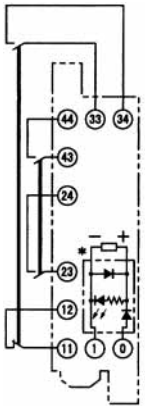


Note: The socket is shown with the finger cover removed.

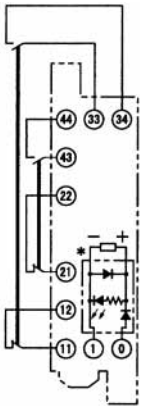
Note: Only the -ND Sockets have LED indicators.

Terminal Installation/Internal Connection Diagram (Top View)

G7SA-3A1B Mounted



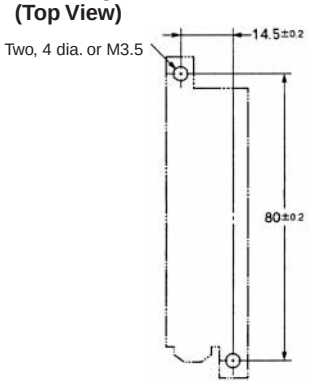
G7SA-2A2B Mounted



* This display circuit is available only for "-ND" models.

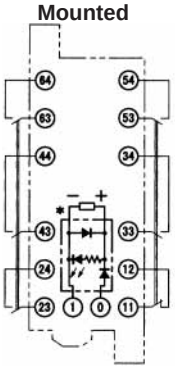
Note: Terminals 23-24, 33-34, and 43-44 are normally open. Terminals 11-12 and 21-22 are normally closed.

Mounting Hole Placement Diagram (Top View)

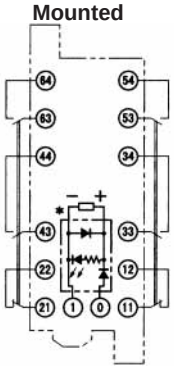


Terminal Arrangement/Internal Connection Diagram (Top View)

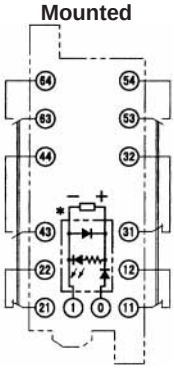
G7SA-5A1B Mounted



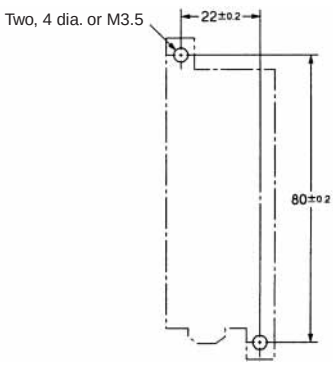
G7SA-4A2B Mounted



G7SA-3A3B Mounted



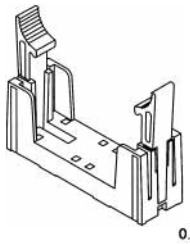
Mounting Hole Placement Diagram (Top View)

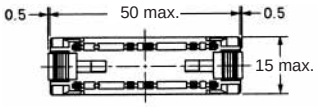


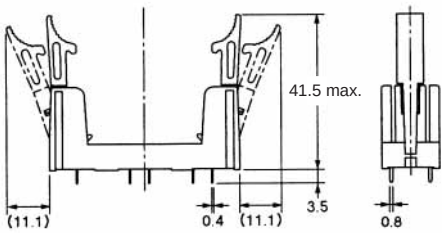
* This display circuit is available only for "-ND" models.

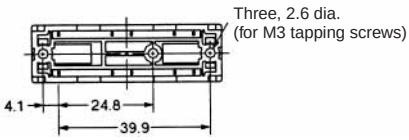
Note: Terminals 23-24, 33-34, 43-44, 53-54, and 63-64 are normally open. Terminals 11-12, 21-22, and 31-32 are normally closed.

P7SA-10P Back-mounting Socket (for PCB)



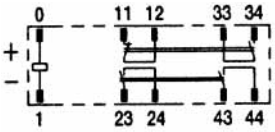




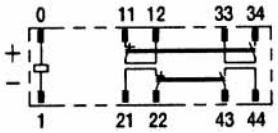


Terminal Arrangement/Internal Connection Diagram (Bottom View)

G7SA-3A1B Mounted

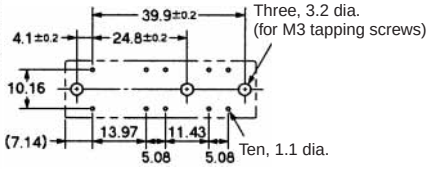


G7SA-2A2B Mounted



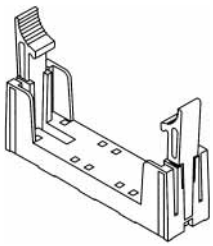
Mounting Hole Placement (Bottom View)

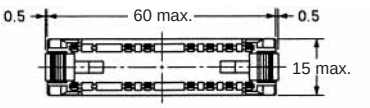
(±0.1 tolerance)

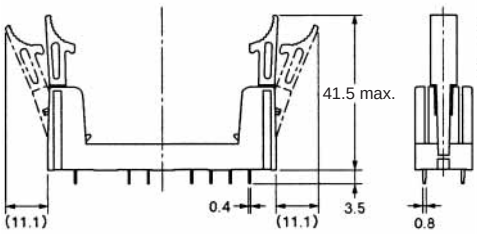


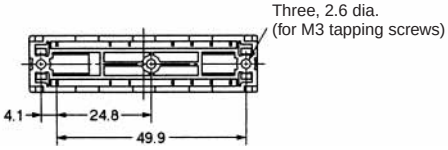
Note: Terminals 23-24, 33-34, and 43-44 are normally open. Terminals 11-12 and 21-22 are normally closed.

P7SA-14P Back-mounting Socket (for PCB)





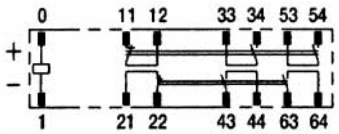




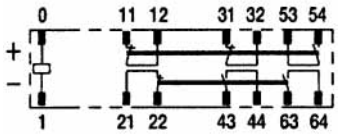
Terminal Arrangement/Internal Connection Diagram (Bottom View)

G7SA-5A1B Mounted

G7SA-4A2B Mounted

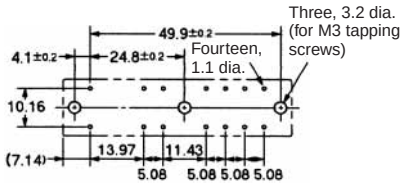


G7SA-3A3B Mounted



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

⚠ Caution

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

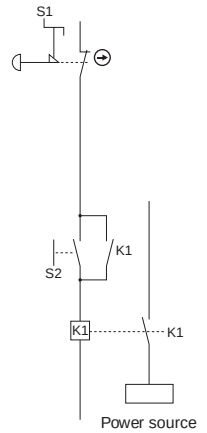
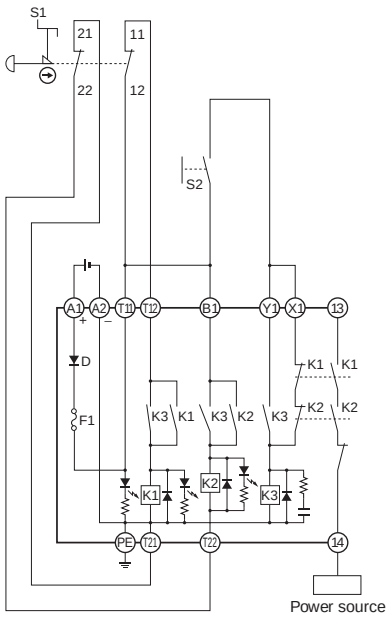


Fig 2



MEMO

Safety Relay Unit (I/O Unit Type)

CQM1-SF200/CS1W-SF200

Same Dimensions as I/O Unit Less Installation Space and Wiring Required

- Safety Relay Unit that can be used as an I/O Unit for OMRON's CQM1H and CS1-series PLCs.
- Requires less installation space and wiring.
- Monitors power supply, output, and internal relays for safety circuits.
- Equipped with four general-purpose input terminals.
- Conforms to EN standards. (TÜV approval)

Ordering Information

I/O Unit Type Emergency-stop Unit

Main contact	Rated voltage	Auxiliary contact	Number of input channels	Number of general-purpose inputs	Model
DPST-NO	24 VDC	None	1 channel or 2 channels possible	4 inputs	CQM1-SF200
					CS1W-SF200

Model Number Legend:

CQM1-□□□□□
1 2 3 4

CQM1: CQM1 I/O Unit Type

CS1W-□□□□□
1 2 3 4

CS1W: CS1 I/O Unit Type

1. **Function**
   SF: I/O Unit Type Emergency-stop Unit
2. **Contact Configuration (Safety Output)**
   2: DPST-NO
3. **Contact Configuration (OFF-delay Output)**
   0: None
4. **Contact Configuration (Auxiliary Output)**
   0: None

Specifications

Ratings

Safety Circuit Block

Power Input

Item	CQM1-SF200	CS1W-SF200
Power supply voltage	24 VDC	
Operating voltage range	85% to 110% of rated power supply voltage	
Power consumption	24 VDC: 1.7 W max.	

Inputs

Item	CQM1-SF200	CS1W-SF200
Input current	75 mA max.	

Contacts

Item	CQM1-SF200	CS1W-SF200
	Resistive load (cos ϕ =1)	
Rated load	250 VAC, 5 A	
Rated carry current	5 A	

General-purpose Input Block

Item	CQM1-SF200	CS1W-SF200
Power supply voltage	24 VDC	
Operating voltage range	85% to 110% of rated power supply voltage	
Input impedance	4.0 kΩ	3.3 kΩ
Input current	6 mA (typical) at 24 VDC	7 mA (typical) at 24 VDC
Must-operate voltage/current	14.4 VDC min./3 mA min.	
Reset voltage/ current	5 VDC max./1 mA max.	
ON/OFF response time	8 ms max. (Settable in the range 1 to 128 ms in the PLC Setup.)	8 ms max. (Settable in the range 0 to 32 ms in the PLC Setup.)
Number of circuits	4 inputs, 1 common	
Simultaneous ON points	All points	
Internal current con-sumption	50 mA max.	100 mA max.

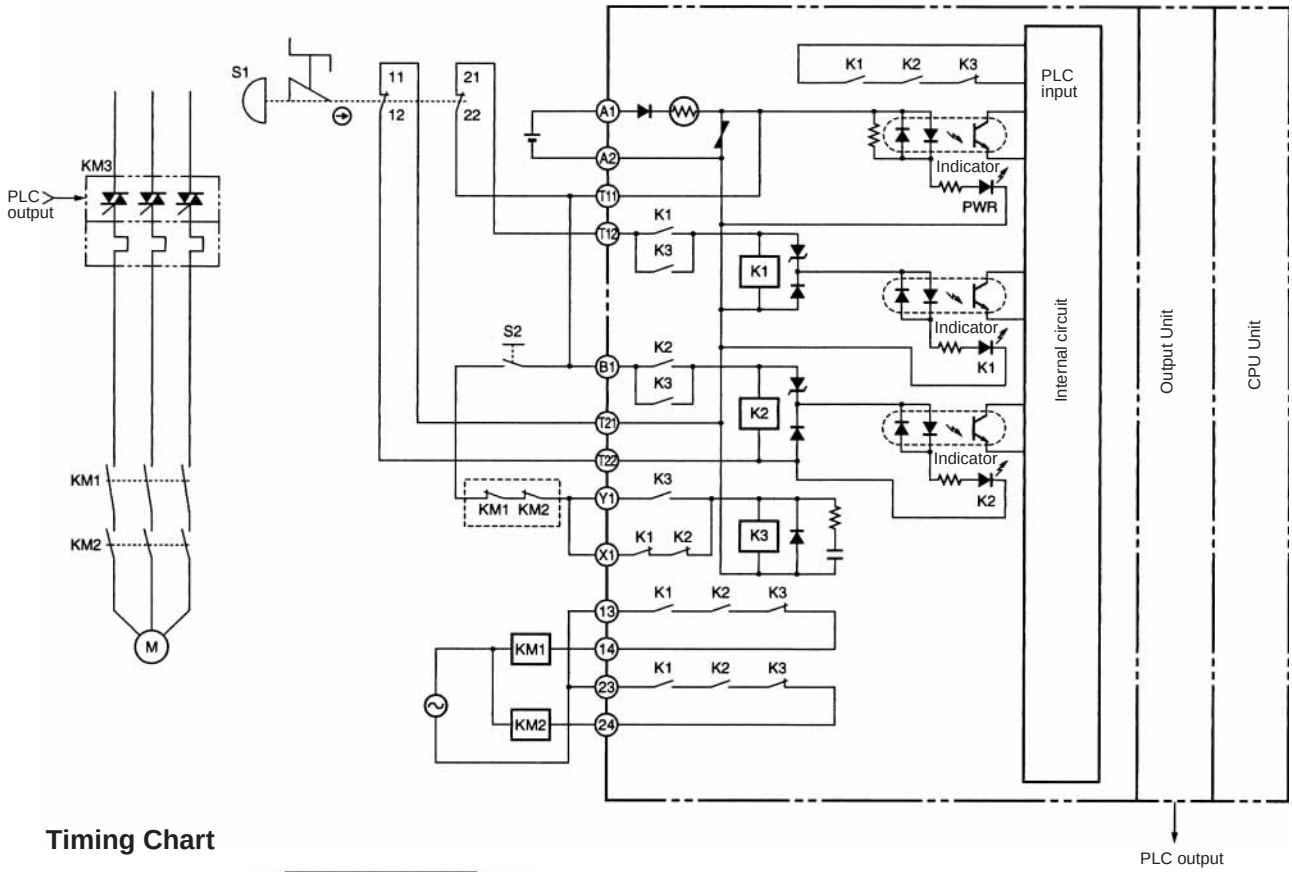
Characteristics

Item		CQM1-SF200	CS1W-SF200
Contact resistance (see note 1)		100 mΩ	
Operating time		300 ms max. (not including bounce time)	
Response time (see note 2)		10 ms max. (not including bounce time)	
Insulation resistance (see note 3)		Between safety circuits and safety output: 20 MΩ min. (at 500 VDC) Between general-purpose inputs and safety output: 20 MΩ min. (at 500 VDC) Between different poles of safety output: 20 MΩ min. (at 500 VDC) Between safety circuits and general-purpose inputs: 20 MΩ min. (at 500 VDC)	
Dielectric strength (see note 3)		Between safety circuits and safety output: 2,500 VAC, 50/60 Hz for 1 min Between general-purpose inputs and safety output: 2,500 VAC, 50/60 Hz for 1 min Between different poles of safety output: 2,500 VAC, 50/60 Hz for 1 min Between safety circuits and general-purpose inputs: 500 VAC, 50/60 Hz for 1 min	
Vibration resistance (see note 3)		10 to 57 Hz at 0.075-mm single amplitude, 57 to 150 Hz at 9.8 m/s^2 for 80 minutes each in X, Y, and Z directions (sweep time 8 minutes x 10 = 80 minutes) Conforms to JIS C0911.	10 to 57 Hz at 0.075-mm single amplitude, 57 to 150 Hz at 9.8 m/s^2 for 80 minutes each in X, Y, and Z directions (sweep time 8 minutes x 10 = 80 minutes) (when mounted on DIN track: 2 to 55 Hz, 2.94 m/s^2 for 20 minutes each in X, Y, and Z directions) Conforms to JIS C0041.
Shock resistance (see note 3)		147 m/s^2, 3 times each in X, Y, and Z directions, Conforms to JIS C0912.	147 m/s^2, 3 times each in X, Y, and Z directions, Conforms to JIS C0041.
Life expectancy	Mechanical	5,000,000 operations min. (at approx. 7,200 operations/hr)	
	Electrical	100,000 operations min. (at approx. 1,800 operations/hr)	
Error rate (P-level) (reference value)		5 VDC, 1 mA	
Ambient operating temperature (see note 3)		0 to 55°C	
Ambient operating humidity (see note 3)		10% to 90% (with no condensation)	
Ambient operating environment (see note 3)		No corrosive gases	
Ambient storage temperature (see note 3)		–20 to 75°C	
Structure		Built into panel	
Approved standards		EN954-1, EN60204-1, UL508, CSA C22.2 No. 14	
EMC		EMI: EN55011 group 1 class A EMS: EN50082-2	
Weight		Approx. 260 g	Approx. 300 g

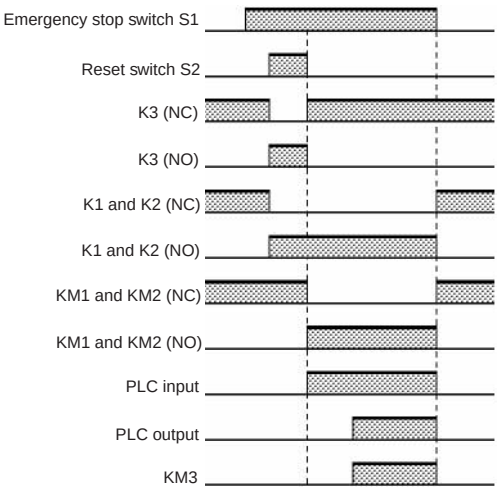
Note: 1. The contact resistance was measured with 1 A at 5 VDC using the voltage-drop method.
2. The response time is the time it takes for the main contact to turn OFF after the input is turned OFF.
3. Measured with the Unit mounted to the PLC.

Application Examples

Two Channels of Emergency Stop Switch Input (Common to CQM1-SF200 and CS1W-SF200)



Timing Chart



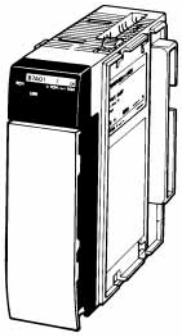
S1:	Emergency stop switch⊖
S2:	Reset switch (momentary operation switch)
KM1 and KM2:	Magnetic Contactor
KM3:	G3J Solid-state Contactor
M:	3-phase motor

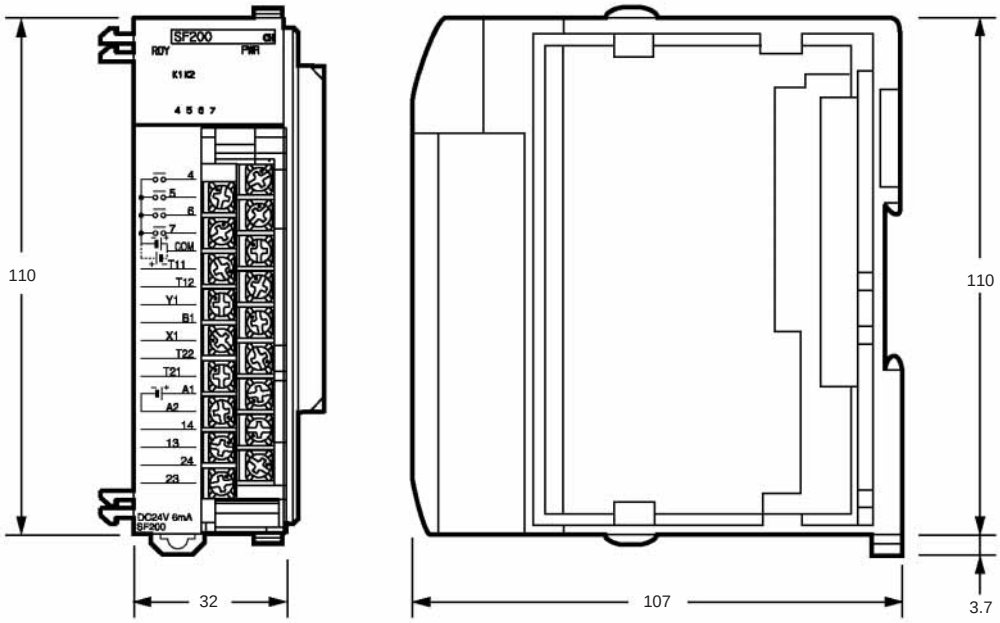
Note: The above circuit example falls under category 4.

Dimensions

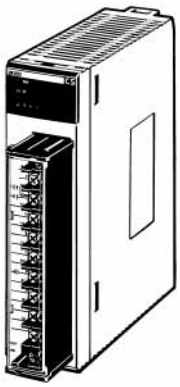
Note: All units are in millimeters unless otherwise indicated.

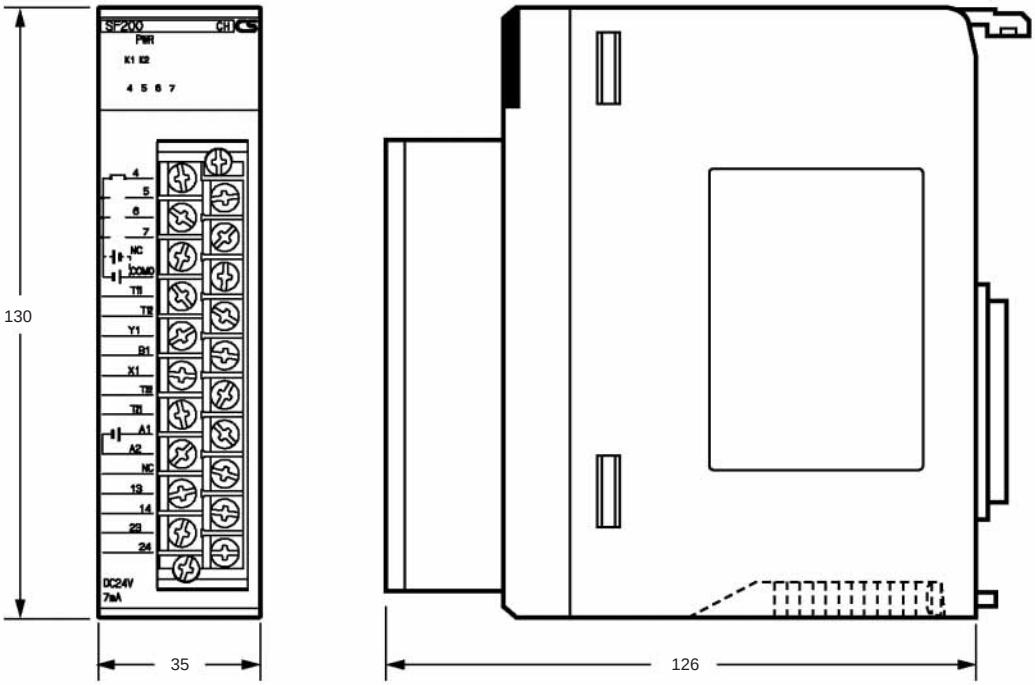
CQM1-SF200





CS1W-SF200





Address Allocations

CQM1-SF200

Addresses are allocated to Basic I/O Units according to the order in which they are mounted in the CPU Block. Addresses (bits) are allocated in word (16-bit) units starting from the left (the position nearest to the CPU Unit) beginning with word 0000.

Note: The 1 to 16-point Units are allocated 16 bits and 17 to 32-point Units are allocated 32 bits. For example, 8-point DC Input Units are allocated bits 00 to 07. CQM1-SF200 is allocated 16 points.

CS1W-SF200

Addresses are allocated to Basic I/O Units according to the order in which they are mounted on the CPU Block. Addresses (bits) are allocated in word (16-bit) units starting from the left (the position farthest from the CPU Unit) beginning with word 0000.

Note: The 1 to 16-point Units are allocated 16 bits and 17 to 32-point Units are allocated 32 bits. For example, 8-point DC Input Units are allocated bits 00 to 15. CS1W-SF200 is allocated 16 points.

MEMO

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
			G1/2	D4NS-2AF
			1/2-14NPT	D4NS-3AF
			M20	D4NS-4AF
		2NC	Pg13.5	D4NS-1BF
			G1/2	D4NS-2BF
			1/2-14NPT	D4NS-3BF
			M20	D4NS-4BF
		2NC/1NO	Pg13.5	D4NS-1CF
			G1/2	D4NS-2CF
			1/2-14NPT	D4NS-3CF
			M20	D4NS-4CF
		3NC	Pg13.5	D4NS-1DF
			G1/2	D4NS-2DF
			1/2-14NPT	D4NS-3DF
			M20	D4NS-4DF
	Slow-action MBB contact	1NC/1NO	Pg13.5	D4NS-1EF
			G1/2	D4NS-2EF
			1/2-14NPT	D4NS-3EF
			M20	D4NS-4EF
		2NC/1NO	Pg13.5	D4NS-1FF
			G1/2	D4NS-2FF
			1/2-14NPT	D4NS-3FF
			M20	D4NS-4FF
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
			G1/2	D4NS-6BF
			M20, includes M20-to-1/2-14NPT conversion adapter	D4NS-7BF
			M20	D4NS-8BF
		2NC/1NO	Pg13.5	D4NS-5CF
			G1/2	D4NS-6CF
			M20, includes M20-to-1/2-14NPT conversion adapter	D4NS-7CF
			M20	D4NS-8CF
		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
		2NC		D4NS-9BF
	Slow-action MBB contact	1NC/1NO		D4NS-9EF

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.

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.

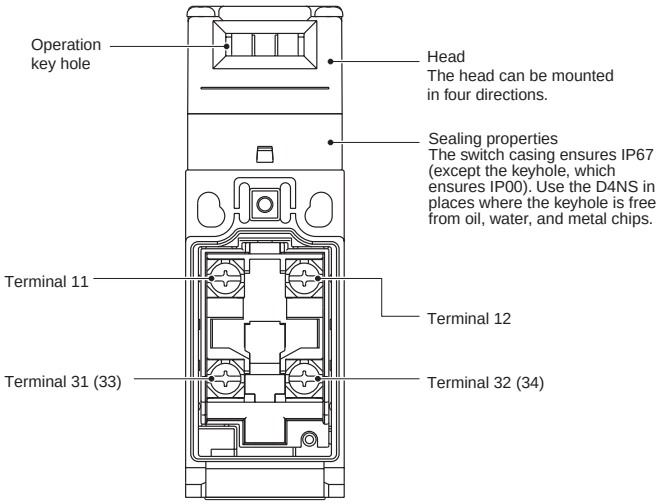
6. These figures are minimum requirements for safe operation.

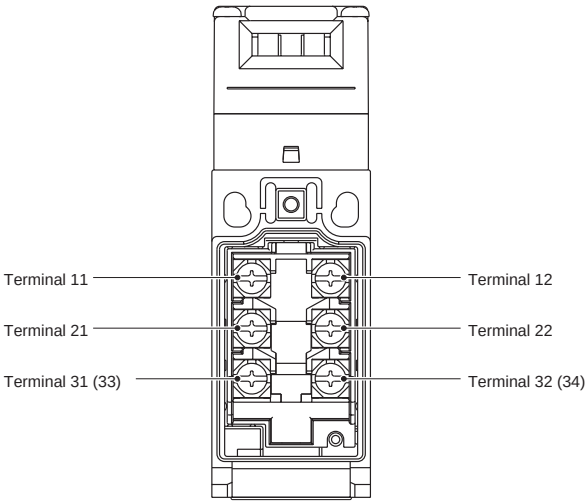
7. This value will vary with the switching frequency, environment, and reliability level. Confirm that correct operation is possible with the actual load beforehand.

Nomenclature

Structure

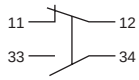
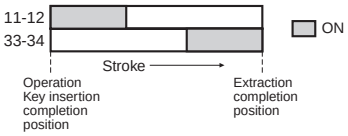
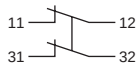
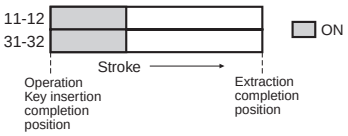
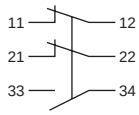
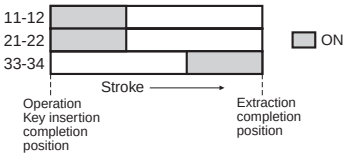
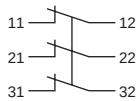
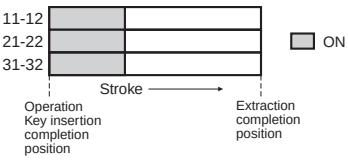
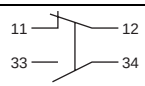
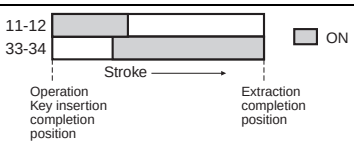
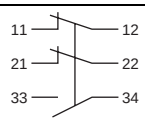
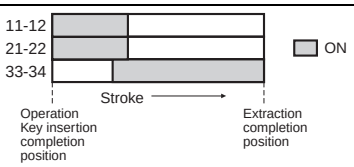
D4NS-□A□, D4NS-□B□, D4NS-□E□
D4NS-□C□, D4NS-□D□, D4NS-□F□





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.

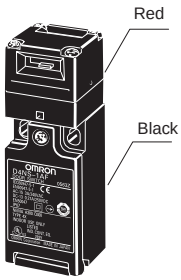
Dimensions/Operating Characteristics

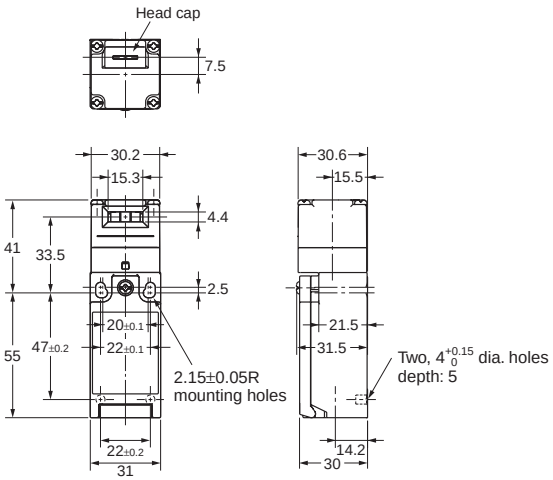
Note: All units are in millimeters unless otherwise indicated.

Switches

1-conduit Models

D4NS-1□F
D4NS-2□F
D4NS-3□F
D4NS-4□F



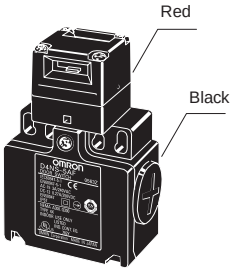


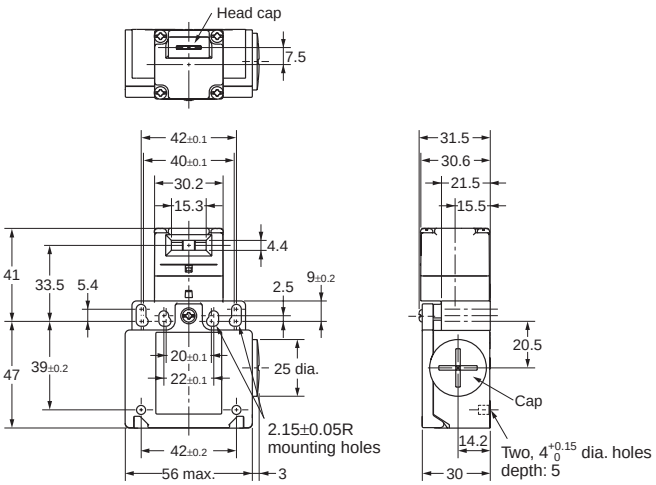
Operating characteristics	D4NS-1□F D4NS-2□F D4NS-3□F D4NS-4□F
Key insertion force Key extraction force	15 N max. 30 N max.
Pretravel (PT)	6±3 mm
Total travel (TT)	(28 mm)
Direct opening force* Direct opening stroke*	60 N min. 10 mm min.

* Always maintain the above operating characteristics for safe use.

2-conduit Models

D4NS-5□F
D4NS-6□F
D4NS-7□F
D4NS-8□F



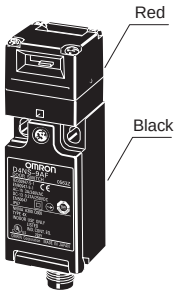


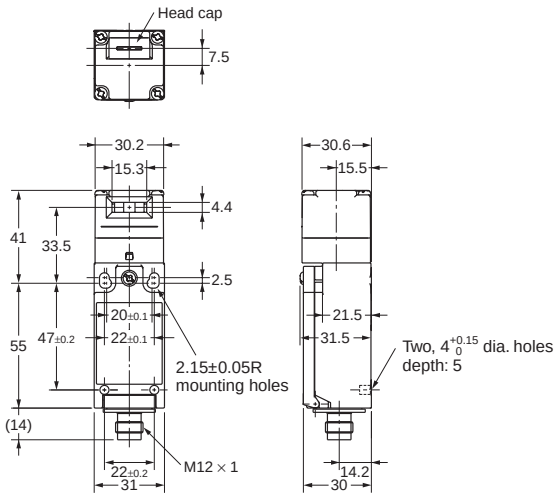
Operating characteristics	D4NS-5□F D4NS-6□F D4NS-7□F D4NS-8□F
Key insertion force Key extraction force	15 N max. 30 N max.
Pretravel (PT)	6±3 mm
Total travel (TT)	(28 mm)
Direct opening force* Direct opening stroke*	60 N min. 10 mm min.

* 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.

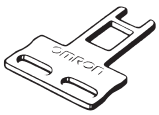
* Always maintain the above operating characteristics for safe use.

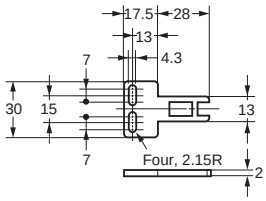
Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

Operation Keys

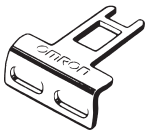
Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

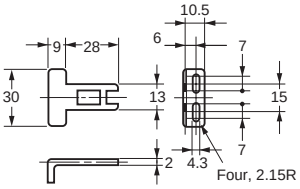
D4DS-K1



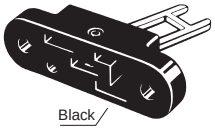


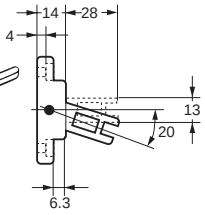
D4DS-K2

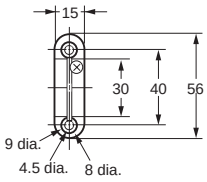




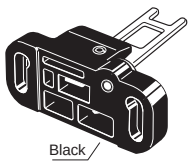
D4DS-K3

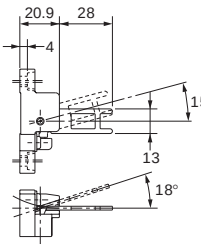


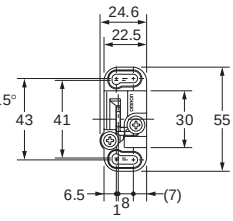




D4DS-K5



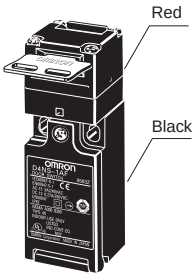


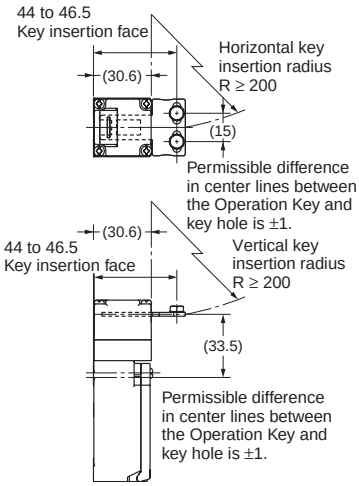


With Operation Key Inserted (Relationship between Insertion Radius and Insertion Hole)

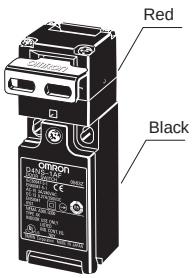
Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

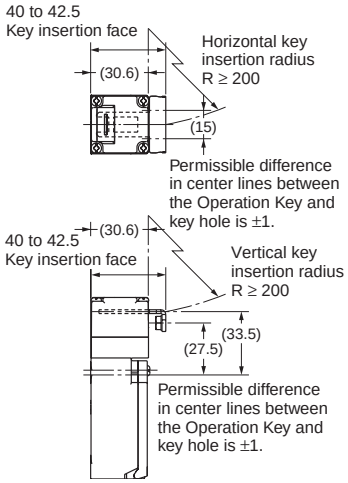
D4NS-1□F + D4DS-K1



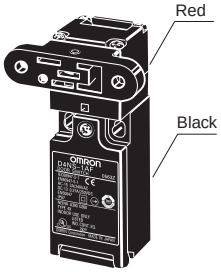


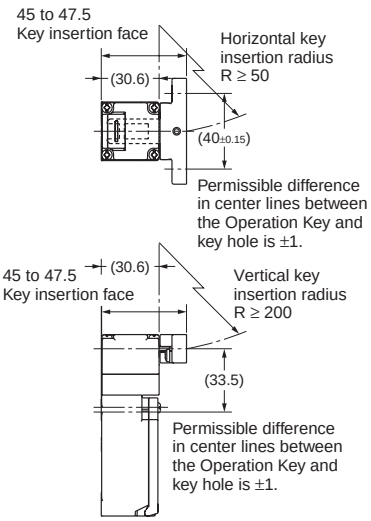
D4NS-1□F + D4DS-K2



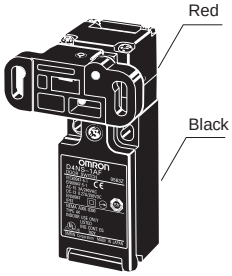


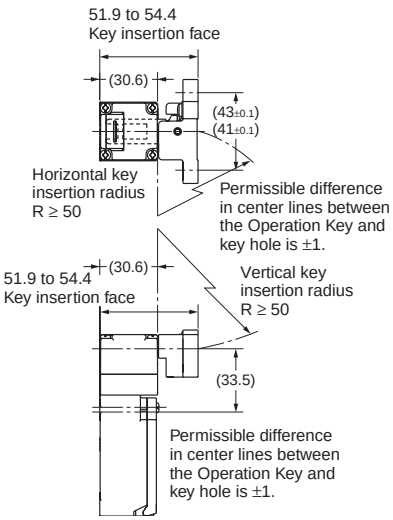
D4NS-1□F + D4DS-K3





D4NS-1□F + D4DS-K5





Safety Precautions

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

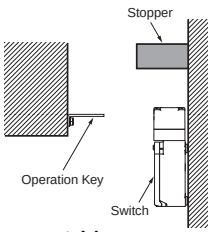
⚠ CAUTION

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

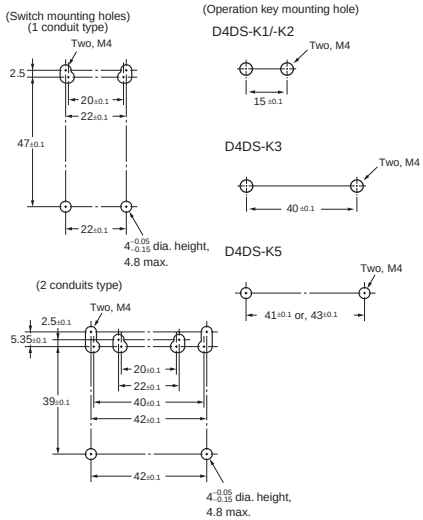
- The switch is intended for indoor use only.
- Do not use your D4NS outdoor, or the switch will malfunction.
- Do not use your D4NS in the atmosphere of hazardous gases (H2S, SO2, NH3, HNO3, CI2, etc.) or high temperature and humidity, or it will cause the imperfect closing of the contacts or the breakage 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.

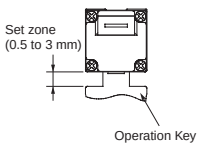
3. Head direction

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.

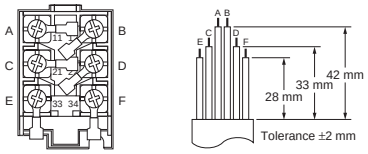
The closed door must be secured with a hook or by similar means.



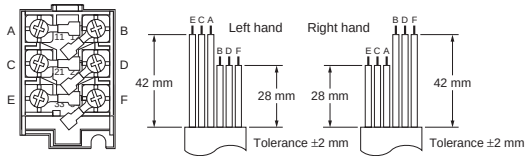
5. Wiring

- 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)

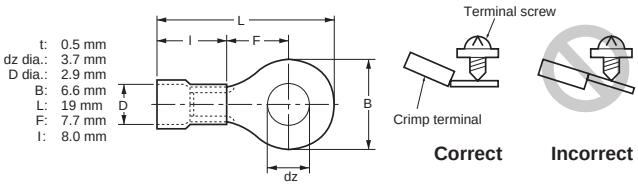


- Do not push the ring connector and the likes into the opening between the parts in order to prevent the case from being broken and deformed.
- Use terminals having the thickness of 0.5 mm or less to avoid the contact between the terminal and the switch case inside.

  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.

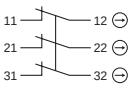


6. Contact arrangement

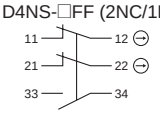
- The following show a safety contact and an auxiliary contact for 3 contacts and 2 contacts types.

(Screw terminal type)

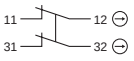
D4NS-□DF (3NC)



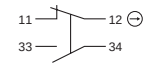
D4NS-□CF (2NC/1NO)
D4NS-□FF (2NC/1NO (MBB))



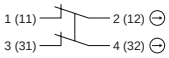
D4NS-□BF (2NC)



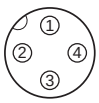
D4NS-□AF (1NC/1NO)
D4NS-□FF (1NC/1NO (MBB))



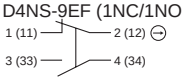
D4NS-9BF (2NC)



(Connector type)



D4NS-9AF (1NC/1NO)
D4NS-9EF (1NC/1NO (MBB))



Pin No. (Terminal No.)

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

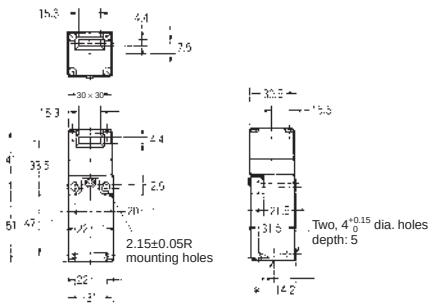
Operation Key

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

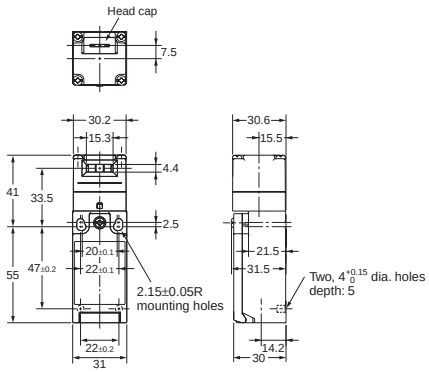
All of the above Operation Keys can be used with the D4NS.

Dimensions (Unit: mm)

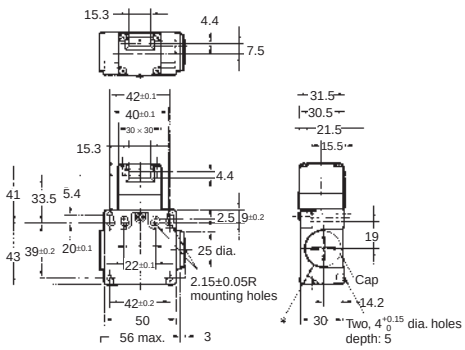
Discontinued Models (1-conduit D4DS)



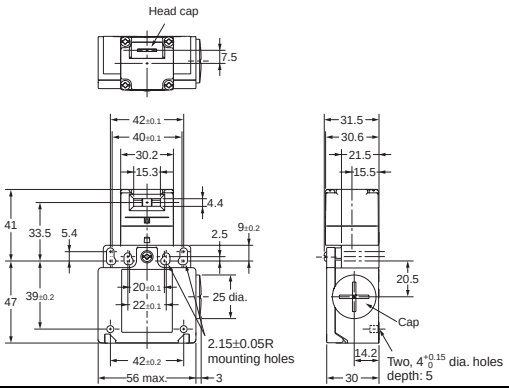
Replacement products (1-conduit D4NS)



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."

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.

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

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)

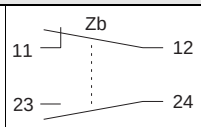
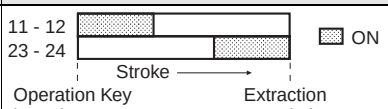
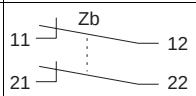
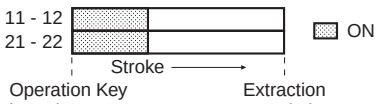
Note: 1. The above values are initial values.

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)

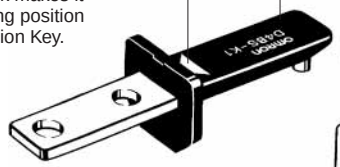
Model	Contact form		Diagram	Remarks
D4BS-□5□S	1NC/1NO			Only NC contact 11-12 has an approved direct opening mechanism. ⊖ Terminals 11-12 and 23-24 can be used as unlike poles.
D4BS-□A□S	2NC			NC contacts 11-12 and 21-22 have an approved direct opening mechanism. ⊖ Terminals 11-12 and 21-22 can be used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

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

Nomenclature

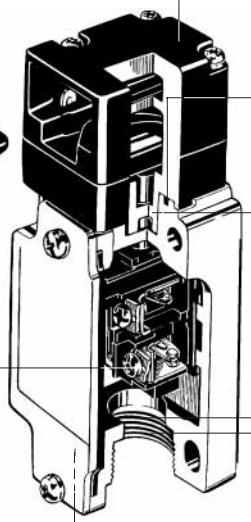
Operation Key
D4BS's exclusive-use Operation Key is provided to assure accurate switching operation.

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



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.



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).

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.)

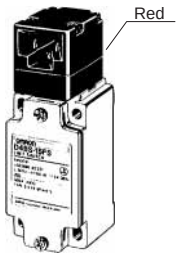
Dimensions

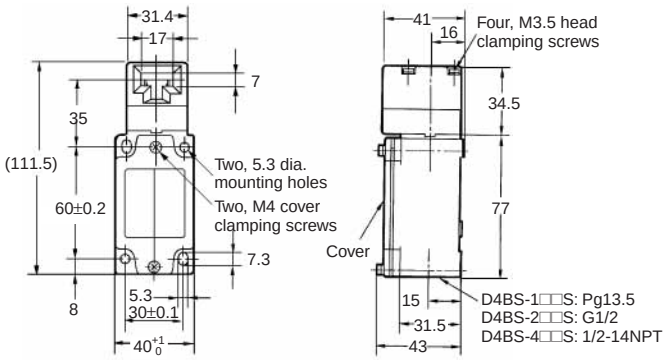
Note: 1. All units are in millimeters unless otherwise indicated.
2. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
3. The conduit thread varies with the model as follows:.

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

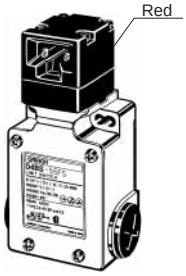
1-conduit
D4BS-1□□S
D4BS-2□□S
D4BS-4□□S

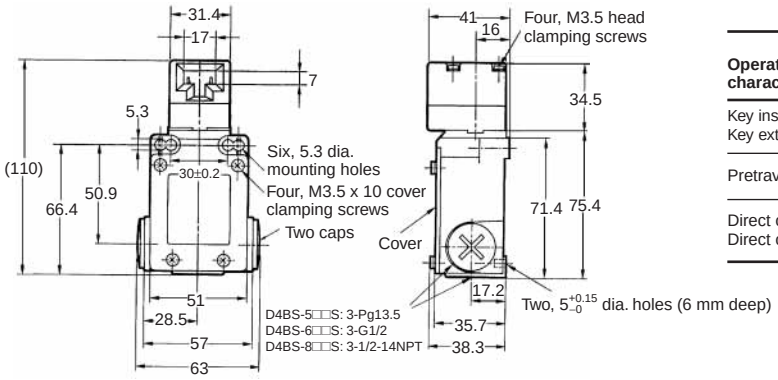




Operating characteristics	D4BS-1□□S D4BS-2□□S D4BS-4□□S
Key insertion force Key extraction force	19.61 N max. 19.61 N max.
Pretravel (PT)	10±5 mm
Direct opening force Direct opening stroke	19.61 N min. 20 mm min.

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

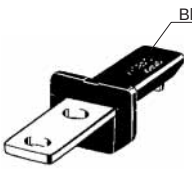


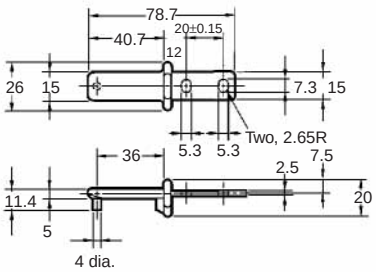


Operating characteristics	D4BS-5□□S D4BS-6□□S D4BS-8□□S
Key insertion force Key extraction force	19.61 N max. 19.61 N max.
Pretravel (PT)	10±5 mm
Direct opening force Direct opening stroke	19.61 N min. 20 mm min.

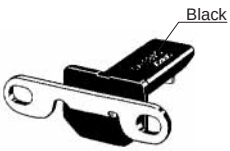
Operation Keys

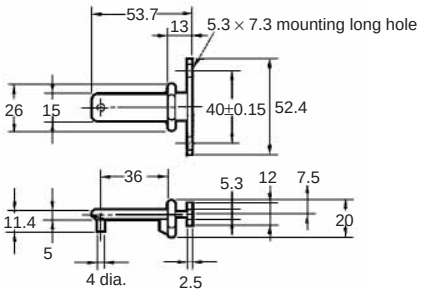
D4BS-K1



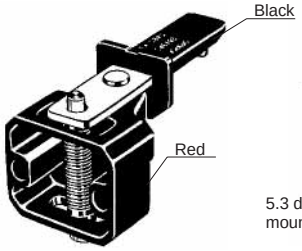


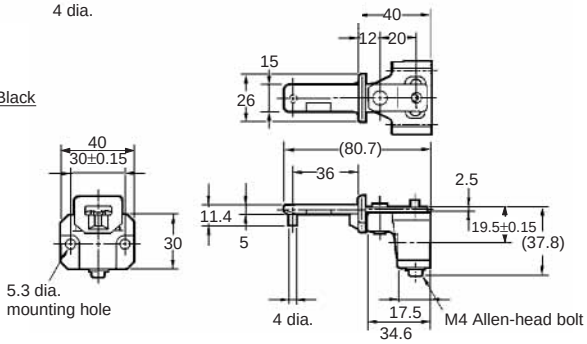
D4BS-K2





D4BS-K3

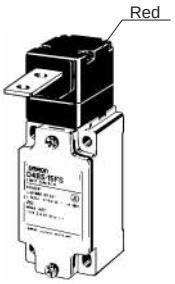


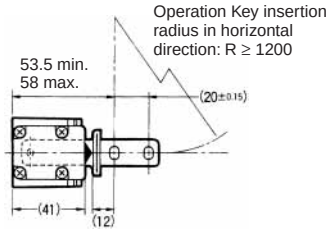


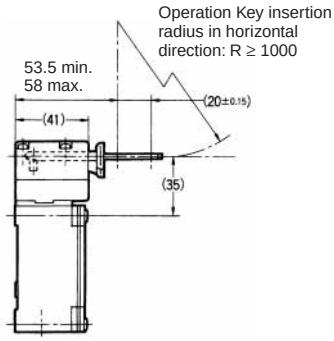
With Operation Key Inserted

Horizontal Mounting

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

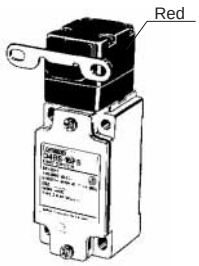


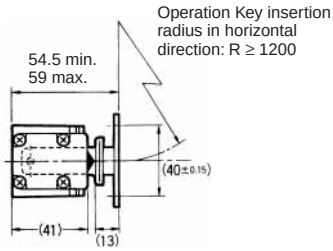


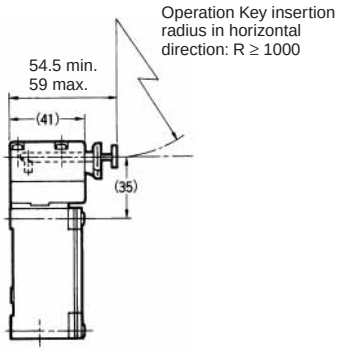


Vertical Mounting

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

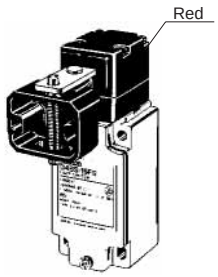


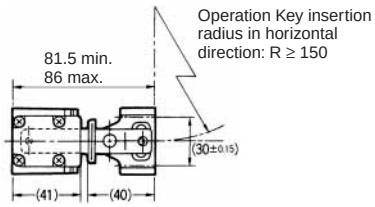


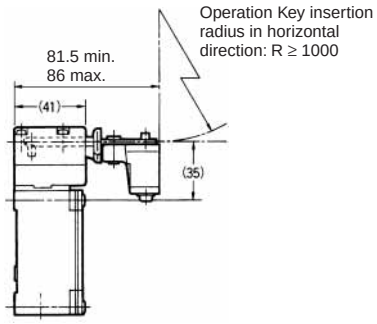


Adjustable Mounting (Horizontal)

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

⚠ 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.

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.

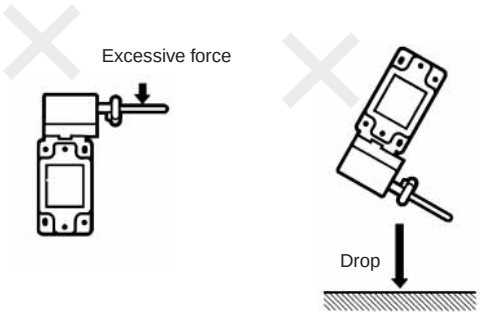
Do not use the D4BS in the following locations:

- 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.

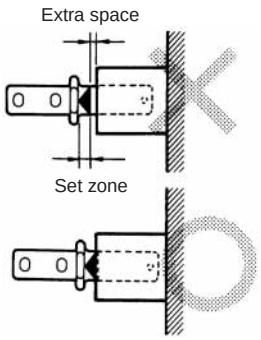
Do not impose excessive force on the Operation Key inserted into the D4BS or drop the D4BS with the Operation Key inserted, otherwise the Operation Key may deform or break.



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

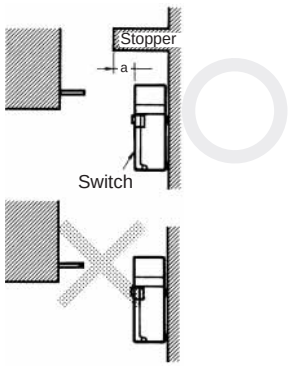
Securing the Door

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.



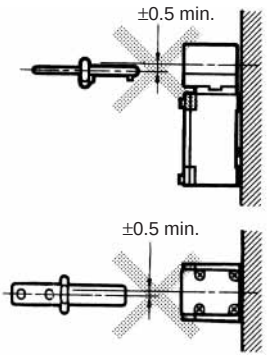
Mounting

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.

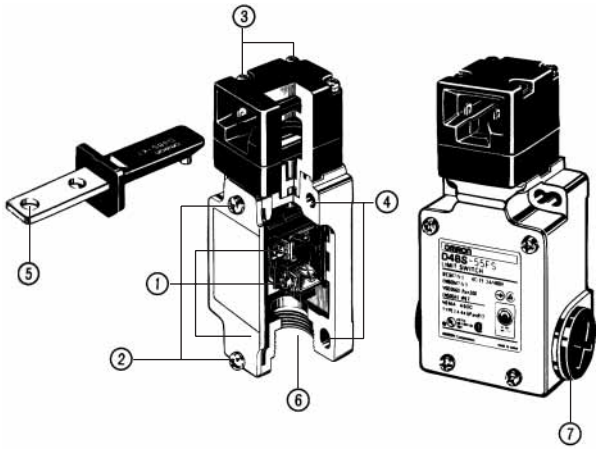


Other

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.



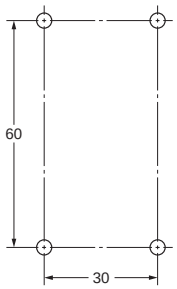
No.	Type	Torque
1	M3.5 terminal screw (including ground terminal screw)	0.59 to 0.78 N·m
2	Cover mounting screw (see note 1)	1.18 to 1.37 N·m
3	Head mounting screw	0.78 to 0.98 N·m
4	M5 body mounting screw (see note 2)	4.90 to 5.88 N·m
5	Operation Key mounting screw	2.35 to 2.75 N·m
6	Connector	1.77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

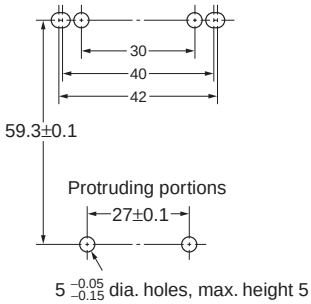
2. Apply a torque of 4.90 to 5.88 N·m in the case of an Allen-head bolt. If it is a pan head screw, apply a torque of 2.35 to 2.75 N·m.

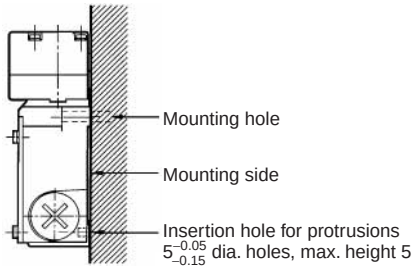
Mounting Dimensions (M5)

Standard Model



Three-conduit Model

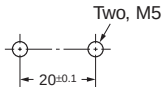




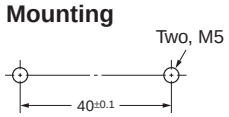
The D4BS can be mounted more securely by adding two protruding portions, each of which is 5 mm maximum in height and 5 $^{-0.05}/_{-0.15}$ mm in diameter as shown below.

Operating Key Mounting Dimensions

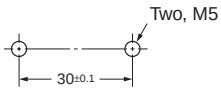
Horizontal Mounting



Vertical Mounting



Adjustable Mounting (Horizontal)



Changes in Head Mounting Direction

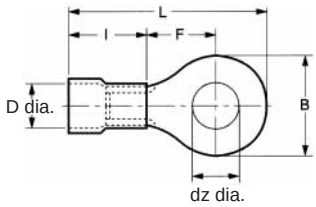
By removing the screws on the four corners of the head, the head can be reset in any of four directions. The head direction can be changed with or without the Operation Key inserted in the head. Make sure that no foreign materials penetrate through the head and that the head is tightened securely within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

Wiring

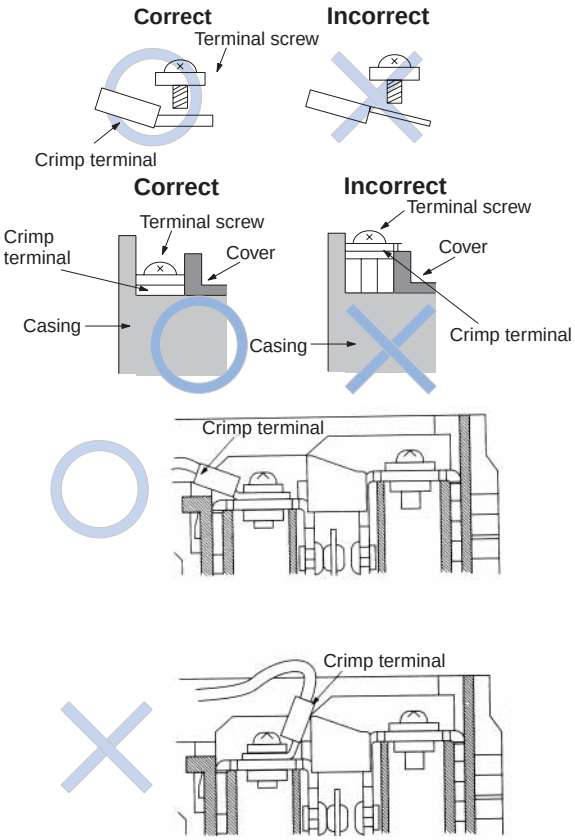
Do not connect the lead wires directly to the terminals. Connect the lead wires through insulation tubes and M3.5 crimp terminals. Tighten each terminal screw within the proper torque range.

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

dz dia.:	3.7
D dia.:	4.5
B:	7.0
L:	20.2
F:	7.7
I:	9.0 (mm)



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.

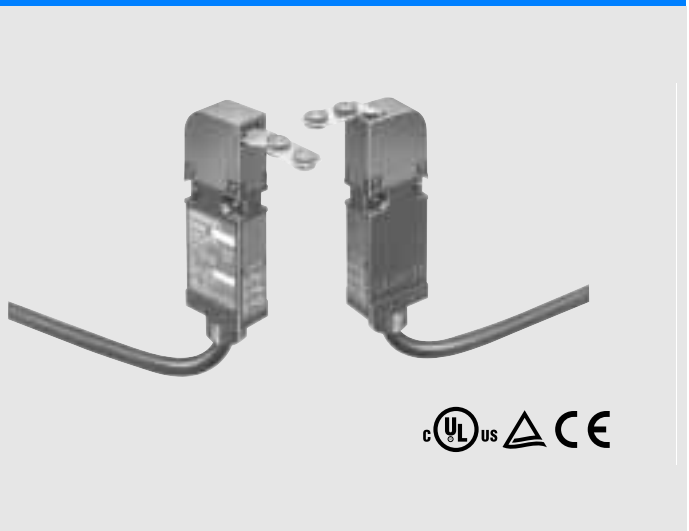
MEMO

Safety-door Switch

D4GS-N

Slim Safety-door Switches with IP67 Rating

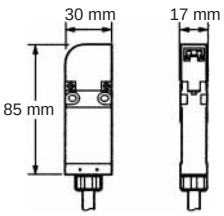
- The slim safety-door switches with a three-terminal contact construction.
- Reversible design allowing either front or rear mounting.
- Built-in switches with two- or three-terminal contact construction are available.
- Operation Key with rubber mounting hole to absorb vibration and shock.



Features

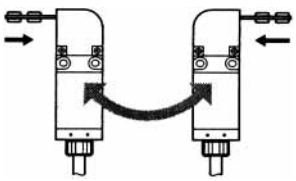
Slim Safety-door Switches with 3-terminal Contact Construction

Thin and 1/2 the size as OMRON's previous models.



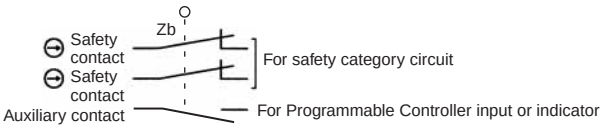
Reversible Design

Front and rear mounting are both possible.



Built-in Switches

Two- and three-terminal contact models are available.



Note: The safety contacts are direct opening contacts approved by EN and each of them is indicated with the mark ⊖.

Key Mounting Hole

The key mounting hole is designed with rubber to absorb vibration and shock.

IP67 Degree of Protection

(Applicable to main body only; Operation Key insertion face meets IP00.)

The D4GS-N uses rust-resistant materials and incorporates a drain opening as effective countermeasures against problems caused by water.

Note: IP67 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.

Safety Standards

Meeting EN (TÜV) Standards and CE marking requirements along with a variety of international standard requirements, such as UL and CSA requirements. All NC contacts satisfy requirements for the direct opening mechanism.

Model Number Structure

Model Number Legend

Switch
D4GS-N□□-□
1 2 3

1. Built-in Switch
1: 1NC/1NO (slow-action)
2: 2NC (slow-action)
3: 2NC/1NO (slow-action)
4: 3NC (slow-action)

2. Direction of Operation Key Insertion
R: Horizontal
T: Vertical

3. Cable Length
Blank: 1 m
3: 3 m
5: 5 m

Operation Key
D4GS-NK□
1

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

Ordering Information

List of Models

Switches

Appearance	Direction of Operation Key insertion	Cable length	1NC/1NO (Slow-action)	2NC (Slow-action)	2NC/1NO (Slow-action)	3NC (Slow-action)
	Horizontal	1 m	D4GS-N1R	D4GS-N2R	D4GS-N3R	D4GS-N4R
		3 m	D4GS-N1R-3	D4GS-N2R-3	D4GS-N3R-3	D4GS-N4R-3
		5 m	D4GS-N1R-5	D4GS-N2R-5	D4GS-N3R-5	D4GS-N4R-5
	Vertical	1 m	D4GS-N1T	D4GS-N2T	D4GS-N3T	D4GS-N4T
		3 m	D4GS-N1T-3	D4GS-N2T-3	D4GS-N3T-3	D4GS-N4T-3
		5 m	D4GS-N1T-5	D4GS-N2T-5	D4GS-N3T-5	D4GS-N4T-5

Operation Keys (Order Separately)

Type	Model
Horizontal mounting 	D4GS-NK1
Vertical mounting 	D4GS-NK2
Adjustable mounting (Vertical) 	D4GS-NK4

Specifications

Approved Standards

Agency	Standard	File No.
TÜV Rheinland	EN60947-5-1 GS-ET-15	J2051125 (Direct opening: approved)
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
EN1088
EN60204-1

Approved Standard Ratings

TÜV (EN60947-5-1)

Item	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 IEC60269 as a short-circuit protection device.

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

C300

Rated voltage	Carry current	Current (A)		Voltage (VA)	
		Make	Break	Make	Break
120 VAC	2.5 A	15	1.5	1,800	180
240 VAC		7.5	0.75		

Q300

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

Characteristics

Degree of protection (see note 1)	Body: IP67 (EN60947-5-1) (Operation Key insertion face: IP00)
Durability (see note 2)	Mechanical:1,000,000 times min. Electrical:100,000 times min. (1-A resistive load at 125 VAC) (see note 3)
Operating speed	0.1 to 0.5 m/s
Contact gap	2 x 2 mm min.
Operating frequency	30 operations/minute
Direct opening force (see note 4)	60 N min.
Direct opening travel (see note 4)	10 mm min.
Insulation resistance	100 MΩ min. (at 500 VDC) between terminals of the same polarities, between terminals of different polarities, and between each terminal and non-current carrying metal parts
Minimum applicable load (see note 5)	4 mA at 24 VDC
Contact resistance	300 mΩ max. (Initial value with 1-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 each terminal and non-current carrying metal parts: Uimp 6 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 (I_{th})	2.5 A (EN60947-5-1)
Protection against electric shock	Class II (double insulation) (IEC60536)
Vibration resistance	Malfunction:10 to 55 Hz, 0.35-mm single amplitude
Shock resistance	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.: 7.2 mm
Weight	Approx. 120 g (D4GS-N1R, 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.
Although the switch box is protected from dust, oil, or water penetration, do not use the D4GS-N in places where dust, oil, water, or chemicals may penetrate through the key hole on the head, otherwise Switch damage or malfunctioning may occur.

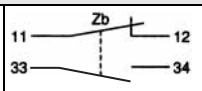
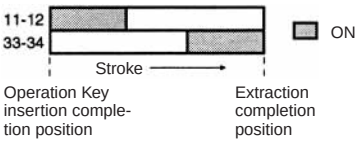
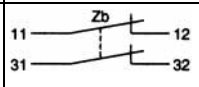
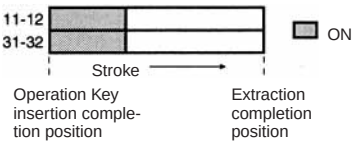
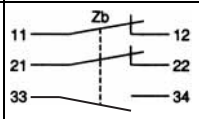
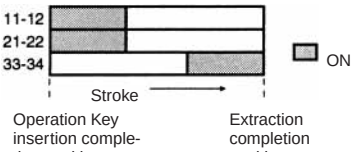
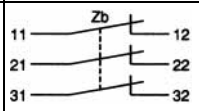
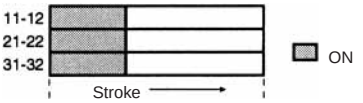
2. The durability is for an ambient temperature of 5°C to 35°C and an ambient humidity of 40% to 70%.

3. When the ambient temperature is 35°C or higher, do not apply 1 A at 125 VAC to more than one circuit.

4. These figures are minimum requirements for safe operation.

5. The value given for minimum applicable load is a reference value for micro-loads. 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.

Contact Form (Diagrams Show State with Key Inserted)

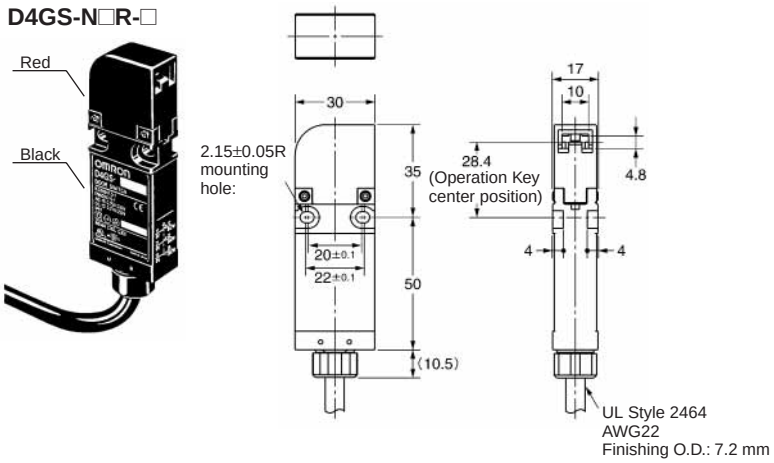
Model	Contact		Diagram	Remarks
D4GS-N1□-□	1NC/1NO			Only NC contact 11-12 has an approved direct opening mechanism. ⊖ The terminals 11-12 and 33-34 can be used as unlike poles.
D4GS-N2□-□	2NC			NC contacts 11-12 and 31-32 have an approved direct opening mechanism. ⊖ The terminals 11-12 and 31-32 can be used as unlike poles.
D4GS-N3□-□	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.
D4GS-N4□-□	3NC			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.

Dimensions

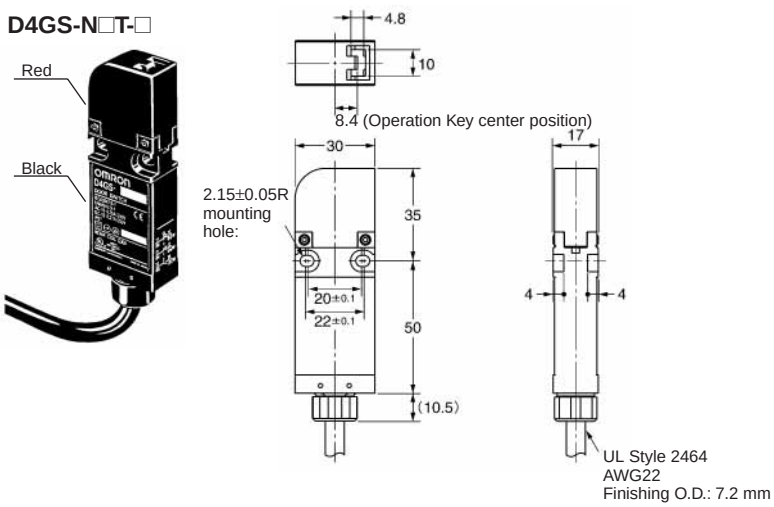
Note: 1. All units are in millimeters unless otherwise indicated.
2. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

Switches

D4GS-N□R-□



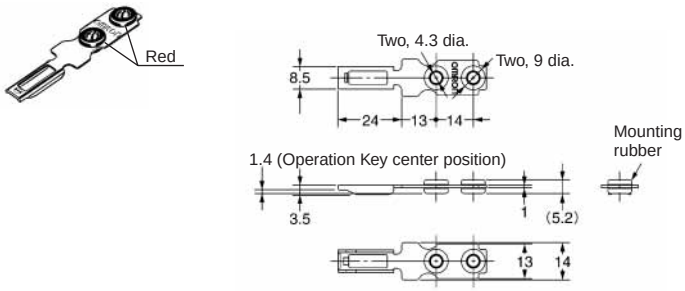
D4GS-N□T-□



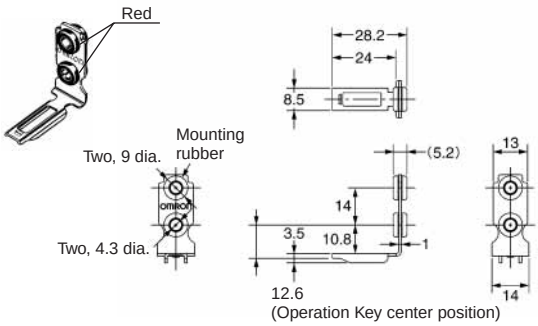
Operating characteristics	Model
Key insertion force	15 N max.
Key extraction force	30 N max.
Movement before being locked	(22 mm) min.
Direct opening force	60 N min.
Direct opening stroke	10 mm min.

Operation Keys

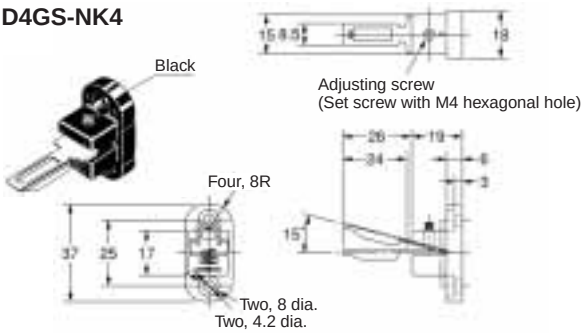
D4GS-NK1



D4GS-NK2

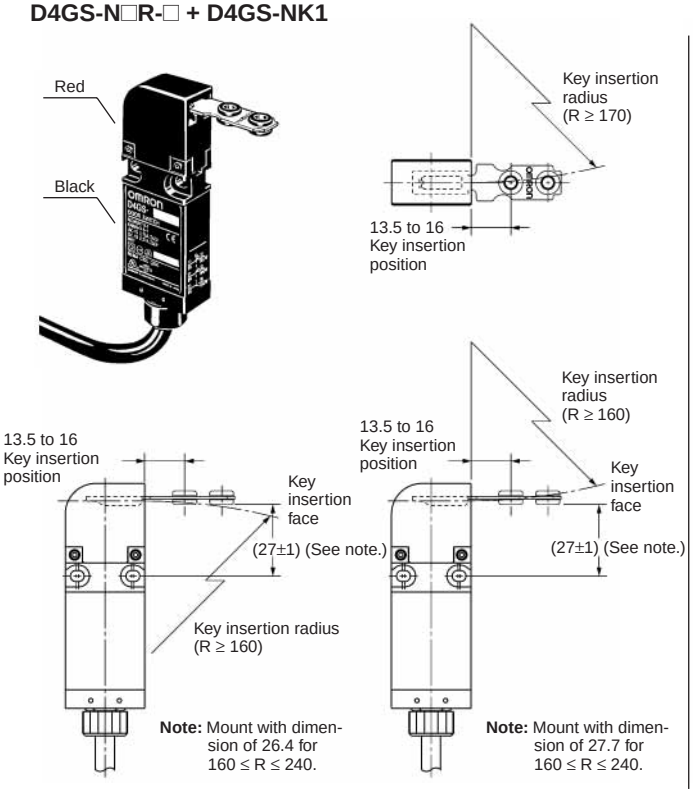


D4GS-NK4



With Operation Key Inserted

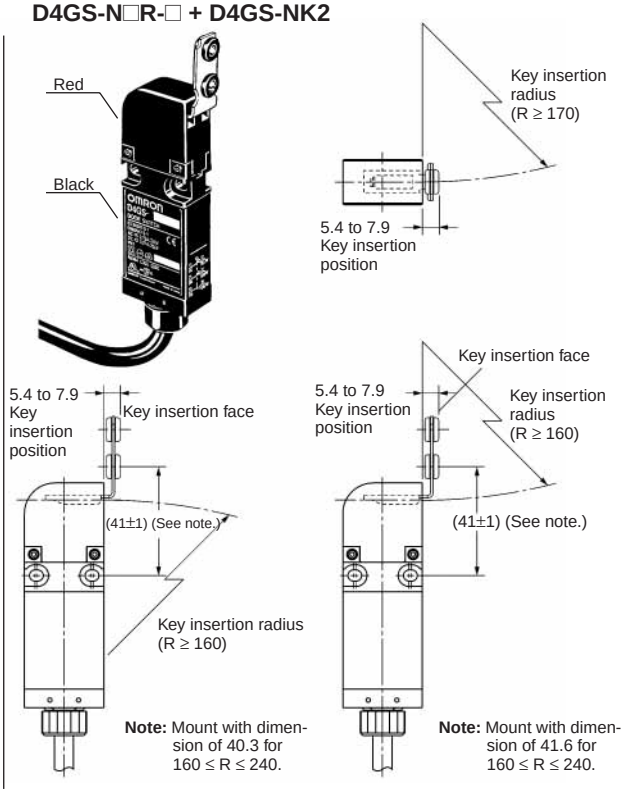
D4GS-N□R-□ + D4GS-NK1



Note: Mount with dimension of 26.4 for 160 ≤ R ≤ 240.

Note: Mount with dimension of 27.7 for 160 ≤ R ≤ 240.

D4GS-N□R-□ + D4GS-NK2



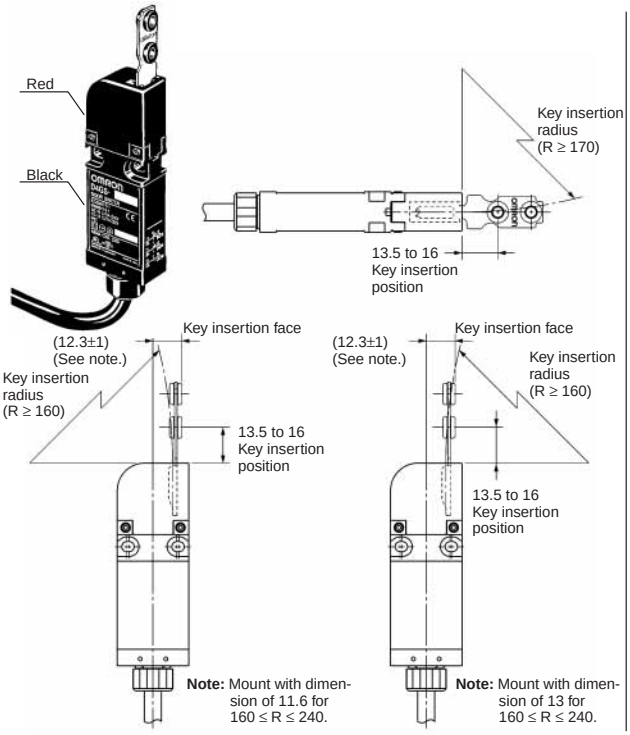
Note: Mount with dimension of 40.3 for 160 ≤ R ≤ 240.

Note: Mount with dimension of 41.6 for 160 ≤ R ≤ 240.

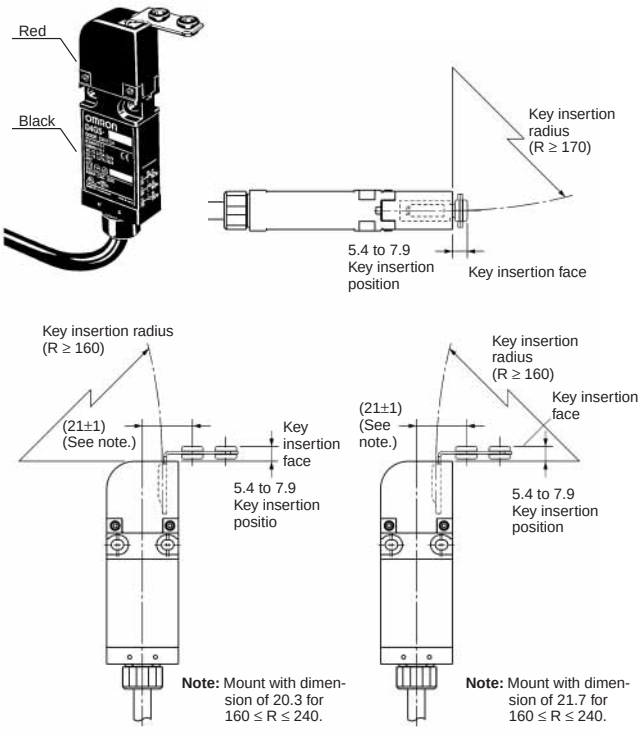
Note: 1. All units are in millimeters unless otherwise indicated.

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

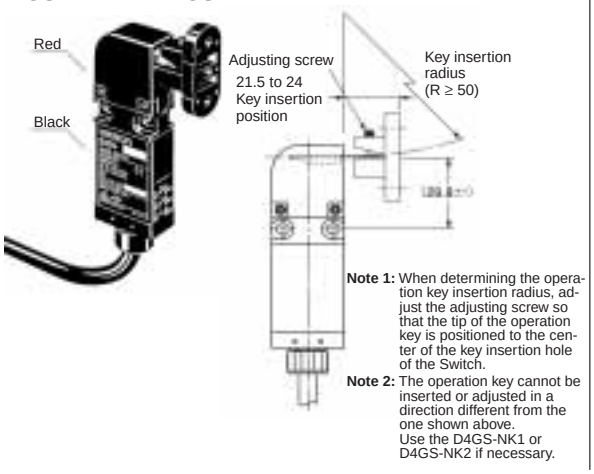
D4GS-N□T-□ + D4GS-NK1



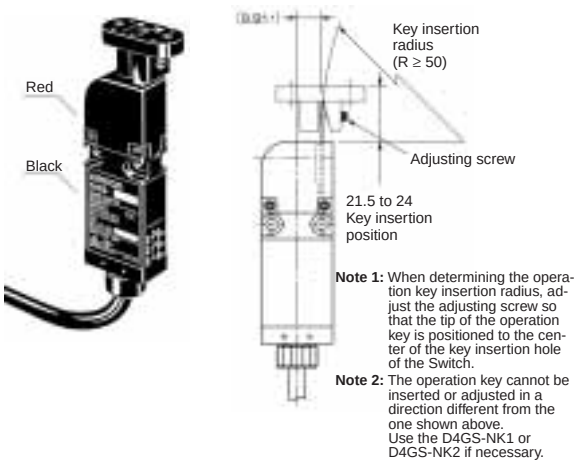
D4GS-N□T-□ + D4GS-NK2



D4GS-N□R-□ + D4GS-NK4



D4GS-N□T-□ + D4GS-NK4



Note: 1. All units are in millimeters unless otherwise indicated.

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

Precautions

WARNING

Do not insert the Operation Key to the switch with the door open. Machine may start operating and injury may be caused.

NOTICE

Do not use the D4GS-N□ Switch or D4GS-NK□ Operation Key (rubber color: red) in combination with the D4GS-□ Switch or D4GS-K□ Operation Key (rubber color: black).

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 D4GS-N 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 D4GS-N.

Connect the fuse to the D4GS-N 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 D4GS-N with EN ratings, use 10-A fuse Type gI or gG that complies with IEC60269.

Do not supply electric power when wiring.

Do not use the D4GS-N where explosive gas, flammable gas, or any other dangerous gas may be present.

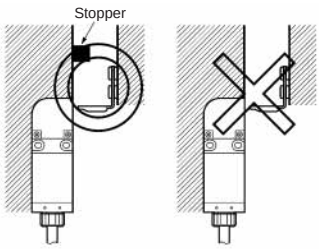
Keep the electrical load below the rated value.

Never wire to a wrong terminal.

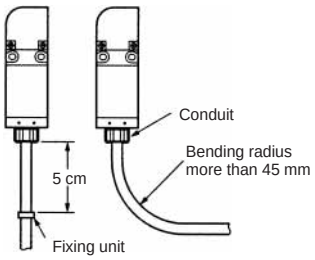
Be sure to evaluate the D4GS-N under actual working conditions after installation.

Do not drop the D4GS-N. Excessive shock or vibration can cause malfunction or damage to Switch characteristics. Do not disassemble the internal switch, there are no user-serviceable parts inside.

Do not use the D4GS-N as a stopper. When mounting the D4GS-N, 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.



Cables should not be bent repeatedly. A cable is fixed with sealing materials on the bottom of the D4GS-N. When excessive force may be imposed on the cable, fix the cable with a fixing unit at the distance of 5 cm from the bottom of the D4GS-N as shown. 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. Do not fasten or loosen the conduit at the bottom of the D4GS-N. When wiring, be sure not to allow a liquid such as water or oil into the tip of cable.



Correct Use

Operating Environment

Do not use the D4GS-N in the following locations:

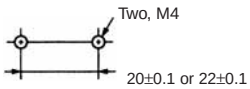
- Locations subject to severe temperature changes
- Locations subject to high temperatures or condensation
- Locations subject to severe vibration
- Locations subject to metal chips, oils, and chemicals inside a protective door

Life Expectancy

The life of the D4GS-N will vary with the switching conditions. Before applying the D4GS-N, test the D4GS-N under actual operating conditions and be sure to use the D4GS-N in actual operation within switching times that will not lower the performance of the D4GS-N.

Mounting

Mounting hole dimensions for mounting the main body are as shown below.



Tightening Torque

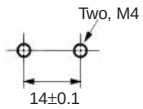
Be sure to tighten each screw of the D4GS-N properly, otherwise the D4GS-N may malfunction.

Type	Torque	Size
Body mounting screw	0.75 to 1.15 N·m	M4 screw
Operation Key mounting screw	0.75 to 1.15 N·m	M4 screw

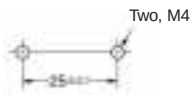
Note: Mount securely, using screws of the specified size together with washers (e.g., plain or spring washers).

Operation Key Mounting Holes

D4GS-NK1/NK2



D4GS-NK4

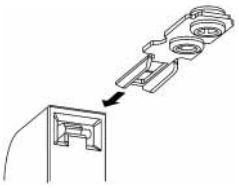


Operation Key

Be sure to use a special Operation Key only.

Do not operate the D4GS-N with anything other than the special Operation Key. Otherwise, the Switch may be damaged.

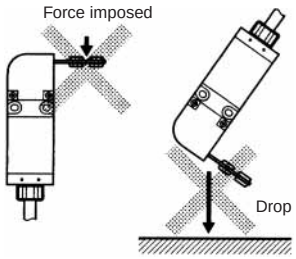
As shown below, mount the Operation Key after matching the concave surface of the Operation Key with the convex surface of the insertion face.



Be sure to adjust the position correctly when mounting the Operation Key and the Switch to ensure that the Operation Key does not miss the insertion face and exert an excessive force on the Switch head.

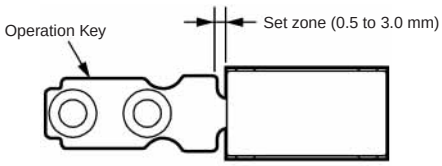
Do not impose excessive force on the Operation Key inserted into the D4GS-N or drop the D4GS-N with the Operation Key inserted. Doing so may deform or damage the Operation Key.

Depending on the conditions in which the Switch is used, the rubber of the Operation Key may deteriorate. If the rubber becomes deformed or cracked, replace it as soon as possible.



Securing the Door

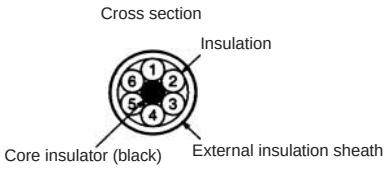
When the door is closed (with the Operation Key inserted), the door (or the Operation Key) may be pulled outside the set zone due to the door's weight or the door cushion rubber. If a load is applied to the Operation Key, the door may fail to unlock. Secure the door with hooks so that it will remain within the set zone.



Wiring

Identifying Wires

Identify wires according to the color (with or without white lines) of the insulation on the wire.



Wire Colors

No.	Color of insulation	No.	Color of insulation
1	Blue/white	4	Orange
2	Brown/white	5	Brown
3	Orange/white	6	Blue

Note: "Blue/white, brown/white, or orange/white" means that the cover is blue, brown, or orange with a white line.

Terminal Numbers

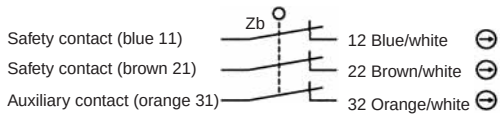
Identify terminal numbers based on the color of the insulation on the wire.

The safety and auxiliary contacts of D4GS-N models of three-terminal contact construction and those of two-terminal contact construction are described below.

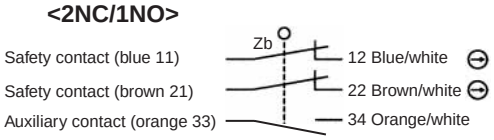
The auxiliary contacts (orange) can be used as safety contacts.

The safety contacts are direct opening contacts approved by EN and each of them is indicated with the mark ⊖ .

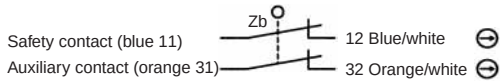
<3NC>



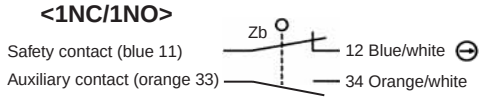
<2NC/1NO>



<2NC>



<1NC/1NO>



Cut the black core insulator and all unused wires at the end of the external insulation sheath when wiring the cable.

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

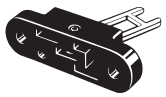
Switches (Operation Keys are sold separately.)

: Models with approved direct opening contacts.

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

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	Special release key	Solenoid: 24 VDC Orange LED: 10 to 115 VAC/VDC	Mechanical lock Solenoid release	1NC/1NO+1NC/1NO	Pg13.5	D4NL-1AFA-B4
						G1/2	D4NL-2AFA-B4
						M20	D4NL-4AFA-B4
					1NC/1NO+2NC	Pg13.5	D4NL-1BFA-B4
						G1/2	D4NL-2BFA-B4
						M20	D4NL-4BFA-B4
					2NC+1NC/1NO	Pg13.5	D4NL-1CFA-B4
						G1/2	D4NL-2CFA-B4
						M20	D4NL-4CFA-B4
					2NC+2NC	Pg13.5	D4NL-1DFA-B4
						G1/2	D4NL-2DFA-B4
						M20	D4NL-4DFA-B4
					2NC/1NO+1NC/1NO	Pg13.5	D4NL-1EFA-B4
						G1/2	D4NL-2EFA-B4
						M20	D4NL-4EFA-B4
					2NC/1NO+2NC	Pg13.5	D4NL-1FFA-B4
						G1/2	D4NL-2FFA-B4
						M20	D4NL-4FFA-B4
					3NC+1NC/1NO	Pg13.5	D4NL-1GFA-B4
						G1/2	D4NL-2GFA-B4
						M20	D4NL-4GFA-B4
					3NC+2NC	Pg13.5	D4NL-1HFA-B4
						G1/2	D4NL-2HFA-B4
						M20	D4NL-4HFA-B4
				Solenoid lock Mechanical release	1NC/1NO+1NC/1NO	Pg13.5	D4NL-1AFG-B4
						G1/2	D4NL-2AFG-B4
						M20	D4NL-4AFG-B4
					1NC/1NO+2NC	Pg13.5	D4NL-1BFG-B4
						G1/2	D4NL-2BFG-B4
						M20	D4NL-4BFG-B4
					2NC+1NC/1NO	Pg13.5	D4NL-1CFG-B4
						G1/2	D4NL-2CFG-B4
						M20	D4NL-4CFG-B4
					2NC+2NC	Pg13.5	D4NL-1DFG-B4
						G1/2	D4NL-2DFG-B4
						M20	D4NL-4DFG-B4
					2NC/1NO+1NC/1NO	Pg13.5	D4NL-1EFG-B4
						G1/2	D4NL-2EFG-B4
						M20	D4NL-4EFG-B4
					2NC/1NO+2NC	Pg13.5	D4NL-1FFG-B4
						G1/2	D4NL-2FFG-B4
						M20	D4NL-4FFG-B4
					3NC+1NC/1NO	Pg13.5	D4NL-1GFG-B4
						G1/2	D4NL-2GFG-B4
						M20	D4NL-4GFG-B4
					3NC+2NC	Pg13.5	D4NL-1HFG-B4
						G1/2	D4NL-2HFG-B4
						M20	D4NL-4HFG-B4

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.

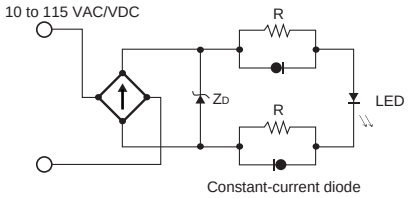
6. This figure is based on the GS-ET-19 evaluation method.

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

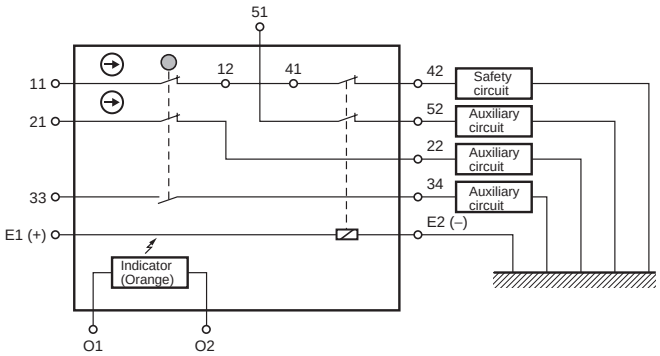
Indicator

Internal Circuit Diagram



Circuit Connection Example

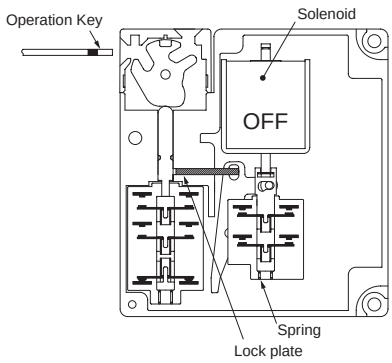
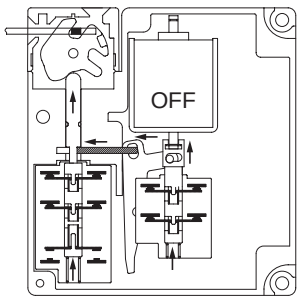
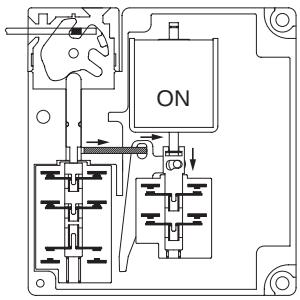
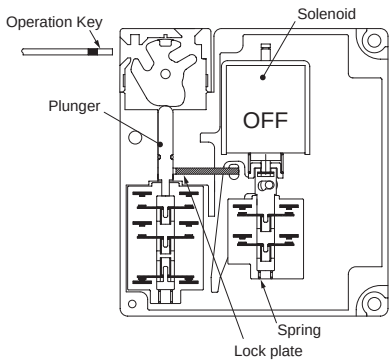
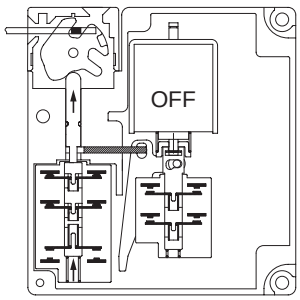
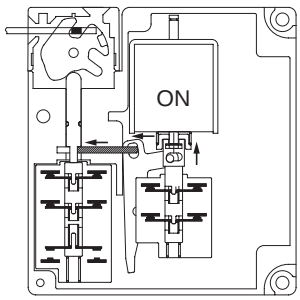
- Terminals 12 and 41 are connected internally and so connect terminals 11 and 42 for safety-circuit input. (GS-ET-19)
- Connect terminals 21 and 22 and terminals 51 and 52 in series when using as safety-circuit input (redundancy circuit for terminals 11 and 12 and terminals 41 and 42 above). Connect 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.

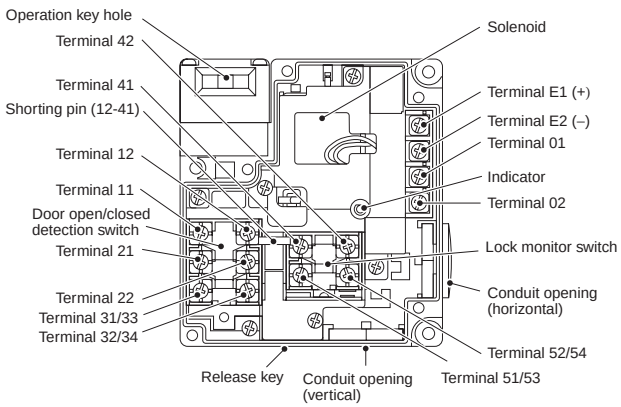
Operation Method

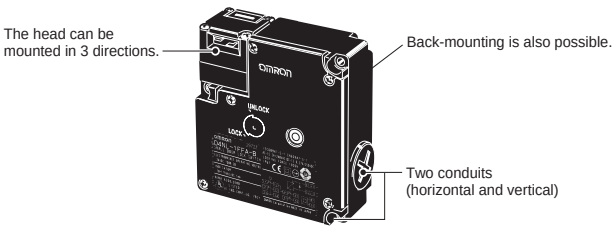
Operation Principles

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).

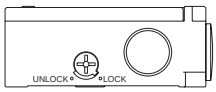
Nomenclature

Structure

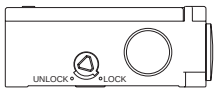




Standard Release Key (Bottom View)



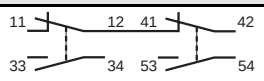
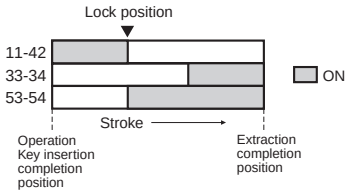
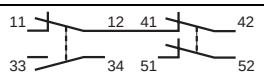
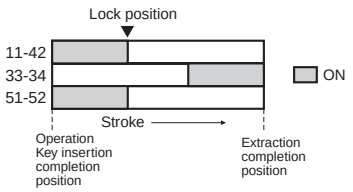
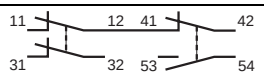
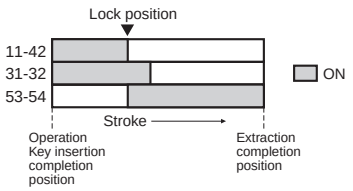
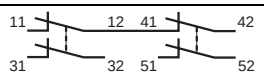
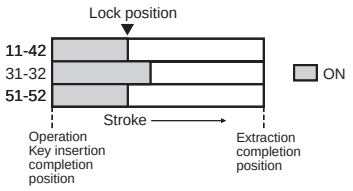
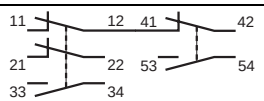
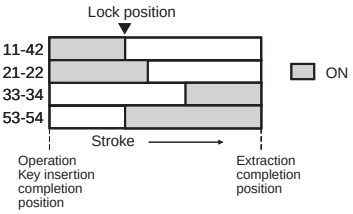
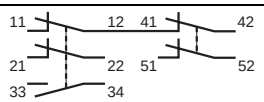
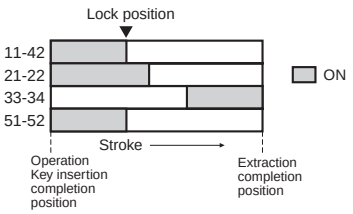
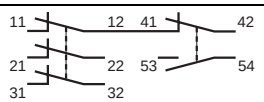
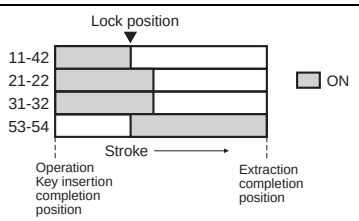
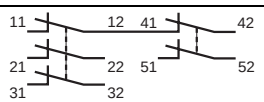
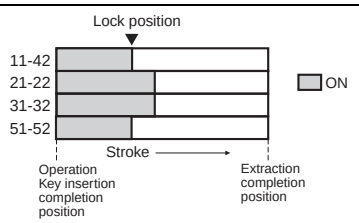
Special Release Key (Bottom View)



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).

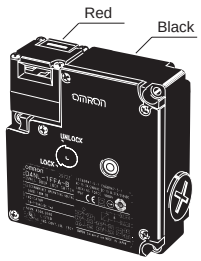
Model	Contact	Contact form	Operating pattern	Remarks
D4NL-□AF□-□	1NC/1NO + 1NC/1NO			Only NC contacts 11-12 and 41-42 have an approved direct opening mechanism. (⊖) The terminals 11-42, 33-34, and 53-54 can be used as unlike poles.
D4NL-□BF□-□	1NC/1NO + 2NC			Only NC contacts 11-12, 41-42, and 51-52 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.

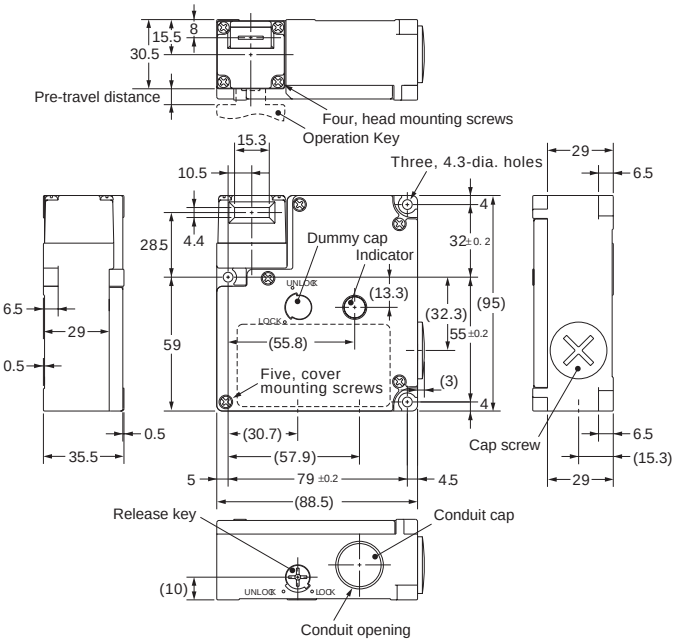
Dimensions

Note: All units are in millimeters unless otherwise indicated

Switches

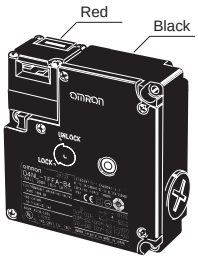
D4NL-□□□□-B

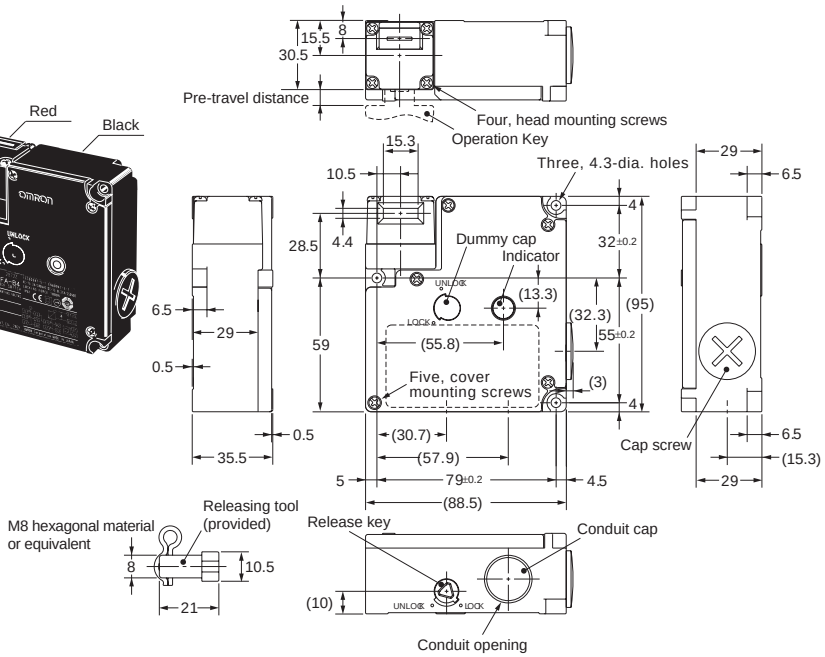




Operating characteristics	D4NL-□□□□-B
Key insertion force Key extraction force	15 N max. 30 N max.
Pre-travel distance	9 mm max.
Movement before being locked	3 mm min.

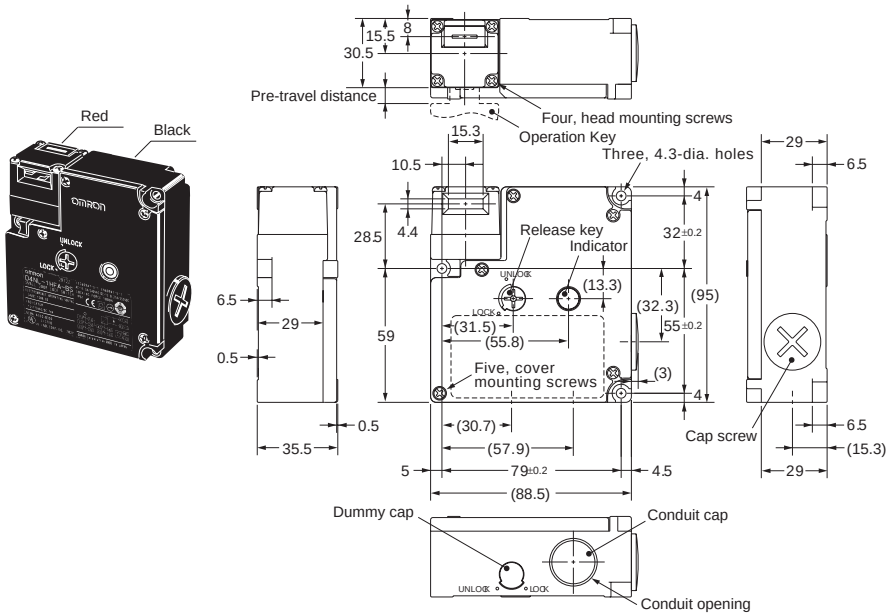
D4NL-□□□□-B4





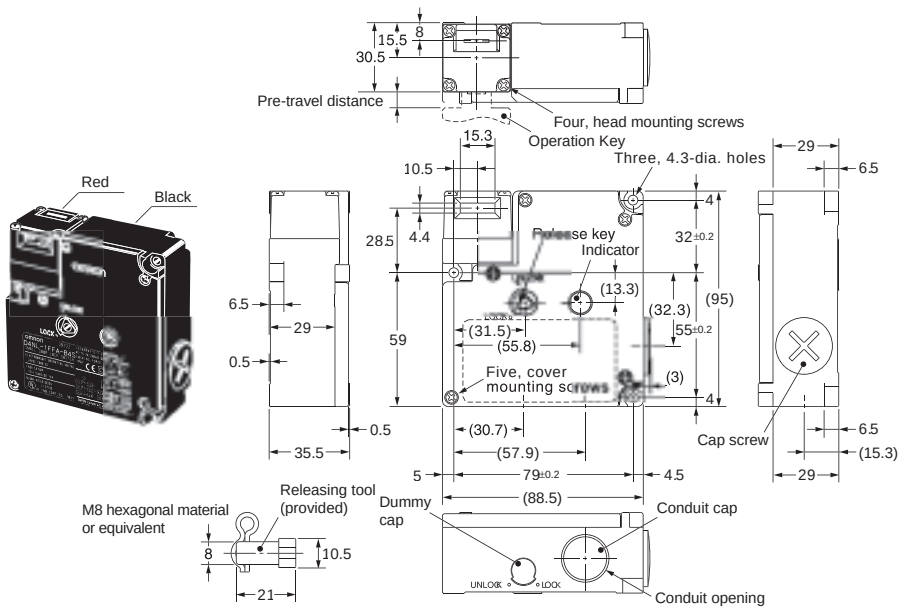
Operating characteristics	D4NL-□□□□-B4
Key insertion force Key extraction force	15 N max. 30 N max.
Pre-travel distance	9 mm max.
Movement before being locked	3 mm min.

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

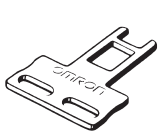


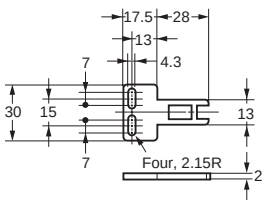
Operating characteristics	D4NL-□□□□-B4S
Key insertion force Key extraction force	15 N max. 30 N max.
Pre-travel distance	9 mm max.
Movement before being locked	3 mm min.

Operation Keys

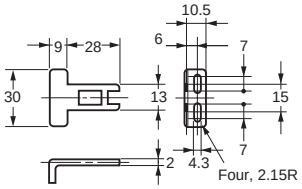
Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

D4DS-K1

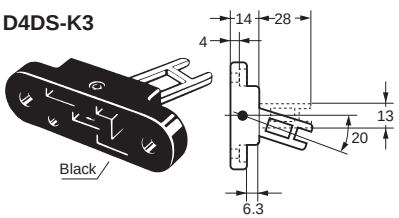




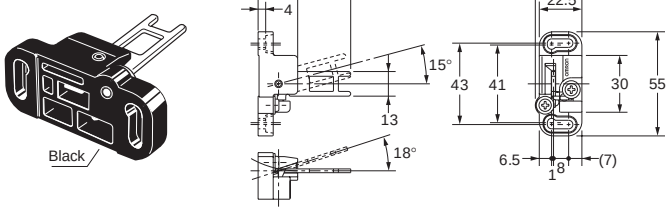
D4DS-K2



D4DS-K3

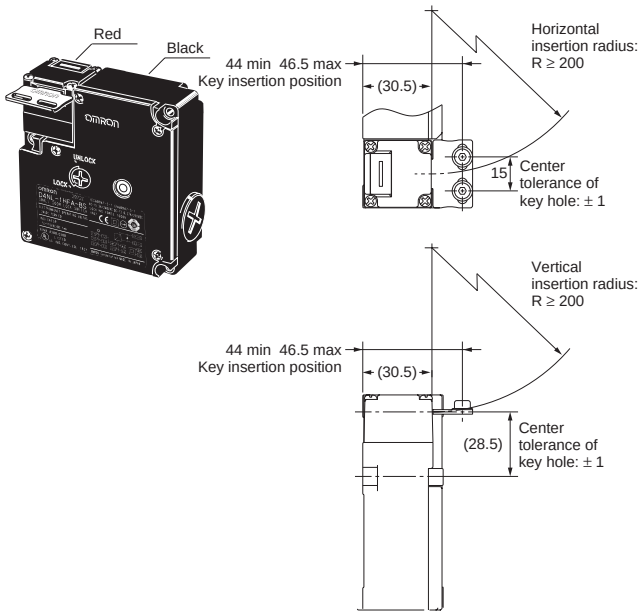


D4DS-K5

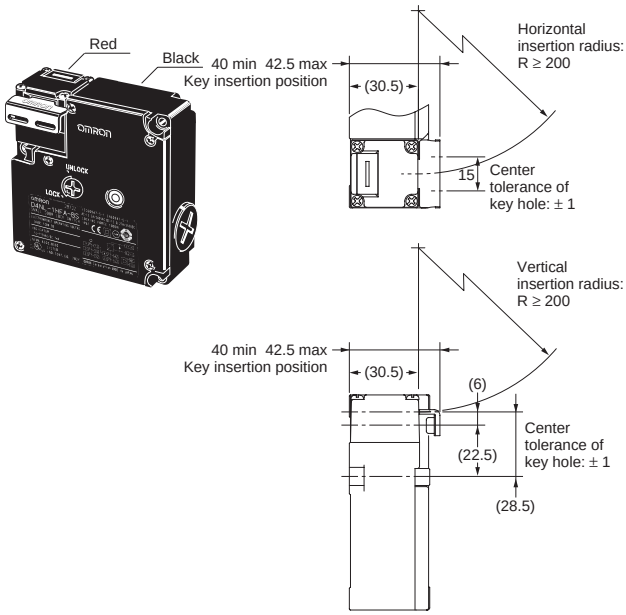


With Operation Key Inserted

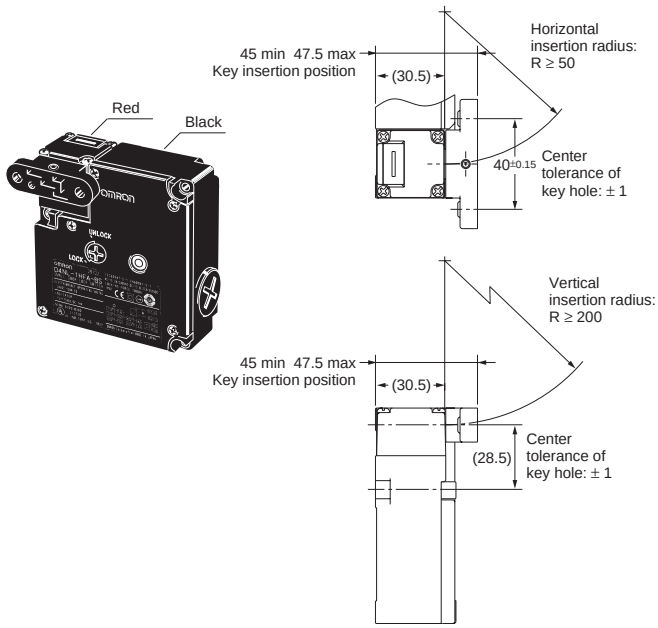
D4NL + D4DS-K1



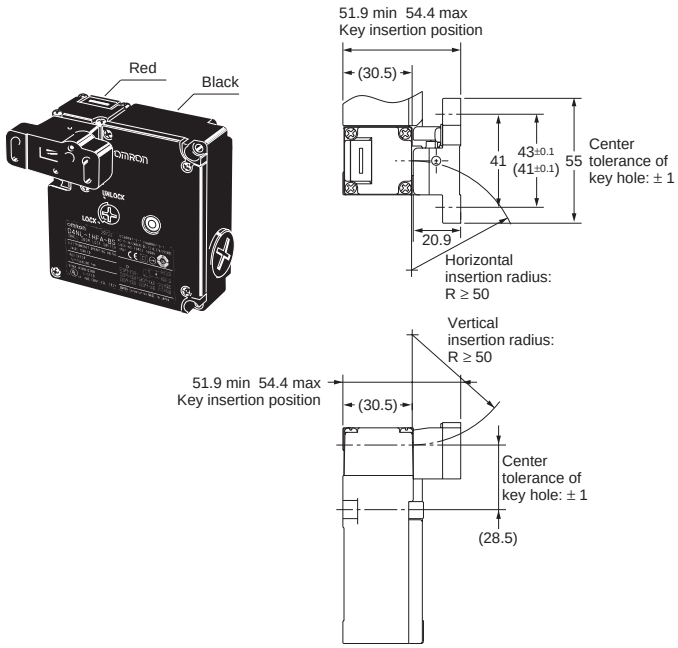
D4NL + D4DS-K2



D4NL + D4DS-K3

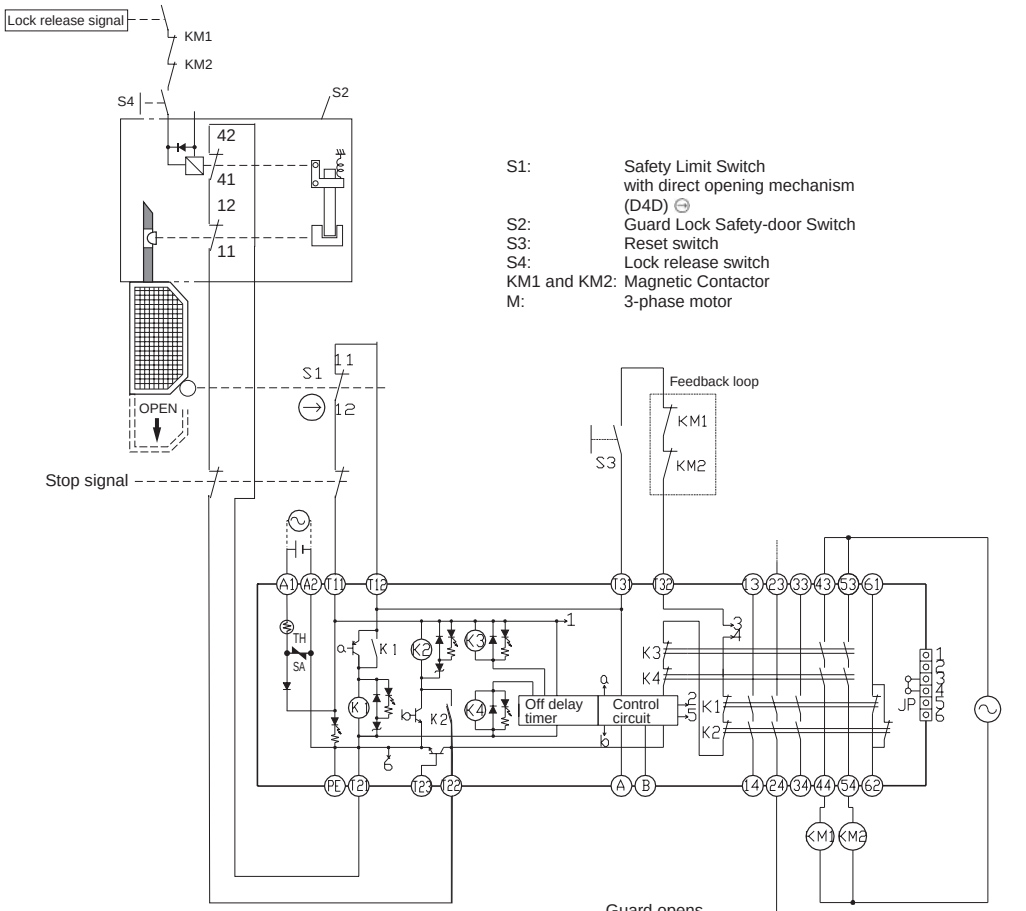


D4NL + D4DS-K5

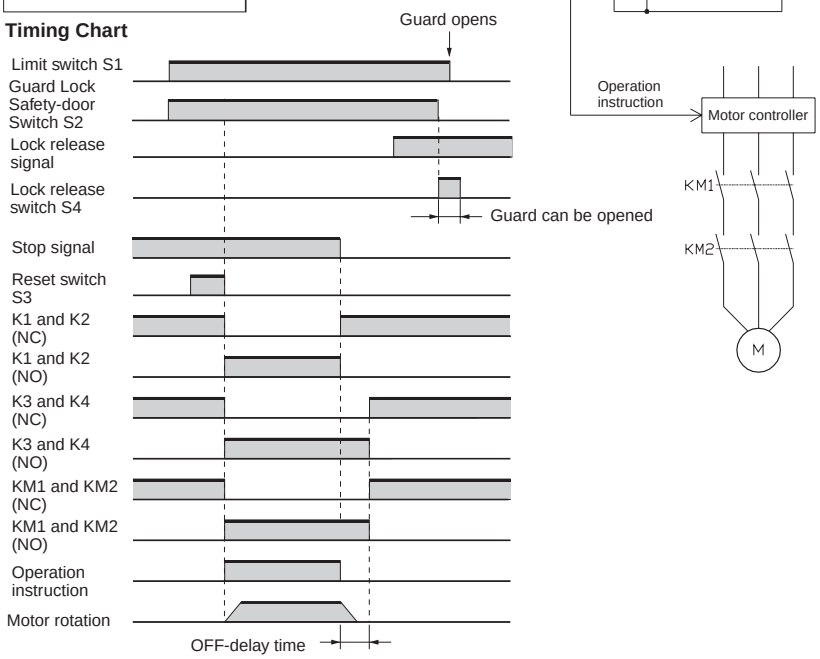


Application Examples

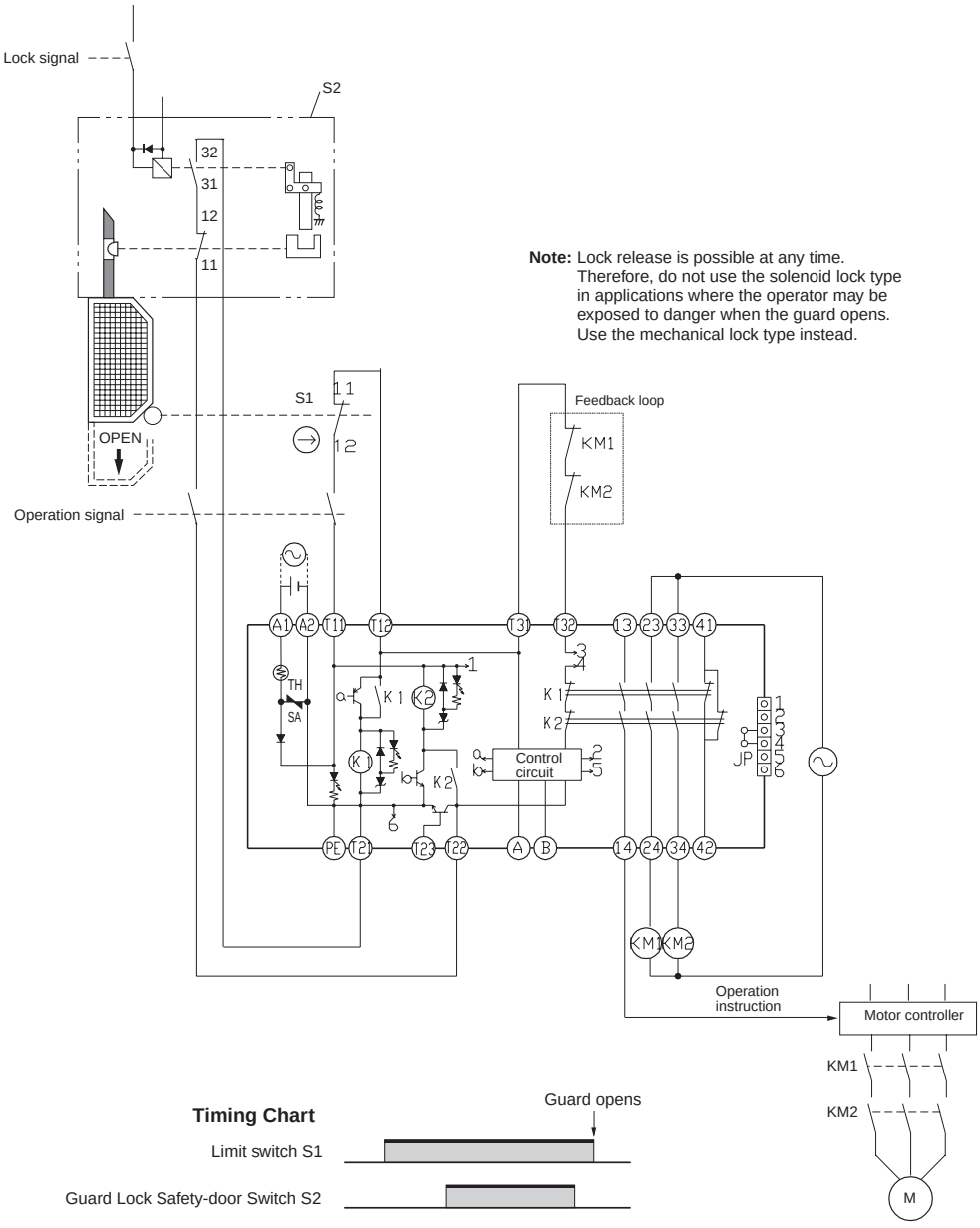
G9SA-321-T□ (24 VAC/VDC) + D4NL-□□□A-□, □□□B-□, □□□C-□
(Mechanical Lock Type) + D4D-□520N Circuit Diagram



Timing Chart

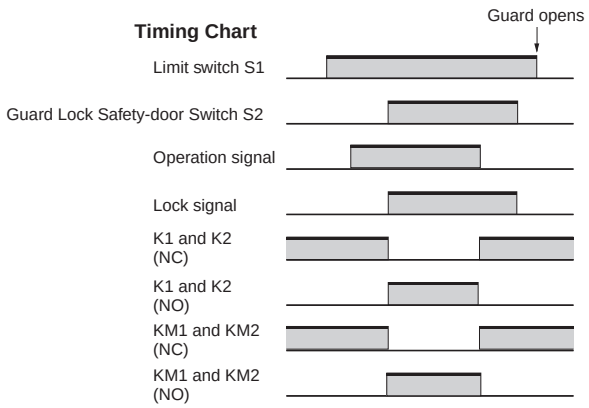


G9SA-301 (24 VAC/VDC) + D4NL-□□□G-□, □□□H-□, □□□J-□ (Solenoid Lock Type) + D4D-□520N Circuit Diagram



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 (D4D)
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.

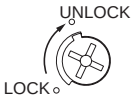
Holding Force

- 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

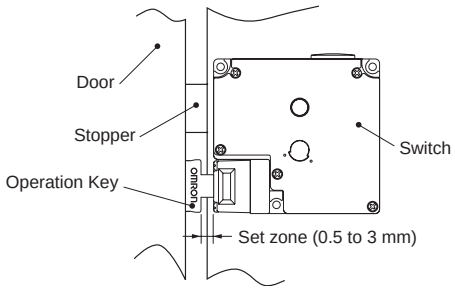
- The Switch contacts can be used for either standard loads or microloads. Once a contact has been used to switch a standard load, however, it cannot be used for a load of a smaller capacity. Doing so may result in roughening of the contact surface and contact reliability may be lost.
- Turn OFF the 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

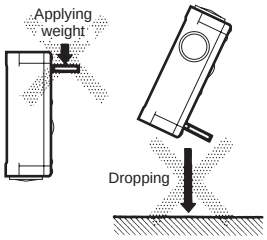
Operating Environment

- 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

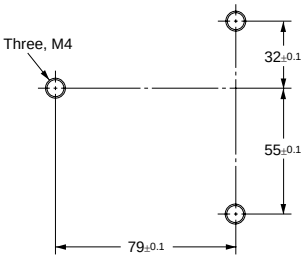
Be sure to tighten each screw of the Switch properly. Loose screws may result in malfunction.

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

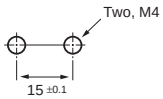
- Mount the Switch and Operation Key securely to the applicable tightening torque with M4 screws.

Mounting Hole Dimensions for Switch

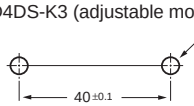


Mounting Hole Dimensions for Operation Key

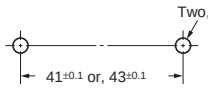
D4DS-K1/-K2 (horizontal/vertical mounting)



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.

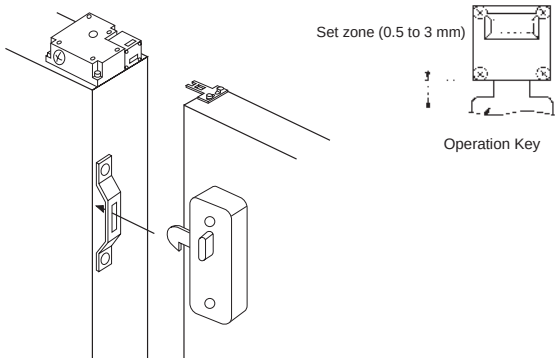
Head Direction

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.

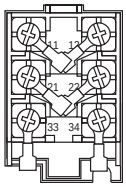
Securing the Door

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).



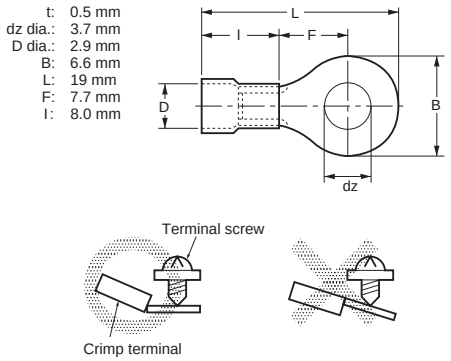
Wiring

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

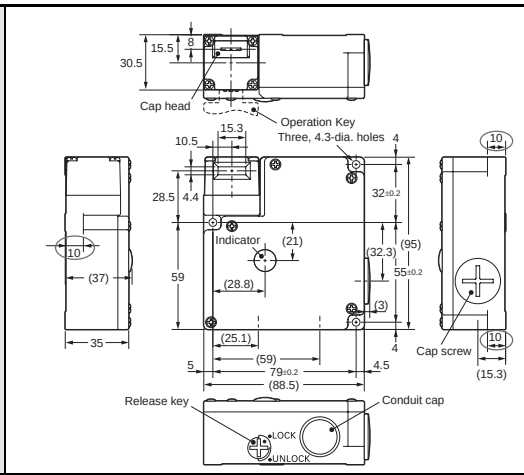
The D4DL and D4NL have basically the same structure, and use the same mounting method and Operation Keys. There are differences, however, in the external appearance and the mounting sections.

Comparison of the D4DL and Substitute Products

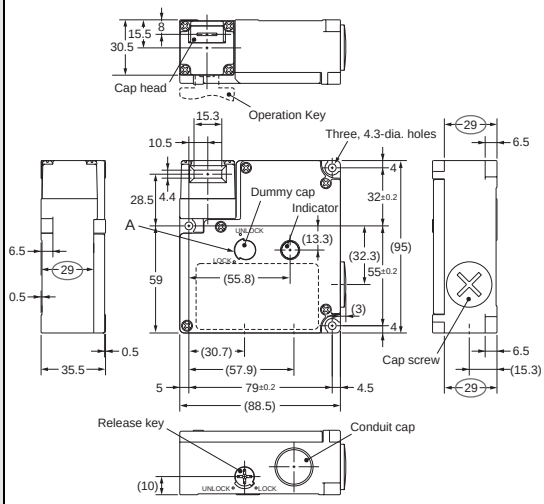
Model	D4NL-□
Switch color	Very similar
Dimensions	Very similar
Wiring/connection	Significantly different
Mounting method	Very similar
Ratings/performance	Very similar
Operating characteristics	Very similar
Operating method	Completely compatible

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.

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

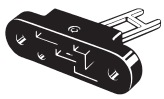
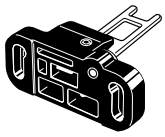
Switches (Operation Keys are sold separately.)

: Models with approved direct opening contacts.

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

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	Special release key	Solenoid: 24 VDC Orange/green LED: 24 VDC	Mechanical lock Solenoid release	1NC/1NO+1NC/1NO	Pg13.5	D4GL-1AFA-A4
					G1/2	D4GL-2AFA-A4
					M20	D4GL-4AFA-A4
				1NC/1NO+2NC	Pg13.5	D4GL-1BFA-A4
					G1/2	D4GL-2BFA-A4
					M20	D4GL-4BFA-A4
				2NC+1NC/1NO	Pg13.5	D4GL-1CFA-A4
					G1/2	D4GL-2CFA-A4
					M20	D4GL-4CFA-A4
				2NC+2NC	Pg13.5	D4GL-1DFA-A4
					G1/2	D4GL-2DFA-A4
					M20	D4GL-4DFA-A4
				2NC/1NO+1NC/1NO	Pg13.5	D4GL-1EFA-A4
					G1/2	D4GL-2EFA-A4
					M20	D4GL-4EFA-A4
				2NC/1NO+2NC	Pg13.5	D4GL-1FFA-A4
					G1/2	D4GL-2FFA-A4
					M20	D4GL-4FFA-A4
				3NC+1NC/1NO	Pg13.5	D4GL-1GFA-A4
					G1/2	D4GL-2GFA-A4
					M20	D4GL-4GFA-A4
				3NC+2NC	Pg13.5	D4GL-1HFA-A4
					G1/2	D4GL-2HFA-A4
					M20	D4GL-4HFA-A4
			Solenoid lock Mechanical release	1NC/1NO+1NC/1NO	Pg13.5	D4GL-1AFG-A4
					G1/2	D4GL-2AFG-A4
					M20	D4GL-4AFG-A4
				1NC/1NO+2NC	Pg13.5	D4GL-1BFG-A4
					G1/2	D4GL-2BFG-A4
					M20	D4GL-4BFG-A4
				2NC+1NC/1NO	Pg13.5	D4GL-1CFG-A4
					G1/2	D4GL-2CFG-A4
					M20	D4GL-4CFG-A4
				2NC+2NC	Pg13.5	D4GL-1DFG-A4
					G1/2	D4GL-2DFG-A4
					M20	D4GL-4DFG-A4
				2NC/1NO+1NC/1NO	Pg13.5	D4GL-1EFG-A4
					G1/2	D4GL-2EFG-A4
					M20	D4GL-4EFG-A4
				2NC/1NO+2NC	Pg13.5	D4GL-1FFG-A4
					G1/2	D4GL-2FFG-A4
					M20	D4GL-4FFG-A4
				3NC+1NC/1NO	Pg13.5	D4GL-1GFG-A4
					G1/2	D4GL-2GFG-A4
					M20	D4GL-4GFG-A4
				3NC+2NC	Pg13.5	D4GL-1HFG-A4
					G1/2	D4GL-2HFG-A4
					M20	D4GL-4HFG-A4

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.

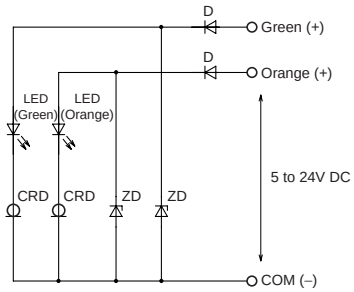
6. This figure is based on the GS-ET-19 evaluation method.

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

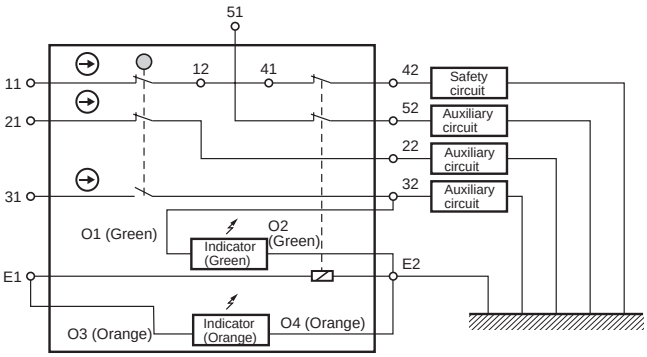
Internal Circuit Diagram



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



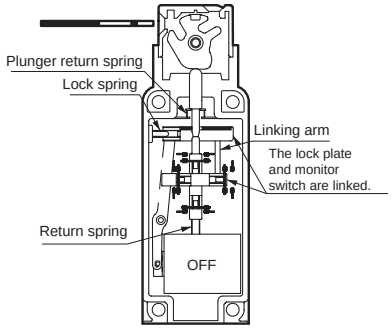
- Direct opening contacts used as safety-circuit input are indicated with the ⊖ mark. Terminals 11 and 12 and terminals 21 and 22 are direct opening contacts.
- Connect the indicators in parallel to the auxiliary circuits or terminals E1 and E2.
- Although the 3 lines are connected at the time of delivery, 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

<table>
<tr>
<td>Mechanical lock models</td>
<td> 
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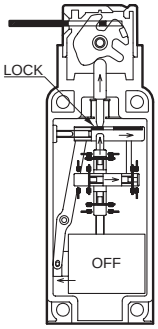
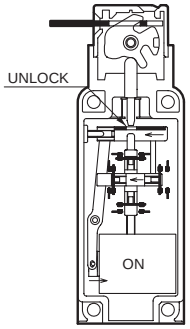
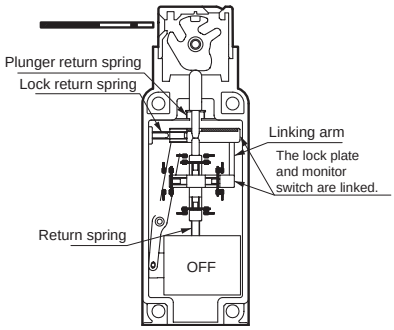
<td> 

When the door is closed, it is locked by the lock spring. The door will stay locked even if there is a power interruption.</td>
<td> 

The solenoid is released only when the lock is turned ON.</td>
</tr>
<tr>
<td>Solenoid lock models</td>
<td> 
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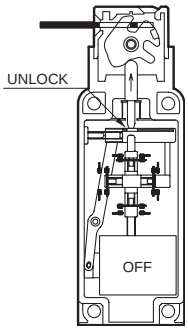
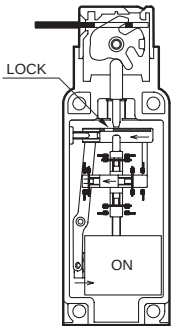
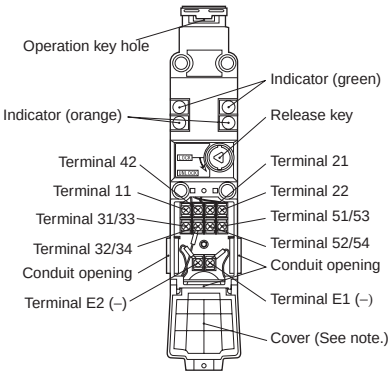
<td> 

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.</td>
<td> 

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).</td>
</tr>
</table>

Nomenclature

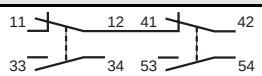
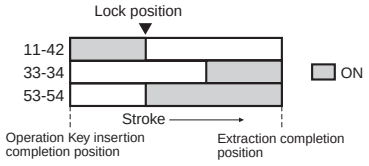
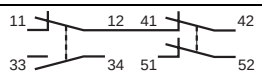
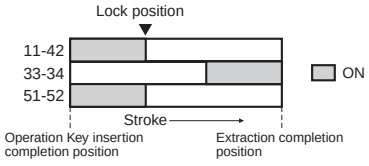
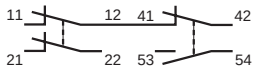
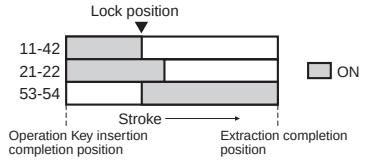
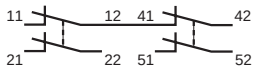
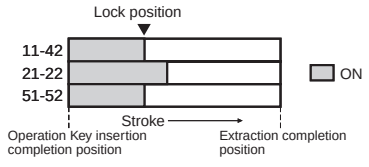
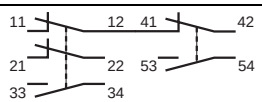
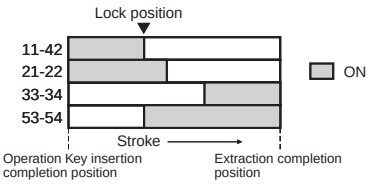
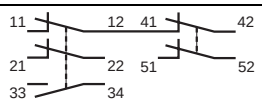
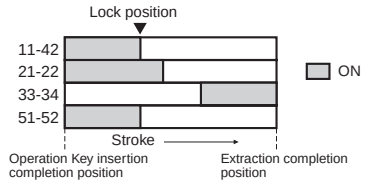
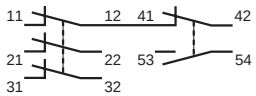
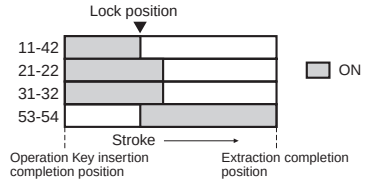
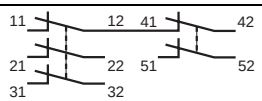
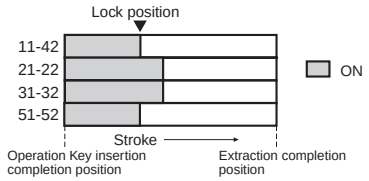
Structure



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).

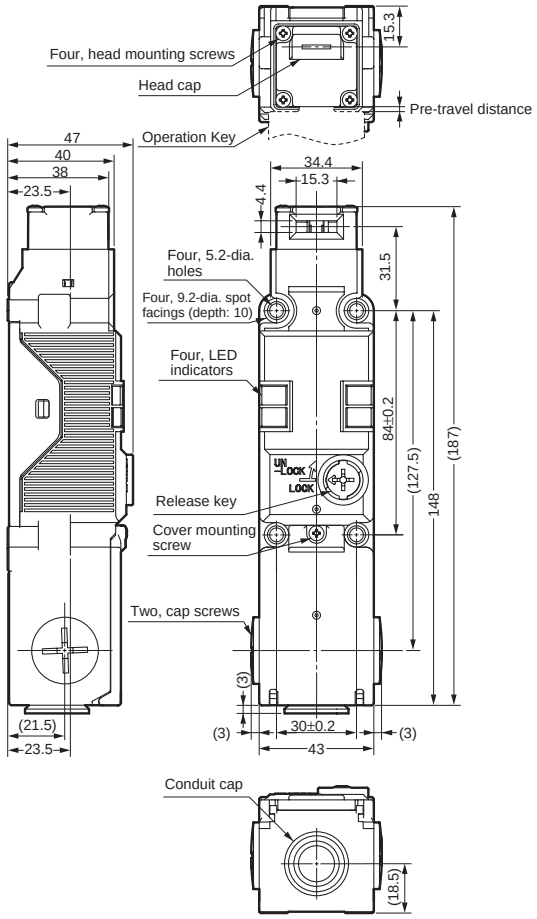
Model	Contact	Contact form (door open/closed detection switch and lock monitor switch contacts)	Operating pattern	Remarks
D4GL-☐AF☐-☐	1NC/1NO + 1NC/1NO			Only NC contact 11-12 has an approved direct opening mechanism. ⊖ The terminals 11-42, 33-34, and 53-54 can be used as unlike poles.
D4GL-☐BF☐-☐	1NC/1NO + 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.

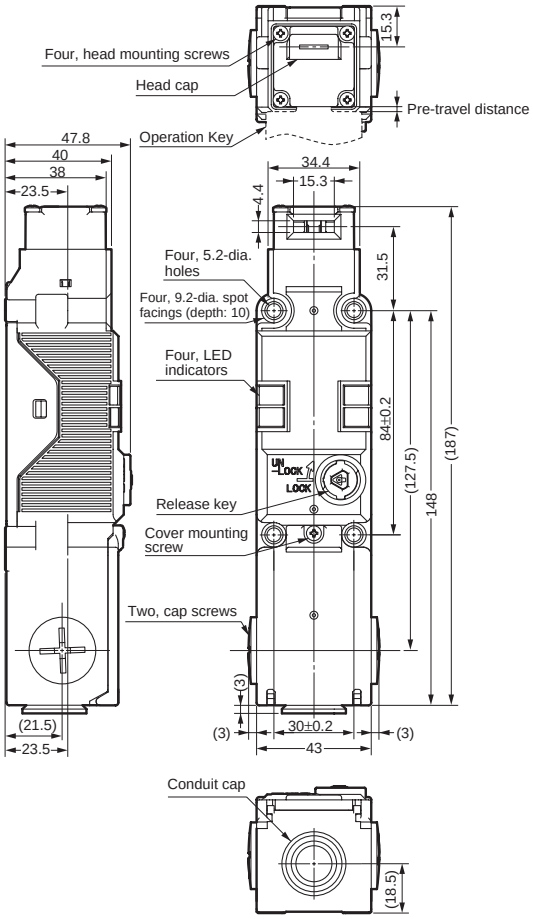
Switches

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

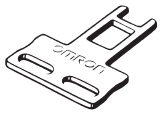


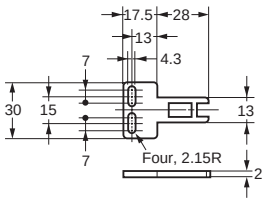
Operating characteristics	D4GL-□□□□-A4
Key insertion force Key extraction force	15 N max. 40 N max.
Pre-travel distance	10 mm max.
Movement before being locked	4 mm min.

Operation Keys

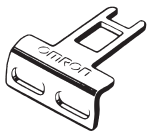
Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

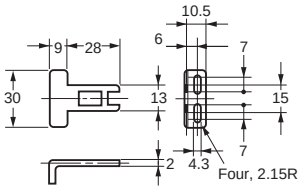
D4DS-K1



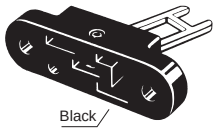


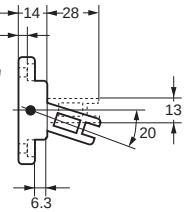
D4DS-K2

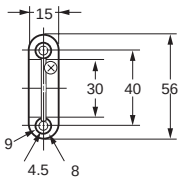




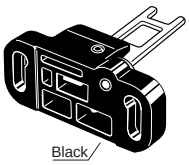
D4DS-K3

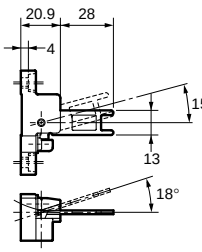


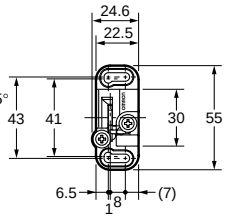




D4DS-K5

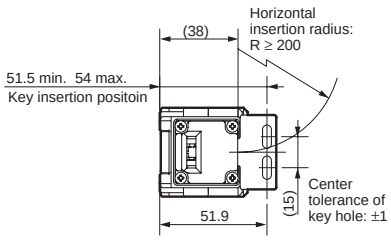


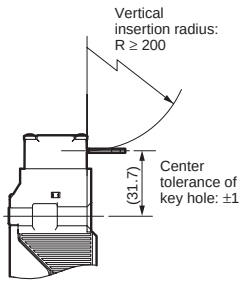




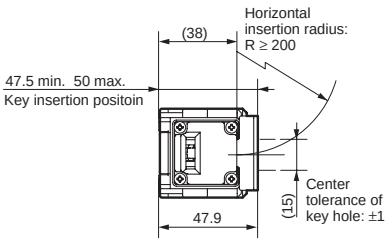
With Operation Key Inserted

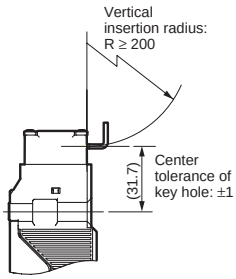
D4GL + D4DS-K1



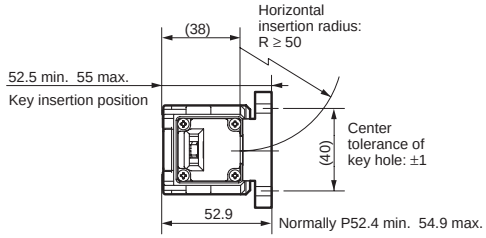


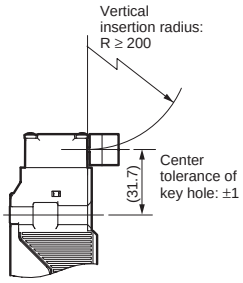
D4GL + D4DS-K2



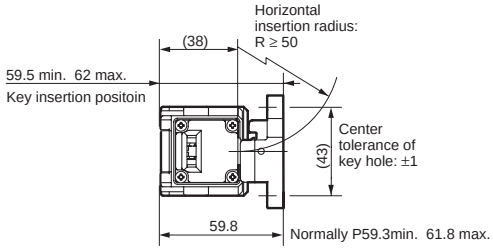


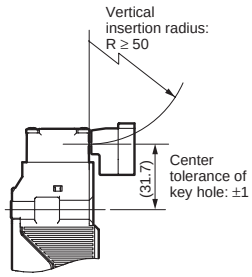
D4GL + D4DS-K3





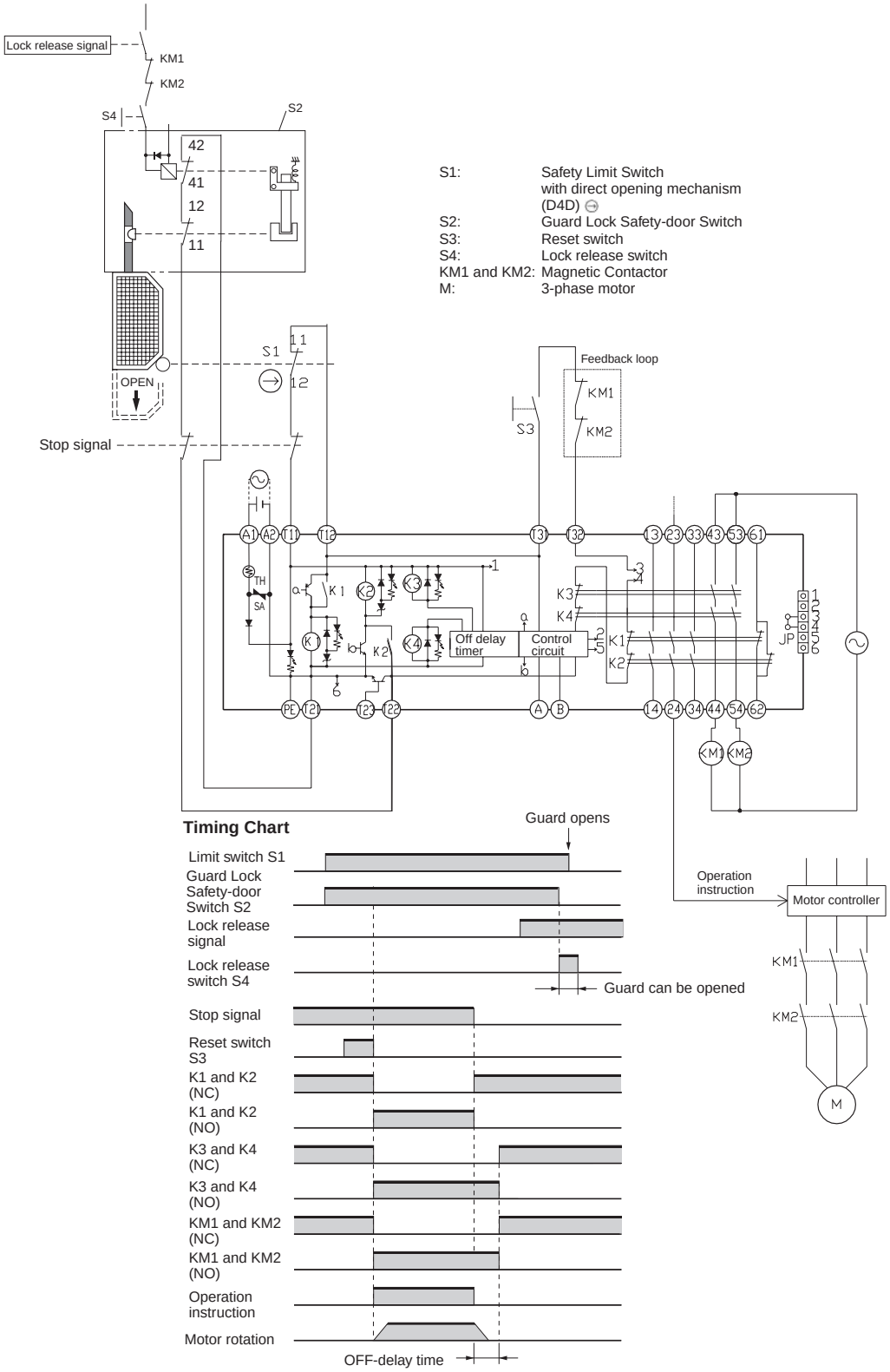
D4GL + D4DS-K5



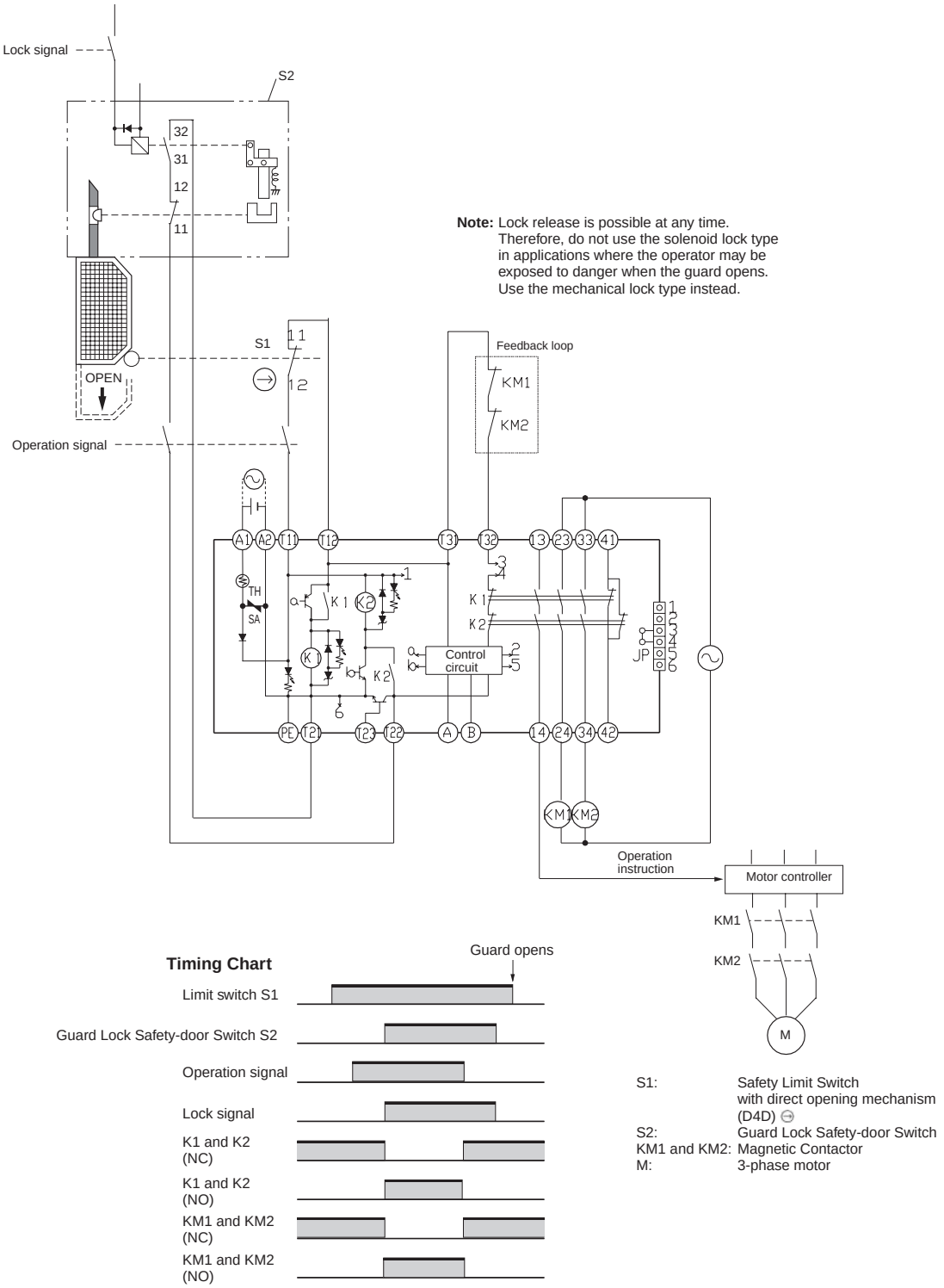


Application Examples

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 (D4D)
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.

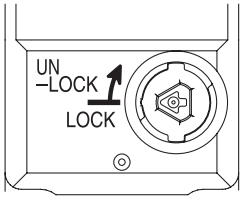
Holding Force

- 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

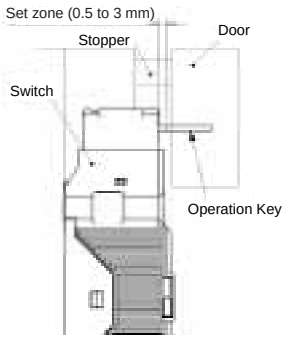
- Turn OFF the power before disassembling the Switch or touching any internal parts. Not doing so may result in electric shock.
- Mount the Operation Key in a location where it will not come in contact with users when the door is opened or closed. Otherwise, injury may result.
- Do not impose excessive 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

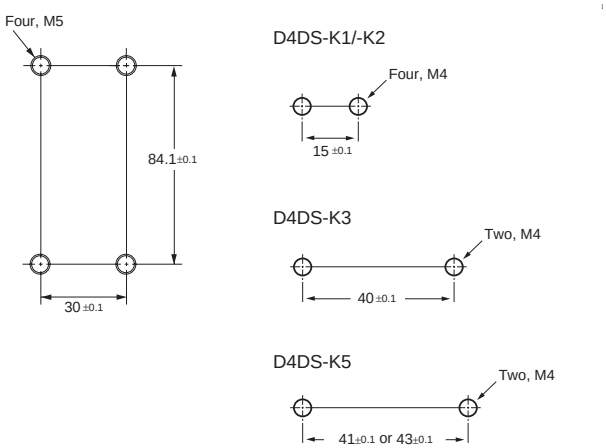
Tightening Torque

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.

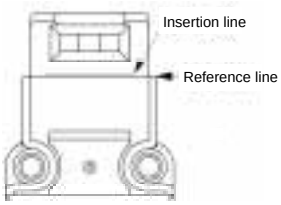


- Use the designated OMRON Operation Key with the Switch. Using another Operation Key may result in Switch damage.
- Ensure that the alignment offset between the Operation Key and the key hole does not exceed ±1 mm.

Head Direction

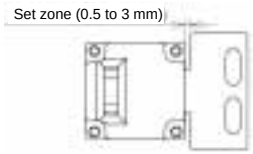
By removing the four screws of the head, the mounting direction of the head can be changed. The head can be mounted in four directions.

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

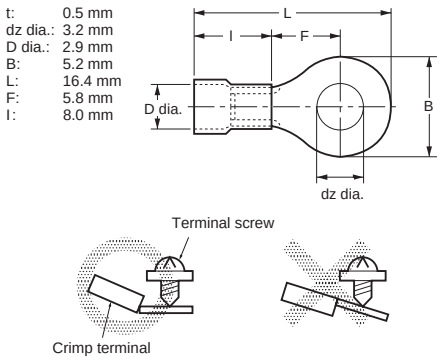
When the door is closed (with the Operation Key inserted), it may be pulled beyond the set zone because of, for example, the door's weight, or the door cushion rubber. Also, if a load is applied to the Operation Key, the door may fail to unlock properly. Use hooks to ensure that the door stays within the set zone.



Wiring

Wiring Precautions

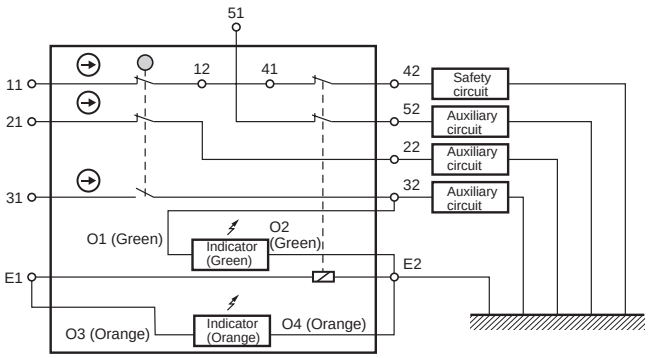
- Applicable lead wire size: AWG22 to AWG24.
- When connecting lead wires directly to terminals, perform wiring securely so that there are no loose wire strands.
- Do not push crimp terminals into gaps in the case interior. Doing so may cause damage or deformation of the case.
- Use lead wires of an 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.

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)

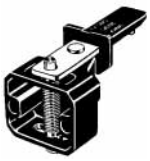
Ordering Information

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		

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%.

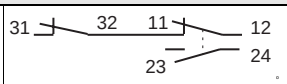
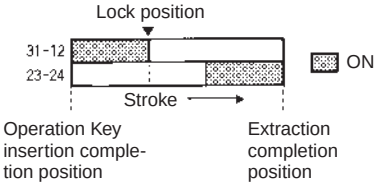
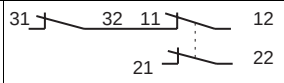
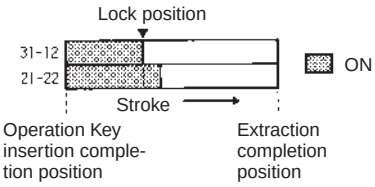
Solenoid Coil Characteristics

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)

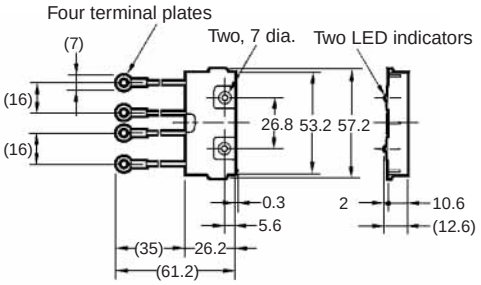
Model	Contact		Diagram	Remarks
D4BL-□C□□-□	1NC/ 1NO+1NC			Only NC contacts 11-12 and 31-32 have an approved direct opening mechanism. ⊖ The terminals 11-12 and 23-24 can be used as unlike poles.
D4BL-□D□□-□	2NC+1NC			NC contacts 11-12, 21-22, and 31-32 have an approved direct opening mechanism. ⊖ The 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.

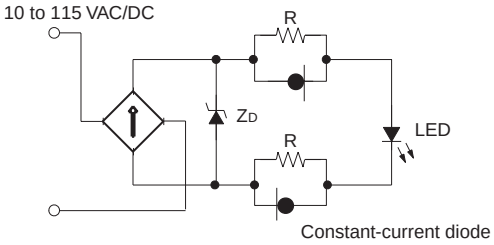
Connections

Indicator Unit

Dimensions



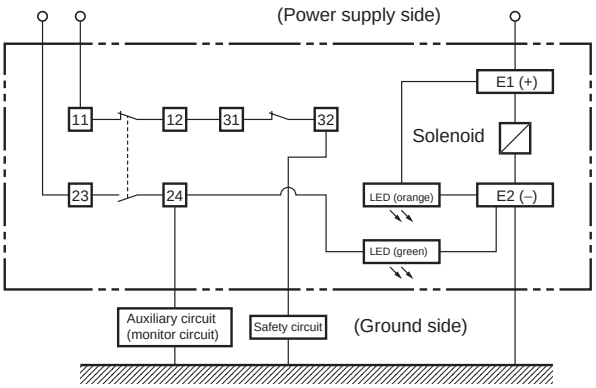
Internal Circuit



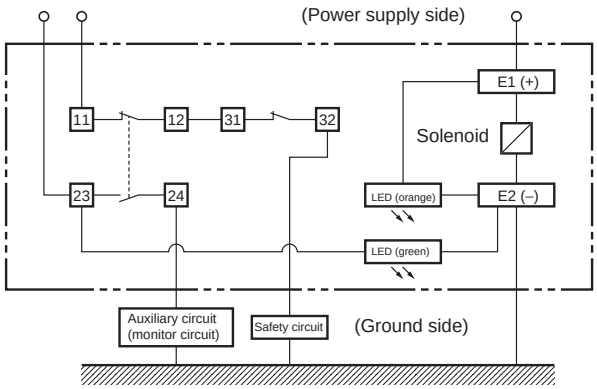
Circuit Connection Example

- 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.

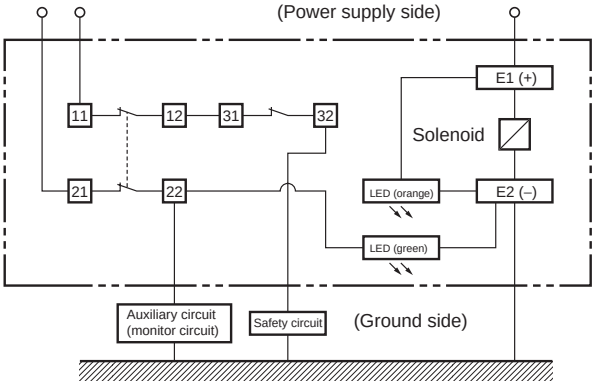
1. Orange: Lights when the solenoid turns ON.
Green: Lights when the door opens.



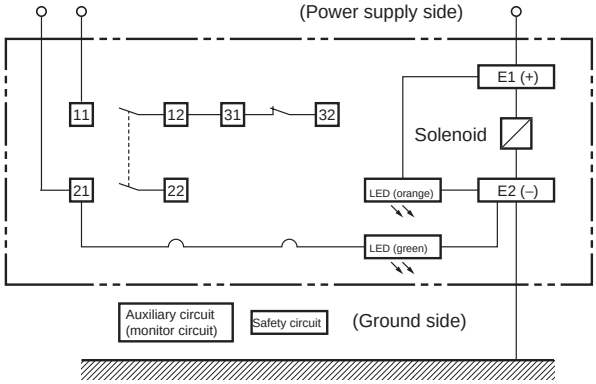
2. Orange: Lights when the solenoid turns ON.
Green: Lights when power turns ON.



3. Orange: Lights when the solenoid turns ON.
Green: Lights when door closes.

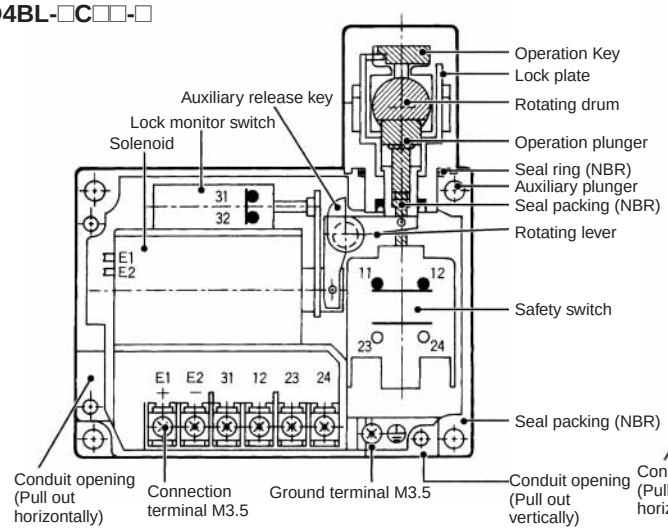


4. Orange: Lights when the solenoid turns ON.
Green: Lights when power turns ON.

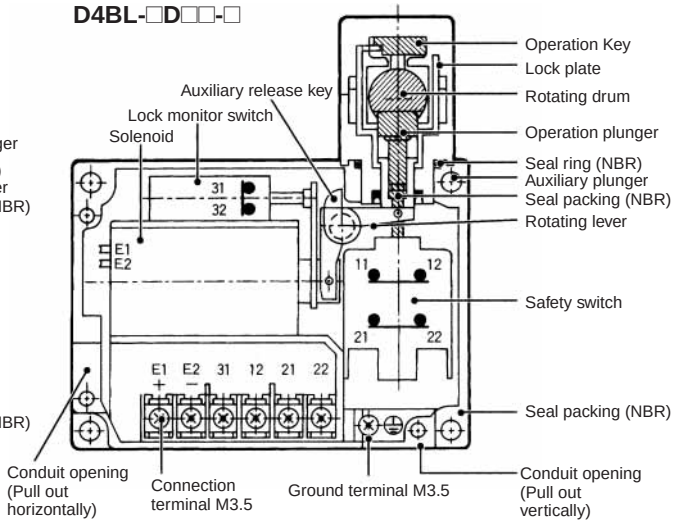


Nomenclature

D4BL-□C□□-□



D4BL-□D□□-□



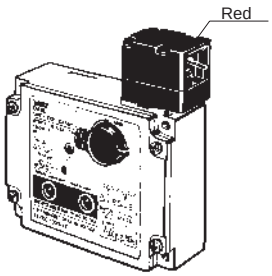
Dimensions

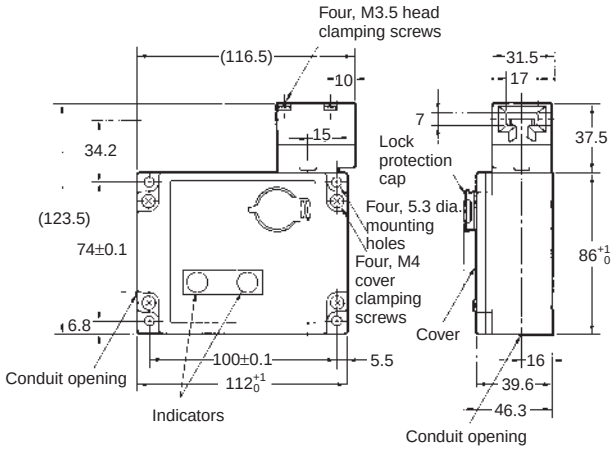
Note: 1. All units are in millimeters unless otherwise indicated.

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

Switches

D4BL-□□□□-□



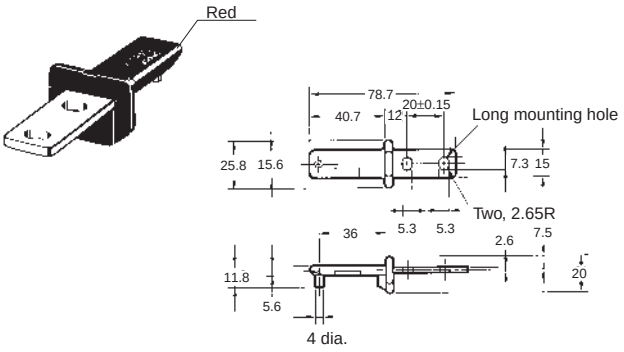


Operating Characteristics	D4BL-□□□□
Key insertion force Key extraction force	19.61 N max. 19.61 N max.
Movement before being locked	15 mm max.

Operation Keys

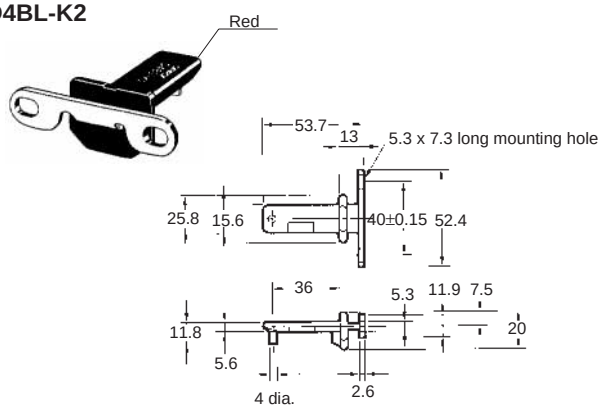
Horizontal Mounting

D4BL-K1



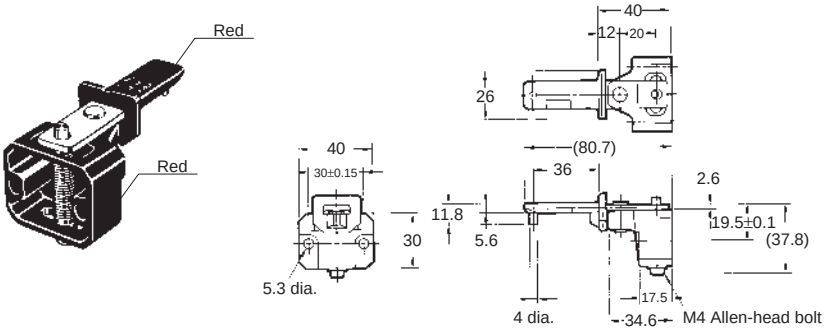
Vertical Mounting

D4BL-K2



Adjustable Mounting (Horizontal)

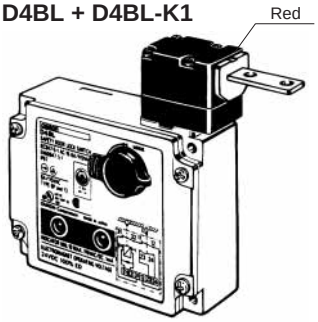
D4BL-K3

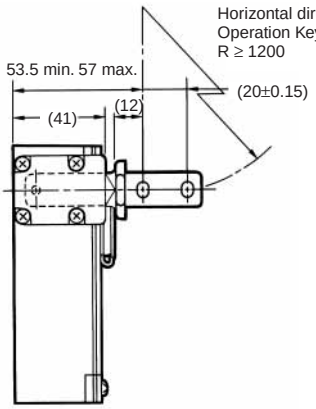


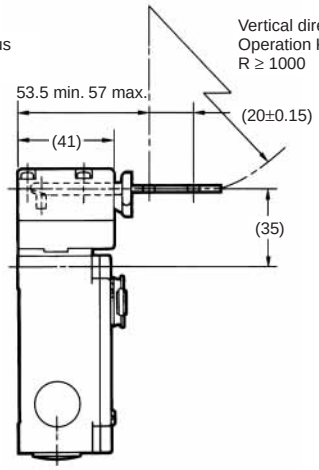
With Operation Key Inserted

Horizontal Mounting

D4BL + D4BL-K1

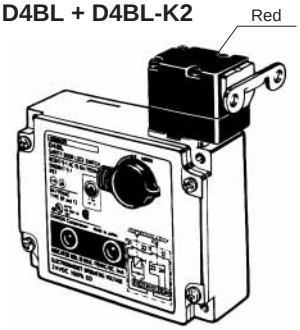


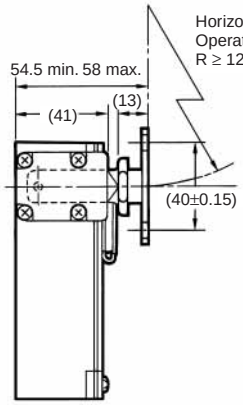


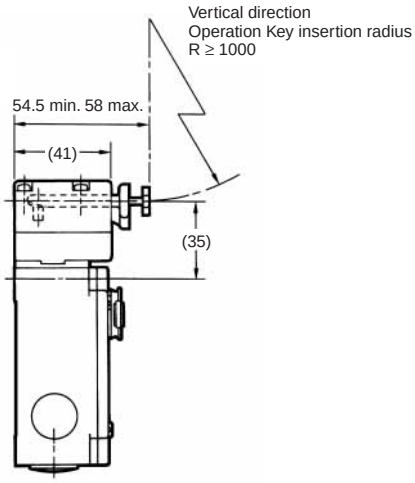


Vertical Mounting

D4BL + D4BL-K2

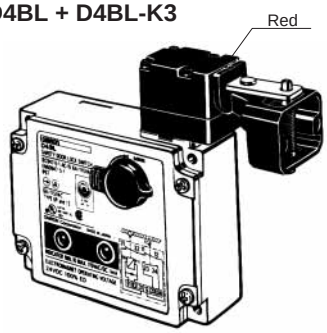


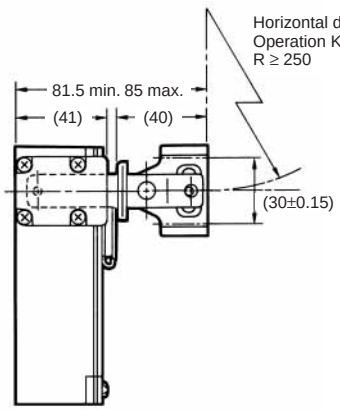


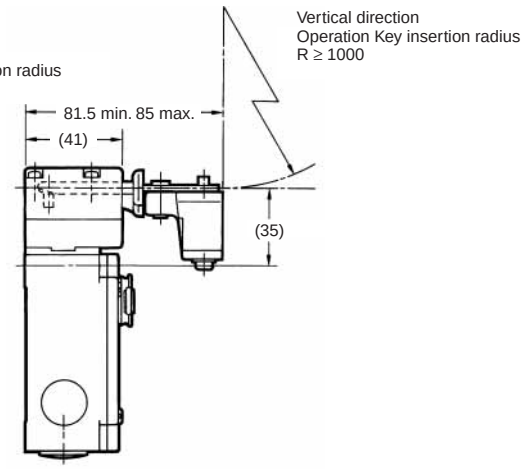


Adjustable Mounting (Horizontal)

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

⚠ Caution

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.

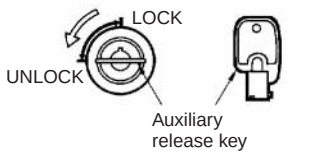
In order to prevent the D4BL from burning due to overvoltage, insert a protection fuse into the solenoid circuit.

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.

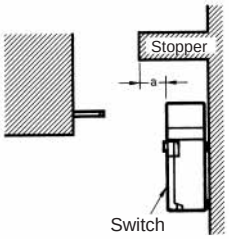
Do not use the auxiliary release key to start or stop machines.

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.

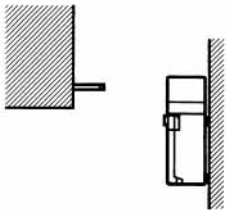
Make sure that the auxiliary release key is kept with the person in charge.

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.

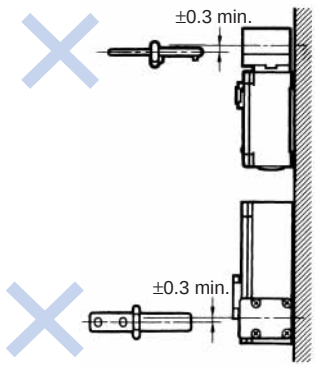
Do not use the D4BL in the following locations.

- 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

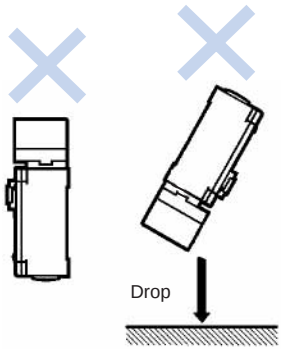
Operation Key

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.



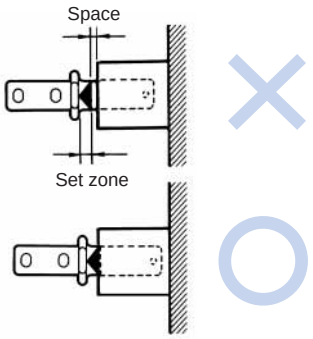
The head is constructed so that it cannot be operated with tools such as screwdrivers. Always use OMRON's Operation Key to operate the head in order to ensure the safety of the machine and protect the D4BL from damage.

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

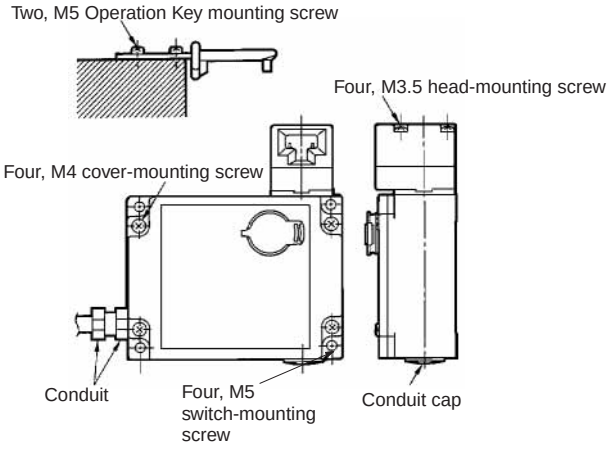
If the Operation Key on the closed door is pulled outside the set zone by a force caused by vibration, the door's weight, or the door cushion rubber, the D4BL may be damaged. Secure the door with hooks so that it will remain within the set zone.



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

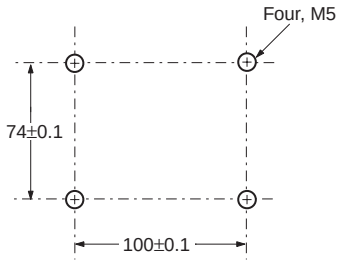


Switch and Operation Key Mounting

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

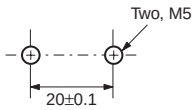
Mounting Dimensions

Switch Mounting Dimensions

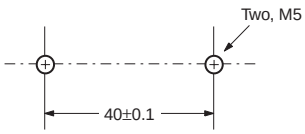


Operation Key Mounting Holes

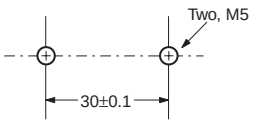
- Horizontal Mounting
  D4BL-K1



- Vertical Mounting
  D4BL-K2



- Adjustable Mounting (Horizontal)
  D4BL-K3

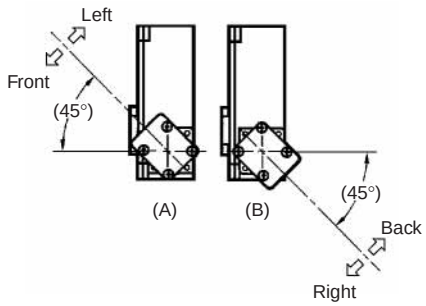


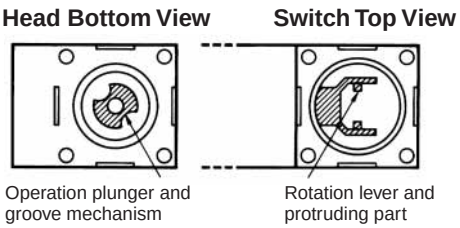
Head Directions

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.

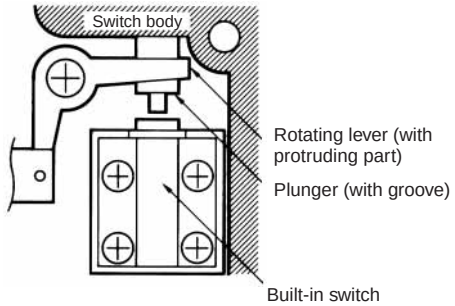
To change the direction of the head, make sure that the protruding part of the rotating lever engages with the groove of the plunger. Then turn the head clockwise or counterclockwise to the desired direction. At that time, make sure that the groove of the plunger is located under the rotating lever. 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





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

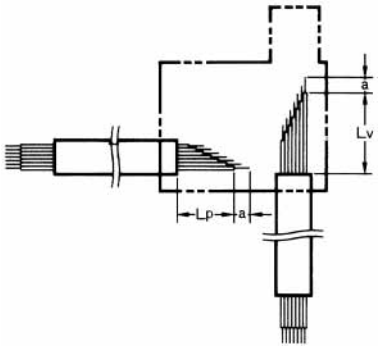
The following procedures are recommended for mounting and wiring the indicator unit securely.

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.

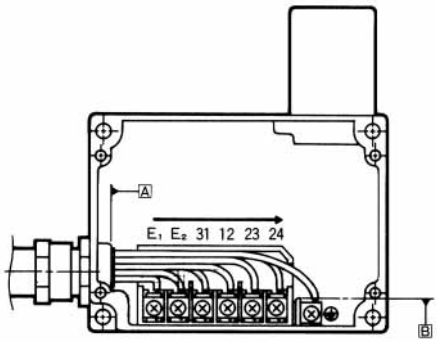


Terminal no.	Lp (mm)	Lv (mm)	a (mm)
E_1	30±2	80±2	8±1
E_2	35±2	75±2	
31	45±2	60±2	
12	55±2	50±2	
23 (21)	65±2	45±2	
24 (22)	70±2	35±2	
⏚	90±2	50±2	

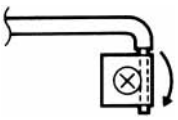
Properly attach and securely tighten the provided conduit cap to the unused conduit opening when wiring the D4BL.

Cable Connection Example

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

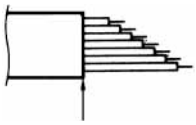


Tighten each wired terminal clockwise to a torque of 0.59 to 0.78 N·m.



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

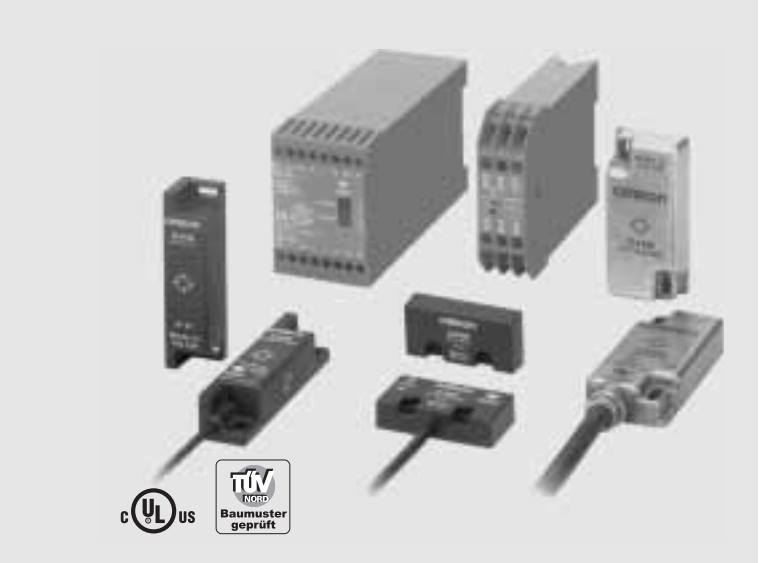
Contact your OMRON representative for any repair or maintenance work on the D4BL. The D4BL must not be maintained or repaired by any unauthorized party.

Others

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

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 key-holes 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

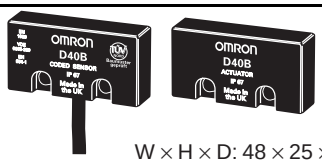
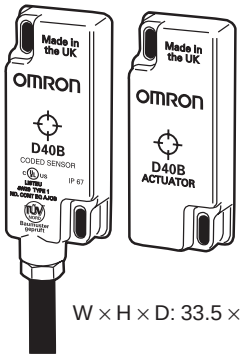
1. **Type**
   1: One main contact + one auxiliary contact (See note.)
   2: Two main contacts + one auxiliary contact (See note.)

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

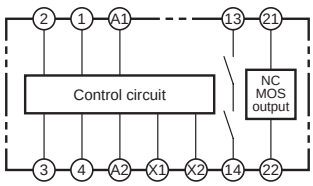
Item	Type	D40B-J1	D40B-J2
Contact resistance		100 mΩ (not including auxiliary output)	100 mΩ
Auxiliary output ON resistance		36 Ω (nominal value)	---
Response time		25 ms max.	
Insulation resistance		100 MΩ (at 500 VDC)	
Dielectric strength	**Between output poles**	1,500 VAC 1 min.	
	Between inputs and 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

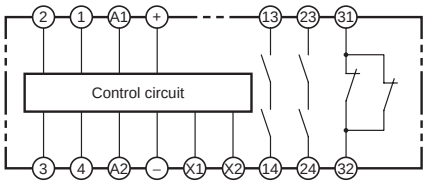
- EN standards certified by TÜV Nord
  EN954-1
  EN/IEC60204-1
  EN/IEC60947-5-3
- UL508, CSA C22.2 No. 14
- EN1088 conformance

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.

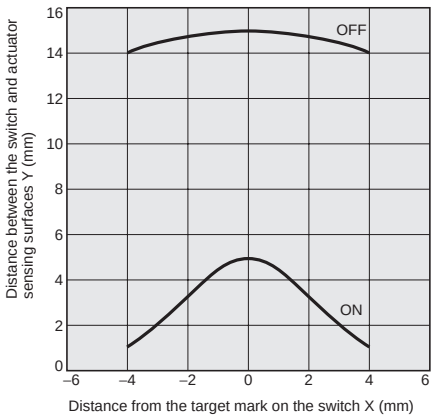
⚠ WARNING

Do not connect a 100/230 VAC power supply to the + and – terminals.
Doing so may result in electric shock.

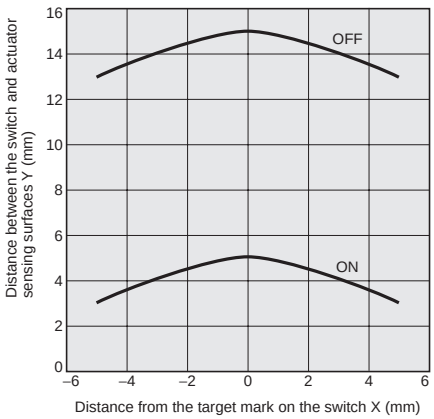
Engineering Data

Detection Ranges

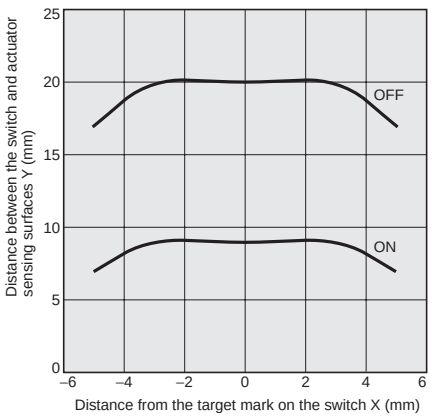
Standard Sensor



Elongated Sensor



High-temperature Type Sensor



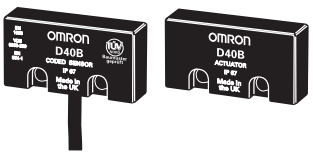
Dimensions

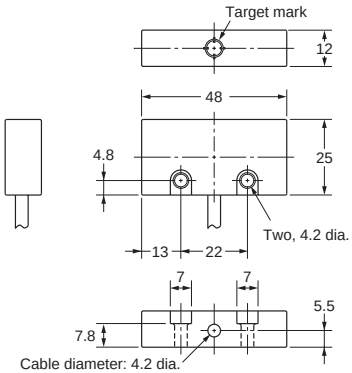
Note: All units are in millimeters unless otherwise indicated.

Sensor (Switch/Actuator)

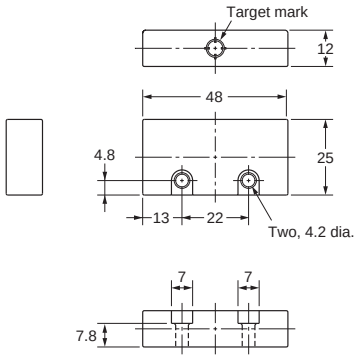
Standard Sensor

D40B-1B3
D40B-1B10
D40B-1D3
D40B-1D10





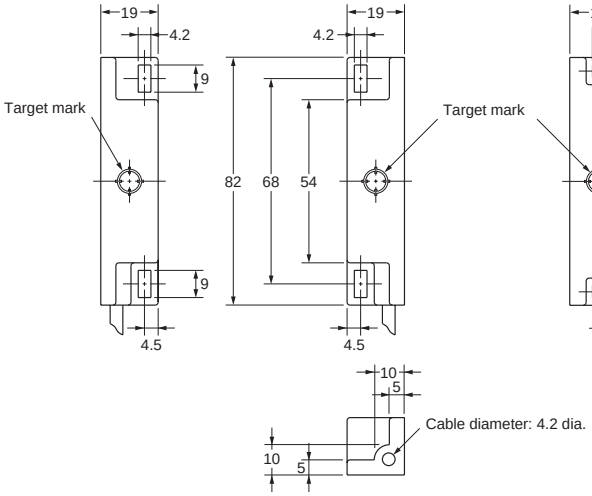
(Switch)



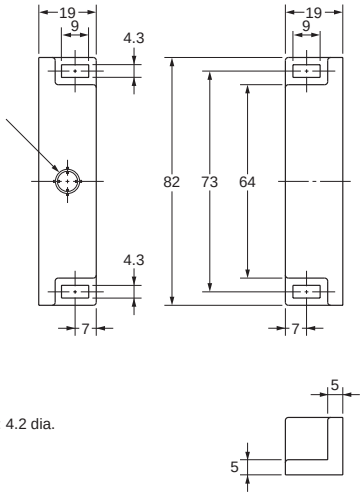
(Actuator)

Elongated Sensor

D40B-2B3
D40B-2B10
D40B-2D3
D40B-2D10



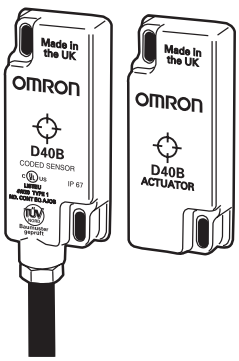
(Switch)



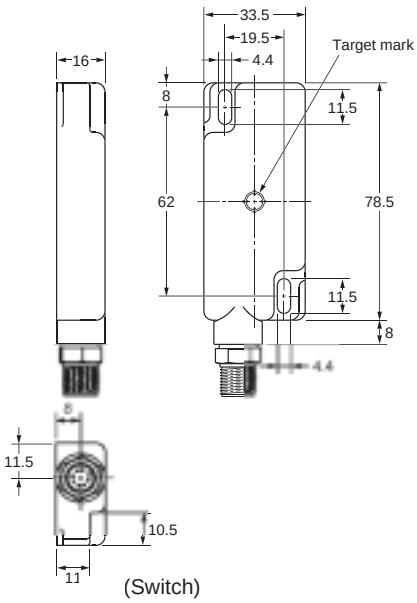
(Actuator)

High-temperature Type Sensor

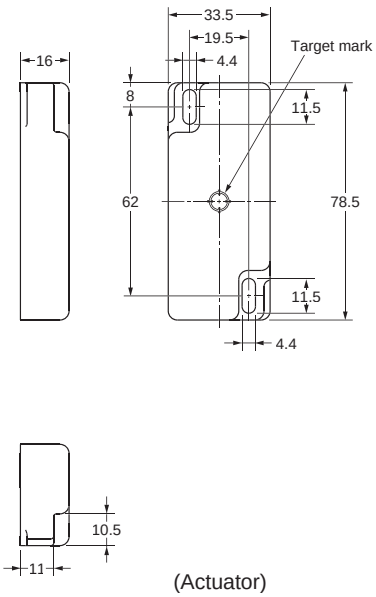
D40B-3D5C
D40B-3E5C



Note: A cable with connectors is included.



(Switch)

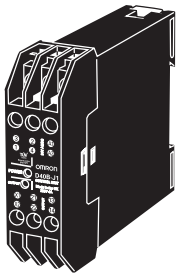


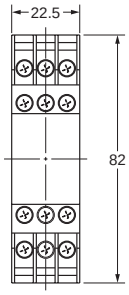
(Actuator)

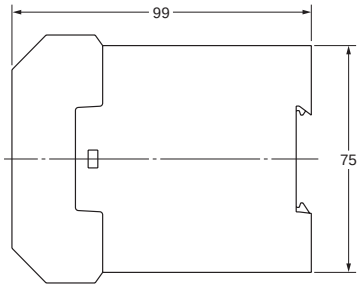
Controller

1-pole Controller

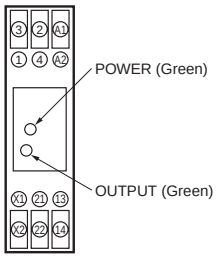
D40B-J1





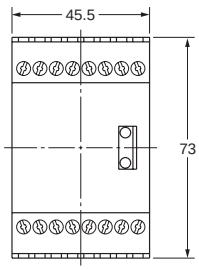


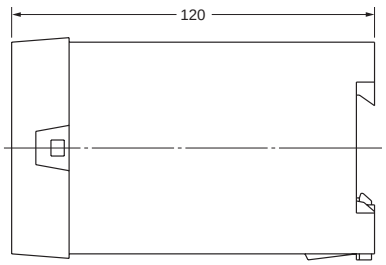
Terminal Arrangement



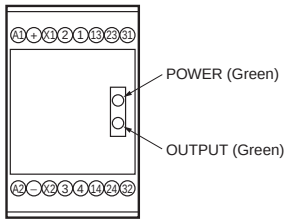
2-pole Controller

D40B-J2





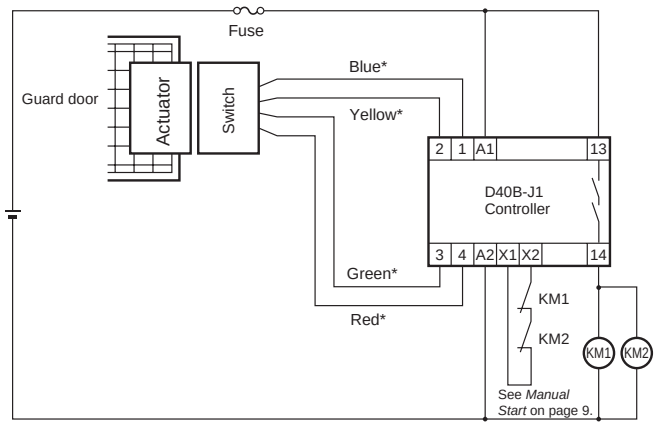
Terminal Arrangement

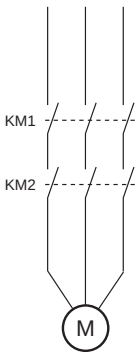


Application Examples

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.



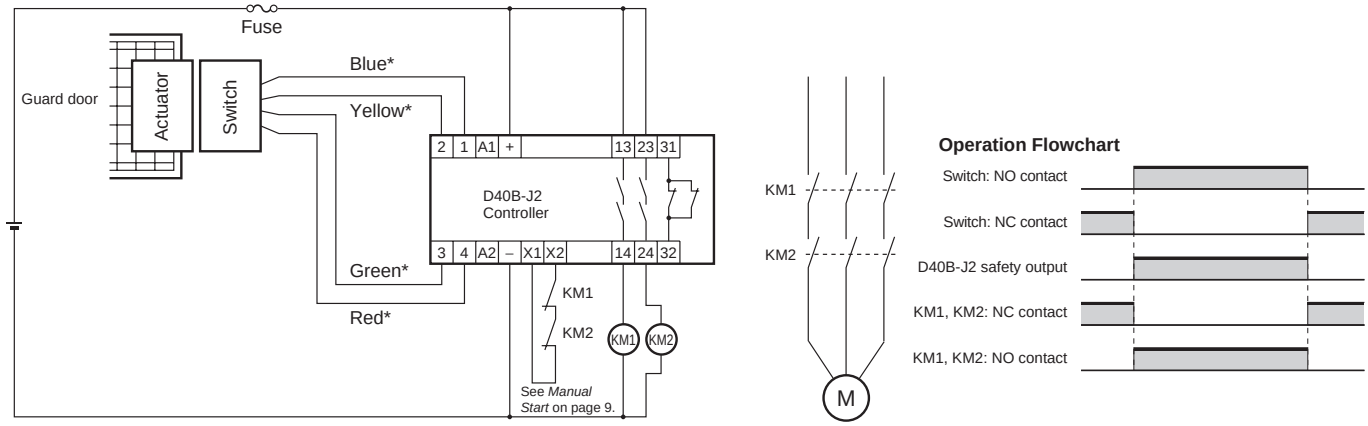


Operation Flowchart

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

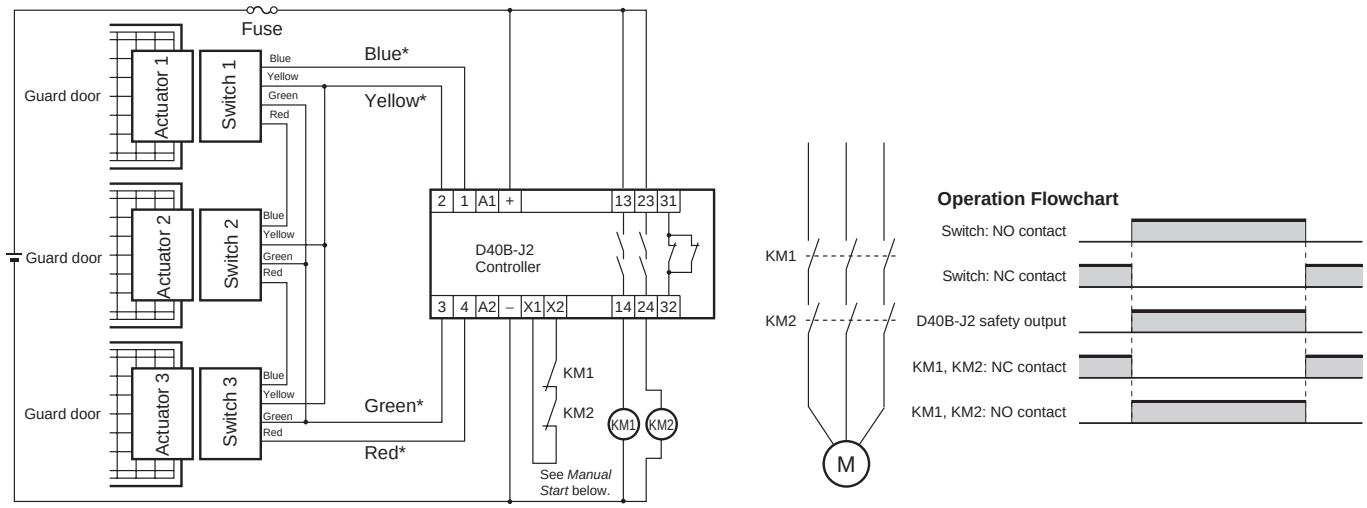
The configuration in this example is for auto-reset and contactor monitoring.



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

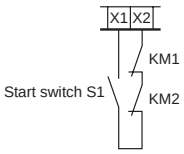
The configuration in this example is for auto-reset and contactor monitoring.



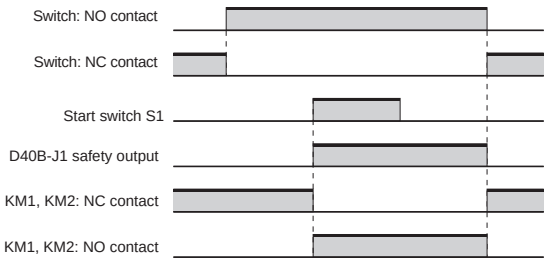
Note 1: The circuit in this example is equivalent to a Category 3 circuit.
Note 2: If two or more Sensors are connected to one Controller, all of the guard doors must open and close independently. If two or more doors open and close at the same time, it is possible that a fault may not be detected.
Note 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.

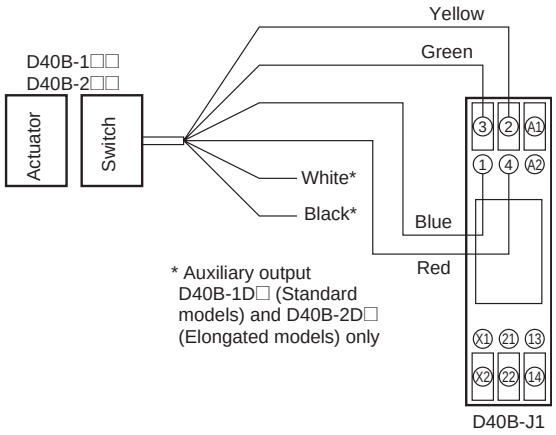


Operation Flowchart

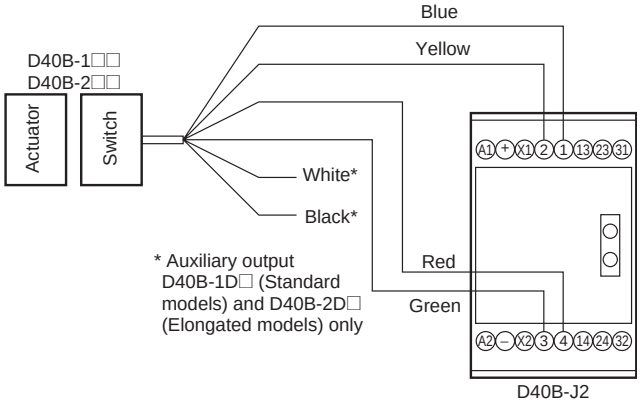


Sensor and Controller Connection Examples

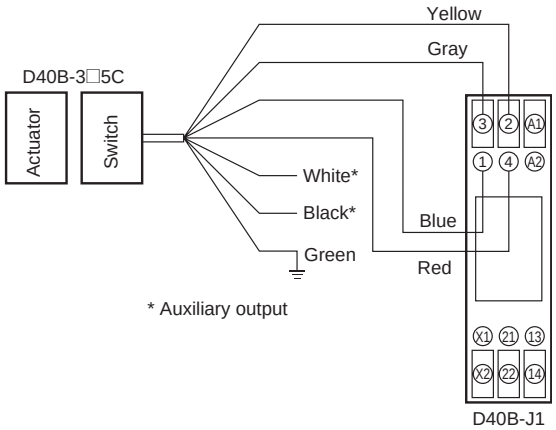
Connection between Standard or Elongated Sensor and 1-pole Controller



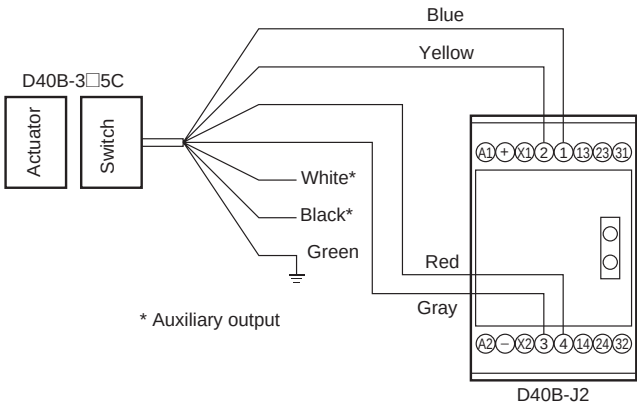
Connection between Standard or Elongated Sensor and 2-pole Controller



Connection between High-temperature Type Sensor and 1-pole Controller



Connection between High-temperature Type Sensor and 2-pole Controller



Safety Precautions

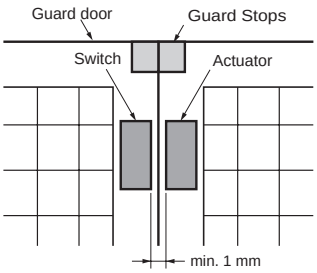
⚠ WARNING

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.



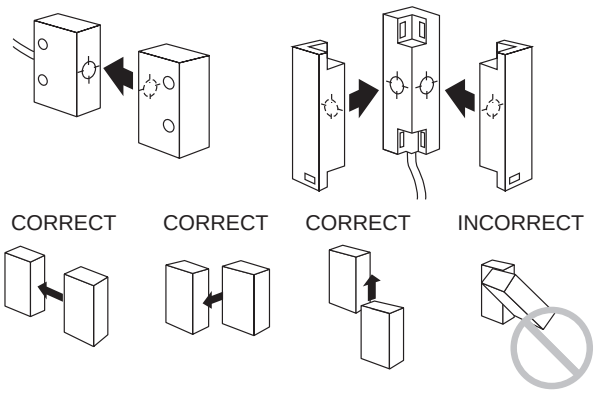
Application Precautions

- 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

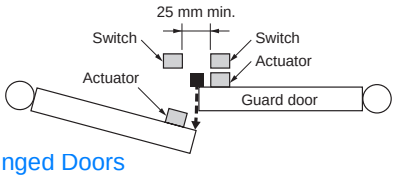
Mounting Direction of Switch and Actuator

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).



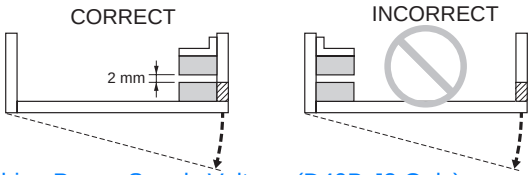
Mutual Interference

If the switch and actuator are mounted in parallel, be sure to separate them by at least 25 mm, as shown below.



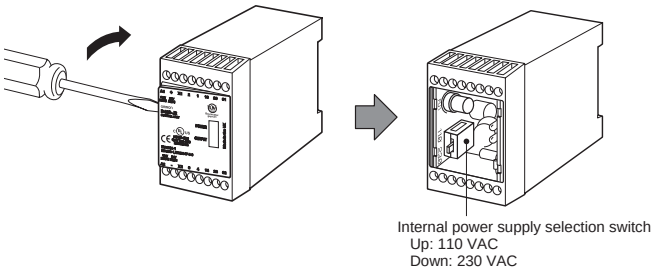
Using for Hinged Doors

On hinged doors, install the Sensor at an opening edge as shown below.



Switching Power Supply Voltage (D40B-J2 Only)

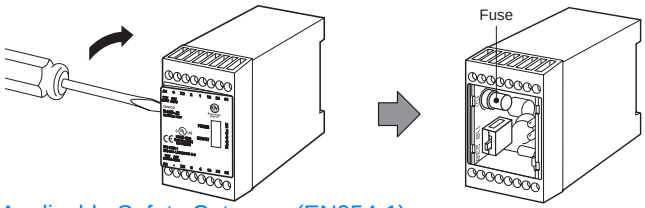
- Turn OFF the power to the Controller.
- Open the Controller's front cover with a flat-bladed screwdriver.
- Change the power supply voltage as required with the internal power supply selection switch. The switch is factory-set to 230 VAC.



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 213.)



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

Safety-door Hinge Switch

D4DH

- Conforms to EN (TÜV) standards corresponding to the CE marking.
- 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.
- Two actuator types are available:
  - Shaft
  - Arm lever
- Double-insulation structure requires no ground terminals (marked with ⧈).
- Wide standard operating temperature range: -30°C to 70°C
- Metric conduit types available

Model Number Structure

Model Number Legend

D4DH-□□□

1 2 3

1. Conduit Size
- 1: Pg13.5 (1-conduit)
- 2: G1/2 (1-conduit)
- 3: 1/2-14NPT (1-conduit)
- 4: M20
- 5: Pg13.5 (2-conduit)
- 6: G1/2 (2-conduit)
- 8: M20 (2-conduit)

2. Built-in Switch
- 5: 1NC/1NO (slow-action)
- A: 2NC (slow-action)

3. Actuator
- AS: Shaft
- BC: Arm lever (mounted upward in the center position)

Ordering Information

List of Models

Switches

Actuator	Conduit size		1NC/1NO (see note)	2NC (see note)
			Model	Model
Shaft	1-conduit	Pg13.5	D4DH-15AS	D4DH-1AAS
		$G^1/_2$	D4DH-25AS	D4DH-2AAS
		M20	D4DH-45AS	D4DH-4AAS
	2-conduit	Pg13.5	D4DH-55AS	D4DH-5AAS
		$G^1/_2$	D4DH-65AS	D4DH-6AAS
		M20	D4DH-85AS	D4DH-8AAS
Arm lever	1-conduit	Pg13.5	D4DH-15BC	D4DH-1ABC
		$G^1/_2$	D4DH-25BC	D4DH-2ABC
		M20	D4DH-45BC	D4DH-4ABC
	2-conduit	Pg13.5	D4DH-55BC	D4DH-5ABC
		$G^1/_2$	D4DH-65BC	D4DH-6ABC
		M20	D4DH-85BC	D4DH-8ABC

Note: All models have slow-action contacts with approved direct opening mechanisms on NC contacts only.

Specifications

Approved Standards

Agency	Standard	File No.
TÜV Rheinland	EN60947-5-1	R9650736 (Direct opening: approved)
BIA	GS-ET-15	9610569
UL (see note)	UL508, CSA C22.2 No.14	E76675
SUVA	SUVA	E6350.d

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

Approved Standard Ratings

TÜV (EN60947-5-1)

Utilization category	AC-15
Rated operating current (I_e)	2 A
Rated operating voltage (U_e)	400 V

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

UL (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

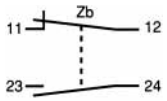
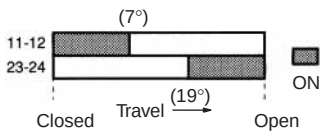
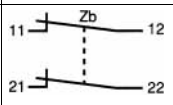
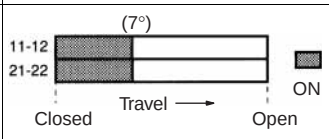
Degree of protection (see note 1)	IP65 (EN60947-5-1)
Durability (see note 2)	Mechanical:1,000,000 times min. Electrical:150,000 times min.
Operating speed	2°/s to 360°/s
Contact gap	2 x 2.0 mm min.
Operating frequency	30 operations/minute max.
Direct opening force (see note 3)	1 N·m min.
Direct opening travel (see note 3)	45° min.
Insulation resistance	100 MΩ min. (at 500 VDC) between terminals of same or different polarity and between each terminal and non-current-carrying metal part.
Contact resistance	25 mΩ max. (initial value)
Rated impulse voltage (Uimp)	Between terminals of same polarity:Uimp 4 kV (EN60947-5-1) Between terminals of different polarity:Uimp 4 kV (EN60947-5-1) Between each terminal and non-current-carrying metal part:Uimp 4 kV (EN60947-5-1)
Rated insulation voltage (U_i)	400 V (EN60947-5-1)
Conditional short-circuit current	100 A (EN60947-5-1)
Switching overvoltage	1,500 V max. (EN60947-5-1)
Pollution degree (operating environment)	3 (EN60947-5-1)
Conventional enclosed thermal current (I_{the})	10 A (EN60947-5-1)
Protection against electric shock	Class II (double insulation)
Vibration resistance	Malfunction:10 to 55 Hz, 0.75 mm single amplitude
Shock resistance	Mechanical: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.
Weight	D4DH-15AS:Approx. 74 g D4DH-15BC:Approx. 84 g

Note: 1. Although the switch box is protected from dust or water penetration, do not use the D4DH in places where dust, water, or chemicals may come in contact with the head, otherwise Switch damage or malfunctioning may occur.

2. The durability is for an ambient temperature of 5°C to 35°C and an ambient humidity of 40% to 70%.

3. These figures are minimum requirements for safe operation.

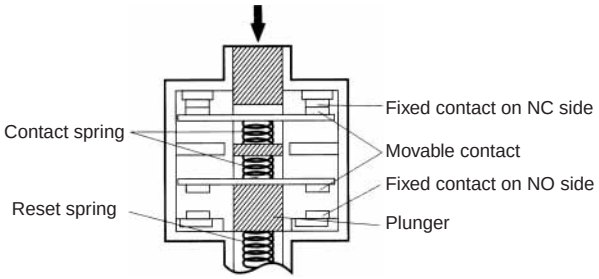
Contact Form

Model	Contact	Contact form	Diagram	Remarks
D4DH-□5□□	1NC/1NO			Only NC contact 11-12 has an approved direct opening mechanism. ⊖ The terminals 11-12 and 23-24 can be used as unlike poles.
D4DH-□A□□	2NC			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.

Note: Terminals are numbered according to EN50013. Contact forms are according to EN60947-5-1.

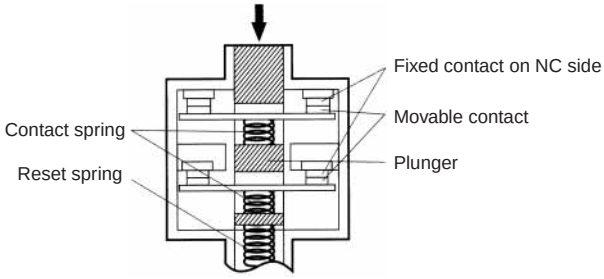
Direct Opening Mechanism

1NC/1NO Contact (Slow-action)



All models have slow-action contacts with approved direct opening mechanisms on the NC contacts, thus forcibly separating the NC contacts even if they weld. (Meets the requirements of EN60947-5-1.)

2NC Contact (Slow-action)

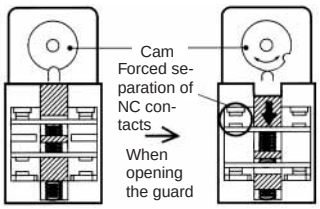


All models have slow-action contacts with approved direct opening mechanisms on both sets of NC contacts, thus forcibly separating the NC contacts even if they weld. (Meets the requirements of EN60947-5-1.)

Nomenclature

D4DH-□□BC

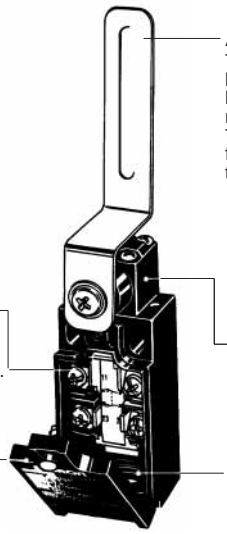
Guard Closed **Guard Open**



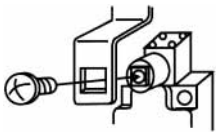
When the guard is opened, the cam that is directly coupled to the shaft rotates to press the Switch in the direction shown by the (vertical) arrow. This action separates the contacts to stop the machine.

Built-in Switch
The built-in switch has a direct opening mechanism that forcibly separates the NC contact even when there is contact deposit. Models with a 1NC contact and 1NO contact or 2NC contacts are available.

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.



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	---
M20	Yes	Yes

* The housing and head of the D4DH 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.

Dimensions

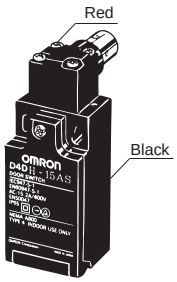
Note: 1. All units are in millimeters unless otherwise indicated.

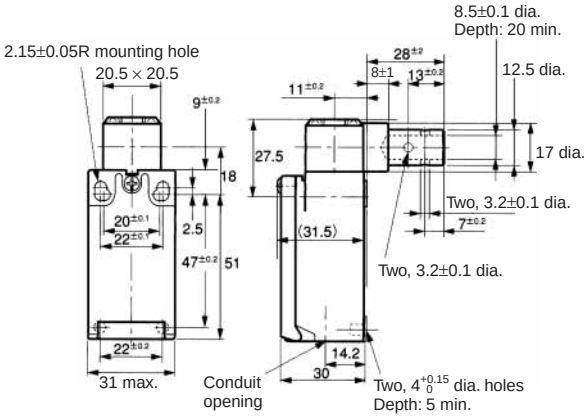
2. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

Switches

Shaft Type with 1 Conduit

D4DH-1□AS
D4DH-2□AS
D4DH-4□AS



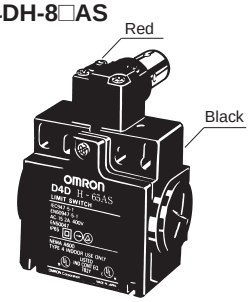


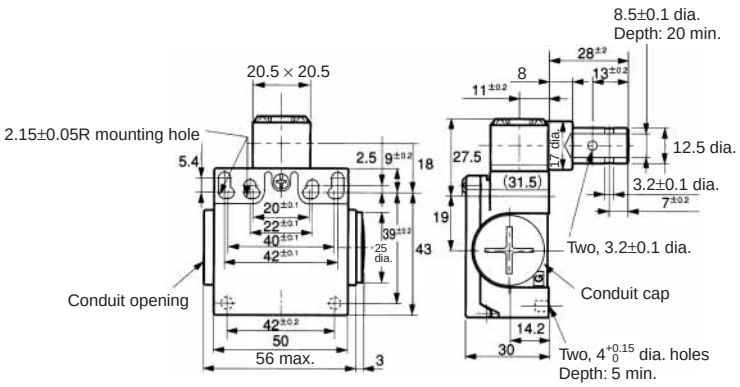
Operating force	0.15 N·m max.
Pre-travel angle 1 (NC)	(7°)
Pre-travel angle 2 (NO) (See note.)	(19°)
Direct opening travel (min.)	45° min.
Direct opening force (min.)	1 N·m min.

Note: Applicable to models with 1NC and 1NO contacts.

Shaft Type with 2 Conduits

D4DH-5□AS
D4DH-6□AS
D4DH-8□AS



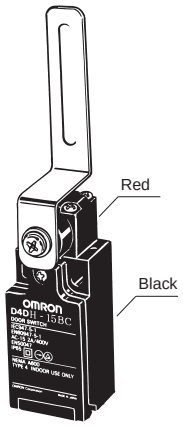


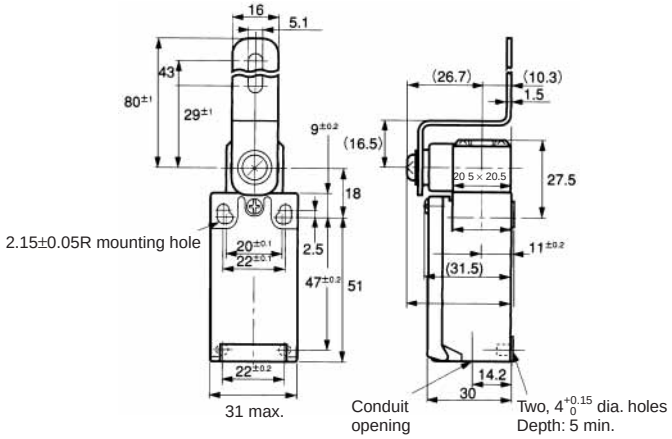
Operating force	0.15 N·m max.
Pre-travel angle 1 (NC)	(7°)
Pre-travel angle 2 (NO) (See note.)	(19°)
Direct opening travel (min.)	45° min.
Direct opening force (min.)	1 N·m min.

Note: Applicable to models with 1NC and 1NO contacts.

Arm Lever Type with 1 Conduit

D4DH-1□BC
D4DH-2□BC
D4DH-4□BC



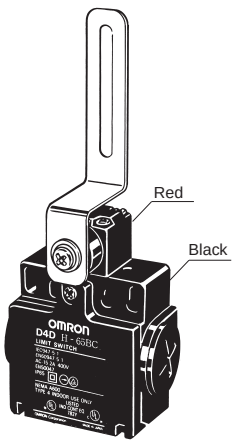


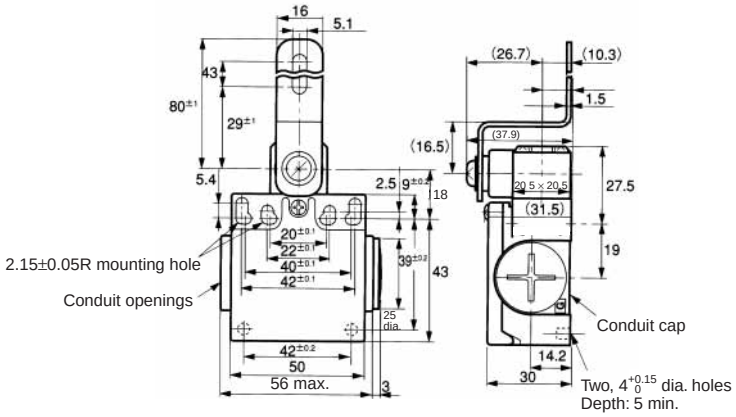
Operating force	0.15 N·m max.
Pre-travel angle 1 (NC)	(7°)
Pre-travel angle 2 (NO) (See note.)	(19°)
Direct opening travel (min.)	45° min.
Direct opening force (min.)	1 N·m min.

Note: Applicable to models with 1NC and 1NO contacts.

Arm Lever Type with 2 Conduits

D4DH-5□BC
D4DH-6□BC
D4DH-8□BC



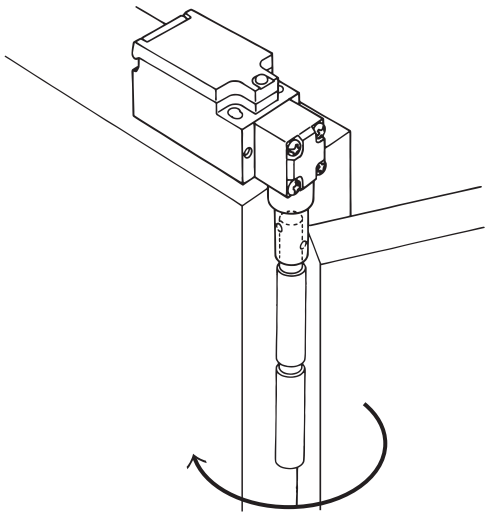


Operating force	0.15 N·m max.
Pre-travel angle 1 (NC)	(7°)
Pre-travel angle 2 (NO) (See note.)	(19°)
Direct opening travel (min.)	45° min.
Direct opening force (min.)	1 N·m min.

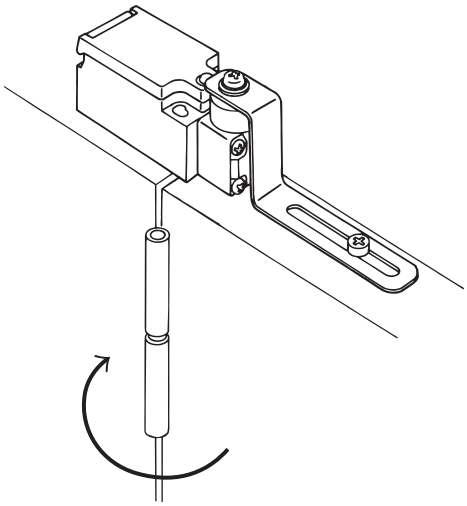
Note: Applicable to models with 1NC and 1NO contacts.

Application Examples

Shaft Actuator



Arm Lever Actuator

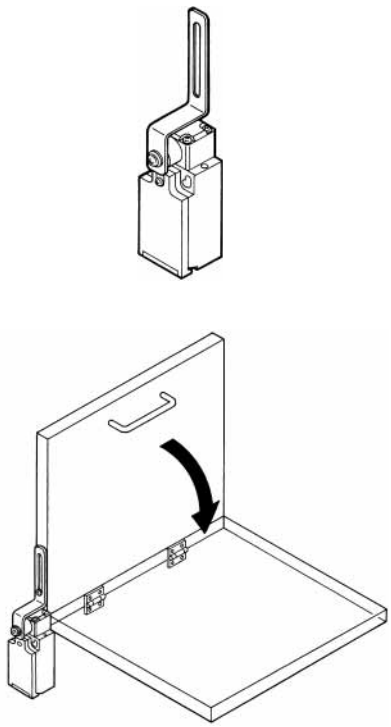


Application Examples of Arm Lever Use

Note: Be sure to evaluate the Switch under actual working conditions after installation.

When Installing at the Center

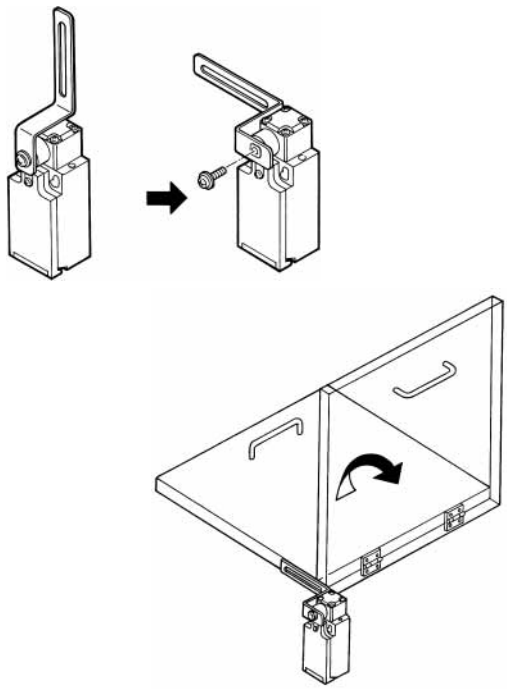
The arm lever is set for center installation at the time of shipment.



Note: Install the arm lever so that it will not rotate more than 90°.

When Installing to the Left

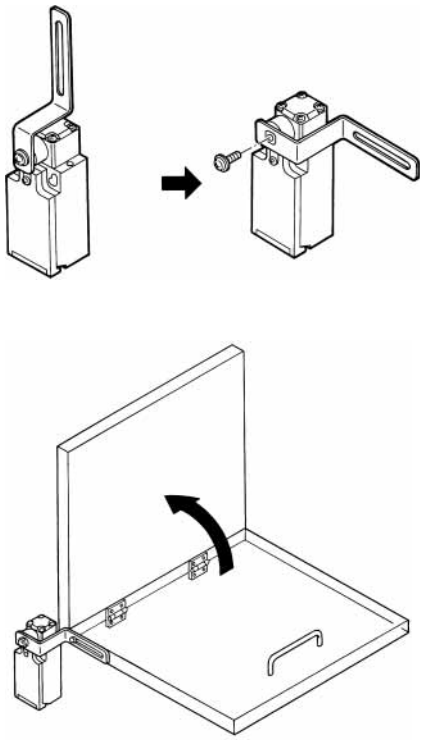
Remove the screw and arm lever, position the arm lever to the left, and then secure it with the screw.



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°.

Precautions

⚠ Caution

Do not use metal connectors or conduits with this Switch. Rigid connectors and conduits may damage the Switch. The broken conduit hole may cause electrical shock hazard.

NOTICE

If the D4DH is applied to a safety category circuit for prevention of injury, use the NC contact, which incorporates a force-separation mechanism, and make sure that the D4DH operates in direct opening mode. Furthermore, secure the D4DH with screws or equivalent parts that are tightened in a single direction so that the D4DH or Operation Key cannot be easily removed or provide a protection cover to the D4DH and post a warning label near the D4DH.

Protect the D4DH with an appropriate cover and post a warning sign near the D4DH for safety reasons so that the D4DH will not be removed carelessly.

To protect the D4DH from damage due to short-circuits, connect the D4DH in series to a fuse that has a breaking current 1.5 to 2 times the rated current of the D4DH. If the D4DH is used under EN-approved rating conditions, use a 10-A fuse, type gI or gG conforming to IEC 269.

Do not touch the live switch terminal. Electric shock hazard may be caused.

Do not use the D4DH in locations subject to corrosive or flammable gases.

Make sure that the load current does not exceed the rated current and that the load terminals are wired correctly.

Pay utmost attention to correctly wire each terminal.

Be sure to evaluate the Switch under actual working conditions after installation.

Do not use the Switch as a stopper.

Do not drop or disassemble the D4DH.

Life Expectancy

The life of the D4DH will vary with the switching conditions. Before applying the D4DH, test the D4DH under actual operating conditions and be sure to use the D4DH in actual operation within switching times that will not lower the performance of the D4DH.

Correct Use

Operating Environment

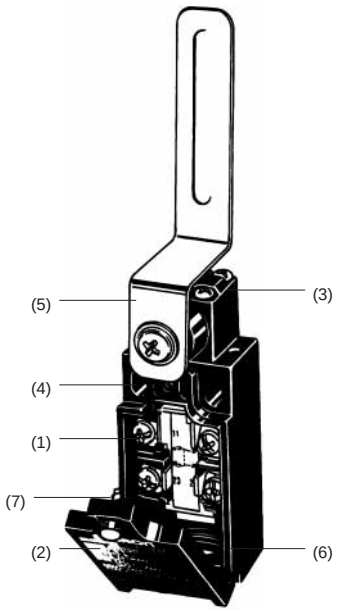
The D4DH is for indoor use only. Do not use the D4DH outdoors. Otherwise, the D4DH may malfunction. Be sure that no metal dust, oil, or chemical will be sprayed onto the D4DH, otherwise the D4DH may malfunction.

Do not use the D4DH 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 D4DH properly, otherwise the D4DH may malfunction.



No.	Type	Torque
(1)	M3.5 terminal screw	0.59 to 0.78 N·m
(2)	Cover mounting screw	0.78 to 0.88 N·m
(3)	Head mounting screw	0.78 to 0.88 N·m
(4)	M4 body mounting screw (see note 1)	0.49 to 0.69 N·m
(5)	Arm lever mounting screw (M5 x 0.8)	1.57 to 1.77 N·m
(6)	Connector	1.77 to 2.16 N·m
		1.37 to 1.77 N·m (see note 2)
(7)	Cap screw (see note 3)	1.27 to 1.67 N·m

Note: 1. Tighten each screw together with a washer to the specified torque.

2. This torque range applies to $^{1}/_{2}$-14NPT connectors.

3. For 2-conduit models only.

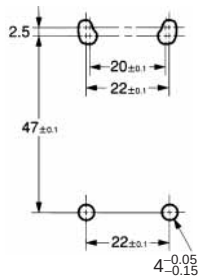
Switch and Mounting

Be sure that the D4DH operates properly after mounting and adjusting the D4DH.

Use two M4 screws (one-way screws, etc.) and washers to mount the D4DH securely. The D4DH can be mounted more securely with two protruding portions inserted into the lower part of the D4DH as shown below. Each protruding portion is $4^{-0.05}_{-0.15}$ mm in diameter with a maximum height of 4.8 mm.

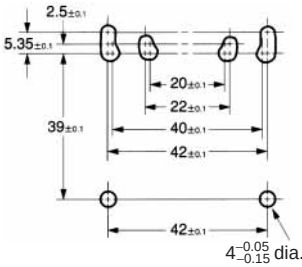
Mounting Holes

• Standard Model

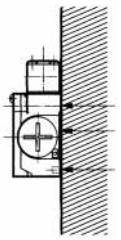


$4^{-0.05}_{-0.15}$ dia., height: 4.8 max.

• 2-conduit Model



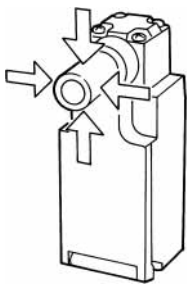
$4^{-0.05}_{-0.15}$ dia., height: 4.8 max.



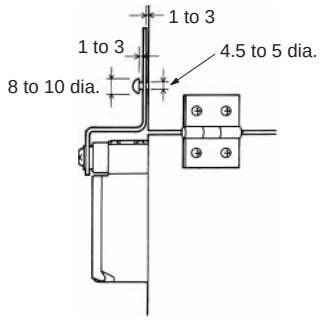
Mounting hole
Mounting surface
Insertion hole for protruding portion
$4^{-0.05}_{-0.15}$ dia.
Depth: 4.8 mm

Mount the shaft or arm lever with a one-way screw, or an equivalent securely so that the shaft or arm lever cannot be easily dismounted.

Although the shaft withstands a force exceeding 500 N, do not impose a force of 50 N or more on the shaft.



Be sure that the arm lever moves smoothly when the door opens or closes.



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.

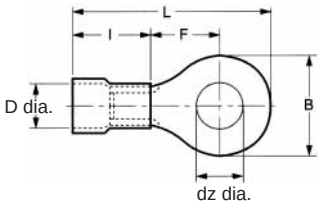
Head Direction

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 during a change in direction.

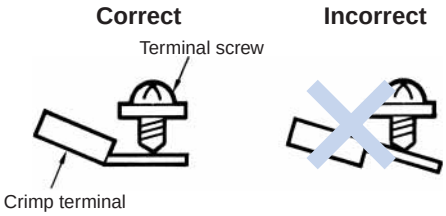
Wiring

Do not connect lead wires directly to the terminals. Be sure to connect the lead wires through insulation tubes and crimp terminals. The tightening torque applied to each crimp terminal is 0.59 to 0.78 N·m. The lead wires must be an AWG20 to AWG14 type (i.e., 0.5 to 2.5 mm^2 thick).

dz dia.:	3.7
D dia.:	4.5
B:	7.0
L:	20.2
F:	7.7
I:	9.0 (mm)



Wire the crimp terminal as shown in the following diagram so that it will not come in contact with the casing or cover.



Safety Limit Switch

D4D-□N

Small, Economical Switch Featuring a Direct Opening Mechanism and Conforming to the CE Marking

- Contacts opened by direct opening mechanism (NC contacts only), thus preventing faulty operation due to factors such as contact weld.
- Double insulation makes ground terminal unnecessary. (Bears □ marking.)
- Conforms to EN (TÜV) standards corresponding to the CE marking.
- Wide standard operating temperature range: -30°C to 70°C.
- Series expanded to include a 2-conduit models, two types of actuator (cat whisker and plastic rod), and metal-lever models.
- Form lock models added to adjustable roller lever model lineup.
- Conforms to EN115 and EN81-1.
- Series includes models with gold-plated contacts for handling micro-load range.
- Metric conduit types available

Model Number Structure

■ Model Number Legend

D4D-□□□□N
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 (2-conduit)
- 6: G1/2 (2-conduit)
- 8: M20 (2-conduit)

2. Built-in Switch
- 1: 1NC/1NO (snap-action)
- 3: 1NC/1NO (snap-action), gold-plated contacts
- 5: 1NC/1NO (slow-action)
- 6: 1NC/1NO (slow-action), gold-plated contacts
- A: 2NC (slow-action)
- B: 2NC (slow-action), gold-plated contacts

3. Head and Actuator
- 20: Roller lever (standard, resin lever)
- 21: Adjustable roller lever
- 22: Roller lever (metal lever)
- 27: Adjustable roller lever (with 50 dia. rubber roller)
- 2H: Adjustable roller lever, form lock (with 50 dia. 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

Safety limit switch, mechanical form lock

Switches

Actuator	Conduit size (see note 1)		Built-in switch mechanism					
			1NC/1NO (Snap-action)		1NC/1NO (Slow-action)		2NC (Slow-action)	
			Direct opening	Model	Direct opening	Model	Direct opening	Model
Roller lever (resin lever)	1-conduit	Pg13.5	⊖	D4D-1120N	⊖	D4D-1520N	⊖	D4D-1A20N
		G1/2		D4D-2120N		D4D-2520N		D4D-2A20N
		M20		D4D-4120N		D4D-4520N		D4D-4A20N
	2-conduit	Pg13.5		D4D-5120N		D4D-5520N		D4D-5A20N
		G1/2		D4D-6120N		D4D-6520N		D4D-6A20N
		M20		D4D-8120N		---		---
Roller lever (metal lever, metal roller)	1-conduit	Pg13.5	⊖	D4D-1122N	⊖	D4D-1522N	⊖	D4D-1A25N
		G1/2		D4D-2122N		D4D-2522N		D4D-2A25N
		M20		D4D-4122N		---		---
	2-conduit	Pg13.5		D4D-5122N		D4D-5522N		D4D-5A22N
		G1/2		D4D-6122N		D4D-6522N		D4D-6A22N
Plunger	1-conduit	Pg13.5	⊖	D4D-1131N	⊖	D4D-1531N	⊖	D4D-1A31N
		G1/2		D4D-2131N		D4D-2531N		D4D-2A31N
		M20		D4D-4131N		D4D-4531N		D4D-4A31N
	2-conduit	Pg13.5		D4D-5131N		D4D-5531N		D4D-5A31N
		G1/2		D4D-6131N		D4D-6531N		D4D-6A31N
		M20		D4D-8131N		---		---
Roller plunger	1-conduit	Pg13.5	⊖	D4D-1132N	⊖	D4D-1532N	⊖	D4D-1A32N
		G1/2		D4D-2132N		D4D-2532N		D4D-2A32N
		M20		D4D-4132N		D4D-4532N		---
	2-conduit	Pg13.5		D4D-5132N		D4D-5532N		D4D-5A32N
		G1/2		D4D-6132N		D4D-6532N		D4D-6A32N
		M20		D4D-8132N		---		---
One-way roller arm lever (horizontal)	1-conduit	Pg13.5	⊖	D4D-1162N	⊖	D4D-1562N	⊖	D4D-1A62N
		G1/2		D4D-2162N		D4D-2562N		D4D-2A62N
		M20		D4D-4162N		D4D-4562N		D4D-4A62N
	2-conduit	Pg13.5		D4D-5162N		D4D-5562N		D4D-5A62N
		G1/2		D4D-6162N		D4D-6562N		D4D-6A62N
		M20		D4D-8112N		---		---
One-way roller arm lever (vertical)	1-conduit	Pg13.5	⊖	D4D-1172N	⊖	D4D-1572N	⊖	D4D-1A72N
		G1/2		D4D-2172N		D4D-2572N		D4D-2A72N
		M20		D4D-4172N		D4D-4572N		---
	2-conduit	Pg13.5		D4D-5172N		D4D-5572N		D4D-5A72N
		G1/2		D4D-6172N		D4D-6572N		D4D-6A72N
Fork lever lock (right operation)	1-conduit	Pg13.5	---	---	---	D4D-15REN	---	D4D-1AREN
		G1/2				D4D-25REN		D4D-2AREN
	2-conduit	Pg13.5				D4D-55REN		D4D-5AREN
		G1/2				D4D-65REN		D4D-6AREN
Fork lever lock (left operation)	1-conduit	Pg13.5	---	---	---	D4D-15LEN	---	D4D-1ALEN
		G1/2				D4D-25LEN		D4D-2ALEN
	2-conduit	Pg13.5				D4D-55LEN		D4D-5ALEN
		G1/2				D4D-65LEN		D4D-6ALEN
Adjustable roller lever, form lock (with rubber roller)	1-conduit	Pg13.5	⊖	D4D-112HN	⊖	D4D-152HN	⊖	
Adjustable roller lever (See note 2.)	1-conduit	Pg13.5	---	D4D-1121N	---	D4D-1521N	---	D4D-1A21N
		G1/2		D4D-2121N		D4D-2521N		D4D-2A21N
		M20		D4D-4121N		D4D-4521N		D4D-4A21N
	2-conduit	Pg13.5		D4D-5121N		D4D-5521N		D4D-5A21N
		G1/2		D4D-6121N		D4D-6521N		D4D-6A21N

Actuator	Conduit size (see note 1)		Built-in switch mechanism					
			1NC/1NO (Snap-action)		1NC/1NO (Slow-action)		2NC (Slow-action)	
			Direct opening	Model	Direct opening	Model	Direct opening	Model
Adjustable roller lever (with rubber roller) (See note 2.) 	1-conduit	Pg13.5	---	D4D-1127N	---	D4D-1527N	---	D4D-1A27N
		G1/2		D4D-2127N		D4D-2527N		D4D-2A27N
		M20		D4D-4127N		D4D-4527N		---
	2-conduit	Pg13.5		D4D-5127N		D4D-5527N		D4D-5A27N
		G1/2		D4D-6127N		D4D-6527N		D4D-6A27N
		M20		D4D-8127N		---		---
Cat whisker (See note 2.) 	1-conduit	Pg13.5	---	D4D-1180N	---	---	---	D4D-1A80N
		G1/2		D4D-2180N				D4D-2A80N
		M20		D4D-4180N				---
	2-conduit	Pg13.5		D4D-5180N				D4D-5A80N
		G1/2		D4D-6180N				D4D-6A80N
		M20		D4D-8180N				---
Plastic rod (See note 2.) 	1-conduit	Pg13.5	---	D4D-1187N	---	---	---	D4D-1A87N
		G1/2		D4D-2187N		---		D4D-2A87N
		M20		D4D-4187N		---		---
	2-conduit	Pg13.5		D4D-5187N		---		D4D-5A87N
		G1/2		D4D-6187N		---		D4D-6A87N

Note: 1. It is recommended that M20/PG 13.5 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.

Specifications

Approved Standards

Snap-action Models

Agency	Standard	File No.
TÜV Rheinland	EN60947-5-1	J9950233 (Direct opening: approved)
		R9451193 (Direct opening: not approved) (see note 1)
UL (see note 2)	UL508 CSA C22.2 No. 14	E76675
BIA (see note 3)	GS-ET-15	1-conduit type: 9407070 2-conduit type: 9601732

Slow-action Models

Agency	Standard	File No.
TÜV Rheinland	EN60947-5-1 EN81 EN115	R9451184 (Direct opening: approved)
UL (see note 2)	UL508 CSA C22.2 No. 14	E76675
BIA (see note 3)	GS-ET-15	1-conduit type: 9407070 2-conduit type: 9601732
SUVA (see note 3)	SUVA	1-conduit type: E6192.d 2-conduit type: E6193.d

Note: 1. Adjustable roller lever, cat whisker, and plastic rod models only.
2. Approval for CSA C22.2 No. 14 is authorized by the UL mark.
3. Except for adjustable roller lever, cat whisker, or plastic rod models.

Standards and EC Directives

- Conforms to the following EC Directives:
  Machinery Directive
  Low Voltage Directive
  EN50047
  EN1088 (slow-action models only)

Approved Standard Ratings

TÜV (EN60947-5-1)

Utilization category	AC-15
Rated operating current (I_e)	2 A
Rated operating voltage (U_e)	400 V

Note: Use a 10-A fuse type gI or gG that conforms to IEC60269 as a short-circuit protection device.

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

A600 (D4D-□5□□N, D4D-□A□□N)

Type	Rated voltage	Carry current	Current		Volt-amperes	
			Make	Break	Make	Break
Slow-action	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

B600 (D4D-□1□□N)

Type	Rated voltage	Carry current	Current		Volt-amperes	
			Make	Break	Make	Break
Snap-action	120 VAC 240 VAC 480 VAC 600 VAC	5 A	30 A 15 A 7.5 A 6 A	3 A 1.5 A 0.75 A 0.6 A	3,600 VA	360 VA

Characteristics

Degree of protection (see note 2)	IP65 (EN60947-5-1)
Durability (see note 3)	Mechanical:15,000,000 operations min. (see note 4) Electrical:150,000 operations min. (10-A resistive load at 25 VAC for snap-action. Refer to *Operating Characteristics* for snap-action.)
Operating speed	1 mm/s to 0.5 m/s (for D4D-1120N)
Contact gap	Snap-action:2 x 0.5 mm min. Slow-action:2 x 2 mm min.
Operating frequency	Mechanical:120 operations/min min. Electrical:30 operations/min 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 metal parts
Contact resistance	25 mΩ max. (initial value)
Dielectric strength	Between terminals of the same polarity: U_{imp} 2.5 kV (snap-action models); Uimp 4 kV (slow-action models) Between terminals of different polarity: U_{imp} 4 kV (slow-action models) Between each terminal and non-current-carrying metal parts: U_{imp} 4 kV
Rated insulation voltage (U_i)	400 V (EN60947-5-1)
Switching overvoltage	1,500 V max. (EN60947-5-1)
Pollution degree (operating environment)	3 (EN60947-5-1)
Conditional short-circuit current	100 A (EN60947-5-1)
Conventional enclosed thermal current (I_{the})	10 A (EN60947-5-1)
Protection against electric shock	Class II (double insulation)
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.
Weight	Approx. 70 g (for D4D-1120N) Approx. 86 g (for D4D-5120N)

Note: 1. The above values are initial values.

2. Although the switch box is protected from dust or water penetration, do not use the D4D-□N in places where dust, water or chemicals may come in contact with 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 operating humidity of 40 to 70%. Contact your OMRON sales representative for more detailed information on other operating environments.

4. The mechanical durability of the fork lever lock model is 10,000,000 operations min.

Operating Characteristics

Snap-action (1NC/1NO), Slow-action (2NC)

1-conduit and 2-conduit Models

Model	D4D-□120N D4D-□A20N	D4D-□12HN D4D-□A2HN	D4D-□121N D4D-□A21N (see note 1)	D4D-□122N D4D-□A22N	D4D-□127N D4D-□A27N (see note 2)	D4D-□131N D4D-□A31N	D4D-□132N D4D-□A32N	D4D-□162N D4D-□A62N	D4D-□172N D4D-□A72N	D4D-□180N D4D-□A80N	D4D-□187N D4D-□A87N
OF max.	4.90 N	4.22 N		4.90 N	4.22 N	6.37 N		3.92 N	4.41 N	1.47 N	
RF min.	0.49 N	0.42 N		0.49 N	0.42 N	1.47 N		0.78 N	0.88 N	---	
PT	18° to 27°					2 mm max.		4 mm max.		15° max.	
OT min.	40°					4 mm		5 mm		---	
MD max. (see note 3)	14°					1 mm	1 mm	1.5 mm		---	
OP	---					18.2±0.5 mm	28.2± 0.8 mm	37±0.8 mm	27±0.8 mm	---	
TT (see note 4)	(70°)					(6 mm)		(9 mm)		---	
DOT min. (see note 5)	50°					3.2 mm		5.8 mm	4.8 mm	---	
DOF min. (see note 5)	19.61 N					19.61 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. Only for snap-action models.
4. Nominal value.
5. Only for slow-action models. DOT (direct opening travel) and DOF (direct opening force) are required values for direct opening.

Slow-action (1NC/1NO)

1-conduit and 2-conduit Models

Model	D4D-□520N	D4D-□52HN	D4D-□521N (see note 1)	D4D-□522N	D4D-□527N (see note 2)	D4D-□531N	D4D-□532N	D4D-□562N	D4D-□572N
OF max.	4.90 N	4.22 N		4.90 N	4.22 N	6.37 N		3.92 N	4.41 N
RF min.	0.49 N	0.42 N		0.49 N	0.42 N	1.47 N		0.78 N	0.88 N
PT (see note 3)	18° to 27°					2 mm max.		4 mm max.	
PT (2nd) (see note 4)	(44°)					(2.9 mm)		(5.2 mm)	(4.3 mm)
OT min.	40°					4 mm		5 mm	
OP	---					18±0.5 mm	28.2± 0.8 mm	37±0.8 mm	27±0.8 mm
TT (see note 5)	(70°)					(6 mm)		(9 mm)	
DOT min. (see note 6)	50°					3.2 mm		5.8 mm	4.8 mm
DOF min. (see note 6)	19.61 N					19.61 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. Measured with NC side in the OFF state.
4. PT (2nd) is the distance required before NO contact occurs.
PT (2nd) is the reference value.
5. Nominal value.
6. DOT (direct opening travel) and DOF (direct opening force) are required values for direct opening.

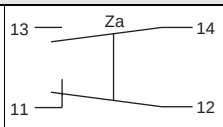
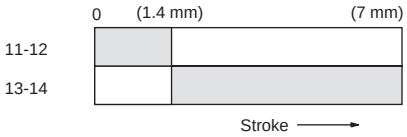
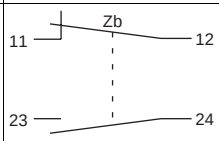
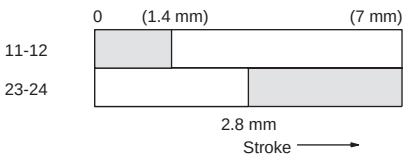
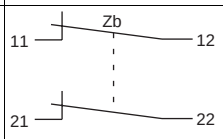
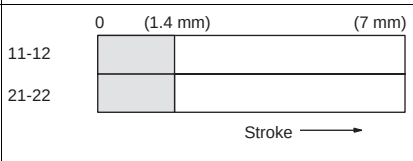
Slow-action (1NC/1NO), Slow-action (2NC)

1-conduit and 2-conduit Models

Model	D4D-□□REN	D4D-□□LEN
Force necessary to reverse the direction of the lever: max.	6.37 N	
Movement until the lever reverses	45° to 65°	
Movement until switch operation (NC)	(6.5°)	
Movement until switch operation (NO)	(18.5°)	
DOT min.	30°	
DOF min.	19.61 N	

Note: DOT (direct opening travel) and DOF (direct opening force) are required values for direct opening.

Contact Form (EN60947-5-1, EN50013)

Model	Contact		Diagrams (see note)	Remarks
D4D-□1□N	1NC/1NO (snap-action)			Only NC contact 11-12 has an approved direct opening mechanism. (→) Terminals 11-12 and 13-14 cannot be used as unlike poles.
D4D-□5□N	1NC/1NO (slow-action)			Only NC contact 11-12 has an approved direct opening mechanism. (→) Terminals 11-12 and 23-24 can be used as unlike poles.
D4D-□A□N	2NC (slow-action)			NC contacts 11-12 and 23-24 have an approved direct opening mechanism. (→) Terminals 11-12 and 21-22 can be used as unlike poles.

Note: 1. Contact operation

Closed Open

2. Terminals are numbered according to EN50013. Contact forms are according to EN60947-5-1.

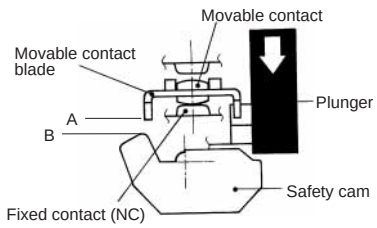
Direct Opening Mechanism

1NC/1NO Contact (Snap-action)

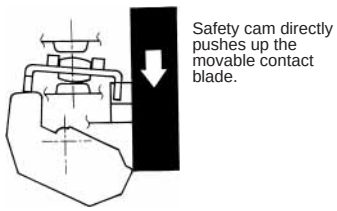
Conforms to EN60947-5-1 Direct Opening (→)

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 black arrow, the Limit Switch releases.

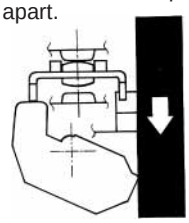
1. When metal deposition occurs.



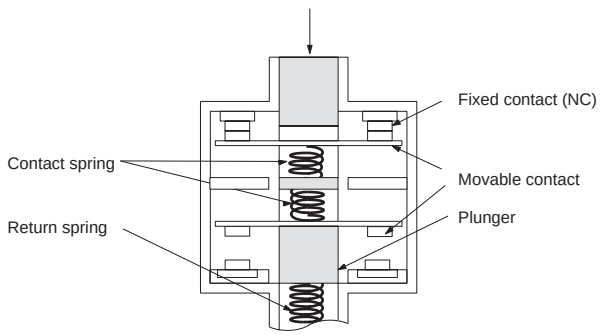
2. When contacts are being pulled apart.



3. When contacts are completely pulled apart.



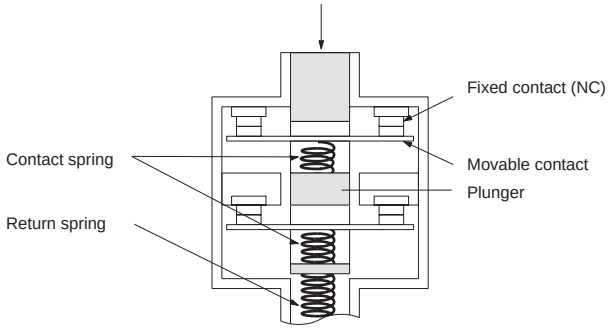
1NC/1NO Contact (Slow-action)



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)



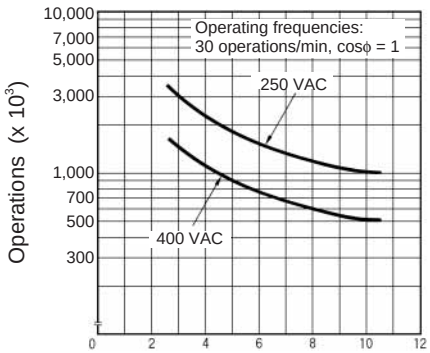
Conforms to EN60947-5-1 Direct Opening

When metal deposition occurs, the contacts are separated from each other by the plunger being pushed in.

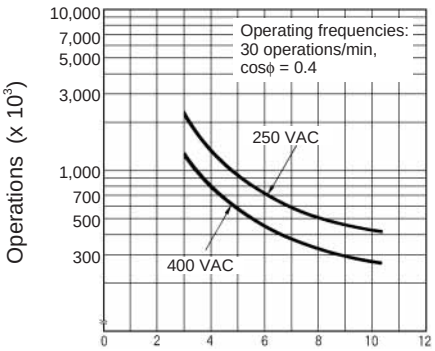
Engineering Data

Electrical Durability
(1NC/1NO Contact, Snap-action)

(cosφ = 1)



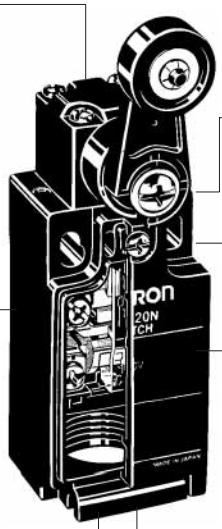
(cosφ = 0.4)



Nomenclature

Head

With roller lever models, the direction of the switch head can be varied to any of the four directions by loosening the roller lever switch screws at the four corners of the head.



Safety-oriented Lever Setting

Grooves which engage the lever every 90° are cut in the operation indicator disk to prevent the lever from slipping against the rotary shaft.
There are resin-lever and metal-lever types.

Cover

Easy to open and wire. (One mounting screw and opposite side is for hinge mounting.)

Built-in Switch

Wide switch variations.
Snap-action: 1NC/1NO
Slow-action: 1NC/1NO
2NC

Contact Material

Ag alloy

Conduit Opening

Available in two different types of conduit threads:

Pg 13.5:	European standard (1-conduit, 2-conduit)
G 1/2:	Japanese standard (1-conduit, 2-conduit)
1/2-14NPT:	US standard (1-conduit)
M20	European Standard (1-conduit, 2-conduit)

Conduit Cap

Can be used as a simple connector under good environmental conditions.

Dimensions

Switches

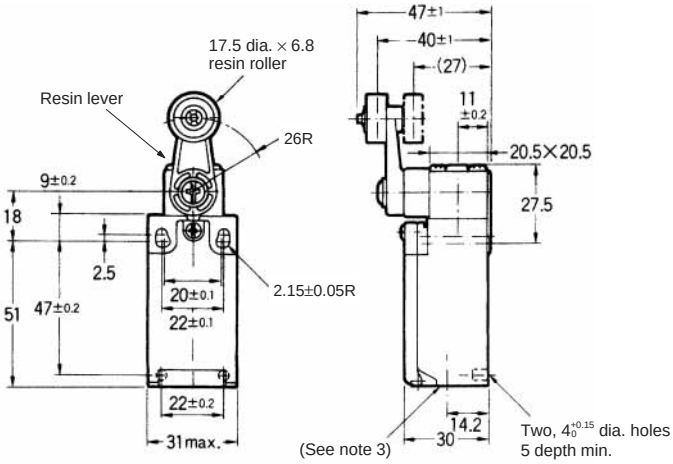
Note: 1. All units are in millimeters unless otherwise indicated.

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

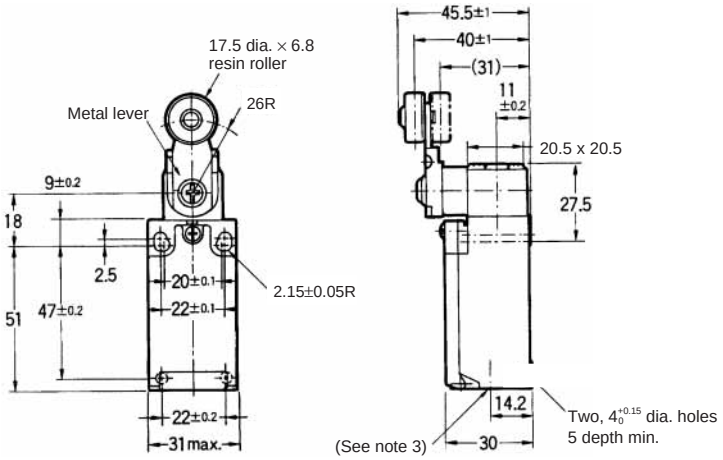
3. When placing your order, specify the conduit type by adding a code from the list below to the blank box of the following model numbers as specified in the model number legend.
1: PG 13.5
2: G1/2
3: M20

1-conduit Models

Roller Lever (Resin Lever, Resin Roller) *1
D4D-□120N
D4D-□520N
D4D-□A20N

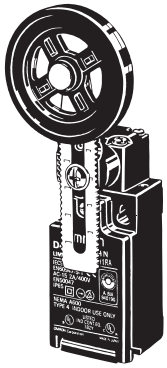


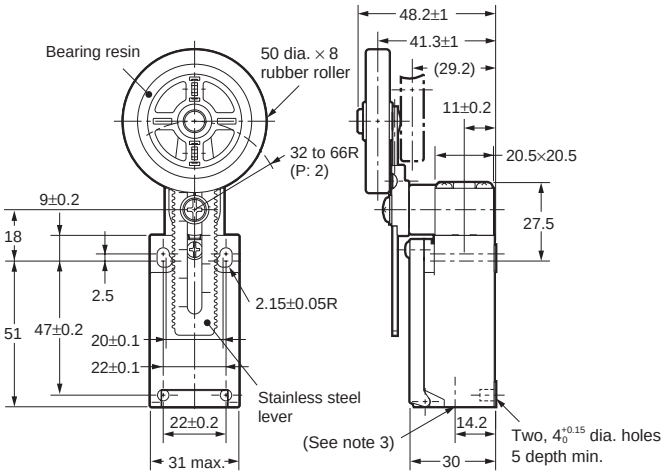
Roller Lever (Metal Lever, Resin Roller) *1
D4D-□122N
D4D-□522N
D4D-□A22N



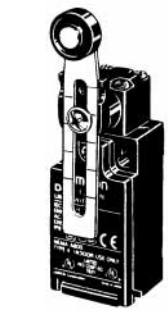
*1. safety limit switch, mechanical form lock (see page D-233)

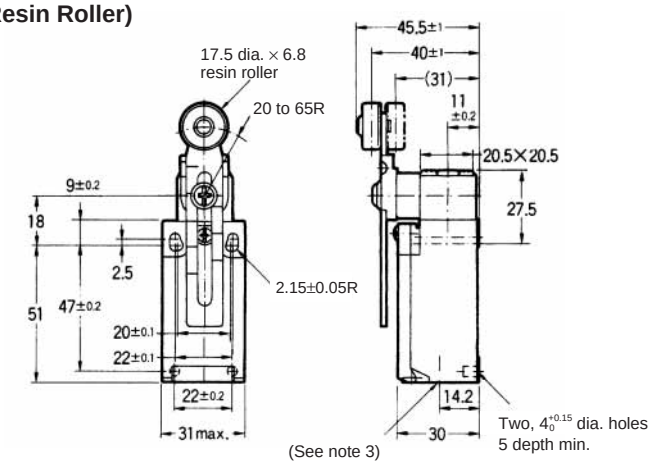
Adjustable Roller Lever, Form Lock *1
(with Rubber Roller)
D4D-112HN
D4D-152HN



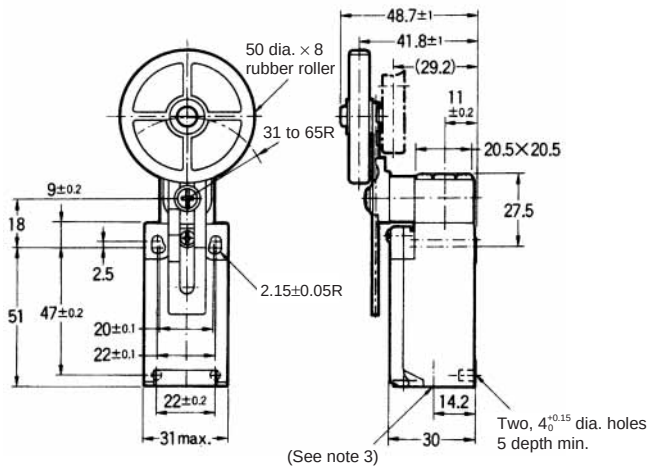


Adjustable Roller Lever (Metal Lever, Resin Roller)
D4D-□121N
D4D-□521N
D4D-□A21N



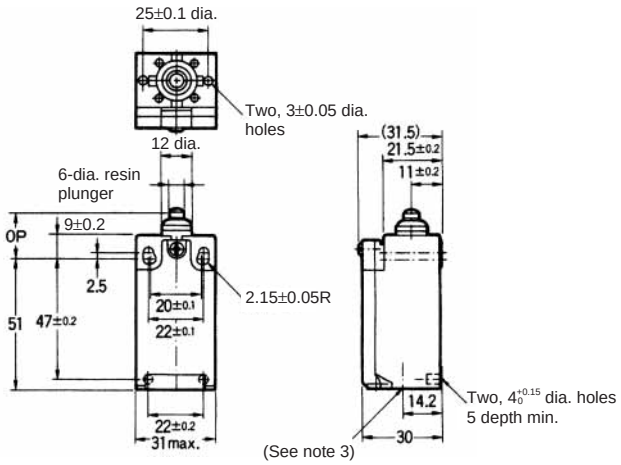


Adjustable Roller Lever
(with Rubber Roller)
D4D-□127N
D4D-□527N
D4D-□A27N

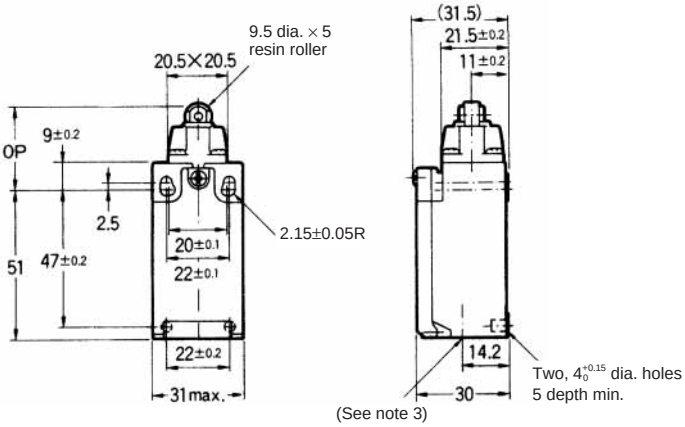


*1. safety limit switch, mechanical form lock (see page D-233)

Plunger *1
D4D-□131N
D4D-□531N
D4D-□A31N

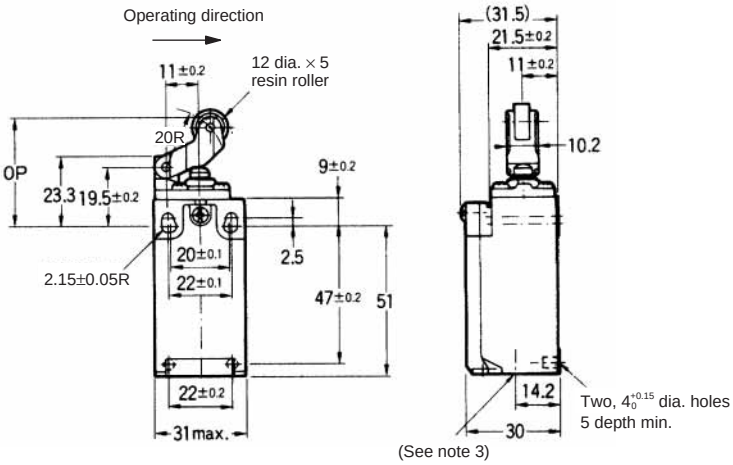


Roller Plunger *1
D4D-□132N
D4D-□532N
D4D-□A32N

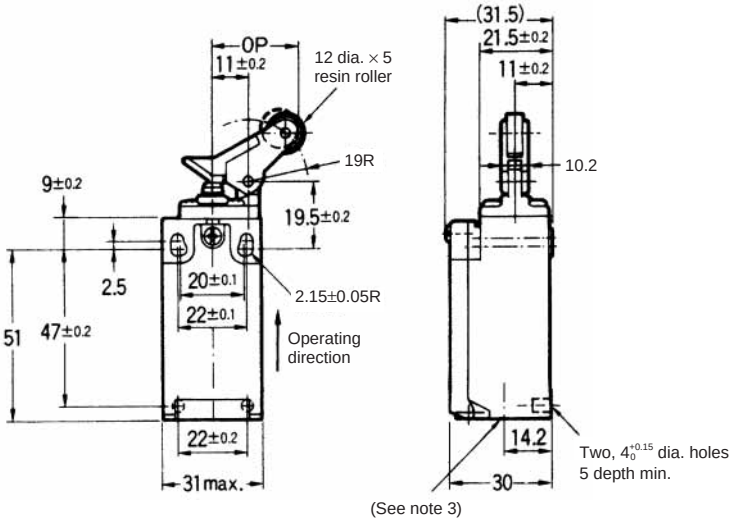


*1. safety limit switch, mechanical form lock (see page D-233)

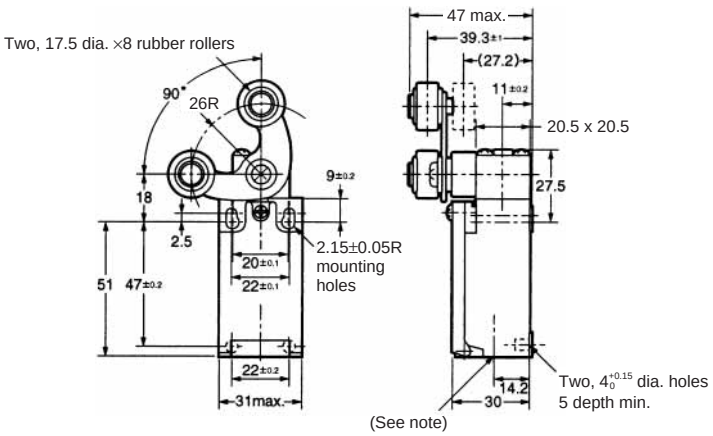
One-way Roller Arm Lever *1
(Horizontal)
D4D-□162N
D4D-□562N
D4D-□A62N



One-way Roller Arm Lever *1
(Vertical)
D4D-□172N
D4D-□572N
D4D-□A72N

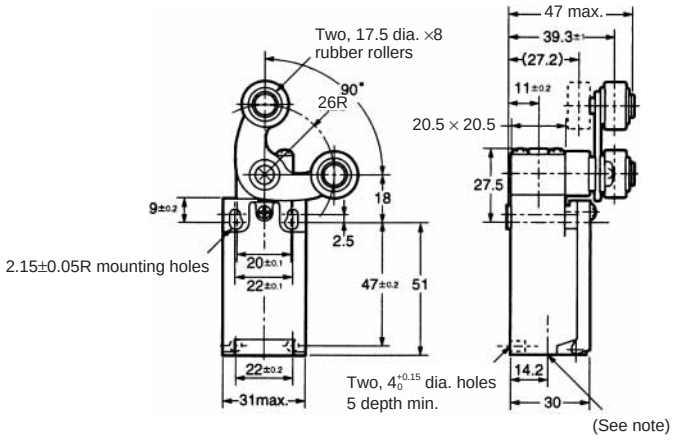


Fork Lever Lock
(Right Operation)
D4D-15REN

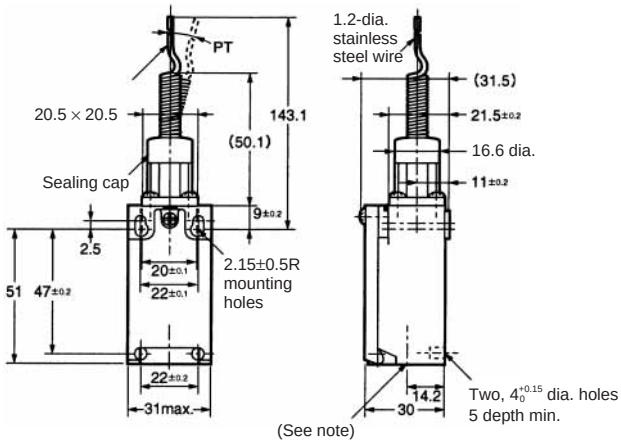


*1. safety limit switch, mechanical form lock (see page D-233)

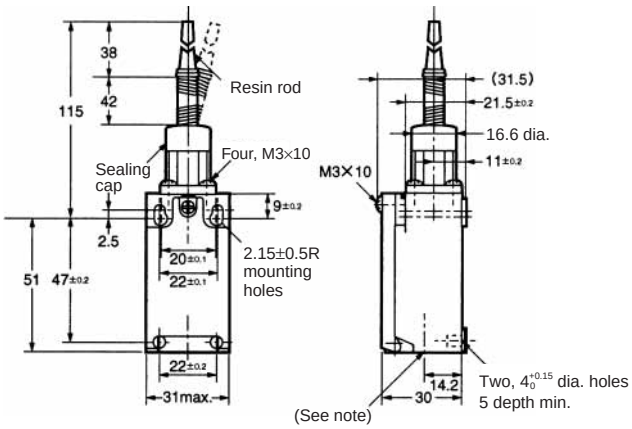
Fork Lever Lock (Left Operation) D4D-15LEN



Cat Whisker D4D-□□80N



Plastic Rod D4D-●●87N



Note: 1. All units are in millimeters unless otherwise indicated.

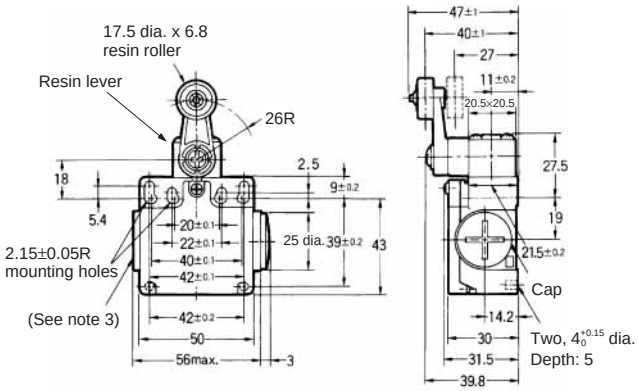
2. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

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 specified in the model number legend:
1: PG 13.5
2: G1/2
3: M20

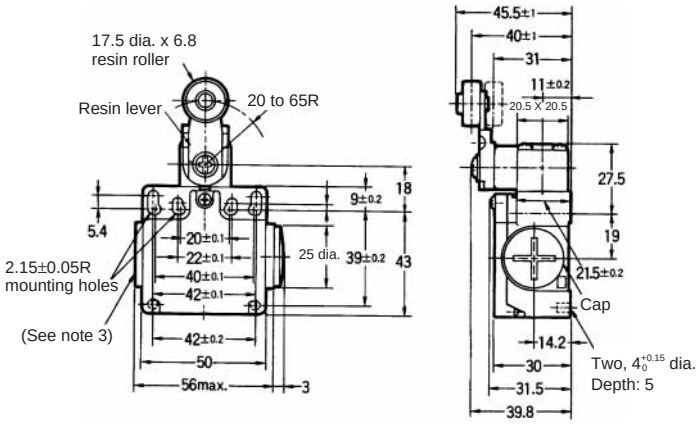
4. The minimum number of screw threads is five when the Pg13.5 conduit is used and four when the G1/2 conduit is used.

2-conduit Models

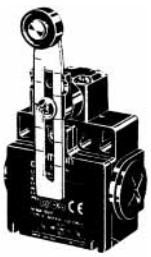
Roller Lever (Resin Lever) *1
D4D-□120N
D4D-□520N
D4D-□A20N

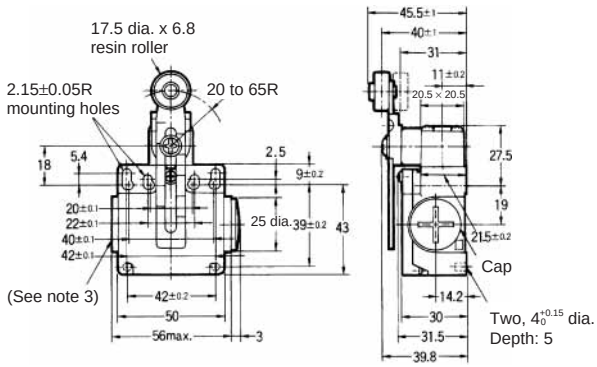


Roller Lever (Metal Lever) *1
D4D-□122N
D4D-□522N
D4D-□A22N

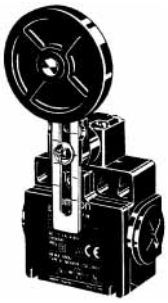


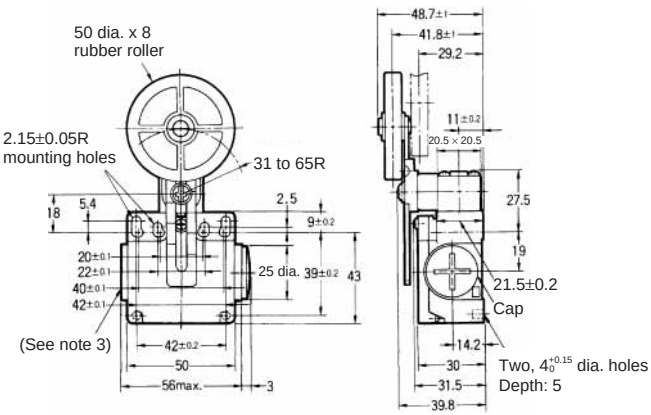
Adjustable Roller Lever
D4D-□121N
D4D-□521N
D4D-□A21N





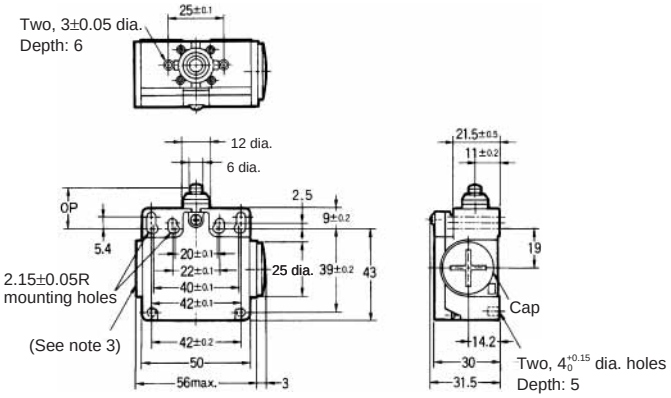
Adjustable Roller Lever (Rubber Roller Lever)
D4D-□127N
D4D-□527N
D4D-□A27N



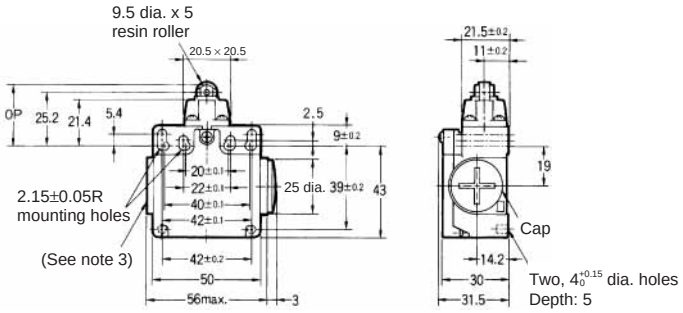


*1. safety limit switch, mechanical form lock (see page D-233)

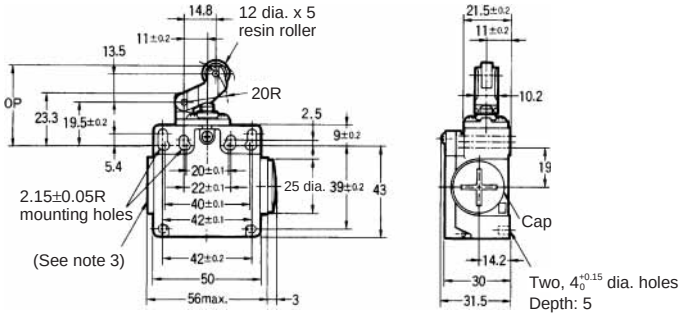
Plunger *1
D4D-□131N
D4D-□531N
D4D-□A31N



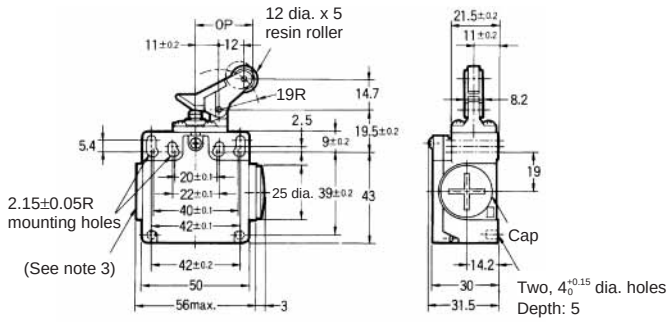
Roller Plunger *1
D4D-□132N
D4D-□532N
D4D-□A32N



One-way Roller Arm Lever *1 (Horizontal)
D4D-□162N
D4D-□562N
D4D-□A62N

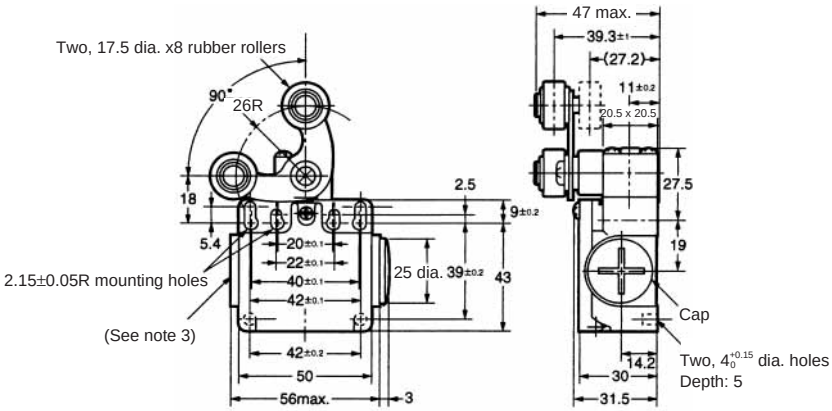


One-way Roller Arm Lever *1 (Vertical)
D4D-□172N
D4D-□572N
D4D-□A72N

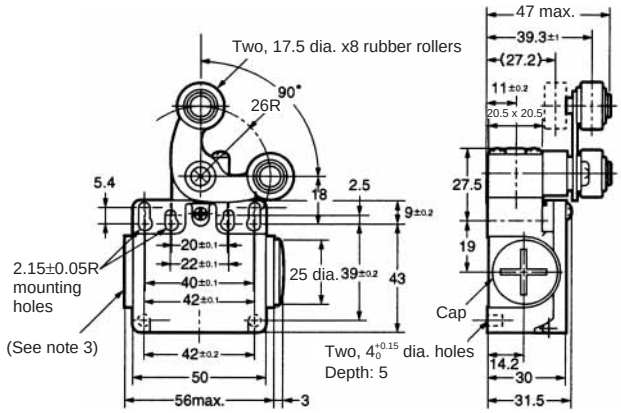


*1. safety limit switch, mechanical form lock (see page D-233)

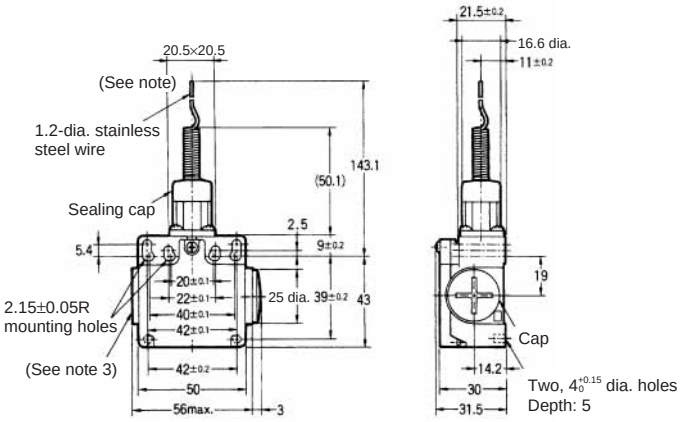
Fork Lever Lock
(Right Operation)
D4D-55REN



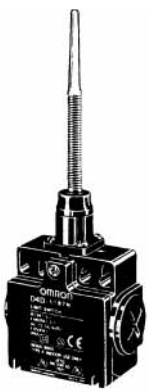
Fork Lever Lock
(Left Operation)
D4D-55LEN

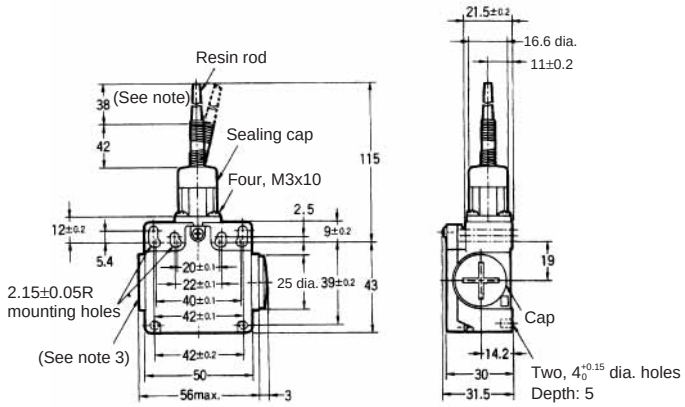


Cat Whisker
D4D-□180N
D4D-□A80N



Plastic Rod
D4D-□187N
D4D-□A87N

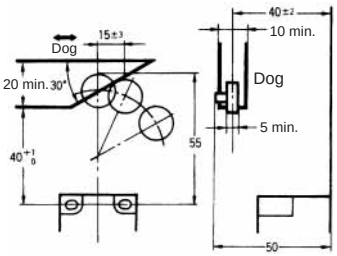




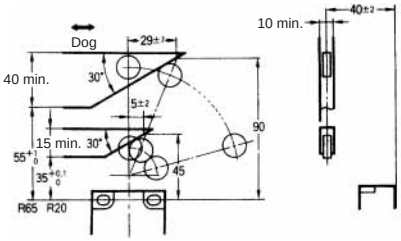
Levers

Refer to the following for the angles and positions of the watchdogs.

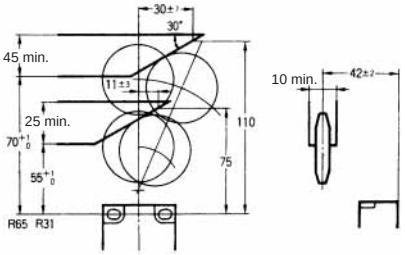
Roller Lever
(D4D-□□20N, D4D-●●22N)



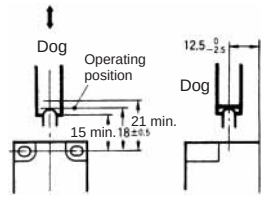
Adjustable Roller Lever
(D4D-□□21N) (Reference Value)



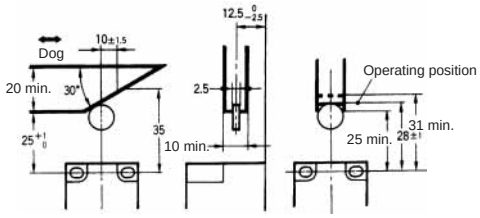
Adjustable Roller Lever
(Rubber Roller Lever)
(D4D-□□27N) (Reference Value)



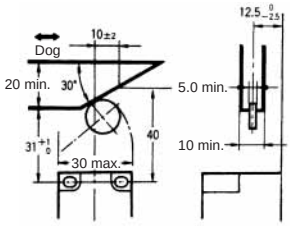
Sealed Plunger
(D4D-□□31N)



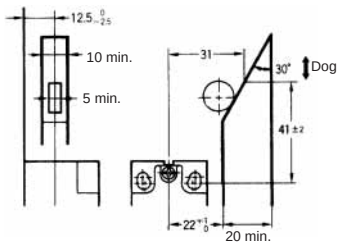
Roller Plunger
(D4D-□□32N)



One-way Roller Arm Lever
(Horizontal)
(D4D-□□62N)



One-way Roller Arm Lever
(Vertical)
(D4D-□□72N)



D4D-□N

Precautions

⚠ Caution

Do not use metal connectors or conduits to wire the Limit Switch, otherwise the conduit of the Limit Switch may break and an electric shock may be received.

- If the D4D-□N is applied to a safety category circuit for prevention of injury, use a D4D-□N model that has an NC contact equipped with a direct opening mechanism, and make sure that the D4D-□N operates in the direct opening mode. Furthermore, secure the D4D-□N with screws or equivalent parts that are tightened in a single direction so that the D4D-□N cannot be easily removed. Then provide a protection cover for the D4D-□N and post a warning label near the D4D-□N.
- Be sure to connect a fuse with a breaking current 1.5 to 2 times larger than the rated current to the Limit Switch in parallel in order to protect the Limit Switch from damage due to short-circuiting.
- When using the Limit Switch for the EN ratings, use the gI or gG 10-A fuse.

Correct Use

Operating Environment

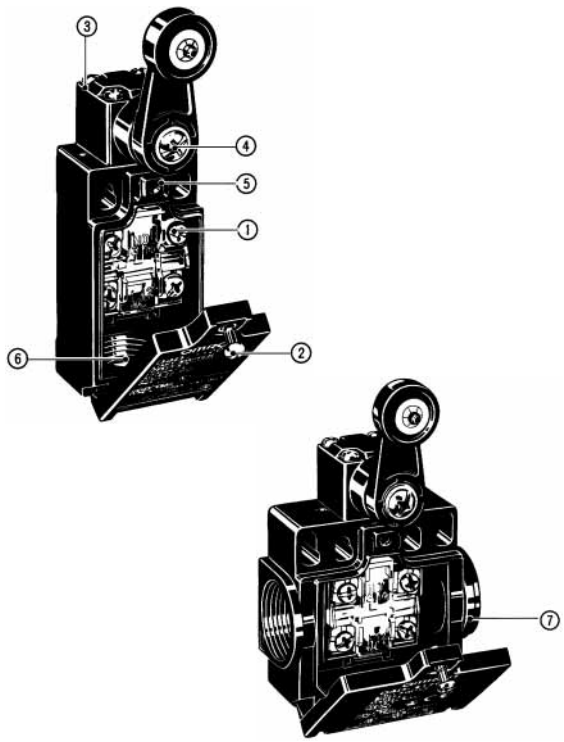
The Limit Switch is intended for indoor use only. Using the Limit Switch outdoors may result in a malfunction.

Tightening Torque

Be sure to tighten each screw of the D4D□N properly, otherwise the D4D□N may malfunction.

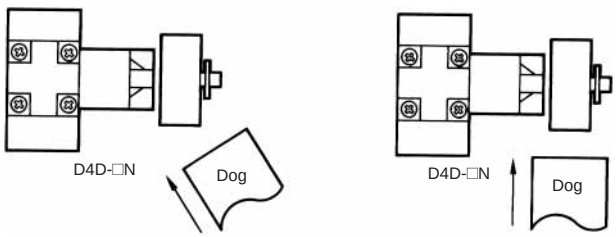
No.	Type	Torque
1	Terminal screw	0.59 to 0.78 N·m
2	Cover mounting screw	0.78 to 0.88 N·m
3	Head mounting screw	0.78 to 0.88 N·m
4	Lever mounting screw	1.57 to 1.77 N·m
5	M4 body mounting screw	0.49 to 0.69 N·m
6	Connector	1.77 to 2.16 N·m 1.37 to 1.77 N·m (see note)
7	Cap screw	1.27 to 1.67 N·m

Note: This torque range applies to 1/2-14NPT connectors.



Operating Method

Use of the Limit Switch at an improper dog angle, operating speed, or operating direction will eventually cause a failure in Limit Switch. Make sure that the dog angle, operating speed, and operating direction are within the specified ranges. Do not set the dog angle to 90°.

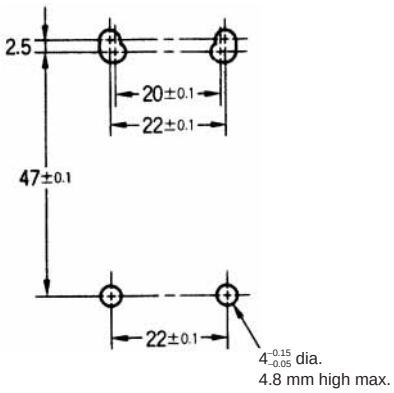


Mounting

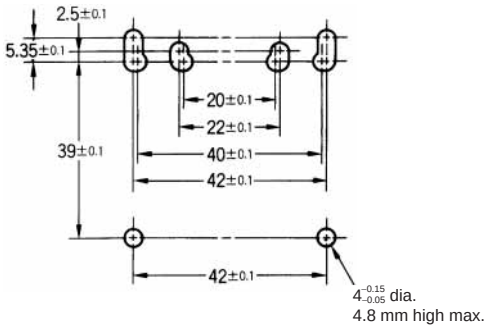
Fasten the Switch with two M4 Allen-head bolts and washers. Provide a stud with a diameter of $4^{-0.05}_{-0.15}$ and a height of 4.8 mm max. at two places as shown below so that the Switch is firmly fixed at four points.

Mounting Holes/Studs

1-conduit Models



2-conduit Models



Changing the Lever Angle

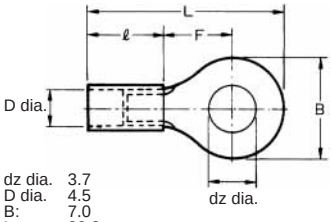
- To change the angle of the lever, loosen the lever mounting screw. Then the lever can be set at any angle in 7.5° increments.
- The length of an adjustable roller lever can be changed by loosening the lever mounting screw.
- The lever mounting position may be inside out after removing the lever mounting screw. Make sure that the lever will not touch the Switch when the lever is mounted inside out.

Changing the Head Direction

If the head direction has been changed, check the torque of each screw and make sure that the screws are free of foreign substances, and that each screw is tightened to the proper torque.

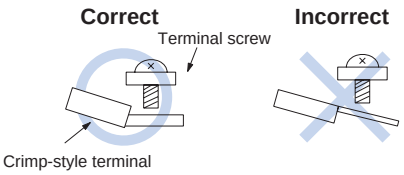
Wiring

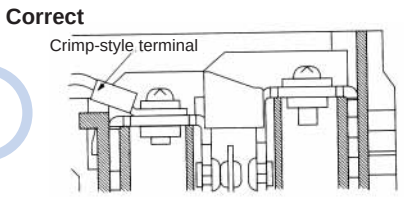
- Do not connect the bare lead wires directly to the terminals but be sure to connect each of them by using an insulation tube and M3.5 round crimp terminals and tighten each terminal screw within the specified torque range.
- The proper lead wire is 20 to 14 AWG (0.5 to 2.5 mm^2) in size.

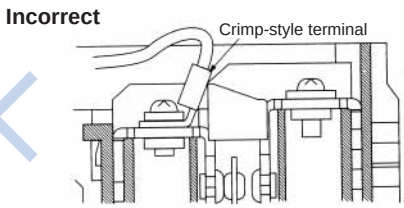


dz dia.	3.7
D dia.	4.5
B:	7.0
L:	20.2
F:	7.7
l:	9.0 (mm)

Perform wiring for the crimp terminals in the orientation shown below, so that they are not resting on the casing or the cover.







Processing the Conduit Opening

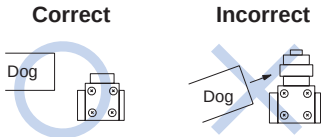
Tighten the connector to a torque of 1.8 to 2.2 N·m (1.37 to 1.77 N·m if it is a 1/2-14NPT). Excessive tightening torque may damage the casing. To satisfy IP65, apply sealing tape to the connector conduit.

The diameter of the cable must be suited to the corresponding connector.

When performing wiring, close conduit openings in any places that will not be used using the cap screws provided as accessories. Tighten the screws to the applicable torque.

Others

Applying a load to the switch actuator (roller) from a slanted direction may deform or damage the actuator, or deform or damage the rotary spindle, so make sure that the dog is straight.



With rubber roller lever models, the rubber roller may turn white with the passage of time, but this will not affect the quality of operation.

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.

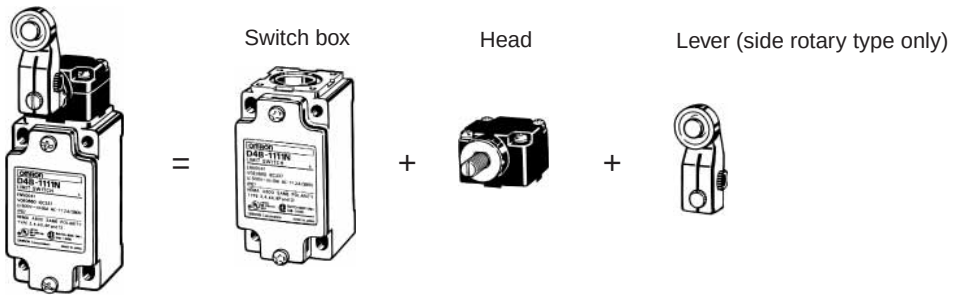
3-conduit Switch

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	---	---
	Adjust-able 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
Wob-ble le-ver (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	

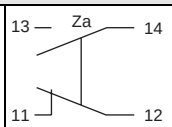
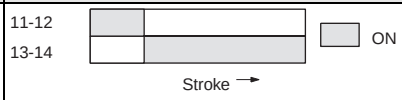
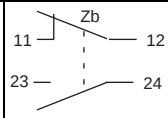
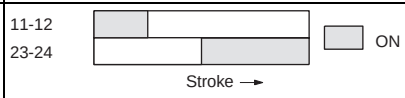
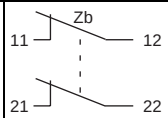
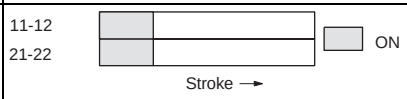
Note: 1. The above values are initial values.
2. The above values may vary depending on the model. Consult your OMRON sales representative for details.
3. The durability is for an ambient temperature of 5°C to 35°C and ambient humidity of 40% to 70%. For further conditions, consult your OMRON sales representative.
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)			3.2 mm		---	
	55° (Snap-action models)						
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)

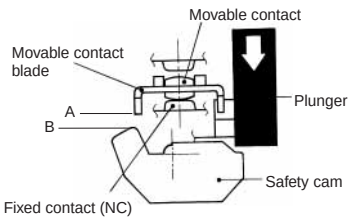
Model	Contact		Diagrams	Explanation
D4B-□1□N	1NC/1NO (Snap-action)			Only NC contact 11-12 has an approved direct opening mechanism. ⊖ Terminal numbers 11-12 and 13-14 cannot be used as unlike poles.
D4B-□5□N	1NC/1NO (Slow-action)			Only NC contact 11-12 has an approved direct opening mechanism. ⊖ Terminal 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

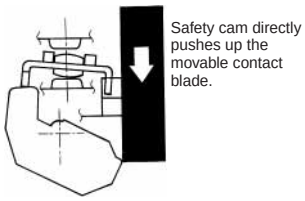
1NO/1NC Contact (Snap-action)

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.

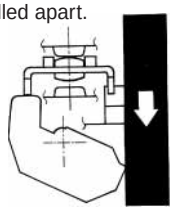
1. When metal deposition occurs.



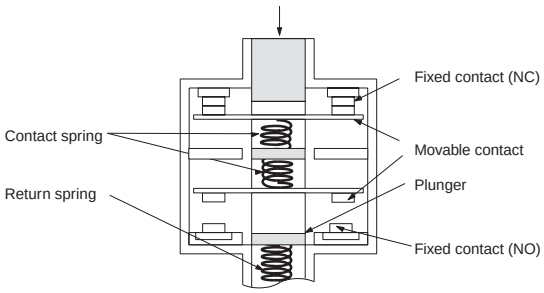
2. When contacts are being pulled apart.



3. When contacts are completely pulled apart.



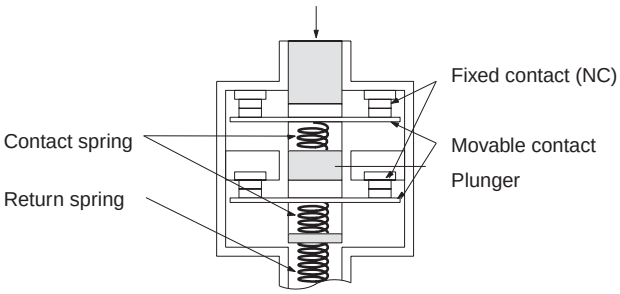
1NC/1NO Contact (Slow-action)



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 ⊖

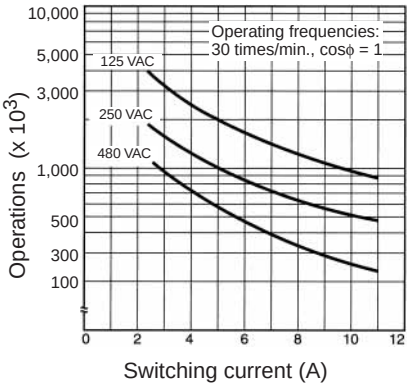
When metal deposition occurs, the contacts are separated from each other by the plunger being pushed in.

⊖ is marked on the product to indicate approval of direct opening.

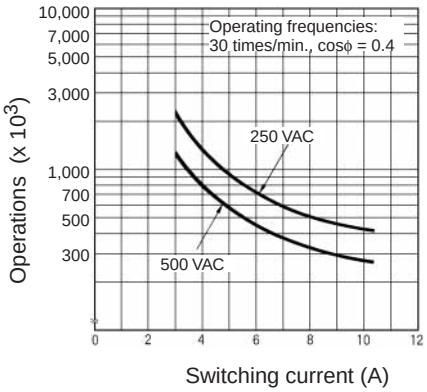
Engineering Data

Electrical Durability (Snap-action)

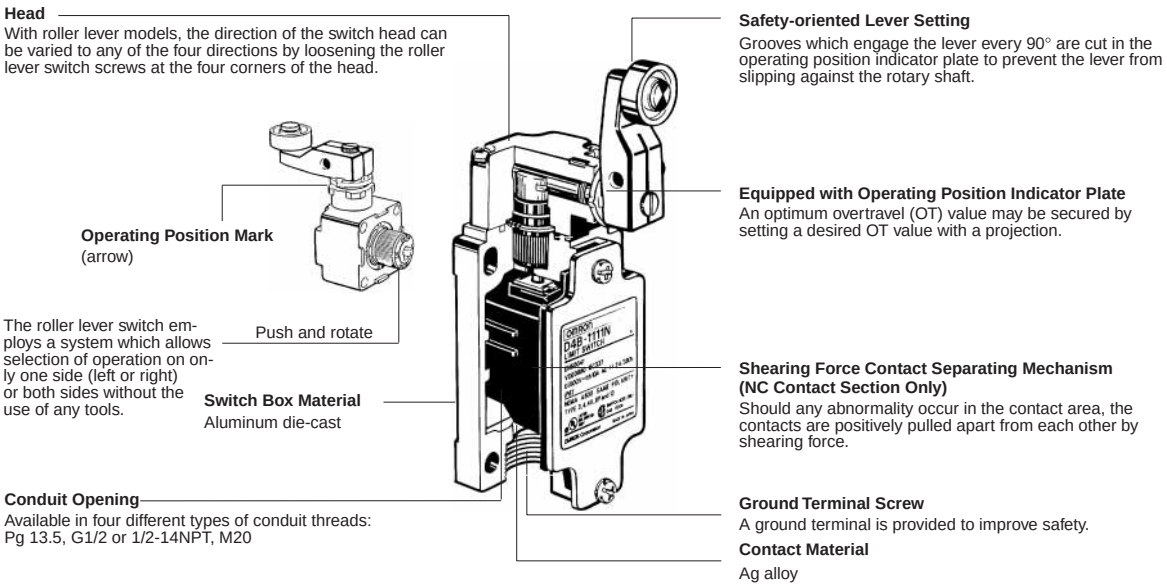
(cosφ = 1)



(cosφ = 0.4)



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.

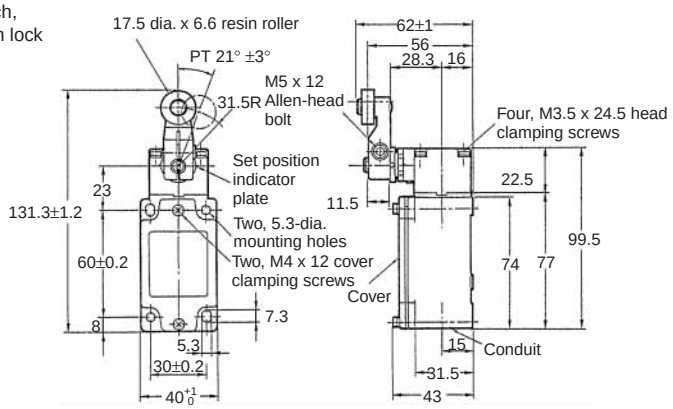
3. When placing your order, specify the conduit type by adding a code from the list below to the blank box of the following model numbers as shown below.

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

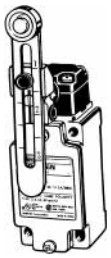
Roller Lever safety limit switch, mechanical form lock

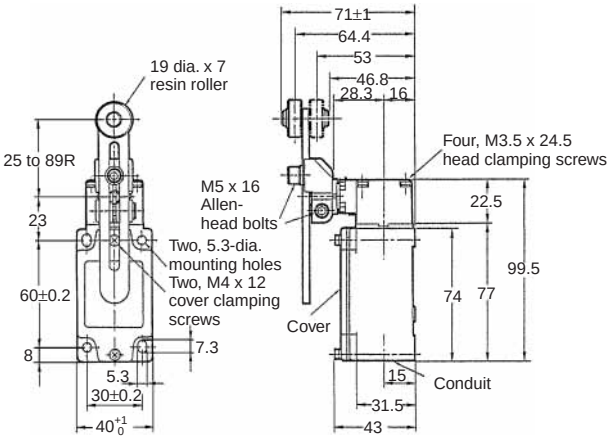
D4B-□□11N



Adjustable Roller Lever

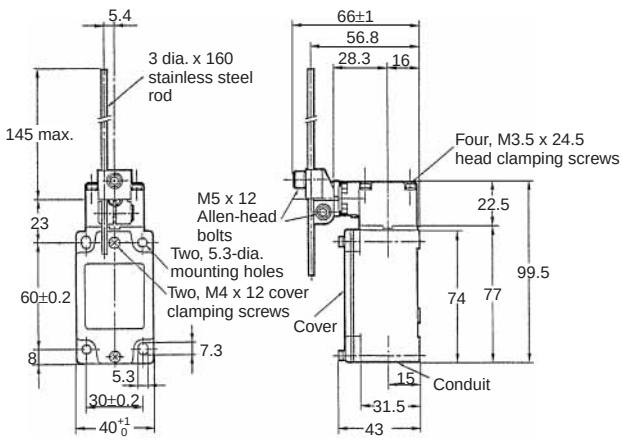
D4B-□□16N





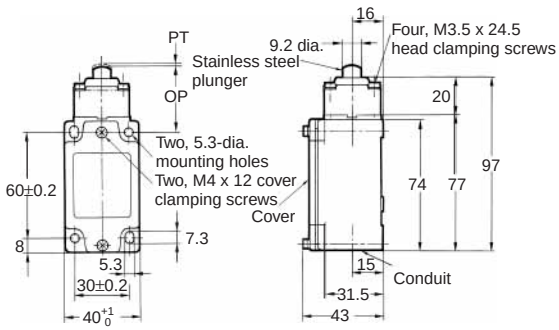
Adjustable Rod Lever

D4B-□□17N



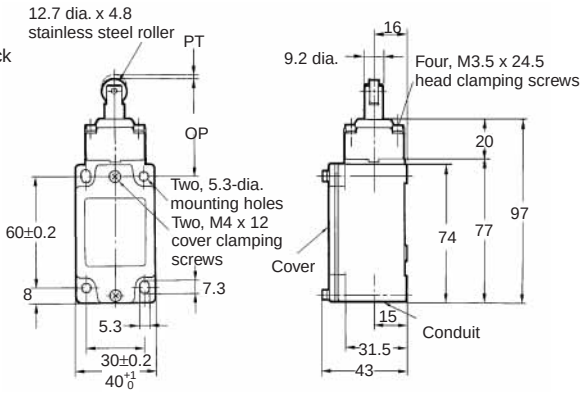
Top Plunger
D4B-□□70N

safety limit switch, mechanical form lock

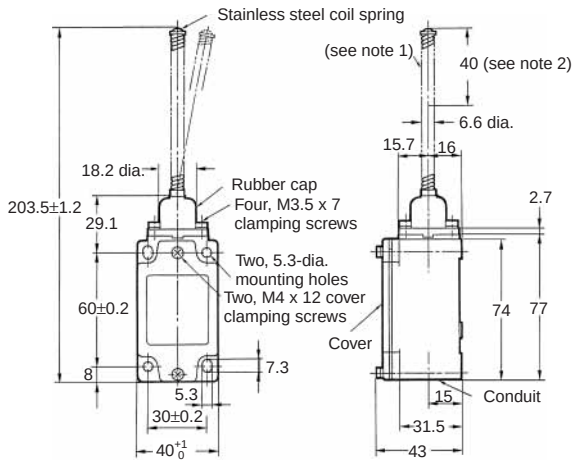


Top Roller Plunger
D4B-□□71N

safety limit switch, mechanical form lock



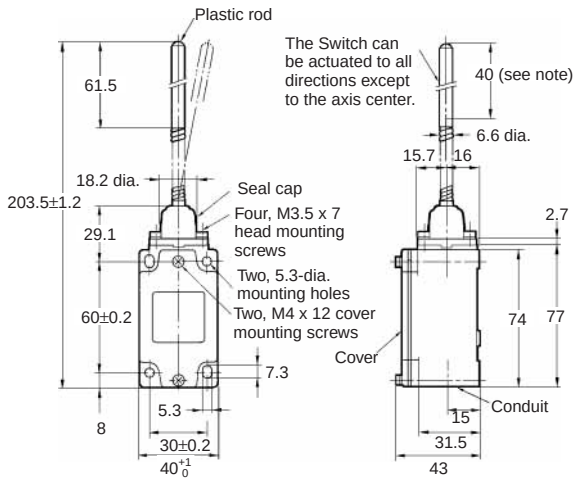
Coil Spring
D4B-□□81N



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



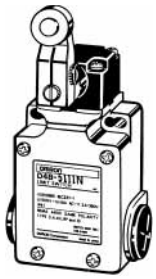
Note: Be sure to adjust the dog to within 40 mm from the top end of the plastic rod.

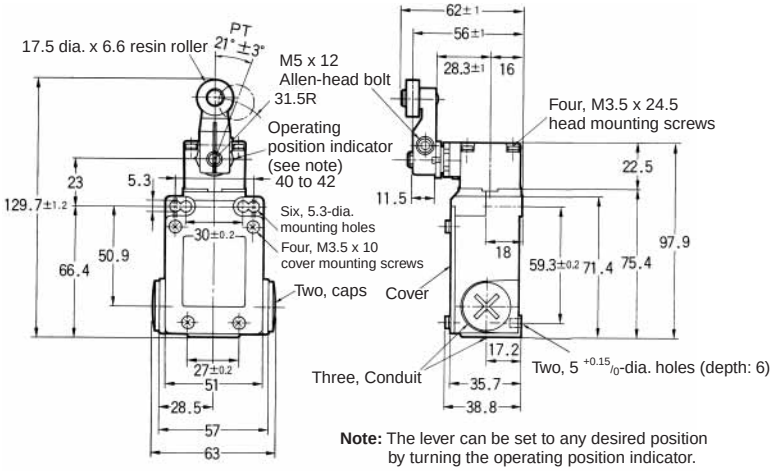
3-conduit Switches

Roller Lever

safety limit switch, mechanical form lock

D4B-□□11N

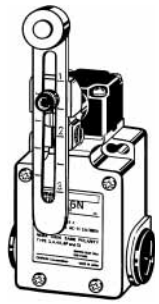


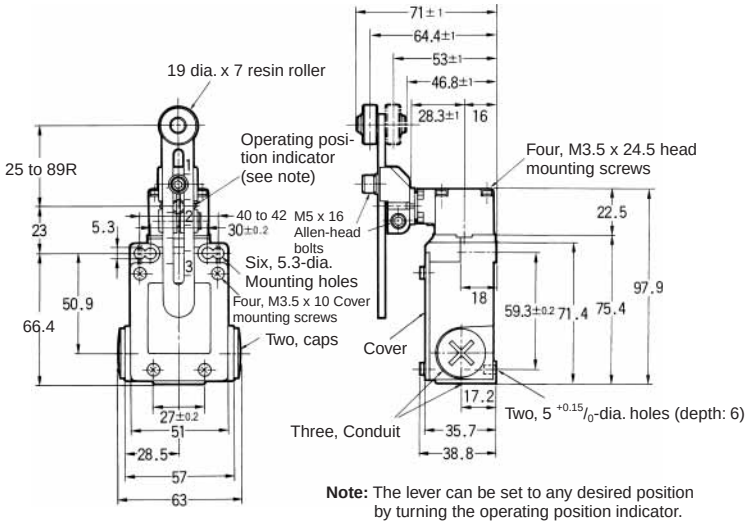


Note: The lever can be set to any desired position by turning the operating position indicator.

Adjustable Roller Lever

D4B-□□16N

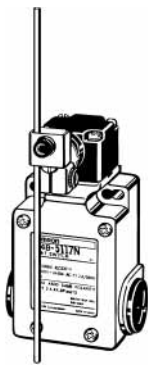


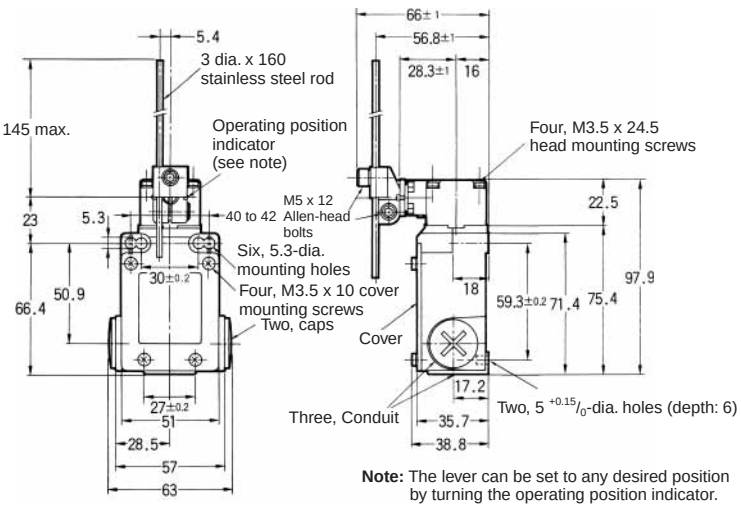


Note: The lever can be set to any desired position by turning the operating position indicator.

Adjustable Rod Lever

D4B-□□17N

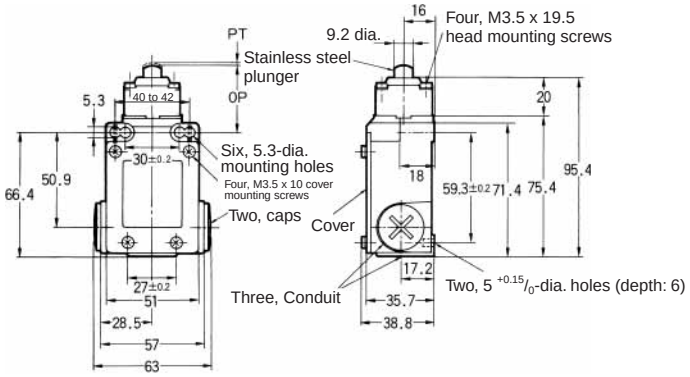




Note: The lever can be set to any desired position by turning the operating position indicator.

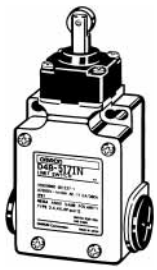
Top Plunger
D4B-□□70N

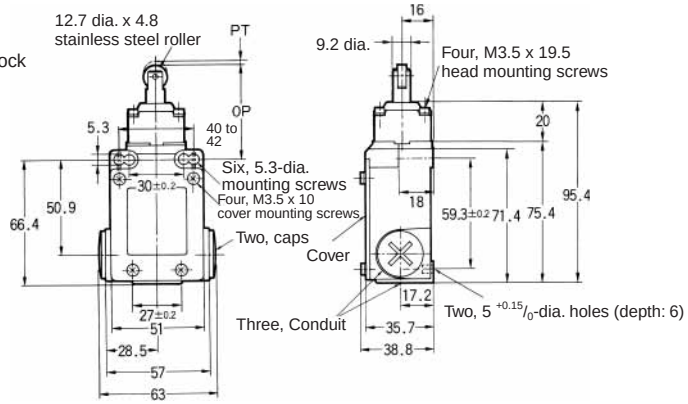
safety limit switch, mechanical form lock



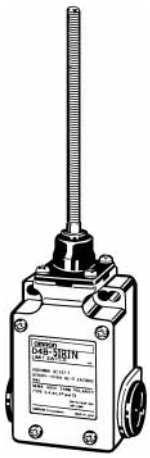
Top Roller Plunger
D4B-□□71N

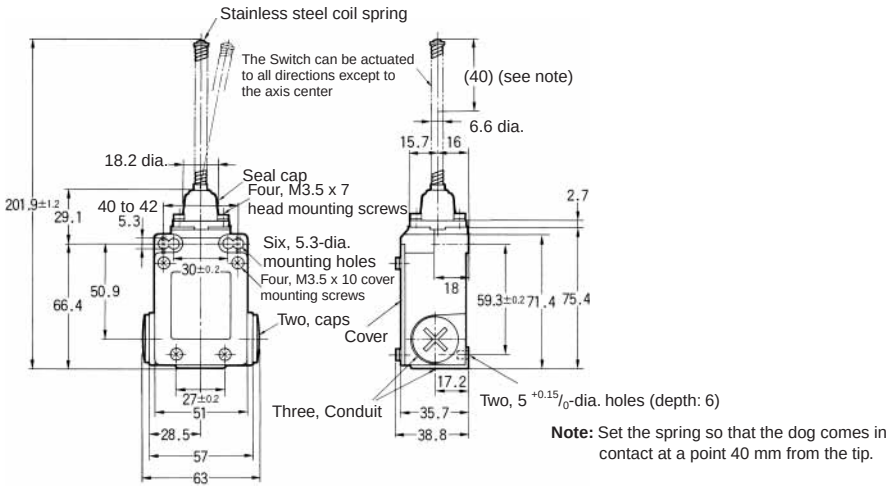
safety limit switch, mechanical form lock





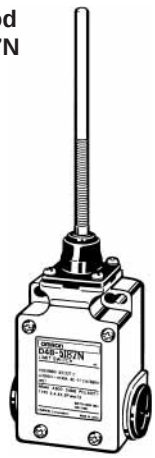
Coil Spring
D4B-□□81N

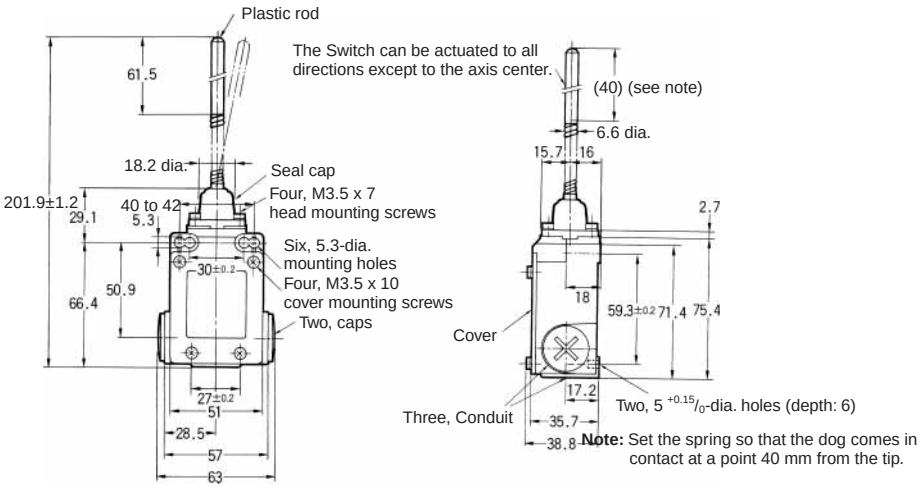




Note: Set the spring so that the dog comes in contact at a point 40 mm from the tip.

Plastic Rod
D4B-□□87N



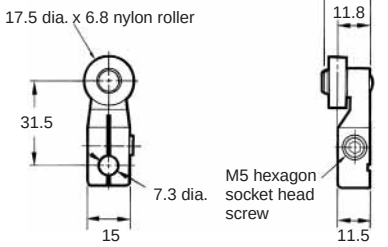


Note: Set the spring so that the dog comes in contact at a point 40 mm from the tip.

Levers

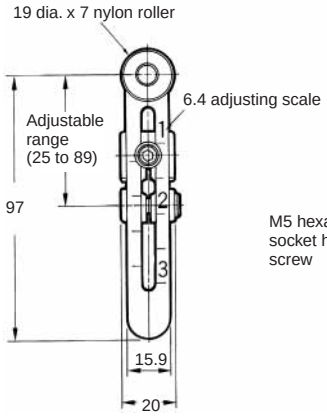
Roller Lever
mechanical form lock

D4B-0001N



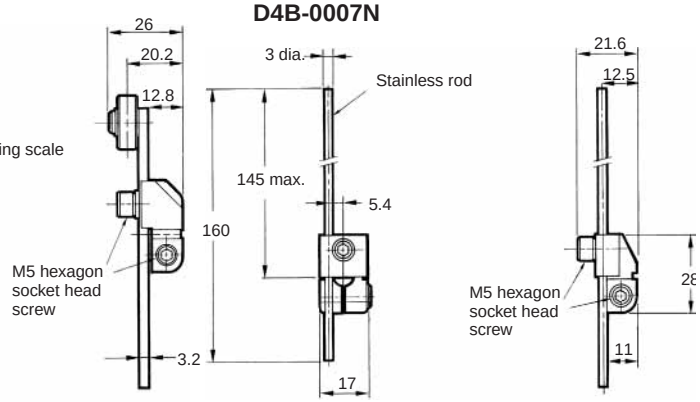
Adjustable Roller Lever

D4B-0006N



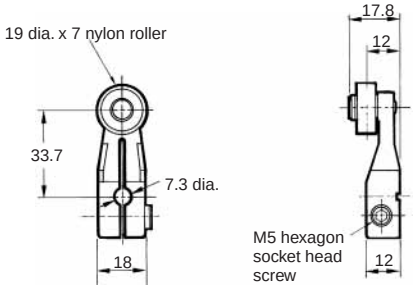
Adjustable Rod Lever

D4B-0007N



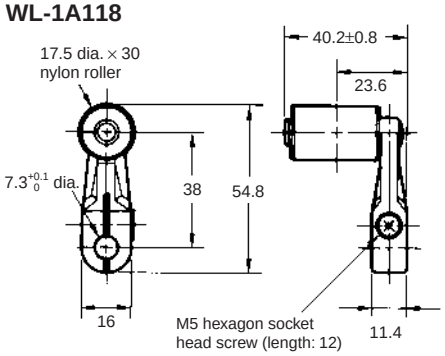
Roller Lever (compatible with previous D4B model)
mechanical form lock

D4B-000RN



Roller Lever

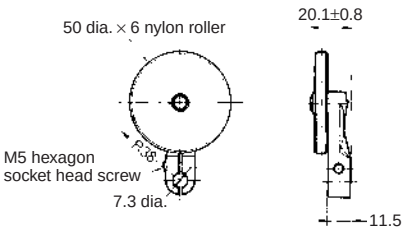
WL-1A118



Note: Reverse the indicator plate when mounting.

Roller Lever

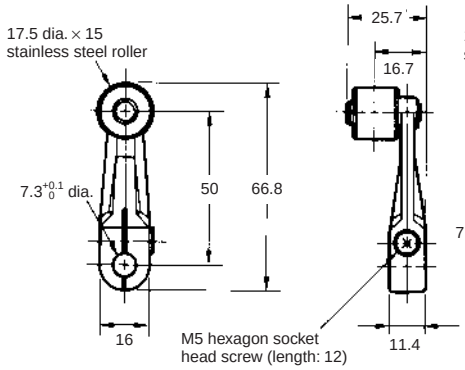
WL-1A106



Note: Reverse the indicator plate when mounting.

Roller Lever
mechanical form lock

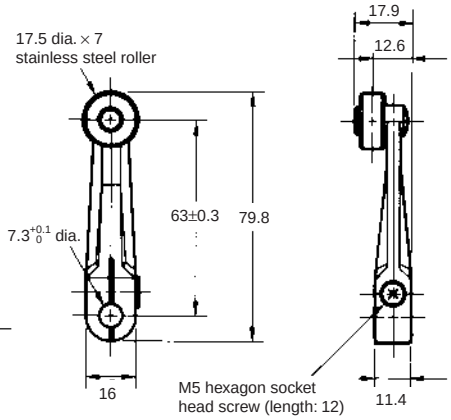
WL-1A206



Note: Reverse the indicator plate when mounting.

Roller Lever

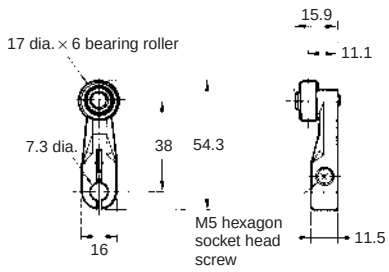
WL-1A300



Note: Reverse the indicator plate when mounting.

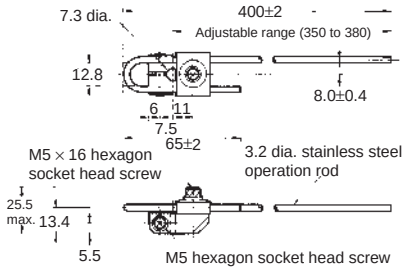
Roller Lever

WL-1A400



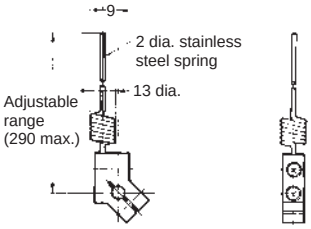
Note: Reverse the indicator plate when mounting.

Adjustable Rod Lever
WL-3A100



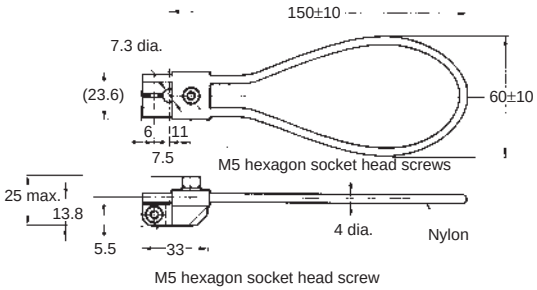
Note: Reverse the indicator plate when mounting.

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

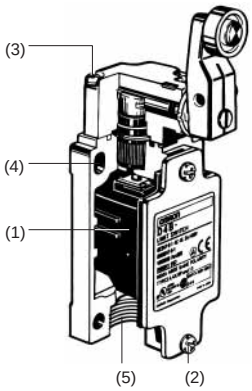
The D4B-□N is for indoor use. The D4B-□N may malfunction if the D4B-□N is used outdoors. Be sure to use a model with a lever-type actuator for outdoor use instead.

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

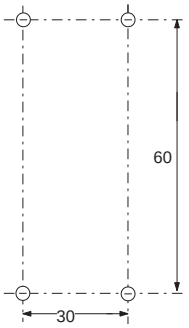
Note: Apply a tightening torque of 0.78 to 0.88 N·m to conduit models.

Mounting

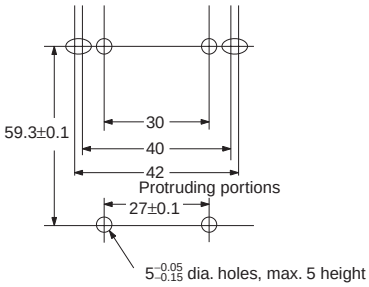
Use four M5 screws with washers to mount the standard model. Be sure to apply the proper torque to tighten each screw. The D4B-□N can be mounted more securely by using the four screws plus two $5\ ^{-0.05}/_{-0.15}$-mm protruding parts, each of which has a maximum height of 4.8 mm as shown below.

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°.

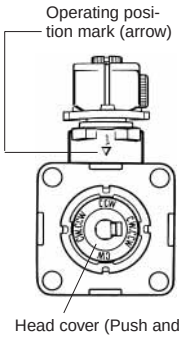
The back of the operating position indicator plate has no protruding parts. The lever can be set at any angle by attaching the operating position indicator plate to the Switch so that this side will face the lever. In this case, however, the D4B-□N will not be approved by SUVA or BIA. Make sure that 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.



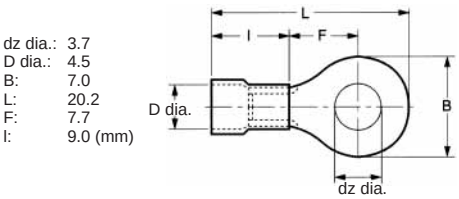
Procedure

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.

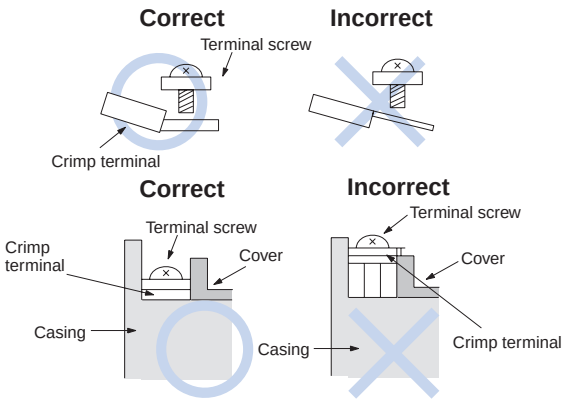
Wiring

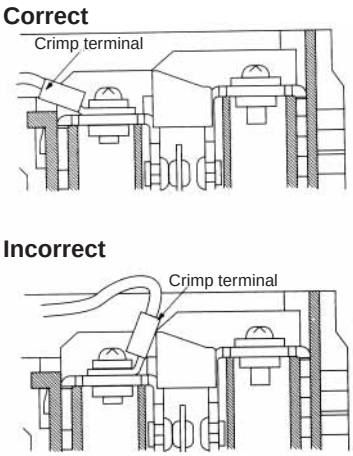
Do not connect the bare lead wires directly to the terminals but be sure to connect each of them by using an insulation tube and M3.5 round crimp terminals and tighten each terminal screw within the specified torque range.

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.

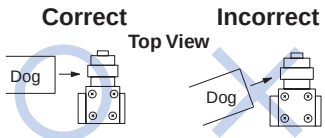
The Pg13.5 connector must be Nippon Flex's ABS-08Pg13.5 or ABS-12 Pg13.5.

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.

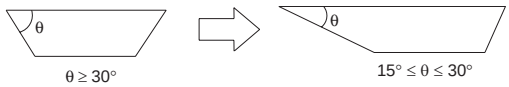
Others

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 D-266, *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.

MEMO

OMRON

Small Safety Limit Switch

D4F

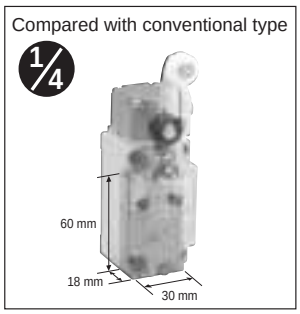
A Smaller Limit Switch than Ever Previously Produced. Ideal for Applications to Small-scale Machinery and Equipment

- 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

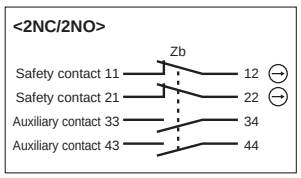
A Dramatic Reduction in Size

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.



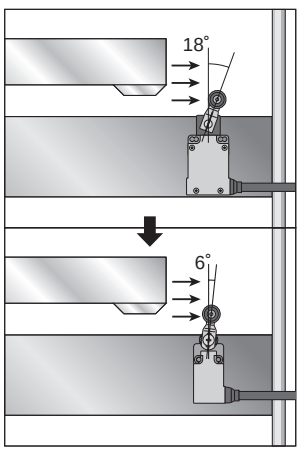
Four-contact Construction is Available

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.



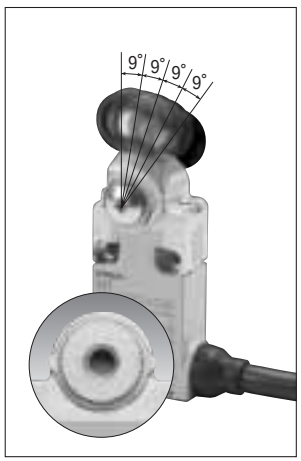
High-sensitivity and Space-saving

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-oo-oo
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

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 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)

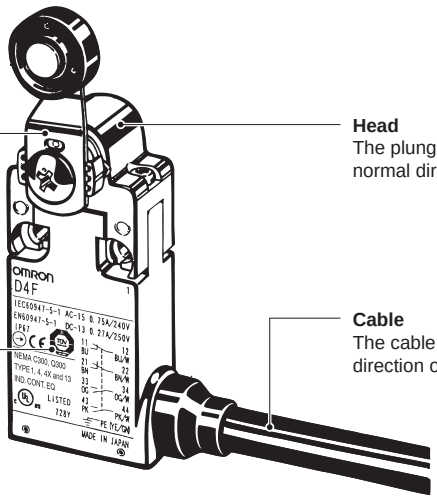
Model **Operating Characteristics**	**D4F-o20-oR** **D4F-o20-oD**	**D4F-o02-oR** **D4F-o02-oD**
Operating force max.: OF (See note 1.)	5 N	12 N
Release force min.: RF (See note 2.)	0.5 N	1.5 N
Pretravel: PT1 (11-12 and 21-22)	6±3° (NC)	1 mm max. (NC)
: PT1 (31-32 and 41-42)	9±3° (NC)	1.3 mm max. (NC)
: 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

Lever
Improved safety of the lever-setting (Form lock configuration). Many grooves are incised on the lever and the rotating shaft that mesh with each other to prevent a slip between the lever and the rotating shaft.
The lever can be set for positioning in steps of 9 degrees.

Built-in Switch
Has a direct opening mechanism separating the contacts when the NC contacts are welded.

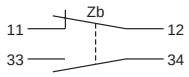
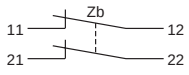
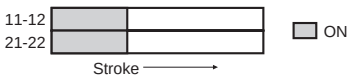
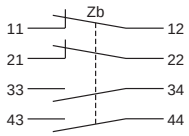
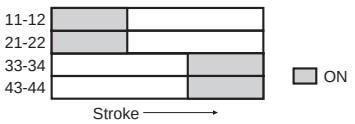
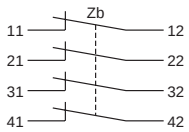
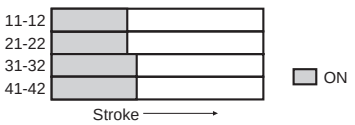


Head
The plunger type of actuator can be used in a normal direction and reverse direction.

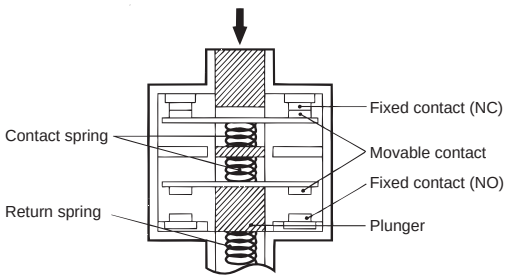
Cable
The cable can be pulled out in a horizontal direction or in a vertical direction.

Operation

Contact Form

Model	Contact		Diagram	Remarks
D4F-1o-oo	1NC/1NO (slow-action)			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-2o-oo	2NC (slow-action)			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-3o-oo	2NC/2NO (slow-action)			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-4o-oo	4NC (slow-action)			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)

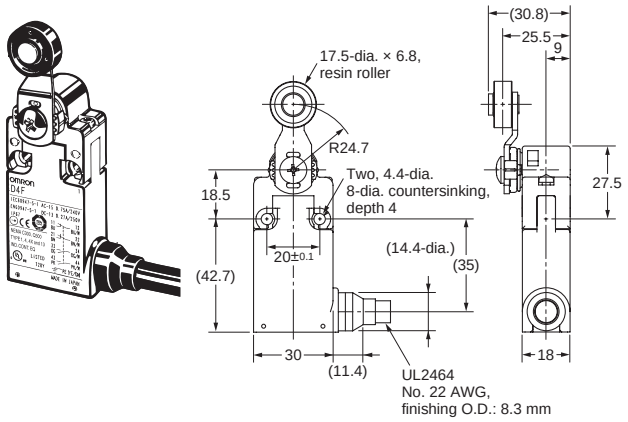


Conforms to EN60947-5-1 Direct Opening (→).
(Only the NC contacts have a direct opening function.)
When metal weld occurs, the NC contacts are separated from each other by pushing in the plunger.

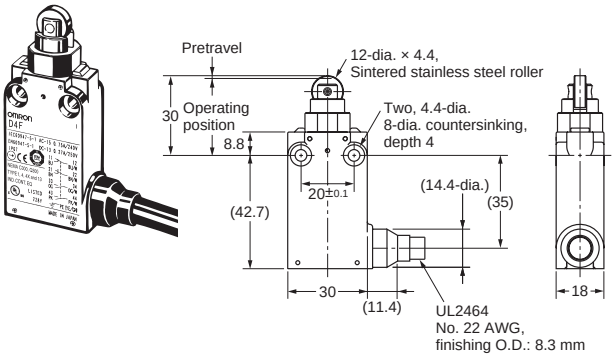
Dimensions

Note: 1. All units are in millimeters unless otherwise indicated.
2. Each dimension has a tolerance of 0.4 mm unless otherwise specified.

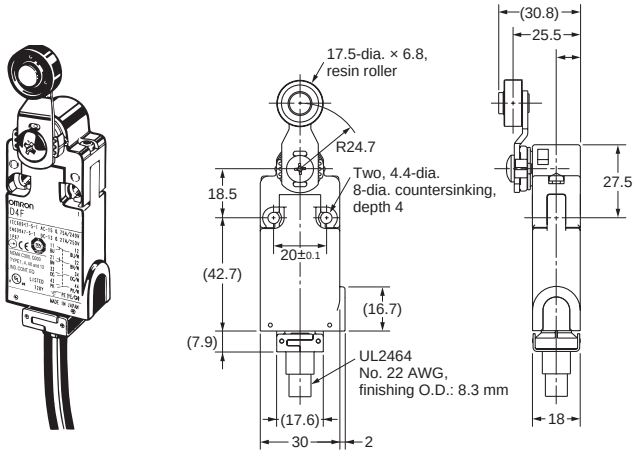
Roller lever (Metallic lever, resin roller) D4F-o20-oR



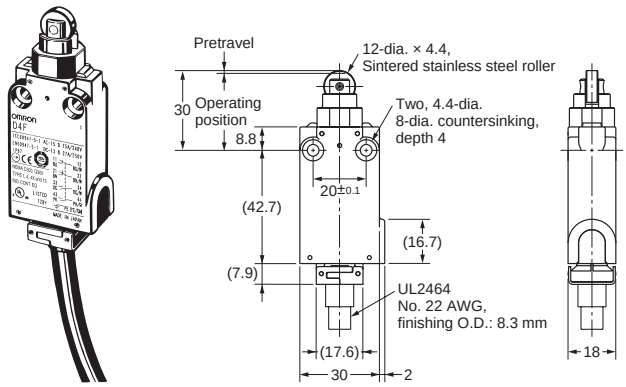
Roller plunger (Metallic roller) D4F-o02-oR



Roller lever (Metallic lever, resin roller) D4F-o20-oD



Roller plunger (Metallic roller) D4F-o02-oD



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.

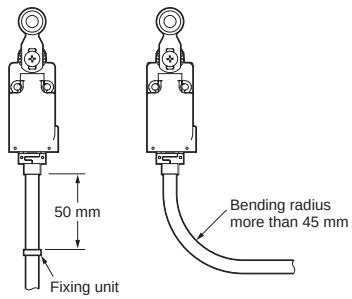
Handling of cables

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.

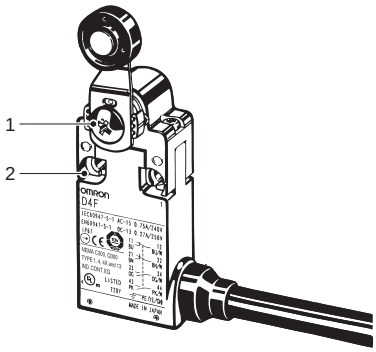
Durability

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.

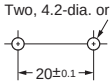
No.	Type	Proper tightening torque
1	Lever mounting screw (M5)	2.4 to 2.8 N·m
2	Body mounting screw (M4)	1.18 to 1.37 N·m



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°).

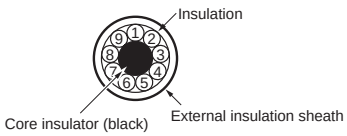
After unfastening the screws that hold the lever, mount the lever the other way (normal side or reverse side). Set an angle of the lever to complete adjustment within a range in which the lever does not touch the switch body.

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.

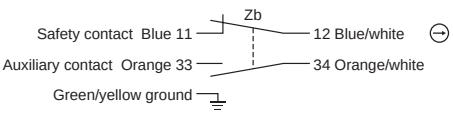
The safety and auxiliary contacts of D4F models of four-terminal contact construction and those of two-terminal contact construction are described below.

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 (⊖).

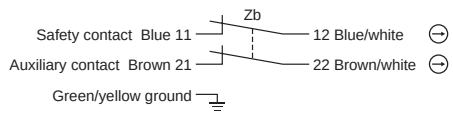
Auxiliary contacts are used to check (to monitor) the operating state of the switch, which are equivalent to NO contacts (33-34 and 43-44) or NC contacts (31-32 and 41-42).

The NC contacts 31-32 and 41-42 of auxiliary contacts (orange or pink) can be used as safety contacts.

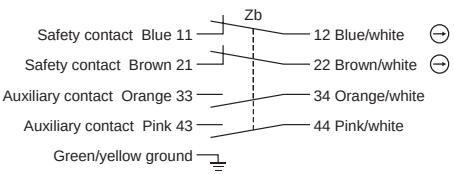
<1NC/1NO>



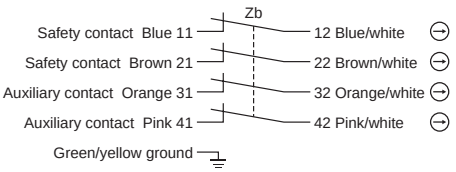
<2NC>



<2NC/2NO>



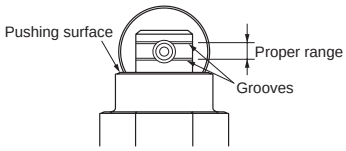
<4NC>



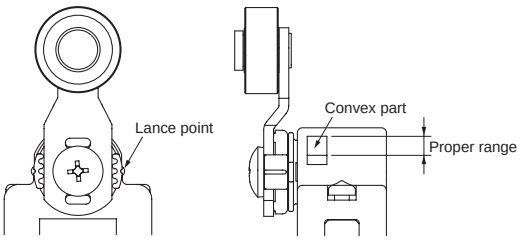
Cut the black core insulator and all unused wires at the end of the external insulation sheath when wiring the cable.

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.

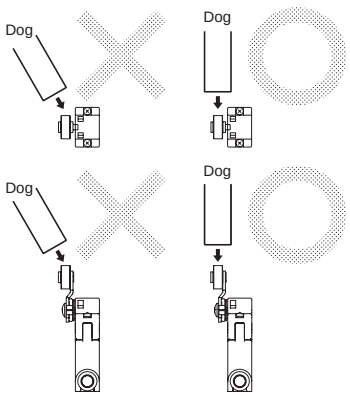


To set the roller lever stroke correctly, push the dog and cam until the the lance point comes within the range of the convex part that is the correct setting position.



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).

MEMO

Manual Reset Limit Switch

D4D-□R

A Series of Pull-reset Models Available

- The Switches, which feature a direct opening mechanism (NC contacts only), are equipped with lockable heads. Lock the Switch by moving the actuator to the lock position, and release the lock using the reset button.
- Conforms to EN (TÜV) standards corresponding to the CE marking. (Direct opening mechanism is shown by ⊖ on the Switch.)
- Approved by UL, CSA, BIA, and SUVA standards.
- Direct opening mechanism ⊖ and double insulation ▣ approved by TÜV and BIA.
- Operates between -30°C and 70°C.
- Metric conduit types available

Model Number Structure

■ Model Number Legend

D4D-□□□□R
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 (2-conduit)
- 6: G1/2 (2-conduit)
- 8: M20 (2-conduit)

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

3. Actuator
- 20: Roller lever
- 21: Adjustable roller lever
- 27: Adjustable roller lever (with rubber roller)
- 2H: Adjustable roller lever, form lock (with rubber roller)
- 31: Plunger
- 32: Roller plunger
- 62: One-way roller arm lever (Horizontal)
- 72: One-way roller arm lever (Vertical)

Ordering Information

List of Models

Safety limit switch, mechanical form lock

Switches

Actuator	Conduit size (see note 1)		1NC/1NO (Slow-action)		2NC (Slow-action)	
			Direct opening (see note 2)	Model	Direct opening (see note 2)	Model
Roller lever	1-conduit	Pg13.5	⊖	D4D-1520R	⊖	D4D-1A20R
		G1/2		D4D-2520R		D4D-2A20R
		M20		D4D-4520R		
	2-conduit	Pg13.5		D4D-5520R		D4D-5A20R
		G1/2		D4D-6520R		D4D-6A20R
Plunger	1-conduit	Pg13.5	⊖	D4D-1531R	⊖	D4D-1A31R
		G1/2		D4D-2531R		D4D-2A31R
		M20		D4D-4531R		
	2-conduit	Pg13.5		D4D-5531R		D4D-5A31R
		G1/2		D4D-6531R		D4D-6A31R
Roller plunger	1-conduit	Pg13.5	⊖	D4D-1532R	⊖	D4D-1A32R
		G1/2		D4D-2532R		D4D-2A32R
		M20		D4D-4532R		
	2-conduit	Pg13.5		D4D-5532R		D4D-5A32R
		G1/2		D4D-6532R		D4D-6A32R
One-way roller arm lever (Horizontal)	1-conduit	Pg13.5	⊖	D4D-1562R	⊖	D4D-1A62R
		G1/2		D4D-2562R		D4D-2A62R
	2-conduit	Pg13.5		D4D-5562R		D4D-5A62R
		G1/2		D4D-6562R		D4D-6A62R
One-way roller arm lever (Vertical)	1-conduit	Pg13.5	⊖	D4D-1572R	⊖	D4D-1A72R
		G1/2		D4D-2572R		D4D-2A72R
	2-conduit	Pg13.5		D4D-5572R		D4D-5A72R
		G1/2		D4D-6572R		D4D-6A72R
Adjustable roller lever, form lock	1-conduit	Pg13.5	⊖	D4D-152HR	⊖	D4D-1A2HR
		G1/2		D4D-252HR		D4D-2A2HR
Adjustable roller lever (See note 3)	1-conduit	Pg13.5	---	D4D-1521R	---	D4D-1A21R
		G1/2		D4D-2521R		D4D-2A21R
		M20		D4D-4521R		
	2-conduit	Pg13.5		D4D-5521R		D4D-5A21R
		G1/2		D4D-6521R		D4D-6A21R
Adjustable roller lever (with rubber roller) (See note 3)	1-conduit	Pg13.5	---	D4D-1527R	---	D4D-1A27R
		G1/2		D4D-2527R		D4D-2A27R
		M20		D4D-4527R		
	2-conduit	Pg13.5		D4D-5527R		D4D-5A27R
		G1/2		D4D-6527R		D4D-6A27R

Note: 1. It is recommended that M20/PG13.5 be used for Switches for Europe and 1/2-14NPT for North America.

2. The Switches are marked with ⊖ indicating approval for the direct opening mechanism.

3. Mechanically speaking, these models are basic limit switches.

Specifications

Approved Standards

Slow-action Models

Agency	Standard	File No.
TÜV Rheinland	EN60947-5-1 EN81, EN115	R9451184 (Direct opening: approved)
UL (see note 1)	UL508 CSA C22.2 No.14	E76675
BIA (see note 2)	GS-ET-15	1-conduit: 9505895 2-conduit: 9509914
SUVA (see note 2)	SUVA	1-conduit: E6337.d 2-conduit: E6338.d

Note: 1. CSA C22.2 No. 14 compliance was verified and approved by UL (Marked with).
2. Except for adjustable roller lever models.

Standards and EC Directives

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

Approved Standard Ratings

Applicable Standards

TÜV (EN60947-5-1)

Utilization category	AC-15
Rated operating current (I_e)	2 A
Rated operating voltage (U_e)	400 V

A600

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

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

Characteristics

Degree of protection	IP65 (EN60947-5-1)
Durability (see note)	Mechanical:1,000,000 operations min. Electrical:150,000 operations min.
Operating speed	1 mm/s to 0.5 m/s
Contact gap	2 x 2 mm min.
Operating frequency	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 metal part
Contact resistance	25 mΩ max. (initial value)
Dielectric strength (U_{imp})	U_{imp} 4 kV between terminals of the same polarity, between terminals of different polarity, and between each terminal and non-current-carrying metal part (EN60947-5-1)
Rated insulation voltage (U_i)	400 V (EN60947-5-1)
Switching overvoltage	1,500 V max. (EN60947-5-1)
Pollution degree (operating environment)	3 (EN60947-5-1)
Conditional short-circuit current	100 A (EN60947-5-1)
Conventional enclosed thermal current (I_{the})	10 A (EN60947-5-1)
Protection against electric shock	Class II (double insulation)
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.
Weight	Approx. 80 g (for D4D-1120R)

Note: 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.

Operating Characteristics

1-conduit Models

Model	D4D-1520R D4D-2520R D4D-4520R D4D-1A20R D4D-2A20R	D4D-1521R D4D-2521R D4D-4521R D4D-1A21R D4D-2A21R (see note 1)	D4D-152HR D4D-252HR D4D-1A2HR D4D-2A2HR	D4D-1527R D4D-2527R D4D-4527R D4D-1A27R D4D-2A27R (see note 2)	D4D-1531R D4D-2531R D4D-4531R D4D-1A31R D4D-2A31R	D4D-1532R D4D-2532R D4D-4532R D4D-1A32R D4D-2A32R	D4D-1562R D4D-2562R D4D-1A62R D4D-2A62R	D4D-1572R D4D-2572R D4D-1A72R D4D-2A72R
LF max.	6.37 N	5.59 N	5.39 N	5.39 N	10.79 N	10.79 N	7.35 N	7.85 N
LT max.	55°	55°	55°	55°	4.5 mm	4.5 mm	7 mm	7 mm
PT1 max. (see note 3)	18° to 27°	18° to 27°	18° to 27°	18° to 27°	2 mm	2 mm	4 mm	4 mm
PT2 (see note 4)	(44°)	(44°)	(44°)	(44°)	(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 5)	(70°)	(70°)	(70°)	(70°)	(6 mm)	(6 mm)	(9 mm)	(9 mm)
DOF min. (see note 6)	19.61 N	19.61 N	19.61 N	19.61 N	19.61 N	19.61 N	19.61 N	19.61 N
DOT min. (see note 6)	50°	50°	50°	50°	3.2 mm	3.2 mm	5.8 mm	4.8 mm

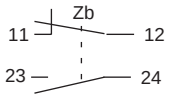
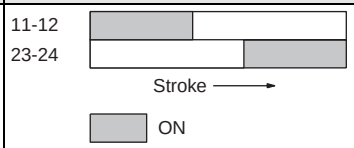
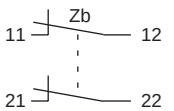
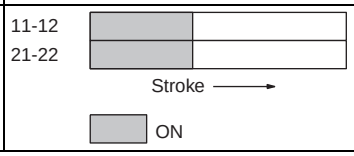
Note: 1. The operating characteristics of these Switches were measured with the roller lever set at 30 mm.
2. The operating characteristics of these Switches were measured with the roller lever set at 31 mm.
3. These PT1 values are possible when the NC contacts are OFF.
4. These PT2 values are possible when the NO contacts are ON (applicable to D4D-□R models with 1NC and 1NO contact each).
5. Reference value.
6. DOT (direct opening travel) and DOF (direct opening force) are required values for direct opening.

2-conduit Models

Model	D4D-5520R D4D-6520R D4D-5A20R D4D-6A20R	D4D-5521R D4D-6521R D4D-5A21R D4D-6A21R	D4D-5527R D4D-6527R D4D-5A27R D4D-6A27R	D4D-5531R D4D-6531R D4D-5A31R D4D-6A31R	D4D-5532R D4D-6532R D4D-5A32R D4D-6A32R	D4D-5562R D4D-6562R D4D-5A62R D4D-6A62R	D4D-5572R D4D-6572R D4D-5A72R D4D-6A72R
LF max.	6.37 N	5.59 N	5.39 N	10.79 N	10.79 N	7.35 N	7.85 N
LT max.	55°	55°	55°	4.5 mm	4.5 mm	7 mm	7 mm
PT1 max. (see note 3)	18° to 27°	18° to 27°	18° to 27°	2 mm	2 mm	4 mm	4 mm
PT2 (see note 4)	(44°)	(44°)	(44°)	(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 5)	(70°)	(70°)	(70°)	(6 mm)	(6 mm)	(9 mm)	(9 mm)
DOF min. (see note 6)	19.61 N	19.61 N	19.61 N	19.61 N	19.61 N	19.61 N	19.61 N
DOT min. (see note 6)	50°	50°	50°	3.2 mm	3.2 mm	5.8 mm	4.8 mm

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. These PT1 values are possible when the NC contacts are OFF.
4. These PT2 values are possible when the NO contacts are ON (applicable to D4D-□R models with 1NC and 1NO contact each).
5. Reference value.
6. DOT (direct opening travel) and DOF (direct opening force) are required values for direct opening.

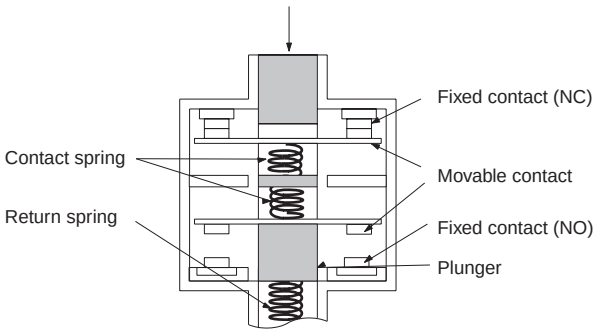
Contact Form

Model	Contact		Diagram	Remarks
D4D-□5□N	1NC/1NO (slow-action)			Only NC contact 11-12 has an approved direct opening mechanism. ⊖ Terminals 11-12 and 23-24 can be used as unlike poles.
D4D-□A□N	2NC (slow-action)			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: Terminals are numbered according to EN50013 and contacts are marked according to EN60947-5-1.

Direct Opening Mechanism

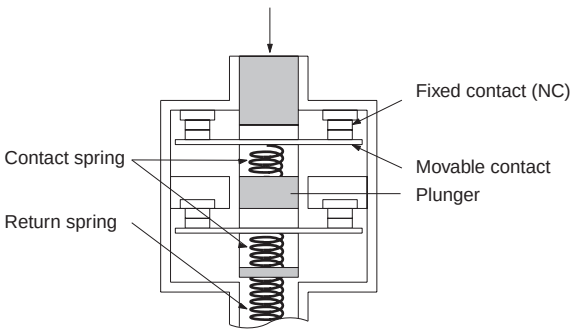
1NC/1NO Contact (Slow-action)



Only the NC contacts have a direct opening function.
When metal deposition occurs, the contacts are separated from each other by pushing in the plunger.

Conforms to EN60947-5-1 Direct Opening

2NC Contact (Slow-action)

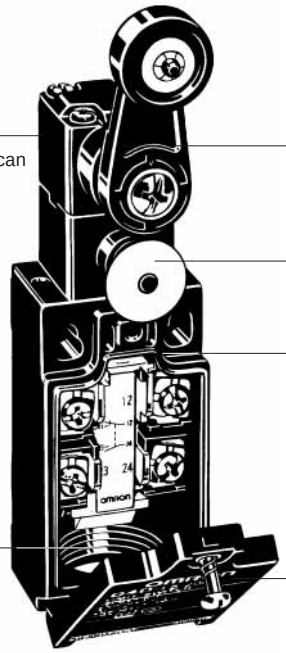


Both NC contacts have a direct opening function.
When metal deposition occurs, the contacts are separated from each other by pushing in the plunger.

Conforms to EN60947-5-1 Direct Opening

Note: The Switches are marked with indicating approval for the direct opening mechanism.

Nomenclature



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
Wide switch variations.
Pg13.5: 1-conduit, 2-conduit models
G1/2: 1-conduit, 2-conduit models
1/2-14NPT: 1-conduit models
M20: 1-conduit models

Safety-oriented Lever Setting
Grooves which engage the lever every 90° are cut in the operation indicator disk to prevent the lever from slipping against the rotary shaft.

Reset Head (Blue)
The direction of the reset head can be adjusted to any of the four directions.

Built-in Switch
Has a direct opening mechanism separating the contacts when the contacts are welded.

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.

Note: The D4D-□R uses NBR.

Dimensions

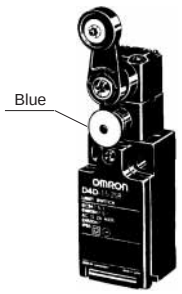
Note: 1. All units are in millimeters unless otherwise indicated.
2. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
3. The minimum number of screw threads is five when the Pg13.5 conduit is used and four when the G1/2 conduit is used.

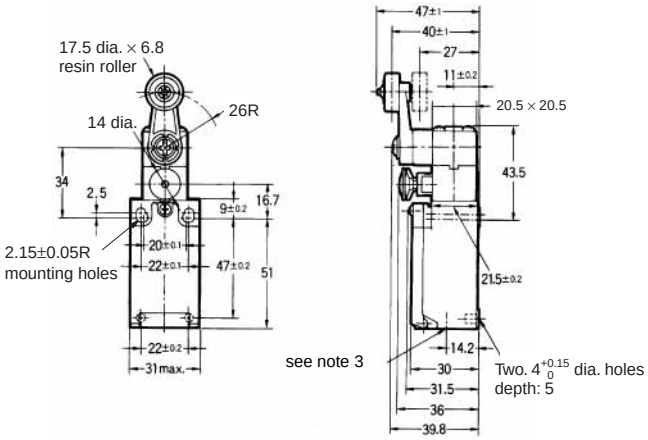
Switches

1-conduit Models

Roller Lever Safety Limit switch, mechanical form lock

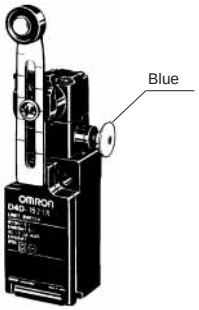
D4D-1520R
D4D-2520R
D4D-4520R
D4D-1A20R
D4D-2A20R

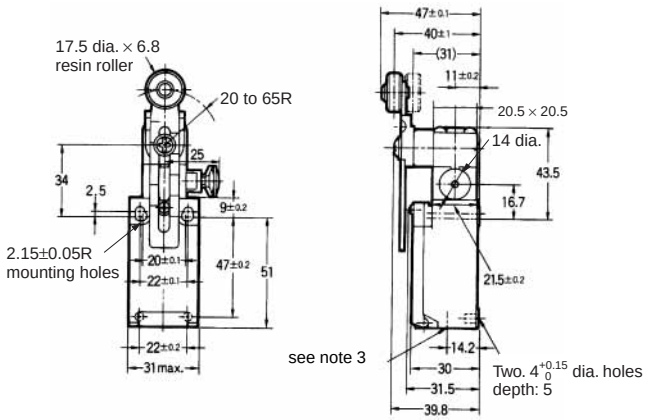




Adjustable Roller Lever

D4D-1521R
D4D-2521R
D4D-4521R
D4D-1A21R
D4D-2A21R

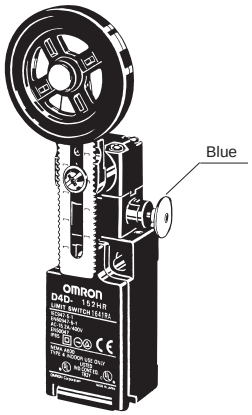


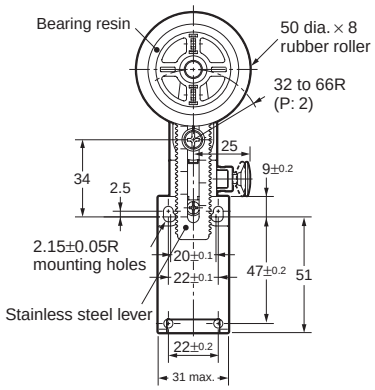


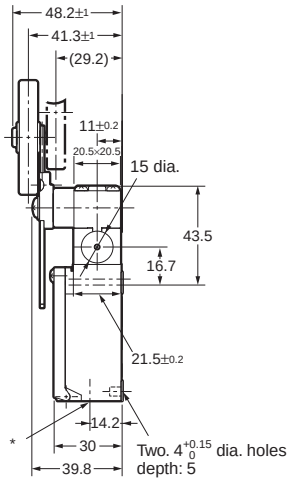
Adjustable Roller Lever, Form Lock (Rubber Roller Lever)

Safety Limit switch, mechanical form lock

D4D-152HR
D4D-252HR
D4D-452HR
D4D-1A2HR
D4D-2A2HR
D4D-4A2HR

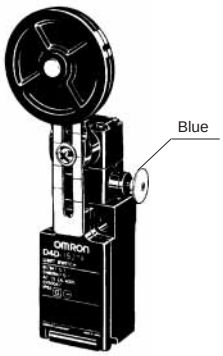


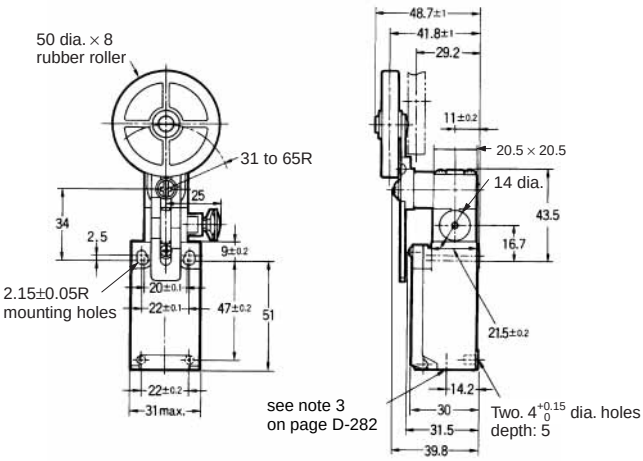




Adjustable Roller Lever (Rubber Roller Lever)

D4D-1527R
D4D-2527R
D4D-4527R
D4D-1A27R
D4D-2A27R

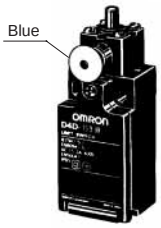


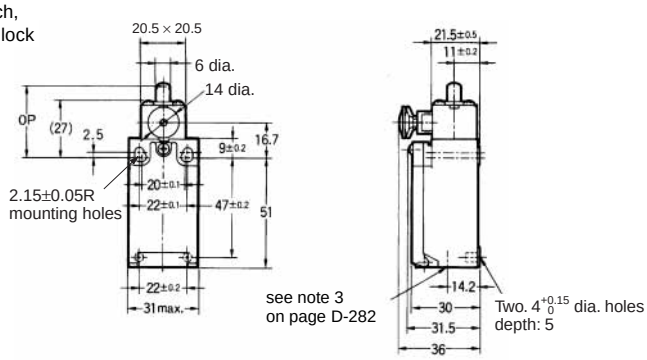


Plunger

D4D-1531R
D4D-2531R
D4D-4531R
D4D-1A31R
D4D-2A31R

Safety Limit switch, mechanical form lock

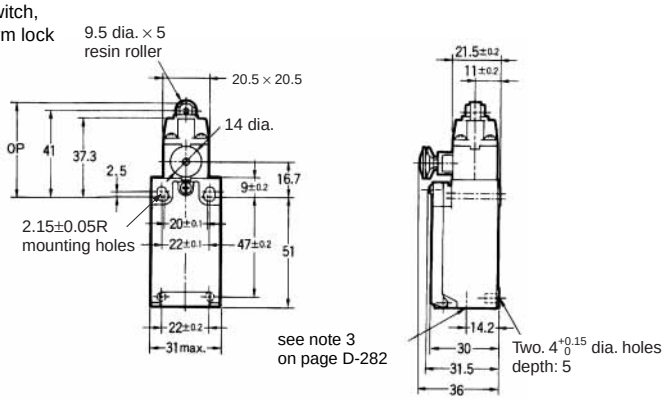




Roller Plunger

D4D-1532R
D4D-2532R
D4D-4532R
D4D-1A32R
D4D-2A32R

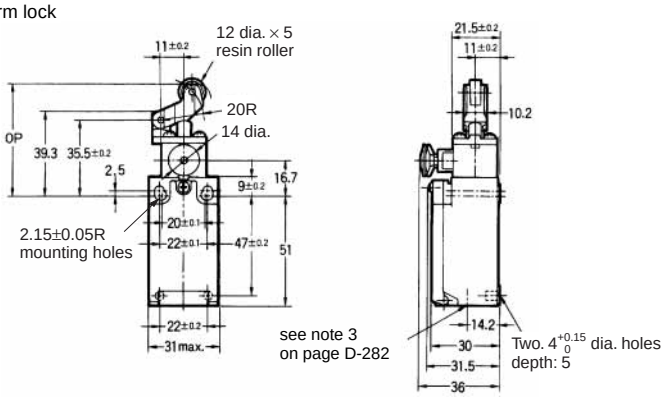
Safety Limit switch, mechanical form lock



One-way Roller Arm Lever (Horizontal)

D4D-1562R
D4D-2562R
D4D-1A62R
D4D-2A62R

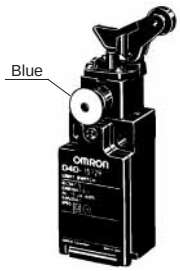
Safety Limit switch, mechanical form lock

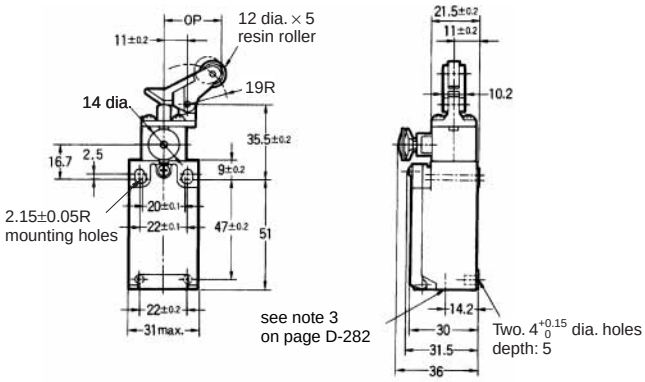


One-way Roller Arm Lever (Vertical)

D4D-1572R
D4D-2572R
D4D-1A72R
D4D-2A72R

Safety Limit switch, mechanical form lock



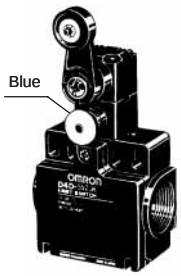


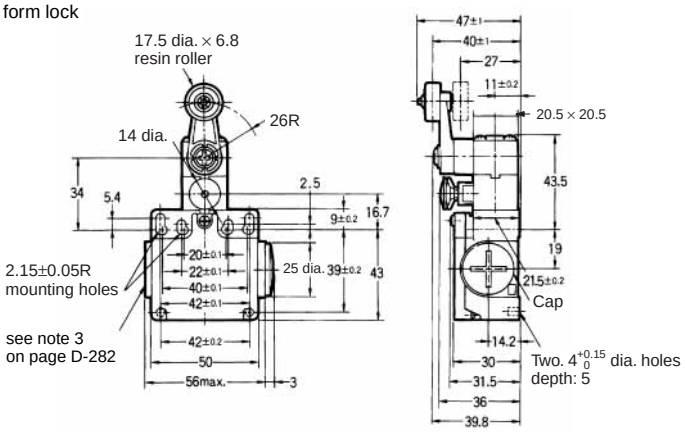
2-conduit Models

Roller Lever

D4D-5520R
D4D-6520R
D4D-5A20R
D4D-6A20R

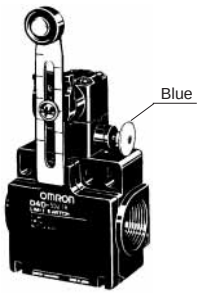
Safety Limit switch, mechanical form lock

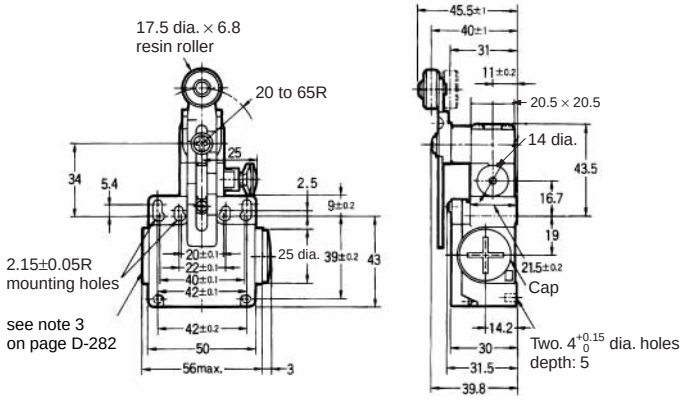




Adjustable Roller Lever

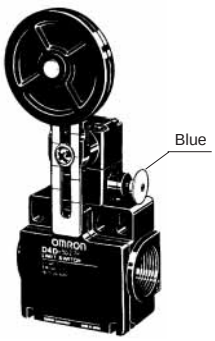
D4D-5521R
D4D-6521R
D4D-5A21R
D4D-6A21R

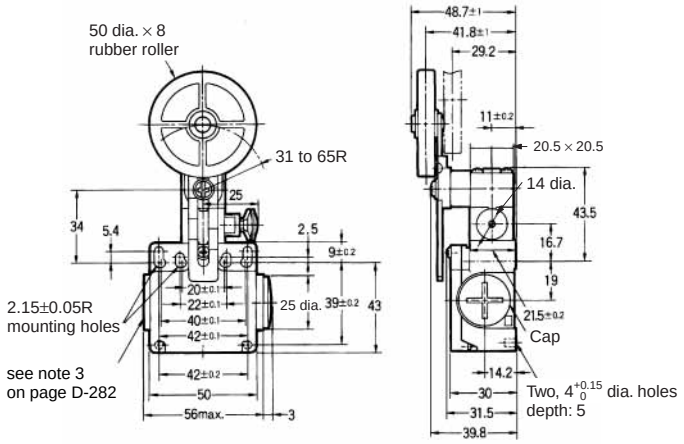




Adjustable Roller Lever (Rubber Roller Lever)

D4D-5527R
D4D-6527R
D4D-5A27R
D4D-6A27R

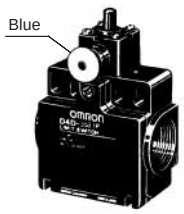


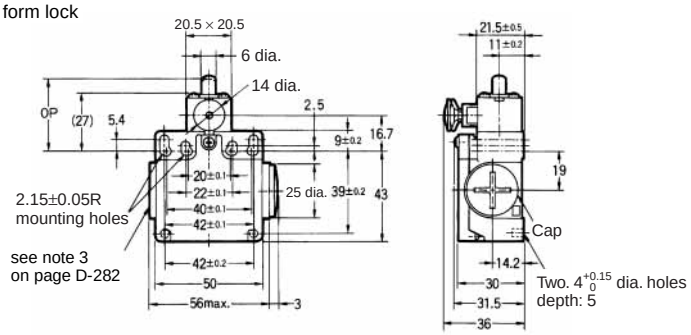


Plunger

Safety Limit switch, mechanical form lock

D4D-5531R
D4D-6531R
D4D-5A31R
D4D-6A31R

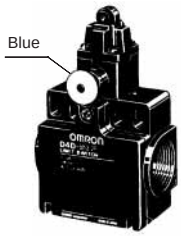


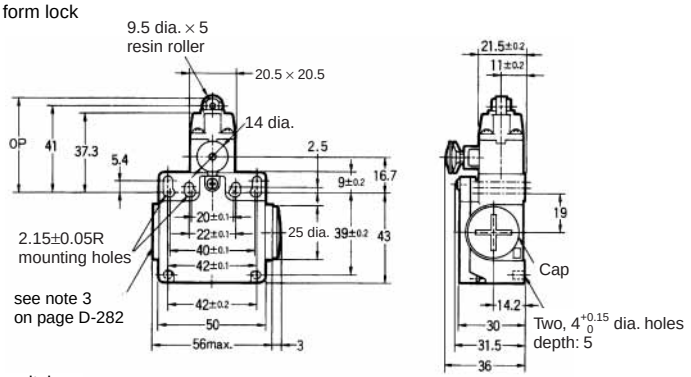


Roller Plunger

Safety Limit switch, mechanical form lock

D4D-5532R
D4D-6532R
D4D-5A32R
D4D-6A32R

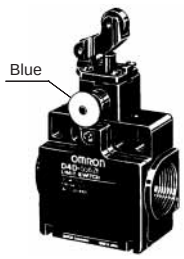


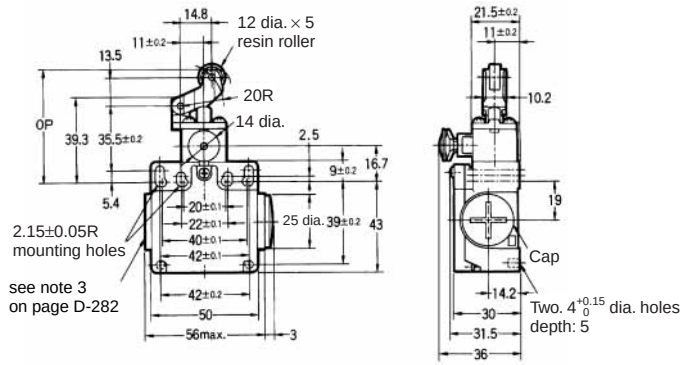


One-way Roller Arm Lever (Horizontal)

Safety Limit switch, mechanical form lock

D4D-5562R
D4D-6562R
D4D-5A62R
D4D-6A62R

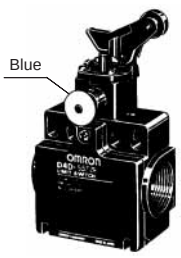


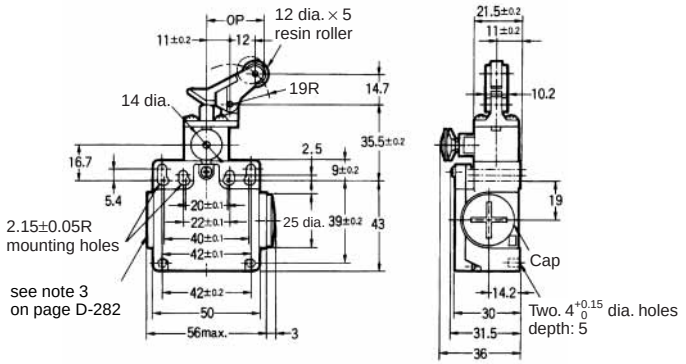


One-way Roller Arm Lever (Vertical)

Safety Limit switch, mechanical form lock

D4D-5572R
D4D-6572R
D4D-5A72R
D4D-6A72R

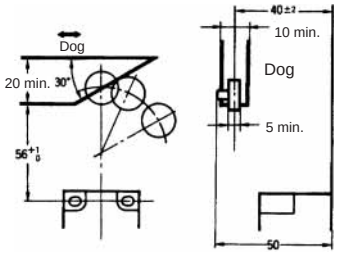




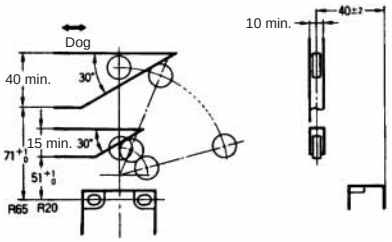
Levers

Refer to the following for the angles and positions of the watchdogs.

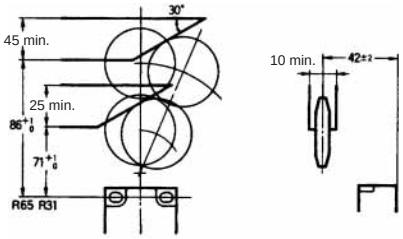
Roller Lever (D4D-□□20R)



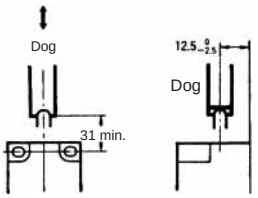
Adjustable Roller Lever (D4D-□□21R)



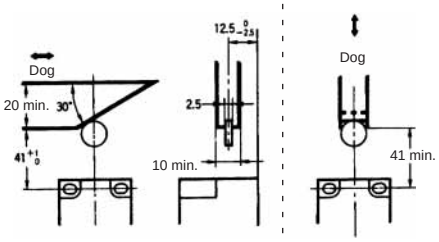
Adjustable Roller Lever (Rubber Roller Lever) (D4D-□□27R)



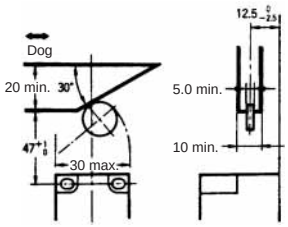
Sealed Plunger (D4D-□□31R)



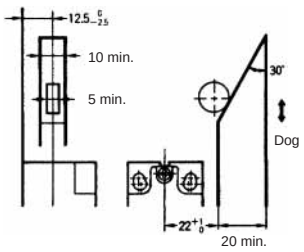
Roller Plunger (D4D-□□32R)



One-way Roller Arm Lever (Horizontal) (D4D-□□62R)



One-way Roller Arm Lever (Vertical) (D4D-□□72R)



Precautions

⚠ Caution

Do not use metal connectors or conduits with this Switch. Rigid connectors and conduits may damage the Switch. The broken conduit hole may cause and electrical shock hazard.

If the D4D-□R is applied to a safety category circuit for prevention of injury, use the D4D-□R model that has an NC contact equipped with a direct opening mechanism, and make sure that the D4D-□R operates in the direct opening mode. Furthermore, secure the D4D-□R with screws or equivalent parts that are tightened in a single direction so that the D4D-□R cannot be easily removed. Then provide a protection cover for the D4D-□R and post a warning label near the D4D-□R.

Ensure that the actuator is pushed into the lock position by, for example, setting up a dog. Not doing so may result in the actuator becoming unlocked and causing an accident.

When the Limit Switch locks due to a fault in the system, be sure to reset the Limit Switch manually before resupplying power after confirming the safety of the system.

Be sure to connect a fuse with a breaking current 1.5 to 2 times larger than the rated current to the Limit Switch in parallel in order to protect the Limit Switch from damage due to short-circuiting.

When using the Limit Switch for the EN ratings, use the gI or gG 10-A fuse.

Do not use the Limit Switch as a stopper.

Actuation of the Limit Switch over a long time may deteriorate parts of the Limit Switch and a releasing failure may result. Be sure to check the condition of the Limit Switch regularly.

When using the Limit Switch as a safety component, be sure to check the system design for both operational and circuit safety.

Correct Use

Operating Environment

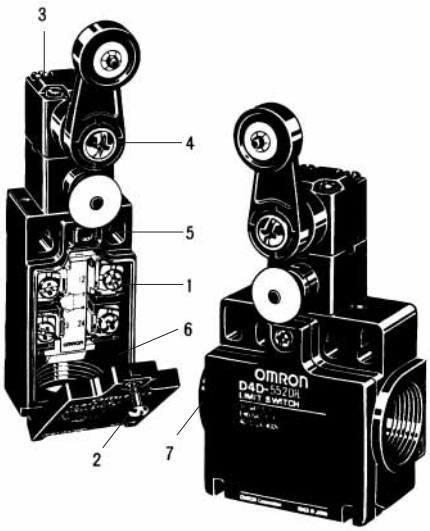
The Limit Switch is intended for indoor use only. Using the Limit Switch outdoors may result in a malfunction.

Tightening Torque

Be sure to tighten each screw of the D4D-□R properly, otherwise the D4D-□R may malfunction.

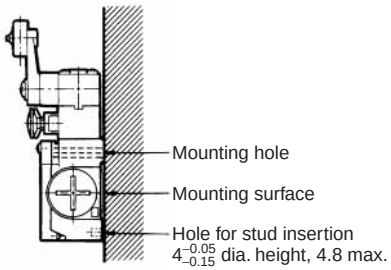
No.	Type	Torque
1	M3.5 terminal screw	0.59 to 0.78 N·m
2	Cover mounting screw	0.78 to 0.88 N·m
3	Head mounting screw	0.78 to 0.88 N·m
4	Lever mounting screw	1.57 to 1.77 N·m
5	M4 body mounting screw	0.49 to 0.69 N·m
6	Connector	1.77 to 2.16 N·m 1.37 to 1.77 N·m (see note)
7	Cap screw	1.27 to 1.67 N·m

Note: This torque range applies to 1/2-14NPT connectors.



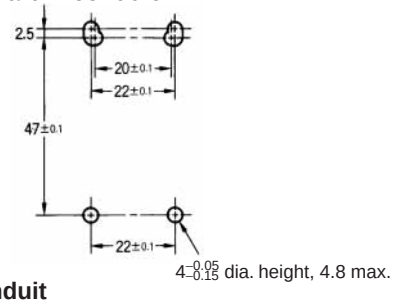
Mounting

Fasten the Switch with two M4 Allen-head bolts and washers. Provide a stud with a diameter of $4^{-0.05}_{-0.15}$ and a height of 4.8 mm max. at two places as shown below so that the Switch is firmly fixed at four points.

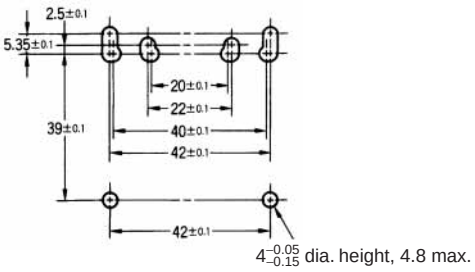


Mounting Holes/Studs

Standard 1-conduit



2-conduit

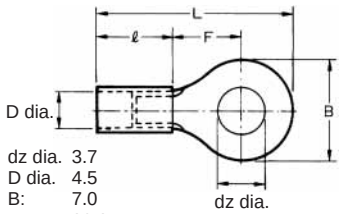


Changing the Head Direction

If the head direction has been changed, check the torque of each screw and make sure that the screws are free of foreign substances, and that each screw is tightened to the proper torque.

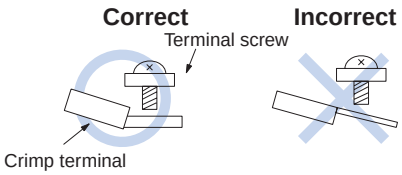
Wiring

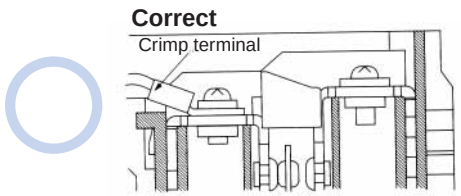
- Do not connect the bare lead wires directly to the terminals but be sure to connect each of them by using an insulation tube and M3.5 round crimp terminals and tighten each terminal screw within the specified torque range.
- The proper lead wire is 20 to 14 AWG (0.5 to 2.5 mm^2) in size.
- Do not touch the terminals while power is being supplied in order to avoid an electrical shock.

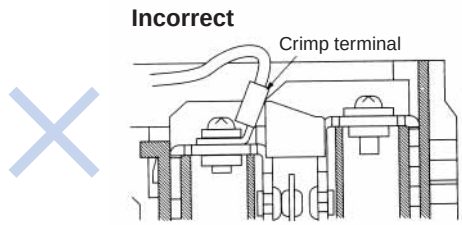


dz dia. 3.7
D dia. 4.5
B: 7.0
L: 20.2
F: 7.7
l: 9.0 (mm)

Perform wiring for the crimp terminals in the orientation shown below, so that they do not rest on the casing or the cover.







Processing the Conduit Opening

Tighten the connector to a torque of 1.8 to 2.2 N·m (1.37 to 1.77 N·m if it is a 1/2-14NPT). Excessive tightening torque may damage the casing. To satisfy IP65, apply sealing tape to the connector conduit. The diameter of the cable must be suited to the corresponding connector.

Insert a cap screw provided with the D4D-□R into any unused conduit opening of the D4D-□R and tighten the cap screw to a torque of 1.27 to 1.67 N·m.

Maintenance and Repairs

The user must not maintain or repair equipment incorporating any D4D-□R model. Contact the manufacturer of the equipment for any maintenance or repairs required.

Others

With rubber roller lever models, the rubber roller may turn white with the passage of time, but this will not affect the quality of operation.

Emergency Stop Switch

A22E

Install in 22-dia. or 25-dia. Panel Cutout

- Direct opening mechanism with minimum contact separation of 3 mm in accordance with EN60947-5-1, ⊖. (only for NC contacts)
- Safety lock mechanism prevents misuse. (No tampering – in accordance with EN 418)
- Easy mounting and removal of Switch Blocks using an incorporated lever.
- Finger protection mechanism on Switch Unit provided as a standard feature.
- Install using either round, forked crimp terminals, or ferrules.

For additional installation of emergency-stop switches.

A22Z-3466-1

A22E-□-□

Emergency-stop switches can be installed easily far from machines.

A22Z-B101Y
Control Box

Model Number Structure

Model Number Legend

Completely Assembled

Shipped as a set which includes the Pushbutton, Lamp (lighted models only), and Switch.

A22E□-□-□-□

1 Lighted/Non-lighted

Code	Description
None	Non-lighted
L	Lighted (see note)

Note: Lighted Emergency Stop Switches are available only for the 40-dia. push-lock turn-reset models.

2 Head Size

Code	Description	
MP	40 dia.	Push-pull
LP	60 dia.	
S	30 dia.	Push-lock, turn-reset
M	40 dia.	
L	60 dia.	
SK	30 dia.	Push-lock key reset
MK	40 dia.	

3 Light Source

Code	Operating Voltage	
Without Voltage Reduction Unit		
None	Non-lighted	
6D	LED	6 VDC
6A		6 VAC
12A		12 VAC/VDC
24A		24 VAC/VDC
With Voltage Reduction Unit		
None	Non-lighted	
T1	LED	110 VAC*1
T2		220 VAC*2

Note: The LED lamp (24 VAC/VDC) can be lit by directly applying 110 VAC/VDC (220 VAC/VDC) to the lamp terminal. LED incorporates the 24-VAC/VDC models.

*1) Operational voltage: 95 to 110 VAC
*2) Operational voltage: 190 to 230 VAC

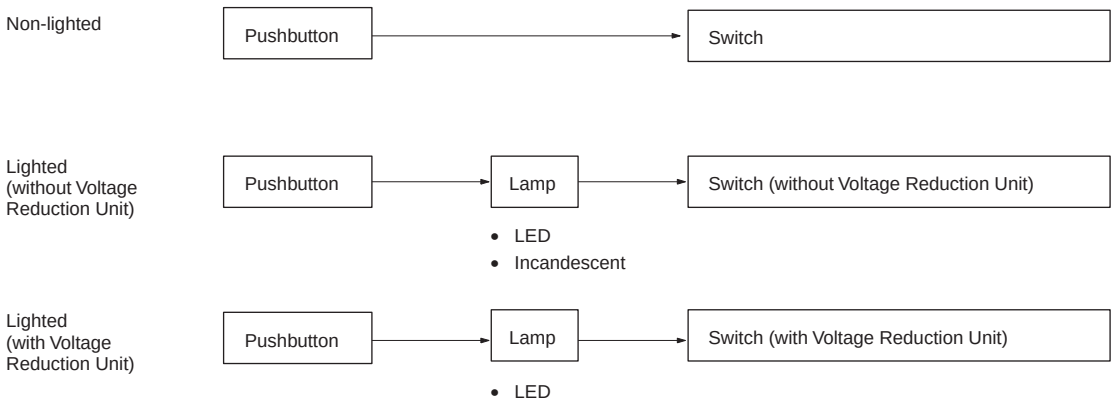
4 Contacts

Code	Description
01	SPST-NC
11	SPST-NO + SPST-NC
02	DPST-NC

Subassembled

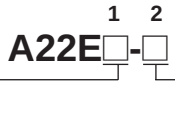
The Pushbutton, Lamp, or Switch can be ordered separately. Use them in combination for models that are not available as assembled Units. These can also be used as inventory for maintenance parts.

Unit Combinations



1. Pushbutton

Lighted/Non-lighted



1 Lighted/Non-lighted

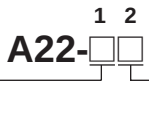
Code	Description
None	Non-lighted
L	Lighted (see note)

Note: Lighted Emergency Stop Switches are available only for the 40-dia. push-lock turn-reset models.

2 Head Size

Code		Description
MP	40 dia.	Push-pull
LP	60 dia.	
S	30 dia.	Push-lock, turn-reset
M	40 dia.	
L	60 dia.	
SK	30 dia.	Push-lock key reset
MK	40 dia.	

2. Lamp



1 Operating Voltage (Rated Voltage)

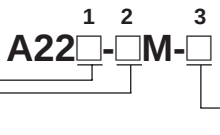
Incandescent	
Code	**LED**
6D	6 VDC (6 VDC)
6A	6 VAC (6 VAC)
12A	12 VAC/VDC (12 VAC/VDC)
24A	24 VAC/VDC (24 VAC/VDC)

2 Illumination Color

Code	Description
R	Red

3. Switch

Lighted/Non-lighted



1 Lighted/Non-lighted

Code	Description
None	Non-lighted
L	Lighted

2 Contacts

Code	Description
01	SPST-NC
11	SPST-NO + SPST-NC
02	DPST-NC

3 Voltage Reduction Unit (Lighted Models Only)

Code	Description
None	Without Voltage Reduction Unit
T1	110 VAC*1
T2	220 VAC*2

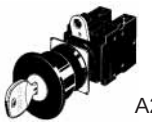
*1) Operational voltage: 95 to 110 VAC
*2) Operational voltage: 190 to 230 VAC

Ordering Information

List of Models

Completely Assembled (Ask your local OMRON representative)

Non-lighted Models

Appearance	Output	Push-lock turn-reset system	Color of cap
40-dia. head Push-pull  A22E-MP	SPST-NC	A22E-MP-01	Red
	SPST-NO/SPST-NC	A22E-MP-11	
	DPST-NC	A22E-MP-02	
60-dia. head Push-pull  A22E-LP	SPST-NC	A22E-LP-01	
	SPST-NO/SPST-NC	A22E-LP-11	
	DPST-NC	A22E-LP-02	
30-dia. head Push-lock Turn-reset  A22E-S	SPST-NC	A22E-S-01	
	SPST-NO/SPST-NC	A22E-S-11	
	DPST-NC	A22E-S-02	
40-dia. head Push-lock Turn-reset  A22E-M	SPST-NC	A22E-M-01	
	SPST-NO/SPST-NC	A22E-M-11	
	DPST-NC	A22E-M-02	
60-dia. head Push-lock Turn-reset  A22E-L	SPST-NC	A22E-L-01	
	SPST-NO/SPST-NC	A22E-L-11	
	DPST-NC	A22E-L-02	
30-dia. head Push-lock Key-reset  A22E-SK	SPST-NC	A22E-SK-01	
	SPST-NO/SPST-NC	A22E-SK-11	
	DPST-NC	A22E-SK-02	
40-dia. head Push-lock Key-reset  A22E-MK	SPST-NC	A22E-MK-01	
	SPST-NO/SPST-NC	A22E-MK-11	
	DPST-NC	A22E-MK-02	

Lighted Models

Appearance	Output	Lighting	Rated voltage	Push-lock turn-reset system	Color of cap
40-dia. head Push-lock Turn-reset 	SPST-NC	LED	6 VDC	A22EL-M-6D-01	Red
			6 VAC	A22EL-M-6A-01	
			12 VAC/VDC	A22EL-M-12A-01	
			24 VAC/VDC	A22EL-M-24A-01	
	SPST-NO/SPST-NC		6 VDC	A22EL-M-6D-11	
			6 VAC	A22EL-M-6A-11	
			12 VAC/VDC	A22EL-M-12A-11	
			24 VAC/VDC	A22EL-M-24A-11	
	DPST-NC		6 VDC	A22EL-M-6D-02	
			6 VAC	A22EL-M-6A-02	
			12 VAC/VDC	A22EL-M-12A-02	
			24 VAC/VDC	A22EL-M-24A-02	
40-dia. head Push-lock Turn-reset with Voltage Reduction Unit 	SPST-NC		110 VAC	A22EL-M-T1-01	
			220 VAC	A22EL-M-T2-01	
	SPST-NO/SPST-NC		110 VAC	A22EL-M-T1-11	
			220 VAC	A22EL-M-T2-11	
	DPST-NC		110 VAC	A22EL-M-T1-02	
			220 VAC	A22EL-M-T2-02	

Subassembled

Pushbuttons

Non-lighted

Sealing capability and size	IP65 oil-resistant models		
	Small (30 dia.)	Medium (40 dia.)	Large (60 dia.)
Push-pull	---	A22E-MP 	A22E-LP 
Push-lock, Turn-reset	A22E-S 	A22E-M 	A22E-L 
Push-lock, key-reset	A22E-SK 	A22E-MK 	---

Lighted

Sealing capability and size	IP65
	Medium (40 dia.)
Push-lock, Turn-reset	A22EL-M 

Lamp

LED

Rated voltage / LED light 	6 VDC	6 VAC	12 VAC/VDC	24 VAC/VDC	Super-bright 24 VAC/VDC
Red	A22-6DR	A22-6AR	A22-12AR	A22-24AR	A22-24ASR

Note: For voltage-reduction lighting, use the A22-24AR.

Incandescent

Rated voltage	6 VAC	14 VAC	28 VAC	130 VAC
	A22-5	A22-12	A22-24	A22-H1

Switch (Standard Load)

Without Voltage Reduction Unit

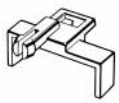
Classification		Non-lighted 	Lighted 
Appearance			
Switch Action		Momentary	Momentary
Contacts			
For standard loads	SPST-NO	A22-10M	A22L-10M
	SPST-NC	A22-01M	A22L-01M
	SPST-NO + SPST-NC	A22-11M	A22L-11M
	DPST-NO	A22-20M	A22L-20M
	DPST-NC	A22-02M	A22L-02M

With Voltage Reduction Unit

Classification		Lighted (110 VAC) 	Lighted (220 VAC) 
Appearance			
Switch Action		Momentary	Momentary
Contacts			
For standard loads	SPST-NO	A22L-10M-T1	A22L-10M-T2
	SPST-NC	A22L-01M-T1	A22L-01M-T2
	SPST-NO + SPST-NC	A22L-11M-T1	A22L-11M-T2
	DPST-NO	A22L-20M-T1	A22L-20M-T2
	DPST-NC	A22L-02M-T1	A22L-02M-T2

Note: 1. The above illustrations are for the DPST-NO contact.
2. When using with a Voltage Reduction Unit, use the A22-24AR.

Accessories (Order Separately)

Item	Appearance	Classification		Model	Remarks
Switch Blocks		SPST-NO		A22-10	Provided as standard. Order Switch Blocks only when adding or replacing them.
		SPST-NC		A22-01	
Lamp Sockets		Direct lighting		A22-TN	Used when changing the lighting method.
		Voltage-reduction lighting	110 VAC	A22-T1	
			220 VAC	A22-T2	
Mounting Latches		For momentary-action models		A22-3200	Provided as standard. Order Mounting Latches only when mounting Switch Blocks or Lamp Sockets that are purchased individually.
		For alternate-action models		A22-3210	
Lock Ring		Rounded shape		A22Z-3360	The body is equipped with a Lock Fitting. This Lock Fitting is used when a more secure lock feature is required.
Hole Plug		Round		A22Z-3530	Can be plugged into pre-cut panel holes for future expansion. The color is black.
Control Boxes (Enclosures)		One hole		A22Z-B101	Material: Polycarbonate resin
		One hole, yellow box (for emergency stop)		A22Z-B101Y	
		Two holes		A22Z-B102	
		Three holes		A22Z-B103	
Connectors		Applicable cable diameter (mm)	7 to 9 dia.	A22Z-3500-1	Plastic connector used to extend a cable from the Switch Box.
			9 to 11 dia.	A22Z-3500-2	
25-dia. Ring		——		A22Z-R25	Can be fit into a 25-dia. hole in the panel. Since this is not attached to the main body, order separately.
Legend Plates for Emergency Stop		60-dia. black letters on yellow back-ground		A22Z-3466-1	“EMERGENCY STOP” is indicated on the plate.
		90-dia. black letters on yellow back-ground		A22Z-3476-1	
Lamp Extractor		——		A22Z-3901	Rubber tool used to replace Lamps easily
Tightening Tool		——		A22Z-3905	Tool used to tighten nuts from the back of the panel
Lock Plate		---		A22Z-3380	Use to fix the lever on the Switch.

Specifications

Approved Standards

Recognized organization	Standards	File No.
UL (See note.)	UL508	E41515
AZCO	EN60947-5-1	C9805502

Note: UL-approved for CSA C22.2 No. 14 and bears the c mark.

Approved Standard Ratings

- UL, cUL (File No. E41515)
  6 A at 220 V, 10 A at 110 VAC
- EN60947-5-1 (Low Voltage Directive)
  Rated current: 10 A; Rated voltage: 220 VAC

Ratings

Contacts (Standard Load)

Rated carry current	Rated voltage	Rated current (A)			
		AC15 (inductive load)	AC12 (resistive load)	DC13 (inductive load)	DC12 (resistive load)
10	24 VAC	10	10	---	---
	110 VAC	5	10		
	220 VAC	3	6		
	380 VAC	2	3		
	440 VAC	1	2		
	24 VDC	---	---	1.5	10
	110 VDC			0.5	2
	220 VDC			0.2	0.6
	380 VDC			0.1	0.2

Note: 1. Rated current values are determined according to the testing conditions. The above ratings were obtained by conducting tests under the following conditions.
(1) Ambient temperature: 20×±2°C
(2) Ambient humidity: 65±5%
(3) Operating frequency: 20 operations/minute

2. Minimum applicable load: 10 mA at 5 VDC

Contacts (Microload)

Rated applicable load	Minimum applicable load
50 mA at 5 VDC (Resistive load)	1 mA at 5 VDC

LED Indicators without Voltage Reduction Unit

Rated voltage	Rated current	Operating voltage
6 VDC	60 mA	6 VDC±5%
6 VAC	60 mA	6 VAC/VDC±5%
12 VAC/VDC	30 mA	12 VAC/VDC±5%
24 VAC/VDC	15 mA	24 VAC/VDC±5%

Super-bright LED Indicator

Rated voltage	Rated current	Operating voltage
24 VAC/VDC	15 mA	24 VAC/VDC ±5%

Incandescent Lamp

Rated voltage	Rated current	Operating voltage
6 VAC/VDC	200 mA	5 VAC/VDC
14 VAC/VDC	80 mA	12 VAC/VDC
28 VAC/VDC	40 mA	24 VAC/VDC
130 VAC/VDC	20 mA	100 VAC/VDC

Voltage-reduction Lighting

Rated voltage	Operational voltage	Applicable lamp (BA9S/13□ gold)
110 VAC	95 to 115 VAC	LED Lamp (A22-24A□)
220 VAC	190 to 230 VAC	

Characteristics

Item		Emergency Stop Switches	
		Non-lighted model: A22E	Lighted model: A22EL
Allowable operating frequency	Mechanical	30 operations/minute max.	
	Electrical	30 operations/minute max.	
Insulation resistance		100 MΩ min. (at 500 VDC)	
Dielectric strength		2,500 VAC, 50/60 Hz for 1 min between terminals of same polarity 2,500 VAC, 50/60 Hz for 1 min between terminals of different polarity and also between each terminal and ground	
Vibration resistance		Malfunction (See note 2.): 10 to 55 Hz, 1.5-mm double amplitude	
Shock resistance	Mechanical	1,000 m/s^2	
	Malfunction (See note 2.)	250 m/s^2 max.	
Durability	Mechanical	Momentary operation: 300,000 operations min.	
	Electrical	300,000 operations min.	
Ambient temperature (See note 1.)		Operating: -20°C to 70°C Storage: -40°C to 70°C	Operating: -20°C to 55°C Storage: -40°C to 70°C
Ambient humidity		Operating: 35% to 85%	
Degree of protection		IP65 (oil-resistant)	IP65
Electric shock protection class		Class II	
PTI (tracking characteristic)		175	
Degree of contamination		3 (IEC947-5-1)	

Note: 1. With no icing or condensation.
2. Malfunction within 1 ms.

Operating Characteristics (for SPST-NO/SPST-NC)

Item	Emergency Stop Switches
	Push-lock turn-reset system
	A22E, A22EL
Total travel force (TTF) max.	44.1 N
Total travel (TT)	10±1 mm
Releasing force (RF) min.	0.25 N·m max. (See note.)

Note: Rotation torque for Emergency Stop Pushbutton.

Nomenclature

Pushbutton

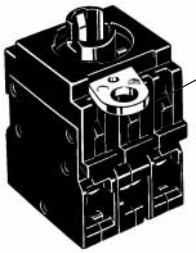
Push-lock Turn-reset System
Available Color: Red

Non-lighted
Lighted

Lamp

- **Light source**

LED Lamp
Incandescent Lamp



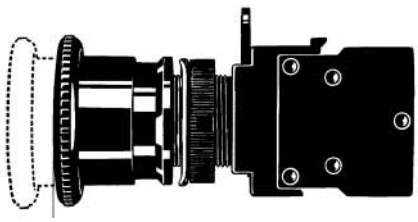
Switch

- **Contact Ratings**
  10 A at 110 VAC (resistive load)
  10 A at 24 VDC (resistive load)
- **Lighting Method**

Non-lighted
Lighted (without Voltage Reduction Unit)
Lighted (with Voltage Reduction Unit)

(The above figures are examples of the lighted model.)

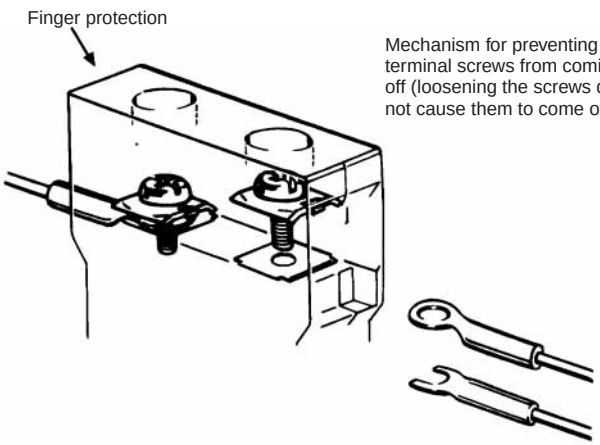
Safety Lock Mechanism to Prevent Misuse



Lock position

This Switch can be intentionally used to stop equipment in an emergency. Even if an object or person touches the Pushbutton by mistake, the contact will not be released unless the Pushbutton reaches the lock position.

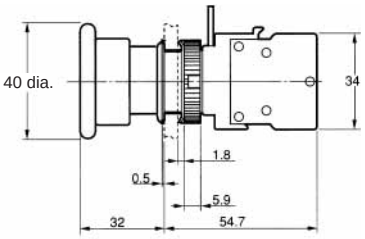
This Switch uses a finger protection mechanism to prevent electrical shocks. Moreover, it is provided with a mechanism to prevent terminal screws from coming off and also allows connection to either round or forked crimp terminals.



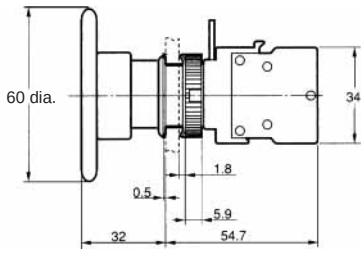
Dimensions

Note: All units are in millimeters unless otherwise indicated.

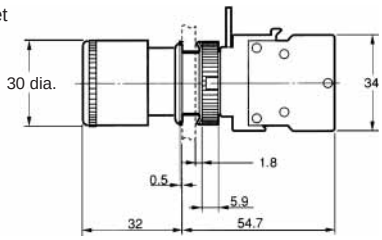
A22E-MP
Non-lighted models
40-dia. Push-pull



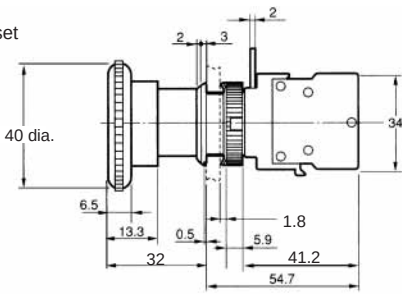
A22E-LP
Non-lighted models
60-dia. Push-pull



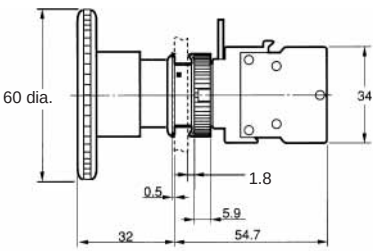
A22E-S
Non-lighted models
30-dia. Push-lock, Turn-reset



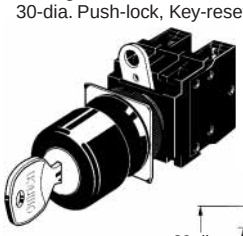
A22E-M
Non-lighted models
40-dia. Push-lock, Turn-reset

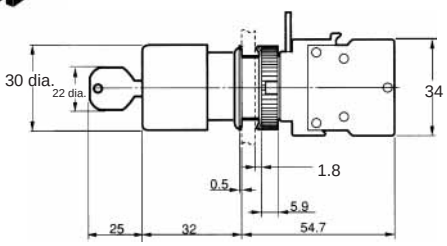


A22E-L
Non-lighted models
60-dia. Push-lock, Turn-reset

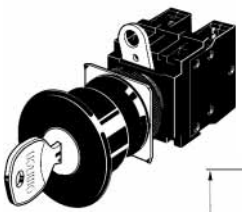


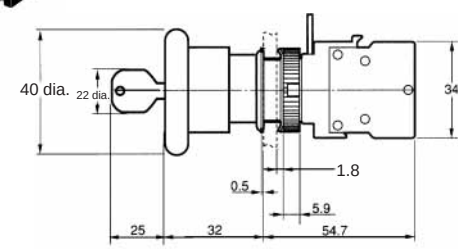
A22E-SK
Non-lighted models
30-dia. Push-lock, Key-reset





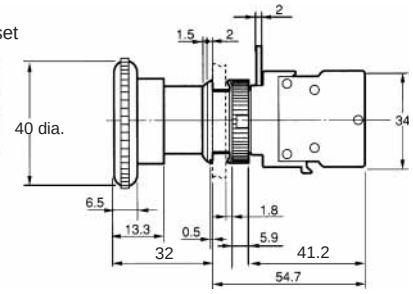
A22E-MK
Non-lighted models
40-dia. Push-lock, Key-reset





A22EL-M

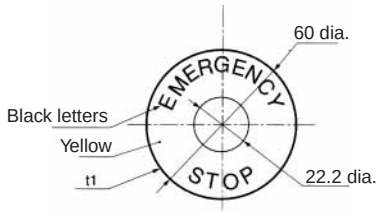
Lighted models
40-dia. Push-lock, Turn-reset



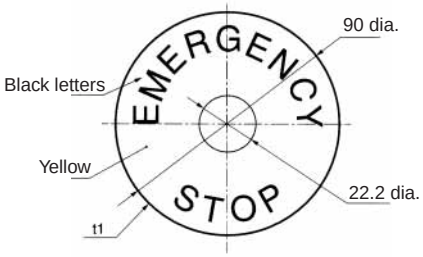
Dimensions for Accessories

Legend Plates For Emergency-stop

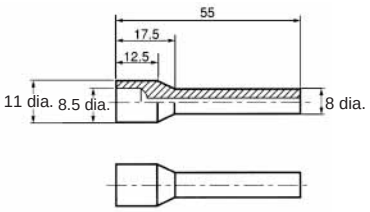
A22Z-3466-1



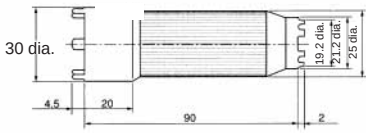
A22Z-3476-1



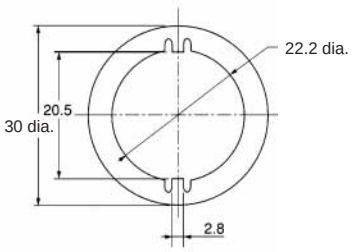
Lamp Extractor
A22Z-3901



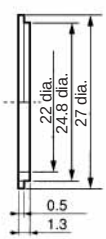
Tightening Wrench
A22Z-3905

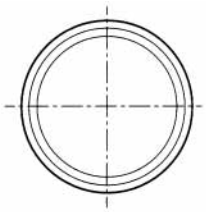


Lock Ring
A22Z-3360

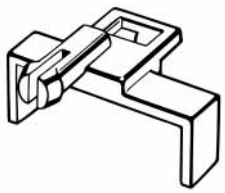


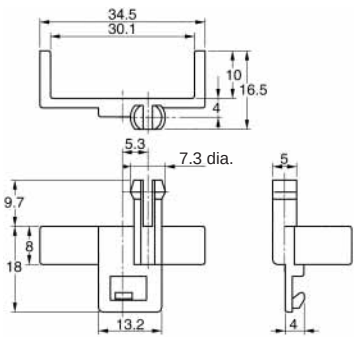
25-dia. Ring
A22Z-R25





Lock Plate
A22Z-3380

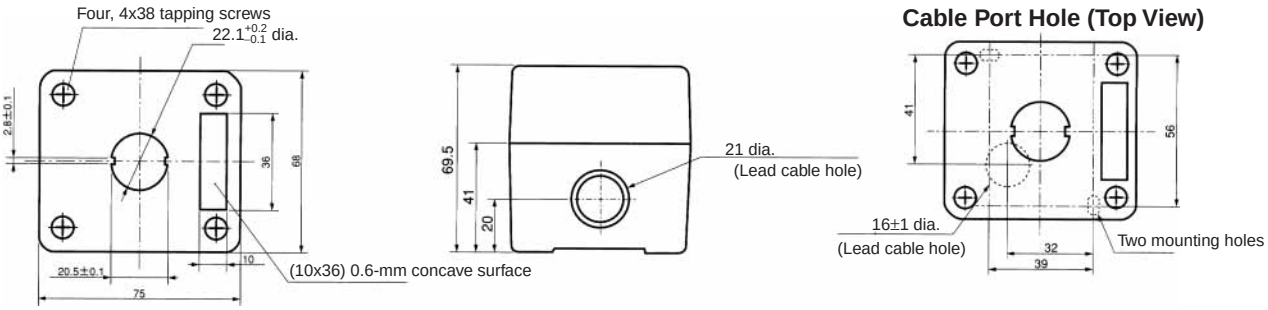




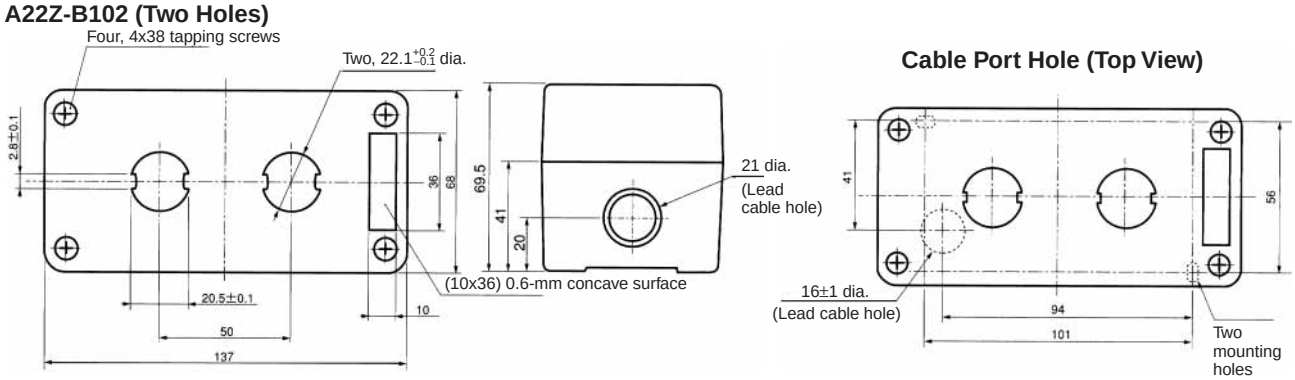
Control Box (Enclosure)

A22Z-B10□

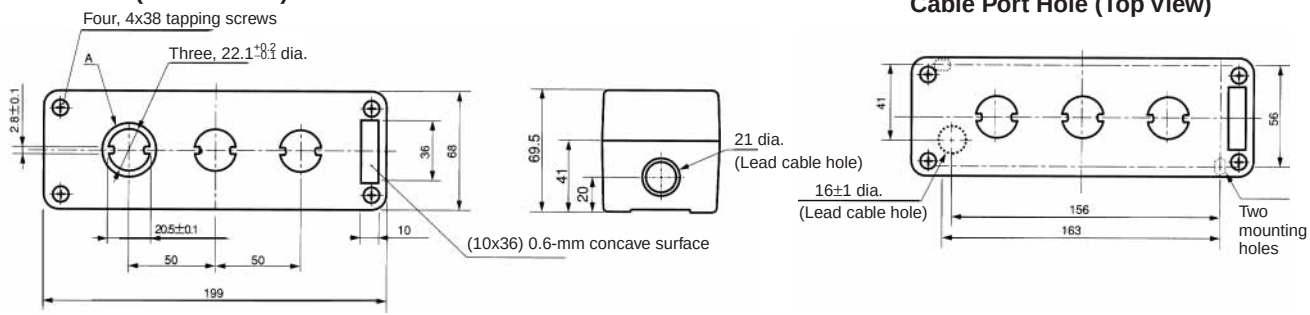
A22Z-B101 (One Hole)
A22Z-B101Y



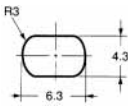
A22Z-B102 (Two Holes)



A22Z-B103 (Three Holes)

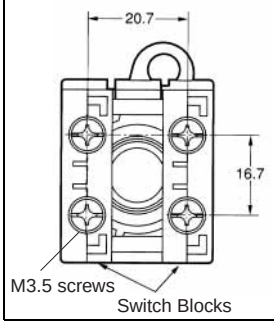
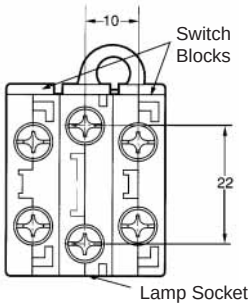


Panel Mounting Hole

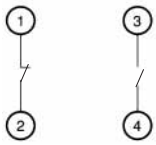
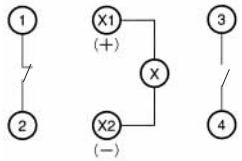
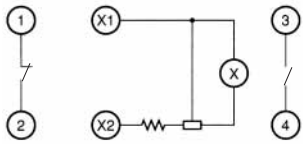


Terminal Arrangement

Terminal Arrangement (Bottom View)

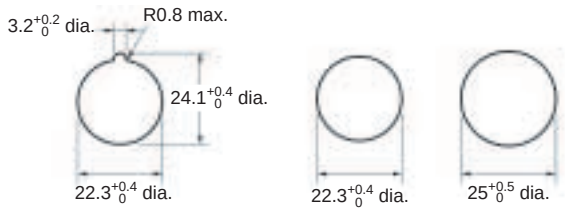
Non-lighted (SPST-NO + SPST-NC)	Lighted (SPST-NO + SPST-NC)
	

Terminal Connection

Type	Terminal connection
Non-lighted	
Lighted without Voltage Reduction Unit	
Lighted with Voltage Reduction Unit	

Note: The above terminal connection diagrams are examples for SPST-NO + SPST-NC.

Panel Cutouts



With Lock Fitting **Without Lock Fitting**

Note: 1. When applying coating such as paint to the panel, the dimensions should be those after the application of coating.

2. Recommended panel thickness: 1 to 5 mm.

3. Use an A22Z-R25 Ring when mounting to a panel with 25-mm holes.

Installation

Mounting to the Panel

Mounting the Operation Unit on the Panel

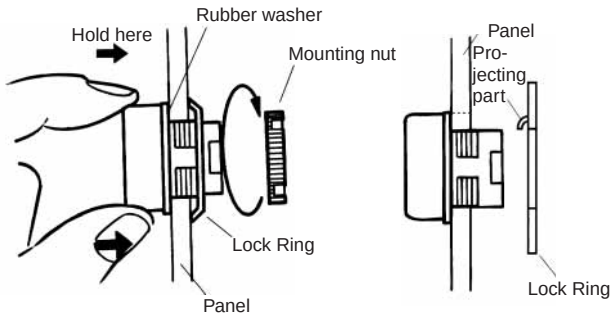
Insert the Operation Unit (Pushbutton, etc.) from the front surface of the panel, insert the Lock Ring and the mounting nut from the terminal side, then tighten the nut. Before tightening, check that the rubber washer is present between the Pushbutton Unit and the panel.

When using a Legend Plate Frame, put one rubber washer each between the Legend Plate Frame and the panel and between the Operation Unit and the Legend Plate Frame. (One rubber washer will be provided when one Legend Plate Frame is ordered.)

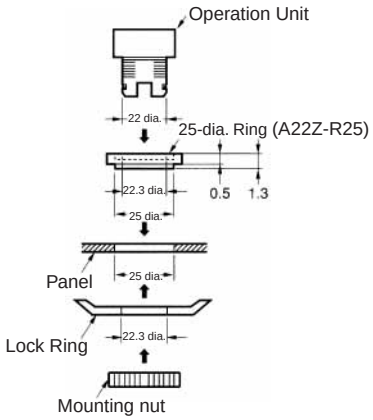
Align the Lock Ring with the groove in the casing, then insert the Lock Ring so that its edge is located on the panel side.

Tighten the mounting nut at a torque of 0.98 to 1.96 N·m.

When using a Lock Ring, replace with the supplied Lock Ring, insert the projecting part into the lock slot, and then tighten the mounting nut.

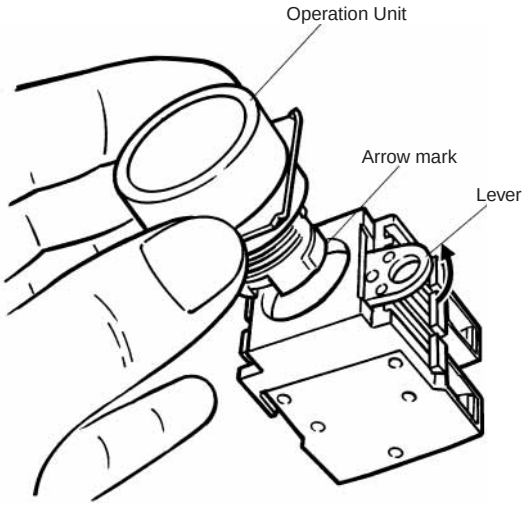


When the panel cutout dimension is 25 dia., remove the supplied rubber washer and mount the 25-dia. Ring as shown below. (Since the A22Z-R25 is not attached to the main body, order separately.)



Mounting the Switch on the Pushbutton Unit

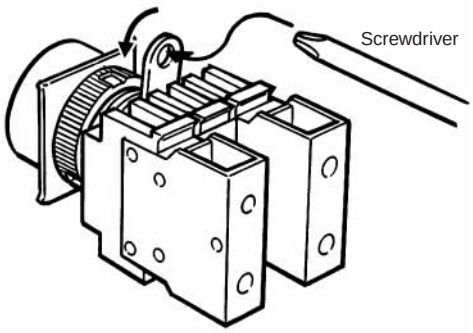
Insert the Pushbutton Unit into the Switch Unit, aligning the arrow mark inscribed on the Case with the lever on the Switch Blocks, then move the lever in the direction indicated by the arrow in the following figure.



Removing the Switch

Move the lever in the direction indicated by the arrow in the following figure, then pull the Pushbutton Unit or the Switch Blocks.

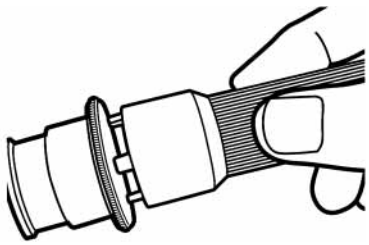
Since the lever has a hole with an inside diameter of 6.5 mm, the lever can be moved in the specified direction by inserting a screwdriver into the hole and then moving the screwdriver.



Assembling the Cap

Emergency Stop Switch

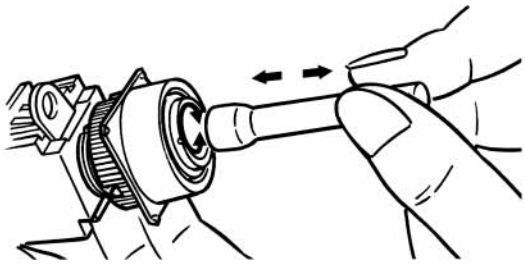
Insert the protrusion of the Tightening Wrench (A22Z-3905) into the Cap slot and then turn to remove the Cap.



Installing/Replacing the Lamp

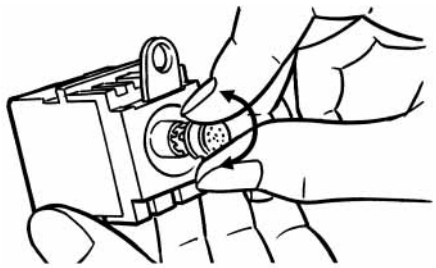
Installing/Replacing from the Panel Surface

Insert the Lamp Extractor (A22Z-3901) into the lamp, then rotate the Extractor while pressing it.



Installing/Replacing on the Switch

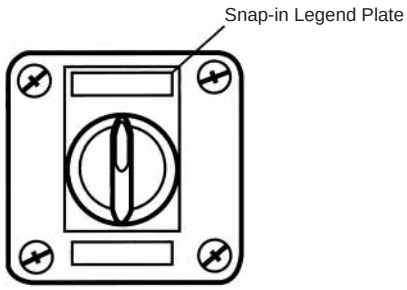
Grip the indicator with your fingers, then rotate the indicator while pressing it against the Switch.



Control Box (Enclosure)

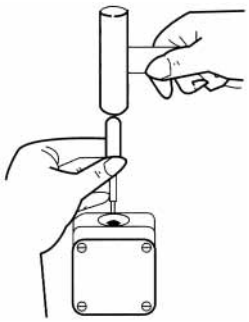
Mounting the Switch

The Standard-size Legend Plate Frame can be mounted. Mount the Frame as shown in the following diagram. Mount the Switch in the same way as for an ordinary panel.



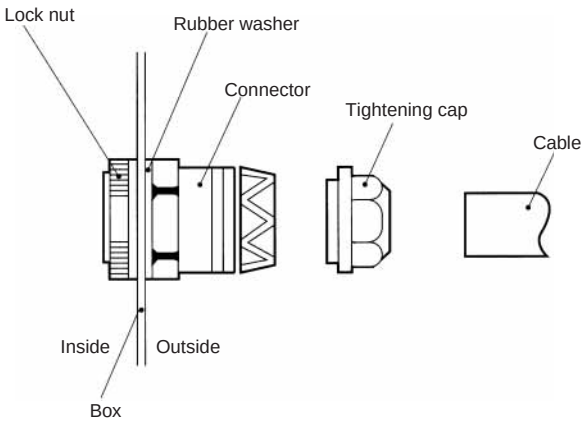
Creating a Cable Port Hole

Place the tip of a screwdriver on the surface where the cable port hole is to be created with the cover attached and strike the screwdriver to punch a hole. Attempts to punch a hole on the other side of the case will damage the Box.



Securing the Connector Cable

1. Insert the connector into the cable port hole in the Box and secure with the fixing nut inside the box.
2. Open a hole in the thin rubber section of the rubber ring.
3. Pass the tightening cap through the cable, insert the cable into the connector, and tighten the hexagonal nut to secure the cable.

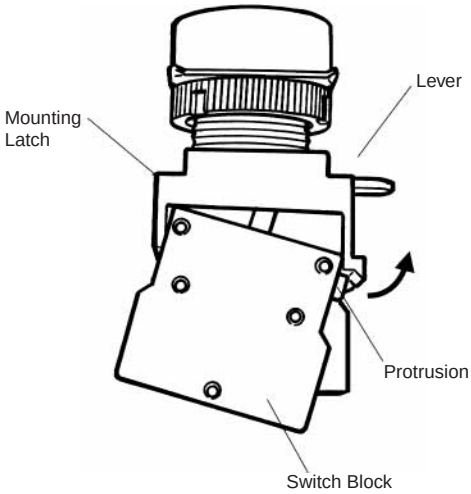


Cable diameter	Connector
7 to 9 dia.	A22Z-3500-1
9 to 11 dia.	A22Z-3500-2

Installing/Removing the Switch Blocks

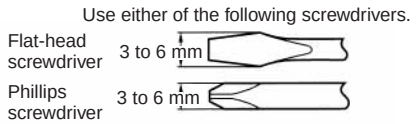
Installing the Switch Blocks

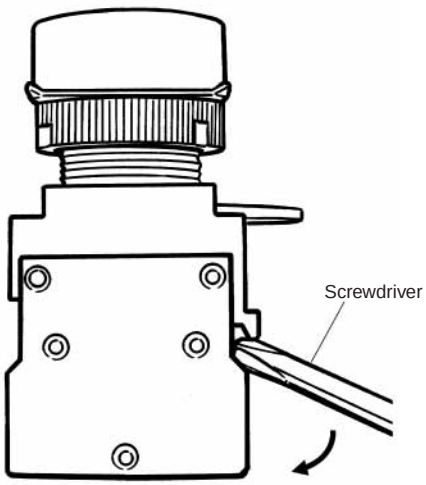
Hook the small protrusion on the Mounting Latch into the groove on the other side of the lever, then push up the Switch Block in the direction indicated by the arrow in the figure below.



Removing the Switch Blocks

Insert a screwdriver between the Mounting Latch and the Switch Block, then push down the screwdriver in the direction indicated by the arrow in the following figure.

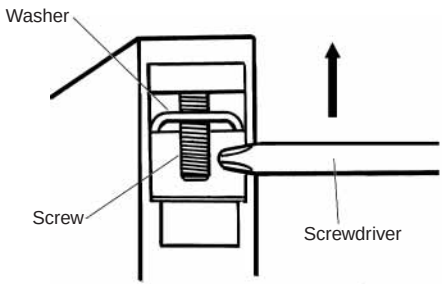




Wiring

Wiring Round Crimp Terminals

Loosen the terminal screw from the Switch Unit until it completely comes off the groove, insert a screwdriver as shown in the following figure, then push up the washer in the direction indicated by the arrow to temporarily secure it. Now, a round crimp terminal can be connected. After inserting the terminal, tighten the screws to complete wiring.



MEMO

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 250 VAC 30 VDC	5 A (General use) 3 A (General use) 3 A (Resistive)	1 A (General use) 0.5 A (General use) 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)

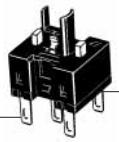
Nomenclature

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)

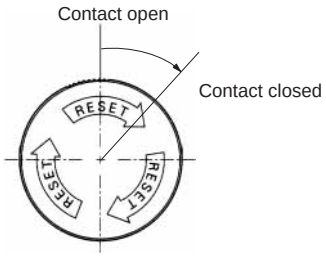
Lamp
- LED lamp



Switch Specifications
- **Standard Loads**
  5 A at 125 VAC
  3 A at 250 VAC
  3 A at 30 VDC

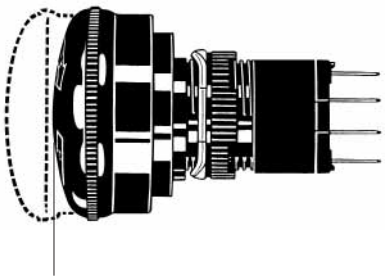
Note: A165E Emergency Stop Switch must be ordered as a set.
No LED is installed for the non-lighted model.

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.

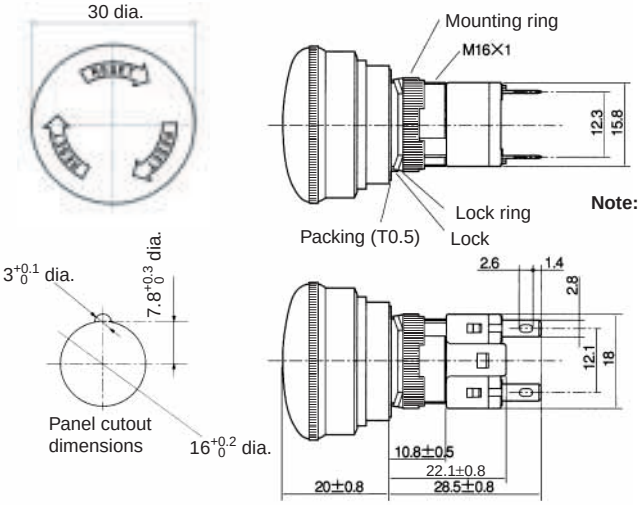


Dimensions

Note: All units are in millimeters unless otherwise indicated.

A165E

Non-lighted models
30 mm diameter

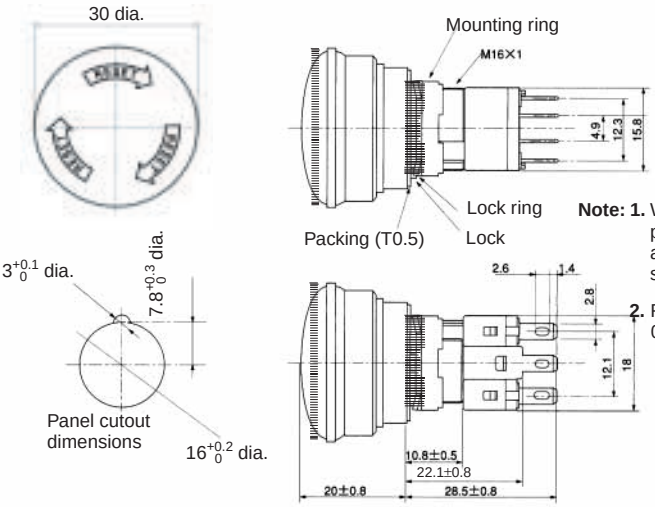


Note: 1. When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.

2. Recommended panel thickness: 0.5 to 3.2 mm.

A165E

Lighted models
30 mm diameter

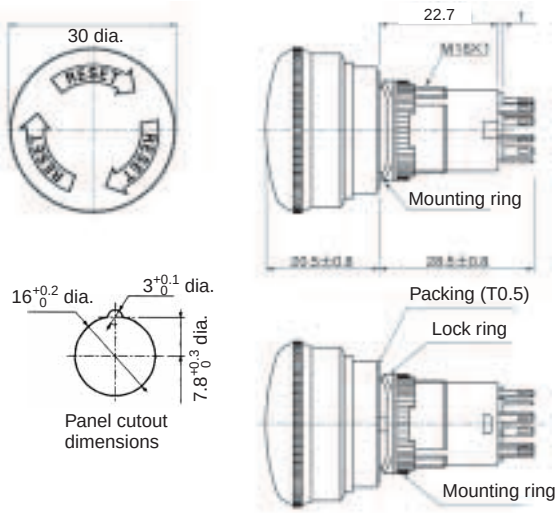


Note: 1. When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.

2. Recommended panel thickness: 0.5 to 3.2 mm.

A165E□U

One-body models
30 mm diameter

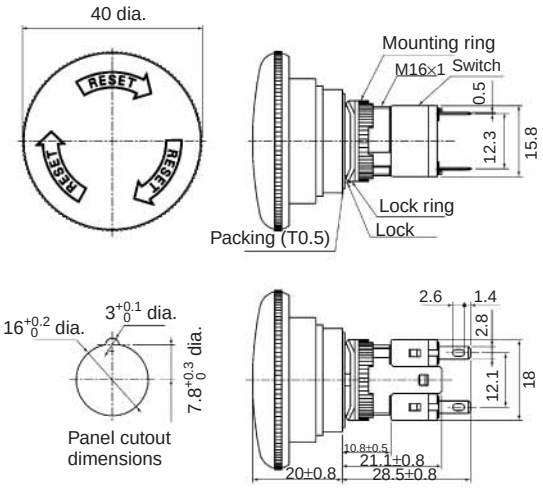


Note: 1. When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.

2. Recommended panel thickness: 0.5 to 3.2 mm.

A165E

Non-lighted models
40 mm diameter

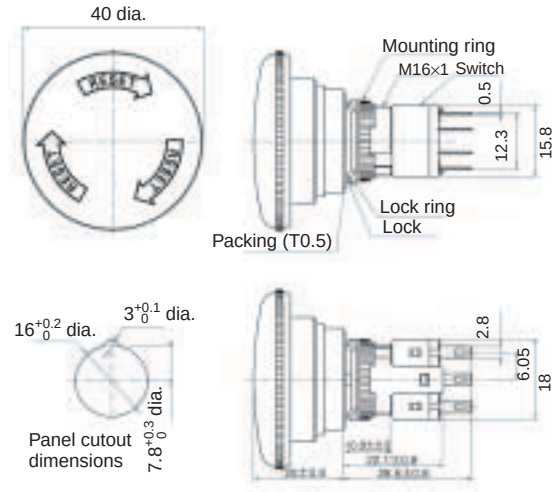


Note: 1. When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.

2. Recommended panel thickness: 0.5 to 3.2 mm.

A165E

Lighted models
40 mm diameter

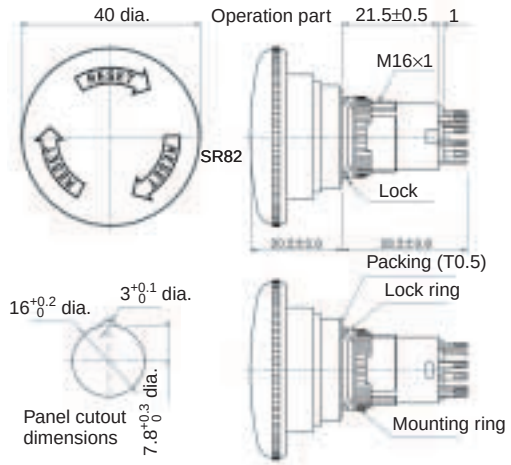


Note: 1. When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.

2. Recommended panel thickness: 0.5 to 3.2 mm.

A165E□U

Non-lighted,
one-body models
40 mm diameter



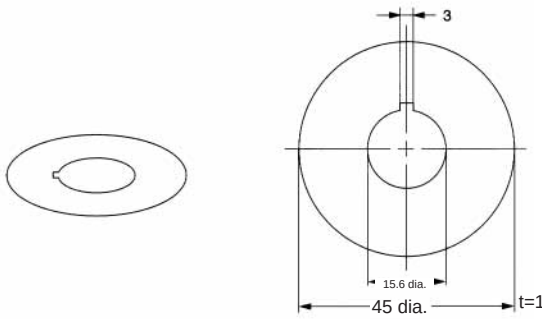
Note: 1. When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.

2. Recommended panel thickness: 0.5 to 3.2 mm.

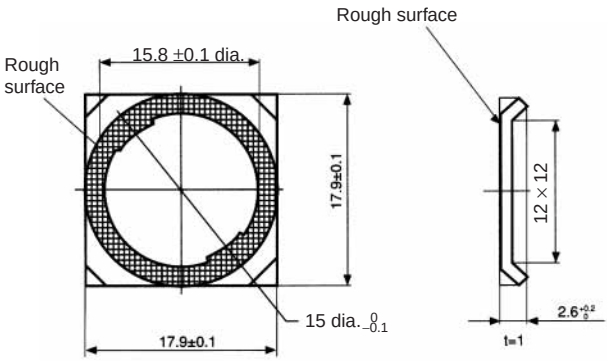
Accessories

Yellow Plate (Vinyl Chloride)

A16Z-5070

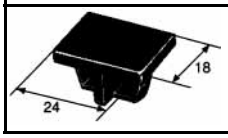
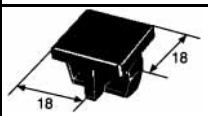
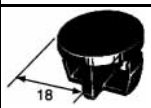


Lock Ring



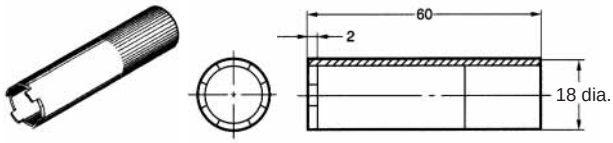
Panel Plugs

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
		

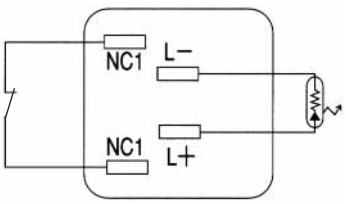
Screw Fitting

A16Z-3004

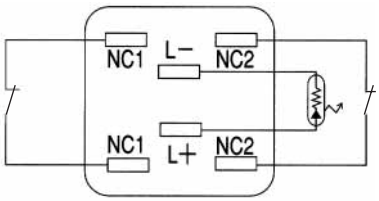


Terminal Arrangement

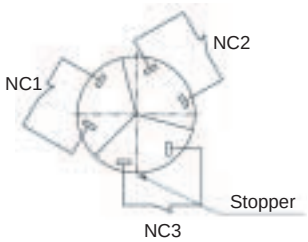
SPST Switches



DPST Switches



TPST Switches



Note: The L+ and L− terminals are not available with the non-lighted models.

MEMO

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

Characteristics

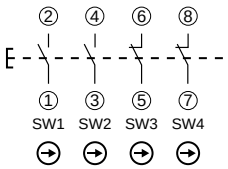
Insulation resistance	100 MΩ min. (at 500 VDC)
Contact resistance	100 mΩ max. (initial value)
Vibration resistance	10 to 55 Hz, 0.75-mm single amplitude min.
Shock resistance	150 m/s^2
Mechanical durability	OFF-ON: 1,000,000 operations min. OFF-ON-OFF (direct opening): 100,000 operations min.
Electrical durability	100,000 operations min.
Degree of protection	IP65 (rubber seal type only)

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.

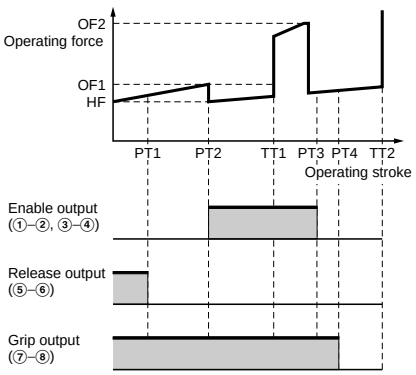
Contact form



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.

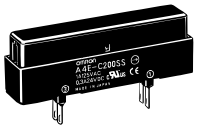
Note: HF indicates “holding force”.

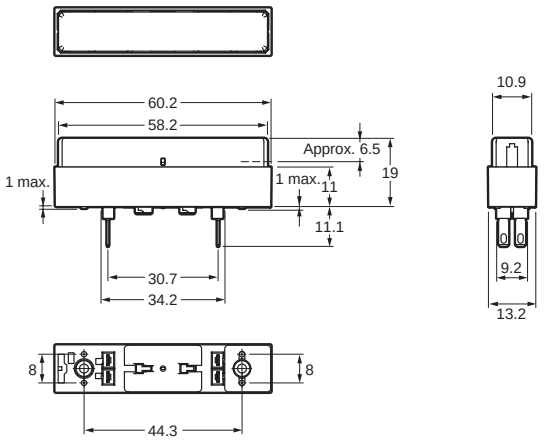
Dimensions

Note: All units are in millimeters unless otherwise indicated.

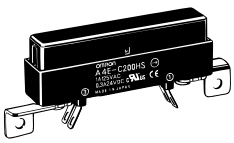
2-contact type

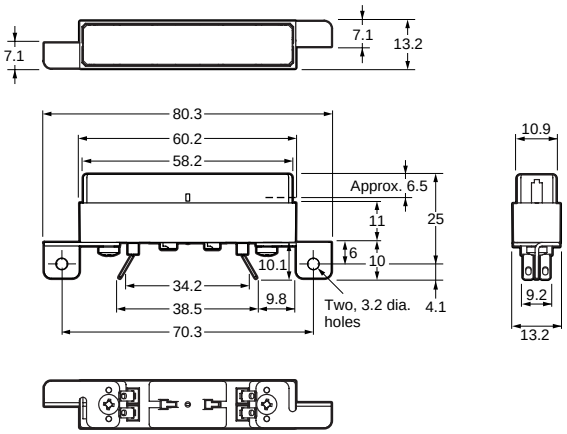
No mounting bracket
A4E-B200SS





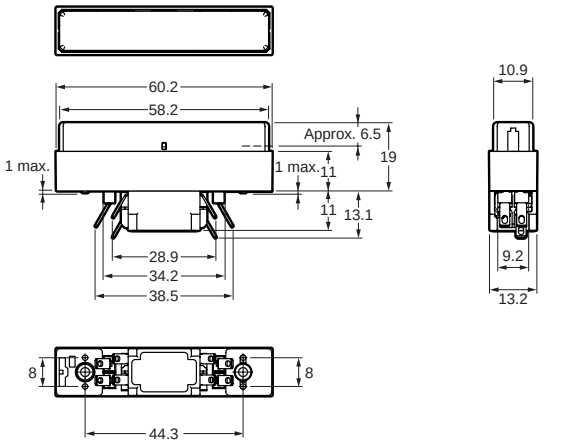
Horizontal mounting
A4E-B200HS



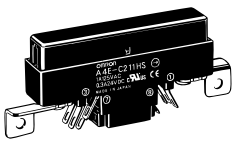


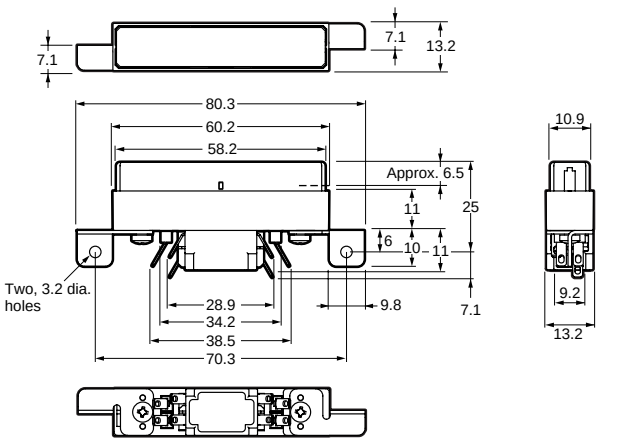
4-contact type

No mounting bracket
A4E-C211SS

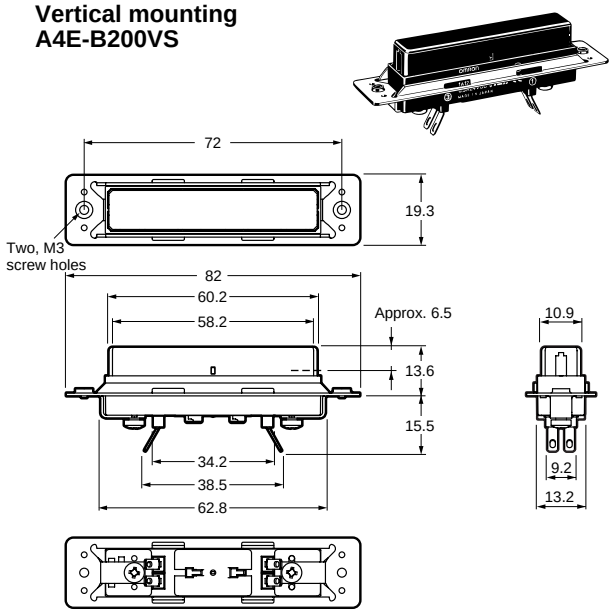


Horizontal mounting
A4E-C211HS

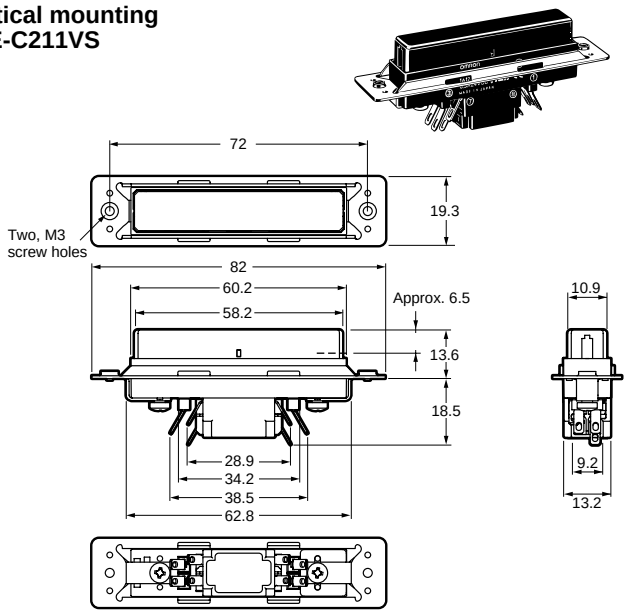




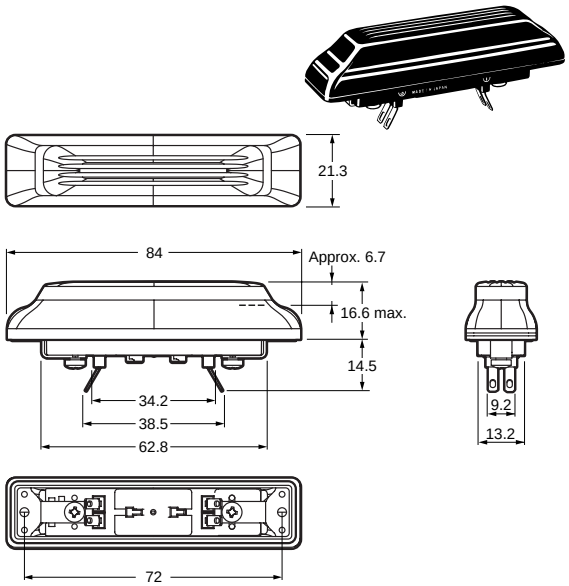
Vertical mounting
A4E-B200VS



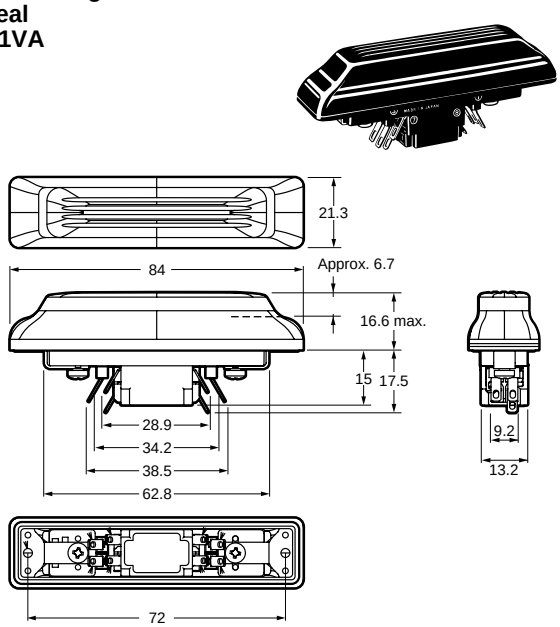
Vertical mounting
A4E-C211VS



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

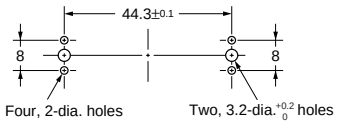
Configure the system so that the machine operates only when the Switch is in the enable position.

Correct Use

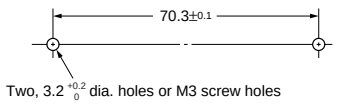
Mounting

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.

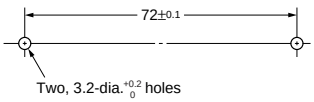
No-mounting-bracket type



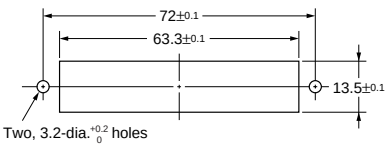
Horizontal mounting type



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.

MEMO

Common Precautions for safety switch

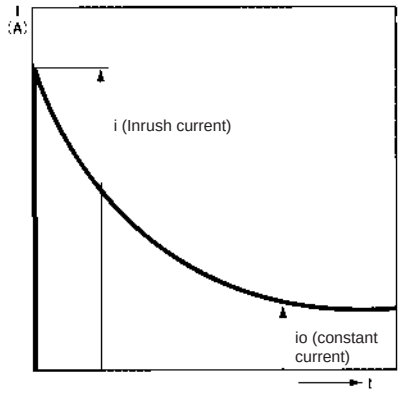
For the individual precautions for each Switch, refer to the precautions for the Switch.

Cautions

- Do not touch the charged switch terminals while the Limit Switch has carry current, otherwise an electric shock may be received.
- Do not assemble the Limit Switch or touch the interior of the Limit Switch while power is connected to the Limit Switch, otherwise an electric shock may be received.

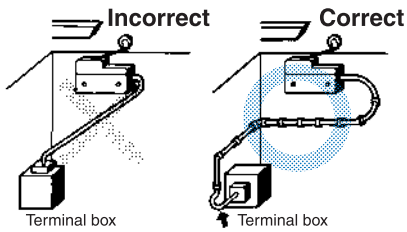
Correct Use

- If the Limit Switch incorporates a ground terminal, be sure to ground it through an appropriate wire, otherwise an electric shock may be received.
- Be sure to connect a fuse with a breaking current 1.5 to 2 times the rated current to the Limit Switch in parallel in order to protect the Limit Switch from damage due to short–circuiting.
- Maintain an appropriate insulation distance between wires connected to the Limit Switch.
- If the Limit Switch has no ground terminal, ground the mounting panel to which the Limit Switch is mounted unless the Limit Switch is of double insulation construction falling under class II. Such models (e.g., the D4D–N, D4D–R or D4DS) ensure good insulation characteristics. Therefore, no ground terminals are incorporated.
- Do not use the Limit Switch in places with flammable or explosive gas without taking any countermeasures taken against explosion or fires. Otherwise switching arcs or heat radiation may cause a fire or explosion.
  Be sure to protect the Limit Switch with appropriate explosion–proof barriers or use a Limit Switch of explosion–proof construction. The Explosion–proof Limit Switch is not available for use in all types of gas or locations. Refer to the *Explosion–proof Device General Catalog* for details.
- The life of the Limit Switch greatly varies with switching conditions. Before using the Limit Switch, be sure to test the Limit Switch under actual conditions. Make sure that the number of switching operations is within the permissible range.
  If a deteriorated Switch is used continuously, insulation failures, contact weld, contact failures, switch damage, or switch burnout may result.
- Some types of load have a great difference between normal current and inrush current. Make sure that the inrush current is within the permissible value. The greater the inrush current in the closed circuit is, the greater the contact abrasion or shift will be. Consequently, contact weld, contact separation failures, or insulation failures may result. Furthermore, the Limit Switch may become broken or damaged.



Wiring

- If the wiring method is incorrect, the wires may get caught by some object or the lead wires may be pulled excessively. Make sure that the lead wires are connected without extraordinary force and that the wires are supported securely.



- Pay the utmost attention so that each terminal is wired correctly. If the terminal is wired incorrectly, the Limit Switch will not function. Furthermore, not only will the Limit Switch have a bad influence on the external circuit, the Limit Switch itself may become damaged or burnt.

Mounting

- Do not modify the actuator, otherwise the operating characteristics and performance of the actuator will change.
- Do not enlarge the mounting holes of the Limit Switch or modify the Limit Switch, otherwise insulation failures or housing damage may result. If the Limit Switch has a force separation mechanism, a modification of the Limit Switch may cause injury.
- Do not apply oil, grease, or other lubricants to the moving parts of the actuator, otherwise the actuator may not operate correctly. Furthermore, intrusion of oil, grease, or other lubricants inside the Limit Switch may cause failures in the Limit Switch.
- Mount the Limit Switch and secure it with the specified screws tightened to the specified torque along with flat washers and springs. The actuator of the Limit Switch

mounted to a panel with excessive tightening torque may not operate correctly if the Limit Switch is a pushbutton model.

- Be sure to wire the Limit Switch so that the conduit opening is free of metal powder or any other impurities.
- If glue or bonding agent is applied, make sure that it does not adhere to the movable parts or intrude inside the Limit Switch, otherwise the Limit Switch may not work correctly or cause contact failure. Some types of glue or bonding agent may generate a gas that may have a bad influence on the Limit Switch. Pay the utmost attention when selecting the glue or locking agent.
- Do not drop or disassemble the Limit Switch, otherwise the Limit Switch will not be capable of full performance. Furthermore, the Limit Switch may become broken or burnt.
- If the contacts are not turned ON or OFF over a long time, the contacts may become oxidized. Consequently, the reliability of the contacts may decrease, which may result in accidents.
- Actuation of the Limit Switch over a long time may deteriorate parts of the Limit Switch and a releasing failure may result. Be sure to check the condition of the Limit Switch regularly.
- Some models allow changes in head directions. When changing the head of such a model, make sure that the head is free of any foreign substance. Tighten each screw of the head to the rated torque.
- Be sure to take measures so that no foreign material, oil, or water will penetrate into the Limit Switch through the conduit opening. Be sure to attach a connector suited to the cable thickness and tighten the connector securely to the rated torque.
- Apply Limit Switch models incorporating a force–separation function, such as the D4BS or D4BL, for safety doors or emergency stop circuits.
- Do not impose shock or vibration on the actuator while it is fully pressed. Otherwise, the actuator will partially abrade and an actuation failure may result.

Limit Switch Operation

- The Limit Switch in actual operation may cause accidents that cannot be foreseen from the design stage. Therefore, the Limit Switch must be practically tested before actual use.
- When testing the Limit Switch, be sure to apply the actual load condition together with the actual operating environment.
- All the performance ratings in this catalog are provided under the following conditions unless otherwise specified.

  Inductive load: A minimum power factor of 0.4 (AC) or a maximum time constant of 7 ms (DC)

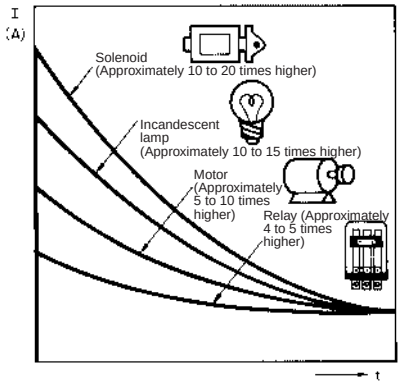
  Lamp load: An inrush current 10 times higher than the normal current

  Motor load: An inrush current 8 times higher than the normal current

  The rated values are obtained from tests conducted in accordance with JIS C4508.

  1. Ambient temperature: +5°C to 35°C
  2. Ambient humidity: 40% to 70%.

Note: An inductive load causes a problem especially in DC circuitry. Therefore, it is essential to know the time constants (L/R) of the load.

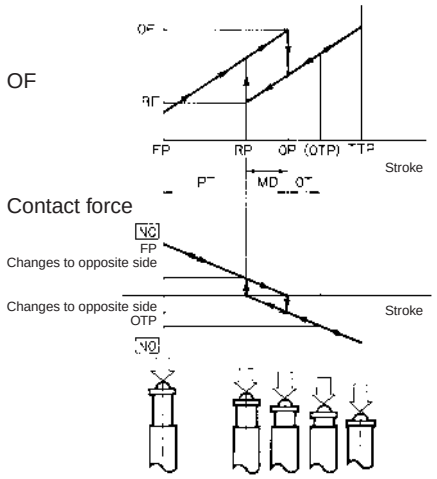


Mechanical Characteristics

Operating Force, Stroke, and Contact Characteristics

- The following graph indicates the relationship between operating force and stroke or stroke and contact force. In order to operate the Limit Switch with high reliability, it is necessary to use the Limit Switch within an appropriate contact force range. If the Limit Switch is used in the normally closed condition, the dog must be installed so that the actuator will return to the FP when the actuator is actuated by the object. If the Limit Switch is used in the normally open condition, the actuator must be pressed to 70% to 100% of the OT (i.e., 60% to 80% of the TT) and any slight fluctuation must be absorbed by the actuator.
- If the full stroke is set close to the OP or RP, contact instability may result. If the full stroke is set to the TTP, the actuator or switch may become damaged due to the inertia of the dog. In that case, adjust the stroke with the mounting panel or the dog. Refer to page D-331, *Dog Design*, page D-332, *Stroke Settings vs. Dog Movement Distance*, and page D-333, *Dog Surface* for details.
- The following graph shows an example of changes in contact force according to the stroke. The contact force near the OP or RP is unstable, and the Limit Switch cannot main-

tain high reliability. Furthermore, the Limit Switch cannot withstand strong vibration or shock.



Mechanical Conditions

- The actuator must be selected according to the operating method.
- Check the operating speed and switching frequency.
  1. If the operating speed is extremely low, the switching of the movable contact will become unstable, thus resulting in incorrect contact or contact weld.
     If the operating speed is extremely low or the pushbutton needs to be set between the FP and OP, consult your OMRON representative in advance.
  2. If the operating speed is extremely high, the Limit Switch may break due to shock. If the switching frequency is high, the switching of the contacts cannot catch up with the switching frequency. Make sure that the switching frequency is within the rated switching frequency. If a higher switching frequency is required, use of a proximity sensor is recommended.
- Do not impose excessive force on the actuator, otherwise the actuator may become damaged or not operate correctly.
- Make sure that the stroke is set within the suitable range specified for the model, or otherwise the Limit Switch may break.
- Make sure that the operating direction of the actuator is parallel to the axis of the actuator if the actuator is a pushbutton type. If they are not in parallel, partial abrasion may result and the actuator may soon become damaged. Refer to page D-330, *Operation* for details.

Electrical Characteristics

Electrical Conditions

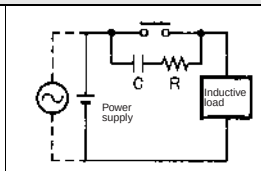
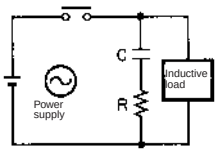
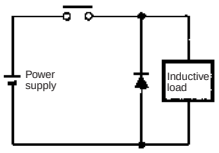
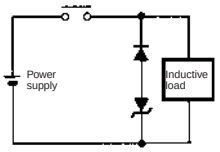
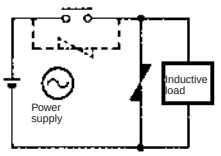
- The switching load capacity of the Limit Switch greatly varies between AC and DC. Always be sure to apply the rated load. The control capacity will drastically drop if it is a DC load. This is because a DC load has no current zero–cross point, unlike an AC load. Therefore, if an arc is generated, it may continue comparatively for a long time. Furthermore, the current direction is always the same, which results in a contact relocation phenomena whereby the contacts easily stick to each other and do not separate when the surfaces of the contacts are uneven.
- If the load is inductive, counter–electromotive voltage will be generated. The higher the voltage is, the higher the generated energy will be, which will increase the abrasion of the contacts and contact relocation phenomena. Be sure to use the Limit Switch within the rated conditions.
- If the load is a minute voltage or current load, use a dedicated Limit Switch for minute loads. The reliability of silver–plated contacts, which are used by standard Limit Switches, will be insufficient if the load is a minute voltage or current load.

Contact Protective Circuit

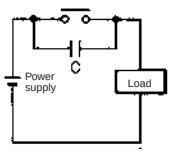
Apply a contact protective circuit to extend the contact life, prevent noise, and suppress the generation of carbide or nitric acid. Be sure to apply the contact protective circuit correctly, otherwise an adverse effect may occur.

The following provides typical examples of contact protective circuits. If the Limit Switch is used in an excessively humid location for switching a load that easily generates arcs, such as an inductive load, the arcs may generate NOx, which will change into HNO_3 if it reacts with moisture. Consequently, the internal metal parts may corrode and the the Limit Switch may fail. Be sure to select the ideal contact preventive circuit from the following.

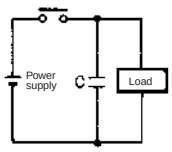
Typical Examples of Contact Protective Circuits

Circuit example		Applicable current		Feature	Element selection
		AC	DC		
CR circuit		*	Yes	*When AC is switched, the load impedance must be lower than the CR impedance.	C: 1 to 0.5 ∝F x switching current (A) R: 0.5 to 1 Ω x switching voltage (V) The values may change according to the characteristics of the load. The capacitor suppresses the spark discharge of current when the contacts are open. The resistor limits the inrush current when the contacts are closed again. Consider the roles of the capacitor and resistor and determine ideal capacitance and resistance values through testing. Use a capacitor that has a low dielectric strength. When AC is switched, make sure that the capacitor has no polarity.
		Yes	Yes	The operating time will be greater if the load is a relay or solenoid. Connecting the CR circuit in parallel to the load is effective when the power supply voltage is 24 or 48 V and in parallel to the contacts when the power supply voltage is 100 to 200 V.	
Diode method		No	Yes	Energy stored in the coil is changed into current by the diode connected in parallel to the load. Then the current flowing to the coil is consumed and Joule heat is generated by the resistance of the inductive load. The reset time delay with this method is longer than that in the CR method.	The diode must withstand a peak inverse voltage 10 times higher than the circuit voltage and a forward current as high or higher than the load current.
Diode and Zener diode method		No	Yes	This method will be effective if the reset time delay caused by the diode method is too long.	Use a Zener diode at a low Zener voltage.
Varistor method		Yes	Yes	This method makes use of constant–voltage characteristic of the varistor so that no high–voltage is imposed on the contacts. This method causes a reset time delay. Connecting a varistor in parallel to the load is effective when the supply voltage is 24 to 48 V and in parallel to the contacts when the supply voltage is 100 to 200 V.	——

Do not apply contact protective circuits as shown below.



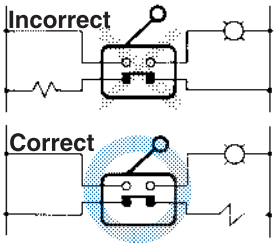
This circuit effectively suppresses arcs when the contacts are OFF. The capacitor will be changed, however, when the contacts are OFF. Consequently, when the contacts are ON again, short-circuited current from the capacitance may cause contact weld.



This circuit effectively suppresses arcs when the contacts are OFF. When the contacts are ON again, however, charge current will flow to the capacitor, which may result in contact weld.

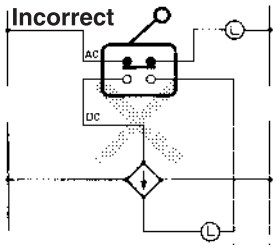
Switching a DC inductive load is usually more difficult than switching a resistive load. By using an appropriate contact protective circuit, however, switching a DC inductive load will be as easy as switching a resistive load.

- Do not contact a single Limit Switch to two power supplies that are different in polarity or type.
  Power Connection Examples
  (Connection of Different Polarities)

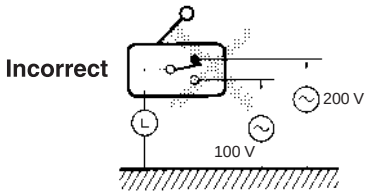


Incorrect Power Connection Example

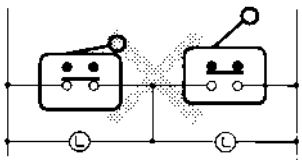
(Connection of Different Power Supplies)
There is a risk of AC and DC mixing.



- Do not design a circuit where voltage is imposed between contacts, otherwise contact weld may result.



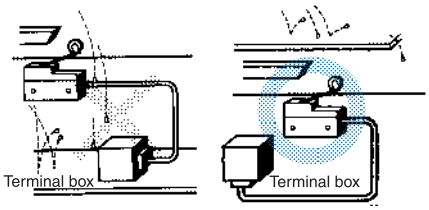
- Do not use a circuit that will short–circuit if an error occurs, otherwise the charged part may melt and break off.



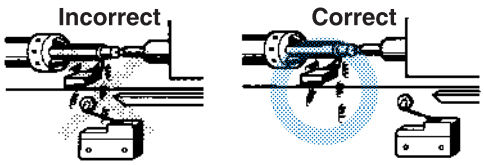
- Application of Limit Switch to a Low–voltage, Low–current Electronic Circuit.
  1. If bouncing or chattering of the contacts results and causes problems, take the following countermeasures.
     (a) Insert an integral circuit.
     (b) Suppress the generation of pulse from the contact bouncing or chattering of the contacts so that it is less than the noise margin of the load.
  3. Conventional silver–plated contacts are not suited to this application. Use gold–plated contacts, which are ideal for handling minute voltage or current loads.
  4. The contacts of the Limit Switch used for an emergency stop must be normally open.
- In order to protect the Limit Switch from damage due to circuit short–circuiting, be sure to connect a quick–response fuse with a breaking current 1.5 to 2 times larger than the rated current to the Limit Switch in parallel. Some models (e.g., the D4B–N and D4BS) specify the types of fuses. In that case, be sure to use the specified fuses.

Operating Environment

- If the Limit Switch used in locations with oil or water spray or excessive dust is not a water–resistive model or of sealed construction, be sure to protect the Limit Switch with a protective cover so that the Limit Switch will not be directly exposed to them.

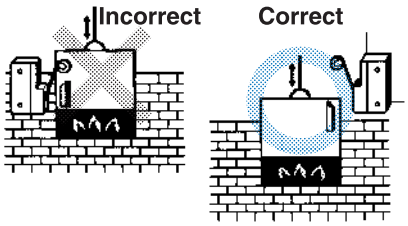


- The materials of Limit Switch may change in quality or deteriorate, if the Limit Switch is used outdoors or any other location where the Limit Switch is exposed to special machining oil. Consult your OMRON representative before selecting the model.
- Be sure to install the Limit Switch so that the Limit Switch is free from dust or metal powder. The actuator and the switch casing must be protected from the accumulation of dust or metal powder.

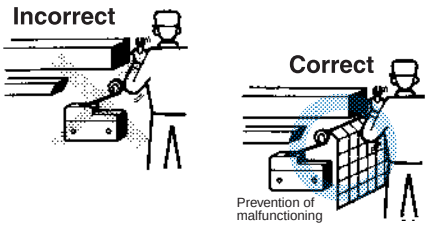


- Do not use the Limit Switch in locations where the Limit Switch is exposed to hot water at a temperature greater than 60°C or steam.
- Do not use the Limit Switch under temperatures or other environmental conditions not within the specified ranges. The rated permissible ambient temperature range varies with the model. Refer to the specifications in this catalog. If the Limit Switch is exposed to radical temperature chang-

es, the thermal shock may deform the Limit Switch and the Limit Switch may malfunction.



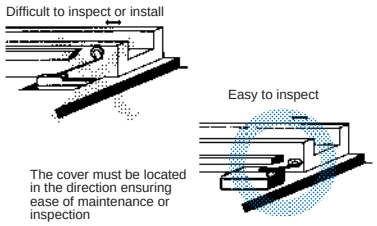
- Be sure to protect the Limit Switch with a cover if the Limit Switch is in a location where the Limit Switch may be actuated by mistake or where the Limit Switch is likely cause an accident.



- Make sure to install the Limit Switch in locations free of vibration, shock, or resonance. If vibration or shock is continuously imposed on the Limit Switch, contact failure, malfunction, or decrease in service life may be caused by abrasive powder generated from the internal parts. If excessive vibration or shock is imposed on the Limit Switch, the contacts may malfunction or become damaged.
- Do not use the Limit Switch with silver–plated contacts for long periods if the switching frequency of the Limit Switch is comparatively low or the load is minute. Otherwise, sulfuric film will be generated on the contacts and contact failures may result. Use the Limit Switch with gold–plated contacts or use a dedicated Limit Switch for minute loads instead.
- Do not use the Limit Switch in locations with corrosive gas, such as sulfuric gas (H_2S or SO_2), ammonium gas (NH_3), nitric gas (HNO_3), or chlorine gas (Cl_2), or high temperature and humidity. Otherwise, contact failure or corrosion damage may result.
- If the Limit Switch is used in locations with silicone gas, arc energy may create silicon dioxide (SiO2) on the contacts and a contact failure may result. If there is silicone oil, silicone sealant, or wire covered with silicone close to the Limit Switch, attach a contact protective circuit to suppress the arcing of the Limit Switch or eliminate the source of silicone gas generation.

Regular Inspection and Replacement

- If the Limit Switch is normally closed with low switching frequency (e.g., once or less than once a day), a reset failure may result due to the deterioration of the parts of the Limit Switch. Regularly inspect the Limit Switch and make sure that the Limit Switch is in good working order.
- In addition to the mechanical life or electrical life of the Limit Switch described previously, the life of the Limit Switch may decrease due to the deterioration of each part, especially rubber, resin, and metal. Regularly inspect the Limit Switch and replace any part that has deteriorated in order to prevent accidents from occurring.
- Be sure to mount the Limit Switch securely in a clean location to ensure ease of inspection and replacement. The Limit Switch with operation indicator is available, which is ideal if the location is dark or does not allow easy inspection or replacement.



Storage of Limit Switch

- When storing the Limit Switch, make sure that the location is free of corrosive gas, such as H_2S, SO_2, NH_3, HNO_3, or Cl_2, or dust and does not have a high temperature or humidity.
- Be sure to inspect the Limit Switch before use if it has been stored for three months or more.

Typical Problems, Probable Causes, and Remedies

Problem		Probable Cause	Remedy
Mechanical failure	1. The actuator does not operate. 2. The actuator does not return to the free position (FP). 3. The actuator has been deformed. 4. The actuator is worn. 5. The actuator has been damaged.	The shape of the cam is incorrect.	• Change the design of the cam and smooth the contacting surface of the cam. • Scrutinize the suitability of the actuator. Make sure that the actuator does not bounce.
		The contacting surface of the dog is rough.	
		The actuator in use is not suitable.	
		The operating direction of the actuator is not correct.	
		The operation speed is excessively high.	• Attach a decelerating device or change the mounting position of the Limit Switch.
		Excessive stroke.	• Change the stroke.
		The rubber or grease hardened due to low temperature.	• Use a cold–resistive switch.
		The accumulation of sludge, dust, or cuttings.	• Use a drip–proof model or one with high degree of protection. • Use a protection cover and change the solvent and materials.
		Dissolution, expansion, or swelling damage to the rubber parts of the driving mechanism.	
	There is a large deviation in operating position (with malfunctioning involved).	Damage to and wear and tear of the internal movable spring.	• Regularly inspect the Limit Switch. • Use a better quality switch. • Tighten the mounting screws securely. Use a mounting board.
		Wear and tear of the internal mechanism.	
		The loosening of the mounting screws.	
	The terminal part wobbles. (The mold part has been deformed.)	Overheating due to a long soldering time.	• Solder the Limit Switch quickly. • Change the lead wire according to the carry current and ratings.
		The Limit Switch has been connected to and pulled by thick lead wires with excessive force.	
		High temperature or thermal shock resulted.	• Use a temperature–resistive switch or change mounting positions.

Problem		Probable Cause	Remedy
Failures related to chemical or physical characteristics	Contact chattering	Vibration or shock is beyond the rated value.	• Attach an anti–vibration mechanism. • Attach a rubber circuit to the solenoid. • Increase the operating speed (with an accelerating mechanism).
		Shock has been generated from a device other than the Limit Switch.	
		Too–slow operating speed.	
	Oil or water penetration	The sealing part has not been tightened sufficiently.	• Use a drip–proof or waterproof switch. • Use the correct connector and cable. (Use a sealed connector for sealed switches.) • Use a switch with terminals sealed with resin.
		The wrong connector has been selected and does not conform to the cable.	
		The wrong switch has been selected.	
		The terminal part is not molded.	
		The Limit Switch has been burnt or carbonated due to the penetration of dust or oil.	
	Deterioration of the rubber part	The expansion and dissolution of the rubber caused by solvent or lubricating oil.	• Use an oil–resistant rubber or Teflon bellows. • Use a weather–resistant rubber or protective cover. • Use a switch with a protective cover or a metal bellows.
		Cracks due to direct sunlight or ozone.	
		Damage to the rubber caused by scattered or heated cuttings.	
	Corrosion (cracks)	The oxidation of metal parts resulted due to corrosive solvent or lubricating oil.	• Use an anti–corrosive switch. • Change the lubricating oil. • Change mounting positions. • Use a crack–resistant material.
		The Limit Switch has been operated in a corrosive environment, near the sea, or on board a ship.	
		The electrical deterioration of metal parts of the Limit Switch resulted due to the ionization of cooling water or lubricating oil.	
		The cracking of alloyed copper due to rapid changes in temperature.	
Failures related to electric characteristics	No actuation or no current breakage caused by contact weld.	Inductive interference in the DC circuit.	• Add an erasing circuit.
		Carbon generated on the surface of the contacts due to switching operations.	• Use a switch with a special alloy contact or use a sealed switch.
		A short–circuit or contact weld due to the deformation and relocation of the contacts.	• Reduce the switching frequency or use a switch with a large switching capacity.
		Contact weld due to an incorrectly connected power source.	• Change the circuit design.
		Foreign materials or oil penetrated into the contact area.	• Use a protective box.

Outdoor Use

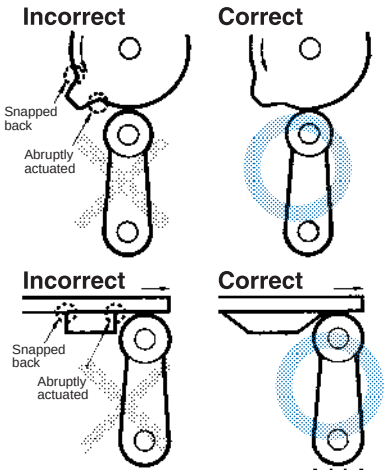
- When using the Limit Switch outdoors, make sure that the Limit Switch is a sealed model. The Limit Switch with IP67 sealing construction does not necessarily mean that the mechanical parts are also of IP67 construction.
- The rubber material exposed to ozone may deteriorate. Check that the rubber parts are environment–resistive, such as chloroprene, silicone, or fluorine rubber.
- If the Limit Switch is used in places with sludge or dust powder sprays, make sure that the mechanical parts are sealed with a rubber cap.
- Due to capillary attraction, rainwater may enter the Limit Switch through the lead wires or sheath. Be sure to cover the wire connections in a terminal box so that they are not directly exposed to rainwater.
- If the Limit Switch is used outdoors, the steel parts of the Limit Switch (such as the screws and plunger parts) may

corrode. Consider the use of outdoor models or proximity sensors in such cases.

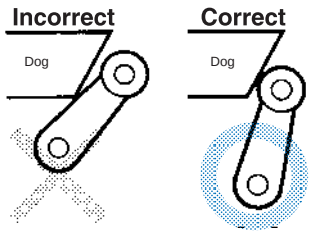
- The expression “Limit Switch is used outdoors” refers to an environment where the Limit Switch is exposed directly to rainwater or sunlight (e.g., multi–story parking lots) excluding locations with corrosive gas or salty breezes.
  The Limit Switch used outdoors may not release due to icing and may not satisfy standards for indoor use.

Operation

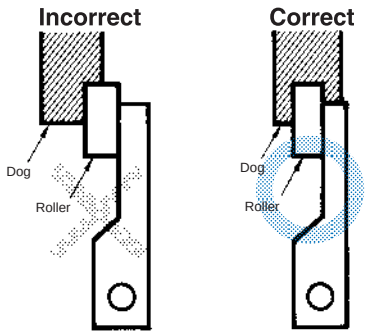
- Carefully determine the position and shape of the cam so that the actuator will not abruptly snap back, thus causing shock. In order to operate the Limit Switch at a comparatively high speed, use an object or cam that keeps the Limit Switch turned ON for a sufficient time so that the relay or valve will be sufficiently energized.
- The shape of the object or cam has a large influence on the life and operating accuracy of the Limit Switch. The cam must be smooth in shape.



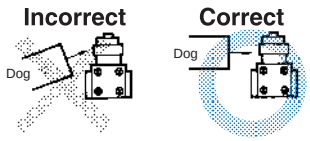
- Appropriate force must be imposed on the actuator by the cam or another object in both rotary operation and linear operation. If the object touches the lever as shown below, the operating position will not be stable.



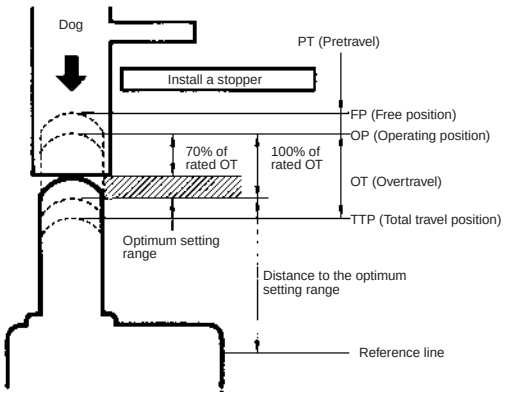
- Unbalanced force must not be imposed on the actuator. Otherwise, wear and tear on the actuator may result.



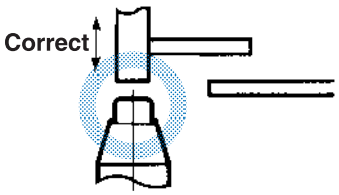
- In the case of a roller–type actuator, the object must touch the actuator at a right angle. Otherwise, the actuator or shaft may deform or break.



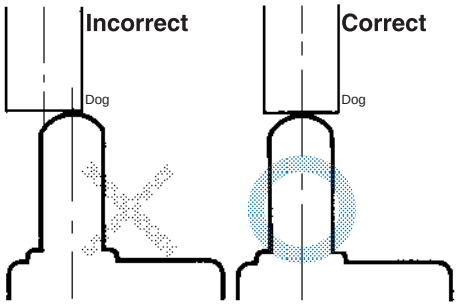
- Make sure that the actuator does not exceed the OT (overtravel) range, otherwise the Limit Switch may malfunction. When mounting the Limit Switch, be sure to adjust the Limit Switch carefully while considering the whole movement of the actuator.



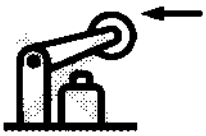
- The Limit Switch may soon malfunction if the OT is excessive. Therefore, adjustments and careful consideration of the position of the Limit Switch and the expected OT of the actuator are necessary when mounting the Limit Switch.



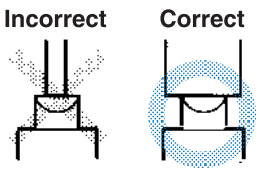
- When using a pin–plunger–type actuator, make sure that the stroke of the actuator and the movement of the object are located along a single straight line.



- Be sure to use the Limit Switch according to the characteristics of the actuator. If a roller arm lever actuator is used, do not attempt to actuate the Limit Switch in the direction shown below.



- Do not modify the actuator to change the OP.
- In the case of a long actuator of an adjustable roller lever type, the following countermeasures against lever shaking are recommended.
  1. Make the rear edge of the object 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 actuated in one direction only.
- In the case of a bevel plunger–type actuator, make sure that the width of the object is wider than that of the plunger.



Dog Design

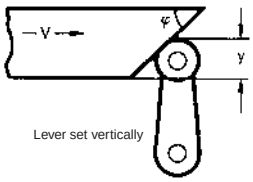
Operating Speed, Dog Angle, and Relationship with Actuator

Before designing a dog, carefully consider the operating speed and angle of the dog and their relationship with the shape of the actuator. The optimum operating speed of a standard dog at an angle of 30° to 45° is 0.5 m/s maximum.

Roller Lever Models

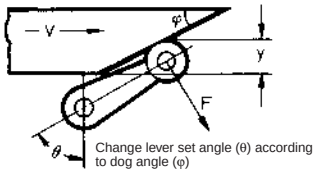
1.Non–overtravel Dog

Dog speed: 0.5 m/s max. (standard speed)



φ	$V_{max.}$ (m/s)	y
30°	0.4	0.8 (TT)
45°	0.25	80% of total travel
60°	0.1	
60° to 90°	0.05 (low speed)	

Dog speed: 0.5 m/s x V x 2 m/s

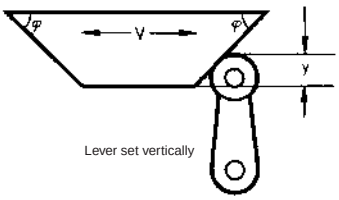


θ	φ	$V_{max.}$ (m/s)	y
45°	45°	0.5	0.5 to 0.8 (TT)
50°	40°	0.6	0.5 to 0.8 (TT)
60° to 55°	30° to 35°	1.3	0.5 to 0.7 (TT)
75° to 65°	15° to 25°	2	0.5 to 0.7 (TT)

Note: The above y values indicate the ratio ranges based on TT (total travel). Therefore, the optimum pressing distance of the dog is between 50% and 80% (or 50% and 70%).

2.Overtravel Dog

Dog speed: 0.5 m/s max.

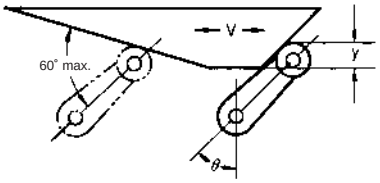


φ	$V_{max.}$ (m/s)	y
30°	0.4	0.8 (TT)
45°	0.25	80% of total travel
60°	0.1	
60° to 90°	0.05 (low speed)	

Dog speed: 0.5 m/s min.

If the speed of the overtravel dog is comparatively high, make the rear edge of the object smooth at an angle of 15° to 30° or make it in the shape of a quadratic curve. Then lever shaking

will be reduced.



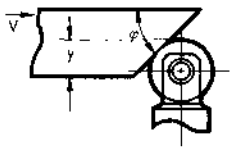
θ	φ	$V_{max.}$ (m/s)	y
45°	45°	0.5	0.5 to 0.8 (TT)
50°	40°	0.6	0.5 to 0.8 (TT)
60° to 55°	30° to 35°	1.3	0.5 to 0.7 (TT)
75° to 65°	15° to 25°	2	0.5 to 0.7 (TT)

Note: The above y values indicate the ratio ranges based on TT (total travel). Therefore, the optimum pressing distance of the dog is between 50% and 80% (or 50% and 70%).

Plunger Models

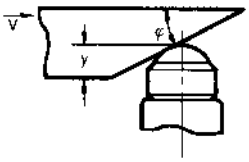
If the dog overrides the actuator, the front and rear of the dog may be the same in shape, provided that the dog is not designed to be separated from the actuator abruptly.

Roller Plunger



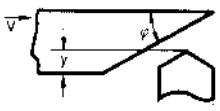
φ	$V_{max.}$ (m/s)	y
30°	0.25	0.6 to 0.8 (TT)
20°	0.5	0.5 to 0.7 (TT)

Ball Plunger



φ	$V_{max.}$ (m/s)	y
30°	0.25	0.6 to 0.8 (TT)
20°	0.5	0.5 to 0.7 (TT)

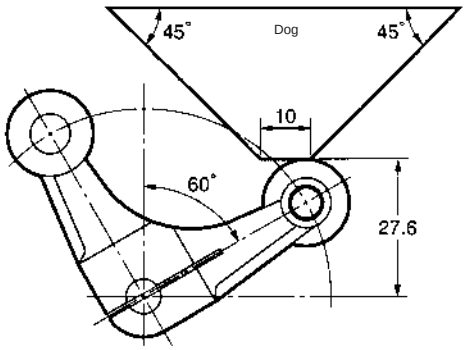
Bevel Plunger



φ	$V_{max.}$ (m/s)	y
30°	0.25	0.6 to 0.8 (TT)
20°	0.5	0.5 to 0.7 (TT)

Note: The above y values indicate the ratio ranges based on TT (total travel). Therefore, the optimum pressing distance of the dog is between 60% and 80% (or 50% and 70%).

Fork Lever Lock Models

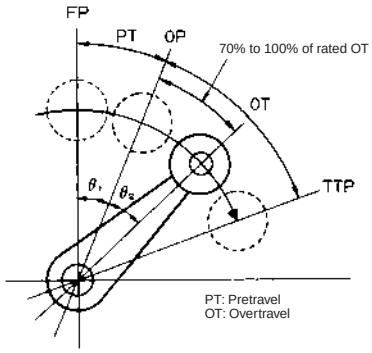


Note: Design the shape of the dog so that it does not come in contact with the other roller lever when the actuator is inverted.

Stroke Settings vs. Dog Movement Distance

- The following provides information on stroke settings based on the movement distance of the dog instead of the actuator angle.
  The following is the optimum stroke of the Limit Switch

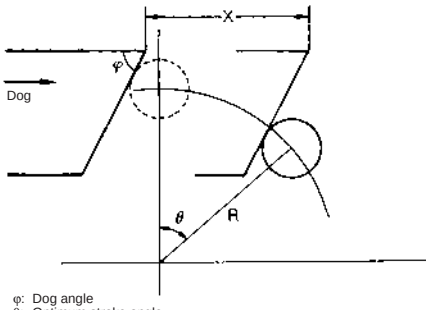
  Optimum stroke: PT + (Rated OT x 0.7 to 1.0)
  The angle converted from the above: $\theta_1 + \theta_2$



- The movement distance of the dog based on the optimum stroke is expressed by the following formula.

  Movement distance of dog

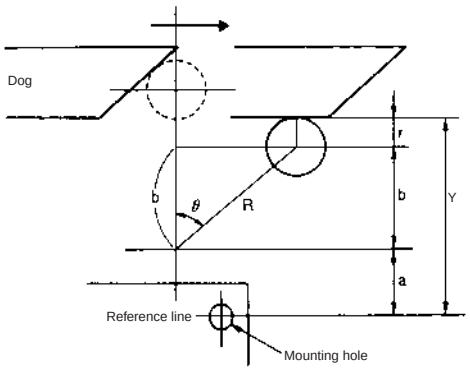
$$X = R\sin\theta + \frac{R(1-\cos\theta)}{\tan\varphi} \text{ (mm)}$$



φ: Dog angle
θ: Optimum stroke angle
R: Actuator length
X: Dog movement distance

- The distance between the reference line and the bottom of the dog based on the optimum stroke is expressed by the following formula.

$$Y = a + b + r\,(mm)$$



a: Distance between reference line and actuator fulcrum
b: R cosθ
r: Roller radius
Y: Distance between reference line and bottom of dog

Dog Surface

- The surface of dog touching the actuator should be 6.3 S in quality and hardened at approximately H450V.
- For smooth operation of the actuator, apply molybdenum disulfide grease to the actuator and the dog touching the actuator. This is ideal for Limit Switches of drip–proof construction and Multiple Limit Switch models.

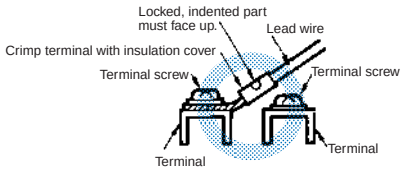
Maintenance and Repairs

- The user must not maintain or repair the system. Consult the manufacturer of the system for maintenance or repairs.

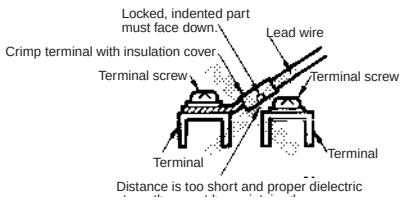
Others

- The Limit Switch has contacts that must be free of silicone gas, otherwise a contact failure may result. Therefore, do not apply cable covered with silicone, silicone sealant, or silicone grease to the Limit Switch.
- The sealing of the standard Limit Switch uses nitrile butadien rubber (NBR), which is highly oil resistive. The NBR exposed to different types of oil or chemical may, however, deteriorate, swell, or shrink. Contact your OMRON representative for details.
- OMRON shall not guarantee the performance and characteristics of any actuator, plunger, or lever modified by the user.
- When using the Limit Switch with a long lever or long rod lever, make sure that the lever is in the downward direction.
- In order to ensure high contact reliability, the correct Limit Switch must be selected according to the load. For details, refer to the precautions for minute load models in this catalog.
- The leads must be wired as shown below.

Correct Method



Wrong Method



SI Units

To conform to the international standards, this datasheet adopts the SI international system for units (SI: Systeme International d'Unites). Refer to the following tables to convert values indicated in conventional units.

SI Unit Conversion

(Shaded units are non–SI units.)

Acceleration	m/s^2	G
	1	$1.01972\ 10^{-1}$
	9.80665	1

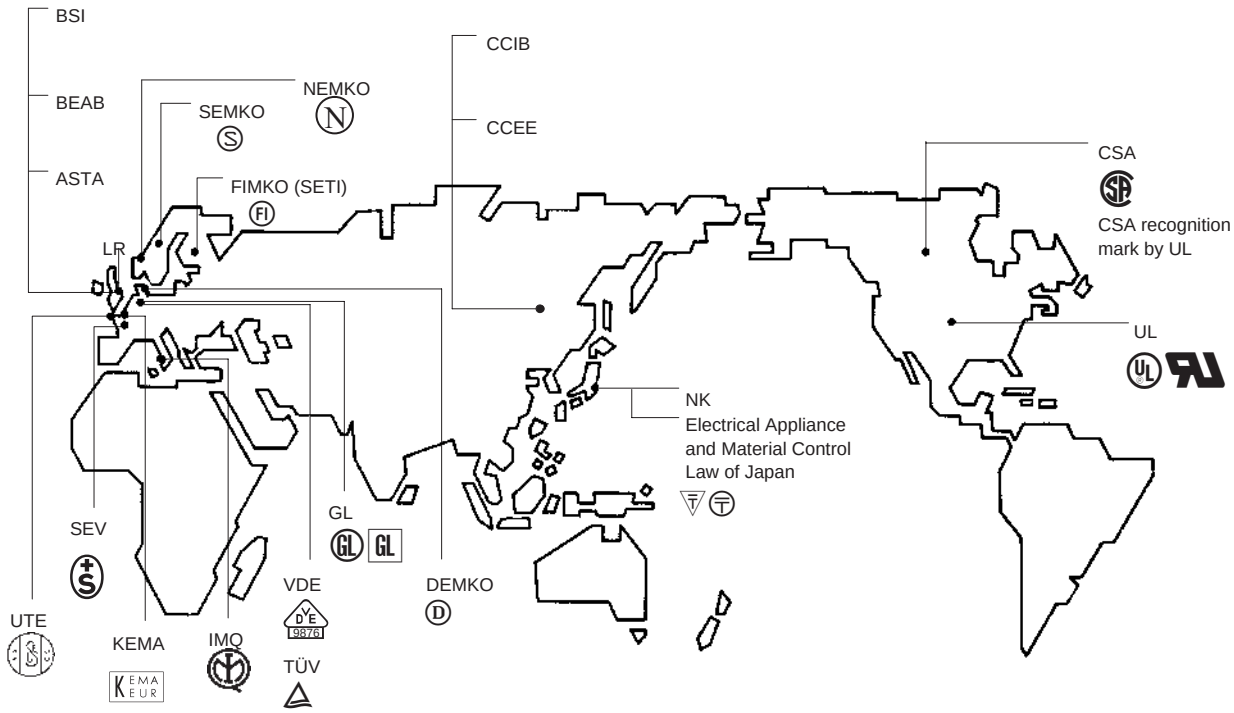
Force	N	kgf
	1	$1.01972\ 10^{-1}$
	9.80665	1

Torque	Nm	kgf•cm	kgf•m
	1	1.01972 10	$1.01972\ 10^{-1}$
	$9.80665\ 10^{2}$	1	$1\ 10^{-2}$
	9.80665	$1\ 10^{2}$	1

Pressure	Pa	kPa	kgf/cm^2	mmHg (Torr)	mmH_2O
	1	$1\ 10^{-3}$	$1.01972\ 10^{-5}$	$7.50062\ 10^{-3}$	$1.01972\ 10^{-1}$
	$1\ 10^{3}$	1	$1.01972\ 10^{-2}$	7.50062	$1.01972\ 10^{2}$
	$9.80665\ 10^{4}$	9.80665 10	1	$7.35559\ 10^{2}$	$1\ 10^{4}$
	$1.33322\ 10^{2}$	$1.33322\ 10^{-1}$	$1.35951\ 10^{-3}$	1	1.35951 10

Standards

National Standards



Note: For detailed information about applicable standards, refer to the relevant catalog.

International Standards

IEC (International Electrotechnical Commission)

The IEC is a standardization commission founded in 1908 to promote unification and coordination of international standards relating to electricity. It is headquartered in Geneva, Switzerland.

IEC standards are provided to accomplish the aim of the above. The IEC strongly recommends all the member nations of the IEC to establish domestic standards that conform with those of the IEC.

At present, there are 50 member nations in the IEC. Based on reports from member nations on the latest science technologies in those nations, IEC standards are issued as technological standards relating to electricity. Established international safety standards provided by various countries and accepted worldwide are based on IEC standards.

In order to simplify approval procedures for electrical devices and promote smooth international trade, there is an international scheme called CB Scheme (Certification Body Scheme), which is authorized by IEC standards. Based on the CB Scheme, safety tests on electrical devices are conducted and certificates are issued if the devices are proved to meet IEC standards. Products issued with such certificates are acceptable in 30 countries in the world.

North America

UL Standards (Underwriters Laboratories INC.)

A nonprofit organization established in 1894 by the American association of fire insurance companies.

Underwriters Laboratories (abbreviated to UL hereafter) conducts approval testing on all kinds of electrical products. In many U.S. cities and states, UL approval is legally required on all electrical items sold.

In order to obtain UL approval on an electrical product, all major internal components also require UL approval.

UL offers two classifications of approvals, the listing mark and the recognition mark.

A Listing Mark constitutes a entirely approval of a product. Products display the Listing Mark shown below.

Listing Mark

The Recognition Mark applies to the components used in a product, and therefore constitutes a more conditional approval of a product. Products display the Recognition Mark shown below.

Recognition Mark

The UL and CSA are unifying their standards with the adoption of a mutual approval system. Furthermore, they are adjusting their standards so that they will be in conformity with IEC standards.

Since October 1992, UL has been approved as a CO (council organization) and TO (test organization) by the SCC (Standard Council of Canada). This authorizes UL to conduct safety tests and certify products conforming to Canadian standards. The above marks are UL marks for products certifying that the products meet Canadian standards.

The designs of the listing marks and recognition marks have been revised as shown below. These marks have been effective since November 1998. The previous marks are valid until November 2007.

LISTING MARKS

	Marks for US	Marks for Canada	Marks for US and Canada
Previous mark			
New mark			

RECOGNITION MARKS

	Marks for US	Marks for Canada	Marks for US and Canada
Previous mark			
New mark			

CSA Standards (Canadian Standards Association)

This association descended from a nonprofit, non–government standardization organization established in 1919. In addition to industrial standardization, the association now carries out safety testing on electrical products.

CSA has closer ties to government agencies than UL, so that electrical products not approved by CSA cannot be sold in Canada. Non–approved goods being sold illegally may have to be withdrawn.

CSA approval is known as “certification,” and consequently, CSA–approved equipment is referred to as “certified equipment.” Products display the mark shown below. For a conditional certification, products display component acceptance mark.

The CSA is adjusting its standards so that they will be in conformity with UL and IEC standards.

Certification Mark

China

GB (Guojia Biaozhun) Chinese National Standards

The GB are established Chinese national standards based on IEC standards.

Products such as home electronics appliances (e.g., televisions, washing machines, and microwave ovens), for which GB standards are obligatory, must be approved by CCIB (China Commodity Inspection Bureau) and CCEE (China Commission for Conformity Certification of Electrical Equipment). The marks shown below are respective marks of recognition.

CCIB Mark CCEE Mark

Shipping Standards

LR (Lloyd’s Register of Shipping)

These are the standards of the Lloyd’s Register of Shipping, headquartered in London. All of the OMRON control components approved in LR are UMS ships, the unmanned engine–room ship classification in the Lloyd’s Register.

Unlike the safety standards such as UL, the devices are checked to ensure that they can function sufficiently under the environmental conditions when they are used in ships.

When a device is approved, Lloyd’s Register doesn’t apply the passing mark on the product, but includes it on the list of approved products that it publishes every year.

NK (Nippon Kaiji Kyokai)

Nippon Kaiji Kyokai (NK), which was established in 1899 under a different name for the purpose of ensuring the safety of vessels and the maintenance of maritime environmental conditions, has been using the present name since 1946.

Automation equipment and devices receive tests and inspections based on the provisions of the steel–ship regulations and can be formally approved if the tests are passed.

Testing at the production factory can be partially or entirely omitted when automation equipment and devices that have been formally approved are installed on ships.

As a general rule, manufacturers of approved products indicate that the products being shipped have been approved. (It is also acceptable to affix a label to products which require it.)

Japan

Electrical Appliance and Material Control Law of Japan

The EAMCL was substantially revised in July 1995 in conformity with IEC standards, such as IEC335. Consequently, the previously–used symbol for second–grade appliances was abolished while the symbol for first–grade appliances remained unchanged. Furthermore, the range of applicable products has been greatly revised.

	First–grade appliance	Second–grade appliance
Previous symbol	282 products	216 products
Present symbol	165 products	333 products (no markings)

Europe

EN (European Norm) Standards

As part of EC unification, 18 European countries are going to integrate their national safety standards into EN standards. When EN standards come into effect, they shall apply as the unified standards in Europe in place of the current safety standards.

EN standards related to electricity are based on IEC standards and include requirements relating to countermeasures against electric shocks. EN codes consist of the prefix “EN” followed by five figures beginning with the figure 6 (e.g., EN60204).

Industrial products exported to Europe must satisfy IEC standards if the products do not fall under EN standards.

Industrial products exported to European countries from Japan or North America or traded between European countries must satisfy EN standards. Furthermore, 12 types of industrial products, such as machines, low–voltage devices, and EMC equipment, must bear CE markings. CE markings on a product indicate that the product meets safety standards specified by all related EC directives. For example, an industrial machine must satisfy the EC Machinery Directive, Low–voltage Directive (LVD), and EMC requirements.

CE Marking

The following marks of recognition are used in European countries in accordance with EN standards.

VDE (Verband Deutscher Elektrotechniker e.V.) in Germany (applicable to electrical appliances only)		TÜV (applicable to electrical appliances, machines and automobiles	
VDE Mark	Monitoring Mark	TÜV Rheinland	TÜV Product Service
DEMKO (Danmarks Elektriske Materielkontrol)		KEMA (Keuring van Electrotechnische Materialen Nederland B.V.)	
NEMKO (Norges Elektriske Materiellkontroll)		UTE (Union Technique De Electricite)	
FIMKO (Finlands Material Kontroll)		IMQ (Instituto Italiano del Marchio di Qualita)	
BSI (British Standards Institution) Britain (applicable to industrial products)		SEMKO (Svenska Elektriska Materielkontroll Anstalten)	
BEAB (British Electrotechnical Approval Board) Britain (applicable to home electronics products)		SEV (Schweizer Elektrotechnischer Verein)	
ASTA (ASTA Certification Services) Britain (applicable to general products)			

List of Approved Models

UL Standards

Safety Switches

Model	Rating	Standard No.	File No.
D4D–N	A600 (Slow-action models) (Carry current: 10 A) B600 (Snap-action models) (Carry current: 5 A)	UL508	E76675
D4F	C300 (Carry current: 2.5 A), Q300 (Carry current: 2.5 A)		
D4B–N	A600 (Carry current: 10 A)		
D4BS	A600 (Carry current: 10 A)		
D4BL	A300 (Carry current: 10 A)		
D4D–R	A600 (Carry current: 10 A)		
D4DS	A600 (Carry current: 10 A)		
D4NL	A300 (Carry current: 10 A)		
D4GL	C300 (Carry current: 2.5 A), Q300 (Carry current: 2.5 A)		
D4DH	A600 (Carry current: 10 A)		
D4GS–N	C300 (Carry current: 2.5 A), Q300 (Carry current: 2.5 A)		

Note: 1. Approval on some models may have been given on representative models. For further information on standard approvals, contact your OMRON sales representative.
2. The standard number shown above is the number the applicable standard and the file number is the approval report number.

Pushbutton Switches

Model	Rating	Standard No.
A165E	5 A, 125 VAC 3 A, 250 VAC 3 A, 30 VDC	UL508
A165E□03U	1 A, 125 VAC 0.5 A, 250 VAC 1 A, 30 VDC	UL508
A22E	6 A, 250 VAC 10 A, 105 VAC	UL508

Safety Relay Units

Model	Number of poles	Operating coil	Contact rating	File No.
G9S-2001 G9S-2002	DPST-NO	24 VDC	5 A, 240 VAC (Resistive)	E95399
G9S-301	3PST-NO/ SPST-NC	24 VDC, 24, 100, 120, 240 VAC		
G9S-501	5PST-NO/ SPST-NC			
G9S-321-T□ (see note 1)	3PST-NO/ SPST-NC+ DPST-NO (OFF-delay)			
G9SA-301	3PST-NO/ SPST-NC	24 VDC, 24 VAC	5 A, 250 VAC (Resistive)	E41515
G9SA-501	5PST-NO/ SPST-NC			
G9SA-321-T□ (see note 2)	3PST-NO/ SPST-NC+ DPST-NO (OFF-delay)			
G9SA-TH301	3PST-NO/ SPST-NC			
G9SA-EX301				
G9SA-EX031-T□ (see note 2)	3PST-NO+ SPST-NC (OFF-delay)			
G9SB-200□-□	DPST-NO	24 VDC, 24 VAC	5 A, 250 VAC (Resistive)	E76675
G9SB-301□-□	3PST-NO/ SPST-NC			
G9SB-3010		24 VDC		
CQM1-SF200	DPST-NO	24 VDC	5 A, 250 VAC (Resistive)	
CS1W-SF200				

Note: 1. T□: T01, T015, T03, T04, T05, T06, T10, T30
2. T□: T075, T15, T30

Safety Relays

Model	Number of poles	Operating coil	Contact rating	File No.
G7S–4A2B	4PST–NO/ DPST–NC	24 VDC	6 A per pole, 20 A total, 277 VAC (Resistive)	E41515
G7S–3A3B	3PST–NO/ 3PST–NC			
G7SA–3A1B	3PST–NO/ SPST–NC		6 A, 250 VAC (Resistive) 6 A, 30 VDC (Resistive)	
G7SA–2A2B	DPST–NO/ DPST–NC			
G7SA–5A1B	5PST–NO SPST–NC			
G7SA–4A2B	4PST–NO DPST–NC			
G7SA–3A3B	3PST–NO/ 3PST–NC			

Safety Area Sensors (Listing Certified)

Model	File No,	Ratings/remarks
F3SN-A F3SH-A	E199694	Input: 24 VDC Output: PNP open collector, 300 mA (24 VDC) Type 4 ESPE/AOPD
F3S-B	E199694	Input: 24 VDC Output: PNP open collector or NPN open collector, 200 mA (24 VDC) Type 2 ESPE/AOPD
F3SS	NRTL certification by CSA	---
F3SL	E199694	Type 4 ESPE/AOPD

Note: If a model is missing, ask your OMRON representative.

CSA Standards

Safety Switches

Model	Rating	Standard No.	File No.
D4BS	A600 (Carry current: 10 A)	CSA C22.2 No. 14	LR45746
D4DS	A600 (Carry current: 10 A)		
D4BL	A300 (Carry current: 10 A)		
D4DL	A300 (Carry current: 10 A)		
D4DH	A600 (Carry current: 10 A)		

Note: 1. Approval on some models may have been given on representative models. For further information on standard approvals, contact your OMRON sales representative.
2. The standard number shown above is the number the applicable standard and the file number is the approval report number.

Safety Relay Units

Model	Number of poles	Operating coil	Contact rating	File No.
G9S-2001 G9S-2002	DPST-NO	24 VDC	5 A, 240 VAC (Resistive)	LR35535
G9S-301	3PST-NO/ SPST-NC	24 VDC, 24, 100, 120, 240 VAC		
G9S-501	5PST-NO/ SPST-NC			
G9S-321-T□ (see note 1)	3PST-NO/ SPST-NC+ DPST-NO (OFF-delay)			
G9SA-301	3PST-NO/ SPST-NC	24 VDC, 24 VAC	5 A, 250 VAC (Resistive)	
G9SA-501	5PST-NO/ SPST-NC			
G9SA-321-T□ (see note 2)	3PST-NO/ SPST-NC+ DPST-NO (OFF-delay)			
G9SA-TH301	3PST-NO/ SPST-NC			
G9SA-EX301				
G9SA-EX031-T□ (see note 2)	3PST-NO+ SPST-NC (OFF-delay)			
G9SB-200□-□	DPST-NO	24 VDC, 24 VAC	5 A, 250 VAC (Resistive)	203880 (LR35535)
G9SB-301□-□	3PST-NO/ SPST-NC			
G9SB-3010		24 VDC		
CQM1-SF200	DPST-NO	24 VDC	5 A, 250 VAC (Resistive)	
CS1W-SF200				

Note: 1. T□: T01, T015, T03, T04, T05, T06, T10, T30
2. T□: T075, T15, T30
3. Approval of G9SA models with AC power supplies is pending (as of June 2001).

Safety Area Sensors

Model	File No,	Ratings/remarks
F3SN-A F3SH-A	(listing based on Canadian safety standards) Refer to UL standards.	Input: 24 VDC Output: PNP open collector, 300 mA (24 VDC) Type 4 ESPE/AOPD
F3S-B	(listing based on Canadian safety standards) Refer to UL standards.	Input: 24 VDC Output: PNP open collector or NPN open collector, 200 mA (24 VDC) Type 2 ESPE/AOPD
F3SS	LR90200 (CSA C22.2 No. 205)	---
F3SL	(listing based on Canadian safety standards) Refer to UL standards.	Type 4 ESPE/AOPD

Safety Relays

Model	Number of poles	Operating coil	Contact rating	File No.
G7SA-3A1B	3PST-NO/ SPST-NC	24 VDC	6 A, 250 VAC (Resistive) 6 A, 30 VDC (Resistive)	LR35535 (CSA C22.2 N0. 14)
G7SA-2A2B	DPST-NO/ DPST-NC			
G7SA-5A1B	5PST-NO SPST-NC			
G7SA-4A2B	4PST-NO DPST-NC			
G7SA-3A3B	3PST-NO/ 3PST-NC			
G7S-4A2B	4PST-NO/ DPST-NC	24 VDC	6 A per pole, 20 A total, 277 VAC (Resistive)	
G7S-3A3B	3PST-NO/ 3PST-NC			
G7SA-4A2B-E	4PST-NO DPST-NC	24 VDC	NO contact: 10 A per pole, 20 A total, 277 VAC (Resistive) NC contact: 6 A per pole, 20 A total, 277 VAC (Resistive)	
G7SA-3A3B-E	3PST-NO/ 3PST-NC			

Safety Limit Switches

Model	Rating	Standard No.	File No.
D4B-N	A600 (Carry current: 10 A)	CSA C22.2 No. 14	LR45746

Note: If a model is missing, ask your OMRON representative.

VDE Standards

Safety Relays

Model	Number of poles	Operating coil	Contact rating	Approval No.
G7S–4A2B	4PST–NO/ DPST–NC	24 VDC	6 A 240 VDC (Resistive)	No. 6611 (IEC255) (VDE0435) (EN50205)
G7S–3A3B	3PST–NO/ 3PST–NC			
G7SA–3A1B	3PST–NO/ SPST–NC		6 A, 250 VAC (Resistive) 6 A, 30 VDC (Resistive)	No. 125547 (EN61810–1) (EN50205) (EN60255–23)
G7SA–2A2B	DPST–NO/ DPST–NC			
G7SA–5A1B	5PST–NO/ SPST–NC			
G7SA–4A2B	4PST–NO/ DPST–NC			
G7SA–3A3B	3PST–NO/ 3PST–NC			

Note: Applicable standard numbers are given in parentheses.

TÜV Standards

Limit Switches

Model	Rating	Standard No.	Approval No.
D4D–R	AC–15 2 A 400 V 50/60 Hz	EN60947–5–1 EN81, EN115	R9451184
D4BS	AC–15 2 A 400 V 50/60 Hz	EN60947–5–1 IEC947–5–1	R9351022
D4D–N	AC–15 2 A 400 V 50/60 Hz	EN60947–5–1 IEC947–5–1	Slow–action: R9451184 Snap–action: J9950233
D4F	AC–15 0.75 A 240 V 50/60 Hz	EN60947–5–1 GS–ET–15	B0203 39656029
D4B–N	AC–15 2 A 400 V 50/60 Hz	EN60947–5–1 IEC947–5–1	Slow–action: R9151643 Snap–action: J9851083
D4DH	AC–15 2 A 400 V 50/60 Hz	EN60947–5–1 IEC947–5–1	R9650736
D4DS	AC–15 2 A 400 V 50/60 Hz	EN60947–5–1 IEC947–5–1	R9551708
D4GL	AC–15 0.75 A 240 V 50/60 Hz DC–13 0.27 A 250 V	EN60947–5–1 GS–ET–19	B0207 39656039
D4NL	AC–15 3 A 240 V 50/60 Hz DC–13 0.27 A 250 V	EN60947–5–1 GS–ET–19	B0207 39656040
D4BL	AC–15 3 A 250 V 50/60 Hz (LED type: AC–15 6 A 115 V 50/60 Hz	EN60947–5–1 IEC947–5–1 GS–ET–19	R9451050
D4GS–N	AC–15 0.75 A 240 V 50/60 Hz DC–13 0.27 A 250 V	EN60947–5–1	J2051125

BIA Standards

Limit Switches

Model	Models rated	Standard No.	Approval No.
D4B–N	Positive opening models approved except adjustable levers, coils, springs, and plastic rods	GS–ET–15, EN60947–5–1	9202158 and 9309655
D4BS	All D4BS models	GS–ET–15, EN60947–5–1	9303323
D4BL	All D4BL models	GS–ET–19, EN60947–5–1	Mechanical: 9402293 Solenoid: 1998, 20462–01
D4D–N	Positive opening models approved except adjustable levers	GS–ET–15, EN60947–5–1	9407070 and 9601732
D4DS	All D4DS models	GS–ET–15, EN60947–5–1	9509915 and 9509913
D4DH	All D4DH models		9610569
D4D–R	Approved except adjustable levers		9505895 and 9509914

Safety Relay Units

Model	Number of poles	Operating coil	Contact rating	File No.
G9S–2001 G9S–2002	DPST–NO	24 VDC	5 A, 240 VAC (Resistive)	R974021 (EN60204–1) (EN954–1)
G9S–301	3PST–NO/ SPST–NC	24 VDC, 24, 100, 120, 240 VAC		
G9S–501	5PST–NO/ SPST–NC			
G9S–321–T□ (see note)	3PST–NO/ SPST–NC+DPST–NO (OFF–delay)			

Note: T□: T01, T015, T03, T04, T05, T06, T10, T30

Note: If a model is missing, ask your OMRON representative.

SUVA Standards

Limit Switches

Model	Models rated	Approved No.
D4B–N	Positive opening models approved except adjustable levers, coils, springs, and plastic rods	E6188.d and E6189.d
D4BS	All D4BS models	E6187.d
D4BL	All D4BL models	E6186/1.d
D4D–N	Positive opening models approved except adjustable levers	E6192.d and E6193.d
D4DS	All D4DS models	6010Z and 6011Z
D4DH	All D4DH models	6123Z
D4DL	All D4DL models	Mechanical: E6190.d Solenoid: E6191.d
D4D–R	Approved except adjustable levers	6012Z and 6013Z

BG Standards

Safety Relay Units

Model	Number of poles	Operating coil	Contact rating	File No.
G9SA–301	3PST–NO/ SPST–NC	24 VDC, 24 VAC	5A, 250 VAC (Resistive)	000115
G9SA–501	5PST–NO/ SPST–NC			000135
G9SA–321–T□ (see note 1)	3PST–NO/ SPST–NC+ DPST–NO (OFF–delay)			000137
G9SA–TH301	3PST–NO/ SPST–NC			
G9SA–EX301	3PST–NO/ SPST–NC			000135
G9SA–EX031–T□ (see note 1)	SPST–NC+ 3PST–NO (OFF–delay)			000137

Note: 1. T□: T075, T15, T30

Note: If a model is missing, ask your OMRON representative.

List of Models Conforming to EN/IEC Standards

Safety Door Switches

Model	CE marking	Safety category	Basic requirements of Machinery Directive/Low–voltage Directive				Basic requirements of EMC Directive			
			Applicable standard No.	Application standard No.	Approving agency	File No./ Applicable period	EMI standard No.	EMS standard No.	Approving agency	File No./ Applicable period
D4BS	YES	4	EN60947-5-1 IEC60947-5-1	---	TÜV, Rheinland	R9351022	Not applicable			
D4BL						R9451050				
D4DS						R9551708				
D4DL						J9650735				
D4DH						R9650736				
D4GS-N						J2051125				
D4GL			EN60947-5-1		TÜV, Product Service	B020739656039				
D4NL						B020739656040				

Safety Sensor

Model	CE marking	Safety category	Machinery Directive			Basic requirements of EMC Directive		
			Applicable directive	Approving agency	File No.	Applicable directive	Approving agency	File No.
F3SN-A F3SH-A	YES (EMC Directive)	4	EN61496-1 ESPE Type 4 IEC61496-1 ESPE Type 4 IEC61496-2 AOPD Type 4	DEMKO	Certificate No. 129794-01	89/336/EEC	DEMKO	Certificate No. 129794-02
F3S-B		2	EN61496-1 ESPE Type 2 IEC61496-1 ESPE Type 2 IEC61496-2 AOPD Type 2	TÜV Hannover/Sachsen Anhalt			TÜV Nord	Certificate 08/205/B1-PM28890
F3SS		4	IEC61496-1 ESPE Type 4 IEC61496-2	TÜV Rheinland	BB9911039	IEC61496-1 compatibility according to TÜV Rheinland. Declaration of conformity to EMC Directive based on certification. Declaration of conformity certificate numbers: MSCS 128A (F3SS) MSCS 129A (F3SL)		
F3SL					BB9910071			
E3FS		2	98/37/EC EN61469-1 prEN91496-2 type2	TÜV Product Service	Z2010842669001	89/336/EEC	TÜV Product Service	
F3SP-U1P F3SP-U3P F3SP-U5P			98/37/EC IEC61496-1		Z1003071845 3015			
F3SP-U2P F3SP-U4P		4	98/37/EC IEC61496-1					
F3SP-P1P			98/37/EC IEC61496-1 IEC61496-2					

Note: If a model is missing, ask your OMRON representative.

Safety Relay Unit

Model	CE marking	Safety category	Basic requirements of Machinery Directive/Low–voltage Directive				Basic requirements of EMC Directive			
			Applicable standard No.	Application standard No.	Approving agency	File No./ Applicable period	EMI standard No.	EMS standard No.	Approving agency	File No./ Applicable period
G9SA	YES	4 (see note 1)	EN60204-1 EN954-1	---	BG	(see note 4)	EN55011	EN50082-2	TÜV, Product Service	E8 00 04 39656 001
G9S		4 (see note 2)			BIA	R974021				(see note 5)
G9SA (24 VAC/ VDC)		4 (see note 1)			BG	(see note 6)		EN61000-6-2		E8 02 03 39656 035
G9SA (100 to 240 VAC)									TÜV, Rheinland	Report No. 02062204 002 Registration No. AE2051327 02
G9SB-200□-□ G9SB-301□-□		4			TÜV, Rheinland	968/EZ 120.00/01				Report No. 02160619 002 Registration No. AV2-50003726
G9SB-3010		3 (see note 3)								
CQM1-SF200		4				968/EZ 110.00/00				Report No. P2062560E 01 Registration No. AE2051219 01
CS1W-SF200										Report No. P2062873E 01 Registration No. AE2051220 01

Note: 1. OFF-delay contact of G9SA-321/EX031 falls in Category 3.
2. OFF-delay output of G9S-321 and G9S-2001 falls in Category 3.
3. G9SB-3010 falls in Category 3 with double breaking.
4. G9SA-301: 00115, 501/EX301: 00135, 321/EX031: 00137, TH301: 01013
5. G9S-301/501/321: E8 97 05 22868 026; G9S-2001/2002: E8 98 03 32014 005
6. G9SA-301: 00115, 501/EX301: 00135, 321/EX031: 00137, TH301: 01013 (24 VAC/VDC)
G9SA-301: 02067, 501: 02063, 321: 02065, TH301: 01013 (100 to 240 VAC)

Safety Relays

Model	CE marking	Safety category	Basic requirements of Machinery Directive/Low–voltage Directive				Basic requirements of EMC Directive			
			Applicable standard No.	Application standard No.	Approving agency	File No./ Applicable period	EMI standard No.	EMS standard No.	Approving agency	File No./ Applicable period
G7SA	Not applicable	For Systems up to cat. 4	EN61810-1	EN50205	VDE	No. 125547	Not applicable			
G7S			IEC60255 (VDE0435)	prEN50205		No. 6611				

Safety Limit Switches

Model		CE marking	Safety category	Basic requirements of Machinery Directive/Low–voltage Directive				Basic requirements of EMC Directive			
				Applicable standard No.	Application standard No.	Approving agency	File No./ Applicable period	EMI standard No.	EMS standard No.	Approving agency	File No./ Applicable period
D4B-□N	Snap-action	YES	4	EN60947-5-1 IEC60947-5-1	---	TÜV, Rheinland	J9851083	Not applicable			
D4D-□N	Snap-action				EN81 (Elevators) EN115 (Escalators, conveyors)		JJ9950233				
D4B-□N	Slow-action						R9151643				
D4D-□N							R9451184				
D4D-□R											
D4F						TÜV, Product Service	B020339656029				

Note: If a model is missing, ask your OMRON representative.

Emergency Stop Switches

Model	CE marking	Safety category	Basic requirements of Machinery Directive/Low–voltage Directive				Basic requirements of EMC Directive			
			Applicable standard No.	Application standard No.	Approving agency	File No./ Applicable period	EMI standard No.	EMS standard No.	Approving agency	File No./ Applicable period
A165E Series (separate construction)	YES	4	EN60947-5-1	---	TÜV, Product Service	B021039656044	Not applicable			
A22E Series						B021039656043				
A165E-□-03U (one-body construction)						B021039656045				

Note: If a model is missing, ask your OMRON representative.

MEMO

Non Safety Picking Sensor

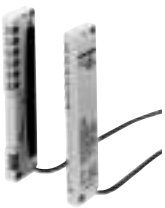
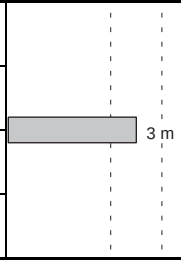
F3W-D

Compact, Resistant to Mutual Interference, and Ideal for Picking a Variety of Parts

- Sensing distance of 3 m.
- Selectable display mode (all lighting, all flashing, elevator-like lighting, accordion-like lighting).
- ·Six picking indicators provide a very clear display.
- ·Selectable display speed (SLOW/FAST).
- External picking indicators may be connected.
- ·External indicators can be directly connected to the Picking Sensor and mounted in an easy-to-see location.

Ordering Information

Sensors

Sensing method	Appearance	Connection method	Sensing distance	Optical-axis pitch	No. of optical axes	Detecting height (mm)	Output type	External indicator	Model
Through-beam		Pre-wired (5 m)		25 mm	5	100	NPN open collector	---	F3W-D052A
								Possible	F3W-D052AP
		Connector (2 m)						---	F3W-D052B
								Possible	F3W-D052BP
		Pre-wired (5 m)					PNP open collector	---	F3W-D052C
								Possible	F3W-D052CP
		Connector (2 m)						---	F3W-D052D
								Possible	F3W-D052DP

⚠ WARNING:
Do not apply F3W-D as safety mechanisms used in pressing machines or any other safety mechanisms for protecting the human body from danger

Accessories (Sold Separately)

Mounting Brackets

Appearance	Model	Quantity	Remarks
	F39-L10	2	L-shaped Mounting Bracket
	F39-L11	2	Flat Mounting Bracket

Protective Bracket

Appearance	Model	Quantity
	F39-L12	One each for Emitter and Receiver (mounting screws included)

Y-shaped Joint Plugs and Sockets (Double-ended Connectors)

Appearance	Overall length	Model	Quantity
	2 m	XS2R-D526-S001-2	1
	5 m	XS2R-D526-S001-5	1

Y-shaped Joint Plugs and Sockets without Cable

Appearance	Model	Quantity	Remarks
	XS2R-D526-S003	1	Connecting cable: Double-ended connector: XS2W Series Single-ended connector: XS2F-series 4-conductor models

Specifications

Ratings / Characteristics

PNP Output

Item		Through-beam	
		F3W-D052C(P) (see note 1)	F3W-D052D(P) (see note 1)
Sensing distance		3 m, switchable between LONG mode (1 to 3 m) and SHORT mode: (0.05 to 1 m), factory-set to SHORT mode	
Optical-axis pitch		25 mm	
No. of optical axes		5	
Detecting height		100 mm	
Sensing object		Opaque, 35 mm dia. min.,	
Light source (wavelength)		Infrared LED (860 nm)	
Power supply voltage		12 to 24 VDC±10% (ripple range (p-p): 10% max.)	
Power consumption		Emitter: 0.6 W max., Receiver: 0.7 W max.	
Control output		PNP open collector with 100 mA max. at 30 VDC Residual voltage: 2,5 V max. at 100 mA Dark ON or Light ON (selectable)	
Picking instruction indicator input		Open collector with relay or transistor input Indicator ON: Input voltage of 0 to 2 V Indicator OFF: Open (with leakage current of 0.1 mA max.)	
Protection circuit		Reverse-connection protection, output short protection, and mutual interference interrupting function (set with frequency selector switch)	
Response time		Operate/Release: 10 ms max.	
Indicator	Receiver	Operation indicator (orange), stability indicator (green), and 6 picking indicators (orange)	
	Emitter	Power indicator (green), different frequency indicator (green), and 6 picking indicators (orange)	
Ambient temperature		Operating: -10° to 55°C Storage: -25° to 70°C (with no icing or condensation)	
Ambient humidity		35 to 85% (with no condensation)	
Insulation resistance		20 MΩ min. (at 500 VDC)	
Dielectric strength		1,000 VAC 50/60 Hz for 1 min	
Vibration resistance		Destruction: 10 to 50 Hz, 1.5-mm double-amplitude for 2 hours each in X, Y and Z directions	
Shock resistance		Destruction: 500 m/s2, 3 times each in X, Y and Z directions	
Degree of protection		IEC60529: IP62 (with the operation cover closed)	
Connection method		Pre-wired Standard cable length: 5 m	Connector (M12 5-pin connector) Standard cable length: 2 m
Weight (including package)		Approx. 360 g	Approx. 230 g
Materials	Case, display window	ABS resin	
	Lens	Acrylic resin	
	Operation cover	Nylon (PA6)	
Accessories		Instruction manual	

Note: 1 . The F3W-D052□P Emitters are provided with the external picking indicator output line shown in the following table.I

Item	F3W-D052CP, F3W-D052DP
Connection method	Pre-wired with connector (standard cable length: 300 mm) Connector model: SMP-02V-NC (manufactured by Nihon Crimp Terminal, Ltd.)
Electrical specifications	Output current: 50 mA max. Output voltage: Fixed at sensor power supply voltage

NPN Output

Item		Through-beam	
		F3W-D052A(P) (see note 1)	F3W-D052B(P) (see note 1)
Sensing distance		3 m, switchable between LONG mode (1 to 3 m) and SHORT mode: (0.05 to 1 m), factory-set to SHORT mode	
Optical-axis pitch		25 mm	
No. of optical axes		5	
Detecting height		100 mm	
Sensing object		Opaque, 35 mm dia. min.,	
Light source (wavelength)		Infrared LED (860 nm)	
Power supply voltage		12 to 24 VDC±10% (ripple range (p-p): 10% max.)	
Power consumption		Emitter: 0.6 W max., Receiver: 0.7 W max.	
Control output		NPN open collector with 100 mA max. at 30 VDC Residual voltage: 1 V max. at 100 mA Dark ON or Light ON (selectable)	
Picking instruction indicator input		Open collector with relay or transistor input Indicator ON: Input voltage of 0 to 2 V Indicator OFF: Open (with leakage current of 0.1 mA max.)	
Protection circuit		Reverse-connection protection, output short protection, and mutual interference interrupting function (set with frequency selector switch)	
Response time		Operate/Release: 10 ms max.	
Indicator	Receiver	Operation indicator (orange), stability indicator (green), and 6 picking indicators (orange)	
	Emitter	Power indicator (green), different frequency indicator (green), and 6 picking indicators (orange)	
Ambient temperature		Operating: -10° to 55°C Storage: -25° to 70°C (with no icing or condensation)	
Ambient humidity		35 to 85% (with no condensation)	
Insulation resistance		20 MΩ min. (at 500 VDC)	
Dielectric strength		1,000 VAC 50/60 Hz for 1 min	
Vibration resistance		Destruction: 10 to 50 Hz, 1.5-mm double-amplitude for 2 hours each in X, Y and Z directions	
Shock resistance		Destruction: 500 m/s2, 3 times each in X, Y and Z directions	
Degree of protection		IEC60529: IP62 (with the operation cover closed)	
Connection method		Pre-wired Standard cable length: 5 m (see note 2)	Connector (M12 5-pin connector) Standard cable length: 2 m (see note 2)
Weight (including package)		Approx. 360 g	Approx. 230 g
Materials	Case, display window	ABS resin	
	Lens	Acrylic resin	
	Operation cover	Nylon (PA6)	
Accessories		Instruction manual	

Note: 1 . The F3W-D052□P Emitters are provided with the external picking indicator output line shown in the following table.I

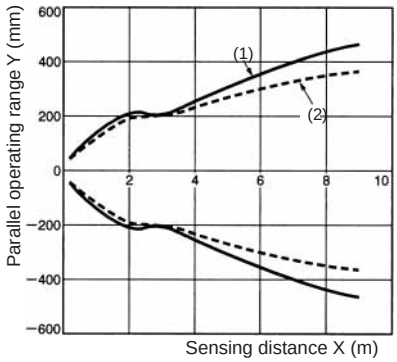
Item	F3W-D052AP, F3W-D052BP
Connection method	Pre-wired with connector (standard cable length: 300 mm) Connector model: SMP-02V-NC (manufactured by Nihon Crimp Terminal, Ltd.)
Electrical specifications	Output current: 50 mA max. Output voltage: Fixed at sensor power supply voltage

2 . The following cable lengths are also available.
F3W-D052A(P): 2 m, 7 m
F3W-D052B(P): 1 m, 3.5 m

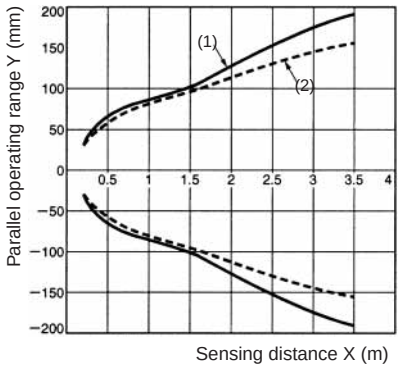
Engineering Data

Parallel Operating Range (Typical)

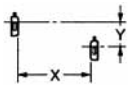
LONG Mode



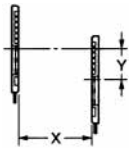
SHORT Mode



(1) Horizontal Movement Characteristics

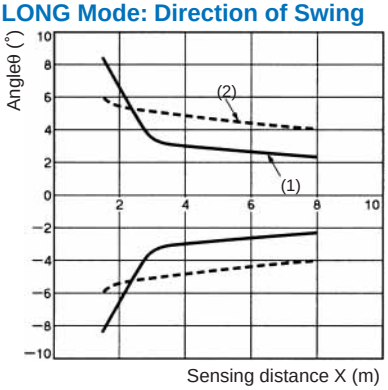


(2) Vertical Movement Characteristics

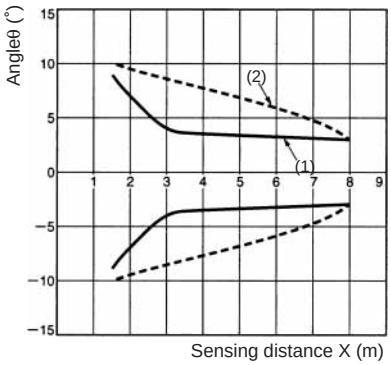


Angle Characteristics (Typical)

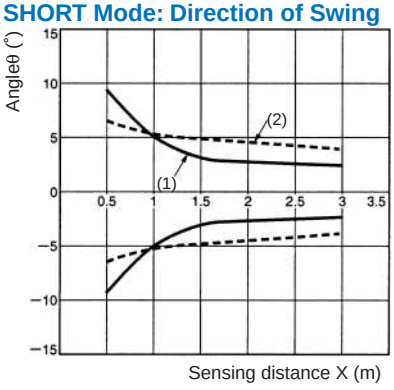
LONG Mode: Direction of Swing



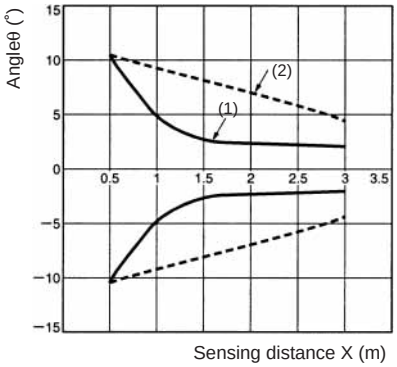
LONG Mode: Direction of Rotation



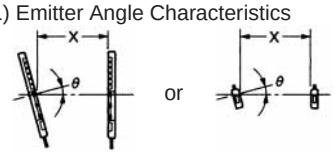
SHORT Mode: Direction of Swing



SHORT Mode: Direction of Rotation

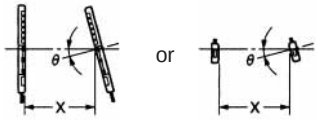


(1) Emitter Angle Characteristics



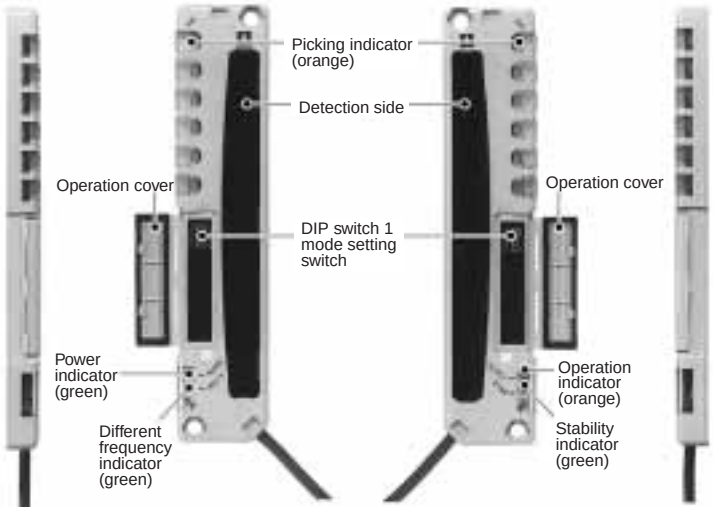
(Direction of swing) (Direction of rotation)

(2) Receiver Angle Characteristics



(Direction of swing) (Direction of rotation)

Nomenclature



NPN Open Collector Output Models

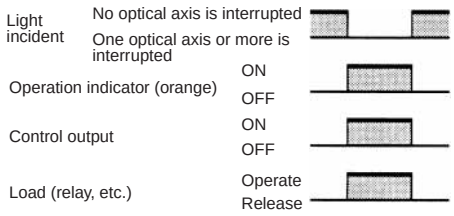
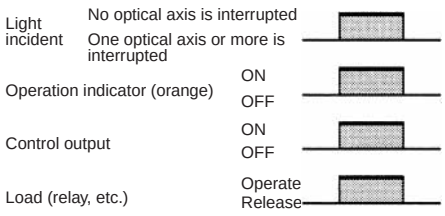
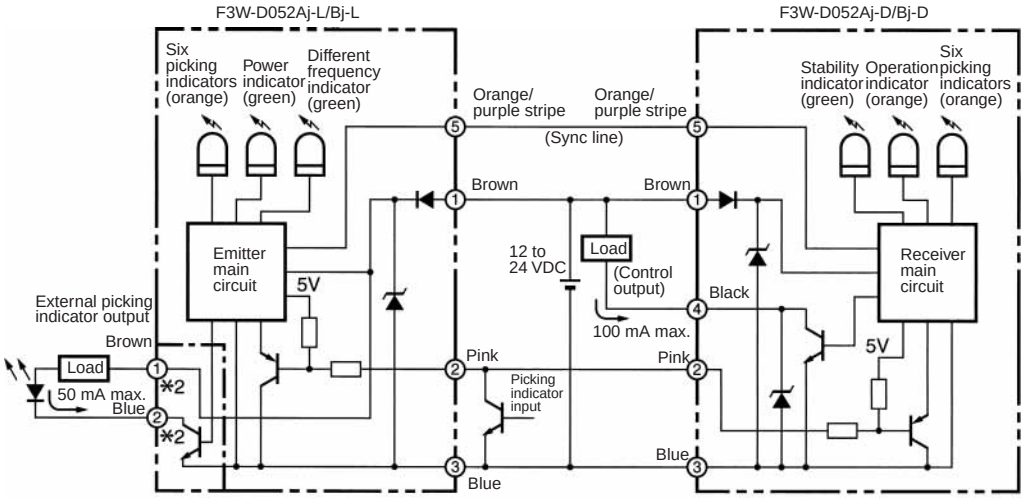
Emitter	Receiver
F3W-D052A(P)-L	F3W-D052A(P)-D
F3W-D052B(P)-L	F3W-D052B(P)-D

PNP Open Collector Output Models

Emitter	Receiver
F3W-D052C(P)-L	F3W-D052C(P)-D
F3W-D052D(P)-L	F3W-D052D(P)-D

Operation

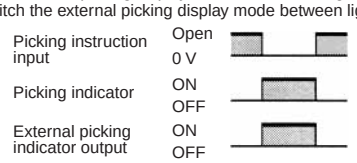
Output Circuits NPN

Output form	NPN open collector output	
Model	F3W-D052A, F3W-D052AP, F3W-D052B, F3W-D052BP	
State of output transistor	Dark-ON mode ON: One optical axis or more is interrupted OFF: No optical axis is interrupted	Light-ON mode ON: No optical axis is interrupted OFF: One optical axis or more is interrupted
Timing chart		
Mode Selector	D.ON (Dark-ON)	L.ON (Light-ON)
Output circuit		

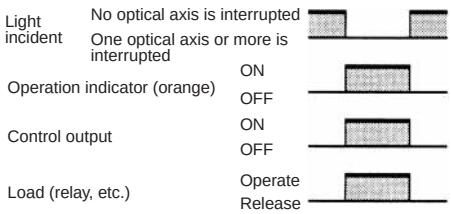
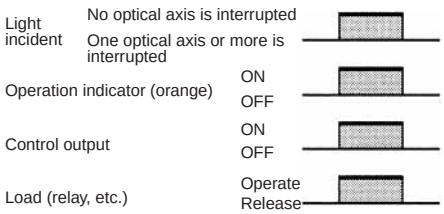
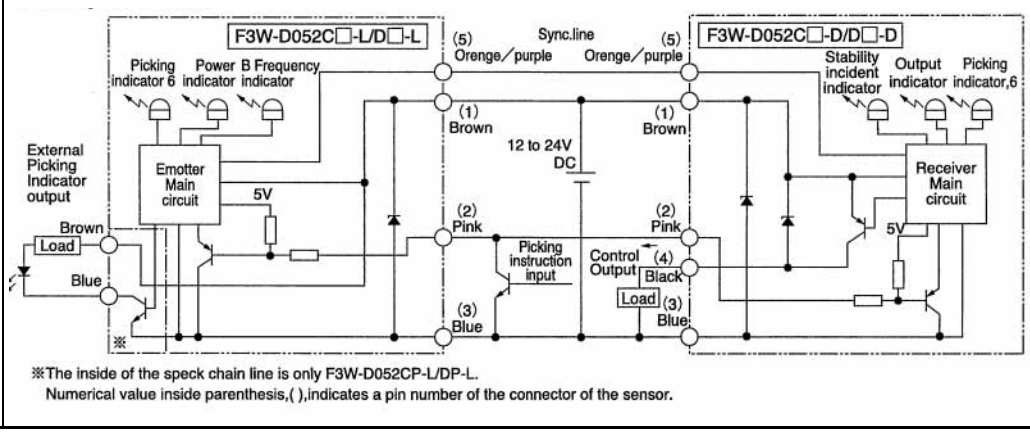
*1 The sections surrounded by single-dashed lines are applicable to the F3W-D052AP-L/BP-L only.

*2 The circled numbers represent external picking indicator output pin numbers for a connector relay type.

The following diagram shows the relationship between picking instruction input, picking indicator status, and external picking indicator output. DIP switch 1 is used to switch the picking display mode between all lighting, all flashing, elevator-like lighting, and accordion-like lighting. It is also possible to switch the external picking display mode between lighting and flashing.



Output Circuits PNP

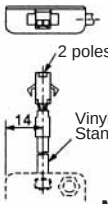
Output form	PNP open collector output	
Model	F3W-D052C, F3W-D052CP, F3W-D052D, F3W-D052DP	
State of output transistor	Dark-ON mode ON: One optical axis or more is interrupted OFF: No optical axis is interrupted	Light-ON mode ON: No optical axis is interrupted OFF: One optical axis or more is interrupted
Timing chart		
Mode Selector	D.ON (Dark-ON)	L.ON (Light-ON)
Output circuit	 ※The inside of the speck chain line is only F3W-D052CP-L/DP-L. Numerical value inside parenthesis,( ),indicates a pin number of the connector of the sensor.	

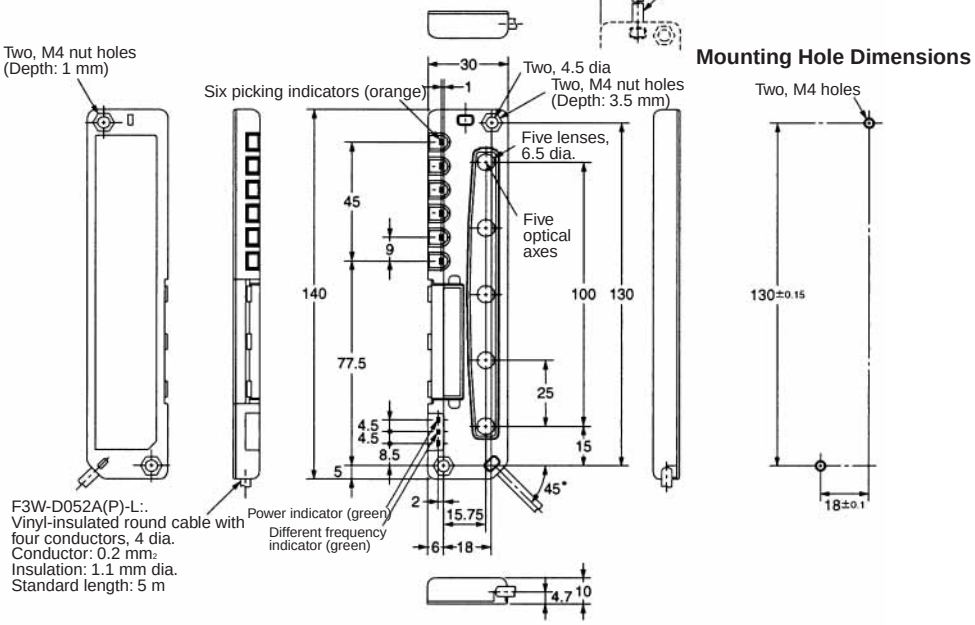
Dimensions

F3WD

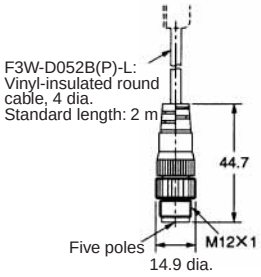
Emitter

F3W-D052A(P)-L
F3W-D052B(P)-L
F3W-D052C(P)-L
F3W-D052D(P)-L



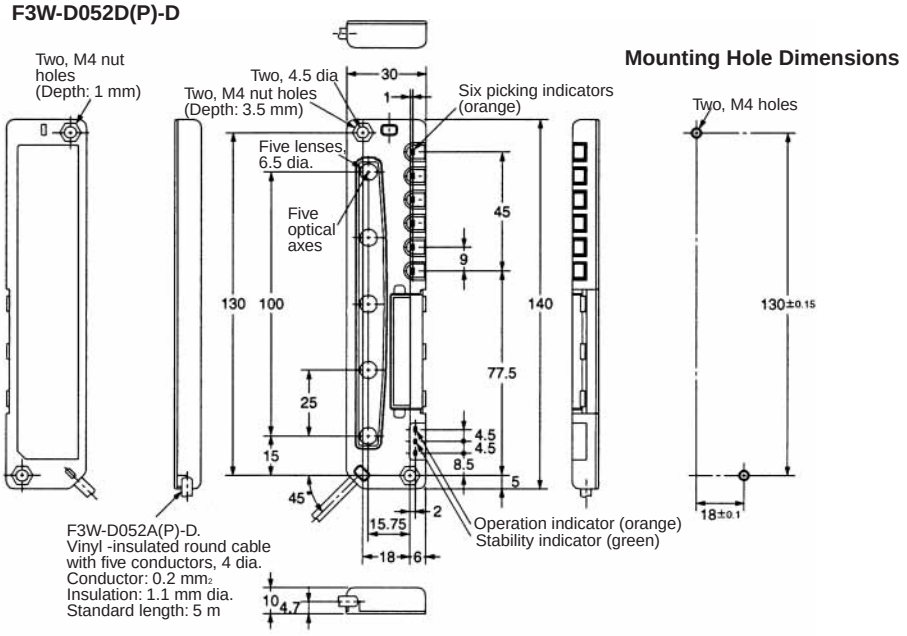


Mounting Hole Dimensions

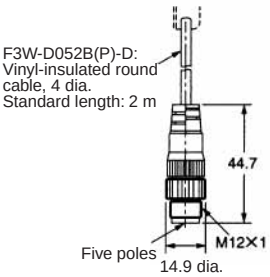


Receiver

F3W-D052A(P)-D
F3W-D052B(P)-D
F3W-D052C(P)-D
F3W-D052D(P)-D



Mounting Hole Dimensions

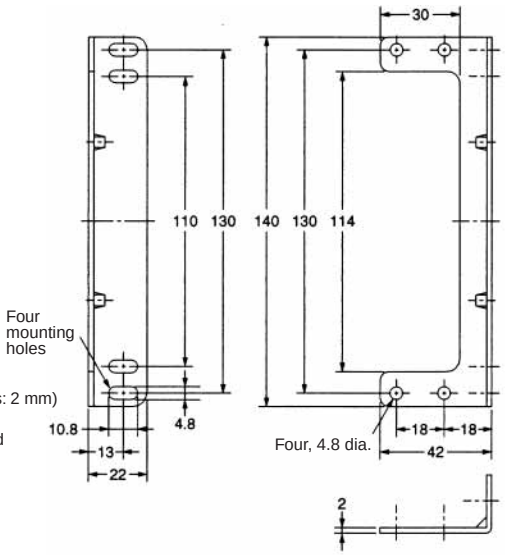


Note: All units are in millimeters unless otherwise indicated

Accessories (Sold Separately)

Mounting Brackets

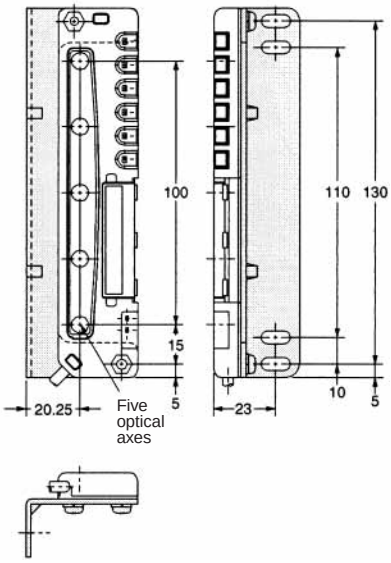
F39-L10 (L-shaped)



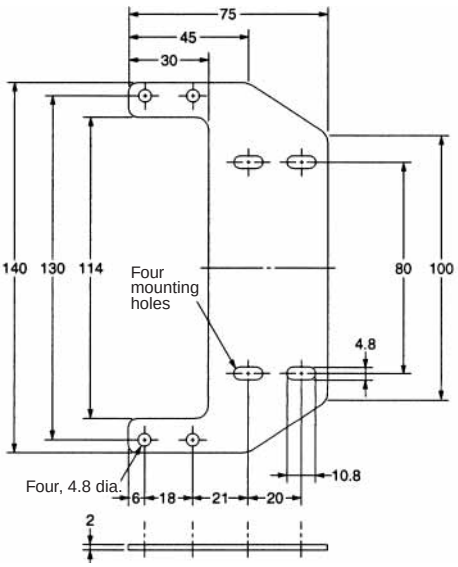
Material: Steel (Thickness: 2 mm)

Mounting screws provided

F3W-D052A-D with Mounting Bracket



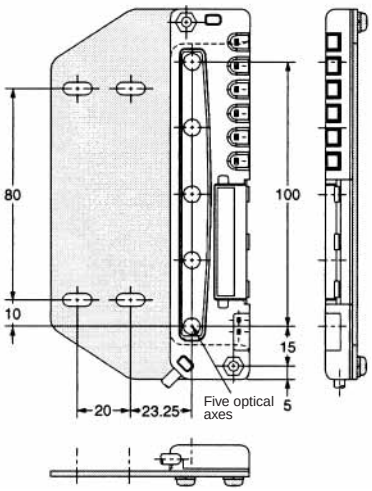
F39-L11 (Flat)



Material: Steel (Thickness: 2 mm)

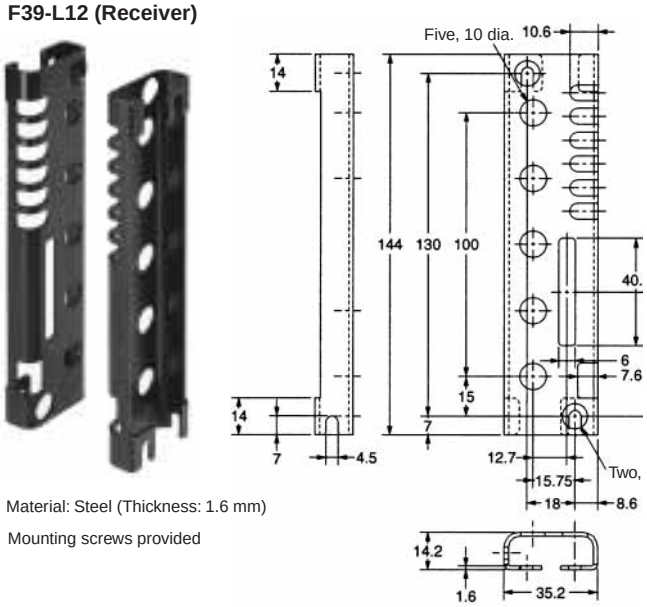
Mounting screws provided

F3W-D052A-D with Mounting Bracket



Protective Bracket

F39-L12 (Receiver)



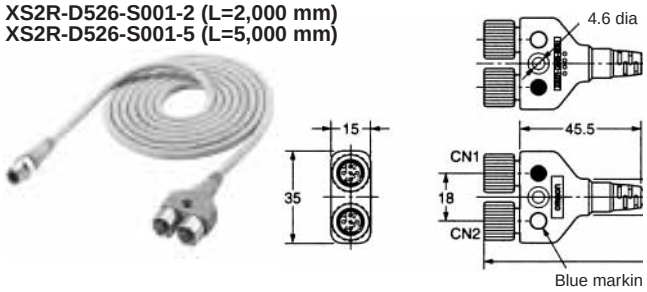
Material: Steel (Thickness: 1.6 mm)

Mounting screws provided

Note: The Emitter and Receiver are axially symmetrical.

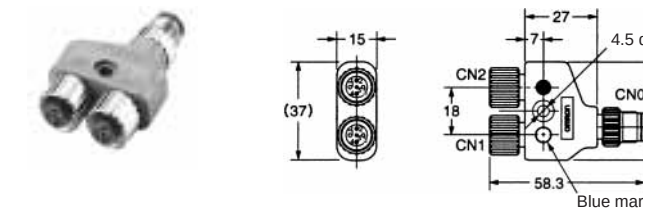
Y-shaped Joint Plugs and Sockets (Double-ended Connectors)

XS2R-D526-S001-2 (L=2,000 mm)
XS2R-D526-S001-5 (L=5,000 mm)



Y-shaped Joint Plugs and Sockets without cable

XS2R-D526-S003



Precautions

⚠ Warning:
Do not apply the F3W-D as safety mechanisms used in pressing machines or any other safety mechanisms for protecting the human body from danger.

1. Do not apply the F3W-D as safety mechanisms used in pressing machines, shears, rolling machines, spinning machines, cotton mill machines, or robots for the protection of an operator's hands and body
2. The F3W-D is designed for detection of the human body or moving objects in the detection area but not for protection against danger.
3. The F3W-D or any product incorporating the F3W-D may be exported to any country. Should the F3W-D cause any problem conflicting with the local law or related to product liability locally, however, OMRON shall, without exception, assume no responsibility for it.

⚠ Caution
Before using more than one F3W-D Unit in parallel or serial, take necessary countermeasures against mutual interference so that the unit will not malfunction. Refer to *Mutual Interference Attenuating Function*.

General Precautions

Supply Voltage
Make sure that the supply voltage is within the rated range. If the supply voltage is not within the rated range or 100 VAC is imposed on a DC Sensor model, the Sensor may be damaged or malfunction.

Load Short-circuiting
Do not short-circuit the load, otherwise the Sensor may be damaged or malfunction.

Incorrect Wiring
Do not make mistakes in the polarity of power supply or wiring, otherwise the Sensor may be damaged or malfunction.

Connection without Load
Make sure that the load is connected to the Sensor in operation, otherwise the Sensor may be damaged or malfunction.

Operating Environment
Do not use the Sensor in an environment containing flammable or explosive gases.

Do not use the Sensor underwater.

Do not disassemble, repair, or modify the Sensor.

Always turn OFF the system power before installing or replacing the Sensor.

System Design

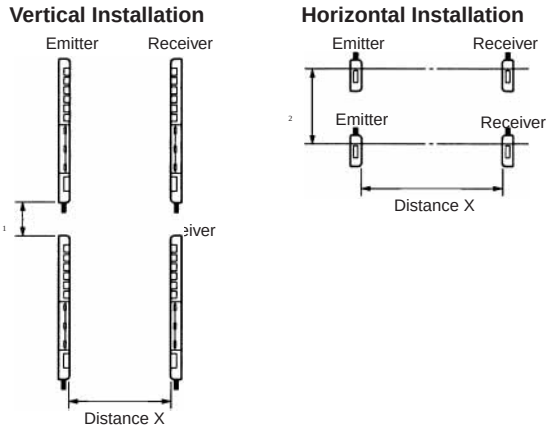
Cables
For both pre-wired and connector models, the maximum tensile force of cables must be 50 N.

Wiring
If the Sensor cables are housed in the same conduit or duct as for high-voltage and power lines, the Sensor may be subject to induced current, resulting in malfunction or damage. For this reason, the Sensor cables must be separated from the high-voltage and power lines or housed in a separate conduit.

Power ON Timing
It takes 100 ms for the Sensor to operate properly after it is turned ON. Therefore, other devices should be turned ON at least 100 ms after the Sensor is turned ON. If the Sensor and the load are connected to different power supplies, the Sensor power must be turned ON first.

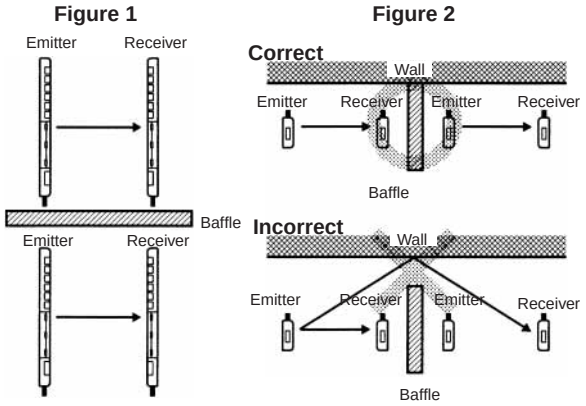
Power Supply
When using a commercially available switching regulator, always ground it to the frame ground (FG) or ground (G) terminal. Otherwise, switching noise may result in malfunctions.

Mutual Interference Attenuating Function
1. Two Sets of Sensors:
   Set these Sensors to different frequencies with the frequency selector. Refer to *DIP Switch 1 Mode Switching* later in this datasheet.
   If the mutual interference attenuating function is not used, and there are two Sensors with the same frequency setting, a beam from the Emitter of one Sensor may hit the Receiver of the other Sensor, resulting in malfunction.
   This function cannot prevent mutual interference between the F3W-D Sensor and a Photoelectric Sensor of another model.
2. Three or More Sets of Sensors:
   When 3 or more sets of Sensors are used in parallel, mutual interference may result in malfunction. Take the following measures to prevent mutual interference, and check for mutual interference.
   - While in LONG mode, the Sensors are more easily affected by interference. Therefore, if the distance between the Emitter and Receiver of a Sensor is 1 m or less, use the SHORT mode.
   - The distance between two adjacent sets of Sensors must be at least ℓ_1 or ℓ_2, which does not cause mutual interference between two Sensors with the same frequency setting. ℓ_1 or ℓ_2 is at least 1.5 times the distance shown in *Parallel Operating Range* of the *Engineering Data*.



• Install a barrier so that there will not be mutual interference between Sensors with the same frequency setting. (See *Figure 1*.)

A light reflection from the wall or floor may go around a barrier and reach the Receivers. Install a barrier so that it will also block any light reflection. (See *Figure 2*.)



Correct Use

DIP Switch 1 Mode Switching

Emitters

DIP switch 1		Function	OFF (left)	ON (right)
	1	Picking display mode setting	(See note 3.)	
	2			
	3	Picking indicator flashing speed setting (see note 1)	SLOW	FAST
	4	External picking display mode setting (see note 4)	Lit	Flashing
	5	NC	---	---
	6	Frequency setting (see note 2)	Frequency A	Frequency B

Receivers

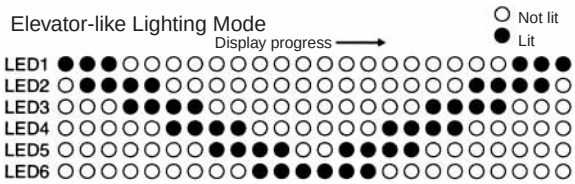
DIP switch 1		Function	OFF (left)	ON (right)
	1	Picking display mode setting	(See note 3.)	
	2			
	3	Picking indicator flashing speed setting (see note 1)	SLOW	FAST
	4	Output mode setting	Dark-ON	Light-ON
	5	Sensing distance (sensitivity) setting	LONG mode (1 to 3 m)	SHORT mode (0.05 to 1 m)
	6	Not used	---	---

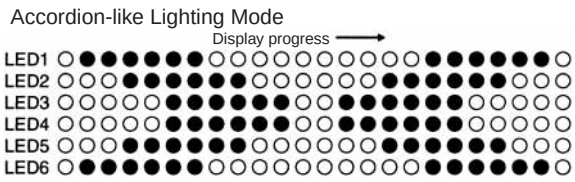
Note: 1 . The flashing speed can be changed in picking display mode (all flashing, elevator-like lighting, or accordion-like lighting) or in external picking display mode. The flashing speed varies with each display mode.

2 . Mutual Interruption Attenuating Function:
The frequency selector is used to switch the emitting frequency between A and B. Making the emitting frequencies of two Sensors different prevents malfunction caused by mutual interference.

3 . Picking Display Mode Setting of DIP Switch 1

DIP switch 1	Pin 1	Pin 2	Display mode
	OFF	OFF	All lighting (All six indicators are lit.)
	ON	OFF	All flashing (All six indicators flash simultaneously.)
	OFF	ON	Elevator-like lighting (Two adjacent indicators simultaneously light so that lighting moves up and down.)
	ON	ON	Accordion-like lighting (Some or all indicators simultaneously light so that lighting moves like an accordion.)





4 . For F3W-D052jP-L Emitters only

Wiring

Before turning ON the power, make sure that the supply voltage is within the maximum allowable voltage range.

Always connect the sync lines.

Extension cables must be 0.3 mm2 or more in cross-sectional area and 100 m or less in length (for the F3W-D052A(P) and F3W-D052B(P) only).

Be very careful not to get metal chips in the connector especially during wiring.

Incorrect wiring may damage the equipment. Make sure that the cable length and routing are appropriate to prevent the connectors and cables from getting disconnected.

Always leave the operation cover closed during operation.

Applying excessive force to the mode selector switch may result in damage. Do not apply a force of more than 5 N.

Cables

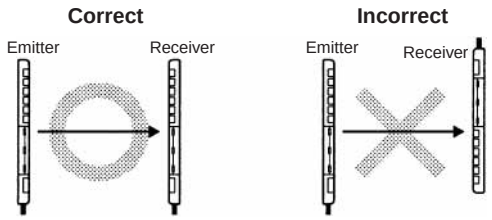
Make sure that the bending radius is 25 mm or more.

Installation

Install the Sensor so that its sensing face will not receive light from the sun, fluorescent lamps, incandescent lamps, and other light sources.

Do not strike the Sensor with a hammer or any other tool during the installation, otherwise the internal circuitry of the Sensor may be damaged.

Install the Emitter and Receiver in the same orientation as shown in the following figure. (The cable pullout direction must be the same.)

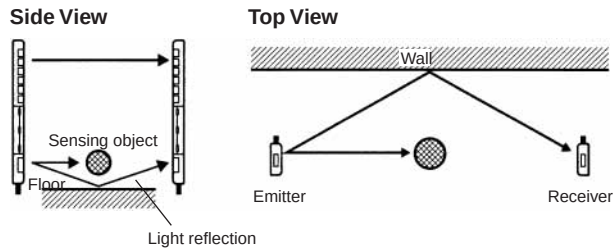


Use M4 screws to secure the Sensor body.

Secure the case to a tightening torque of 1.2 N×m or less.

Reflection from Wall or Floor

If the Emitter and Receiver are installed as shown in the following illustration, all the axes may not be interrupted due to light reflection from the floor or wall. Make sure that the Emitter and Receiver detect the sensing object properly before using the F3W-D in actual operation.



M12 Connectors

Always turn OFF the power before connecting or disconnecting an M12 connector.

Always connect or disconnect an M12 connector by holding its cover.

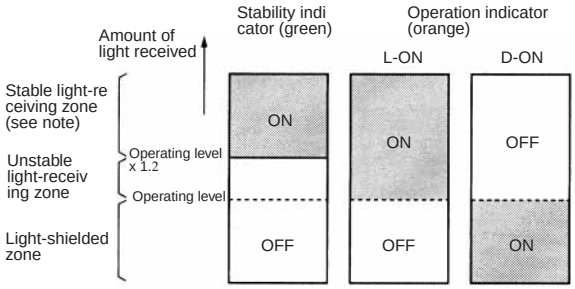
Always tighten the fixture by hand. Using pliers may result in damage.

Insufficient tightening may loosen the connector due to vibration, resulting in failure to ensure the specified degree of protection.

Operation and Stability Status Display

The following illustration shows the indicator status corresponding to each incident level.

Install the Receiver so that the green stability indicators are both ON in light receiving status.



Note: If the Receiver is set to the stable light-receiving zone, it will become more resistant to environmental fluctuations such as temperature, voltage, dust, and setting deviation after installation. For applications where a stable light-receiving zone is not obtained, attention must be paid to environmental fluctuations.

Installation Environment

Do not install the F3W-D Sensor under the following conditions.

- Where direct sunlight is received
- Where humidity is high and there is a risk of condensation
- Where there are corrosive gases
- Where vibration and shock are directly transmitted to the Sensor

Cleaning

- Do not use organic solvents for cleaning. Otherwise, the surfaces of the Sensor will be eroded.
- Use a soft, dry cleaning cloth.

Non Safety Area Sensor

F3ZN

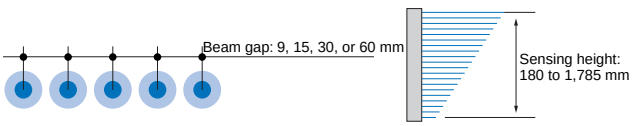
Discrimination of a wide range of shapes makes this sensor ideal for a variety of applications, such as sorting, inspection, quality control and positioning

Features

Fits perfectly into installations!

Protective Height

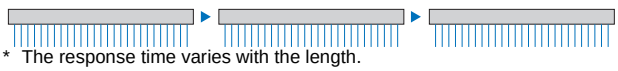
The Scanner can be produced with a beam gap of 9, 15, 30, or 60 mm, and with a sensing height of up to 1,785 mm.



Connects in series for up to 240 beams.

Series Connection Specifications

Up to 3 Scanners can be connected in series to enable sensing with up to 240 beams.



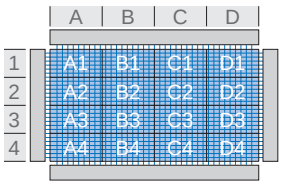
* The response time varies with the length.

Support software for PCs allows functions to be set as desired with programmable I/O.

The status of the beams are output in parallel to allow height and area measurement as well as completeness checks.

- The total number of interrupted (or incident) beams can be output.
- Up to two types of status, such as the number of the highest (or lowest) beam that is interrupted (or incident), can be simultaneously output using 16 points of programmable I/O (P-I/O).

Beams can be handled in groups of a size selected by the user. Dropping position inspections and picking checks are possible.

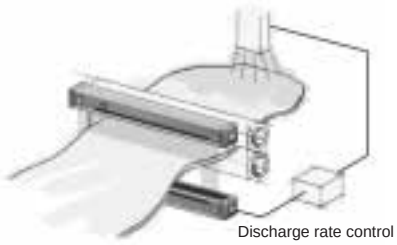


- Beams can be divided into as many as 16 groups.

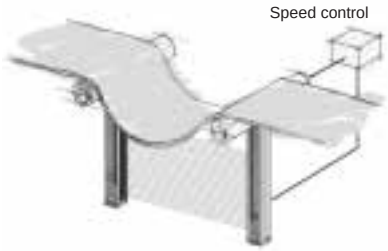
Communication (RS-485/RS-232C) with PLC (Programmable Controllers) is supported.

Applications

Control of discharge rate based on area measurement of coated material



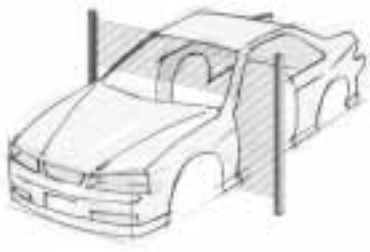
Speed control of sheets based on sag measurement



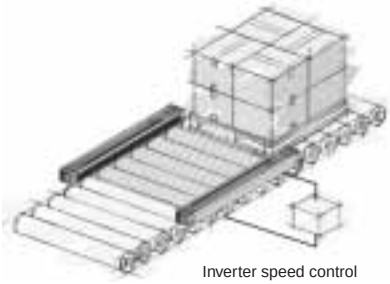
Completeness checks for sheets, quality control

Picking applications (POKA YOKE)

Automatic line changes based on discrimination of car bodies by tracing



Control of stopping position for pallets



Features

Smarter and easier operation with PC control*, providing the optimum function for your needs.

* “Ascan” (for PCs) function setting support software required for PC integration.

Incident Level Monitoring

Conventional area sensors use ON/OFF control. The Area Scanner facilitates analog monitoring of the incident level and so installation and operating status checks and sensitivity adjustment can be performed simply. There are also features that allow smoother threshold setting.

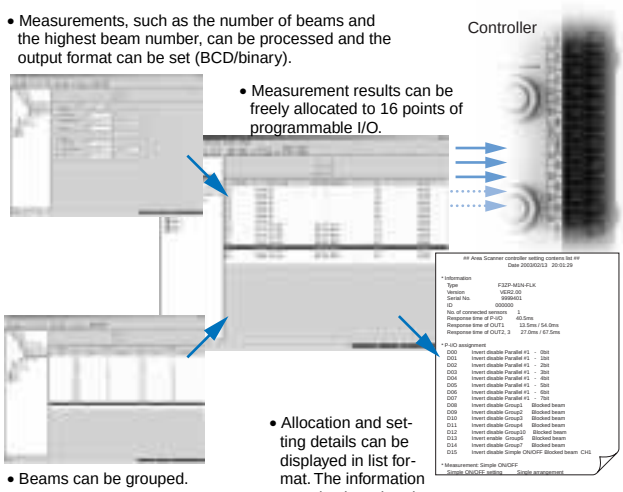
Scan Monitor

It is possible to keep track of ON/OFF data for all beams, together with times. This allows accurate object comparisons and checks based on a variety of settings.

*The screen images shown here may differ from the actual product.

Programmable I/O can be allocated to various measurement processes.

- Measurements, such as the number of beams and the highest beam number, can be processed and the output format can be set (BCD/binary).
- Measurement results can be freely allocated to 16 points of programmable I/O.
- Beams can be grouped.
- Allocation and setting details can be displayed in list format. The information can also be printed or saved as data.

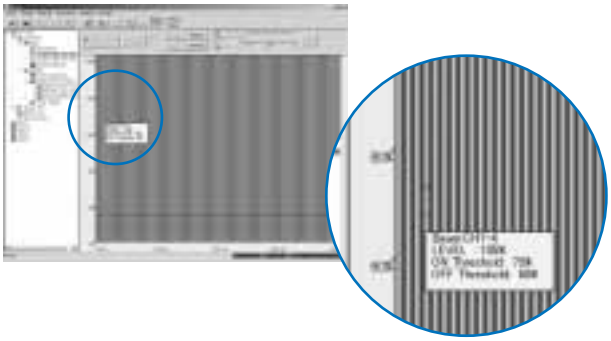


F3ZN

Main Functions of Ascan Ver. 2.10

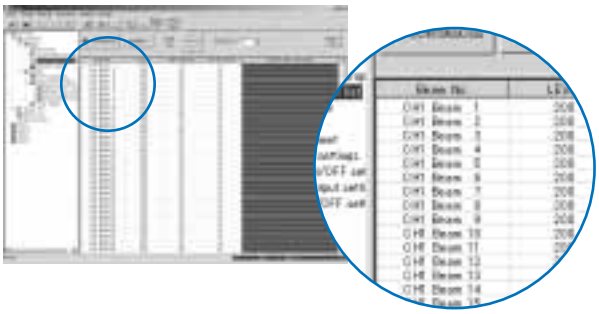
Beam Level Graph

The light receiving sensitivity can be displayed as a graph. ON/OFF sensitivity adjustment is possible.



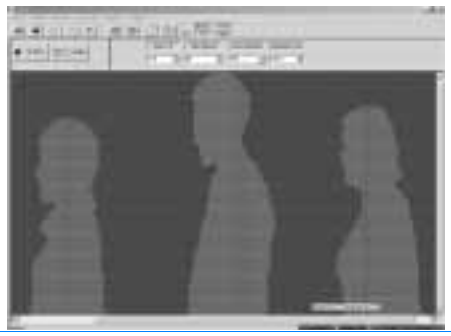
Beam Level List

The light receiving sensitivity can be displayed in digital figures and incident level data can be saved in files.



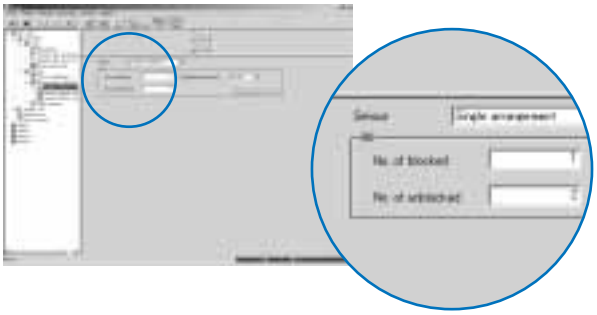
Scan Monitor

The ON/OFF status can be displayed at intervals of a user-set sampling time.



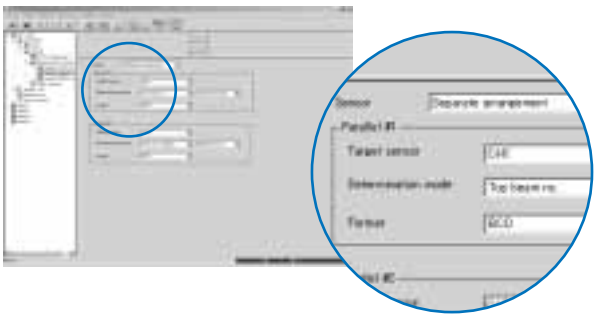
Combined ON/OFF Judgement

Output conditions based on the status of all the beams can be set as required (e.g., ON when 3 or more beams are incident, ON when 2 or more beams are interrupted, etc.)



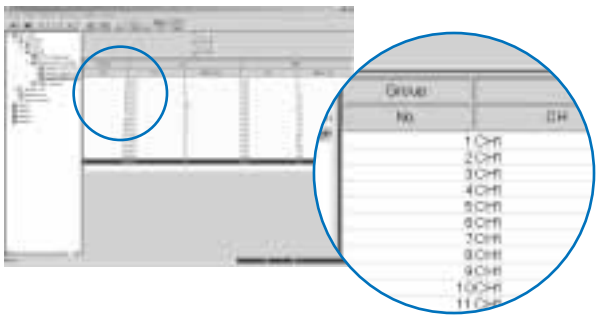
Parallel Output

The output format can be selected as required. For example, it is possible to output the number of the highest incident beam and the total number of interrupted beams.



Group Judgement

Beams within an area can be handled as a group.

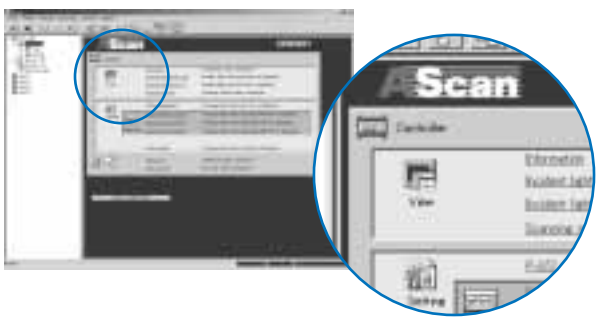


P-I/O (16 Points)

The conditions set for combined ON/OFF judgement, parallel output, and group judgement can be allocated to output as required.

BANK Function

Four banks can be set.



Available Models

Main Units

Sensor Infrared

Appearance	Operating range	Beam gap	Number of beams	Sensing height	Model	
					PNP output	NPN output
	0.2 to 7 m	9 mm	21 to 125 (See *1.)	180 to 1,116 mm	F3ZN- *3 S□□□□P09	F3ZN- S□□□□N09
	0.2 to 10 m	15 mm	13 to 120	180 to 1,785 mm	F3ZN- *3 S□□□□P15	F3ZN- S□□□□N15
		30 mm	7 to 60	180 to 1,770 mm	F3ZN- *3 S□□□□P30	F3ZN- S□□□□N30
		60 mm	4 to 30	240 to 1,740 mm	F3ZN- *3 S□□□□P60	F3ZN- S□□□□N60

*1. Models with a 9-mm beam gap can only be produced for an odd number of beams.
*2. For details on model numbers, refer to page D-364 *Recommended Area Scanner Models*.
*3. PNP version available as at 2004

Controller

Appearance	Output	Model
	PNP	F3ZP-M1P-FLK*1
	NPN	F3ZP-M1N-FLK

*1. PNP version available as at 2004

Accessories (Sold Separately)

Double-ended Connector Cable (Set of 2 for Emitter and Receiver)

Appearance	Cable length	Specification	Model	Application
	0.2 m	M12 connector (8 pins)	F39-JCR2B	Series connection or connection to the F3ZP-M1□-FLK
	3 m		F39-JC3B	
	7 m		F39-JC7B	Connection to the F3ZP-M1□-FLK
	10 m		F39-JC10B	
	15 m		F39-JC15B	

Area Scanner Function Setting Support Software (AScan)

Appearance	OS	Model
	Consult your OMRON representative.	(English version) F3ZP-CD100-E

Recommended Area Scanner Models

F3ZN-S□□□□N(P)09 and F3ZN-S□□□□N(P)09-01 (Beam gap: 9 mm)

Model	Sensing height	Number of beams
F3ZN-S0180N(P)09(-01)	180 mm	21
F3ZN-S0288N(P)09(-01)	288 mm	33
F3ZN-S0432N(P)09(-01)	432 mm	49
F3ZN-S0576N(P)09(-01)	576 mm	65
F3ZN-S0720N(P)09(-01)	720 mm	81
F3ZN-S0864N(P)09(-01)	864 mm	97
F3ZN-S1008N(P)09(-01)	1,008 mm	113
F3ZN-S1116N(P)09(-01)	1,116 mm	125

F3ZN-S□□□□N(P)15 and F3ZN-S□□□□N(P)15-01 (Beam gap: 15 mm)

Model	Sensing height	Number of beams
F3ZN-S0180N(P)15(-01)	180 mm	13
F3ZN-S0390N(P)15(-01)	390 mm	27
F3ZN-S0510N(P)15(-01)	510 mm	35
F3ZN-S0630N(P)15(-01)	630 mm	43
F3ZN-S0750N(P)15(-01)	750 mm	51
F3ZN-S0870N(P)15(-01)	870 mm	59
F3ZN-S0990N(P)15(-01)	990 mm	67
F3ZN-S1110N(P)15(-01)	1,110 mm	75
F3ZN-S1230N(P)15(-01)	1,230 mm	83
F3ZN-S1350N(P)15(-01)	1,350 mm	91
F3ZN-S1470N(P)15(-01)	1,470 mm	99
F3ZN-S1590N(P)15(-01)	1,590 mm	107
F3ZN-S1710N(P)15(-01)	1,710 mm	115
F3ZN-S1785N(P)15(-01)	1,785 mm	120

Connector Type

No extra figures at end of model number	-01 at end of model number
	 (Series connection type)

F3ZN-S□□□□N(P)30 and F3ZN-S□□□□N(P)30-01 (Beam gap: 30 mm)

Appearance	Sensing height	Number of beams
F3ZN-S0180N(P)30(-01)	180 mm	7
F3ZN-S0270N(P)30(-01)	270 mm	10
F3ZN-S0390N(P)30(-01)	390 mm	14
F3ZN-S0510N(P)30(-01)	510 mm	18
F3ZN-S0630N(P)30(-01)	630 mm	22
F3ZN-S0750N(P)30(-01)	750 mm	26
F3ZN-S0870N(P)30(-01)	870 mm	30
F3ZN-S0990N(P)30(-01)	990 mm	34
F3ZN-S1110N(P)30(-01)	1,110 mm	38
F3ZN-S1230N(P)30(-01)	1,230 mm	42
F3ZN-S1350N(P)30(-01)	1,350 mm	46
F3ZN-S1470N(P)30(-01)	1,470 mm	50
F3ZN-S1590N(P)30(-01)	1,590 mm	54
F3ZN-S1710N(P)30(-01)	1,710 mm	58
F3ZN-S1770N(P)30(-01)	1,770 mm	60

F3ZN-S□□□□N(P)60 and F3ZN-S□□□□N(P)60-01 (Beam gap: 60 mm)

Appearance	Sensing height	Number of beams
F3ZN-S0240N(P)60(-01)	240 mm	5
F3ZN-S0300N(P)60(-01)	300 mm	6
F3ZN-S0420N(P)60(-01)	420 mm	8
F3ZN-S0540N(P)60(-01)	540 mm	10
F3ZN-S0660N(P)60(-01)	660 mm	12
F3ZN-S0780N(P)60(-01)	780 mm	14
F3ZN-S0900N(P)60(-01)	900 mm	16
F3ZN-S1020N(P)60(-01)	1,020 mm	18
F3ZN-S1140N(P)60(-01)	1,140 mm	20
F3ZN-S1260N(P)60(-01)	1,260 mm	22
F3ZN-S1380N(P)60(-01)	1,380 mm	24
F3ZN-S1500N(P)60(-01)	1,500 mm	26
F3ZN-S1620N(P)60(-01)	1,620 mm	28
F3ZN-S1740N(P)60(-01)	1,740 mm	30

Ratings and Performance

Main Units

Common Ratings and Performance Data for F3ZN-S□□□□P□□(-01 to -05) Sensors

Item	Model	F3ZN-S□□□□P09	F3ZN-S□□□□P15	F3ZN-S□□□□P30	F3ZN-S□□□□P60
Operating range		0.2 to 7 m	0.2 to 10 m		
Beam gap		9 mm	15 mm	30 mm	60 mm
Number of beams		21 to 125	13 to 120	7 to 60	4 to 30
Sensing height		180 to 1,116 mm	180 to 1,785 mm	180 to 1,770 mm	240 to 1,740 mm
Minimum detectable object size (non-transparent)		14 mm in diameter	25 mm in diameter	40 mm in diameter	70 mm in diameter
Light source (wavelength)		Infrared LED (870 nm)			
Supply voltage		24 VDC ±10%; ripple (p-p): 10% max.			
Current consumption (under no-load conditions)		Emitter: 170 mA max.; Receiver: 120 mA max.			
Control output		PNP:PNP transistor output (load current: 50 mA) Output 1: Light ON Output 2: Dark ON (default)			
External diagnosis input		Open or 0 to 1.5 VDC: inactive (emitting) 9 to 24 VDC: active (emitting OFF), short-circuit current is 3 mA max.			
Indicators	Emitter	Incident level indicators (green): 5 LED indicators that turn ON/OFF according to the amount of incident light. Error indicators (red): 3 LED indicators that turn ON/OFF according to the type of errors that occur. Power indicator (green): Turns ON for normal operation; flashes when errors occur. External diagnosis indicator (orange): Turns ON in response to external diagnosis input.			
	Receiver	Incident level indicators (green): 5 LED indicators that turn ON/OFF according to the amount of incident light. Error indicators (red): 3 LED indicators that turn ON/OFF according to the type of errors that occur. Control output 1 operation indicator (orange): Turns ON when light is incident. Control output 2 operation indicator (orange): Turns ON when light is interrupted (factory setting). Power indicator (green): Turns ON for normal operation; flashes when errors occur. Function indicator (green): Turns ON when option is set.			
Protection		Reverse polarity protection (for power supply) and output short-circuit protection			
Response time		Refer to page D-368 for details.			
Ambient light intensity		Light intensity on the receiver surface: Incandescent lamp: 3,000 lx max. Sunlight: 10,000 lx max.			
Ambient temperature		Operating: -10 to 55 °C; Storage: -30 to 70 °C (with no icing or condensation)			
Ambient humidity		Operating/storage: 30% to 95% (with no condensation)			
Insulation resistance		20 MΩ min. (at 500 VDC)			
Dielectric strength		1,000 VAC, 50/60 Hz for 1 min			
Vibration resistance (malfunction)		10 to 55 Hz with a 0.7-mm double amplitude, 20 sweeps each in X, Y, and Z directions			
Shock resistance (malfunction)		100m/s^2, 1,000 times each in X, Y, and Z directions			
Degree of protection		IP65 (IEC)			
Connection method		M12 connector			
Weight (in packaging)		(Protective height + 100) × 2 + 2,100 g			
Materials	Case	Aluminum			
	Front cover	Acrylic (PMMA resin)			
	Cable	Oil-resistant PVC			
Accessories		Top, bottom, and intermediate* mounting brackets, and instruction manual			

* Intermediate mounting brackets are supplied only with the following models:
Models with a total length between 640 and 1,280 mm: One set (i.e., one each for emitter and receiver)
Models with a total length greater than 1,280 mm: Two sets (i.e., two each for emitter and receiver)

* PNP models available as of 2004.

Main Units

Common Ratings and Performance Data for F3ZN-S□□□□N□□(-01 to -05) Sensors

Item	Model	F3ZN-S□□□□N09	F3ZN-S□□□□N15	F3ZN-S□□□□N30	F3ZN-S□□□□N60
Operating range		0.2 to 7 m	0.2 to 10 m		
Beam gap		9 mm	15 mm	30 mm	60 mm
Number of beams		21 to 125	13 to 120	7 to 60	4 to 30
Sensing height		180 to 1,116 mm	180 to 1,785 mm	180 to 1,770 mm	240 to 1,740 mm
Minimum detectable object size (non-transparent)		14 mm in diameter	25 mm in diameter	40 mm in diameter	70 mm in diameter
Light source (wavelength)		Infrared LED (870 nm)			
Supply voltage		24 VDC ±10%; ripple (p-p): 10% max.			
Current consumption (under no-load conditions)		Emitter: 170 mA max.; Receiver: 120 mA max.			
Control output		NPN:NPN transistor output (load current: 50 mA) Output 1: Light ON Output 2: Dark ON (default)			
External diagnosis input		Open or 9 to 24 VDC: inactive (emitting) 0 to 1.5 VDC: active (emitting OFF), short-circuit current is 3 mA max.			
Indicators	Emitter	Incident level indicators (green): 5 LED indicators that turn ON/OFF according to the amount of incident light. Error indicators (red): 3 LED indicators that turn ON/OFF according to the type of errors that occur. Power indicator (green): Turns ON for normal operation; flashes when errors occur. External diagnosis indicator (orange): Turns ON in response to external diagnosis input.			
	Receiver	Incident level indicators (green): 5 LED indicators that turn ON/OFF according to the amount of incident light. Error indicators (red): 3 LED indicators that turn ON/OFF according to the type of errors that occur. Control output 1 operation indicator (orange): Turns ON when light is incident. Control output 2 operation indicator (orange): Turns ON when light is interrupted (factory setting). Power indicator (green): Turns ON for normal operation; flashes when errors occur. Function indicator (green): Turns ON when option is set.			
Protection		Reverse polarity protection (for power supply) and output short-circuit protection			
Response time		Refer to page D-368 for details.			
Ambient light intensity		Light intensity on the receiver surface: Incandescent lamp: 3,000 lx max. Sunlight: 10,000 lx max.			
Ambient temperature		Operating: -10 to 55 °C; Storage: -30 to 70 °C (with no icing or condensation)			
Ambient humidity		Operating/storage: 30% to 95% (with no condensation)			
Insulation resistance		20 MΩ min. (at 500 VDC)			
Dielectric strength		1,000 VAC, 50/60 Hz for 1 min			
Vibration resistance (malfunction)		10 to 55 Hz with a 0.7-mm double amplitude, 20 sweeps each in X, Y, and Z directions			
Shock resistance (malfunction)		100m/s^2, 1,000 times each in X, Y, and Z directions			
Degree of protection		IP65 (IEC)			
Connection method		M12 connector			
Weight (in packaging)		(Protective height + 100) × 2 + 2,100 g			
Materials	Case	Aluminum			
	Front cover	Acrylic (PMMA resin)			
	Cable	Oil-resistant PVC			
Accessories		Top, bottom, and intermediate* mounting brackets, and instruction manual			

* Intermediate mounting brackets are supplied only with the following models:
Models with a total length between 640 and 1,280 mm: One set (i.e., one each for emitter and receiver)
Models with a total length greater than 1,280 mm: Two sets (i.e., two each for emitter and receiver)

Ratings and Performance

Main Units

Controller

Item	Model	F3ZP-M1N-FLK	F3ZP-M1P-FLK
Supply voltage		24 VDC ±10%; ripple (p-p): 10% max.	
Current consumption		50 mA max. (not including the Sensor's current consumption and output current)	
Connectable Sensors		F3ZN-S□□□□N□□	F3ZN-S□□□□P□□
Number of connectable Sensors		3 sets of Sensors and Sensor configurations with 240 beams.	
Output (OUT1, OUT2, OUTPUT (OUT3, ERROR, BANK OUT, TCH OUT))		Load supply voltage: 24 VDC max.; NPN open collector output (load current: 30 mA max.)	Load supply voltage: 24 VDC max.; PNP open collector output (load current: 30 mA max.)
Input (TCH, EDI, RESET, BANKIN, BANK1, BANK2)		DC input: Maximum input voltage: 24 V ±10% Operating voltage: ON voltage: 9 V min.; OFF voltage: 1.5 V max. Input current: 3 mA max.	
Programmable I/O ports (D00 to D15)	Output	Function can be configured by AScan software.	
		Load supply voltage: 24 VDC max.	
		NPN open collector output (load current: 50 mA max.)	PNP open collector output (load current: 30 mA max.)
	Input	DC input; Input voltage: 24 V ±10%; Input current: 3 mA max.	
	Operating voltage	ON voltage: 9 V min. OFF voltage: 1.5 V max.	ON voltage: 1.5 V max. OFF voltage: 9 V min.
Communications functions	Communications ports	RS-232 port (D-sub 9-pin connector) and RS-485 port (terminal block) (DIP-Switch setting)	
	Communications protocol	CompoWay/F	
	Unit numbers	00 to 15 (Set by rotary switch.)	
	Baud rate	9,600, 14,400, 19,200, 38,400, 57,600, or 115,200 bps (Selected by switch.)	
	Data configuration	Data bits: 7; Parity: Even; Start bits: 1; Stop bits: 2; No flow control	
Clock function		Year, month, day, hour, minute, second, and day of week	
Indicators		POWER (green), MODE (green), RUN (green), and ERROR (red)	
Protection		Reverse polarity protection (for power supply) and output short-circuit protection	
Response time		Refer to page D-368 for details.	
Ambient temperature		Operating: -10 to 55 °C; Storage: -20 to 75 °C (with no icing or condensation)	
Ambient humidity		Operating/storage: 10% to 90% (with no condensation)	
Insulation resistance		20 MΩ min. (at 500 VDC) between all terminals and the case	
Dielectric strength		1,000 VAC, 50/60 Hz for 1 min; Leakage current: 10 mA max.	
Vibration resistance (destruction)		Conforms to IEC 60068-6 10 to 57 Hz with 0.075-mm double amplitude and 57 to 150 Hz with acceleration of 9.8 m/s^2 for 80 min each in X, Y, and Z directions (10 sweeps × 8 min per sweep = 80 min)	
Shock resistance (destruction)		Conforms to IEC 60068-27 147 m/s^2, 3 times each in X, Y, and Z directions	
Structure		Built into panel, DIN-Rail mounting	
Accessories		RS-232C connector (plug, cover) and instruction manual	

* PNP models available as of 2004

Response Times

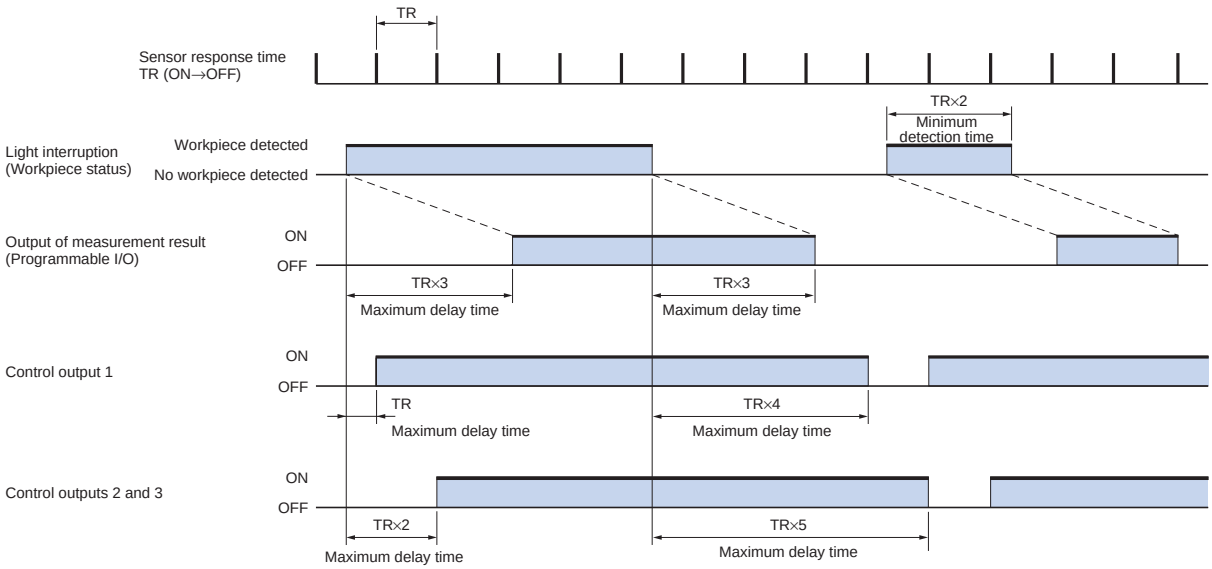
Detection Output Response Times

The response times vary with the length (sensing height) of the Sensor.

Model		Sensing height (mm)			
F3ZN-S□□□□N(P)09 (-01 to -05)		**0180 to 0441**	**0450 to 0756**	**0765 to 1071**	**1080 to 1116**
F3ZN-S□□□□N(P)15/30/60		**0180 to 0735**	**0750 to 1260**	**1275 to 1785**	**---**
Control output 1	ON→ OFF	11 ms	13.5 ms	16 ms	16.5 ms
	OFF→ ON	44 ms	54 ms	64 ms	66 ms
Control outputs 2 and 3	ON→ OFF	22 ms	27 ms	32 ms	33 ms
	OFF→ ON	55 ms	67.5 ms	80 ms	82.5 ms
Programmable I/O (D00 to D15)		33 ms	40.5 ms	48 ms	49.5 ms

Note: The response times for control outputs 2 and 3 given in the above table are for when the output is set to “Light-ON” (i.e., ON if the beam is incident), which is the same setting as control output 1.

Timing Chart for the Period between Workpiece Detection and Output Response



TR: Response time of control output 1 (ON→OFF). (Refer to Detection Output Response Times.)

Minimum detection time: The minimum time in which changes in the interrupted (or incident) state can be detected.

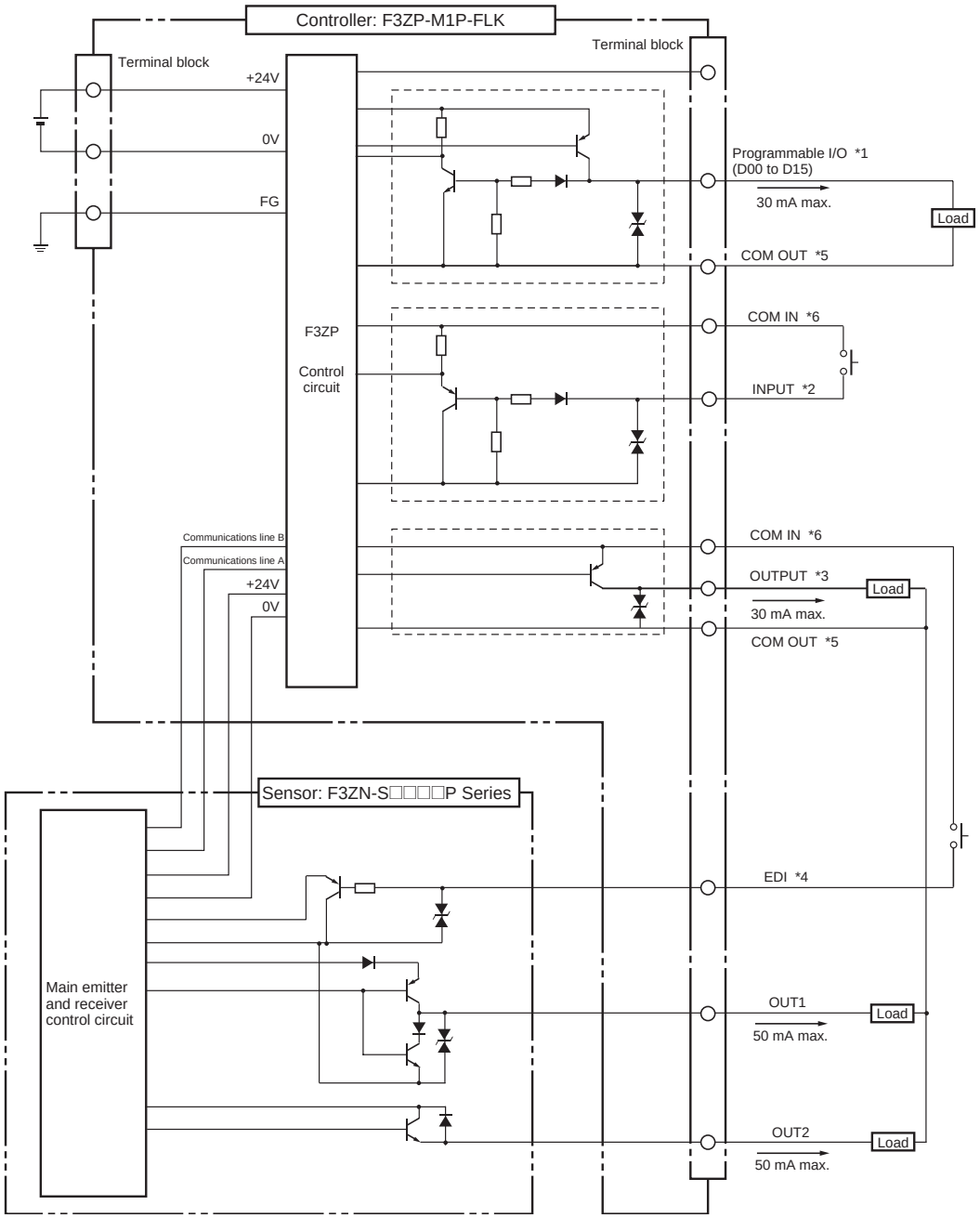
Minimum detection time for programmable I/O = TR × 2
Minimum detection time for control outputs 1, 2, and 3 (interrupted) = TR
Minimum detection time for control outputs 1, 2, and 3 (incident) = TR × 3

Maximum delay time (maximum response time): The maximum time between light interruption (or incidence) and the resulting change in output.

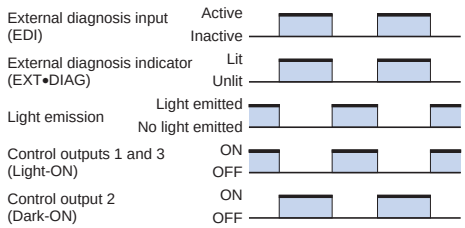
Maximum delay time for programmable I/O output (D00 to D15) = TR × 3
Maximum delay time for control output 1 (interrupted) = TR
Maximum delay time for control output 1 (incident) = TR × 4
Maximum delay time for control outputs 2 and 3 (interrupted) = TR × 2
Maximum delay time for control outputs 2 and 3 (incident) = TR × 5

Note: Consult your OMRON representative for details on response times when the Sensors are connected in series.

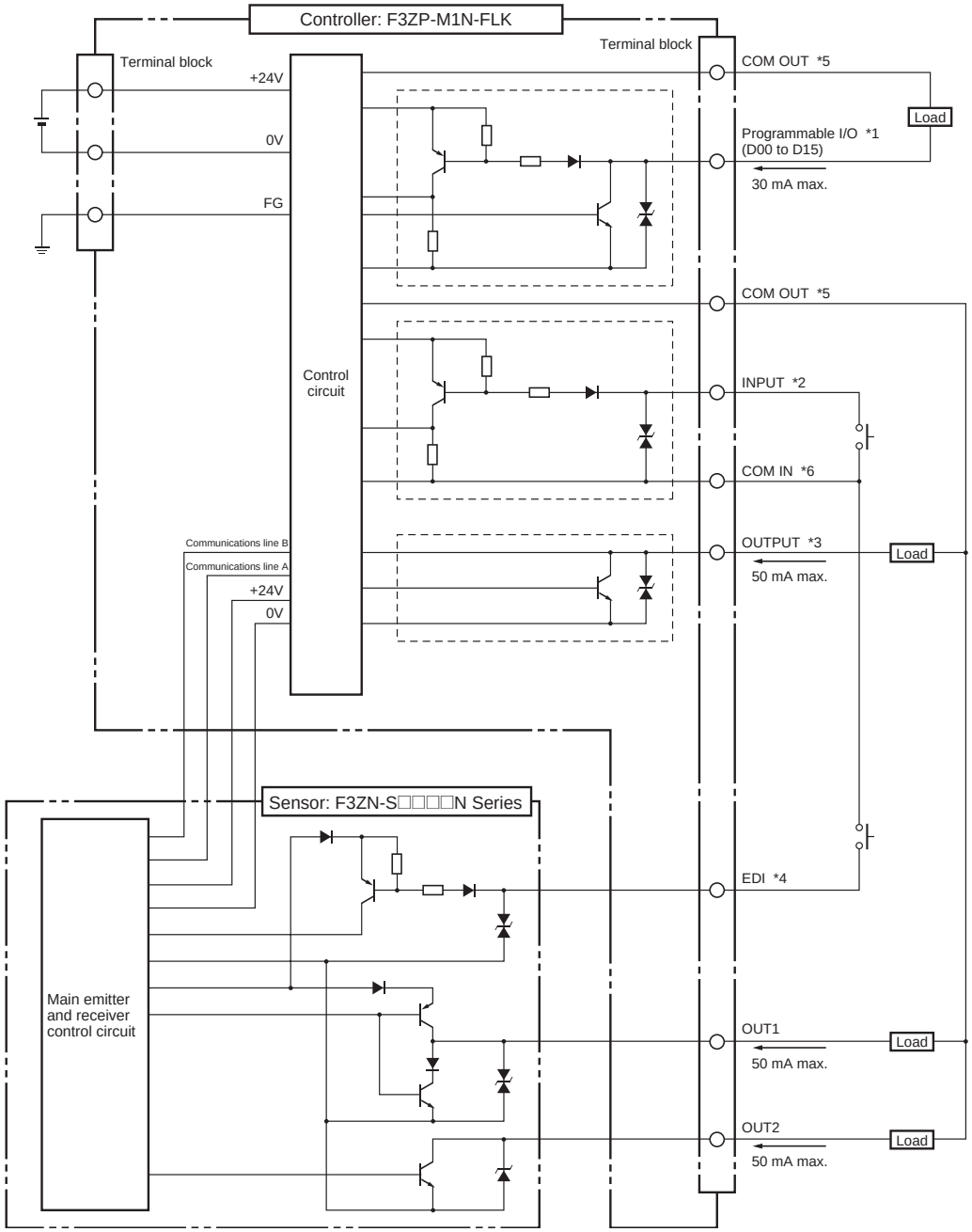
I/O Block Circuit Diagram



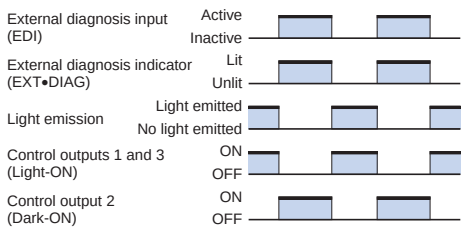
Timing Chart for External Diagnosis Function (Stable Incidence)



*1. INPUT is used for RESET and TCH.
*2. OUTPUT is used for OUT3, ERROR, and TCH OUT.
*3. EDI is external diagnosis input.
*4. COM OUT is connected to +24V.
*5. COM IN is connected to 0V.



Timing Chart for External Diagnosis Function (Stable Incidence)

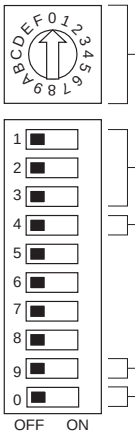


*6. INPUT is used for RESET and TCH.
*7. OUTPUT is used for OUT3, ERROR, and TCH OUT.
*8. EDI is external diagnosis input.
*9. COM OUT is connected to +24V.
*10. COM IN is connected to 0V.

Controller Communications Settings

Mode Selection Switch

If necessary, make changes to the communications settings using the mode selection switch.
The baud rate is factory-set to 9,600 bps and the unit number is factory-set to 1.



Unit number selection switch
(Unit number: Rotary switch number)

Baud rate selection pins
(Baud rate: Pins 1, 2, and 3 of the DIP switch)

Pin number			Baud rate
1	2	3	
OFF	OFF	OFF	9,600 bps
ON	OFF	OFF	14,400 bps
OFF	ON	OFF	19,200 bps
ON	ON	OFF	38,400 bps
OFF	OFF	ON	57,600 bps
ON	OFF	ON	115,200 bps

Baud rate selection pin
(Communications port: Pin 4 of the DIP switch)

Pin 4	Communications port
OFF	RS-232C
ON	RS-485

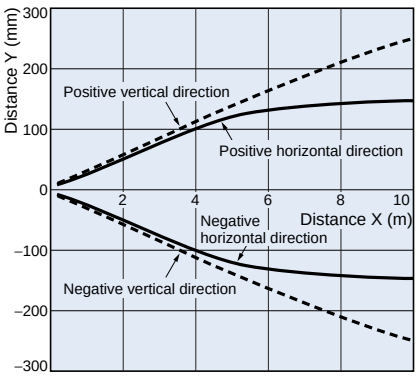
Be sure to set pin 9 of the DIP switch to OFF.

This is the termination setting for RS-485 communications.
Set to ON if used as the termination point (normally OFF).

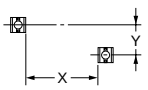
Engineering Data (Typical Examples)

Parallel Operating Range

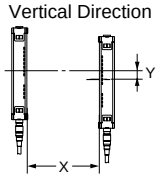
F3ZN-S□□□□N(P)09(-01)



Horizontal Direction

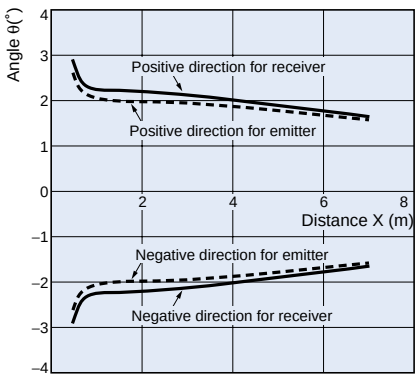


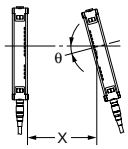
Vertical Direction



Angular Range (Angle of Elevation)

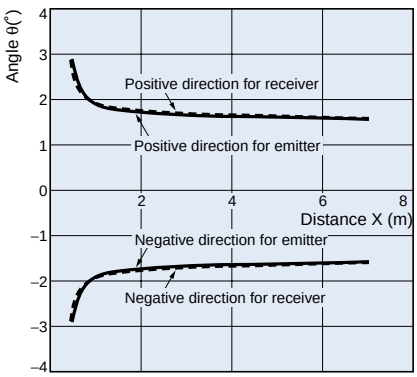
F3ZN-S□□□□N(P)09(-01)

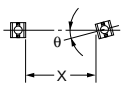




Angular Range (Angle of Rotation)

F3ZN-S□□□□N(P)09(-01)





⚠ WARNING

Do not use the F3ZN area scanner as a safety device in pressing machines or as a safety device for protecting the human body in any other kind of installation. Use F3S□ safety sensors.

(1) Do not use the Scanner in environments where flammable or explosive gases are present.
(2) The Scanner cannot be used as a safety device for protecting the operator's hands or any other part of the body in pressing machines, shears, rolling machines, spinning machines, cotton mill machines, or robots.
(3) This product is designed for applications such as detecting the entrance of human bodies into the operator area and detecting moving objects. It is not designed for use as a safety device.
(4) If this product is used in exported equipment in any of the ways 1) to 4) listed below, OMRON shall accept no responsibility for any problems concerning local law or product liability.
   1) Application as a safety device for preventing injury resulting from the operator's hands or any other part of the body entering a dangerous area
   2) Application in interlocks in machinery or installations
   3) Application as a safety device that detects the presence of the operator's hands or any other part of the body in a dangerous area and stops the machinery or installation in which it is incorporated
   4) Application as a sensing device in installations for preventing access to dangerous areas by detecting the operator's hands or any other part of the body, and opening/closing a window or door

⚠ Caution

When using more than one Scanner installed close together, in order to prevent malfunctions due to mutual interference, be sure to observe the points mentioned under *Preventing Mutual Interference*.

Application Precautions

In order to ensure safety, be sure to observe the points described below.

• Wiring

Operating Environment

• Do not attempt to disassemble, repair, or modify the product.
• Be sure to turn OFF power to the system before installing or replacing the product.

Correct Use

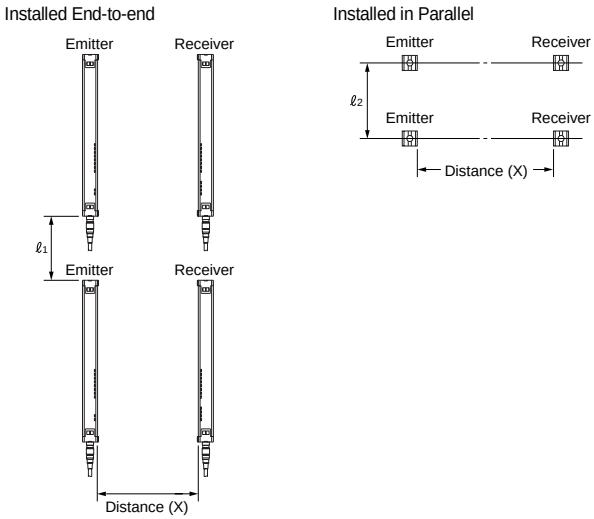
• Designing the System

Operation at Power-ON

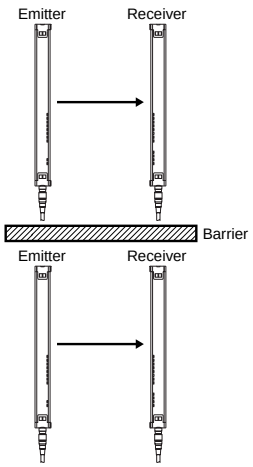
After turning ON the power, one second must elapse before the Sensor can perform sensing. Therefore, do not use other related devices until at least one second has elapsed after turning the power ON. If the load and the Sensor are connected to different power supplies, be sure to turn ON the power to the Sensor first.

Preventing Mutual Interference

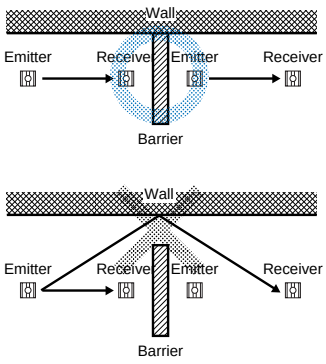
• When using more than one Sensor installed close together, separate them by the distances ℓ_1 or ℓ_2 (at least 1.5 times the distances shown under page D-371 *Parallel Operating Range*) in the way shown below.



• Install barriers to block out light from other emitters. (See Fig. 1.)
In addition to direct light, light may also be reflected off walls, the floor, and other surfaces. Install the barriers so that all light from other emitters, including reflected light, is blocked. (See Fig. 2.)



(Fig. 1)



(Fig. 2)

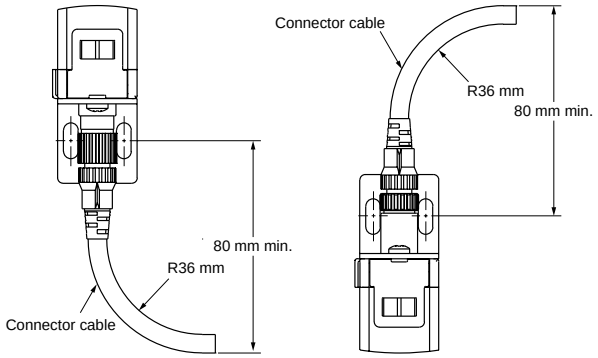
• Wiring

Connection

- To extend the connection distance, use lines with a cross-sectional area of at least 0.3 mm^2, and do not extend to a distance exceeding 100 m. Use a shielded cable, and connect the shield line to the 0-V line.
- Incorrect wiring may result in damage to devices. Ensure that connectors and cables do not come loose by giving careful consideration to the cable length and installation arrangement.

Cables

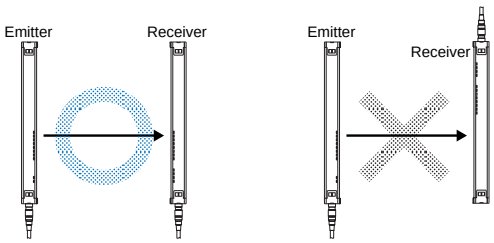
In configurations where the cable must be bent, allow at least the dimensions shown below. (Cable's minimum bending radius: 36 mm.)



• Installation

Installation Precautions

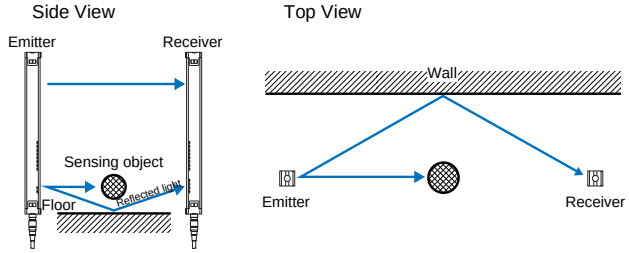
- Install the Sensor so that no beams of strong light, such as sunlight, fluorescent light, or incandescent light can enter at an angle less than the effective aperture angle of the Sensor.
- Do not strike the Sensor with a hammer during installation. Doing so may damage the internal structure.
- Install the Sensor so that the cables on the emitter and receiver point in the same direction. (See below.)



- Secure the Controller using M4 screws.
- Secure the case using a tightening torque of 1.2 N·m max.

Reflection off Walls and Floors

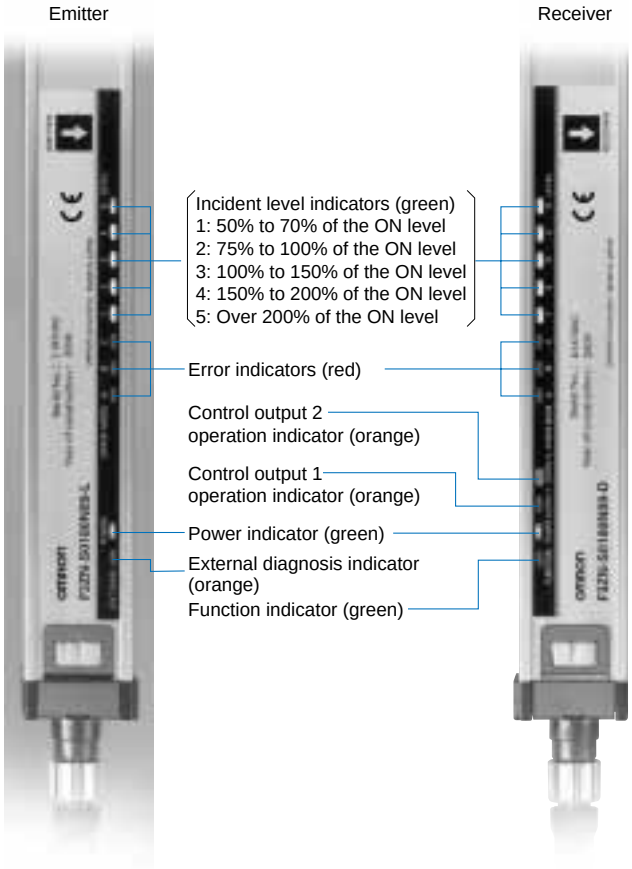
If the Sensor is installed in the way shown below, the beam may not be blocked properly due to the reflection of light off the floor. The same problem can also occur with light reflected off walls. Check that the sensing object can be detected properly before starting actual operation.



• Adjustment

Operation/Stability Indicators

- The indicators operate according to the incident level in the way shown below.
- Set the Scanner so that all the incident level indicators are lit.



Note: The Sensor's ON/OFF indication and the Controller's ON/OFF status may vary, depending on the settings made by the user.

Dimensions

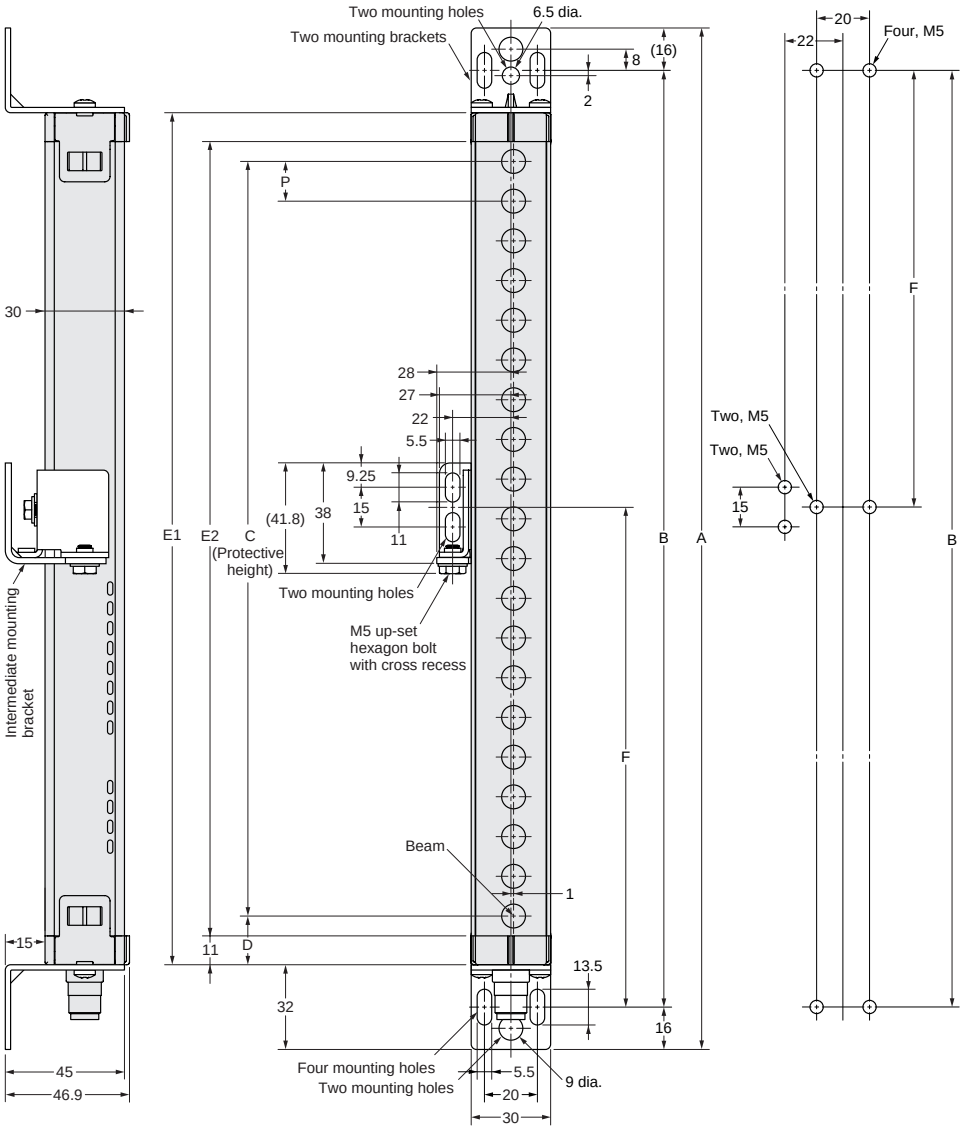
(Units: mm)

Main Units

Sensor

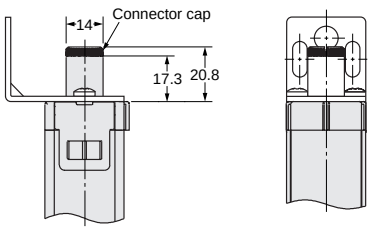
F3ZN-S□□□□N(P)□□
F3ZN-S□□□□N(P)□□-01

Mounting Hole Dimensions



Note: In the above diagram, the intermediate mounting bracket (refer to page D-376) is shown mounted on the left as an example.
If the intermediate mounting bracket is mounted on the right, the mounting holes must also be on the right.

F3ZN-S□□□□N(P)□□-01 (-03, -05)



The dimensions for different model numbers can be calculated using the following formulae.

- F3ZN-S□□□□N(P)09
  Dimension C (protective height) = The 4 digits in the model number
  Dimension A = C + 95
  Dimension B = C + 63
  Dimension D = 15.5
  Dimension E1 = C + 31
  Dimension E2 = C + 9
  Dimension F = See table below.
  Dimension P = 9

Protective height (C)	Number of intermediate mounting brackets	Dimension F (See note.)
Up to 611	0	---
612 to 1,116	1	F = B/2

Note: When not using the value of F obtained with the above calculation, use a value not exceeding 670 mm.

- F3ZN-S□□□□N(P)15,
  F3ZN-S□□□□N(P)30, or
  F3ZN-S□□□□N(P)60
  Dimension C (protective height) = The 4 digits in the model number
  Dimension A = C + 101
  Dimension B = C + 69
  Dimension D = 18.5
  Dimension E1 = C + 37
  Dimension E2 = C + 15
  Dimension F = See table below.
  Dimension P = 15

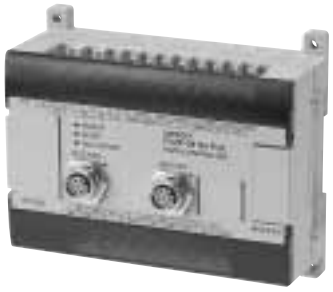
Protective height (C)	Number of intermediate mounting brackets	Dimension F (See note.)
Up to 611	0	---
612 to 1,230	1	F = B/2
1,231 to 1,785	2	F = B/3

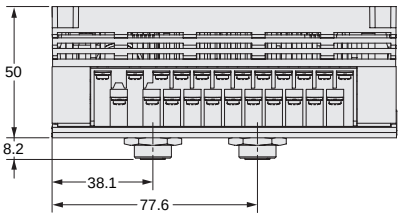
Note: When not using the value of F obtained with the above calculation, use a value not exceeding 670 mm.

* Consult your OMRON representative for other dimension diagrams.

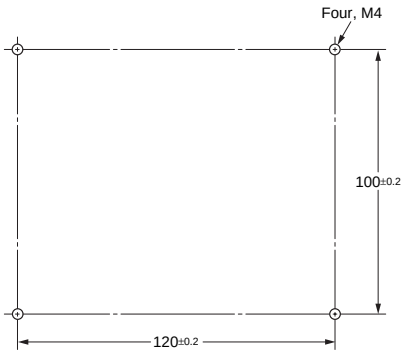
Controller

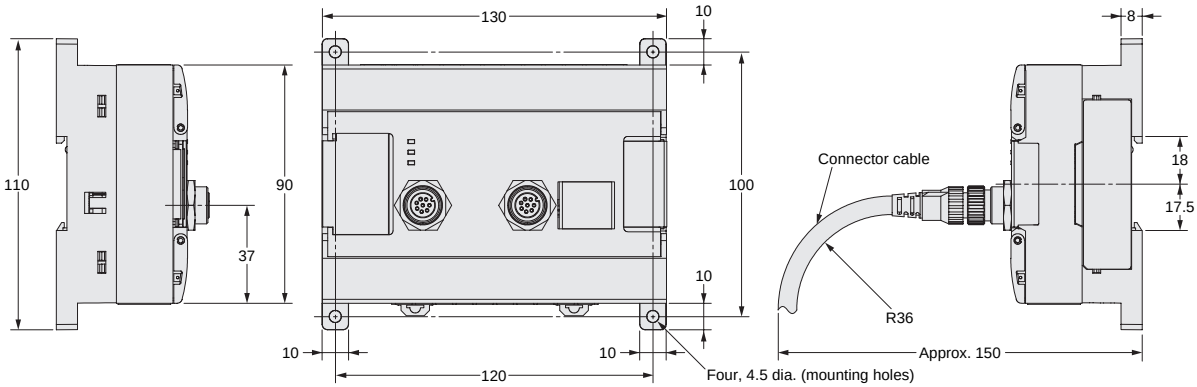
F3ZP-M1N-FLK
F3ZP-M1P-FLK





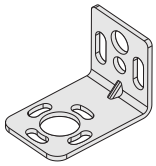
Mounting Hole Dimensions



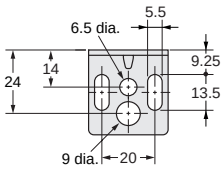


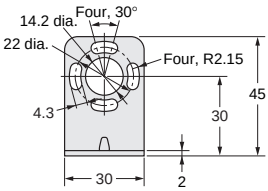
Accessories

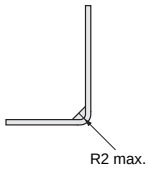
Top and Bottom Mounting Brackets



Material: Iron

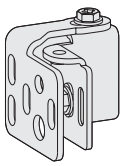




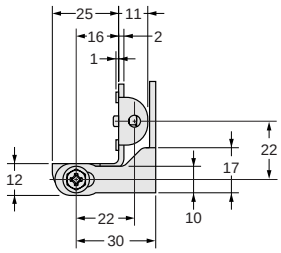


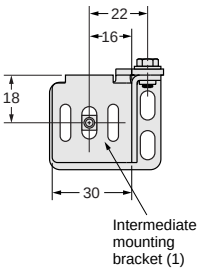
Note: Provided with the product.

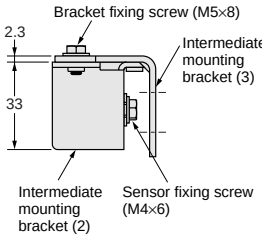
Intermediate Mounting Bracket

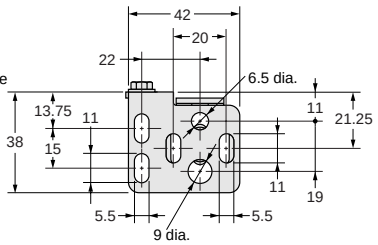


Material: Iron







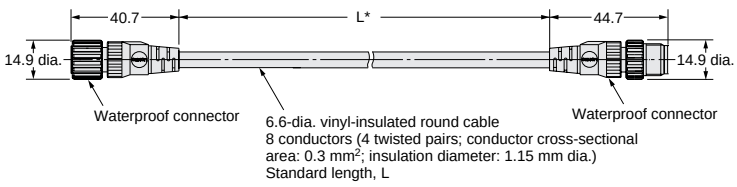


Note: Provided with the product. The number of brackets required depends on the total length of the Sensor.

Accessories (Sold Separately)

Double-ended Connector Cable

F39-JCR2 (L = 0.2 m)
F39-JC3 (L = 3 m)
F39-JC7 (L = 7 m)
F39-JC10B (L = 10 m)
F39-JC15 (L = 15 m)



6.6-dia. vinyl-insulated round cable
8 conductors (4 twisted pairs; conductor cross-sectional area: 0.3 mm^2; insulation diameter: 1.15 mm dia.)
Standard length, L

*Available in the following dimensions: L = 0.2, 3, 7, 10, and 15 m.

Color:
Emitter: Gray
Receiver: Black