Panasonic

General Catalog

LIMIT SWITCHES

The ideal Limit Switch

- Compact (reduced attachment space)
- Contact reliability (DC, low-level loads)
- Maintenance and safety guaranteed
- Expanded detection functions (different kinds of actuators)
- Improved construction easy wiring and mounting (wiring and attachments)

Installation and maintenance

- Easy wiring
- Installation work standardized
- Operating checks easy

Flexible output

- PC control
- Controls switching of low-level loads
- Flexible load control

Easy to use

- Improved machine accuracy (repeat detection accuracy improved)
- Responds to detected object (abundant variety of actuators)

Reliability

- Stout (prevents external damage)
- Environment-resistant (dust-proof, drip-proof, oil-proof)
- Longevity (need for maintenance and parts replacement reduced)

IP64

Terminal mold model

AZ7 limit switches

IP64

AZ8 limit switches

IP67

AZD1 limit switches

Industrie
Forum
Design
Hannover

AZC1 Magnelimit

Standard glossary

Fixed rating values

The values that guarantee the standards for the limit switch characteristics and functions. For example, the rated current and rated voltage, which are preset conditions (load type, current, voltage, frequency, etc.)

Operating object

The mechanism and mountings that operate the limit switch actuator. Used for mechanical operators such as cams and dogs.

Detective object

The unit other than mechanical mountings that operate the limit switch. Products, parts, jigs, etc.

Reaction spring (movable spring)

The mechanical part that switches the limit switch contact is called either the reaction spring or the moveable spring.

Contact

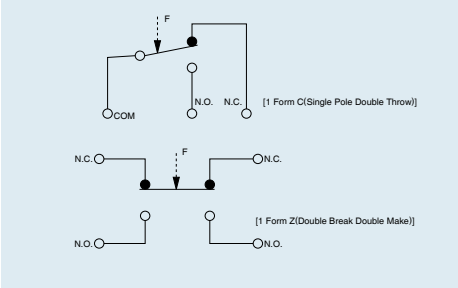
When the counter-spring revolves, power is switched on and off through the contact between metal parts.

Contact gap

The effective clearance between the fixed contact and the moveable contact. Also called breaking distance.

Contact arrangement

The construction of the electrical input/output circuit depending on use. For example, the following two applications:



Contact type

Used in opposition to a semiconductor switch that has switching characteristics. Fulfills switch functions through a mechanical ON/OFF contact.

Terminal mold

After wiring, the connecting part is molding by epoxy resin for waterproof, oil-resistant and dust-proof capabilities.

Construction

Actuator

This part directly detects movement of the dog, cam, and so forth in the operating unit, and transmits external force to the changeover mechanism, thereby engaging the moveable contact and operating the switch.

Headblock

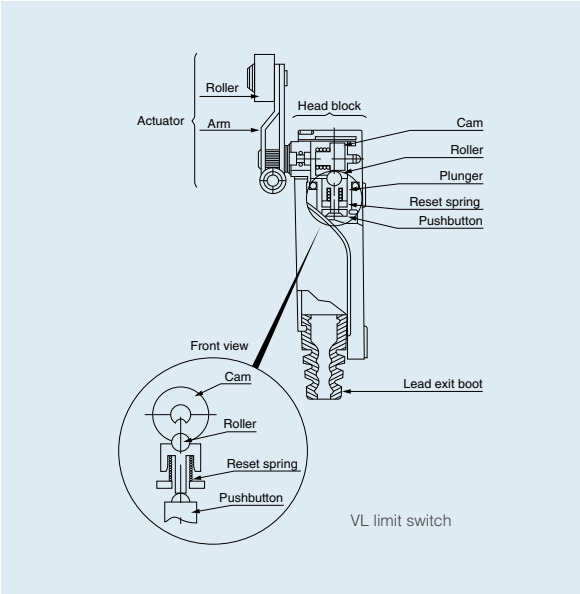
An independent part of the actuator mechanism of the Limit Switch.

Wiring vent (cord vent)

The seal on the wiring at the mouth of the wiring vent. Also called the conduit vent for the screw hole used in the wiring.

Terminals

The part of the wiring work in the wiring that forms the circuit for electrical input and output.



VL limit switch

Operating characteristics

Operating Force (O.F.)

The force required to cause contact snap-action. It is expressed in terms of force applied to the actuator.

Release Force (R.F.)

The force to be applied to the actuator, at the moment contact snaps back from the operated position to unoperated position.

Total Force (T.F.)

The force required to make the actuator travel to overtravel position.

Pretravel (P.T.)

Distance of the actuator movement from free position to operating position.

Overtravel (O.T.)

The distance which the actuator is permitted to travel after actuation without any damage to the switching mechanism.

Total Travel (T.T.)

The distance which the actuator is permitted to travel from free position without any damage to the switching mechanism.

Movement Differential (M.D.)

The distance from operating to release position of the actuator.

Operating Position (O.P.)

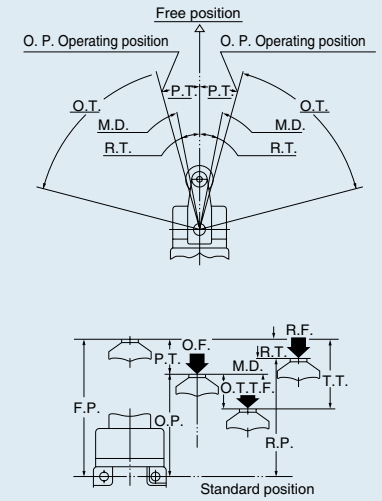
The position of the actuator when the traveling contact snaps to the fixed contact.

Release Position (R.P.)

The position of the actuator when the traveling contact snaps back from the operating position to its original position.

Free Position (F.P.)

Position of the actuator when no force is applied to it.



Note: F.P., O.P., and R.P. are expressed as distances from the standard position.

Glossary relating to the EN60947-5-1

EN60947-5-1

EN standard same as IEC947-5-1

Utilization categories

The following examples express the classification of switches by category of use.

Current type	Category	Contents
AC	AC-15	Controls electromagnetic loads in excess of 72VA (Volt Amperes.)
DC	DC-12	Controls resistance loads and semiconductor loads.

Rated operational voltage (Ue)

The maximum rated voltage for switch operation. This must never exceed the maximum ratings insulation voltage (Ui).

Rated operational current (Ie)

The maximum rated current for switch operation.

Switching overvoltage

The surge momentarily generated when a circuit is closed. Must be lower than the Uimp value.

Pollution degree

Expresses in levels the environment in which the switch is used. The four levels are shown below.
Limit switches come under contamination level 3.

Rated insulation voltage (Ui)

The maximum rated current value which guards the switch's insulation functions, forming the parameters for the resistance values and the mounting distance.

Rated impulse withstand voltage (Uimp)

The peak impulse current value which enables the switch to resist without insulation breakdown.

Rated enclosed thermal current (Ithe)

The current value that enables current to flow without exceeding the specified maximum temperature in the recharging contact switch. If the pins are made of brass, the maximum temperature limit is 65°C 149°F.

Conditional short circuit current

The current the switch can resist until the short circuit protection device is activated.

Short circuit protection device

A device that protects the switch from short circuits through a circuit break (breakers, fuses, etc.)

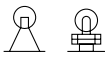
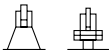
Pollution degree	Contents
1	No contamination or, even if contamination is present, only non-conducting contamination is generate.
2	Normally, only non-conducting contamination is generated, but there remains the possibility of temporary conducting contamination when the circuit is formed.
3	Conducting contamination is generated, or else dry non-conducting contamination is generated by circuits which can be anticipated.
4	Permanent conducting contamination is generated by dust, rain, snow, and other conductors.

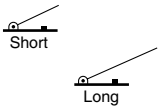
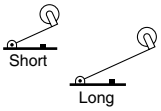
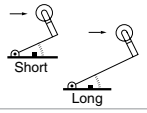
LIMIT SWITCHES SELECTOR CHART

Classification			Compact size			Door switch
Product name			AZ7 limit switches	AZD1 limit switches	AZ8 limit switches	AZC1 Magnelimit
Appearance Head code			 AZ7	 AZD1	 AZ8	 AZC1
Feature			› Switches installed with both economical and compact Z-basic microswitches and Limit Switch protective construction. › Coil spring system provides long life.	› Excellent safety even if the contact point is welded, due to the forced contact opening mechanism. › Block mount system makes parts replacement easy. › Conforms to DIN standards.	› In addition to the characteristics of stand mounted limit switches, is compact, easily installable, highly reliable, light weight and economical.	› Secured by magnet. › Built-in switch detection. › Dual-role switch in one unit. › Construction possible with 100V AC power.
Protective construction	Dust-proof type	IP60	■	■	■	–
	Abrasion-proof type	IP64	■	■	■	–
	Surge-proof type	IP65	–	■	■	–
	Corrosion-proof type	IP67	–	■	–	–
	Oil-resistant type	-	–	–	–	–
Ratings (load resistance)			10A250V AC 10A125V AC 0.4A115V DC	6A250V AC 6A380V AC 5A24V DC	[Standard type] 5A250V AC 5A125V AC 0.4A125V DC	5A 125V AC 5A 250V AC 5A 30V DC
Life (Min. ope.)	Mechanical		10^7	10^7	10^7	10^5
	Electrical		$2x10^5$	$1.5x10^5$	$3x10^5$	$3x10^4$
Operating force (max.) (hinge lever type)			1.47N {150gf}, 1.77N {180gf}, 1.96N {200gf}, 2.16N {220gf}, 2.35N {240gf}, 2.75N {280gf}, 5.88N {600gf} max.	6.37N {650gf} 4.90N {500gf} 3.29N {400gf}	0.88N {90gf}, 5.88N {600gf}, 8. 83N {900gf}, 9.16N {200gf}	3.43N {350gf}
Available actuators			1 2 3 9 10 11 12	1 2 3 4 6 13	1 2 3 4 5 6 8 9	1
Terminals			Screw terminal	Screw terminal (Conduit connectors: PF: 1/2, PG: 13.5 types)	Screw terminal	Screw terminal
Wiring			Cabtire cable	Cabtire code	Cabtire cord Cabtire cable	Cabtire cord
Mounting pitch (Applicable screw)			25.4mm 1.000inch (M4 screw)	22 u (47mm) .866 u 1.850inch	21 u 56mm .827 u 2.205inch (M4 screws)	52mm 2.047inch (M4)
Available standards			UL, CSA, TÜV, CE	UL, CSA, TÜV, CE	UL, CSA, TÜV, CE	UL, CSA, CE
Page			22	33	26	41

Notes:
1) Excludes exposed part of terminals, externally mounted components, and magnet catches.
2) Figures in parentheses ( ) indicate rated current of water-resistant type.

Actuators

1 Push plunger	2 Roller plunger	3 Cross-roller plunger	4 Roller arm	5 Adjustable roller arm	6 Adjustable rod	7 Fork
						

8 Spring wire	9 Flexible rod	10 Hinge lever	11 Roller lever	12 One-way roller lever	13 Roller lever
					

AZ7

compact size side limit switches

- Long life
- More than 107 mechanical operations
- Great mechanical strength while being compact and lightweight
- Strong plastic outer cover cap with excellent mechanical characteristics
- M4 bolt can be used for mounting
- The overtravel (O.T.) is large with great shock absorption
- Dust-proof and oil resistant
- Flushed with the diaphragm and the compressed rubber ring
- Conforms to UL/CSA TÜV standards

PRODUCT TYPE

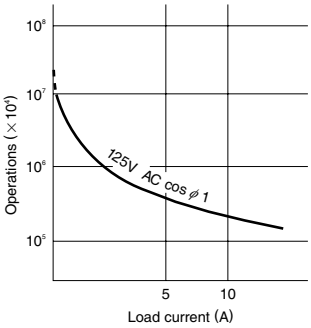
1. Standard type

Actuator	Part No.
Short push plunger	AZ7100
Push plunger	AZ7110
Hinge lever	AZ7120
Roller lever	AZ7121
One-way roller lever	AZ7124
Hinge short lever	AZ7140
Short roller lever	AZ7141
One-way short roller lever	AZ7144
Panel mount push plunger	AZ7310
Panel mount roller plunger	AZ7311
Panel mount cross roller plunger	AZ7312
Flexible rod	AZ7166

Note 1. Cadmium free contact types are available on a custom-made basis.
Please add an "F" to the end of the part number when ordering.

DATA

Life curve



FOREIGN STANDARDS

Standards	Applicable product	Part No.
UL	File No. : E-122222 Ratings : 10A 250V AC Product type : Standard type only	Order by standard part No.
CSA	File No. : LR55880 Ratings : 10A 250V AC Product type : Standard type only	
TÜV	File No. : J9551204 Ratings : AC-15 2A/250V~ Product type : Standard type only	

SPECIFICATIONS

1. Rating

Load / Rated control voltage	Resistive load (cosϕ ≒ 1)	Inductive load (cosϕ ≒ 0.4)	Motor or lamp load	
			N.C. contact	N.O. contact
125V AC	10A	6A	3A	1.5A
250V AC	10A	4A	1.5A	1A
115V DC	0.4A	0.05A	–	–

2. Characteristics

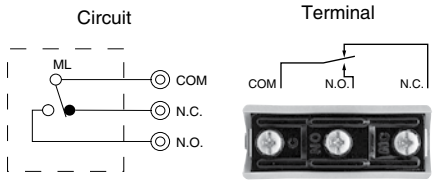
Contact arrangement		1 Form C
Initial contact resistance, max.		15mΩ* (By voltage drop 6 to 8V DC at rated current)
Initial insulation resistance (At 500V DC)		Min. 100 mΩ
Initial breakdown voltage		1,500 Vrms for 1 min between non-consecutive terminals 2,000 Vrms for 1 min between dead metal parts and each terminal 2,000 Vrms for 1 min between ground and each terminal
Shock resistance	In the free position	Max. 98m/s^2 {10G}
	In the full operating position	Max. 294m/s^2 {30G}
Vibration resistance		55 Hz, double amplitude of 1.5 mm
Expected life (Min. operation)	Mechanical	10^7 (at 50 cpm)
	Electrical	2 x 10^5 (at 20 cpm)
Ambient temperature/Ambient humidity		–20 to +60°C –4 to +140°F/Max. 95% R.H. (at 20°C 68°F)
Max. operating speed		120 cpm

*The resistance of a copper wire is not included.

3. EN60947-5-1 performance

Item	Rating
Rated insulation voltage (Ui)	250VAC
Rated impulse withstand voltage (Uimp)	2.5kV
Switching over voltage	2.5kV
Rated enclosed thermal current (Ithe)	10A
Conditional short-circuit current	100A
Short-circuit protection device	10A fuse
Protective construction	IP64 (switch)
Pollution degree	3

WIRING DIAGRAM



4. Operating characteristics

Characteristics / Actuator	O.F. (N{gf}) max.	R.F. (N{gf}) min.	Pretravel (P.T.), max. mm inch	Movement Differential (M.D.), max. mm inch	Overtravel (O.T.), min. mm inch	Operating Position (O.P.) mm inch
Short push plunger	5.88 {600}	0.98 {100}	2.0 .079	0.8 .031	0.8 .031	30±0.8 1.181±.031
Push plunger	5.88 {600}	0.98 {100}	2.0 .079	0.8 .031	5.0 .197	44±1.2 1.732±.047
Hinge lever	1.47 {150}	0.39 {40}	13.5 .531	3.2 .126	4.0 .157	25±2.0 .984±.079
Roller lever	1.77 {180}	0.49 {50}	11.0 .433	2.4 .094	3.0 .118	40±1.9 1.575±.75
One-way roller lever	1.96 {200}	0.59 {60}	11.0 .433	2.4 .094	3.0 .118	50±2.0 1.969±.079
Hinge short lever	2.16 {200}	0.59 {60}	8.5 .335	2.0 .079	2.5 .098	25±1.3 .984±.051
Short roller lever	2.35 {240}	0.78 {80}	6.5 .256	1.5 .059	2.0 .079	40±1.6 1.575±.063
One-way short roller lever	2.75 {280}	0.98 {100}	6.5 .256	1.5 .059	2.0 .079	50±1.6 1.969±.063
Panel mount push plunger	5.88 {600}	0.98 {100}	2.0 .079	0.8 .031	6.0 .236	21.8±0.8 .858±.031
Panel mount roller plunger	5.88 {600}	0.98 {100}	2.0 .079	0.8 .031	6.0 .236	33.3±1.2 1.311±.047
Panel mount cross roller plunger	5.88 {600}	0.98 {100}	2.0 .079	0.8 .031	6.0 .236	33.3±1.2 1.311±.047
Flexible rod	1.18 {120}	–	25 .984	–	11 .433	36 1.417 (T.T.)

Note: For the operating characteristics, refer to the TECHNICAL INFORMATION.

5. Protective characteristics

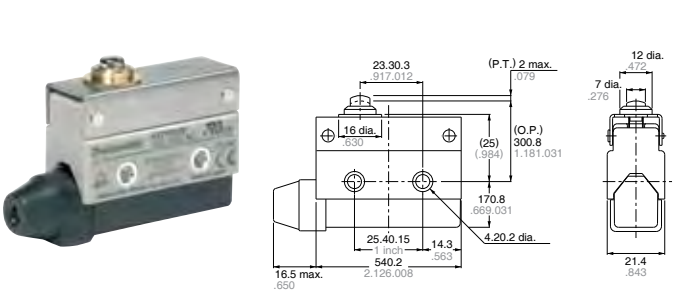
Protective construction / IEC	Screw terminal type	Epoxy-sealed terminal type
IP60	■	■
IP64	–	■

Cautions

- When the switch is to be used in places where oil is abundant, bore a drain hole in the bottom of the terminal cover.
- Avoid places where highly acid or alkaline fluids are used or high temperatures prevail.
- Wiring
  Remove the terminal cover with a ⊖ driver. Insert the lead wire through the knock-out of the terminal cover. Connect the lead wire to the terminal. When connecting the terminals with the fasten lug, those with the insulation sleeve are recommended. The terminal cover can be mounted in both directions.
  In this case, fasten the terminal cover in the opposite direction.
  For epoxy-sealed terminal types, there are two types by the cord outlet direction; N.C. side and COM side.
- Flexible rod type
  Put the detective object to the tip of plastic part.
  Avoid pushing the tip of actuating spring in the direction of axis. In the places of oil or water splashes and much dust area, use the limit switch with keeping the actuating spring in the vertical direction.

Short push plunger type

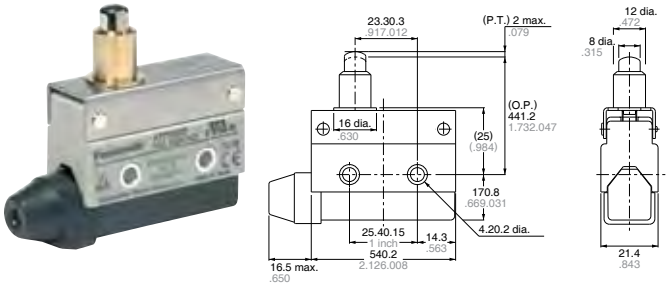
AZ7100



Push plunger type

mm inch

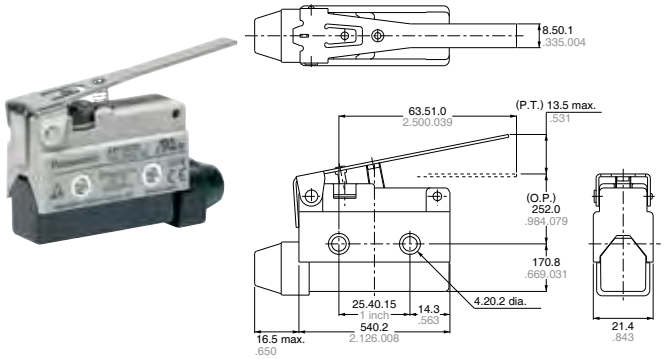
AZ7110



General tolerance: ±0.4 ±.016

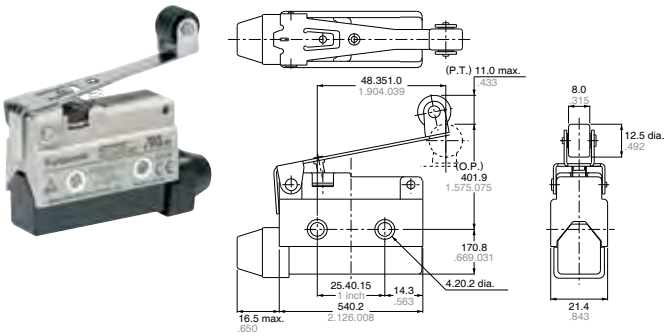
Hinge lever type

AZ7120



Roller lever type

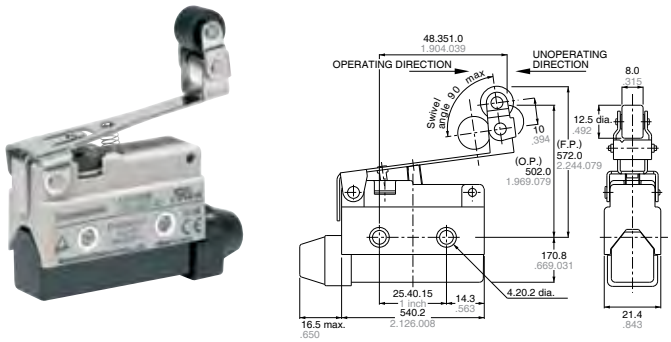
AZ7121



General tolerance: ±0.4 ±.016

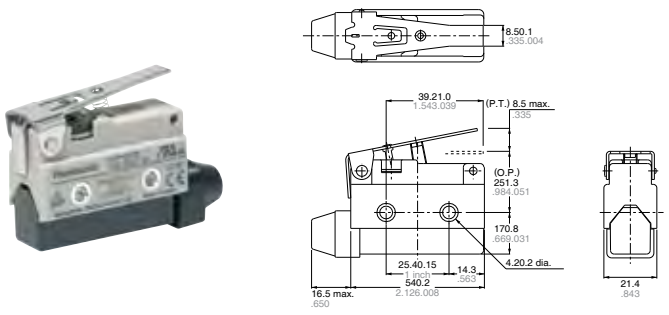
One-way roller lever type

AZ7124



Hinge short lever type

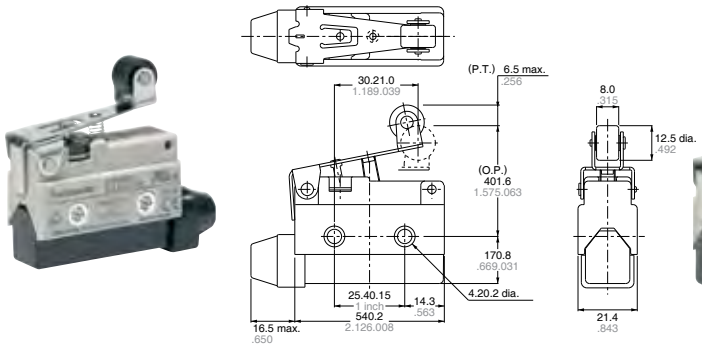
AZ7140



General tolerance: ±0.4 ±.016

Short roller lever type

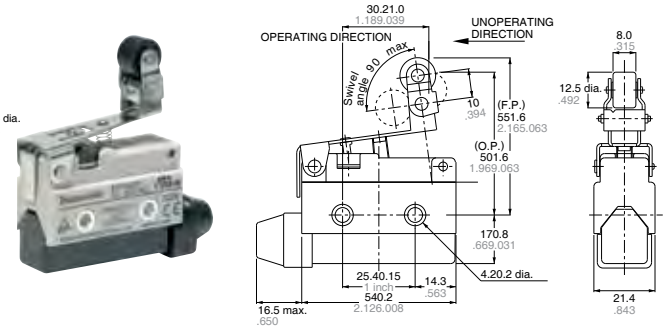
AZ7141



One-way short roller lever type

mm inch

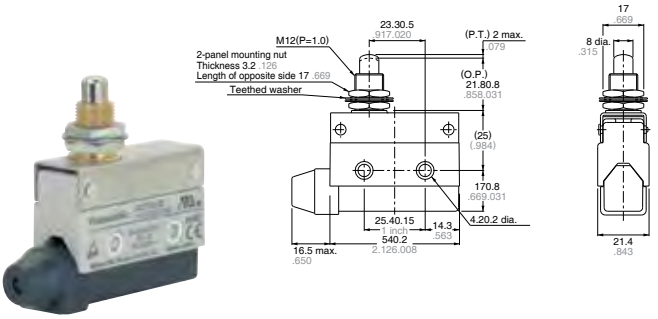
AZ7144



General tolerance: ±0.4 ±.016

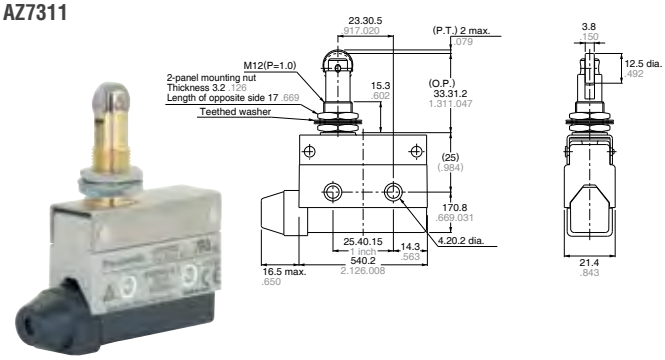
Panel mount push plunger type

AZ7310



Panel mount roller plunger type

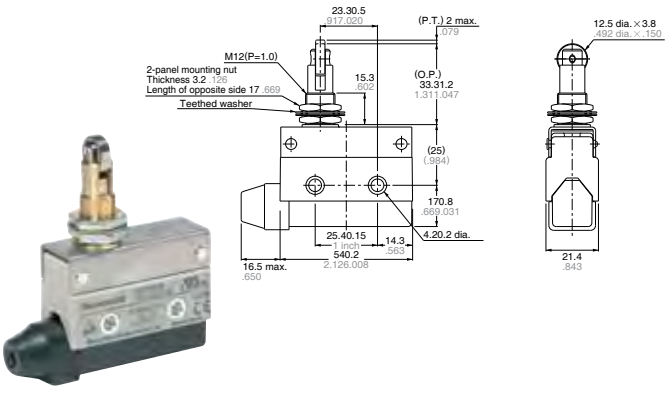
AZ7311



General tolerance: ±0.4 ±.016

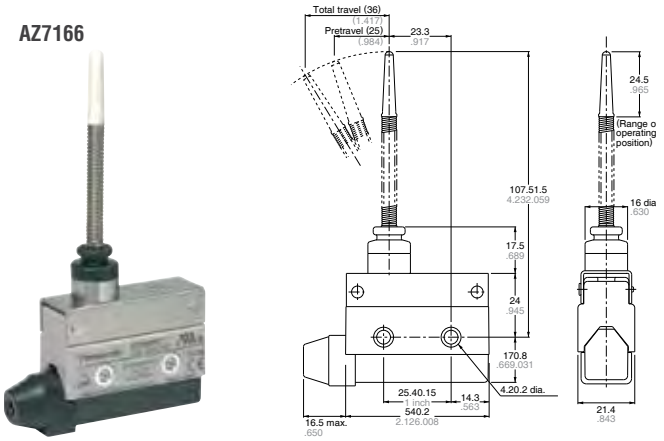
Panel mount cross roller plunger type

AZ7312



Flexible rod type

AZ7166



General tolerance: ±0.4 ±.016

AZ8

compact size limit switches

- Compact design
- Au-clad contacts that can even use low level circuit and little chattering and bouncing
- Easy wiring with full-open terminals
- Mounting are possible to both front and back
- Dust-proof, waterproof, oil resistant con-struction (IP64)
- Zinc coated* type available (bolts and nuts)

*roller arm type

Product type

■ Standard Type

Actuator	Part No.
Push plunger	AZ8111
Roller plunger	AZ8112
Cross roller plunger	AZ8122
Roller arm	AZ8104
Adjustable roller arm	AZ8108
Adjustable rod	AZ8107
Flexible rod	AZ8166
Spring wire	AZ8169

Note: When ordering an overseas-specified product, refer to the Overseas Standards given below.

Foreign standards

Standard	Applicable product	Part No.
UL	File No. : E122222 Ratings : 5A 250V AC Pilot duty B300 Product type : Standard model	Order by standard part No. However, add “9” to the end of the part No.
CSA	File No. : LR55880 Ratings : 5A 250V AC Pilot duty B300 Product type : Standard model	
TÜV	File No. : J9551203 Ratings : AC-15 2A/250V~ Product type : Standard model only	Order by standard part No.

Option

	Application	Part No.
VL limit conduit adapter	VL, VL-T	AZ8801

Protective construction

Protective construction IEC	VL Mini Limit SW	VL Mini Limit SW (with indicator)
IP60	■	■
IP64	■	■

1. Rating

■ Standard type

Load Rated control voltage	Resistive load (cos $\phi \fallingdotseq 1$)	Inductive load (cos $\phi \fallingdotseq 0.4$)
125V AC	5A	3A
250V AC	5A	2A
125V DC	0.4A	0.1A

2. Characteristics

Contact arrangement		1 Form Z
Initial contact resistance, max.		15mΩ (By voltage drop 6 to 8V DC at rated current)
Contact material		Gold clad over silver
Initial insulation resistance (At 500V DC)		Min. 100MΩ
Initial breakdown voltage		1,000Vrms for 1 min Between non-consecutive terminals 2,000Vrms for 1 min Between dead metal parts and each terminal 2,000Vrms for 1 min Between ground and each terminal
Shock resistance max.	In the free position	Max. 98m/s^2 {10G}
	In the full operating position	Max. 294m/s^2{30G}
Vibration resistance		Standard type: Max. 55Hz Type with indicator: 10 to 50Hz, double amplitude of 1.5mm
Expected life (Min. operations)	Mechanical	10^7 (at 120 cpm)
	Electrical	3×10^5 (at rated resistive load) 5×10^6 (Magnetic contactor FC-100 200V AC load)
Ambient temperature/Ambient humidity		–20 to +60°C –4 to +140°F/Max. 95%
Max. operating speed		120 cpm

3. EN60947-5-1 performance

Item	Rating
Rated insulation voltage (Ui)	250VAC
Rated impulse withstand voltage (Uimp)	2.5kV
Switching overvoltage	2.5kV
Rated enclosed thermal current (Ithe)	5A
Conditional short-circuit current	100A
Short-circuit protection device	10A fuse
Protective construction	IP64
Pollution degree	3

4. Operating characteristics

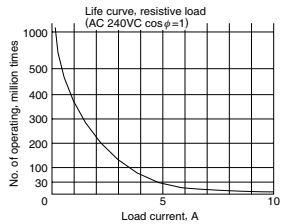
Characteristics / Actuator	O.F. (N {gf}) max.	R.F. (N {gf}) min.	Pretravel (P.T.), max. mm inch	Movement Differential (M.D.), max. mm inch	Overtravel (O.T.), min. mm inch	Totaltravel (T.T.), min. mm inch
Push plunger Roller plunger Cross roller plunger	8.83 {900}	1.47 {150}	1.5 .059	0.7 .028	4 .028	5.5 .217
Roller arm	5.88 {600}	0.49 {50}	20°	10°	75°	95°
Adjustable roller arm	7.84 {800}~3.35 {342}	0.49 {50}~0.21 {21}	20°	10°	75°	95°
Adjustable rod	7.84 {800}~1.99 {203}	0.49 {50}~0.12 {12}	20°	10°	75°	95°
Flexible spring wire	0.88 {90}	–	30 (1.181)	–	20 (.787)	50 (1.969)
Remote wire control plunger	19.61 {2,000}~ 24.52 {2,500}*	1.96 {200}~ 1.96 {200}*	1.5 .059 4 .157*	0.7 .028 2.0 .079*	4.5 .177 2.0 .079*	6 .236 6 .236*

* Characteristics measured at bent condition: min. radius 100mm 3.937inch.

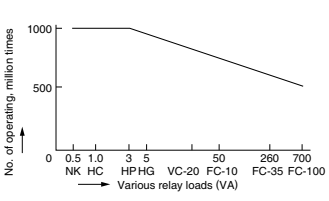
Notes: 1. Keep the total travel values in the specified range. Otherwise the actuator force may rise to several times the operating force, resulting in a mechanical failure or much shorter service life.
2. For the operating characteristics, refer to the TECHNICAL INFORMATION.

Data

1. Life curve



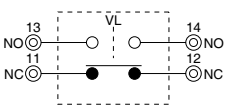
2. Actual load life curve (relay coil load)



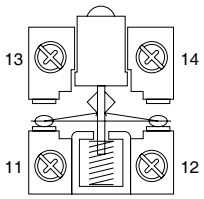
Note: The FC magnetic contactor series is 200V AC. The K is 2 Form C 24V DC type.

Wiring diagramm

Output circuit



Terminal

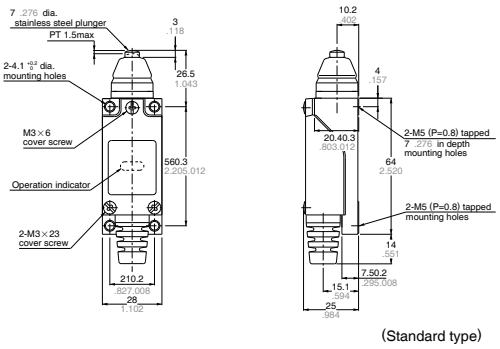


Push plunger type

mm inch General tolerance: ±0.4 ±.016

Standard type

AZ8111CEJ



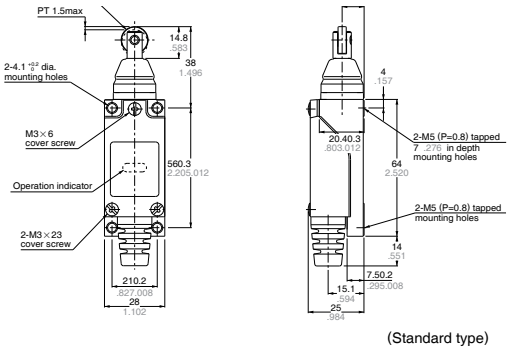
(Standard type)

Roller plunger type

mm inch General tolerance: ±0.4 ±.016

Standard type

AZ8112CEJ



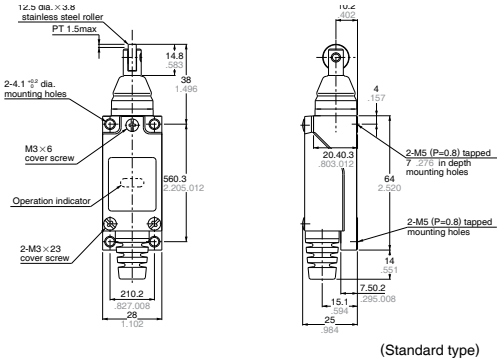
(Standard type)

Cross roller plunger type

mm inch General tolerance: ±0.4 ±.016

Standard type

AZ8122CEJ



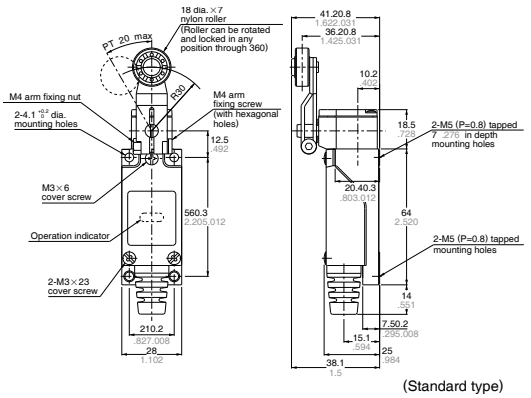
(Standard type)

Roller arm type

mm inch General tolerance: ±0.4 ±.016

Standard type

AZ8104CEJ



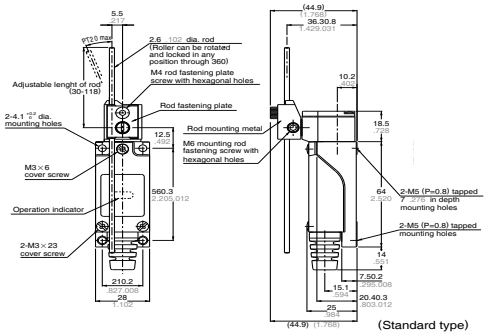
(Standard type)

Adjustable rod type

■ Standard type

AZ8107CEJ

mm inch General tolerance: ±0.4 ±.016



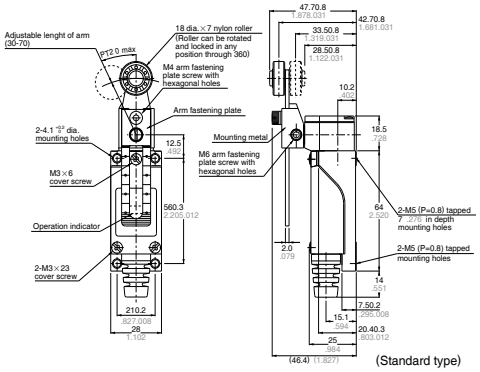
Adjustable roller arm type

■ Standard type

AZ8108CEJ

(Length of arm can be adjustable within 30 to 70mm 1.181 to 2.756inch by 1mm .039inch pitch)

mm inch General tolerance: ±0.4 ±.016



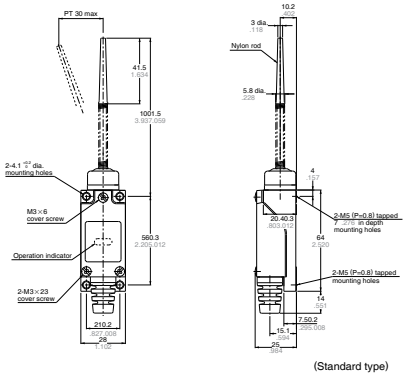
Flexible rod type

■ Standard type

AZ8169CEJ

(Should be used with less than 50mm 1.969inch of T.T.)

mm inch General tolerance: ±0.4 ±.016



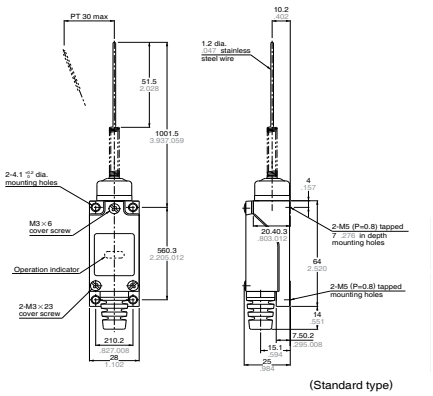
Spring wire type

■ Standard type

AZ8169CEJ

(Should be used with less than 50mm 1.969inch of T.T.)

mm inch General tolerance: ±0.4 ±.016

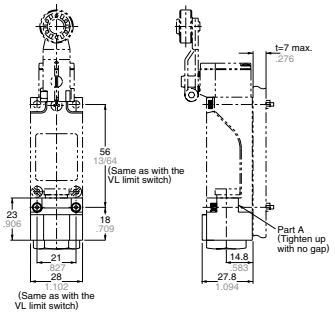


Option

VL conduit adaptor

AZ8801

(A set of mounting hex. socket screws is supplied.)



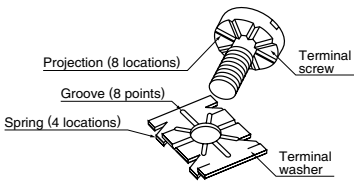
Cable treatment
Ordinary terminal

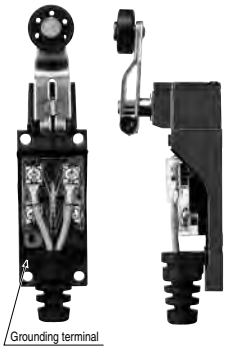
Applicable wire

Electric wire name	Finished outside diameter
Vinyl cabtire cord (VCTF)	8.7 to 11 dia. .343 to .433 dia.
Vinyl cabtire cable (VCT)	

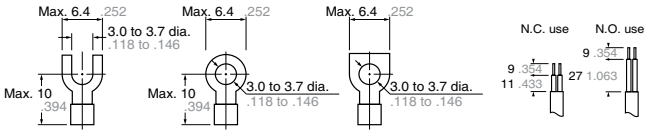
Wiring mm inch

- Insulation distance more than 6.4mm 252inch for wiring and live parts
- Special assembly screws
- Grounding is available



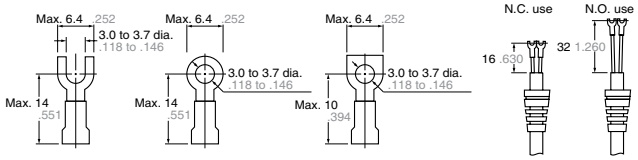


Applicable fasten terminal



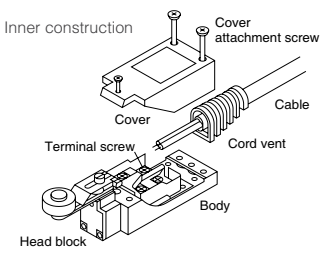
With insulated grip

Fasten terminal



Applicable wire

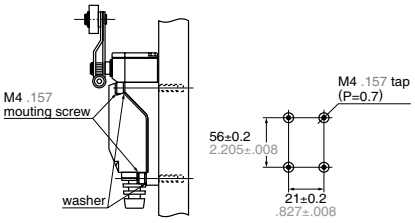
Wire name	Applicable wire		
	Wire-strand	Conductor	Finished outside diameter
Vinyl cabtire cord (VCTF)	2-wire 3-wire 4-wire	0.75mm²•1.25mm² 2.0mm² 0.75mm²•1.25mm²	Round shape 6 dia. to 9 dia. Flat shape Max. 9.4
Vinyl cabtire cable (VCT)	2-wire	0.75mm²	
600V vinyl insulation sealed cable (VVF)	2-wire	1.0 dia. to 1.2 dia.	
		1.6 dia.	



Mounting dimensions

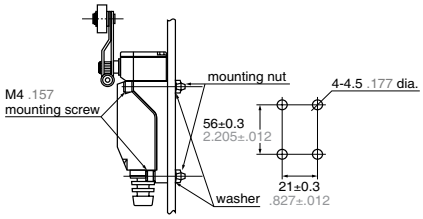
mm inch

Surface mounting



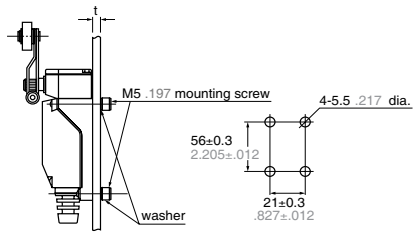
Depth of screw holes > 15mm .591inch

Through hole mounting



Thickness of panel < 5mm .197inch

Rear mounting

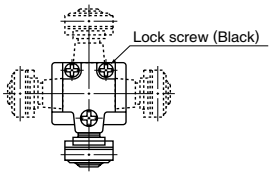


Length of bolt < panel thickness t+7mm .276inch

Head direction change

(Roller arm, adjustable roller arm, adjustable rod types)

Actuator heads may be moved in 90° increments to any of four directions, by removing one screw.



Cautions

› When overtravel is too large, life is shortened due to possible damage to the mechanism. Please use in the following appropriate range.

Types	Overtravel
Plunger (AZ8111, 8112, 8122)	1.5 to 2.0mm (.059 to .079inch)
Roller Arm (AZ8104, 8107, 8108)	20 to 30°
Flexible Rod (AZ8166, 8169)	15 to 20mm .591 to .787inch (at the top)

› Because these switches are not of immersion protected construction, their use in water or oil should be avoided. Also, locations where water or oil can normally impinge upon the switch or where there is an excessive accumulation of dust should be avoided.

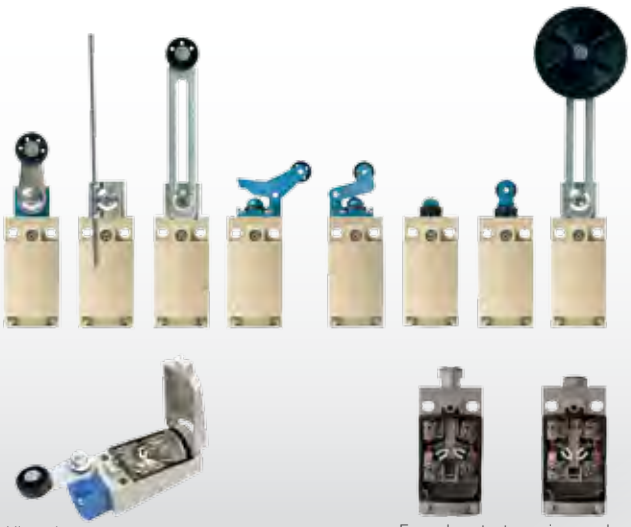
› The use of these switches under the following conditions should be avoided. If the following conditions should become necessary, we recommend consulting us first.

» Use where there will be direct contact with organic solvents, strong acids or alkalis, or direct exposure to their vapors.

» Use where inflammable or corrosive gases exist.

› In order to maintain the reliability at a high level under practical conditions of use, the actual operating conditions should be checked for the benefit of the quality of the product.

› Mounting
Three cover screws should be fasten uniformly. The rubber for opening cord should be corrected as normal condition after connecting the wire.



Hinged cover

Forced contact opening mechanism

AZD1

compact size limit switches

- Forced contact opening mechanism
  When the limit switch is ON, the contact is forced open by the N.C. contact through the cam movement.
- Conforms to EN standard (EN50047)
- Uses a unit system
  Any combination of actuator, head block, and unit block is possible. The units are also sold separately, making maintenance easy.
- Hinged cover for easy wiring
- Protective construction (IP67)
- Wide operating temperature range (–30°C to +80°C –22°F to +176°F)
- Conforms to UL/CSA, CE, TÜV standards

Product type

1. Basic products

Actuator	Part No.	
	PF type	PG type
Roller lever	AZD1000	AZD1050
Push plunger	AZD1001	AZD1051
Roller plunger	AZD1002	AZD1052
Roller arm	AZD1004	AZD1054
Adjustable roller arm	AZD1008	AZD1058
Adjustable roller arm (50 dia. rubber roller)	AZD1003	AZD1053
Adjustable rod (2.6 dia.)	AZD1007	AZD1057
Roller lever (vertical action)	AZD1009	AZD1059

Notes:
1. Type of conduit size: PF type (G1/2), PG type (PG13.5)
2. PG is a size standard used in Europe.
3. The roller arm and adjustable roller arm are available with metal rollers on a custommade basis. Please inquire.
4. Cadmium free contact types are available on a custom-made basis. Please add an "F" to the end of the part number when ordering.

3. Conduit connector

Product name	Part No.
PF type conduit connector	AZD1830

Note: The conduit connector is for Cables.
Rubber seals with an inside diameter of 9 and 11 are attached.

Data

2. Blocks

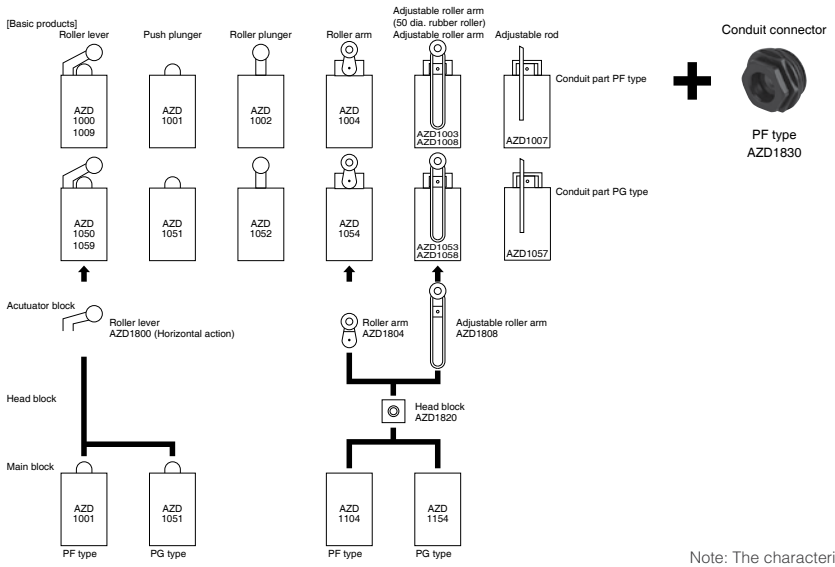
Product name			Part No.
Type of actuators	Roller lever		AZD1800
	Roller arm		AZD1804
	Adjustable roller arm		AZD1808
Head block			AZD1820
Main block	For plunger	PF type	AZD1001
		PG type	AZD1051
	For arm type	PF type	AZD1104
		PG type	AZD1154

Foreign standards

1. Rating

Standards	Applicable product	Part No.
UL	File No. : E122222 Ratings : 6A 380V AC Pilot duty A300 Product type : All models	Order by standard part No.
CSA	File No. : LR55880 Ratings : 6A 380V AC Pilot duty A300 Product type : All models	
TÜV	File No. : J9551205 Ratings : AC-15 2A/250V~ Pilot duty A300 Product type : All models	

Product combination



Note: The characteristics may change when the individual blocks are combined.

Specifications

1. Rating

Voltage \ Load		Resistive load (cos ϕ≒1)	Inductive load (cos ϕ≒0.4)
AC	125V	6A	6A
	250V	6A	6A
	380V	6A	3A
DC	24V	5A	2.5A
	60V	1.5A	1.5A
	220V	0.3A	0.3A

Note: When DC voltage is applied, the time constant is (τ=) 0ms for resistive load, (τ=) 100ms or less for inductive load.

2. Characteristics

Contact arrangement		1a1b
Initial contact resistance, max.		25mΩ (By voltage drop of 5 to 6 V DC 1A)
Contact material		Silver alloy
Initial insulation resistance (At 500V DC)		Min. 100MΩ
Initial breakdown voltage		1,000Vrms for 1 min between non-consecutive terminals 2,500Vrms for 1 min between dead metal parts and each terminal 2,500Vrms for 1 min between ground and each terminal
Shock resistance	Functional	Max. 294 m/s² (equivalent 30G) (Note 1)
	Destructive	Max. 980 m/s² (equivalent 100G)
Vibration resistance		10 to 55Hz, double amplitude of 1.5mm
Expected life (min. operations)	Mechanical	10^7 (at 120 cpm)
	Electrical	1.5×10^5 (at 20 cpm, 6A 380V AC resistive load)
Ambient temperature		–30 to +80°C –22°F to +176°F (but not in a frozen environment)
Ambient humidity		Max. 95%R.H. (without dew at 40°C 104°F)
Max. operating speed		120 cpm

Note: The ratings, performance and operating characteristics are based on the basic model.
Note 1: This value applies when the arm length of the adjustable roller arm (50 dia. rubber roller) is 70 mm or less.

3. EN60947-5-1 performance

Item	Rating
Rated insulation voltage (Ui)	250VAC Note*
Rated impulse withstand voltage (Uimp)	2.5kV Note*
Switching overvoltagew	2.5kV
Rated enclosed thermal current (Ithe)	6A
Conditional short-circuit current	100A
Short-circuit protection device	10A Fuse
Protective construction	IP67 (Note 1)
Pollution degree	2

Note) * The ratings, performance and operating characteristics are based on the basic model.
Note 1: Adjustable roller arm (50 dia. rubber roller) type is IP65.

4. Operating characteristics

Actuator \ Characteristics	O.F. (N {gf}) max.	R.F. (N {gf}) min.	Pretravel (P.T.), max. mm inch	Movement Diferential (M.D.), max. mm inch	Overtravel (O.T.), min. mm inch	Operating Position (O.P.), mm inch
Push plunger	6.37 {650}	1.47 {150}	2 .079	1.2 .047	4 .157	18±0.5 .708±.020
Roller plunger	6.37 {650}	1.47 {150}	2 .079	1.2 .047	4 .157	28±1 1.102±.03
Roller arm	4.90 {500}	0.49 {50}	20° to 26°	14°	30°	–
Roller lever	3.92 {400}	0.78 {80}	4 .157	1.6 .063	5 .197	–
Adjustable roller arm	4.90 {500}	0.49 {50}	20° to 26°	14°	30°	–
Adjustable roller arm (50 dia. rubber roller)	4.17 {425}	0.42 {43}	20° to 26°	14°	30°	–
Adjustable rod (2.6 dia.)	4.90 {500}	0.49 {50}	20° to 26°	14°	30°	–
Roller lever (vertical action)	4.41 {450}	0.88 {90}	4 .157	1.7 .067	5 .197	27±0.8 1.063±.031

Note: The above values of adjustable roller arm show the values when roller length is set at 26mm same as roller type. The value of adjustable roller arm (50 dia. rubber roller) type shows the value when roller length is set at 32 mm. The value of adjustable rod (2.6 dia.) type shows the value when length of rod is set at 26 mm same as the roller arm type.

5. Protective characteristics

Protective con struction	DL mini limit switches
IEC	
IP60	■
IP64	■
IP67	■ (Note 1)

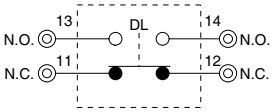
Note 1: The value for protective function characteristics is the initially set value. Also, adjustable roller arm (50 dia. rubber roller) type is IP65.

The switches are compatible with DIN EN50047.

WIRING DIAGRAM

mm inch

Internal circuit

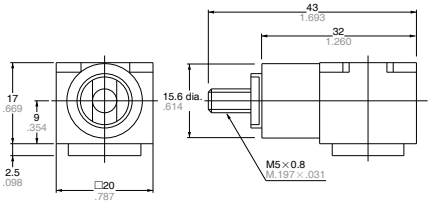


Terminals

DIMENSIONS

Head block

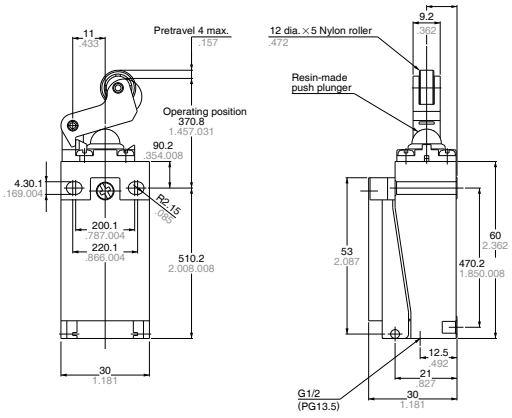
AZD1820

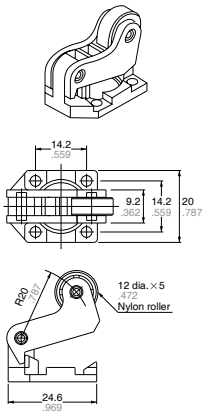


General tolerance: ±0.4 ±.016

Roller lever type

AZD1000
AZD1050

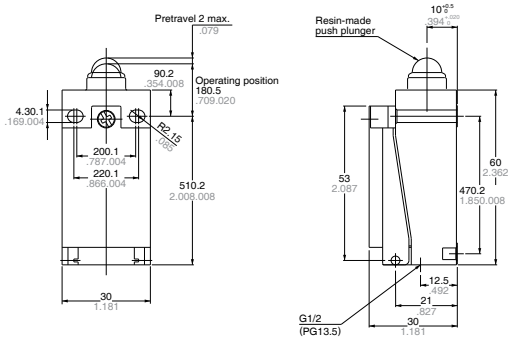




General tolerance: ±0.4 ±.016

Push plunger type

AZD1001
AZD1051

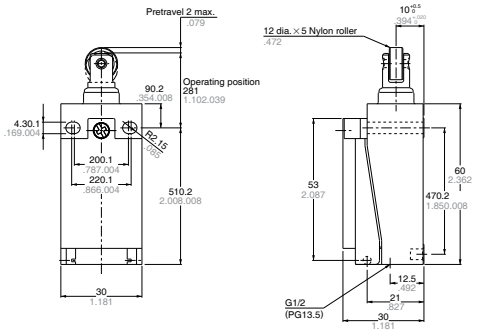


General tolerance: ±0.4 ±.016

Roller plunger type

mm inch

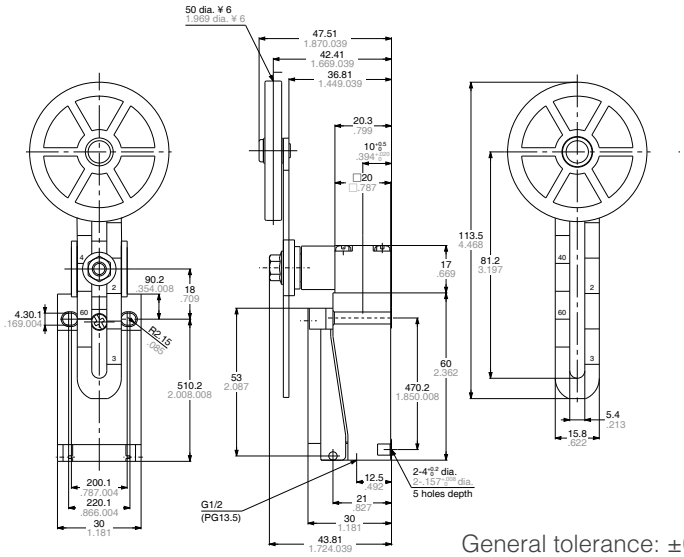
AZD1002
AZD1052



General tolerance: ±0.4 ±.016

Adjustable roller arm (50 dia. rubber roller)

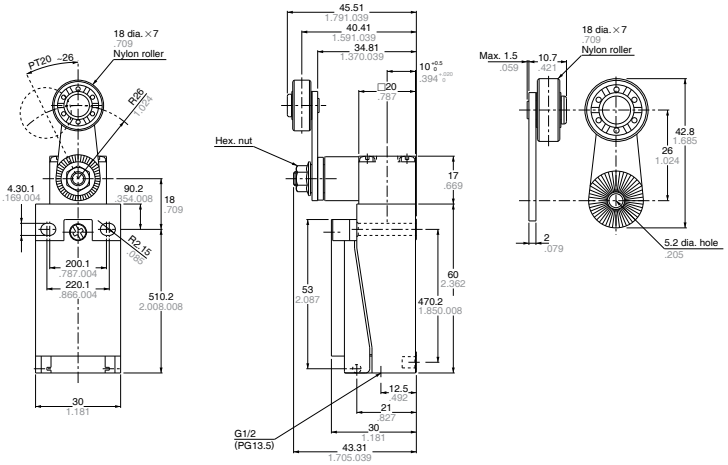
AZD1003
AZD1053



General tolerance: ±0.4 ±.016

Roller arm type

AZD1004
AZD1054

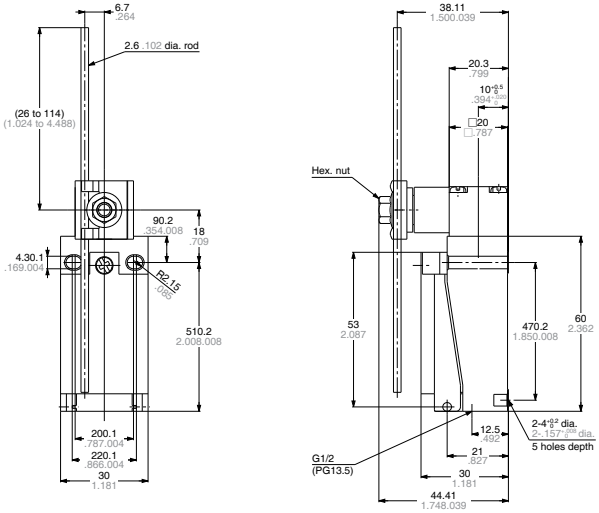


General tolerance: ±0.4 ±.016

Adjustable rod (2.6 dia.)

mm inch

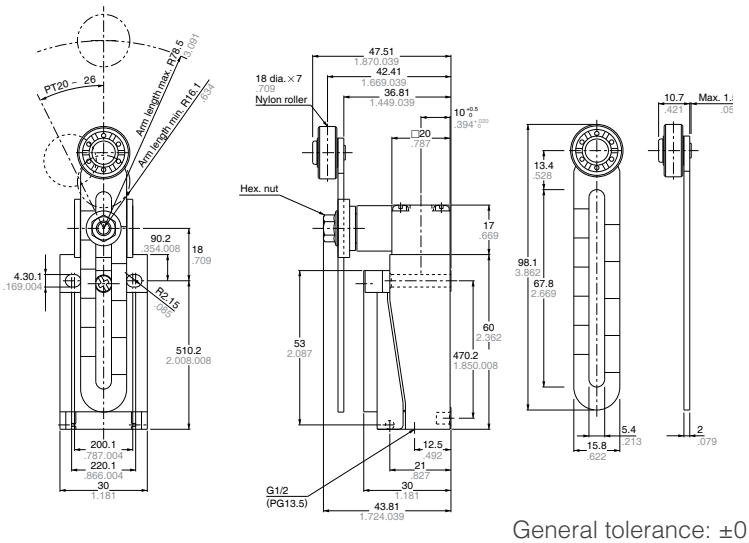
AZD1007
AZD1057



General tolerance: ±0.4 ±.016

Adjustable roller arm type

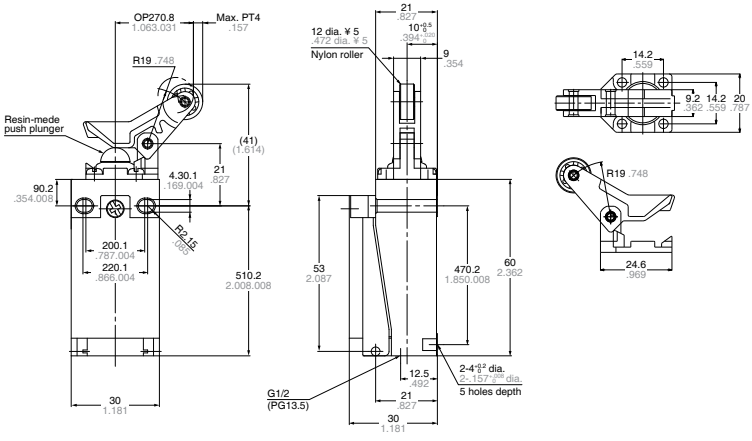
AZD1008
AZD1058



General tolerance: ±0.4 ±.016

Roller lever (vertical action)

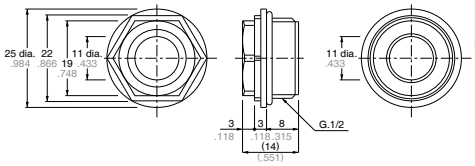
AZD1009
AZD1059



General tolerance: ±0.4 ±.016

Conduit connector (PF type)

AZD1830

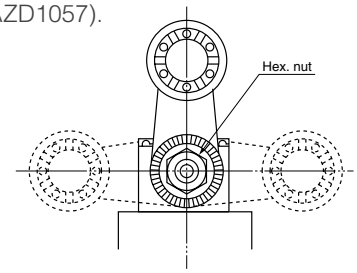


Rubber seal inside diameter	Adaptable cable outer diameter	
	Min.	Max.
9 dia. (.354)	7.5 dia. (.295)	9.5 dia. (.374)
11 dia. (.433)	9 dia. (.354)	11 dia. (.433)

General tolerance: ±0.5 ±.020

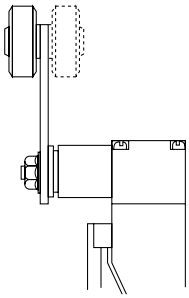
Arm Setting Position

The roller arm of the arm types (AZD1003, AZD1004, AZD1008, AZD1053, AZD1054 and AZD1058) can be set in any position at 15° intervals. Loosen the arm fastening hex. nut, reposition the arm, and retighten the hex. nut. When doing so tighten the hex. nut with the arm secured to the unit. Tightening without securing may cause damage. Also, the same is true of the variable rod types (AZD1007 and AZD1057).



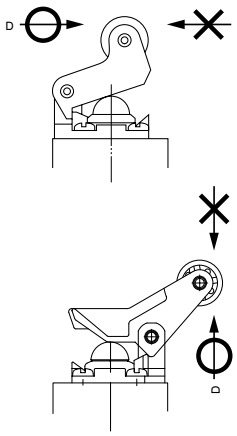
Roller Direction

The roller of the arm types (AZD1004, AZD1008, AZD1054 and AZD1058) can be mounted on the front and rear (dotted line in the figure) sides of the switch, as shown below. (Positioned on the front side at delivery.)
To set the roller on the rear side, remove the arm fastening hex. nut, and reinsert the arm so as to face the roller in the rear direction. Then, retighten the hex. nut.



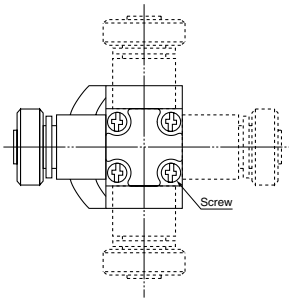
Roller Lever Direction

AZD1000, AZD1009, AZD1050 and AZD1059 type is move a detection object in the D direction as shown below. Be sure not to move the object oppositely. If the opposite direction is required, change the direction of the lever.



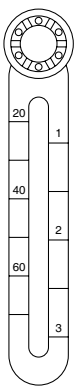
Head Direction

The head of the arm types (AZD1003, AZD1004, AZD1008, AZD1053, AZD1054 and AZD1058) can be set in any of four directions at 90° intervals, but not in any other intermediate directions. Loosen four screws on the upper side of the head, and set the head in a desired direction, and retighten them at a torque of 0.20 to 0.39 Nm. Be careful not to use too much strength when tightening as this will cause the threads to strip. Also, the same is true of the variable rod types (AZD1007 and AZD1057).



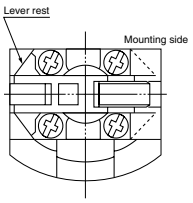
Adjustable Arm Length

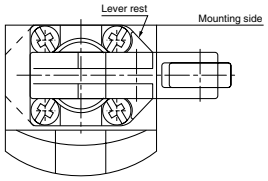
To adjust the length of the adjustable arm of AZD1008 and AZD1058, slightly loosen the arm fastening hex. nut, and adjust the length.
The adjustable arm is graduated in two kinds of length units. Use these indications as the reference during adjustment.



Roller Lever Direction

The roller lever can be set in two directions at 180° intervals. (Even though it can be also set in the 90° direction, the mounting surface will project.) Remove the four lever base fastening screws, turn the lever together with the lever base in 180°, and retighten the four screws at a torque of 0.20 to 0.39 Nm. {2 to 4 kg•cm}.





Open and close the cover

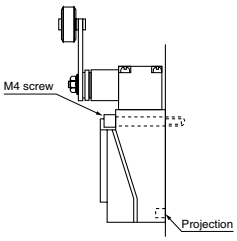
For the adjustable roller arm type, the cover will not open and close since it contacts the adjustable arm. Either extend the arm fully or remove the arm, then open or close the cover. Also, the same is true of the variable rod types (AZD1007 and AZD1057).

Adjustable Rod Length

To adjust the length of the variable rod, slightly loosen the hex. nut that is securing the rod and then change the length. After making the change, tighten the hex. nut keeping within a tightening torque of 0.98 and 1.37 Nm. Over tightening might damage the rod presser plate.

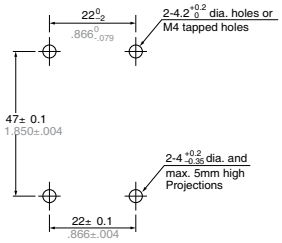
Mounting

1) When mounting, use washers (to prevent loosening) and tighten at a torque of 0.49 to 0.69 Nm.
2) To securely mount the switch, not only fasten the main switch body only with two mounting holes, but also provide two $4^{+0.2}_{-0.35}$ mm dia. and max. 5 mm .197 inc high projections and insert them into the holes on the bottom of the main switch body.



(Terminal with insulating grip)

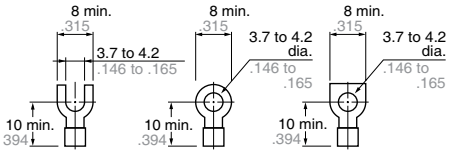
Mounting dimensions



CAUTIONS

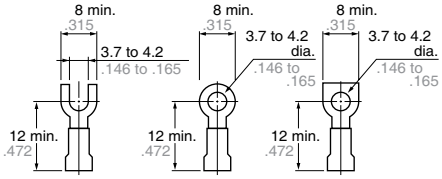
1) This model uses silver terminals. Therefore, if used at relatively low frequencies for long periods of time, or if used with very small loads, the oxidization that forms on the contact surfaces will not wear away and eventually cause improper contact. For such applications, use limit switches with gold/metal contacts (e.g. VL limit switches) or ones meant for small loads (e.g. HL limit switches).
2) This switch is not designed for under-water use. Do not use the unit under-water.
3) Do not use the switch where it may come in direct contact with organic solvents, strong acids, strong alkaline liquids or stream, or in atmospheres containing flammable or corrosive gases.
4) For the arm type (roller arm type, adjustable roller arm type), the arm can only be set at 15° interval.
5) To improve reliability during actual use, it is recommended that the operation be checked under installation conditions.
6) If O.T. is too big, the life of limit switch will be shortened switching friction. Use it with enough margin of O.T. 70% of O.T. standard value will be good for use.
7) Do not use the switch in a silicon atmosphere. Case should be taken where organic silicon rubber, adhesive, sealing material, oil, grease or lead wire generates silicon.
8) When wiring, do not connect the lead wires directly to the terminals, but use the crimp terminals and tighten them to a torque of 0.39 to 0.59 Nm.

Adaptable crimp terminal
(Bare terminal)



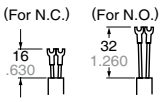
mm inch

(Terminal with isulating grip)



mm inch

When crimp terminals are used.



mm inch

CAUTIONS

9) After wiring, when attaching the cover to the switch body, be careful that the cover seal rubber is set normaly on it and tighten the screw to a torque of 0.20 to 0.39 Nm. If you tighten the screw strongly, the thread is broken.

10) Safety mechanism is adopted which secures positive break under such abnormal conditions like contact welding, spring break, etc. In case of using the safety mechanism which breaks welded N.C. contact, conform to the conditions as shown below.

(For the value below of adjustable rod, the length of the rod shows the value when length of rod is set at 26 mm same as the roller arm. The value of adjustable roller arm (50 dia. rubber roller) type shows the value when arm length is set at 40 mm.)

	Actuator movement	Required force (Min.)
Push plunger Roller plunger	Approx. 3.5mm .138 inch	Approx. 29.4 N
Roller arm Adjustable rod Adjustable roller arm	Approx. 45°	9.8 N
(50 dia. rubber roller)	Approx. 45°	6.4 N
Roller lever type	Approx. 7 mm .276 inch	19.6 N

11) To protect against entry of foreign matter from the outside, we recommend sealing as much as possible using conduit connectors.

12) Avoid use in excessively dusty environments where actuator operation would be hindered.

13) When used outdoors (in places where there is exposure to direct sunlight or rain such as in multistory car parks) or in environments where ozone is generated, the influence of these environments may cause deterioration of the rubber material. Please consult us if you intend to use a switch in environments such as these.

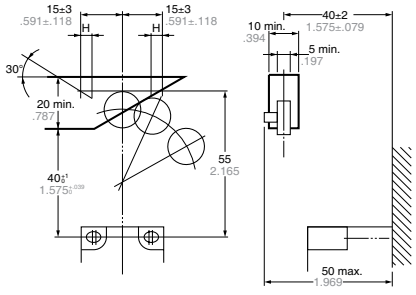
14) Do not store in places where organic gas might be generated or in places of high dust content or high humidity.

15) Since the roller section of the roller arm (50 mm dia. rubber roller type) (AZD1003 and AZD1053) is heavy, the contacts may reverse due to inertia of the roller section which easily leads to erroneous operation.

If there is a possibility of exposure to shock, please make considerations for safety, for example, by providing a redundant circuit so that danger can be avoided in the event that the contacts reverse and cause erroneous operation.

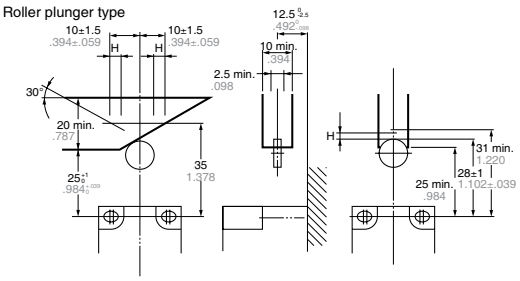
Design of operation dog

Roller arm type



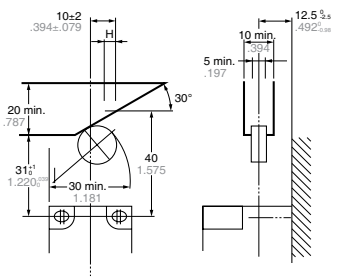
(H: Hysteresis)

Roller plunger type



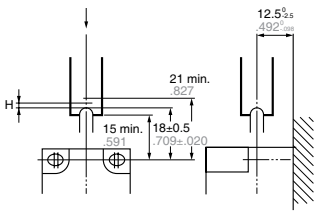
(H: Hysteresis)

Roller lever type



(H: Hysteresis)

Push plunger type



(H: Hysteresis)

AZC1

safeguarded by magnet built-in detector switch

- Electrical construction possible at 100V power.
- The built-in magnet safeguards checking of the facility cover and gate.
- Built-in switch with accurate ON/OFF detection.
- Combination of magnet (support) and limit switch (detection) saves on both construction and space.
- Two types of contact: 1 Form A (ON when gate is closed)
- 1 Form B (ON when gate is open.)
- The unit case is available in three colors: Yellow, brown, and gray.
- The product comes with three different types of weight sustainability: 1kg, 3kg and 5kg.

Product type

Product name	Specifications				Part No.
	Contact construction	Case color	Sustainable weight sustainability	Packaging	
Magnelimit 1 Form A	1a (ON when gate is closed)	Yellow	3kg type (29.4N {3kgf}) (Note: 1)	–	AZC11013Y
		Brown		–	AZC11013A
		Gray		–	AZC11013H
Magnelimit 1 Form B	1b (ON when gate is open)	Yellow		–	AZC11113Y
		Brown		–	AZC11113A
		Gray		–	AZC11113H
Options	Metal plate	Metal plate (13mm u 60mm u 1.6mm .512inch u 2.362inch u .063inch)			AZC1801

Notes: 1. The unit comes with an metal plate enclosed.
2. The blister pack type comes with 1 metal plate and 4 screws (2 long, 2 short) enclosed. 3. Weight sustainability also comes in 1kg and 5kg types. Specify when ordering by replacing "3" with "1" for the 1kg type, and "5" for the 5kg type at the end of the part No.

Specifications

1. Ratings

Load type / Rated voltage	Resistance load	Lamp load	Guidance load
125V AC	5A	1.5A	3A
250V AC	5A	–	3A
30V DC	5A	–	1.5A

Notes:1. Inductive load is a minimum 0.4 (AC) and time duration is maximum 7ms (DC).
2. Lamp load has 10 times the inrush current.
3. Minute load ratings: 5mA 6V DC, 1mA 24V DC.

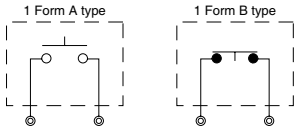
2. Switch operating features

Operating force (O.F.) (N{gf})	3.43 {350} max.
Return force (R.F.) (N{gf})	0.49 {50} min.
Pretravel (P.T.)	1.8mm .071inch max.
Movement differential (M.D.)	0.2 to 0.8
Release position (R.P.)	4.0mm .157inch max.

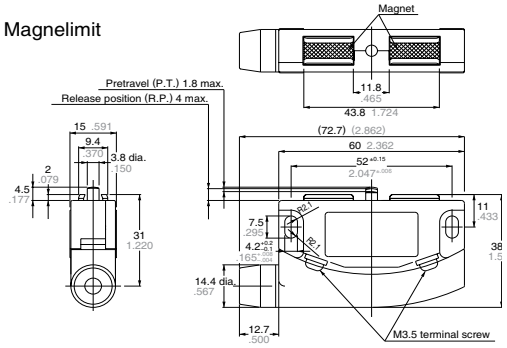
3. Capabilities overview

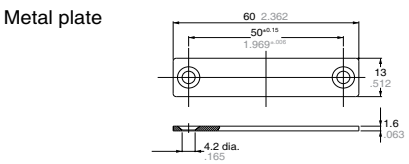
Electrical capabilities	Insulation resistance (initial)	Min. 100Ω (measured at 500V DC insulation resistance)
	Voltage resistance	Contact distance: AC 1000V/1 min. (initial) Distance between each pin and uncharged metal parts: AC 2100V/1 min. Distance between each pin and earth: AC 2100V/1 min.
Life	Mechanical life	Min. 100 thousand times (ON/OFF frequency 60 times/min.)
	Electrical life	Min. 50 thousand times (resistance load AC 250V 5A) Min. 30 thousand times (lamp load AC 125V 1.5V) ON/OFF frequency 20 times/min.
Protective capabilities		IP40
Usage conditions	Ambient temperature	–20 to +80°C –4 to 176°F (but not in a frozen environment.)
	Ambient humidity	Max. 95% RH
	Tolerable operating frequency	Mechanical: 60 times/min. Electrical: 20 times/min.

Output circuit diagramm



Dimensions mm inch

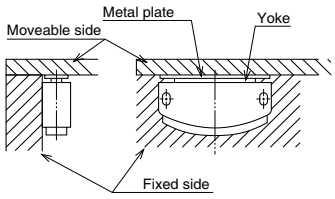




Metal plate attachment

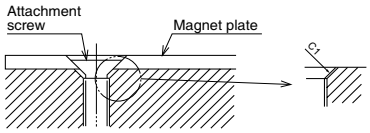
Attaching the main unit

1. Using an M4 screw, attach firmly remembering to employ a washer, etc. The appropriate torque is 1.18 to 1.47N (12 to 15kg/cm.)
2. When moveable parts such as the gate are closed, ensure that the yoke and metal plate are flush with each other.

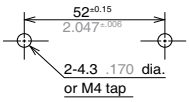


Attaching the metal plate

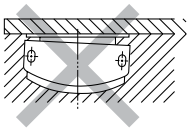
1. Using an M3 dish screw, attach to the side opposite from the yoke. Pay particular attention that the head of the attached screw does not protrude further than the surface of the metal plate (if using wooden screws, a call of 2.7 is optimum).
2. If the adhesive side is magnetic (metal plate), the adhesion may prove ineffective. Further, since the sustainability varies depending on the board thickness and the surface processing (paint, etc.), it is best to check beforehand.



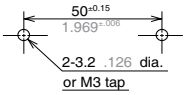
Unit attachment hole processing dimensions



Unless the metal plate and the yoke are flush with each other, adhesive power will be lost, and there is a risk that the switch will not operate.



Adhesion board hole processing dimensions



(Fit a C1 panel to the inlet vent)

SUITABLE WIRING

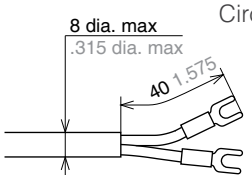
Maximum external dimensions upon completion

Circular: 8mm dia. .315 inch dia. max.
Flat: Lengthwise 9.4mm .370inch max.
(VVF 2 cores, conductor radius 1.6 dia.)

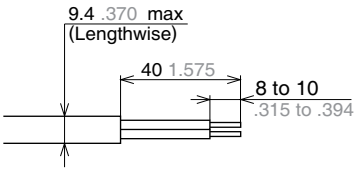
Wiring processing dimensions

Refer to the diagram below for the wiring processing dimensions

Circular



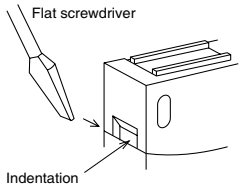
Flat (VVF 2 cores, conductor radius 1.6 .063 dia)



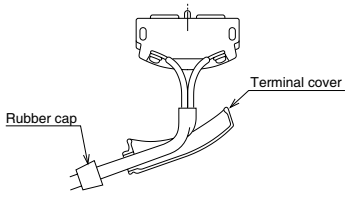
WIRING

- Terminal uses a M3.5 angle washer attachment.
- During wiring work, do not connect the lead wire directly to the terminal, but via a crimp contact. However, this excludes single wiring.
- Wiring by solder should be avoided.

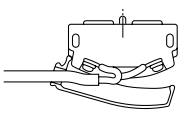
1. Wiring method
Insert a flat screwdriver into the indentation of the product side, and remove the terminal cover.



2. Slide the rubber cap and the terminal cover over the wire, as shown in the illustration, then attach a crimp contact to the terminal. The torque applied to the terminal screw should be within the range of 0.39-0.59 Nm (4-6 kg/cm).



3. If using a VVF wire, bend the wire towards the unit, and once it has taken the proper shape, install the terminal cover. After installing the terminal cover, attach the rubber cap.



CAUTIONS FOR USE

- Because the magnelimit is not waterproof, avoid using in areas where it may be splashed with either water or oil. Also, avoid using in locations where dust may accumulate.
- Do not use in atmospheres where the unit may directly come into contact with any kind of organic solvent, strong acid or alkaline liquids, or combustible or corrosive gasses.
- Avoid using in silicon environments such as organic silicon-based rubber, solvents, sealants, oil, grease, or wiring.
- The moveable parts on the magnelimit such as the gates are equipped with a stopper, so avoid attachments that require them to bear the full load.
- In order to improve reliability under actual working conditions, check the quality under as close to actual working conditions as possible.
- This magnelimit has a built-in electromagnet. For this reason, take care not to place floppy disks, magnetic cards, or other magnetic recording mediums near the unit, as the data may be corrupted or lost.

1. UL specifications

UL is an abbreviation of Underwriter's Laboratories Inc., a non-profit organization that was established by an American disaster insurance conference in 1894. At UL, products that meet the requirements of the manufacturers are inspected, and the announcing of specifications and safety standards for products across a wide range of fields such as crime prevention, radiation exposure prevention, automatic controls, scientific safety levels, safety of electrical equipment, fire prevention, and gas and oil are announced. UL publishes a list of those products which pass their specifications and work to facilitate ease of use on the part of the users. The safety standards set by UL cover all events that may occur during the use of a product, across a very wide range, thoroughly. The reliability of products bearing the UL mark is extremely high, and in many American states and cities, there are legal restrictions on the sale of products not bearing the mark, and even in unregulated states, such products are treated as inferior.

2. CSA specifications

An abbreviation for the Canadian Standard Association, this body possesses the authority to determine whether or not electrical products conform to their standards and to set standards for manufacturing products that are used by the general public. The CSA has enormous public trust and authority, and nearly all of the Canadian provinces are required to receive CSA approval in order to sell electrical products within their province, which the CSA enforces. Consequently, electrical products exported from Japan to Canada must receive CSA approval and display the CSA mark; if not, the product in question will not be legally approved valid as VDE approval.

3. TÜV (Technischer Überwachungs-Verein)

The "German Boiler Monitoring Association" which was inaugurated in 1875 with the aim of preventing boiler accidents, is the parent body of this civil non-profit, independent organization. The TÜV has the unique characteristic of existing as an independent body in each of Germany 14 states (TÜV Rheinland, TÜV Bayern's etc.) The TÜV conducts wide-ranging inspections of factory plants, facilities, etc. and is entrusted by the government to conduct inspection and approval work on electrical products as well, mainly based upon EN specifications.

TÜV approval is valid in all of Germany's 14 states regardless of which TÜV body issued it, and this approval is as equally valid as VDE approval.

4. Pilot Duty

One of the specifications in the "UL508 Industrial Control Equipment" regulations at UL (Underwriters Laboratories Inc.), has to do with the grade of contact control capacity by NEMA (National Electrical Manufacturers Association) standards. By obtaining both UL and CSA approval for this grade, the product becomes authorized publicly.

Pilot Duty A300

AC applied voltage [V]	Electrification current [A]	Input power [A]	Breaker power [A]	[VA]	
				During input	During breaker
120	10	60	6	7,200	720
240		30	3	7,200	720

Pilot Duty B300

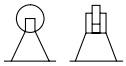
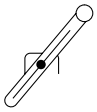
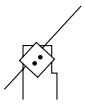
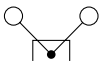
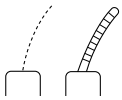
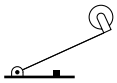
AC applied voltage [V]	Electrification current [A]	Input power [A]	Breaker power [A]	[VA]	
				During input	During breaker
120	5	30	3	3,600	360
240		15	1.5	3,600	360

Pilot Duty C300

AC applied voltage [V]	Electrification current [A]	Input power [A]	Breaker power [A]	[VA]	
				During input	During breaker
120	2.5	1.5	1.5	1,800	180
240		7.5	0.7	1,800	180

SUMMARY OF SAFETY STANDARDS RECOGNITION: LIMIT SWITCHES

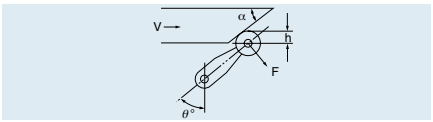
Product name		UL recognized		CSA certified		TÜV approval	
		File No.	Approved ratings	File No.	Approved ratings	File No.	Approved ratings
ML limit switches	Standard model	E122222	10A 250V AC	LR55880	10A 250V AC	J9551204	AC-15 2A 250V~
	Terminal mold model	–	–	–	–	–	–
QL limit switches		E122222	5A 250V AC	LR55880	5A 250V AC	–	–
VL limit switches	Standard model	E122222	5A 250V AC Pilot duty B300	LR55880	5A 250V AC Pilot duty B300	J9551203	AC-15 2A 250V~
DL limit switches		E122222	6A 380V AC Pilot duty A300	LR55880	6A 380V AC Pilot duty A300	J9551205	AC-15 2A 250V~
Magnelimit		E122222	5A 250V AC Pilot duty B300	LR55880	5A 250V AC Pilot duty B300	–	–

Type	Classification	Pretravel (P.T.)	Overtravel (O.T.)	Operating force (O.F.)	Accuracy	Vibration shock	Characteristics
	Push plunger type	Small	Medium	Large	Excellent	Excellent	High-level accuracy gives firm detection for position fixing, etc., by using perpendicular movement.
	Roller plunger type (includes cross roller plunger)	Small	Medium	Large	Excellent	Excellent	Operating range can be widened by mounting accessory actuators like cams, dogs, cylinders, etc. High-level detection for position fixing.
	Roller arm type	Small to large	Large	Medium	Good to excellent	Excellent	The stroke in the direction of revolution is large at between 45° and 90° and the lever angle can be set at will to within 360° for easy use. Wide angle type (large O.T.) available. Can be used for wide-range position fixing.
	Adjustable roller arm type	Small to large	Large	Medium	Good to excellent	Good	Lever length can be altered to allow rough operation detection using the roller lever characteristics.
	Adjustable rod type	Large	Large	Medium	Good	Good	Wide range of operations, and convenient for uneven mountings. Lightest operation among the revolving operation type of limit switches. Rod length is adjustable, and bending is also easy.
	Fork	Large	Medium	Medium	Good	Excellent	If operated up to 55° position, revolves automatically to retain 90° position. Two dog operation enables recovery operation through single dog, or for anything that has caused the roller position to slip.
	Spring wire and flexible rod	Medium	Large	Small	Possible	Possible	Excluding the thread direction, direction can be adjusted up to 360°. Operating power is the lowest of the limit switches, and is effective in detecting when direction and conditions are uneven. In order to absorb the movements after operation in the actuator part, work slippage tolerances are also large.
	Hinge lever type	Large	Medium	Small	Possible	Possible	Using a low speed, low torque cam, the lever can assume various shapes suited to the operation. The lever is very sturdy.
	Roller lever type	Large	Medium	Small	Possible	Possible	Suited to high speed cams through the attachment of a hinge roller lever.
	One way roller lever type	Medium	Medium	Medium	Possible	Possible	Operation is possible with both hinge lever type and one way operation, but the roller will break if operated in the opposite direction, rendering the unit inoperable. Can be used to prevent opposite direction movement.
	Roller lever type	Medium	Medium	Medium	Possible	Possible	The roller position can be changed.

Design of operating dog and operating speed

Pay attention to the following points when designing the dog for limit switch operation.
1) Make the dog faceplate as smooth as possible.
2) Adjust both the dog angle and the set arm angle as below, depending on the operating speed.
3) The depth (h) of the dog effects the lifespan of the limit switch. Therefore, set the depth to a maximum of 80% of the Total Travel (T.T.)
4) The relationship between the speed of the dog (V = m/s) and the tip angle (α) is as follows:

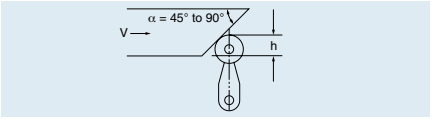
3. 0.5m/s < V≦2m/s



α	Vmax (m/s)
40°	0.7
35°	0.9
30°	1.3
25°	2.0

The maximum tolerable speed can be extended by further reducing the dog rise angle from 45° when 0.5m/s < V≦2m/s. It is necessary to set the arm so that the dog's cutting surfaces are always parallel (θ o = 90°– α)

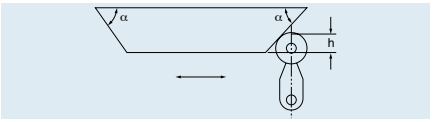
1. V≦0.2m/s



α	Vmax (m/s)
45°	0.2
65°	0.1
60 to 90°	0.05

When V≦0.2m/s, set the arm to perpendicular and set the arm rise angle to between 45° and 90°. If the dog rise angle is reduced, the maximum tolerable speed is increased.
As a rule, α = 45° is optimum.

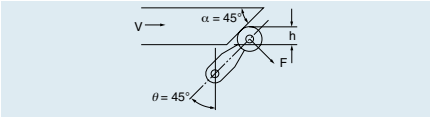
4. Overriding the dog (V≦0.2m/s)



α	Vmax (m/s)
45°	0.2
65°	0.1
60 to 90°	0.05

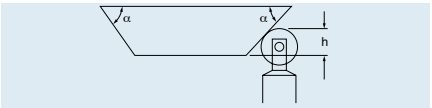
If overriding the dog, set the arm perpendicularly, so that α =45°. If the dog angle is reduced, the tolerable speed is increased.

2. V≦0.5m/s



Because the arm jiggle is as a minimum at a comparative speed such as V≦0.5m/s, setting both the dog angle so that it travels perpendicularly and the arm angle to 45° is optimum.

5. Roller plunger type

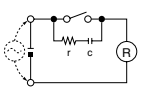
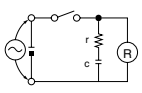
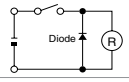
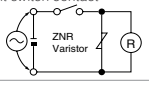


α	Vmax (m/s)	Vmax (m/s)
45°	0.2	(0.5 to 0.7) T.T.
65°	0.1	(0.6 to 0.8) T.T.

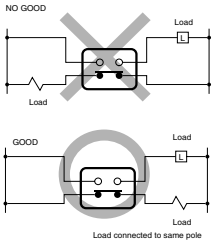
Even if overriding the dog, set the forwards and rearwards motion exactly the same, and avoid any settings that make the actuator accelerate rapidly from the dog.

Protection circuit

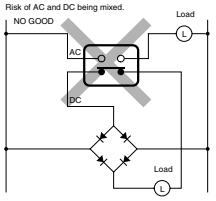
1) The ON/OFF circuit for the guidance load may suffer contact damage due to surges or inrushes when the power is turned either ON or OFF. Consequently, insertion of a protective circuit as per the following diagram is recommended, in order to protect the contacts.

Circuit	Cautions for use
Limit switch contact 	(1) r must be a minimum of 10Ω; (2) When using AC power: Q Impossible when R impedance is large. W Possible when c, r impedance is sufficiently small compared with R impedance.
Limit switch contact 	Can be used with both AC and DC as appropriate. r~R C: 0.1 μF
Limit switch contact 	(1) Dedicated DC use. (2) AC is impossible
Limit switch contact 	Can be used with both AC and DC as appropriate.

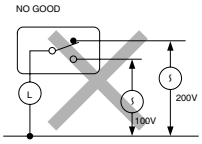
2) Do not connect either irregular poles or power sources to a switch contact. Power connection examples (irregular pole connection)



Example of unsuitable power connection (abnormal power connection)



3) Avoid circuits where power may find a way between the contact points (as this may cause welding.)



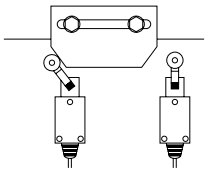
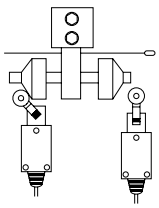
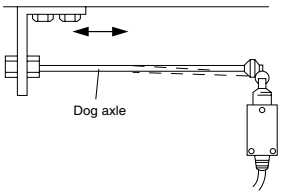
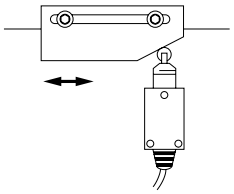
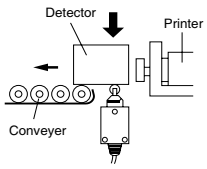
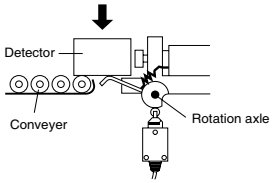
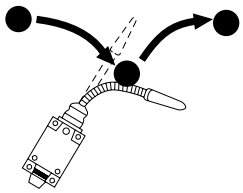
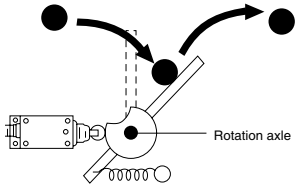
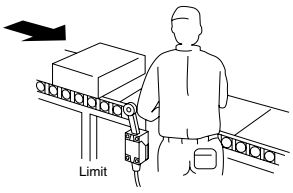
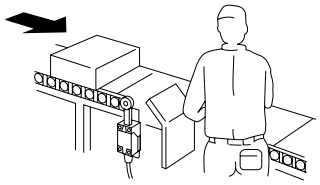
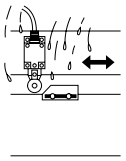
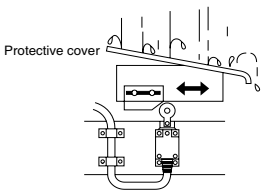
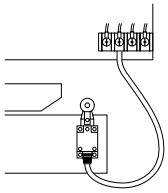
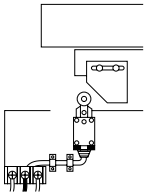
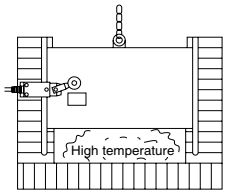
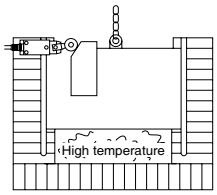
4) Using electronic switch circuits (low power, low current). Bouncing and chattering are generated due to collision between the contacts when the limit switch is switching between them, and this sometimes causes such problems as white noises and error pulses in both the electronic circuit and the reverberation equipment. If the generation of bouncing and chattering becomes a problem, it is necessary to consider installing a CR circuit or other absorption circuit given the circuit design. This is particularly necessary when high contact reliability is needed, and is unsuitable for silver contact switches. Switches with silver contacts possess excellent performance.

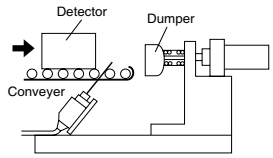
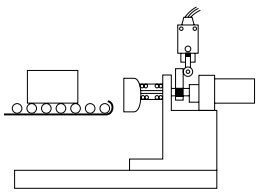
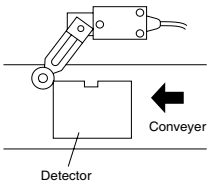
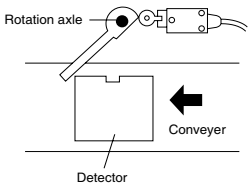
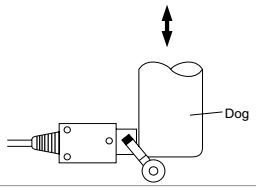
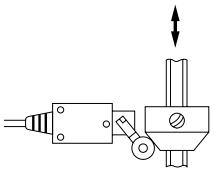
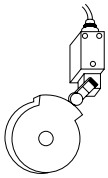
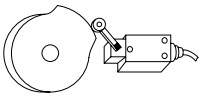
Cautions for use

- Do not attempt to physically alter any part of the switch itself, such as the actuator, or switch attachment vent, as this may cause alterations to both characteristics and performance, and damage the insulation.
- Do not pour any lubricants such as oil or grease onto the moving parts of the actuator, as there is a possibility that this will cause a malfunction due to seepage into the inside, and impair the motion. Silicon-based grease in particular affects the contact points badly.
- If the switches are not to be used for an extended period of time, their contact reliability may be reduced due to oxidation of the contact points. Because accidents may result from the impaired conductivity, always implement a check beforehand.
- Prolonged continuous use of the switch hastens deterioration of the parts (especially the seal rubber) and may cause a malfunction in the release. For this reason, always implement a check beforehand.
- Usage in the vicinity of either the switch operating position (O.P.) or the release position (R.P.) results in unstable contacts. If using the NC contact point, set the actuator to return to the free position (F.P.) Also, is using the NO contact point, hold the ratings values down to 70 to 100% for the overtravel (O.T.)
- If the actuator is forced beyond its total travel (T.T.), the internal mechanism may be damaged. Always use within the T.T.
- Do not apply unreasonable force to the actuator, as this may result in damage and impaired movement.
- The switch, if dropped, may break due to excessive vibration and impact. Therefore, please use extra caution when transporting and installing.
- Condensation inside the switch may occur if there are rapid ambient temperature changes when the switch is in a high temperature and humidity. Since this occurs easily during marine transport, be extra cautious of what the environment will be when shipping. Condensation is the phenomenon in which water vapor condenses into switch-adhering water droplets when the temperature rapidly drops in a high-temperature, high-humidity atmosphere or when the switch is quickly moved from a low temperature location to a place of high temperature and high humidity. It is the cause of insulation deterioration and of rust.
- Be careful of freezing in temperatures below 0°C. Freezing is the phenomenon in which moisture adhering to the switch from condensation or when in unusually high-humidity environments freezes onto the switch when the temperature drops below the freezing point. Please extra caution because freezing can lock moving parts, cause operational delays, or interfere with conductivity when there is ice between the contacts.
- In low-temperature, low-humidity conditions, plastic becomes brittle and the rubber and grease harden, which may lead to malfunction.
- Long term storage (including during transport) in high temperature or high humidity environments or where the atmosphere contains organic or sulfide gas, will cause sulfide or oxide membrane to form on the contact surfaces. This in turn will cause unstable or failed contacting that may lead to functional malfunction. Please verify the atmosphere when storing and transporting.
- Packaging should be designed to reduce as much as possible the potential influence of humidity, organic gas, and sulfide gas, etc.
- Please avoid sudden changes in temperature. This is a cause of switch deformation and encourages the seal structure to breathe, which may lead to seal failure and operational malfunction.
- If installing a thermoplastic resin case, the use of a spring washer tightened directly against the case will cause the case to collapse and become damaged. Therefore, please add a flat washer before tightening. Also, be careful not to install if the case is being twisted.
- When used outdoors (in places where there is exposure to direct sunlight or rain such as in multistory car parks) or in ambient temperature environments where ozone is generated, the influence of these environments may cause deterioration of the rubber material. Please consult us if you intend to use a switch in such environments.
- For the purpose of improving quality, materials and internal structure may be changed without notice.

Precautions relating to the installation environment

Avoid using in silicon environments such as organic silicon-based rubber, solvents, sealants, oil, grease, or wiring.

Poor design	Improved design	Explanation
		› Problem » Dog adjustment is difficult. › Solution » Separate each one until the dog can be adjusted.
		› Problem » The dog axis is too long, and slips out during operation. » For this reason, the limit switch operating position slips. › Solution » Firmly fix the dog plate to the base.
		› Problem » The detector sinks, applying force to the limit switch. » The limit switch O.T. cannot be set. › Solution » Relieve the pressure using an additional actuator, and the O.T. can also be set.
		› Problem » The area around the actuator coil is easily damaged. » Friction generated during operation. › Solution » Relieve the friction by installing an additional actuator. » Change the type of limit switch.
		› Problem » Workers keep bumping the actuator. › Solution » Fit a protective cover to the side of the limit switch.
		› Problem » Because the cord vent for the limit switch faces upwards, water droplets and so forth can easily penetrate the interior. » The cord is constantly moving and thus easily damaged. › Solution » Fix the limit switch position on the stationary board. » Fit a protective cover, so that water and oil cannot come into direct contact with the limit switch.
		› Problem » The cord is not fixed, and gets pulled during work. » Dog adjustment is ineffective. › Solution » Change the limit switch position, and fix the cord. » Attach an adjustment mechanism to the dog.
		› Problem » The limit switch is near a high-temperature area. » Dog adjustment is ineffective, and the dog keeps bumping the lever. › Solution » Move the limit switch further away. » Make dog adjustment possible, and change the shape of the unit.

Poor design	Improved design	Explanation
		› Problem » The detector is scratched. » Limit attachment adjustments are difficult. » The actuator is damaged. » Specimen transfer is impeded. › Solution » Fix the limit position to behind the dumper to solve the above problems.
		› Problem » The transfer path of the detector is not fixed, and it keeps bumping the actuator. » The operating position is unstable. » The actuator is damaged. › Solution » Stabilize the operating position by fitting an additional actuator. » Make limit switch adjustment possible.
		› Problem » Stroke adjustment ineffective. » Release the limit switch position, and ensure that the dog does not bump the lever. › Solution » Make dog adjustment possible. » Change the limit switch position, and sure that the dog does not bump the lever.
		› Problem » The rubber shape is unsuitable (especially during release and strike release.) » Direction of limit switch attachment is unsuitable. › Solution » Render the rubber shape smooth. » Change the limit switch position.

CE MARKINGS OVERVIEW

LIMIT SWITCHES CONFORMING TO IE/IEC STANDARDS

The limit switches shown below conform to both EN and IEC standards, and may display the CE markings.

Product classification	Product name	Suitable standard	Approving body	File No.
Limit switches	HL	EN60947-5-1	TÜV	J9650514/J9650515
	ML	EN60947-5-1	TÜV	J9551204
	VL	EN60947-5-1	TÜV	J9551203
	DL	EN60947-5-1	TÜV	J9551205
	Magnelimit	EN60947-5-1	–	–

Note: Refer to the page for each individual product for detailed approval conditions and approved types. Moreover, the HL limit switch alone does not display the CE mark as standard. If the CE mark is necessary, add (CE) to the end of the part No. when ordering.

WHAT ARE EN STANDARDS?

An abbreviation of Norme Europeenne (in French), and called European Standards in English. Approval is by vote among the CEN/CENELEC member countries, and is a unified standards limited to EU member countries, but the contents conform to the international ISO/IEC standards.
If the relevant EN standard does not exist, it is necessary to obtain approval based on the relevant IEC standard or, if the relevant IEC standard does not exist, the relevant standard from each country, such as VDE, BS, SEMKO, and so forth.

CE MARKINGS & EC DIRECTIVES

The world's largest single market, the European Community (EC) was born on 1 January 1993 (changing its name to EU in November 1993. It is now always expressed as EU, apart from EC directives.) EU member country products have always had their quality and safety guaranteed according to the individual standards of each member country. However, the standards of each country being different prevented the free flow of goods within the EU. For this reason, in order to eliminate non-tariff barriers due to these standards, and to maximize the merits of EU unification, the EC directives were issued concomitant to the birth of the EU.
The EN standards were established as universal EU standards in order to facilitate EU directives. These standards were merged with the international IEC standards and henceforth reflect the standards in all countries. Also, the CE markings show that products conform to EC directives, and guarantee the free flow of products within the EC.

APPROPRIATE EC DIREC-TIVES FOR CONTROL EQUIPMENT PRODUCTS

The main EC directives that are to do with machinery and electrical equipment are the machinery directive, the EMC directive, the low voltage directive, and the telecom directive. Although these directives have already been issued, the date of their enactment is different for each one. The machinery directive was 1 January 1995. The EMC directive was 1 January 1996, and the low voltage directive was enacted from 1 January 1997. The telecom directive was established by the separate CTR (Common Technology references.)

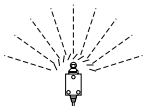
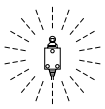
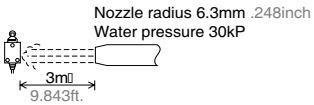
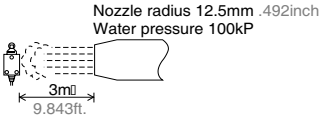
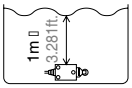
Protective construction

Expresses the degree of protective construction that guards the level of functionability of the switch against ingress of solid objects, water, and oil. The standards are IEC529 (IEC: International Electrotechnical Commission) standards. IEC standards determine the level of protection against both water and solid objects but not against oil.

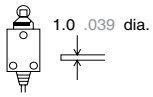
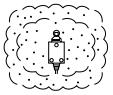
Protection against both water and solid objects

IP- □ □

Protection against water

Level	Protection level	Protection level and test methods	
0	No particular protection	—	
3	Protection against sprays to 60° from the vertical.		No damage incurred when sprayed with water continuously for 10 minutes at angles of up to 60° from the vertical.
4	Protection against water splashed from all directions		No damage incurred when sprayed with water continuously for 10 minutes at angles of up to 180° from the perpendicular across a wide area.
5	Protection against jets of water		No damage incurred when sprayed with a jet of water for 3 minutes from all directions, as per the diagram on the left.
6	Protection against strong jets of water		Water does not invade the interior when sprayed with a jet of water for 3 minutes from all directions, as per the diagram on the left.
7	Protection against the effects of immersion		Water does not invade the interior during immersion for 30 minutes at a depth of 1m 3.281ft..

Protection against solid foreign matter

Level	Protection level	Protection level and test methods	
4	Protection against solid objects exceeding 1mm .039inch in size.		A hard wire 1mm dia. .039 inch dia. across cannot penetrate he inside.
5	Protection against dust. Limited ingress of dust permited. (no harmful deposit)		The unit is left for 8 hours in an atmosphere in which 2kg of talcum powder per 1m^3 is floating. No damage incurred from talcum powder penetrating the inside.
6	Totally protected against ingress of dust		The unit is left for 8 hours in an atmosphere in which 2kg of talcum powder per 1m^3 is floating. The talcum powder does not penetrate the inside.

Notes:
1. All of the tests cited above were conducted with the cord vent (conduit vent) tightly shut.
2. The above protective constructions are based on IEC standard but major differences may arise due to length of use and operating environment. This should be thoroughly discussed and verified.
3. When the corrosion-proof model is immersed in water for 30 minutes or more, verify that no water has penetrated the inside before use.

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The MAC-I standard switches complete the Panasonic limit switch product range. They come in plastic or metal casings and in a large array of different widths and depths. The MAC-I standard switches are suitable for all types of applications, can even be used in harsh environments and in all types of industries (food, packing, lifting, automotive).

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