Limit Switches
Technical Information

■ Safety Precautions

For the individual precautions for each Switch, refer to the *Precautions* section of each Switch.

⚠ WARNING

Do not touch the charged switch terminals while the Limit Switch has carry current. Doing so may result in electric shock.

⚠ WARNING

Do not assemble the Limit Switch or touch the interior of the Limit Switch while power is being supplied to the Limit Switch. Doing so may result in electric shock.

If the Limit Switch incorporates a ground terminal, be sure to ground it through an appropriate wire, otherwise an electric shock may be received.

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

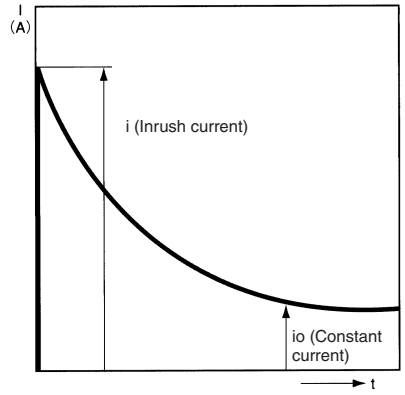
Maintain an appropriate insulation distance between wires connected to the Limit Switch.

If the Limit Switch has no ground terminal, ground the mounting panel to which the Limit Switch is mounted unless the Limit Switch is of double insulation construction falling under class II. Such models (e.g., the D4D-N, D4D-R, D4DS, SHL, D4E-N, ZC, or D4MC) ensure good insulation characteristics. Therefore, no ground terminals are incorporated.

Do not use the Limit Switch in places with flammable or explosive gas without taking any countermeasures against explosion or fires. Otherwise switching arcs or heat radiation may cause a fire or explosion.
Be sure to protect the Limit Switch with appropriate explosion-proof barriers or use a Limit Switch of explosion-proof construction. The Explosion-proof Limit Switch is not available for use in all types of gas or locations. Refer to the *Explosion-proof Device General Catalog* for details.

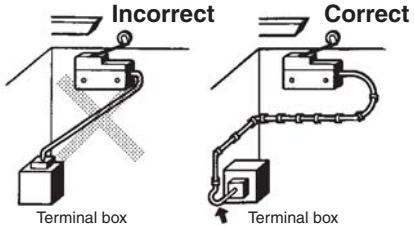
The life of the Limit Switch greatly varies with switching conditions. Before using the Limit Switch, be sure to test the Limit Switch under actual conditions. Make sure that the number of switching operations is within the permissible range.
If a deteriorated Switch is used continuously, insulation failures, contact weld, contact failures, switch damage, or switch burnout may result.

Some types of load have a great difference between normal current and inrush current. Make sure that the inrush current is within the permissible value. The greater the inrush current in the closed circuit is, the greater the contact abrasion or shift will be. Consequently, contact weld, contact separation failures, or insulation failures may result. Furthermore, the Limit Switch may become broken or damaged.



Wiring

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



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

Mounting

Do not modify the actuator, otherwise the operating characteristics and performance of the actuator will change.

Do not enlarge the mounting holes of the Limit Switch or modify the Limit Switch, otherwise insulation failures or housing damage may result. If the Limit Switch has a force separation mechanism, a modification of the Limit Switch may cause injury.

Do not apply oil, grease, or other lubricants to the moving parts of the actuator, otherwise the actuator may not operate correctly. Furthermore, intrusion of oil, grease, or other lubricants inside the Limit Switch may cause failures in the Limit Switch.

When mounting the Limit Switch to the mounting panel, maintain a minimum insulation distance of 1 mm between the mounting panel and the Limit Switch. If the insulation distance is insufficient, add an appropriate insulation guard or separator, otherwise a fire or current leakage may occur or an electric shock may be received.

Mount the Limit Switch and secure it with the specified screws tightened to the specified torque along with flat washers and springs. The actuator of the Limit Switch mounted to a panel with excessive tightening torque may not operate correctly if the Limit Switch is a push-button model.

Be sure to wire the Limit Switch so that the conduit opening is free of metal powder or any other impurities.

If glue or bonding agent is applied, make sure that it does not adhere to the movable parts or intrude inside the Limit Switch, otherwise the Limit Switch may not work correctly or cause contact failure. Some types of glue or bonding agent may generate a gas that may have a bad influence on the Limit Switch. Pay the utmost attention when selecting the glue or locking agent.

Do not drop or disassemble the Limit Switch, otherwise the Limit Switch will not be capable of full performance. Furthermore, the Limit Switch may become broken or burnt.

If the contacts are not turned ON or OFF over a long time, the contacts may become oxidized. Consequently, the reliability of the contacts may decrease, which may result in accidents.

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

Some models allow changes in head directions. When changing the head of such a model, make sure that the head is free of any foreign substance. Tighten each screw of the head to the rated torque.

Be sure to take measures so that no foreign material, oil, or water will penetrate into the Limit Switch through the conduit opening. Be sure to attach a connector suited to the cable thickness and tighten the connector securely to the rated torque.

Apply Limit Switch models incorporating a force-separation function, such as the D4BS or D4BL, for safety doors or emergency stop circuits.

Do not impose shock or vibration on the actuator while it is fully pressed. Otherwise, the actuator will partially abrade and an actuation failure may result.

■ Correct Use

Limit Switch Operation

The Limit Switch in actual operation may cause accidents that cannot be foreseen from the design stage. Therefore, the Limit Switch must be practically tested before actual use.

When testing the Limit Switch, be sure to apply the actual load condition together with the actual operating environment.

All the performance ratings in this catalog are provided under the following conditions unless otherwise specified.

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

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

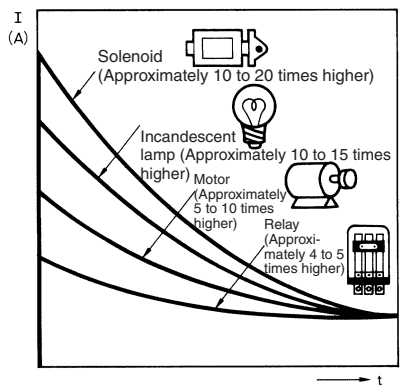
Motor load: An inrush current 8 times higher than the normal current

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

1. Ambient temperature: +5°C to 35°C

2. Ambient humidity: 40% to 70%.

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



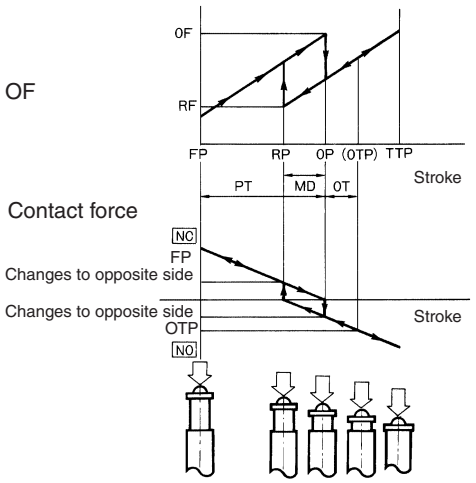
Mechanical Characteristics

Operating Force, Stroke, and Contact Characteristics

The following graph indicates the relationship between operating force and stroke or stroke and contact force. In order to operate the Limit Switch with high reliability, it is necessary to use the Limit Switch within an appropriate contact force range. If the Limit Switch is used in the normally closed condition, the dog must be installed so that the actuator will return to the FP when the actuator is actuated by the object. If the Limit Switch is used in the normally open condition, the actuator must be pressed to 70% to 100% of the OT (i.e., 60% to 80% of the TT) and any slight fluctuation must be absorbed by the actuator.

If the full stroke is set close to the OP or RP, contact instability may result. If the full stroke is set to the TTP, the actuator or switch may become damaged due to the inertia of the dog. In that case, adjust the stroke with the mounting panel or the dog. Refer to page 6, *Dog Design*, page 7, *Stroke Settings vs. Dog Movement Distance*, and page 8, *Dog Surface* for details.

The following graph shows an example of changes in contact force according to the stroke. The contact force near the OP or RP is unstable, and the Limit Switch cannot maintain high reliability. Furthermore, the Limit Switch cannot withstand strong vibration or shock.



Mechanical Conditions

The actuator must be selected according to the operating method.

Check the operating speed and switching frequency.

1. If the operating speed is extremely low, the switching of the movable contact will become unstable, thus resulting in incorrect contact or contact weld.
If the operating speed is extremely low or the pushbutton needs to be set between the FP and OP, consult your OMRON representative in advance.

2. If the operating speed is extremely high, the Limit Switch may break due to shock. If the switching frequency is high, the switching of the contacts cannot catch up with the switching frequency. Make sure that the switching frequency is within the rated switching frequency. If a higher switching frequency is required, use of a proximity sensor is recommended.

Do not impose excessive force on the actuator, otherwise the actuator may become damaged or not operate correctly.

Make sure that the stroke is set within the suitable range specified for the model, or otherwise the Limit Switch may break.

Make sure that the operating direction of the actuator is parallel to the axis of the actuator if the actuator is a pushbutton type. If they are not in parallel, partial abrasion may result and the actuator may soon become damaged. Refer to page 5, *Operation* for details.

Electrical Characteristics

Electrical Conditions

The switching load capacity of the Limit Switch greatly varies between AC and DC. Always be sure to apply the rated load. The control capacity will drastically drop if it is a DC load. This is because a DC load has no current zero-cross point, unlike an AC load. Therefore, if an arc is generated, it may continue comparatively for a long time. Furthermore, the current direction is always the same, which results in a contact relocation phenomena whereby the contacts easily stick to each other and do not separate when the surfaces of the contacts are uneven.

If the load is inductive, counter-electromotive voltage will be generated. The higher the voltage is, the higher the generated energy will be, which will increase the abrasion of the contacts and contact relocation phenomena. Be sure to use the Limit Switch within the rated conditions.

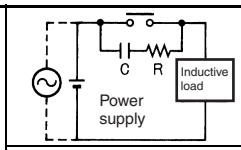
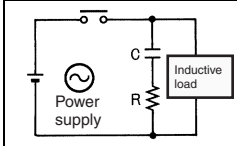
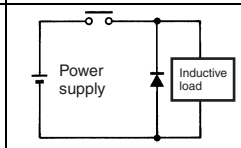
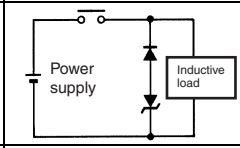
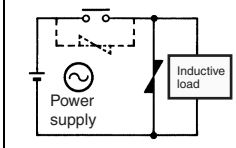
If the load is a minute voltage or current load, use a dedicated Limit Switch for minute loads. The reliability of silver-plated contacts, which are used by standard Limit Switches, will be insufficient if the load is a minute voltage or current load.

Contact Protective Circuit

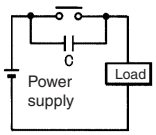
Apply a contact protective circuit to extend the contact life, prevent noise, and suppress the generation of carbide or nitric acid. Be sure to apply the contact protective circuit correctly, otherwise an adverse effect may occur.

The following provides typical examples of contact protective circuits. If the Limit Switch is used in an excessively humid location for switching a load that easily generates arcs, such as an inductive load, the arcs may generate NOx, which will change into HNO_3 if it reacts with moisture. Consequently, the internal metal parts may corrode and the Limit Switch may fail. Be sure to select the ideal contact preventive circuit from the following.

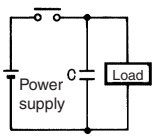
Typical Examples of Contact Protective Circuits

Circuit example		Applicable current		Feature	Element selection
		AC	DC		
CR circuit		*	Yes	*When AC is switched, the load impedance must be lower than the CR impedance.	C: 1 to 0.5 μF x switching current (A) R: 0.5 to 1 Ω x switching voltage (V) The values may change according to the characteristics of the load. The capacitor suppresses the spark discharge of current when the contacts are open. The resistor limits the inrush current when the contacts are closed again. Consider the roles of the capacitor and resistor and determine ideal capacitance and resistance values through testing. Use a capacitor that has a low dielectric strength. When AC is switched, make sure that the capacitor has no polarity.
		Yes	Yes	The operating time will be greater if the load is a relay or solenoid. Connecting the CR circuit in parallel to the load is effective when the power supply voltage is 24 or 48 V and in parallel to the contacts when the power supply voltage is 100 to 200 V.	
Diode method		No	Yes	Energy stored in the coil is changed into current by the diode connected in parallel to the load. Then the current flowing to the coil is consumed and Joule heat is generated by the resistance of the inductive load. The reset time delay with this method is longer than that in the CR method.	The diode must withstand a peak inverse voltage 10 times higher than the circuit voltage and a forward current as high or higher than the load current.
Diode and Zener diode method		No	Yes	This method will be effective if the reset time delay caused by the diode method is too long.	Use a Zener diode at a low Zener voltage.
Varistor method		Yes	Yes	This method makes use of constant-voltage characteristic of the varistor so that no high-voltage is imposed on the contacts. This method causes a reset time delay. Connecting a varistor in parallel to the load is effective when the supply voltage is 24 to 48 V and in parallel to the contacts when the supply voltage is 100 to 200 V.	---

Do not apply contact protective circuits as shown below.



This circuit effectively suppresses arcs when the contacts are OFF. The capacitor will be charged, however, when the contacts are OFF. Consequently, when the contacts are ON again, short-circuited current from the capacitance may cause contact weld.

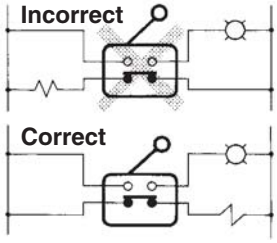


This circuit effectively suppresses arcs when the contacts are OFF. When the contacts are ON again, however, charge current will flow to the capacitor, which may result in contact weld.

Switching a DC inductive load is usually more difficult than switching a resistive load. By using an appropriate contact protective circuit, however, switching a DC inductive load will be as easy as switching a resistive load.

Do not contact a single Limit Switch to two power supplies that are different in polarity or type.

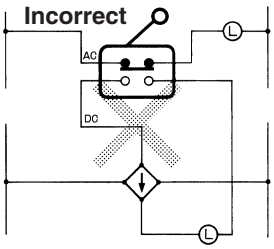
Power Connection Examples
(Connection of Different Polarities)



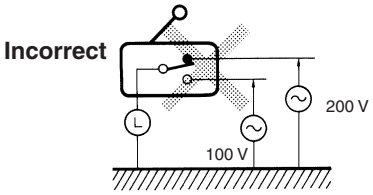
Connect the load to the same polarities.

Incorrect Power Connection Example

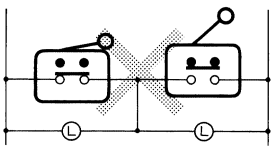
(Connection of Different Power Supplies)
There is a risk of AC and DC mixing.



Do not design a circuit where voltage is imposed between contacts, otherwise contact weld may result.



Do not use a circuit that will short-circuit if an error occurs, otherwise the charged part may melt and break off.



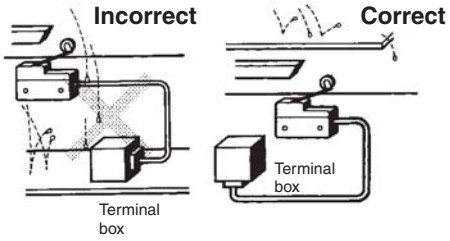
Application of Limit Switch to a Low-voltage, Low-current Electronic Circuit

1. If bouncing or chattering of the contacts results and causes problems, take the following countermeasures.
   (a) Insert an integral circuit.
   (b) Suppress the generation of pulse from the contact bouncing or chattering of the contacts so that it is less than the noise margin of the load.
2. Conventional silver-plated contacts are not suited to this application. Use gold-plated contacts, which are ideal for handling minute voltage or current loads.
3. The contacts of the Limit Switch used for an emergency stop must be normally open.

In order to protect the Limit Switch from damage due to circuit short-circuiting, be sure to connect a quick-response fuse with a breaking current 1.5 to 2 times larger than the rated current to the Limit Switch in parallel. Some models (e.g., the D4B-N and D4BS) specify the types of fuses. In that case, be sure to use the specified fuses.

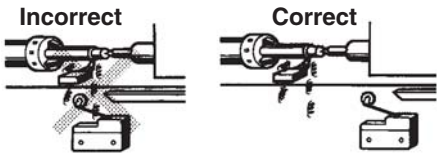
Operating Environment

If the Limit Switch used in locations with oil or water spray or excessive dust is not a water-resistive model or of sealed construction, be sure to protect the Limit Switch with a protective cover so that the Limit Switch will not be directly exposed to them.



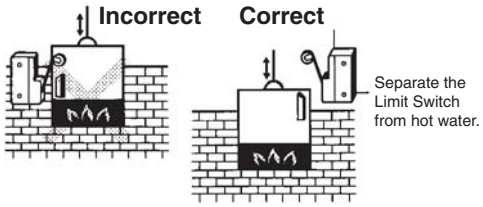
The materials of Limit Switch may change in quality or deteriorate, if the Limit Switch is used outdoors or any other location where the Limit Switch is exposed to special machining oil. Consult your OMRON representative before selecting the model.

Be sure to install the Limit Switch so that the Limit Switch is free from dust or metal powder. The actuator and the switch casing must be protected from the accumulation of dust or metal powder.

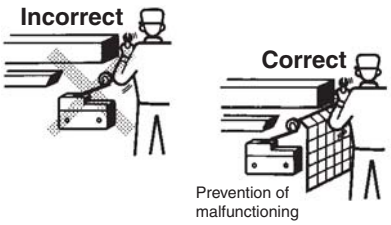


Do not use the Limit Switch in locations where the Limit Switch is exposed to hot water at a temperature greater than 60°C or steam.

Do not use the Limit Switch under temperatures or other environmental conditions not within the specified ranges. The rated permissible ambient temperature range varies with the model. Refer to the specifications in this catalog.
If the Limit Switch is exposed to radical temperature changes, the thermal shock may deform the Limit Switch and the Limit Switch may malfunction.



Be sure to protect the Limit Switch with a cover if the Limit Switch is in a location where the Limit Switch may be actuated by mistake or where the Limit Switch is likely to cause an accident.



Make sure to install the Limit Switch in locations free of vibration, shock, or resonance. If vibration or shock is continuously imposed on the Limit Switch, contact failure, malfunction, or decrease in service life may be caused by abrasive powder generated from the internal parts. If excessive vibration or shock is imposed on the Limit Switch, the contacts may malfunction or become damaged.

Do not use the Limit Switch with silver-plated contacts for long periods if the switching frequency of the Limit Switch is comparatively low or the load is minute. Otherwise, sulfuric film will be generated on the contacts and contact failures may result. Use the Limit Switch with gold-plated contacts or use a dedicated Limit Switch for minute loads instead.

Do not use the Limit Switch in locations with corrosive gas, such as sulfuric gas (H_2S or SO_2), ammonium gas (NH_3), nitric gas (HNO_3), or chlorine gas (Cl_2), or high temperature and humidity. Otherwise, contact failure or corrosion damage may result.

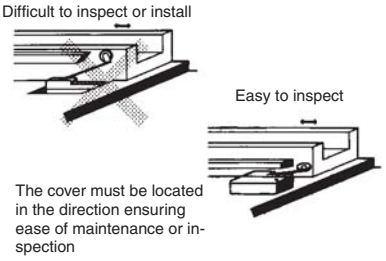
If the Limit Switch is used in locations with silicone gas, arc energy may create silicon dioxide (SiO_2) on the contacts and a contact failure may result. If there is silicone oil, silicone sealant, or wire covered with silicone close to the Limit Switch, attach a contact protective circuit to suppress the arcing of the Limit Switch or eliminate the source of silicone gas generation.

Regular Inspection and Replacement

If the Limit Switch is normally closed with low switching frequency (e.g., once or less than once a day), a reset failure may result due to the deterioration of the parts of the Limit Switch. Regularly inspect the Limit Switch and make sure that the Limit Switch is in good working order.

In addition to the mechanical life or electrical life of the Limit Switch described previously, the life of the Limit Switch may decrease due to the deterioration of each part, especially rubber, resin, and metal. Regularly inspect the Limit Switch and replace any part that has deteriorated in order to prevent accidents from occurring.

Be sure to mount the Limit Switch securely in a clean location to ensure ease of inspection and replacement. The Limit Switch with operation indicator is available, which is ideal if the location is dark or does not allow easy inspection or replacement.



Storage of Limit Switch

When storing the Limit Switch, make sure that the location is free of corrosive gas, such as H_2S, SO_2, NH_3, HNO_3, or Cl_2, or dust and does not have a high temperature or humidity.

Be sure to inspect the Limit Switch before use if it has been stored for three months or more.

Outdoor Use

When using the Limit Switch outdoors, make sure that the Limit Switch is a sealed model. The Limit Switch with IP67 sealing construction does not necessarily mean that the mechanical parts are also of IP67 construction.

The rubber material exposed to ozone may deteriorate.
Check that the rubber parts are environment-resistive, such as chloroprene, silicone, or fluorine rubber. The following models are recommended.
WL□-P1 or D4C-□P

If the Limit Switch is used in places with sludge or dust powder sprays, make sure that the mechanical parts are sealed with a rubber cap.

Due to capillary attraction, rainwater may enter the Limit Switch through the lead wires or sheath. Be sure to cover the wire connections in a terminal box so that they are not directly exposed to rainwater.

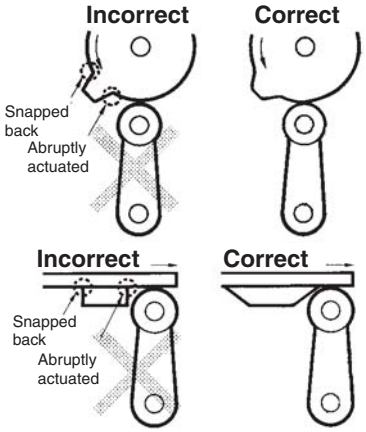
If the Limit Switch is used outdoors, the steel parts of the Limit Switch (such as the screws and plunger parts) may corrode. Consider the use of outdoor models, such as WL-□P1 or D4C-□P, or proximity sensors in such cases.

The expression “Limit Switch is used outdoors” refers to an environment where the Limit Switch is exposed directly to rainwater or sunlight (e.g., multi-story parking lots) excluding locations with corrosive gas or salty breezes.
The Limit Switch used outdoors may not release due to icing and may not satisfy standards for indoor use.

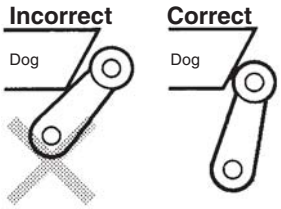
Operation

Carefully determine the position and shape of the cam so that the actuator will not abruptly snap back, thus causing shock. In order to operate the Limit Switch at a comparatively high speed, use an object or cam that keeps the Limit Switch turned ON for a sufficient time so that the relay or valve will be sufficiently energized.

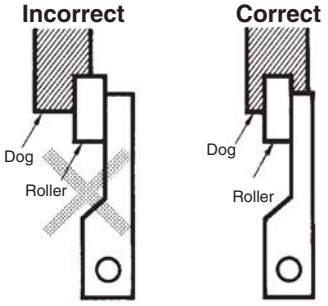
The shape of the object or cam has a large influence on the life and operating accuracy of the Limit Switch. The cam must be smooth in shape.



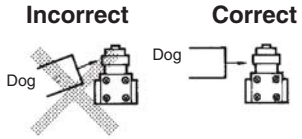
Appropriate force must be imposed on the actuator by the cam or another object in both rotary operation and linear operation. If the object touches the lever as shown below, the operating position will not be stable.



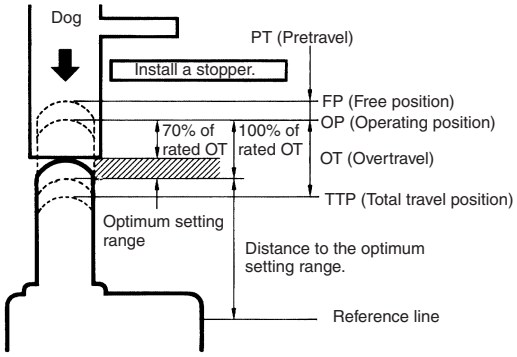
Unbalanced force must not be imposed on the actuator. Otherwise, wear and tear on the actuator may result.



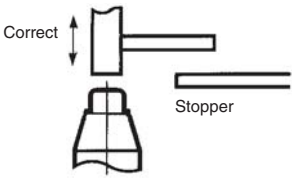
In the case of a roller-type actuator, the object must touch the actuator at a right angle. Otherwise, the actuator or shaft may deform or break.



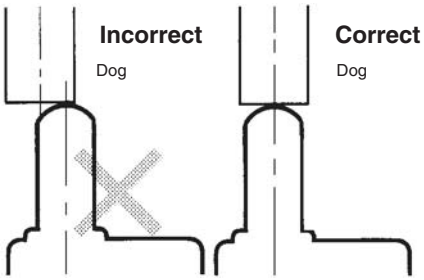
Make sure that the actuator does not exceed the OT (overtravel) range, otherwise the Limit Switch may malfunction. When mounting the Limit Switch, be sure to adjust the Limit Switch carefully while considering the whole movement of the actuator.



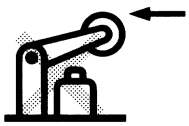
The Limit Switch may soon malfunction if the OT is excessive. Therefore, adjustments and careful consideration of the position of the Limit Switch and the expected OT of the actuator are necessary when mounting the Limit Switch.



When using a pin-plunger-type actuator, make sure that the stroke of the actuator and the movement of the object are located along a single straight line.



Be sure to use the Limit Switch according to the characteristics of the actuator. If a roller arm lever actuator is used, do not attempt to actuate the Limit Switch in the direction shown below.

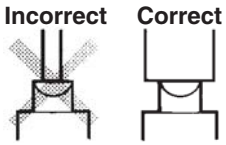


Do not modify the actuator to change the OP.

In the case of a long actuator of an adjustable roller lever type, the following countermeasures against lever shaking are recommended.

1. Make the rear edge of the object smooth with an angle of 15° to 30° or make it in the shape of a quadratic curve.
2. Design the circuit so that no error signal will be generated.
3. Use or set a switch that is actuated in one direction only.

In the case of a bevel plunger-type actuator, make sure that the width of the object is wider than that of the plunger.



Dog Design

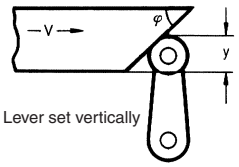
Operating Speed, Dog Angle, and Relationship with Actuator

Before designing a dog, carefully consider the operating speed and angle of the dog and their relationship with the shape of the actuator. The optimum operating speed of a standard dog at an angle of 30° to 45° is 0.5 m/s maximum.

Roller Lever Models

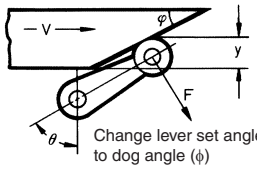
1. Non-overtravel Dog

Dog speed: 0.5 m/s max. (standard speed)



φ	V max. (m/s)	y
30° 45° 60° 60° to 90°	0.4 0.25 0.1 0.05 (low speed)	0.8 (TT) 80% of total travel

Dog speed: 0.5 m/s ≤V ≤2 m/s

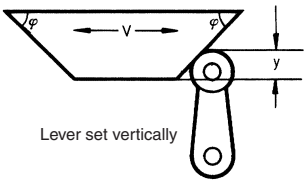


θ	φ	V max. (m/s)	y
45°	45°	0.5	0.5 to 0.8 (TT)
50°	40°	0.6	0.5 to 0.8 (TT)
60° to 55°	30° to 35°	1.3	0.5 to 0.7 (TT)
75° to 65°	15° to 25°	2	0.5 to 0.7 (TT)

Note: The above y values indicate the ratio ranges based on TT (total travel). Therefore, the optimum pressing distance of the dog is between 50% and 80% (or 50% and 70%).

2. Overtravel Dog

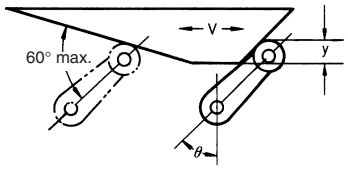
Dog speed: 0.5 m/s max.



φ	V max. (m/s)	y
30° 45° 60° 60° to 90°	0.4 0.25 0.1 0.05 (low speed)	0.8 (TT) 80% of total travel

Dog speed: 0.5 m/s min.

If the speed of the overtravel dog is comparatively high, make the rear edge of the object smooth at an angle of 15° to 30° or make it in the shape of a quadratic curve. Then lever shaking will be reduced.



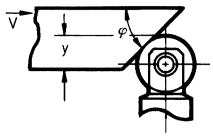
θ	φ	V max. (m/s)	y
45°	45°	0.5	0.5 to 0.8 (TT)
50°	40°	0.6	0.5 to 0.8 (TT)
60° to 55°	30° to 35°	1.3	0.5 to 0.7 (TT)
75° to 65°	15° to 25°	2	0.5 to 0.7 (TT)

Note: The above y values indicate the ratio ranges based on TT (total travel). Therefore, the optimum pressing distance of the dog is between 50% and 80% (or 50% and 70%).

Plunger Models

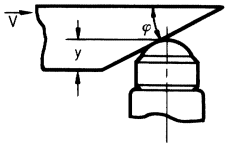
If the dog overrides the actuator, the front and rear of the dog may be the same in shape, provided that the dog is not designed to be separated from the actuator abruptly.

Roller Plunger



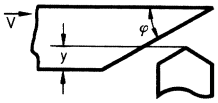
φ	V max. (m/s)	y
30°	0.25	0.6 to 0.8 (TT)
20°	0.5	0.5 to 0.7 (TT)

Ball Plunger



φ	V max. (m/s)	y
30°	0.25	0.6 to 0.8 (TT)
20°	0.5	0.5 to 0.7 (TT)

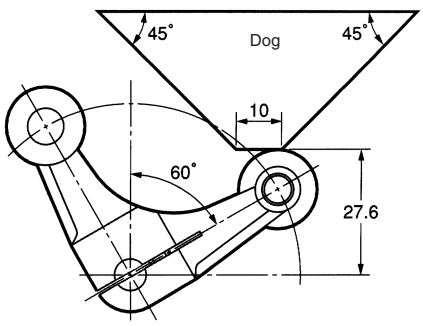
Bevel Plunger



φ	V max. (m/s)	y
30°	0.25	0.6 to 0.8 (TT)
20°	0.5	0.5 to 0.7 (TT)

Note: The above y values indicate the ratio ranges based on TT (total travel). Therefore, the optimum pressing distance of the dog is between 60% and 80% (or 50% and 70%).

Fork Lever Lock Models

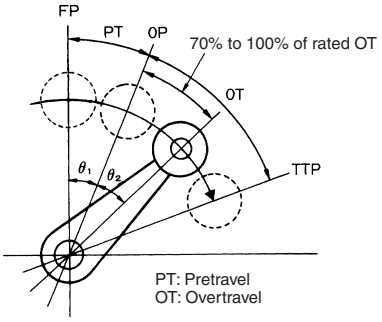


Note: Design the shape of the dog so that it does not come in contact with the other roller lever when the actuator is inverted.

Stroke Settings vs. Dog Movement Distance

The following provides information on stroke settings based on the movement distance of the dog instead of the actuator angle.
The following is the optimum stroke of the Limit Switch

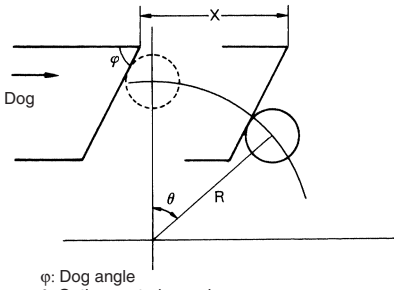
Optimum stroke: PT + (Rated OT x 0.7 to 1.0)
The angle converted from the above: $\theta_1 + \theta_2$



The movement distance of the dog based on the optimum stroke is expressed by the following formula.

Movement distance of dog

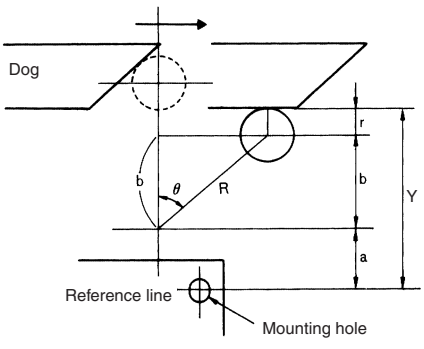
$$X = R\sin\theta + \frac{R(1-\cos\theta)}{\tan\varphi} \text{ (mm)}$$



φ: Dog angle
θ: Optimum stroke angle
R: Actuator length
X: Dog movement distance

The distance between the reference line and the bottom of the dog based on the optimum stroke is expressed by the following formula.

$$Y = a + b + r \text{ (mm)}$$



a: Distance between reference line and actuator fulcrum
b: R cosθ
r: Roller radius
Y: Distance between reference line and bottom of dog

Dog Surface

The surface of dog touching the actuator should be 6.3 S in quality and hardened at approximately H450V.

For smooth operation of the actuator, apply molybdenum disulfide grease to the actuator and the dog touching the actuator. This is ideal for Limit Switches of drip-proof construction and Multiple Limit Switch models.

Maintenance and Repairs

The user must not maintain or repair the system. Consult the manufacturer of the system for maintenance or repairs.

Others

The Limit Switch has contacts that must be free of silicone gas, otherwise a contact failure may result. Therefore, do not apply cable covered with silicone, silicone sealant, or silicone grease to the Limit Switch.

The sealing of the standard Limit Switch uses nitrile butadien rubber (NBR), which is highly oil resistive. The NBR exposed to different types of oil or chemical may, however, deteriorate, swell, or shrink. Contact your OMRON representative for details.
The WLNJ, D4C-□□32, and ZE-N□ incorporate exposed seal caps, which may be deteriorated by ozone. Consult your OMRON representatives before using the above models outdoors, near large bodies of water, or in locations where ozone is generated.

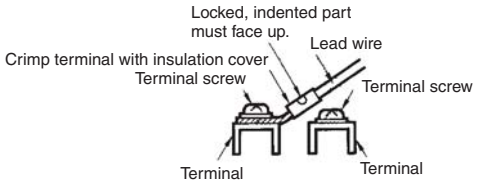
OMRON shall not guarantee the performance and characteristics of any actuator, plunger, or lever modified by the user.

When using the Limit Switch with a long lever or long rod lever, make sure that the lever is in the downward direction.

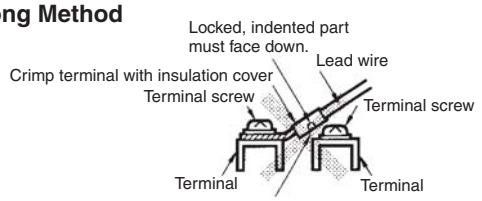
In order to ensure high contact reliability, the correct Limit Switch must be selected according to the load. For details, refer to the precautions for minute load models in this catalog.

The leads must be wired as shown below.

Correct Method



Wrong Method



Distance is too short and proper dielectric strength cannot be maintained.

■ Switch Trouble and Remedial Action

Problem		Probable cause	Remedy
Mechanical failure	**1.** The actuator does not operate. **2.** The actuator does not return to the free position (FP). **3.** The actuator has been deformed. **4.** The actuator is worn. **5.** The actuator has been damaged.	The shape of the cam is incorrect.	Change the design of the cam and smooth the contacting surface of the cam.
		The contacting surface of the dog is rough.	
		The actuator in use is not suitable.	Scrutinize the suitability of the actuator. Make sure that the actuator does not bounce.
		The operating direction of the actuator is not correct.	
		The operation speed is excessively high.	Attach a decelerating device or change the mounting position of the Limit Switch.
		Excessive stroke.	Change the stroke.
		The rubber or grease hardened due to low temperature.	Use a cold-resistive switch.
		The accumulation of sludge, dust, or cuttings.	Use a drip-proof model or one with high degree of protection.
		Dissolution, expansion, or swelling damage to the rubber parts of the driving mechanism.	Use a protection cover and change the solvent and materials.
	There is a large deviation in operating position (with malfunctioning involved).	Damage to and wear and tear of the internal movable spring.	Regularly inspect the Limit Switch. Use a better quality switch.
		Wear and tear of the internal mechanism.	Tighten the mounting screws securely. Use a mounting board.
		The loosening of the mounting screws.	
	The terminal part wobbles. (The mold part has been deformed.)	Overheating due to a long soldering time.	Solder the Limit Switch quickly.
		The Limit Switch has been connected to and pulled by thick lead wires with excessive force.	Change the lead wire according to the carry current and ratings.
		High temperature or thermal shock resulted.	Use a temperature-resistive switch or change mounting positions.

Problem		Probable cause	Remedy
Failures related to chemical or physical characteristics	Contact chattering	Vibration or shock is beyond the rated value.	Attach an anti-vibration mechanism. Attach a rubber circuit to the solenoid. Increase the operating speed (with an accelerating mechanism).
		Shock has been generated from a device other than the Limit Switch.	
		Too-slow operating speed.	
	Oil or water penetration	The sealing part has not been tightened sufficiently.	Use a drip-proof or waterproof switch. Use the correct connector and cable. (Use a sealed connector for sealed switches.) Use a switch with terminals sealed with resin.
		The wrong connector has been selected and does not conform to the cable.	
		The wrong switch has been selected.	
		The terminal part is not molded.	
		The Limit Switch has been burnt or carbonated due to the penetration of dust or oil.	
	Deterioration of the rubber part	The expansion and dissolution of the rubber caused by solvent or lubricating oil.	Use an oil-resistant rubber or Teflon bellows. Use a weather-resistant rubber or protective cover. Use a switch with a protective cover or a metal bellows.
		Cracks due to direct sunlight or ozone.	
		Damage to the rubber caused by scattered or heated cuttings.	
	Corrosion (cracks)	The oxidation of metal parts resulted due to corrosive solvent or lubricating oil.	Use an anti-corrosive switch. Change the lubricating oil. Change mounting positions. Use a crack-resistant material.
		The Limit Switch has been operated in a corrosive environment, near the sea, or on board a ship.	
		The electrical deterioration of metal parts of the Limit Switch resulted due to the ionization of cooling water or lubricating oil.	
		The cracking of alloyed copper due to rapid changes in temperature.	
Failures related to electric characteristics	No actuation or no current breakage caused by contact weld.	Inductive interference in the DC circuit.	Add an erasing circuit.
		Carbon generated on the surface of the contacts due to switching operations.	Use a switch with a special alloy contact or use a sealed switch.
		A short-circuit or contact weld due to the deformation and relocation of the contacts.	Reduce the switching frequency or use a switch with a large switching capacity.
		Contact weld due to an incorrectly connected power source.	Change the circuit design.
		Foreign materials or oil penetrated into the contact area.	Use a protective box.

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

Cat. No. C121-E2-01