

Limit Switches - 101

A basic guide to ABB's limit switch portfolio



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Objectives

The purpose of this guide is to reinforce the basic aspects of ABB's mechanical limit switch offering. This includes the following:

- Understand fundamental limit switch terminology
- Recognize marketing opportunities
- Develop solutions with related components
- Make educated sales recommendations
- Compete in the market and improve ABB's market position in limit switches
- Learn where to find the limit switch tools and resources available from ABB

Using this guide

This guide has been designed to give a thorough overview of limit switches, both as a general industrial product, and also as a quality ABB offering.

Readers who are new to the limit switch controls industry should begin with Section 2, which explains several industry-wide terms and products.

For those who are familiar with limit switches, but are new to the ABB product ranges, you may go straight to Section 3 which gets into the ABB product portfolio.

Product definition Limit switches are a type of sensor that detect presence and absence. Specifically, *mechanical limit switches* are switches that are mechanically activated, meaning that they have some sort of arm, lever, knob, plunger, etc., which is physically—or mechanically—activated by making contact with another object. As the object makes contact with the actuator of the switch, it eventually moves the actuator to its “limit” where the contacts change state. Other varieties of sensors/switches exist, including proximity sensors, light sensors, electric switches, among others.

In its simplest form, a limit switch is a “switch” that can be mounted into remote locations so that it is actuated by an object other than a human operator. Some basic functions of limit switches are:

- Detecting presence/absence
- Counting
- Detecting range of movement
- Detecting positioning & travel limit
- Breaking a live circuit when unsafe conditions arise
- Detecting speed
- ...and hundreds of other applications

Limit switches are a problem-solving product. There is often “no right answer” as to which switch can be used in any given situation. Usually product choice is left to the user to determine how he can best utilize the switch. Because of this characteristic, limit switches can be fun to sell a “fun” product—they are the solution to a brainteaser game!

Mechanical limit switches can be found in *any* industrial or commercial application where detection or safety is needed.

Strengths & weaknesses

Limit switches are a practical solution for sensing in most situations. There are, however, a few disadvantages to using limit switches. Some of the strengths and weaknesses of the product are listed below:

Strengths	Weaknesses
<ul style="list-style-type: none">• Switching high currents is no problem (up to 10A)• High precision, accuracy, and repeatability• Economic sensing solution• Can withstand most environments	<ul style="list-style-type: none">• Must make physical contact with an object to actuate• Mechanical component can wear out

Applications, industries & markets

Limit switches are very commonly used devices. Think about these simple applications:

- What keeps the microwave from starting without the door being shut first?
- What turns the light off when the refrigerator door is closed?
- Why do your car's dome lights come on when you open the door?
- What stops the washing machine when a load becomes unbalanced?

Industrial Application Examples:

Case 1: Packaging. Boxes of paper approach the end of the packaging line, ready to be stacked onto pallets 6 boxes high. A palletizer with suction-cup grippers picks up a box and swings around to a waiting pallet. How does the unit know it has reached the sixth layer of boxes?

When the pivot arm reaches the top of its vertical travel, the arm hits a limit switch. The switch signals the system to send the full pallet down line and sets up an empty pallet to restart the process.



Case 2: Working where people cannot. Inside a sawmill, a high-speed saw quickly reduces logs into construction beams. In the process, chips and dust float in the air. Breathing is impossible in the area without a mask. Even with goggles, it would be impossible to inspect the cutting. The production department devised a system of limit switches to do the inspecting automatically.

A remote operator can configure the switches to allow the log to be cut to the desired dimensions.



Case 3: Food and beverage. At a frozen food processor, an automatic pallet stacking system is used. This system uses a wobble stick limit switch to detect when the pallets have been loaded to their desired level. The switch then signals the conveyor to send the load through an automatic vertical rise door into the freezer for quick freezing.



Case 4: Fire safety. In a manufacturing plant, rooms need to be closed off quickly in case of contamination or fire. To help facilitate this process, high-speed doors have been developed. These doors may move as quickly as six feet per second. At such speeds, the door would destroy itself quickly, if not for the use of limit switches. The limit switches are used to slow the door just before it is fully opened or fully closed.

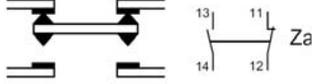
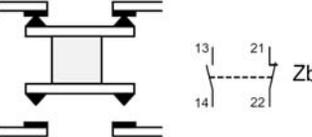


Some of many industries with limit switch needs:

- Material handling – packaging, moving, warehousing, distribution
- Food & beverage packaging, distribution
- Manufacturing – automotive/heavy equipment, machining, marine/aviation, glass & plastics
- Metals – mining, refining, processing, forming
- Commercial applications
- Control cabinets
- Many, many more!

Terminology

AC-13	Utilization category: Switching of electromagnetic loads using an alternating current (>72VA)
Actuator Free Position	The initial or “neutral” position of the actuator when there is no external force applied to it.
Actuator Operating Position	The position of the actuator when the contacts are operating
Contact	The conducting part of a switch that makes or breaks a circuit. Available as “normally open”, in which the circuit is open in its neutral state, or “normally closed”, in which the circuit will be closed. Activation of the operator will reverse the neutral state of the contact.
DC-15	Utilization category: Switching of electromagnets using a direct current.
Double Insulation,	Class II materials, according to IEC 536, are designed with double insulation. This doubles the functional insulation with an additional layer of insulation so as to eliminate the risk of electric shock and thus not having to protect elsewhere. No conductive part of “double insulated” material should be connected to a protective conductor. Commonly indicated by this symbol: 
Operator/Actuator/Head	The part of the switch that is physically touched to operate the contacts. This mechanism transmits the applied force from the actuating device to the contacts. Operators include levers, rollers, plungers, wobble sticks, cable pulls, rods, and more.
Operating Force	The straight line force in the designed direction applied to the switch actuator to cause the contacts to move to the operated position.
Operating Torque	The torque that must be applied to the actuator to cause the movable contacts to move to the operated contact position.
Overtravel	The movement of the actuator beyond the contact operating position.
Pretravel	The movement of the actuator from the free position to the point in which the contacts are actuated.
Positive Action	A contact structure similar to snap action with one addition: continued operation of the operating mechanism beyond the normal snap action position applies force directly to the normally closed (NC) contact if it has not opened with the snap action mechanism. This helps to ensure opening of even a welded contact. No direct opening forces are applied to the NO contact. Commonly indicated by this symbol: 

Rated operational current	The amperage the pilot device can withstand in AC-15 or DC-13 applications for a given voltage level (ABB's max is 10A).
Slow action	Contact action characterized by when a switch actuator's speed is directly relevant to the speed of the contacts opening or closing.
Slow make/Slow break	A type of contact structure with no overcenter mechanism. Contacts move at a speed directly proportional to the speed of operation of the actuator. Contacts may touch with little contact pressure.
Snap Action	Contact action when movement of the actuator applies force to an overcenter mechanism, which creates a fast change in contact state once the overcenter position has been exceeded. This results in a "trigger" action opening or closing the contacts.
Total/Maximum Travel	Sum of the pretravel and overtravel; the complete travel limit of a switch.
Za	Contact shape: contacts have the same polarity. 
Zb	Contact shape: moving contacts are electrically separated on either side of the circuit. 

Specifications

In general, devices are designed for two markets: the IEC (global) market, and the NEMA (North American) market. ABB's product line meets both IEC and NEMA requirements.

European (International) Standards

EN standards are published for low voltage industrial products, using the IEC as a basis. For limit switches, the applicable EN standards for limit switches are:

- **EN 50047**, for 30mm devices
- **EN 50041**, for 40mm devices
These standards apply to the dimensional standardization of the switches.
- **EN 60947-1-5**, Low-voltage controlgear: electromechanical control circuit devices
Requirements for switches, including requirements for positive-opening operation
- **CE marking**
CE marking must not be confused with a quality label. A CE mark placed on a product is proof of conformity with the European Directives

concerning that product type. It is part of an administrative procedure and guarantees free movement of the product within the European Community.

U.S. & Canadian Standards

For limit switches, these are equivalent to, but differently marked from, IEC/EN specifications.

UL – Underwriter’s Laboratory

CSA – Canadian Standards Association

Product variations

Mechanical limit switch operators are available in many shapes and sizes based on their functionality and application. Switches can be divided into two types: **momentary** and **maintained**. Momentary, or “spring return” switches return to their normal state as soon as the actuator is released from the object it is sensing. Maintained switches will remain in the actuated position even after the actuator has been released. Some common operator heads and their applications are further discussed below:



Roller lever

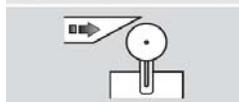


A-Shape & E-shape:

Roller lever

Levers and roller levers actuate radially, that is they rotate on an axis. Roller levers are tipped with a roller to lessen the friction and the force required to activate the lever. Levers spring-return to neutral when the force is removed. This is one of the most popular styles of switch operators.

Adjustable roller lever



Adjustable roller lever

Similar to a standard roller lever, but the length of the lever is adjustable anywhere from a few millimeters to up to 5 centimeters. The rollers are also available in various diameters.

Plain plunger

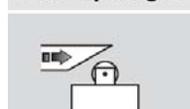


B-Shape:

Rounded plunger

Plunger heads come in many varieties and sizes. Plungers are actuated by a perpendicular force applied directly to the end of the plunger.

Roller plunger

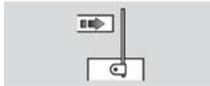


C-Shape:

Roller plunger

When a plunger switch is needed, but the force will not be applied directly at a 90° angle, a roller plunger can be used. The roller translates some of the non-perpendicular force into perpendicular force that can actuate the plunger.

Adjustable rod lever



D-Shape:

Rod lever

Rod levers are also actuated radially like levers; however these are thin rods that are much longer. Adjustable rods can be as long as 10 or more centimeters.



F-Shape:

Lateral rounded plunger

This plunger head varies from the standard B-shape in that the plunger is perpendicular to the switch.

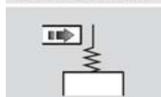


G-Shape:

Lateral roller plunger

This plunger head varies from the standard C-shape in that the plunger is perpendicular to the switch.

Flexible rod



Additional Operators:

Flexible rod

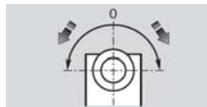
Similar to a rod lever in their length and appearance, rods (whiskers, spring rods, etc.). However, unlike levers that actuate only in one plane, flex rods activate in 360°.

Pull action



Cable pull

These switches are tipped with a lanyard to which can be attached a cable. Pulling or tightening the cable draws out the spring-loaded lever, which activates the switch.



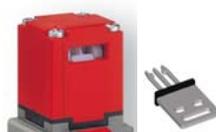
Rotative Axis

These switches can be installed onto an axis (i.e., a door hinge) so that when the hinge or axis turns, the switch actuates.



Latch/Reset

Latch & reset switches can come in a variety of operating head styles. These switches do NOT spring return to neutral; instead, they latch when activated and must be physically, manually released before being deactivated.



Key Latch

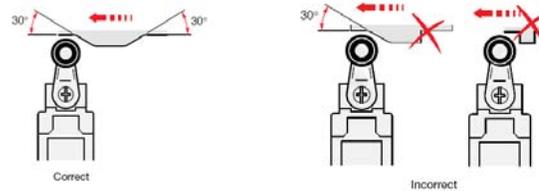
This switch is coupled with a "key". Once removed from the keyhole, the switch is actuated. Returning the key to the hole deactivates the contacts. Commonly used in door jams to shut off power when opened.

Mounting considerations

Considering which type of switch to use is important when applying a limit switch. But just as important is determining where and how to mount the switch.

Cam design

In many situations, such as a conveyor system, a cam is used to operate the actuator. The cam should be of a shape that does not allow the actuator to receive a severe impact or that releases the actuator suddenly, allowing it to snap back freely.



Mounting location

Limit switches should never be mounted in locations that could allow false operations by normal movements of operator or machine components. They should be mounted rigidly, be maintenance accessible, and have the side of the body with the cover screws facing outward.

If liquid intrusion is a possibility, the switch should be mounted face down to allow gravity to prevent seepage through the seals on the operating head. All conduit connections should be tightly sealed.

In applications where machining chips or other debris accumulates, the limit switch should be mounted in a location or at such an angle that minimized buildup on the operating head.

Section 3 – ABB's Product Scope

Overview

ABB offers four complete series of limit switches designed for most types of industrial or commercial environments. The following pages explain the differences and benefits of the various ranges:

- **Metallic** – Industrial Strength
- **Non-metallic** – General Purpose/Economical
- **Miniature** – Compact
- **Safety** – Reliable

The Metallic, Non-metallic, and Safety series are all physically interchangeable and share the same body design across the product range. The miniature pre-wired range is a specially designed compact line of switches available in 30mm (standardized) and 35mm widths.

Mechanical limit switches are sized by their width, and the most common mounting dimensions in the U.S. are 30mm and 40mm. ABB's switches are available in 30, 40, and 60mm widths. All of ABB's mechanical limit switches are available as either fully-assembled units or as component parts.

Metallic

The toughest line of switches from ABB, the LS..M.. metal series, are designed for harsh industrial or corrosive environments. These switches are rated NEMA 4X, and are the perfect choice for heavy duty, corrosive, or industrial applications.



Product Features:

- Electrically isolated bodies for industrial/corrosive environments, NEMA 4X, IP66. Zinc casings sealed w/ epoxy resin
- Standard drilling plan as conventional 30mm, 40mm, & 60mm switches make replacing an existing switch easy
- Shock and vibration resistant
- 26 standard operating heads, including rollers, levers, rods, whiskers, and plungers, for 99% of applications
- Available as assembled units or individual components for simplified ordering, no assembly needed
- Strong current switching (10A conventional thermal current)
- Immune to electromagnetic interference
- Positive opening contacts help ensure opening of even a welded contact by applying force directly to a normally closed contact, even if it has not opened with the snap action mechanism

Applicable Markets:

- Heavy Conveyors
- Manufacturing
- Food & Beverage
- Chemical Processing
- Gates, Doors, Hinges
- Water/waste water
- Harsh outdoor environments
- Transportation/Railway
- ...Hundreds of other applications!

Non-metallic

The thermoplastic line of mechanical limit switches from ABB, the LS..P.. series, are designed to deliver sensing consistency, excellent contact integrity, and long-lasting product life. Standard mounting dimensions of 30, 40, or 60mm widths.

**Product Features:**

- Double insulation to reduce the risk of electrical shock; NEMA 4, IP65. Thermoplastic (UL-V0) casings.
- Standard drilling plan as conventional 30mm, 40mm, & 60mm switches make replacing an existing switch easy
- Shock and vibration resistant
- 28 standard operating heads, including rollers, levers, rods, whiskers, and plungers, for a 99% of applications
- Available as assembled units or individual components for simplified ordering, no assembly needed
- Strong current switching (10A conventional thermal current)
- Immune to electromagnetic interference
- Positive opening contacts help ensure opening of even a welded contact by applying force directly to a normally closed contact, even if it has not opened with the snap action mechanism

Applicable Markets:

- Conveyors
- Control Panels & Cabinets
- Food & Beverage
- Pulp & Paper
- Gates, Doors, Hinges
- Packaging
- Counting
- Indoor or outdoor environments
- ...Hundreds of other applications!

Miniature, pre-wired

At only 16mm wide and weighing 5 ounces, ABB's LS2.. series of limit switches offers trusted performance in a miniature package. And to save time and labor, each switch comes fully-assembled and pre-wired with a choice of 5 cable lengths.



Product Features:

- Compact size for mounting in tight spaces
- Side or bottom wire exit, pre-wired with desired length of cable
- Rapid 2-screw mounting, with same standard drilling plan as conventional 30mm switches
- Shock and vibration resistant
- Metal casing: NEMA 4, 4X, 6; Plastic casing: NEMA 1
- 30mm and 35mm widths
- 16 standard operating heads, including rollers, levers, rods, whiskers, and plungers, for a variety of applications
- Strong current switching (5A conventional thermal current)
- Immune to electromagnetic interference
- Positive opening contacts help ensure opening of even a welded contact by applying force directly to a normally closed contact, even if it has not opened with the snap action mechanism

Applicable Markets:

- Conveyors
- Control Enclosures & Cabinets
- Manufacturing
- Gates, Doors, Hinges
- Packaging & Material Handling
- ...Hundreds of other applications!

Safety switches

When safety is an issue, ABB's LS..-S and LS..-SCR safety switches deliver security and protection in any industrial environment. Safety switches monitor protective equipment (panel doors or screens) or detect hazardous movements of machine parts. Among other things, they feature positive-opening contacts, which ensure a circuit is broken when the safety mechanism is activated (EN 60947-5-1). All of our safety line is also bright safety orange, a common indicator in the industry that this switch meets the safety requirements established for switches. ABB's series of safety limit switches meet all applicable industry standards for safety.



ABB's safety limit switches are available with these types of actuators:

Latch Key switches, are commonly used on doors in which a key is mounted so that opening the door pulls the key from the hole in the switch, activating the contacts



Rotative axis switches, commonly used on hinges, are designed so that the axis of the switch is mounted directly onto an axis—or the end of a hinge. Swinging the hinge (i.e., opening a door) activates the contacts.



Latch and Manual Reset switches are available in a variety of types; they all are maintained switches, meaning that the contacts remain activated even when the force is removed from the actuator, and require a latch to be manually reset before they can return to their normal state.



Cable pull switches are designed so that pulling on a cable (which is connected to the actuator lanyard on the switch) will activate the contacts until the cable is released.



Rotative lever, also commonly used on doors, is a lever that rotates on an axis and can be mounted to actuate when a door is opened/closed.



Product Features:

- Metal or plastic casings, NEMA 4, 4X
- Standard drilling plan as conventional 30mm, 40mm, & 60mm switches (according to EN50047) make replacing an existing switch easy
- Shock and vibration resistant
- Various operators available: keyed, latch/reset, cable pull, rotative axis/lever fit into any application necessary
- Available as assembled units or individual components for simplified ordering, no assembly needed
- Up to 3 contacts available, electrically separated (Zb design)
- Immune to electromagnetic interference
- Positive opening contacts → help ensure opening of even a welded contact by applying force directly to a normally closed contact, even if it has not opened with the snap action mechanism

Applicable Markets:

- Heavy Conveyors
- Manufacturing
- Food & Beverage
- Metal processing
- Gates, Doors, Hinges
- Control cabinet doors
- Indoor & outdoor environments
- ...Hundreds of other applications!

Material properties

Material	Characteristic
Zinc	Good corrosion resistance for inland, sea, and industrial atmospheres
Thermoplastic (UL-V0)	Thermoplastic polyester is a partly crystalline, thermoplastic polyester based on polybutylene terephthalate (PBT). It is used as a material for high-quality, highly stressed engineering parts in a wide variety of industrial sectors. Low water absorption, good resistance to many chemicals, and outstanding heat aging performance.

Section 4 – Literature Reference List

Catalogs

All of our literature is available in electronic form from our website:

→ www.abb-control.com

→ Literature Resources

→ Online Literature Library

→ Catalog Index

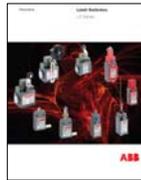
Then scroll to the Limit Switches section (sections are listed alphabetically).



Product Selector – LV023

Section 8 of the ABB Product Selector catalog features our complete range of ABB limit switch products, as well as our other control products in our portfolio.

Sales Literature



Limit Switch Panorama – LV122

This full-color booklet style brochure is a simple selection guide tool for ABB limit switches. It showcases our entire range of assembled limit switch products available, with easy-order part numbers.



Fast Facts: Metallic – LV123

This full-color sales sheet is a simple piece of literature describing the metallic range of ABB limit switches, including product features, benefits, and market applications.



Fast Facts: Non-metallic – LV126

This full-color sales sheet is a simple piece of literature describing the thermoplastic range of ABB limit switches, including product features, benefits, and market applications.



Fast Facts: Miniature – LV124

This full-color sales sheet is a simple piece of literature describing the miniature pre-wired range of ABB limit switches, including product features, benefits, and market applications.



Fast Facts: Safety Range – LV125

This full-color sales sheet is a simple piece of literature describing the safety range of ABB limit switches, including product features, benefits, and market applications.

Section 5 – QuickView: Product Benefits

Metallic

1. **High environmental rating:** With casings made of hardened zinc alloy and sealed with epoxy, these switches can withstand harsh environments. NEMA 4, 4X, IP66.
2. **Wide selection of operators:** Available assembled with a choice of 26 operator heads, and even more options as components, this is one of the widest selections of limits switches on the market.
3. **Positive-opening contacts:** This product range features over 22 operators with positive-opening contacts, which helps ensure the opening of even a welded contact.

Non-Metallic

1. **Economical solution:** For less-demanding environments, ABB's plastic switches are the perfect economical solution. The same switching integrity is available in a less-expensive package.
2. **Wide selection of operators:** Available assembled with a choice of 28 operator heads, and even more options as components, this is one of the widest selections of limits switches on the market.
3. **Positive-opening contacts:** This product range features over 22 operators with positive-opening contacts.

Miniature pre-wired

1. **Compact design:** These switches can be mounted into locations too tight for standard industrial switches. They weigh less and are the thinnest on the market, but still offer the same trusted performance as our standard ranges.
2. **Time-saving:** Save installation time—eliminate the wiring step. These switches come with the pigtail leads pre-installed; just mount them with the quick 2-screw pattern (forget those 4-screw patterns that take twice the time!)
3. **Highest environmental rating:** With casings made of hardened zinc alloy and sealed with epoxy, these switches can withstand harsh environments. NEMA 4, 4X, 6, IP66. Also available in thermoplastic casings.

Safety switches

1. **High environmental rating:** With casings made of hardened zinc alloy and sealed with epoxy, these switches can withstand harsh environments. NEMA 4, 4X, IP66. Thermoplastic casings also available.
2. **Positive-opening contacts:** This product range features positive-opening contacts, which helps ensure the opening of even a welded contact.

1. List three basic functions of limit switches:

2. In which contact structure is an additional force applied to aid in opening even a welded contact?

- A. Snap Action
- B. Positive Opening
- C. Fast Break
- D. Zb Shape

3. Which is not a common actuator type offered by ABB?

- A. Adjustable roller lever
- B. Lateral round plunger
- C. Key latch
- D. All are common types from ABB

4. Match the ABB product series with it's corresponding NEMA rating:

- Metallic _____ A. NEMA 4
- Non-metallic _____ B. NEMA 4X
- Miniature Pre-wired _____ C. NEMA 1, 4, 4X, 6

5. Which of the following are specifications for limit switches?

- A. EN 50041
- B. EN 60947-1-5
- C. Both A and B
- D. Neither B nor B

True or False:

6. Mechanical limit switches offer high repeatability, precision, and accuracy. T F

7. One weakness of limit switches is that they must make physical/mechanical contact with an object to be actuated. T F

8. The Za contact shape features electrically-separated contacts. T F

9. ABB safety switches are available with latch/key, cable pull, and rotative axis actuators. T F

10. Limit switches are a large group of products that can be implemented in many different ways to provide a sensing solution for a variety of applications. T F

Answers: 1) examples: counting, detecting presence/absence, positioning, detecting speed, safety, range of movement, travel maximum, etc. 2)B 3)D 4)B,A,C 5)C 6)T 7)T 8)F 9)T 10)T

Metallic technical sheets

Technical data
IP 65, UL Type 4

Metal
Limit switches

General technical data

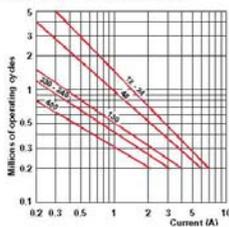
Standards	Devices conform with international IEC 947-5-1 and European EN 60 947-5-1 standards	
Certifications - Approvals	UL & CSA	
Air temperature near the device (IEC)	°C	- 25 ... + 70
- during operation	°C	- 30 ... + 80
- for storage		
Climatic withstand	According to IEC 68-2-3 and salty mist according to IEC 68-2-11	
Mounting positions	All positions are authorized	
Shock withstand (according to IEC 68-2-27 and EN 60 068-2-27)	50g @ (1/2 sinusoidal shock for 11 ms) no change in contact position	
Resistance to vibrations (acc. to IEC 68-2-6 and EN 60 068-2-6)	25g (10 - 500 Hz) no change in position of contacts greater than 100 µs	
Protection against electrical shocks (acc. to IEC 536)	Class I	
Degree of protection	UL Type 4X & IP 66	
Consistency (measured over 1 million operations)	0.05 mm (upon closing point)	
Minimum actuation speed	m/s	Slow action contacts 0.060 / Snap action contacts 0.001

Electrical Data

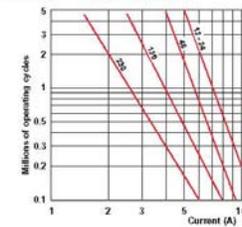
Rated insulation voltage U_i - according to IEC 947-1 and EN 60-947-1 - according to UL 508 and CSA C22-2 n° 14		500 V (degree of pollution 3) A 600, Q 600
Rated impulse withstand voltage U_{imp} (according to IEC 947-1 and EN 60 947-1)	kV	6
Conventional free air thermal current I_{th} (according to IEC 947-5-1) $q \leq 40$ °C	A	10
Short-circuit protection $I_{sc} \leq 500$ V a.c. - gG (gI) type fuses	A	10
Rated operational current I_n / AC-15 (according to IEC 947-5-1)	24 V - 50/60 Hz A 130 V - 50/60 Hz A 230 V - 50/60 Hz A 240 V - 50/60 Hz A 400 V - 50/60 Hz A	10 5.5 3.1 3 1.8
I_n / DC-13 (according to IEC 947-5-1)	24 V - d.c. A 110 V - d.c. A 250 V - d.c. A	2.8 0.6 0.27
Switching frequency	Cycles/h	3600
Load factor		0.5
Resistance between contacts	mW	25
Connecting terminals		M3.5 (+, -) pozidriv 2 screw with cable clamp
Terminal for protective conductor		M3.5 (+, -) pozidriv 2 screw with cable clamp
Connecting capacity	1 or 2 x mm ²	0.5 ... 2.5
Terminal marking		According to EN 50 013
Mechanical durability	Millions of operations	30 40 11- 13; 21 - 23; 31 - 33 25 LS M 41 - 44; 51 - 54; 61 - 72 10 60 91 - 93
Electrical durability (according to IEC 947-5-1)		Utilization categories AC-15 and DC-13 (Load factor of 0.5 according to curves below)

9

AC-15 – Snap action



AC-15 – Slow action



DC-13	Voltage	Snap action	Slow action
		Power breaking for a durability of 5 million operating cycles	
	24 V	9.5 W	12 W
	48 V	6.8 W	9 W
	110 V	3.6 W	6 W

⊙ except for LS30/31/35 (P42): 25g

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Non-metallic technical sheets

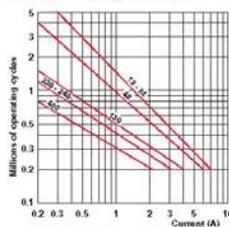
Technical data
IP 65, UL Type 4

Plastic
Limit switches

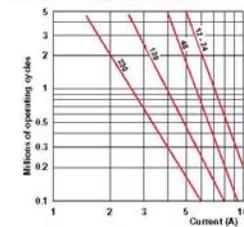
General technical data		Devices conform with international IEC 947-5-1 and European EN 60 947-5-1 standards											
Standards		Devices conform with international IEC 947-5-1 and European EN 60 947-5-1 standards											
Certifications - Approvals		UL & CSA											
Air temperature near the device (IEC)													
- during operation	°C	- 25 ... + 70											
- for storage	°C	- 30 ... + 80											
Climatic withstand		According to IEC 68-2-3 and salty mist according to IEC 68-2-11											
Mounting positions		All positions are authorized											
Shock withstand (according to IEC 68-2-27 and EN 60 068-2-27)		50g Ⓢ (1/2 sinusoidal shock for 11 ms) no change in contact position											
Resistance to vibrations (acc. to IEC 68-2-6 and EN 60 068-2-6)		25g (10 - 500 Hz) no change in position of contacts greater than 100 μs											
Protection against electrical shocks (acc. to IEC 536)		Class II											
Degree of protection		UL Type 4 & IP 65											
Consistency (measured over 1 million operations)		0.1 mm (upon closing point)											
Minimum actuation speed	m/s	Slow action contacts 0.060 / Snap action contacts 0.001											
Electrical Data													
Rated insulation voltage U_i - according to IEC 947-1 and EN 60-947-1 - according to UL 508 and CSA C22-2 n° 14		500 V (degree of pollution 3) A 600, Q 600											
Rated impulse withstand voltage U _{imp} (according to IEC 947-1 and EN 60 947-1)	kV	6											
Conventional free air thermal current I _n (according to IEC 947-5-1) q ≤ 40 °C	A	10											
Short-circuit protection U _{sc} ≤ 500 V a.c. - gG (gI) type fuses	A	10											
Rated operational current I _e / AC-15 (according to IEC 947-5-1)													
24 V - 50/60 Hz	A	10											
130 V - 50/60 Hz	A	5.5											
230 V - 50/60 Hz	A	3.1											
240 V - 50/60 Hz	A	3											
400 V - 50/60 Hz	A	1.8											
I _e / DC-13 (according to IEC 947-5-1)													
24 V - d.c.	A	2.8											
110 V - d.c.	A	0.6											
250 V - d.c.	A	0.27											
Switching frequency	Cycles/h	3600											
Load factor		0.5											
Resistance between contacts	mW	25											
Connecting terminals		M3.5 (+, -) pozidriv 2 screw with cable clamp											
Terminal for protective conductor		M3.5 (+, -) pozidriv 2 screw with cable clamp											
Connecting capacity	1 or 2 x mm ²	0.5 ... 2.5											
Terminal marking		According to EN 50 013											
Mechanical durability	Millions of operations	<table border="0"> <tr> <td>15</td> <td rowspan="4">} LS</td> <td rowspan="4">} P</td> <td rowspan="4">} 10 - 12; 30 - 34</td> </tr> <tr> <td>10</td> <td rowspan="4">} 13; 41 - 44; 51 - 54; 61 - 72</td> </tr> <tr> <td>5</td> </tr> <tr> <td>> 1</td> <td>40</td> <td>15; 16</td> </tr> </table>		15	} LS	} P	} 10 - 12; 30 - 34	10	} 13; 41 - 44; 51 - 54; 61 - 72	5	> 1	40	15; 16
15	} LS	} P	} 10 - 12; 30 - 34										
10				} 13; 41 - 44; 51 - 54; 61 - 72									
5													
> 1					40	15; 16							
Electrical durability (according to IEC 947-5-1)		Utilization categories AC-15 and DC-13 (Load factor of 0.5 according to curves below)											

9

AC-15 – Snap action



AC-15 – Slow action



DC-13	Snap action	Slow action
	Power breaking for a durability of 5 million operating cycles	
Voltage 24 V	9.5 W	12 W
Voltage 48 V	6.8 W	9 W
Voltage 110 V	3.6 W	6 W

Ⓢ except for LS30/31/35 (P42): 25g

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Miniature pre-wired

LS20 ... LS26 Prewired Limit Switches

Plastic Casing IP67 and Metal Casing IP67

Technical Data

General Technical Data

	Plastic Casing	Metal Casing
Standards	IEC 60947-1, IEC 60947-5-1, EN 60947-1, EN 60947-5-1, UL 508 and CSA C22-2 n° 14	
Certifications - Approvals	UL - CSA (only with UL62-1581 cable)	
Air temperature near the device		
- during operation	°C - 25 ... + 70	- 25 ... + 70
- for storage	°C - 40 ... + 70	- 40 ... + 70
Climatic withstand	According to IEC 68-2-3 and salty mist according to IEC 68-2-11	
Mounting positions	All positions are authorized	
Shock withstand (according to IEC 68-2-27 and EN 60068-2-27)	25g* (1/2 sinusoidal shock for 11 ms) no change in contact position	
Resistance to vibrations (acc. to IEC 68-2-6 and EN 60068-2-6)	25g** (10 ... 500 Hz) no change in position of contacts greater than 100 µs	
Protection against electrical shocks (acc. to IEC 536)	Class II	Class I
Degree of protection (according to IEC 529 and EN 60529)	IP67	
Degree of protection (according to UL 50 and NEMA)	Type 1 Enclosure (indoor use)	Type 4 - 4x - 6 Enclosure (Outdoor use)
Consistency (measured over 1 million operations)	0.1 mm (upon closing point)	

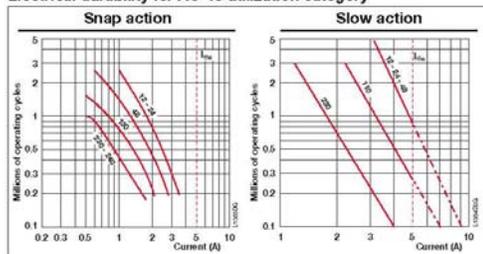
Electrical Data

Rated insulation voltage U_i		
- according to IEC 60947-1 and EN 60947-1	V	400 (degree of pollution 3)
- according to UL 508, CSA C22-2 n° 14	V	300
Rated impulse withstand voltage U_{imp}	kV	4
(according to IEC 60947-1 and EN 60947-1)		
Conventional enclosed thermal current I_{thc}	A	5
(according to IEC 60947-5-1 and EN 60947-5-1) θ ≤ 40 °C		
Short-circuit protection gG type fuses	A	6
Rated operational current		
I_n / AC-15 - acc. to IEC 60947-5-1		
24 V - 50/60 Hz	A	5.0
120 V - 50/60 Hz	A	3.0
240 V - 50/60 Hz	A	1.5
- acc. to UL 508, CSA C22 n° 14	B	300
I_n / DC-13 - acc. to IEC 60947-5-1		
24 V - d.c.	A	1.1
125 V - d.c.	A	0.22
250 V - d.c.	A	0.1
- acc. to UL 508, CSA C22 n° 14	R	300
Positivity	Contacts with positive opening operation as per IEC 60947-5-1 chapter 3 and EN 60947-5-1	
Resistance between contacts	mΩ	25
Pre-wired connection	mm ² / AWG	4 x 0.75 mm ² / 4 x AWG 18 5 x 0.75 mm ² / 5 x AWG 18
Type of cable		
- UL 62-1581 (PVC)		Black - Ø ext. 7.20 ± 0.2
- IEC 20/22 II (PVC) (no flame propagation)		Black - Ø ext. 7.20 ± 0.2
		Grey - Ø ext. 8.20 ± 0.2
Terminal marking	According to EN 50013	
Mechanical durability	10 Millions of operations	
Electrical durability (according to IEC 60947-5-1 appendix C)	Utilization categories AC-15 and DC-13 (See curves and values below)	
- max. switching frequency	Cycles/h	3600
- load factor		0.5

* Shock: 25g for LS20P/M, ... LS26P/M with D11 contact block
5g for LS20P/M, ... LS26P/M with B11 contact block

** Vibrations: except for LS20P/M93 ... LS26P/M93: 15 g

Electrical durability for AC-15 utilization category



Electrical durability for DC-13 utilization category

	Snap action		Slow action	
	Power breaking for a durability of 5 million operating cycles			
Voltage 24 V	5.7 W		7.2 W	
Voltage 48 V	4.1 W		5.4 W	
Voltage 110 V	2.2 W		3.6 W	

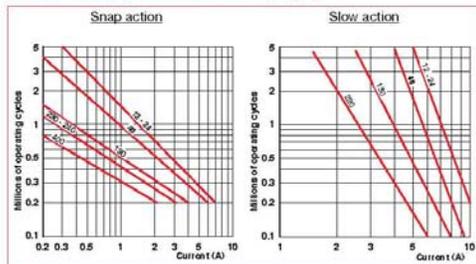
Compact dimensions

Safety
limit switches

Latch & manual reset
Technical data

General Data		
Standards		IEC 60947-1, IEC 60947-5-1, EN 60947-1, EN 60947-5-1, UL 508, CSA C22-2 No.14
Certifications - Approvals		UL and CSA
Air temperature near the device		
- during operation	°C	-25 ... +70
- for storage	°C	-30 ... +80
Climatic withstand		According to IEC 68-2-3 and salty mist according to IEC 68-2-11
Mounting positions		All positions are authorised
Shock withstand (according to IEC 68-2-27 and EN 60068-2-27)	g	50 g (1/2 sinusoidal shock for 11 ms) no change in contact position
Resistance to vibrations (acc. to IEC 68-2-6 and EN 60068-2-6)	g	25 g (10 ... 500 Hz) no change in position of contacts > 100 µs
Protection against electrical shocks (acc. to IEC 536)		Class II
Degree of protection (according to IEC 529 et EN 60529)		IP65
Consistency		0.1 mm upon closing points
Minimum actuation speed	m/s	Slow action contacts 0.060 / Snap action contacts 0.001
Electrical Data		
Rated insulation voltage U_i - according to IEC 60947-1 and EN 60947-1 - according to UL 508, CSA C22-2 No.14	V	690 (degree of pollution 3) A600, Q600
Rated impulse withstand voltage U_{imp} (according to IEC 60947-1 and EN 60947-1)	kV	6
Conventional free air thermal current I_{th} (according to IEC 60947-5-1 and EN 60947-5-1) ($\theta \leq 40$ °C)	A	10
Short-circuit protection gG type fuses	A	10
Rated operational current		
I_n / AC-15 - acc. to IEC 60947-5-1	24 V - 50/60 Hz 130 V - 50/60 Hz 230 V - 50/60 Hz 240 V - 50/60 Hz 400 V - 50/60 Hz	A A A A A
		10 5.5 3.1 3 1.8
	- according to UL 508, CSA C22 No.14	
		A600
I_n / DC-13 - according to IEC 60947-5-1	24 V - d.c. 110 V - d.c. 250 V - d.c.	A A A
		2.8 0.6 0.27
	- according to UL 508, CSA C22 No.14	
		Q600
Positivity		Contacts with positive opening operation as per IEC 60947-5-1 chapter 3 and EN 60947-5-1
Resistance between contacts	mΩ	25
Mechanical durability	Millions of operations	> 1 million of operating cycles
Max. switching frequency	Cycles/h	600
Electrical durability (according to IEC 60947-5-1 appendice C)		Utilization categories AC-15 and DC-13 (see curves and values below)
- Max. switching frequency	Cycles/h	3600
- Load factor		0.5

Electrical durability for AC-15 utilization category



Electrical durability for DC-13 utilization category

	Snap action	Slow action
Power breaking for a durability of 5 million operating cycles		
Voltage 24 V	9,5 W	12 W
Voltage 48 V	6,8 W	9 W
Voltage 110 V	3,6 W	6 W

NEMA rating definitions

NEMA Rating	Enclosure Protection:
1	Indoor Falling dirt
2	Indoor Falling dirt Dripping/light splashing of liquids
3	Indoor/Outdoor Falling dirt, rain, sleet, snow, windblown dust, external ice formation
3R	Indoor/Outdoor Falling dirt, rain, sleet, snow, external ice formation
3S	Indoor/Outdoor Indoor/Outdoor Falling dirt, rain, sleet, snow, windblown dust, external mechanism remain operable with ice formation
4	Indoor/Outdoor Falling dirt, rain, sleet, snow, windblown dust, external ice formation, splashing water, hose-directed water
4X	Indoor/Outdoor Falling dirt, rain, sleet, snow, windblown dust, external ice formation, splashing water, hose-directed water, corrosion
5	Indoor Airborne dust, lint, fibers, flyings, light splashing of liquids
6	Indoor/Outdoor Falling dirt, hose-directed water and occasional, temporary submersion, formation of ice
6P	Indoor/Outdoor Falling dirt, hose-directed water and prolonged submersion, undamaged by external formation of ice
12	Indoor Falling dirt, circulating dust, lint, fiber, flyings, dripping and light splashing of liquids
13	Indoor Falling dirt, circulating dust, lint, fiber, flyings, dripping and light splashing of liquids, spray/splashing/seepage of oil and non-corrosive coolants



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