These basic principles apply to all our precision switches. The specific characteristics of each model are given in more detail in the relevant production sections.

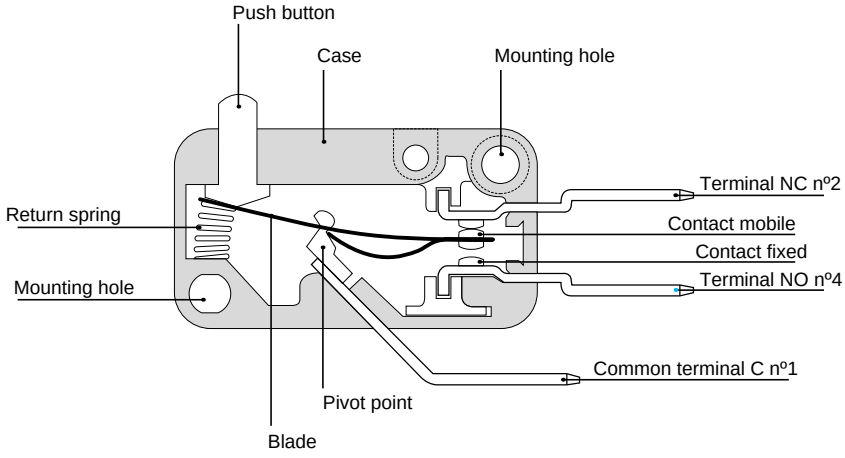
Introduction

Our switches are high-precision, snap-action switches and these are a few of the key features which distinguish our switches:

- High ratings with small dimensions
- Very short travels
- Low operating forces
- Highly dependable force and travel values
- Long life
- Large range of actuators for easy adaptation to the most varied applications

Switch construction

Single-pole changeover switch (i.e. 83 161)



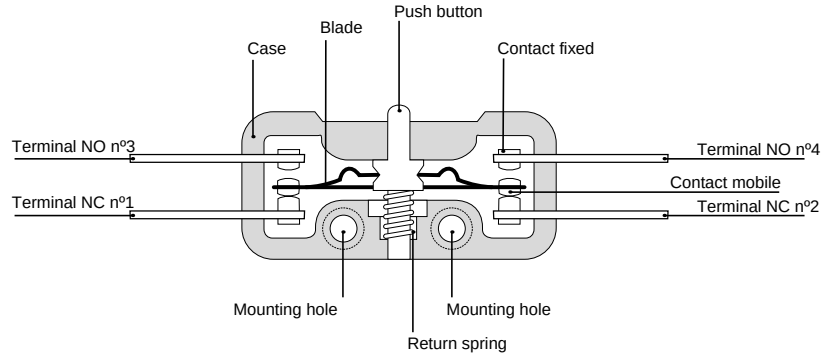
Electrical function

SPDT **(C)**

Normally closed **(NC)**

Normally open **(NO)**

Double-pole changeover switch (i.e. 83 132 0)

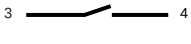


Electrical function

SPDT **(C)**

Normally closed **(NC)**

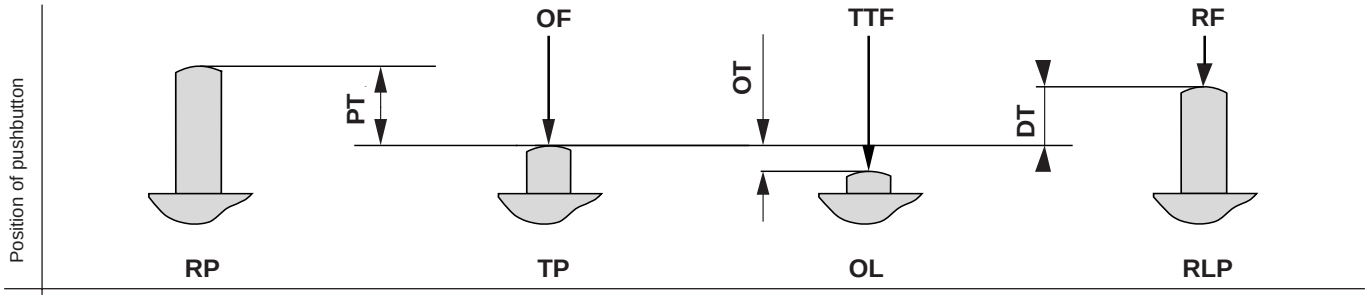
Normally open **(NO)**



The NO and NC circuits must both be of the same polarity.

Mechanical characteristics

Terminology - Forces - Positions - Travel



Forces

OF Operating Force
Maximum force which must be applied to the operating device to displace the rest position RP to the tripping point TP.

TTF Total travel force
Force required to displace the operating device from its rest position RP to its overtravel limit position. (We only specify this value if it is higher than the operating force. When not quoted, it is equal to or less than the operating force).

MOF Maximum overtravel force
The maximum force which can be applied to the operating device, without damaging it, in the end of travel position where it is in abutment internally or against the face of the case.

RF Release force
Force to which the operating force must be reduced to allow the snap-action mechanism to return to its release position RLP.

Positions

RP Rest position
Position of the operating device when no external mechanical force is applied. Also described as "height at rest".

TP Tripping point
Position of the operating device relative to the fixing point (hole, face) at the moment when the microswitch trips.

OL Overtravel limit
Position of the operating device when an extreme force has moved it to the effective end of the available travel.

RLP Release position
Position of the operating device at the moment when the snap-action mechanism trips on its return to its original position.

Travel

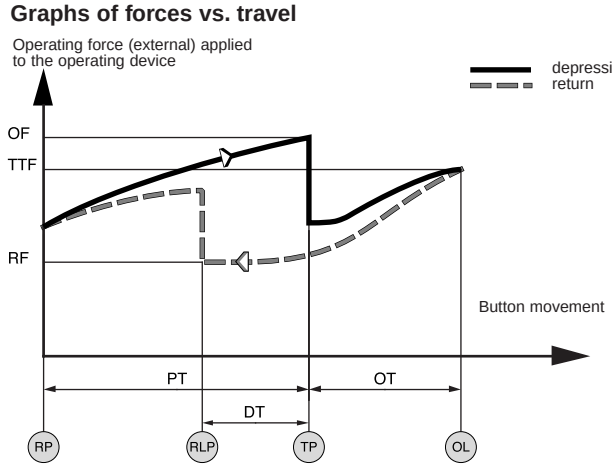
PT Pre-travel
Distance between the rest position RP and the tripping point TP.

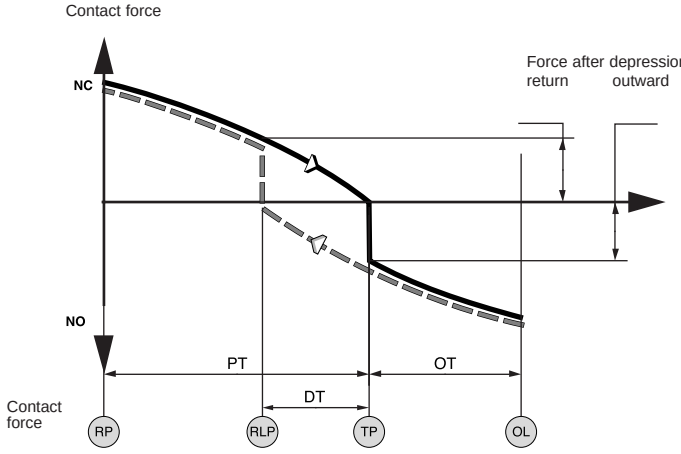
OT Overtravel
Distance between the tripping point TP and the overtravel limit OL.

DT Differential travel
Distance between the tripping point TP and the release position RLP.

The reference point for the figures given for travel and forces is a point F situated on the button in the case of a plain microswitch, or, generally, 3 mm in from the end of a plain actuator.
The reference point for the positions is one of the fixing holes, unless otherwise indicated.

Graphs of forces vs. travel

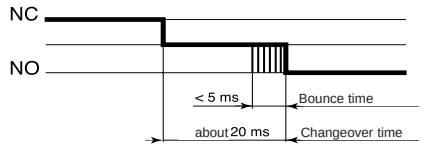


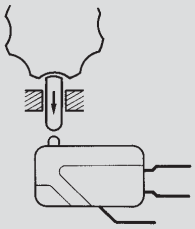


Mechanical characteristics

Changeover time

This is the time taken by the mobile contact when moving from one fixed contact to another until it becomes fully stable (contact bounce included). This time is a function of the contact gap, the mechanical characteristics of the snap action and the mass of the mobile element. However, thanks to the snap-action mechanisms employed, the time is largely independent of the speed of operation.
It is normally less that 20 milliseconds (including bounce times of less than 5 ms).



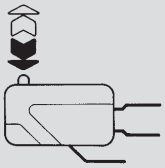


Mechanical durability

This is an average value indicating the purely mechanical performance of a switch when not subject to any electrical load.
It may be useful for evaluation purposes in cases where the power levels involved are very low and the electrical life is thus close to the mechanical life.

Maximum speed and rate of operation

Our switches will work at speeds of operation varying over a very wide range : normally from 1 mm/min to 1 ms.
The maximum rate of operation with a low electrical load may be as high as 10 operations/second.



Mounting - Operation

- To conform to the leakage paths and air gaps in the standard EEC24 - EN/IEC 61058 - EN/IEC 60947:
- An insulation pad must be inserted between the switch and the fixing surface if the latter is metal.
- Manual operation of a metal actuator must only be carried out with the help of a secondary actuator made of insulating materials.

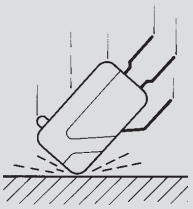
- The installer must ensure adequate protection against direct contact with the output terminals.

Fixing - Screw torque

- Unless otherwise indicated in the mechanical characteristics table, the torque required for the fixing screws must conform to the following values :

Ø of fixing screw		2	2.5	3	3.5	4
Screw torque in cm.N	maximum	25	35	60	100	150
	minimum	15	25	40	60	100

Environmental conditions



Resistance to shocks and vibrations

Resistance to impact and vibration depends on the mass of the moving parts and on the forces holding the contacts together.
Generally speaking, for a switch without an actuator :
- Vibration >10 G 10 at 500 Hz
- Impact > 50 G 11 ms 1/2 sine-wave
Further information on request.

Ambient operating temperature

The maximum and minimum temperatures at which the mechanical and electrical characteristics of the switch will remain substantially unaltered.

Degree of protection

Under the IEC 529 or NFC 20010 classification scheme, standards employ an IP code to define the degree or class of protection which electrical equipment provides against access to live components, the entry of solid foreign bodies and ingress of water.

1st numeral		
Protection equipment provides against the entry of solid foreign bodies		Protection for persons against access to dangerous parts
0	(not protected)	(not protected)
4	diameter ≥ 1 mm	1 mm Ø wire
5	protected against dust	1 mm Ø wire
6	sealed against dust	1 mm Ø wire

2nd numeral	
Protection equipment provides against ingress of water	
0	(not protected)
4	splashed water
5	hosed water
6	high-pressure hosed water
7	temporary immersion
8	prolonged immersion

Under this classification, our switches come within the following categories :
- Plain switches = IP 00
- Protected switches = IP 40 with isolated connection
- Sealed switches = IP 66 or IP 67

Dielectric characteristics

Current rating

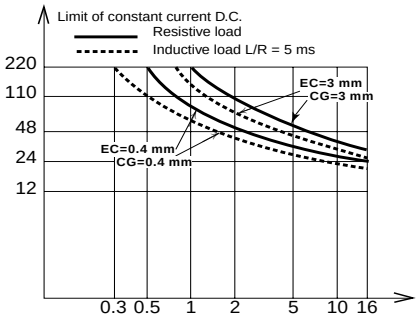
This is the current the switch is capable of making and breaking which forms the basis for the life tests.

Thermal rating

This is the current the switch will withstand when not being operated, for a temperature rise of not more than 60 °C.

Switch rating

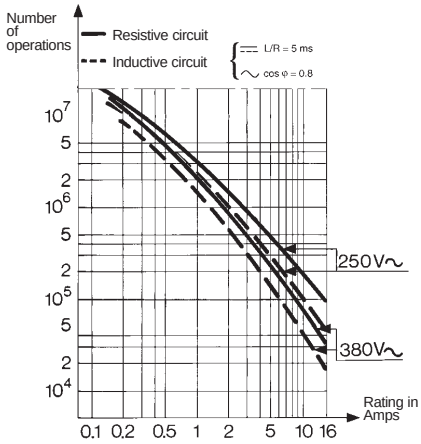
AC voltages: see the current rating.
With DC voltages the switch rating is very much dependent on the voltage, the contact gap **(CG)** and the nature of the load being switched. There is a risk of prolonged or indeed permanent arcing if the following limits are exceeded:



For special applications, please enquire.

Operating curves

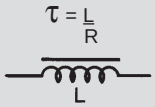
These indicate the electrical life of the switches, under standard conditions (20 °C, 1 cycle/2 seconds), by showing the number of switching operations which can be performed with given types of load.



Circuit types

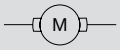
Resistive circuit

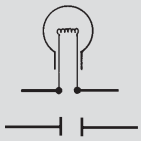
For a circuit with alternating voltage, this is in phase with the current : Cos φ = 1.



Inductive circuit

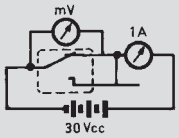
A circuit of this type with direct current is characterised by a time constant.
An inductive circuit, with alternating voltage, for example, incorporating a motor (cos φ < 1) can cause current surges up to 6 times the normal current. For certain switches, we give electrical endurance curves with $\frac{L}{R}$ = 5 ms in DC and cos φ = 0.8 in AC.





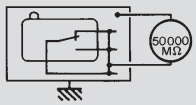
Lamp and capacitance circuit

The currents at the time when the circuit is closed are very high in this case, being up to 10 times the nominal figure.



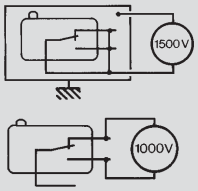
Internal resistance

This consists of the intrinsic resistance (fixed) of the parts carrying current and the contact resistance (variable).
Close to the tripping point and release position, the force holding the contacts together drops considerably and this may cause a rise in internal resistance.



Insulation resistance

The insulation resistance of the switches is generally greater than 50,000 MΩ measured at 500 V DC.



Dielectric strength

The dielectric strength of our switches is generally better than:
- 1500 volts between live parts and earth
- 1000 volts between contacts
- 600 volts between contacts for switches whose contact gap is less than 0.3 mm.

3

Contact materials

Choice of contact material

To choose the best material for the contacts there are various factors to be considered:
- the current and voltages levels
- the type of load
- the number of operations
- the switching frequency
- the environmental conditions.

Contacts for general-purpose use

Our switches are normally fitted with silver contacts. These are suitable for the majority of applications and provide the best compromise between electrical performance, thermal performance and life.

Contacts for low-power circuits

E < 20 V and/or I < 100 mA
The contacts used in this case are plated with gold (or a gold alloy) for good reliability even in corrosive atmospheres.

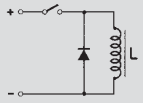
Contacts for special applications

We can supply special contacts suitable for particular applications, such as:
- Ag CdO contacts for very high drawn currents,
- Cross Bar gold-plated Ag Ni contacts which allow a very wide range of applications to be covered by a single type of switch.

Electrical recommendations

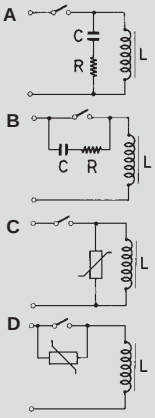
Inductive circuits

To increase the life of contacts and their DC rating, arcing on opening can be cut down by using the following circuits:



- for DC

Fast diode V R > 5 x V nominal
I nominal > 10 x I winding



- for DC or AC

A - RC circuit across inductor
B - RC circuit across switch

C (nF) ~100 x I nominal (A)
V insulation > V peak
R(Ω) ~ load resistance (Ω)

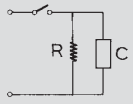
C - Varistor circuit across load
D - Varistor circuit across switch
V > V peak supply

$$E\ (J) \geq \frac{P\ (V.A.)}{100}$$

Very low power circuits

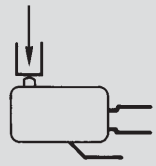
In very low power circuits (I > 1 mA, V ≤ 5 V), switching is highly sensitive to environmental conditions (the atmosphere, pollution).

If the supply is powerful enough, adding a passive resistor to increase the current broken by the switch to a few milliamps will substantially improve reliability of operation.



R - Load resistance
C - Very low current load

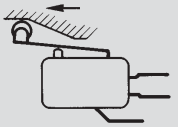
Methods of actuation



Direct operation

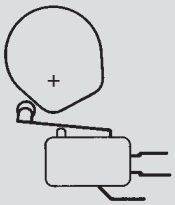
Preferably, force should be directly applied to the device – the plunger – along its axis for operation. However, the majority of our microswitches will accept skewed operation provided the angle of application is not more than 45°.

The device used to apply the force must never hamper the travel of the plunger to the tripping point (TP). It must under all circumstances move the plunger through at least 0.5 times the overtravel (OT) quoted. Steps must also be taken to see that it does not cause the overtravel limit (OL) or maximum overtravel force (MOF) quoted to be overrun or exceeded.



Operation by actuator

When operation is by a roller lever, force should preferably be applied in the direction shown on the left.



Where the movements involved are fast, the ramp should be so designed as to ensure that the operating device is not subjected to any violent impact or abrupt release.

Quality

Quality is built into our switches from the initial design stage right through to the point where they are put into action at the customer's premises. All departments of the company are guided by the Quality Manual and the stipulations of the ISO 9000 international standard.

The location where the switches are manufactured (the la Plaine works at Valence) holds **ISO 9001** certification, guaranteeing a high standard of quality.

Control procedures

Manufacturing quality of our switches is controlled systematically during assembly operations and on final completion. All our products are subjected to a final inspection, either at 100% on important characteristics, or according to the statistical sampling rules of French standards X 06-222 and X 06-023. The quality levels applied, for normal use such as defined in previous paragraphs are for the following defects, according to the standards :
- critical fault : NQA : 0.40
- major fault : NQA : 1
- minor fault : NQA : 2.5

At the customer's request, and for certain ranges of our products which must meet specific needs expressed in the specifications, it is always possible to adapt or create an inspection specification of a standard product.

Standards - Approvals

Our switches are designed according to international recommendations (IEC), American standards (UL) and/or European standards (EN).

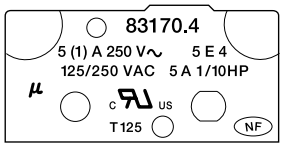
Proof of compliance with these standards and recommendations is demonstrated by:

- the manufacturer's declaration of conformity (drafted in accordance with the ISO/IEC 22 guidelines), or
- approval granted directly by an accredited body, or by application of the CCA (Cenelec Certification Agreement).

More detailed information on the approval for a particular type of microswitch can be obtained on request.

The 83170 switch as an example

An 83 170 4 switch marked with the symbols for the European (according to CCA/MC12) and American approvals it holds.



Rules and regulations

EC directives

Our switches are compatible with European Community technical directive (Low Voltage) 73/23 and can be used within the framework of Machinery directive 83/392.

Environmental protection

The modern concept of protection of the environment is an integral part of the manufacture of our switches, from product design through to packaging.