Limit Switches – Technical Guide

Introduction

What is meant by a "position detector" is any device which needs to be operated by a member which exerts a physical force, in view of :
- either the form which its operating device takes
- or the considerable force needed to operate it

The distinguishing features of position detectors are :
- their high electrical performance capability
- their excellent resistance to accidental impact
- good protection against splashed or dripping water
- a wide range of operating devices to allow the detectors to be adapted to a vast variety of mechanisms

Construction

Our detectors are designed to conform to international IEC recommendations and/or European standards (EN).
Proof that a detector conforms to these standards or recommendations takes the form of a conformity declaration made by the manufacturer (drafted as indicated in guidance document ISO/IEC 22 - EN 450-14).
Characteristics in line with the general requirements of standards NFC 63140, IEC 947.5.1 and EN 60947.5.1.
- Leakage paths and air gaps : IEC 664.1 - NFC 20-040.

Our position detectors which comply with IEC 947.5.1 can be fitted to machine-tools and industrial machines complying with NFC 79130, IEC 204.1, EN60204 or VDE 113.

Electrical characteristics

Assigned working current (Ie):
- the current level adopted as a basis for the operating conditions quoted for a detector, and for the life tests on it.

Thermal rating (Ith):
- the current the microswitch will withstand when not being operated electrically, for a temperature rise of not more than 60 °C.

Assigned insulation voltage (Ui):
- the voltage adopted as a reference for the dielectric tests and leakage paths. It must be equal to or greater than the assigned working voltage.

Categories of use (IEC 947.5.1):
- AC 15 for operating AC solenoids and electromagnets
- DC 13 for operating DC solenoids and electromagnets

Contact element designation (IEC 947.5.1):
- a letter and number which define the use category and the assigned working voltage and current
  For example, A 300 means : in category AC 15, a maximum working voltage of 300 V and 6 A at 120 V or 3 A at 240 V.

Contact block electrical wiring diagram

Form Za

Both contacts have the same polarity

Form Zb

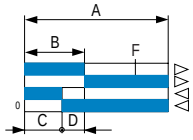
The 2 contacts are electrically isolated

Positive break contact operation (IEC 947-5-1, chapter 3)
For contacts used in safety applications, limit switches, emergency stop devices, assurance that opening has occurred is essential (see IEC 204, EN60204). After each attempt, contact opening is checked by an impulse voltage test (2500 V).

Contact element :

- Snap action contact

This is characterized by tripping points and release points which cannot be confused. The speed at which the control devices moves is independent from the speed of the control device. This feature makes it possible to obtain satisfactory electrical performance even where the control device is moving at low speed.



A : Total travel (TT) of the control device
B : Pre-travel (PT) until the contact element opens
C : Release travel until the contact element closes
D : B-C = Differential travel
F : Travel required to reach the positive opening point (POT)

Rules and regulations

EC Directives
Our detectors conform to the EC Low Voltage Technical Directive 73/23/EEC and can be used in accordance with the specifications of the Machinery Directive 89/392/EEC.

Environmental conditions

Temperature limits
When they are used in the temperature range quoted, the mechanical and electrical characteristics of our position detectors will remain substantially unchanged. If you intend to use them outside this range, please consult us.

Protective treatment
The treatment given to our position detectors is suitable in the vast majority of applications.
Parts made of steel are zinc-coated or painted according to their mechanical function. Further information is available on request.
This treatment allows our detectors to be used under the following temperature and humidity conditions :

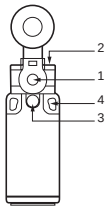
T °C	20	40	50
Relative humidity %	95	80	50

This treatment may thus be suitable for applications in tropical or equatorial climates where the equipment concerned is in an interior location sheltered from direct exposure to atmospheric conditions.
Other types of reinforced protection are possible for resistance to very severe environments.
Please enquire.

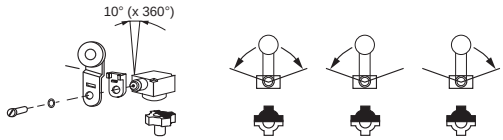
Mounting requirements
Electric shock protection.
The user should observe the mounting instructions relating to the mode of protection against electric shocks defined in the IEC 536.1, EN 60204.1 - NFC 20030 standards :
Class I : earth circuit link. Protection via differential circuit-breaker.
Class II : double insulation.
Class III : very low safety voltage.

Screw tightening torque :

1 : Actuator tightening	1.2 to 1.5 Nm	
	Plastic body	Metal body
2 : Head fixing screw	0.7 to 0.8 Nm	0.8 to 1 Nm
3 : Body fixing screw	0.7 to 0.8 Nm	0.8 to 1 Nm
4 : Fixing screw	2 to 2.5 Nm	



Adjustment of rotary heads with momentary action to right and left :
For series 83 850, 83 851, 83 861, 83 854, 83 855, 83 863



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 a position detector provides against access to live components and against the entry of solid foreign bodies and the entry 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

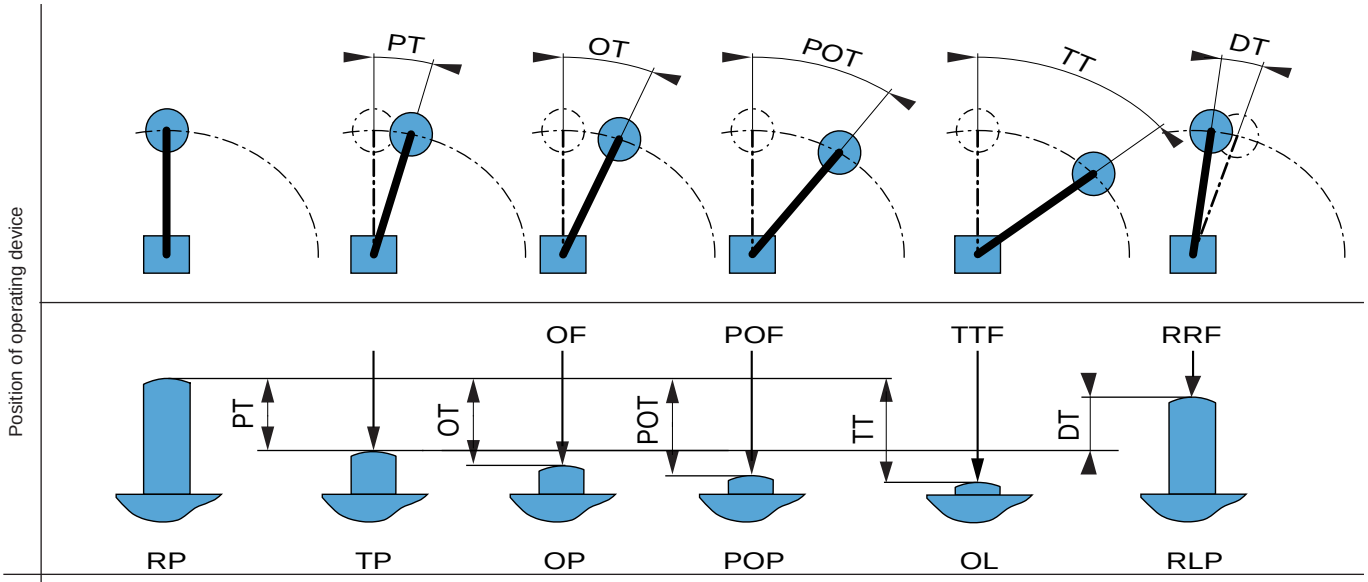
2nd numeral			
Protection equipment provides against the entry of water			
0	(not protected)	**6**	high-pressure hosed water
4	splashed water	**7**	temporary immersion
5	hosed water	**8**	prolonged immersion

3

Mechanical characteristics

Terminology

Forces - Positions - Travel



Forces			**OF Operating force** Force which must be applied to the operating device to displace the rest position RP to the tripping point TP.	**POF Positive opening force** Operating force applied to the operating device to cause the positive opening action to take place.	**TTF Total travel force** Force applied to the operating device to move it through its total travel.	**RRF Release force** Level to which the operating force OF must be reduced to allow the 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 in relation to its mounting (hole, face) at the moment when an operating force causes the snap action of the mechanism to trip.	**OP Operating point** Position of the operating device when the applied force has moved it to the point on its travel where mechanical and electrical operation of the detector can be relied on to occur.	**POP Positive opening point** Position of the operating device at the moment when a force produces the positive opening action.	**OL Overtravel limit** Position of the operating device when the force applied has brought it to the effective end of its permitted travel without causing damage.	**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 Operating travel** Distance between the rest position RP and the operating point OP.	**POT Positive opening travel** Minimum movement of the operating device required to ensure that the opening contact is positively opened.	**TT Total travel** Distance between the rest position RP and the overtravel limit OL.	**DT Differential travel** Distance between the tripping point TP and the release position RLP.

- Positive opening action : see IEC 947-5-1 chapter 3, § 2.2

N.B. : The max. and min. values quoted for each detector (min. operating force, max. total travel, etc.) are the maxima and minima users must allow for if they are to use our products under the proper conditions.

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