

Application & Guidance Notes



Safety Limit Switches

Safety Circuits

When installing a safety switch, it is imperative that it is used in an approved circuit design. The essential requirements are:

1. The machine must stop when the guard is opened or the rope operated emergency stop is pulled.

2. The machine must not be able to be re-started with the guard open or before the rope switch is reset

3. The machine must not re-start automatically when the guard is closed or the rope switch is reset – the ‘start’ or ‘on’ push-button should still need to be pressed.

Safety switch design principles

Positive Break

An important principle of a safety switch is positive break i.e. forced mechanical disconnection of the safety contacts in the event of contact weld. The system should not rely on spring pressure as this may not be sufficient to break the weld.

many other forms of physical abuse. It is essential that the switches can withstand this treatment without breaking.

Sealing

The working conditions can be extremely dirty with swarf and other foreign matter present. It is critical that the design should not allow any particles to enter the mechanism which could prevent it from operating.

Security

When switches are used on machine guards, it is essential that the mechanism should not be defeated easily i.e. operators should not be able to override the switch either accidentally or intentionally. Switches that can be activated by the operator leaning on a plunger or inserting various objects (screwdrivers etc.) into the mechanism are not acceptable.

Complete Electrical Separation of NO and NC Contacts

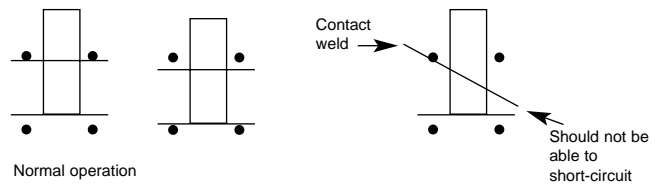
The British and European Standard BS EN 60947 shows three changeover contact configurations, two of which can be used in separate NO and NC circuits, but only one, the Zb arrangement, has completely electrically separate NO and NC contacts. The design of the Zb contact should be such that if one contact welds, the resultant imbalance of the mechanism, before the weld is forcibly broken, should not allow the NO and NC circuits to short-circuit:

Fail-safe

In the event of component failure, the switch must fail with the safety contacts open.

Reliability

It is very important that the mechanism should function reliably everytime it is used which means a high quality assembly with very little wear in use, giving a lifetime in excess of one million operations.



Strength

In an industrial environment, safety switches can receive severe impacts and

The IMO Safety Limit Switches meet all these requirements:

Positive break of the safety contacts	Strong
Tamper-proof	Sealed against contamination
Fail-safe	Electrically separate NO and NC contacts
Reliable	

The **European Machinery Directive**, which came into force on 1st January 1995, requires machinery manufacturers to ensure that their equipment conforms to all relevant safety standards. The use of **IMO Safety Limit Switches** will protect machinery and equipment to assist in meeting these standards.

Specification

Rated thermal current I _{th}	10A
Rated working voltage	500VAC/600VDC
Initial contact resistance	<25 mΩ
Contact gap	>2.5mm (2 x 1.25mm conforming to VDE 0660 part 206)
Contact material	silver
Dielectric strength	2000VAC, 50/60Hz for 1 minute between open contacts 2000VAC, 50/60Hz for 1 minute between current-carrying parts and ground
Ambient operating temperature	-25 to +80 deg. C
Ambient humidity	95% r.h.
Maximum wire size	2 x 1.5mm ² flexible, 2 x 2.5mm ² solid
Conduit entry	PG13.5

Contact ratings

BS EN 60947-5-1		DC13 – Control of DC electromagnetic loads where the time in ms taken to reach 95% of the rated current is equal to 6 times the power of the load (where P<50W) – replaces DC11	24VDC 6A
AC15 – Control of AC electromagnetic loads >72VA sealed – replaces AC11	230VAC 6A 400VAC 4A 500VAC 1A		125VDC 1.1A 250VDC 0.4A

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Safety Limit Switches (continued)

If limit switches with positive break of the NC safety contacts are used in safety applications, it is essential that they are used in the positive mode, i.e. opening the guard should operate the switch, forcibly breaking the NC contacts.

When the door is opened, the switch must be pressed directly (fig 2) or by a cam (fig 3). Only in this way the positive opening of the NC contacts (11-12 and 21-22) is assured.

Figure 1 shows switches used in the negative mode, i.e. opening the guard releases the switch, which relies on spring pressure to open the contacts and is not acceptable.

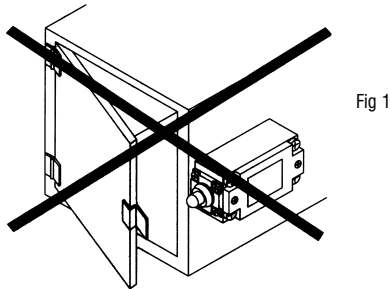


Fig 1

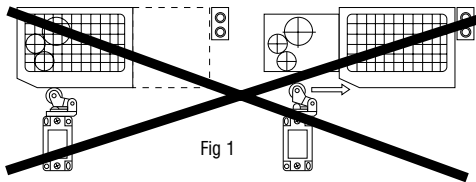


Fig 1

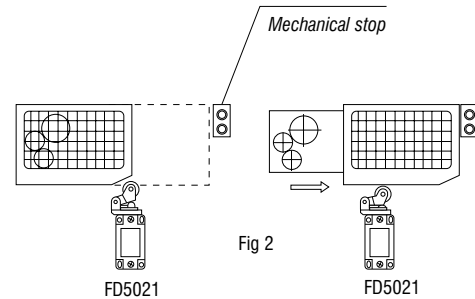


Fig 2

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FD5021

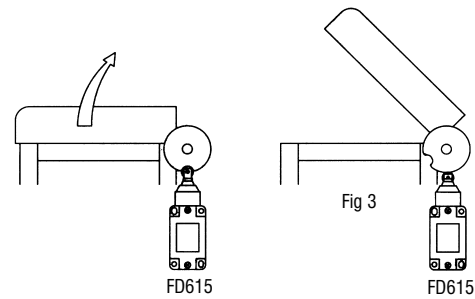


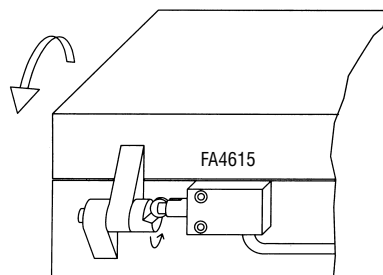
Fig 3

FD615

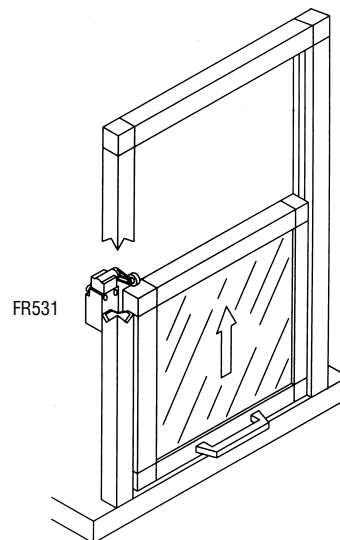
FD615

The NO contacts (13-14) must be used only for signals. This contact must not be connected to the safety circuit.

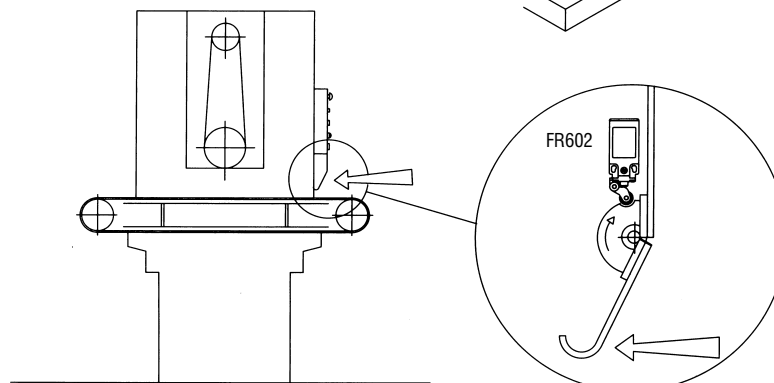
Exceeds the breaking point by 1.5mm (25°) to guarantee positive opening of the NC contacts.



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Any information or application examples including connections, illustrated in this document, must be intended as purely descriptive.

It is the user's responsibility to ensure that the products are chosen and applied in conformity with any applicable safety regulations to prevent accidents or injury.