

Compact limit switches with snap-action contacts and positive break according to BS/EN60947-5-1

- Bifurcated contacts for low resistance and high reliability – suitable for switching low-level electronic currents
- Double-break contacts with electrically separate NO and NC circuits in conformity with VDE 0660 part 206
- 10A 500VAC/600VDC rated
- Turret head position rotatable in 90° increments
- Centre-position indicator arrow – lever actuators
- Wide range of actuators
- Single and dual cable entry models
- Removable contact block for ease of wiring
- Metal or plastic housing options
- IP65 according to BS EN 60947-1
- FM and FR dimensions in accordance with EN50047 with dual fixing centres: 20 and 22mm
- Approvals: UL, CSA



Options and ordering codes

	FM	5	01	-	7	
Compact metal housing	FM				-	Standard turret without reset button
Compact plastic housing	FR				7	With reset button
Dual-entry metal housing	FZ				71	Early trip point with reset button
Dual-entry plastic housing	FX					
Snap-action contacts, 1NO + 1NC		5				Standard actuators – options overleaf
Slow-action, break before make 1NO + 1NC		6				
Slow-action, make before break 1NO + 1NC		7				
Slow-action contacts, 2NC		9				
Slow-action contacts, 2NO		10				
Snap-action contacts, 2NC		11				
Slow-action contacts, break before make 2NC + 1NO		20				
Slow-action contacts, break before make 3NC		21				
Slow-action contacts, break before make 1NC + 2NO		22				
Snap-action contacts, 2NO + 2NC		2				
					38	Lift-style turret
						Specify lever type for lift-style switches:
					L313	Fixed position roller
					L353	Single adjustment roller
					L354	Dual adjustment roller

Please note: Positive break applies to the NC contacts of types 5, 6, 7, 9, 11, 20, 21 and 22 only.

Specifications

Rated thermal current I _{th}	10A
Rated working voltage	500VAC/600VDC
Maximum operating frequency	6000/hour
Mechanical life	>20 million operations
Contact form	1NO + 1NC
Initial contact resistance	<25 mOhms
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
Protection rating	IP65
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
Housing material	FM/FZ: die-cast metal alloy, FR/FX: self-extinguishing, glass-reinforced, thermoplastic resin
Conduit entry	PG 13.5

Contact ratings

BS/EN 60947-5-1

AC15 – Control of AC electromagnetic loads >72VA sealed – replaces AC11

230VAC 6A
400VAC 4A
500VAC 1A

DC13 – Control of DC electromagnetic loads where the time 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
125VDC 1.1A
250VDC 0.4A

Terminal connections

Standard contacts: NO: 13–14 NC: 21–22

Terminal screws: M3.5 with rising cable clamps.

Note: The positive break of the type 5 contact block applies to the NC contacts only. Connections to safety circuits should NOT be made using the NO contacts.

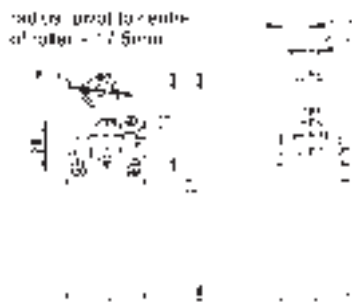
To ensure positive breaking of the contacts, exceed the pre-travel by 1.5mm or 25° according to the model. Maximum screw tightening torque 0.8Nm (8Kgcm)

Standard actuator options – FM and FR series



Actuator type 01 Piston plunger

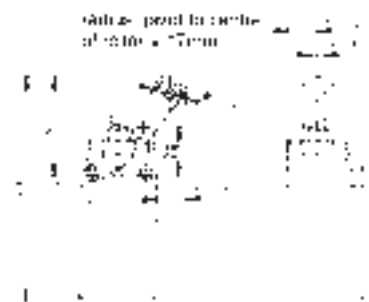
Operating force min.	OF	820g
Pre-travel	PT	2mm
Over-travel	OT	4mm
Movement differential	MD	1mm
Operating point	OP	19mm
Operating speed max.	OS	0.5m/s



Actuator type 02 One-way roller – top actuated

Operating force min.	OF	615g
Pre-travel	PT	2.9mm
Over-travel	OT	5.6mm
Movement differential	MD	1.6mm
Operating point	OP	36.1mm
Operating speed max.	OS	1m/s using a 30° cam

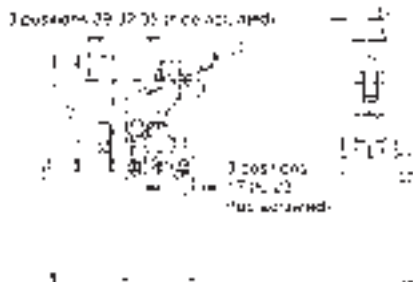
Note: plastic roller only



Actuator type 05 One-way roller – side actuated

Operating force min.	OF	615g
Pre-travel	PT	2.9mm
Over-travel	OT	5.6mm
Movement differential	MD	1.6mm
Operating point	OP	–
Operating speed max.	OS	1m/s using a 30° cam

Note: plastic roller only



Actuator type 07 One-way roller adjustable 3 positions top actuated 3 positions side actuated

Operating force min.	OF	410g
Pre-travel	PT	5mm
Over-travel	OT	8mm
Movement differential	MD	2.8mm
Operating point	OP	47mm
Operating speed max.	OS	1m/s using a 30° cam

Note: plastic roller only
radius: pivot to centre of roller = 28mm



Actuator type 08 Sealed piston plunger

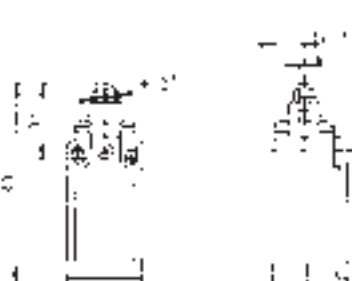
Operating force min.	OF	820g
Pre-travel	PT	2mm
Over-travel	OT	4mm
Movement differential	MD	1mm
Operating point	OP	30mm
Operating speed max.	OS	0.5m/s

Also available:
Actuator type 10.
Piston plunger with
M12 mounting bush
on the turret.
Characteristics as for
type 08 except:
OP=34mm.



Actuator type 14 Mushroom head plunger (red plastic)

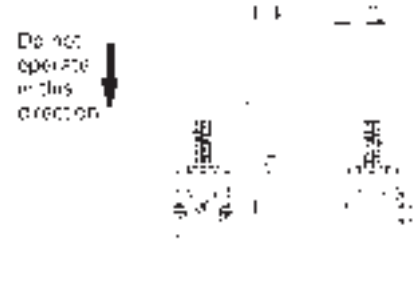
Operating force min.	OF	820g
Pre-travel	PT	2mm
Over-travel	OT	4mm
Movement differential	MD	1mm
Operating point	OP	26mm
Operating speed max.	OS	0.5m/s



Actuator type 15 Roller piston plunger

Operating force min.	OF	820g
Pre-travel	PT	2mm
Over-travel	OT	4mm
Movement differential	MD	1mm
Operating point	OP	29mm
Operating speed max.	OS	0.3m/s using a 30° cam

Notes: FM515 ø 12mm metal roller as standard,
FR515 ø 11mm plastic roller as standard.
For FR with ø 12mm metal roller: FR5151

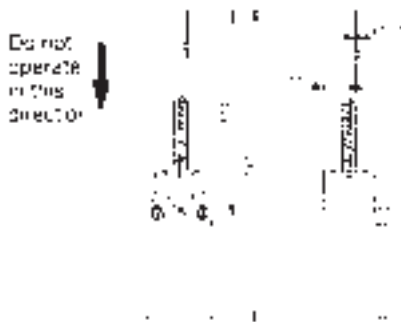


Actuator type 20 Sealed coil spring with flexible rod

Operating force min.	OF	100g at 2/3 the length of the actuator
Pre-travel	PT	18°
Over-travel	OT	–
Movement differential	MD	10°
Operating point	OP	–
Operating speed max.	OS	1m/s

Notes: Not suitable for safety circuits.
Not suitable for use with contact
blocks 20, 21 or 22

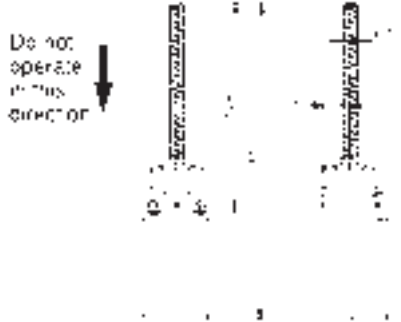
Standard actuator options – FM and FR series

**Actuator type 21****Sealed coil spring with cat's whisker**

OF	70g at $\frac{2}{3}$ the length of the actuator.
PT	18°
OT	–
MD	10°
OP	–
OS	1m/s

Notes: Not suitable for safety circuits

Not suitable for use with contact blocks 20, 21 or 22

**Actuator type 25****Sealed coil spring**

OF	185g at $\frac{2}{3}$ the length of the actuator
PT	18°
OT	–
MD	10°
OP	–
OS	1m/s

Notes: Not suitable for safety circuits

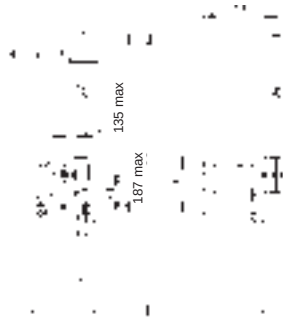
Not suitable for use with contact blocks 20, 21 or 22

**Actuator type 31****Roller-lever**

OF	1000gcm
PT	30°
OT	45°
MD	13°
OP	–
OS	1.5m/s using a 30° cam

Notes: 1. ø18mm plastic roller as standard, ø20mm metal roller actuator part no.: 311.

2. Lever position adjustable over 360° in 10° increments.

**Actuator type 50****Adjustable steel rod**

OF	1000gcm
PT	30°
OT	45°
MD	13°
OP	–
OS	1.5m/s

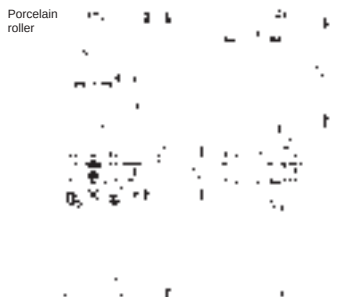
Note: Lever position adjustable over 360° in 10° increments.

Also available:

Actuator type 69.
Adjustable glass-fibre rod ø6x200mm.
Characteristics as for type 50, but not suitable for safety circuits.**Actuator type 51****Roller-lever with large offset**

OF	1000gcm
PT	30°
OT	45°
MD	13°
OP	–
OS	1.5m/s using a 30° cam

Notes: 1. Plastic roller as standard, metal roller actuator part no.: 511. 2. Lever position adjustable over 360° in 10° increments.

**Actuator type 53****Porcelain roller-lever**

OF	615gcm
PT	30°
OT	45°
MD	13°
OP	–
OS	–

Note: Lever position adjustable over 360° in 10° increments.

**Actuator type 54****Roller-lever with small offset**

OF	1000gcm
PT	30°
OT	45°
MD	13°
OP	–
OS	1.5m/s using a 30° cam

Notes: 1. Plastic roller as standard, metal roller actuator part no.: 541. 2. Lever position adjustable over 360° in 10° increments.

**Actuator type 55****Adjustable roller-lever**

OF	1000gcm
PT	30°
OT	45°
MD	13°
OP	–
OS	1.5m/s using a 30° cam

Notes: 1. Plastic roller as standard, metal roller actuator part no.: 551. 2. Lever position adjustable over 360° in 10° increments.

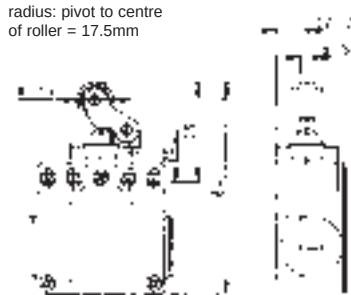
Standard actuator options – FZ and FX series



Actuator type 01
Piston plunger

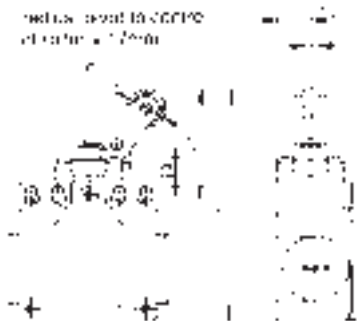
OF 820g
PT 2mm
OT 4mm
MD 1mm
OP 19mm
OS 0.5m/s

radius: pivot to centre
of roller = 17.5mm



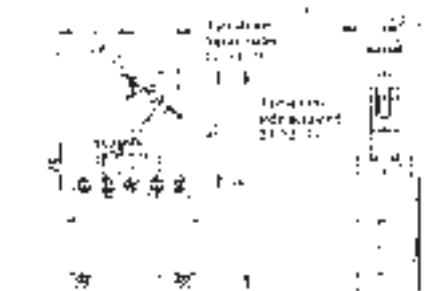
Actuator type 02
One-way roller – top actuated

OF 615g
PT 2.9mm
OT 5.6mm
MD 1.6mm
OP 36.1mm
OS 1m/s using a 30° cam
Note: plastic roller only



Actuator type 05
One-way roller – side actuated

OF 615g
PT 2.9mm
OT 5.6mm
MD 1.6mm
OP –
OS 1m/s using a 30° cam
Note: plastic roller only



Actuator type 07
One-way roller adjustable
3 positions top actuated
3 positions side actuated

OF 410g
PT 5mm
OT 8mm
MD 2.8mm
OP 47mm
OS 1m/s using a 30° cam
Note: Plastic roller only
radius: pivot to centre of roller = 28mm



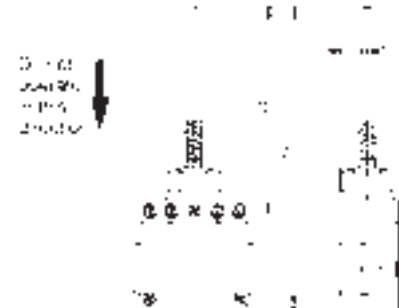
Actuator type 08
Sealed piston plunger

OF 820g
PT 2mm
OT 4mm
MD 1mm
OP 30mm
OS 0.5m/s



Actuator type 15
Roller piston plunger

OF 820g
PT 2mm
OT 4mm
MD 1mm
OP 29mm
OS 0.3m/s using a 30° cam
Note: FZ515 ø12mm metal roller as standard,
FX515 ø11mm plastic roller as standard.
For FX with ø12mm metal roller: FX5151



Actuator type 20
Sealed coil spring with flexible rod

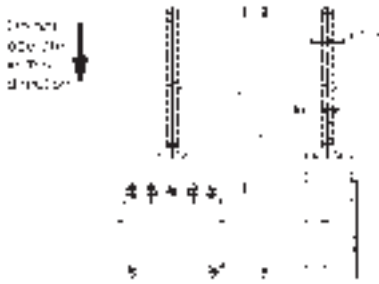
OF 100g at $\frac{2}{3}$ the length of the actuator
PT 18°
OT –
MD 10°
OP –
OS 1m/s
Notes: Not suitable for safety circuits
Not suitable for use with contact blocks 20,
21 or 22



Actuator type 21
Sealed coil spring with cat's whisker

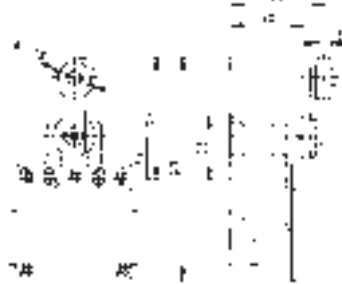
OF 70g at $\frac{2}{3}$ the length of the actuator
PT 18°
OT –
MD 10°
OP –
OS 1m/s
Notes: Not suitable for safety circuits
Not suitable for use with contact blocks 20,
21 or 22

Standard actuator options – FZ and FX series

**Actuator type 25****Sealed coil spring**

OF	185g at $\frac{2}{3}$ the length of the actuator
PT	18°
OT	–
MD	10°
OP	–
OS	1m/s

Notes: Not suitable for safety circuits
Not suitable for use with contact blocks
20, 21 or 22

**Actuator type 31****Roller-lever**

OF	1000gcm
PT	30°
OT	45°
MD	13°
OP	–
OS	1.5m/s using a 30° cam

Notes: 1. ø18mm plastic roller as standard, ø20mm metal roller actuator part no.: 311
2. Lever position adjustable over 360° in 10° increments.

**Actuator type 50****Adjustable steel rod**

OF	1000gcm
PT	30°
OT	45°
MD	13°
OP	–
OS	1.5m/s

Note: Lever position adjustable over 360° in 10° increments.

**Actuator type 51****Roller-lever with large offset**

OF	1000gcm
PT	30°
OT	45°
MD	13°
OP	–
OS	1.5m/s using a 30° cam

Notes: 1. Plastic roller as standard, metal roller actuator part no.: 511. 2. Lever position adjustable over 360° in 10° increments.

**Actuator type 53****Porcelain roller-lever**

OF	615gcm
PT	30°
OT	45°
MD	13°
OP	–
OS	–

Note: Lever position adjustable over 360° in 10° increments.

**Actuator type 54****Roller-lever with small offset**

OF	1000gcm
PT	30°
OT	45°
MD	13°
OP	–
OS	1.5m/s using a 30° cam

Notes: 1. Plastic roller as standard, metal roller actuator part no.: 541. 2. Lever position adjustable over 360° in 10° increments.

**Actuator type 55****Adjustable roller-lever**

OF	1000gcm
PT	30°
OT	45°
MD	13°
OP	–
OS	1.5m/s using a 30° cam

Notes: 1. Plastic roller as standard, metal roller actuator part no.: 551. 2. Lever position adjustable over 360° in 10° increments.

**Actuator type 69****Adjustable glass-fibre rod**

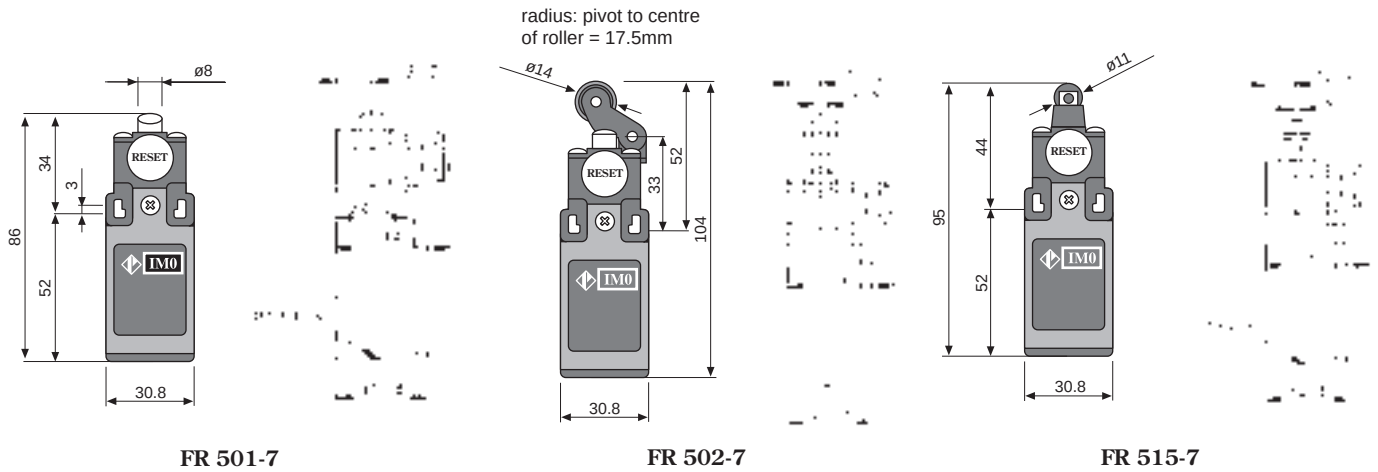
OF	1000gcm
PT	30°
OT	45°
MD	13°
OP	–
OS	1.5m/s

Notes: 1. Not suitable for safety circuits
2. Lever position adjustable over 360° in 10° increments.

Standard switches with reset buttons

Examples – many other types available – for reset button, add suffix – 7 to standard part numbers

Operation – once contacts have changed-over and latched, the reset button must be operated for the contacts to change back



Piston plunger

Pre-travel 2mm

Additional travel beyond the operating point until the mechanism latches 2mm

One-way roller – top actuated

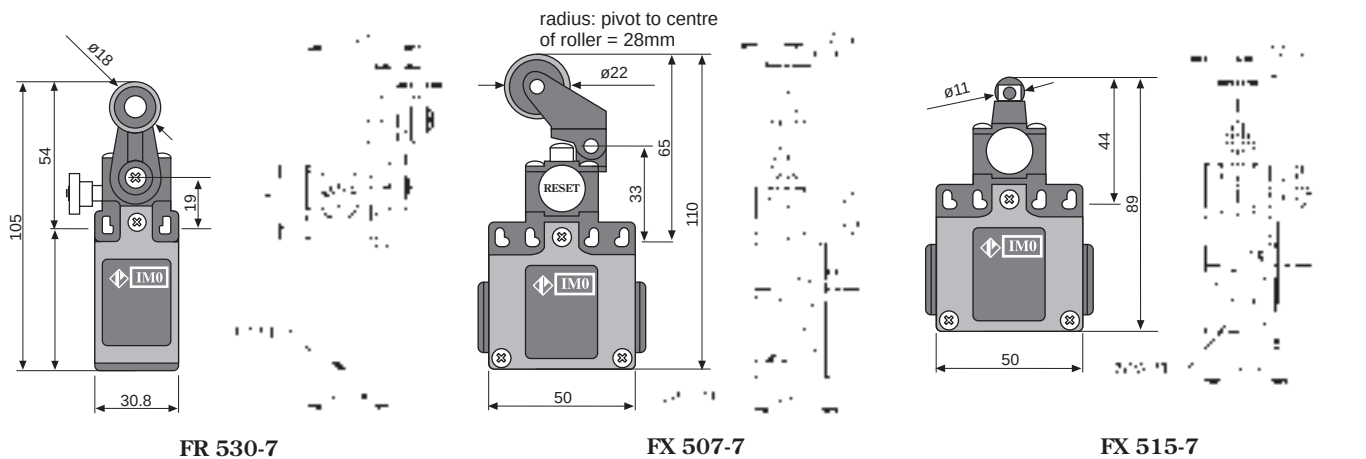
Pre-travel 2.9mm

Additional travel beyond the operating point until the mechanism latches 2.3mm

Roller piston plunger

Pre-travel 2mm

Additional travel beyond the operating point until the mechanism latches 2mm



Roller-lever

Pre-travel 30°

Additional travel beyond the operating point until the mechanism latches 25°

One-way roller – adjustable

3 positions top actuated

3 positions side actuated

Pre-travel 5mm

Additional travel beyond the operating point until the mechanism latches 3.4mm

Roller piston plunger

Pre-travel 2mm

Additional travel beyond the operating point until the mechanism latches 2mm

Glossary

The following is a glossary of terms in specifying actuator characteristics:

Operating force (OF)

The force applied to the actuator required to operate the switch contacts.

Releasing force (RF)

The value to which the force on the actuator must be reduced to allow the contacts to return to the normal position.

Total force (TF)

The force applied to the actuator required to reach the stopper from the free position.

Free position (FP)

The initial position of the actuator when there is no external force applied.

Operating position (OP)

The position of the actuator at which the contacts snap to the operated contact position measured with respect to the centres of the mounting holes.

Releasing position (RP)

The position of the actuator at which the contacts snap from the operated contact position to their normal position.

Total travel position (TTP)

The position of the actuator when it reaches the limit of travel – must not be exceeded.

Pretravel (PT)

The distance or angle through which the actuator moves from the free position to the operating position.

Overtravel (OT)

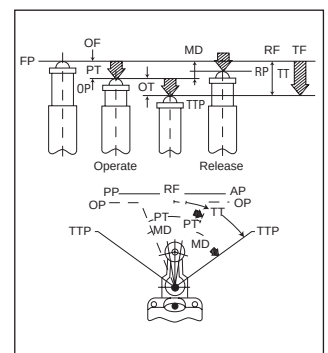
The distance or angle of the actuator movement beyond the operating position.

Movement differential (MD)

The distance or angle from the operating position to the releasing position.

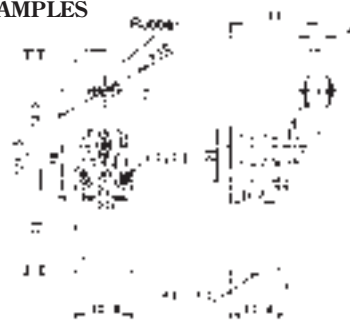
Total travel (TT)

The sum of the pretravel and overtravel expressed by distance or angle.

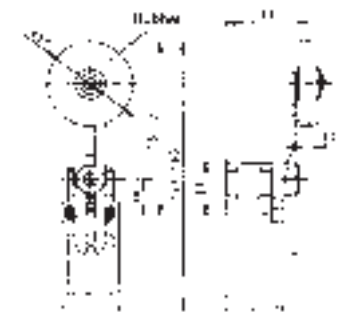


Lift-style switches

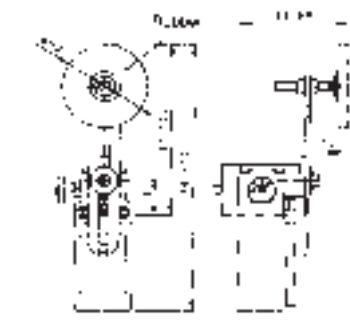
EXAMPLES



FR538 or FR938 + LE543
FM538 or FM938 + LE543
Turret type 38 (without reset button)
Lever type LE543 (fixed position roller)
Pre-travel = 30°



FR538 or FR938 + LE553
FM538 or FM938 + LE553
Turret type 38 (without reset button)
Lever type LE553 (single adjustment roller)
Pre-travel = 30°



FR538-71 + LE554 FM538-71 + LE554
Turret type 38-71 (early trip point with reset button)
Lever type LE554 (dual adjustment roller)
Pre-travel = 30°
Additional travel to latching point -0°/+8°

- Three lever options, all with or without manual reset button.
 - FZ and FX models also available with a choice of turret and lever.
 - Age-resistant and oil-resistant rubber rollers.
 - Lever position adjustable over 360° in 10° increments.
 - Head rotatable in 90° increments.
- Glass-reinforced thermoplastic resin models (FR and FX) double insulated for electrical safety.
 - Die-cast metal alloy models (FM and FZ) include earth terminal.

Note: Types with reset button have non-removable contact block due to interlocking with reset mechanism.

FR538-71 formerly FR581

Types L353 and L354 have a location slot at the end to lock the levers at full extension if required.

Replacement contact blocks

B5	1NO+1NC 13 21 V - 7 14 22	Positive break Snap action standard contact block	➔ Zb
B6	1NO+1NC 13 21 V - 7 14 22	Positive break Slow action break before make	➔ Zb
B7	1NO+1NC 13 21 V - 7 14 22	Positive break Slow action make before break	➔ Zb
B9	2NC 11 21 7 - 7 12 22	Positive break Slow action, contacts 11-12, 21-22 open at the same time	➔ Zb
	B14	Positive break Slow action, contacts 11-12 open first, further actuator travel causes contacts 21-22 to open	
B10	2NO 13 23 V - V	Slow action, contacts 13-14, 23-24 close at the same time	
	B15	Slow action, contacts 13-14 close first, further actuator travel causes contacts 23-24 to close	
B2	2NO+2NC 13 21 43 31 V - V - V - V 14 22 44 32	Snap action, double pole	

Plug and socket limit switches

All FR/FM/FZ/FX series limit switches can be converted to a plug-in style by the addition of an adaptor.

Part number
8R4D26E03C3003



The adaptor is screwed into the limit switch and the four flying leads connected to the four terminals of the contact block.
Suitable 4-wire plug leads are available – see pages 332 to 335.

Ratings
250VAC/300VDC
3A
IP67

Cable glands

Cable glands are available to enable standard multi-core cables to be connected without the use of conduit.
Two sizes are possible:

Part number PG13.5 Cable size ø9-12mm Part number PG13.5/6 Cable size ø6-9mm

