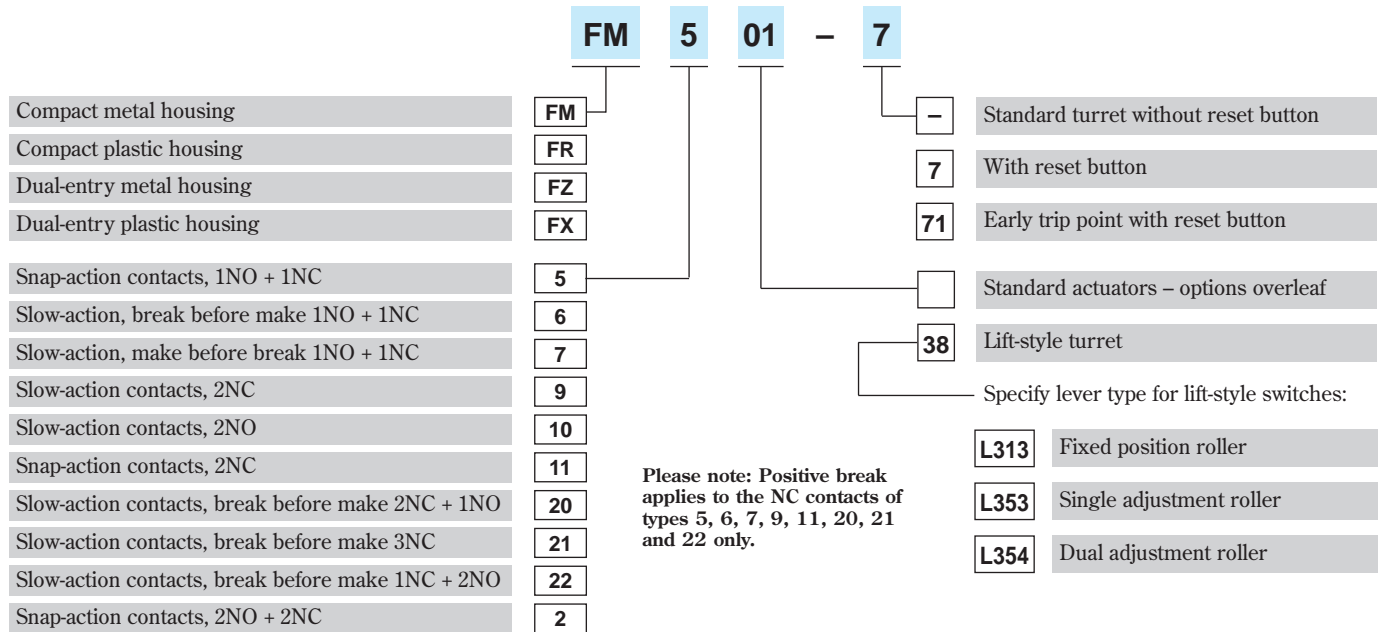


## Compact limit switches with snap-action contacts and positive break according to BS/EN60947-5-1

- 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



## Specifications

Rated thermal current I <sub>th</sub>	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 <sup>2</sup> flexible, 2 x 2.5mm <sup>2</sup> 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 400VAC 500VAC	6A 4A 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 125VDC 250VDC	6A 1.1A 0.4A

## Terminal connections

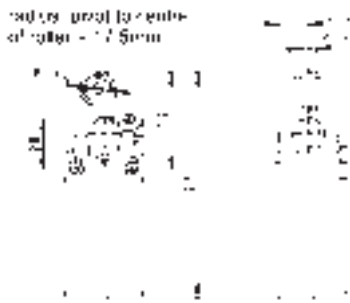
Standard contacts: NO: 13–14 NC: 21–22  
Terminal screws: M3.5 with rising cable clamps.  
Note: The positive break of the type 5 contact block applies to the NC contacts only. Connections to safety circuits should NOT be made using the NO contacts.  
To ensure positive breaking of the contacts, exceed 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

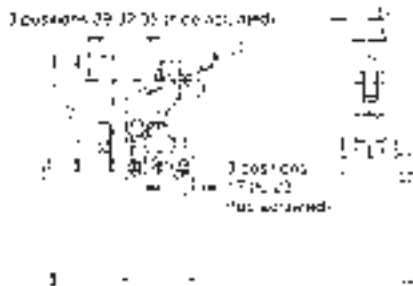
Note: plastic roller only



### 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

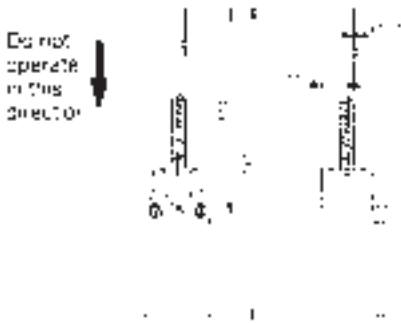


### Actuator type 20 Sealed coil spring with flexible rod

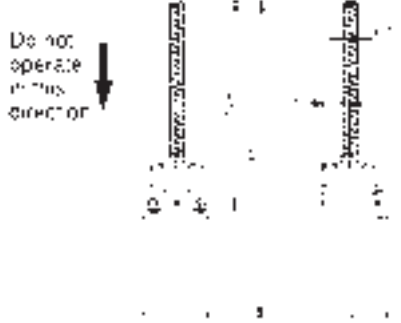
Operating force min.	OF	100g at 2/3 the length of the actuator
Pre-travel	PT	18°
Over-travel	OT	–
Movement differential	MD	10°
Operating point	OP	–
Operating speed max.	OS	1m/s

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

Standard actuator options – FM and FR series



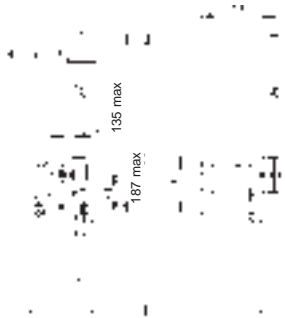
**Actuator type 21**  
**Sealed coil spring with cat's whisker**  
 OF 70g at  $\frac{2}{3}$  the length of the actuator.  
 PT 18°  
 OT –  
 MD 10°  
 OP –  
 OS 1m/s  
 Notes: Not suitable for safety circuits  
 Not suitable for use with contact blocks 20, 21 or 22



**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.

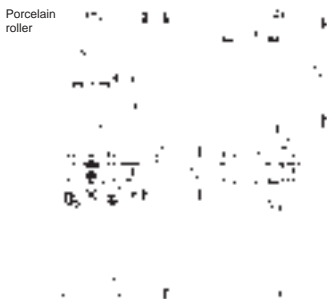


**Actuator type 50**  
**Adjustable steel rod**  
 OF 1000gcm  
 PT 30°  
 OT 45°  
 MD 13°  
 OP –  
 OS 1.5m/s  
 Note: Lever position adjustable over 360° in 10° increments.

**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

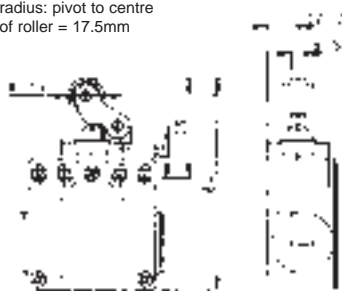


### Actuator type 01

#### 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

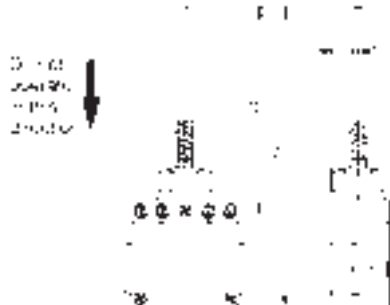
#### Roller piston plunger

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 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

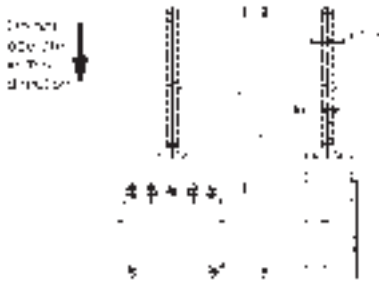
OF	70g at 2/3 the length of the actuator
PT	18°
OT	–
MD	10°
OP	–
OS	1m/s

Notes: Not suitable for safety circuits

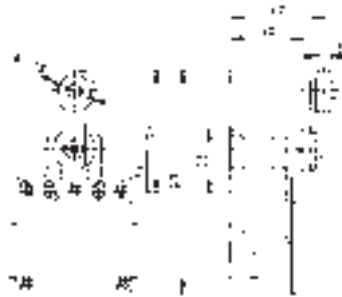
Not suitable for use with contact blocks 20,

21 or 22

Standard actuator options – FZ and FX series



**Actuator type 25**  
**Sealed coil spring**  
 OF 185g at 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.

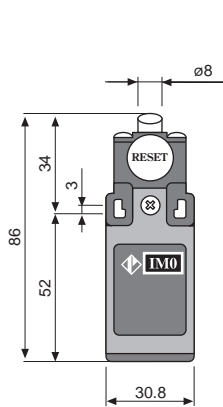


**Actuator type 69**  
**Adjustable glass-fibre rod**  
 OF 1000gcm  
 PT 30°  
 OT 45°  
 MD 13°  
 OP –  
 OS 1.5m/s  
 Notes: 1. Not suitable for safety circuits  
 2. Lever position adjustable over 360° in 10° increments.

## 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

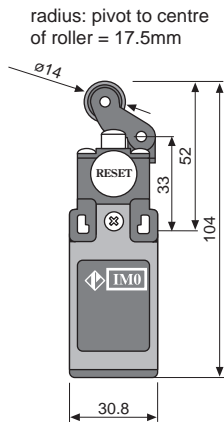


FR 501-7

**Piston plunger**

Pre-travel 2mm

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

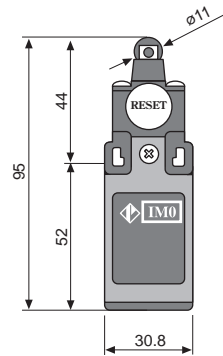


FR 502-7

**One-way roller – top actuated**

Pre-travel 2.9mm

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

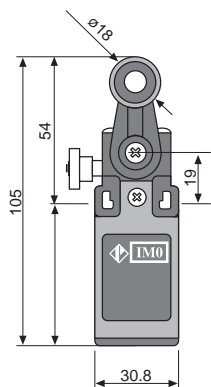


FR 515-7

**Roller piston plunger**

Pre-travel 2mm

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

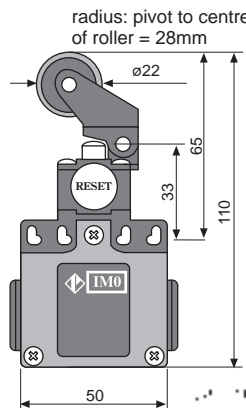


FR 530-7

**Roller-lever**

Pre-travel 30°

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



FX 507-7

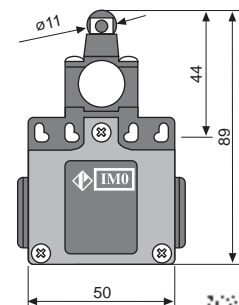
**One-way roller – adjustable**

3 positions top actuated

3 positions side actuated

Pre-travel 5mm

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



FX 515-7

**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)**

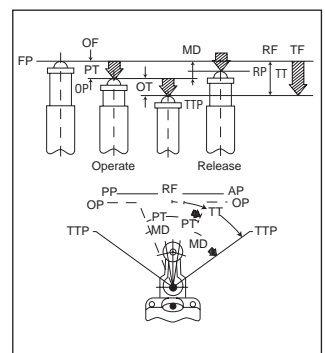
The distance or angle of the actuator movement beyond the operating position.

**Movement differential (MD)**

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

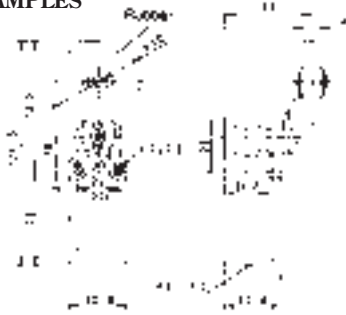
**Total travel (TT)**

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

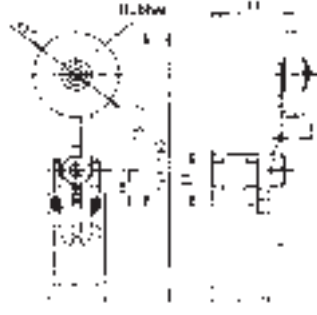


## Lift-style switches

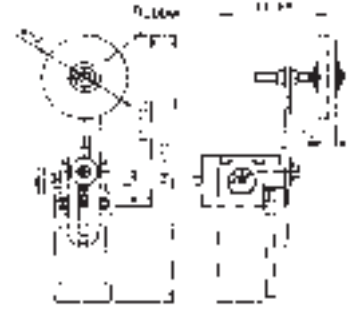
### EXAMPLES



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

## 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

