Compact Heavy Duty Limit Switches FM/FR/FZ/FX

IMO

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
- UL and CUL approved

Options and ordering codes

FM **5** **01** **7**

Compact metal housing	**FM**
Compact plastic housing	**FR**
Dual-entry metal housing	**FZ**
Dual-entry plastic housing	**FX**

Snap-action contacts, 1NO + 1NC	**5**
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, 3NC	**21**
Slow-action contacts, break before make 1NC + 2NO	**22**
Snap-action contacts, 2NO + 2NC	**2**

-	Standard turret without reset button
7	With reset button
71	Early trip point with reset button

-	Standard actuators - see following pages for type options
38	Lift style turret pecify lever type for lift-style switches
VFL313	Fixed position roller
VFL353	Single adjustment roller
VFL354	Dual adjustment roller

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

Contact ratings

BS/EN 60947-5-1		
AC15 – Control of AC electromagnetic	230VAC	6A
loads>72VA sealed – replaces AC11	400VAC	4A
	500VAC	1A
DC13 – Control of DC electromagnetic	24VDC	6A
loads where the time taken to reach	125VDC	1.1A
95% of the rated current is equal to	250VDC	0.4A

6 times the power of the load (where P≤ 50W) – replaces DC11

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.

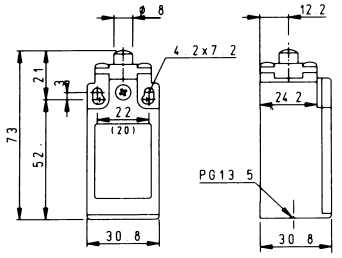
To ensure positive breaking of the contacts, exceed the pre-travel by 1.5mm or 25˚ according to the model. Maximum screw tightening torque 0.8Nm (8Kgcm)

Compact Heavy Duty Limit Switches FM/FR/FZ/FX continued

Specification

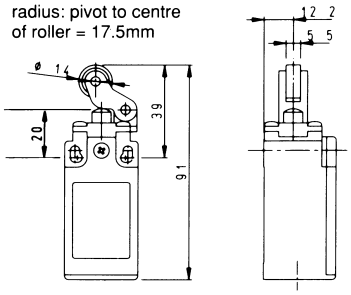
Rated thermal current Ith	10A
Rated working voltage	500VAC/600VDC
Maximum operating frequency	6000/hour
Mechanical life	>20 million operations
Contact form	1NO + 1NC
Initial contact resistance	<25 mOhms
Contact gap	>2.5mm (2 x 1.25mm conforming to VDE 0660 part 206)
Contact material	silver
Dielectric 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 1.5mm² flexible, 2 x 2.5mm² solid
Housing material	FM/FZ: die-cast metal alloy, FR/FX: self-extinguishing, glass-reinforced, thermoplastic resin
Conduit entry	PG 13.5

Standard actuator options – FM and FR series



Actuator type 01
Piston plunger

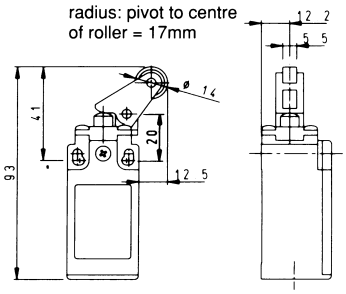
Operating force min.	OF	820g
Pre-travel	PT	2mm
Over-travel	OT	4mm
Movement differential	MD	1mm
Operating point	OP	19mm
Operating speed max.	OS	0.5m/s



Actuator type 02
One-way roller – top actuated

OF	615g
PT	2.9mm
OT	5.6mm
MD	1.6mm
OP	36.1mm
OS	1m/s using a 30˚ cam

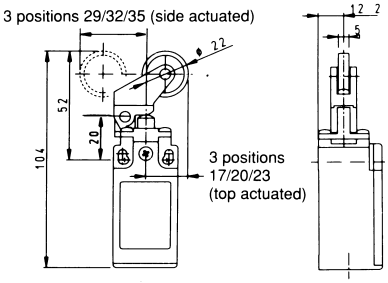
Note: plastic roller only



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

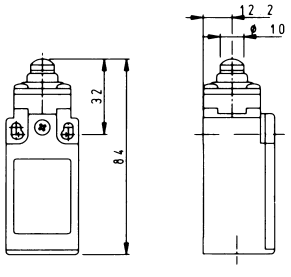
Note: plastic roller only



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



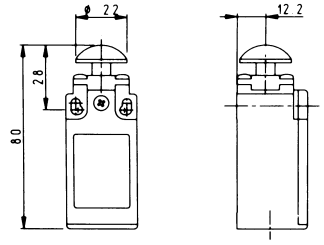
Actuator type 08
Sealed piston plunger

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

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

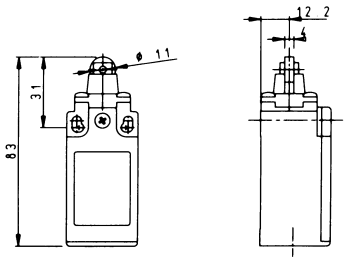
Compact Heavy Duty Limit Switches FM/FR/FZ/FX continued

Standard actuator options – FM and FR series continued



Actuator type 14
Mushroom head plunger (red plastic)

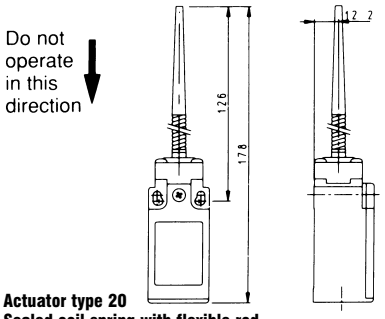
OF	820g
PT	2mm
OT	4mm
MD	1mm
OP	26mm
OS	0.5m/s



Actuator type 15
Roller piston plunger

OF	820g
PT	2mm
OT	4mm
MD	1mm
OP	29mm
OS	0.3m/s using a 30˚ cam

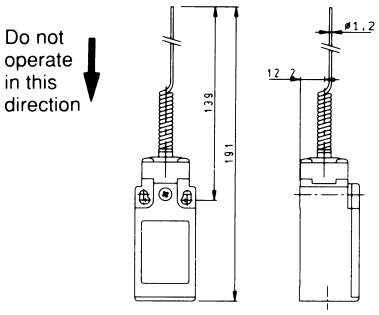
Notes: FM515 ø 12mm metal roller as standard,
FR515 ø 11mm plastic roller as standard.
For FR with ø 12mm metal roller: FR5151



Actuator type 20
Sealed coil spring with flexible rod

OF	100g at 2/3 the length of the actuator
PT	18˚
OT	–
MD	10˚
OP	–
OS	1m/s

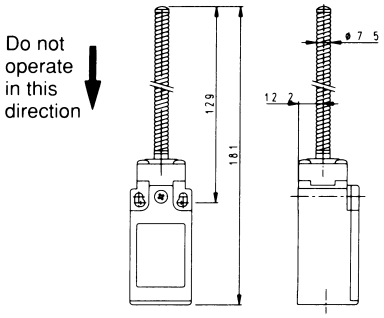
Notes: Not suitable for safety circuits.
Not suitable for use with contact blocks 20, 21 or 22



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

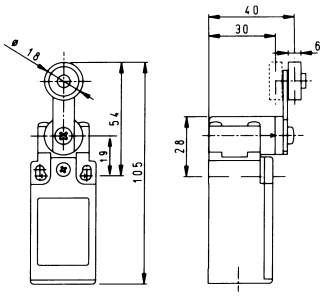
Notes: Not suitable for safety circuits
Not suitable for use with contact blocks 20, 21 or 22



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

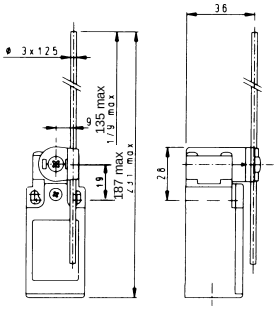
Notes: Not suitable for safety circuits
Not suitable for use with contact blocks 20, 21 or 22



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.

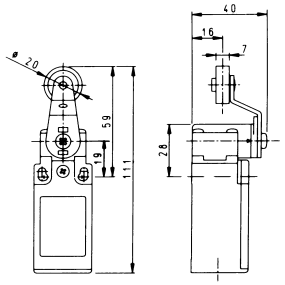


Actuator type 50
Adjustable steel rod

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

Note: Lever position adjustableover 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.



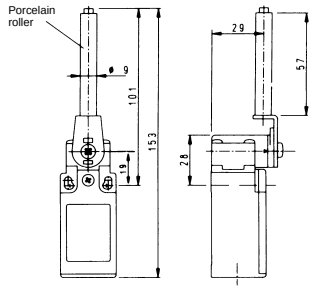
Actuator type 51
Roller-lever with large offset

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

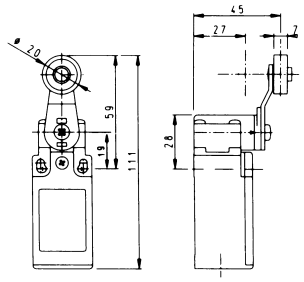
Notes: 1. Plastic roller as standard, metal roller actuator part no.: 511. 2. Lever position adjustable over 360˚ in 10˚ increments.

Compact Heavy Duty Limit Switches FM/FR/FZ/FX continued

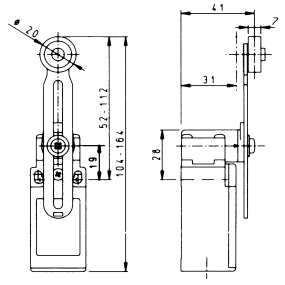
Standard actuator options – FM and FR series continued



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.

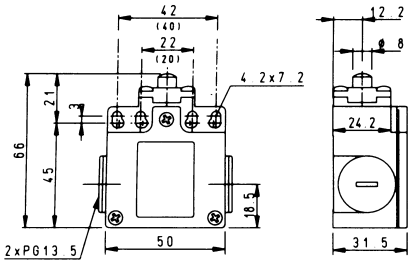


Actuator type 54
Roller-lever with small offset
OF 1000gcm
PT 30˚
OT 45˚
MD 13˚
OP –
OS 1.5m/s using a 30˚ cam
Notes: 1. Plastic roller as standard, metal roller actuator part no.: 541. 2. Lever position adjustable over 360˚ in 10˚ increments.

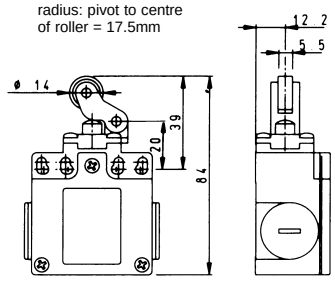


Actuator type 55
Adjustable roller-lever
OF 1000gcm
PT 30˚
OT 45˚
MD 13˚
OP –
OS 1.5m/s using a 30˚ cam
Notes: 1. Plastic roller as standard, metal roller actuator part no.: 551. 2. Lever position adjustable over 360˚ in 10˚ increments.

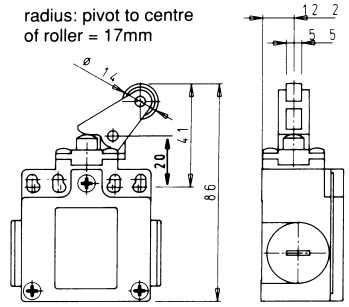
Standard actuator options – FZ and FX series



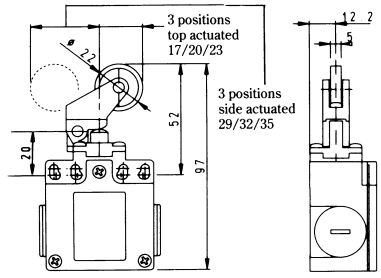
Actuator type 01
Piston plunger
OF 820g
PT 2mm
OT 4mm
MD 1mm
OP 19mm
OS 0.5m/s



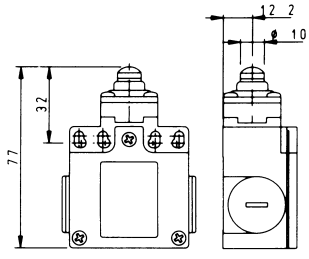
Actuator type 02
One-way roller – top actuated
OF 615g
PT 2.9mm
OT 5.6mm
MD 1.6mm
OP 36.1mm
OS 1m/s using a 30˚ cam
Note: plastic roller only



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



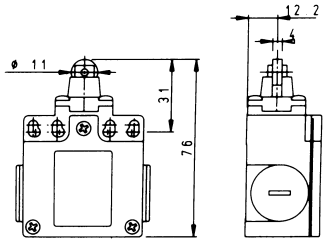
Actuator type 07
One-way roller adjustable
3 positions top actuated
3 positions side actuated
OF 410g
PT 5mm
OT 8mm
MD 2.8mm
OP 47mm
OS 1m/s using a 30˚ cam
Note: Plastic roller only radius: pivot to centre of roller = 28mm



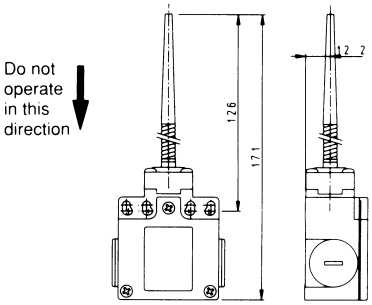
Actuator type 08
Sealed piston plunger
OF 820g
PT 2mm
OT 4mm
MD 1mm
OP 30mm
OS 0.5m/s

Compact Heavy Duty Limit Switches FM/FR/FZ/FX continued

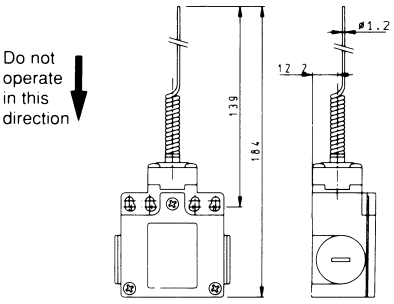
Standard actuator options – FZ and FX series continued



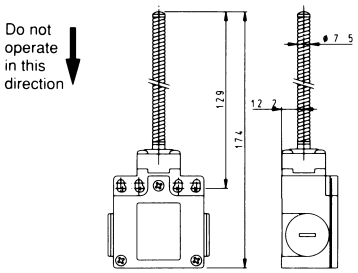
Actuator type 15
Roller piston plunger
OF 820g
PT 2mm
OT 4mm
MD 1mm
OP 29mm
OS 0.3m/s using a 30˚ cam
Note: FZ515 ø12mm metal roller as standard,
Note: FX515 ø11mm plastic roller as standard.
Note: For FX with ø12mm metal roller: FX5151



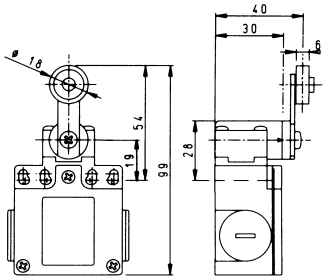
Actuator type 20
Sealed coil spring with flexible rod
OF 100g at 2/3 the length of the actuator
PT 18˚
OT –
MD 10˚
OP –
OS 1m/s
Notes: Not suitable for safety circuits
Not suitable for use with contact blocks 20, 21 or 22



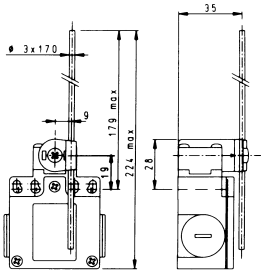
Actuator type 21
Sealed coil spring with cat's whisker
OF 70g at 2/3 the length of the actuator
PT 18˚
OT –
MD 10˚
OP –
OS 1m/s
Notes: Not suitable for safety circuits
Not suitable for use with contact blocks 20, 21 or 22



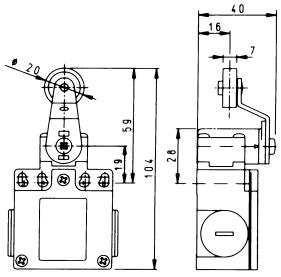
Actuator type 25
Sealed coil spring
OF 185g at 2/3 the length of the actuator
PT 18˚
OT –
MD 10˚
OP –
OS 1m/s
Notes: Not suitable for safety circuits
Not suitable for use with contact blocks 20, 21 or 22



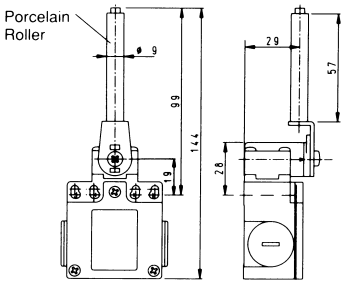
Actuator type 31
Roller-lever
OF 1000gcm
PT 30˚
OT 45˚
MD 13˚
OP –
OS 1.5m/s using a 30˚ cam
Notes: 1. ø18mm plastic roller as standard, ø20mm metal roller actuator part no.: 311
2. Lever position adjustable over 360˚ in 10˚ increments.



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.



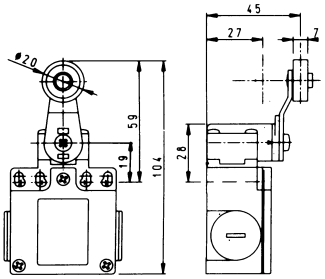
Actuator type 51
Roller-lever with large offset
OF 1000gcm
PT 30˚
OT 45˚
MD 13˚
OP –
OS 1.5m/s using a 30˚ cam
Notes: 1. Plastic roller as standard, metal roller actuator part no.: 511. 2. Lever position adjustable over 360˚ in 10˚ increments.



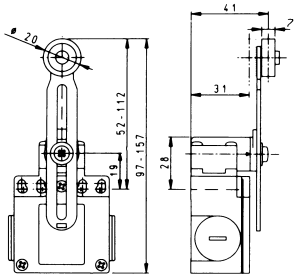
Actuator type 53
Porcelain roller-lever
OF 615gcm
PT 30˚
OT 45˚
MD 13˚
OP –
OS –
Note: Lever position adjustable over 360˚ in 10˚ increments.

Compact Heavy Duty Limit Switches FM/FR/FZ/FX continued

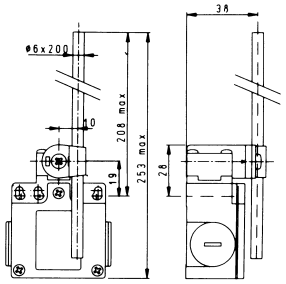
Standard actuator options – FZ and FX series continued



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.

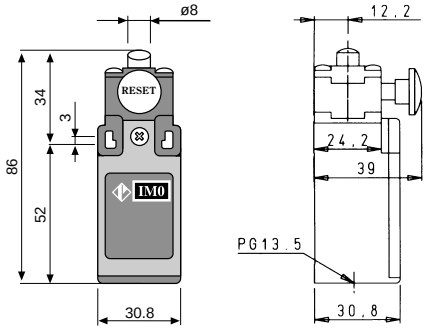


Actuator type 69
Adjustable glass-fibre rod
OF 1000gcm
PT 30˚
OT 45˚
MD 13˚
OP –
OS 1.5m/s
Notes: 1. Not suitable for safety circuits 2. Lever position adjustable over 360˚ in 10˚ increments.

Standard switches with reset buttons

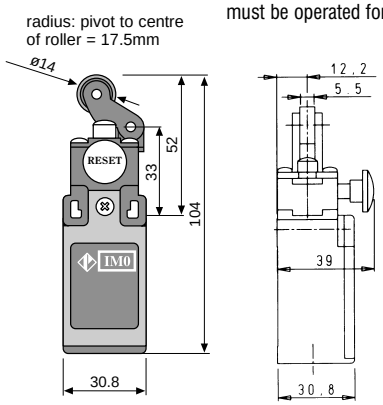
Examples – many other types available – for reset button, add suffix – 7 to standard part numbers

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



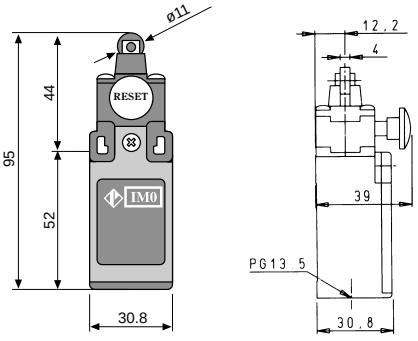
FR 501-7

Piston plunger
Pre-travel 2mm
Additional travel beyond the operating point until the mechanism latches 2mm



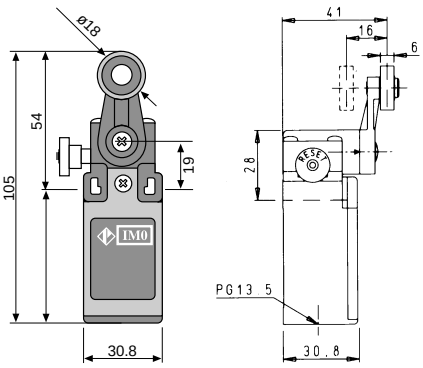
FR 502-7

One-way roller – top actuated
Pre-travel 2.9mm
Additional travel beyond the operating point until the mechanism latches 2.3mm



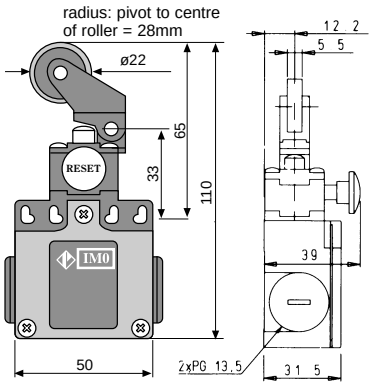
FR 515-7

Roller piston plunger
Pre-travel 2mm
Additional travel beyond the operating point until the mechanism latches 2mm



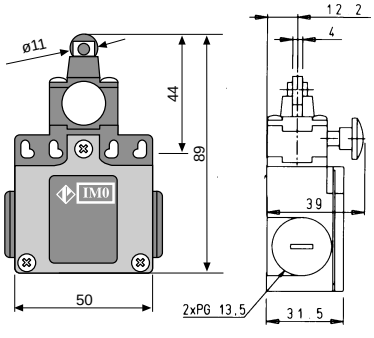
FR 530-7

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

Compact Heavy Duty Limit Switches FM/FR/FZ/FX continued

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.

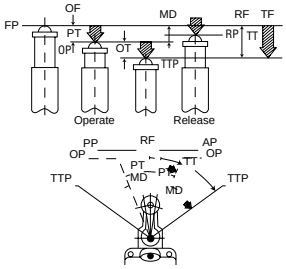
Total travel position (TTP)
The position of the actuator when it reaches the limit of travel – must not be exceeded.

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.

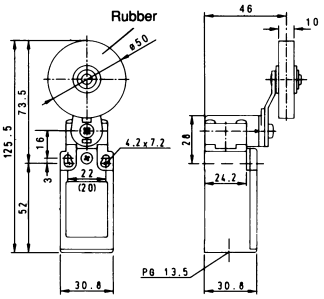
Movement differential (MD)
The distance or angle from the operating position to the releasing position.

Total travel (TT)
The sum of the pretravel and overtravel expressed by distance or angle.

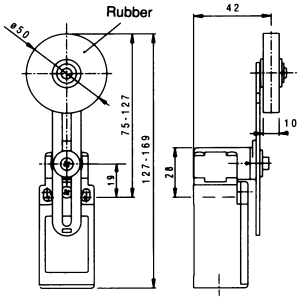


Lift-style switches

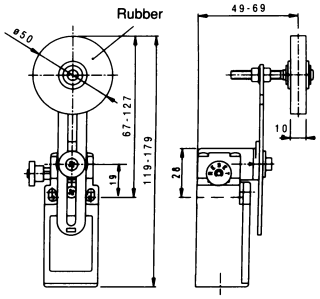
EXAMPLES



FR538 or FR938 + VFLE543
FM538 or FM938 + VFLE543
Turret type 38 (without reset button)
Lever type VFLE543 (fixed position roller)
Pre-travel = 30˚



FR538 or FR938 + VFLE553
FM538 or FM938 + VFLE553
Turret type 38 (without reset button)
Lever type VFLE553 (single adjustment roller)
Pre-travel = 30˚



FR538-71 + VFLE554 FM538-71 + VFLE554
Turret type 38-71 (early trip point with reset button)
Lever type VFLE554 (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

Compact Heavy Duty Limit Switches
FM/FR/FZ/FX continued

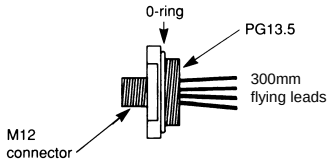
Replacement contact blocks

B5	1NO+1NC 13 21 14 22	Positive break *Snap action* standard contact block	Zb
B6	1NO+1NC 13 21 14 22	Positive break *Slow action* break before make	Zb
B7	1NO+1NC 13 21 14 22	Positive break *Slow action* make before break	Zb
B9	2NC 11 21 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 14 24	*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 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.

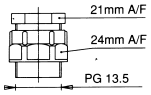
Suitable 4-wire plug leads are available.

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 **VFPG13.5** Cable size ø9-12mm
Part number **VFPG13.5/6** Cable size ø6-9mm