Standard Heavy Duty Limit Switches

FD/FP/FL

Heavy duty 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
- Lever types can be user-set to switch by clockwise movement only, anti-clockwise only or both
- Turret head position rotatable in 90˚ increments
- Centre-position indicator arrow – lever actuators
- Wide range of actuators
- Single and triple cable entry models
- Removable contact block for ease of wiring
- Metal or plastic housing options
- IP66 according to BS EN60947-1
- FD and FP dimensions in accordance with EN50041
- Approvals: UL, CSA

Options and ordering codes

FD **5** **01**

Heavy duty metal housing	FD
Heavy duty plastic housing	FP
Triple entry metal housing	FL
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, break before make 3NC	21
Slow-action contacts, break before make 1NC + 2NO	22
Snap-action contacts, 2NO + 2NC	2

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

–	Standard actuators – options overleaf
38	Lift-style turret with 75˚ total travel
385	Lift-style turret with 90˚ total travel

Specify lever type for lift-style switch:

L313	Fixed position roller
L353	Single adjustment roller
L354	Dual adjustment roller

Specifications

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	IP66
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	FD/FL: die-cast metal alloy, FP: 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

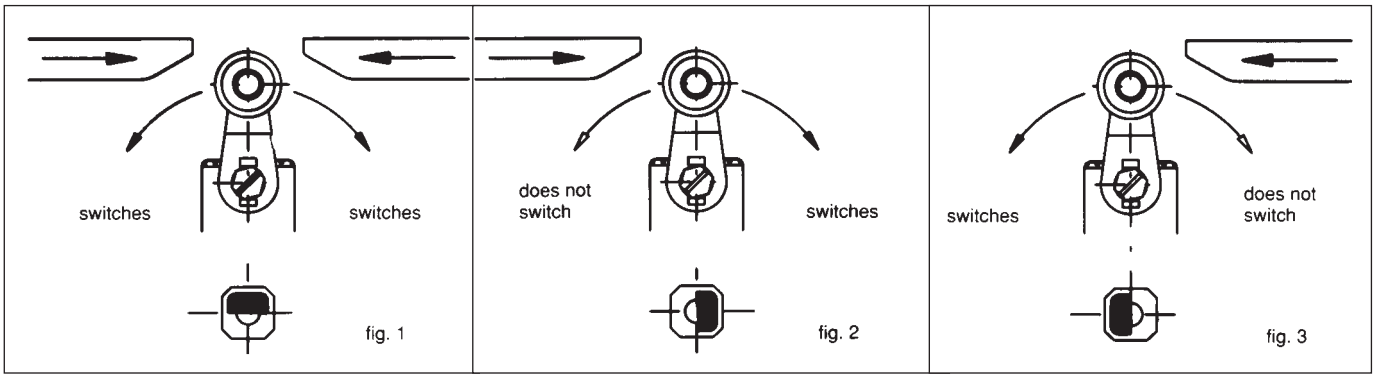
Terminal screws: M3.5 with rising cable clamps.
Standard contacts (type 5) NO: 13-14, NC: 21-22
Note: The positive break of the type 5 contact block applies to the NC contacts only. Connections to safety circuits should NOT be made using the NO contacts.
To ensure positive breaking of the contacts, exceed the pre-travel by 1.5mm or 25˚ according to the model.
Maximum screw tightening torque 0.8Nm (8Kg cm)

Programmable head – lever operation models

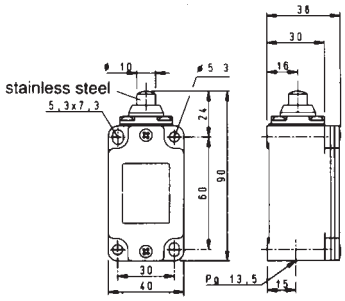
All limit switches with lever operation in the FD/FP/FL ranges can be user-set to switch by clockwise rotation only, anti-clockwise only or both. To change the operation, which is factory set to switch in both directions, the four screws securing the turret head should be loosened, the head removed and the internal piston rotated through 90˚. The head should then be replaced.

The models to which this applies are: 531; 532; 533; 535; 536; 538; 551; 552; 553.

Figure 1 shows the piston position for switching in both directions, figure 2 for clockwise only and figure 3 for anti-clockwise only.

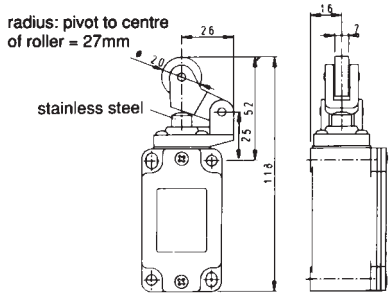


Standard actuator options – FD and FP series



Actuator type 01
Piston plunger

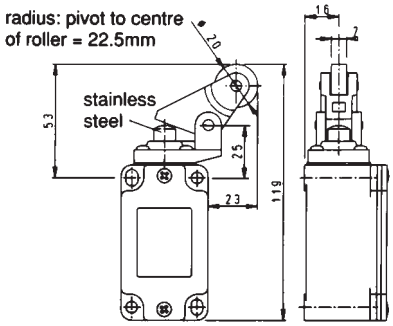
Operating force min.	OF	820g
Pre-travel	PT	2mm
Over-travel	OT	4mm
Movement differential	MD	1mm
Operating point	OP	22mm
Operating speed max.	OS	0.5m/s



Actuator type 02
One-way roller - top actuated

OF	615g
PT	2.9mm
OT	5.6mm
MD	1.6mm
OP	49.1mm
OS	0.5m/s using a 30˚ cam

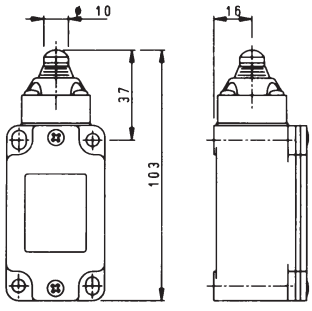
Note: ø20mm plastic roller as standard,
ø20mm metal roller actuator part no.: 021



Actuator type 05
One-way roller-side actuated

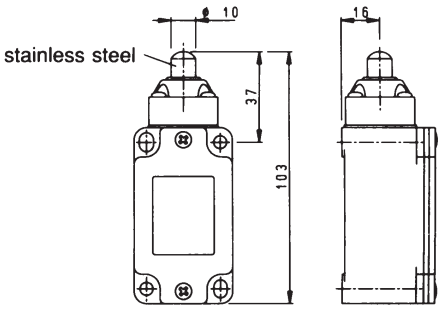
OF	615g
PT	2.9mm
OT	5.6mm
MD	1.6mm
OP	–
OS	0.5m/s using a 30˚ cam

Note: ø20mm plastic roller as standard,
ø20mm metal roller actuator part no.: 051



Actuator type 10
Sealed piston plunger

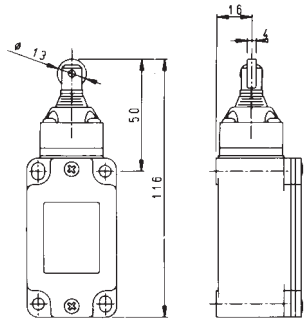
OF	1125g
PT	2mm
OT	4mm
MD	1mm
OP	35mm
OS	0.5m/s



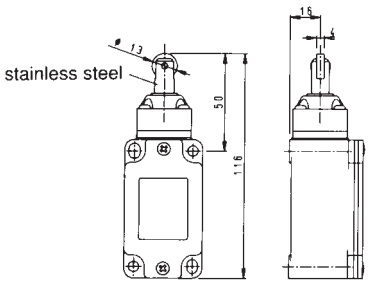
Actuator type 11
Long piston plunger

OF	820g
PT	2mm
OT	4mm
MD	1mm
OP	35mm
OS	0.5m/s

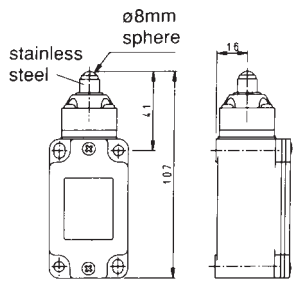
Standard actuator options – FD and FP series



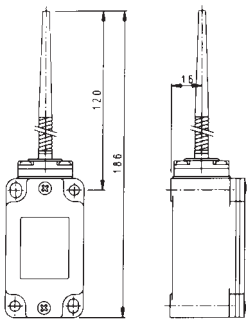
Actuator type 15
Sealed roller piston plunger
OF 1125g
PT 2mm
OT 4mm
MD 1mm
OP 48mm
OS 0.5m/s using a 30˚ cam
Note: ø13mm metal roller only



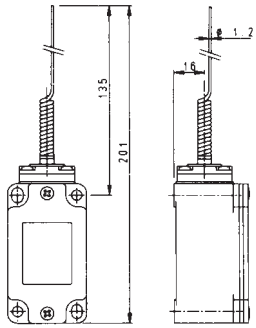
Actuator type 16
Roller piston plunger
OF 820g
PT 2mm
OT 4mm
MD 1mm
OP 48mm
OS 0.5m/s using a 30˚ cam
Note: ø13mm metal roller only



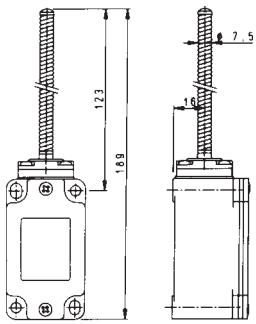
Actuator type 18
Rolling ball piston plunger
OF 820g
PT 2mm
OT 4mm
MD 1mm
OP 39mm
OS 0.5m/s



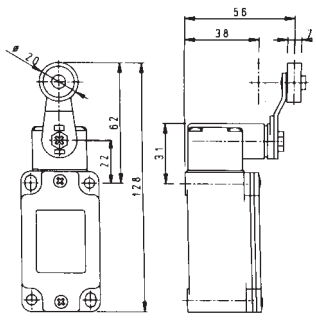
Actuator type 20
Sealed coil spring with flexible rod
OF 125g at 2/3 the length of the actuator
PT 14˚
OT –
MD 7˚
OP –
OS 1m/s
Notes: Not suitable for safety circuits
Not suitable for use with contact blocks 20, 21 or 22



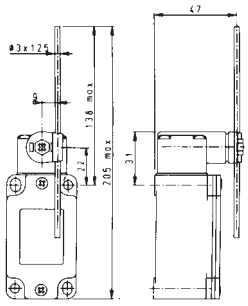
Actuator type 21
Sealed coil spring with cat's whisker
OF 92g at 2/3 the length of the actuator
PT 14˚
OT –
MD 7˚
OP –
OS 1m/s
Notes: Not suitable for safety circuits
Not suitable for use with contact blocks 20, 21 or 22



Actuator type 25
Sealed coil spring
OF 195g at 2/3 the length of the actuator
PT 14˚
OT –
MD 7˚
OP –
OS 1m/s
Notes: Not suitable for safety circuits
Not suitable for use with contact blocks 20, 21 or 22

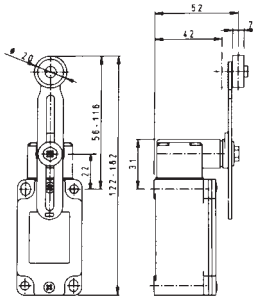


Actuator type 31
Roller-lever with small offset
OF 1530gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s using a 30˚ cam
Notes: 1. ø20mm plastic roller as standard, ø20mm metal roller actuator part no.:311; ø35mm plastic roller actuator part no.:312; ø50mm rubber roller actuator part no.:313. 2. Lever position adjustable over 360˚ in 10˚ increments

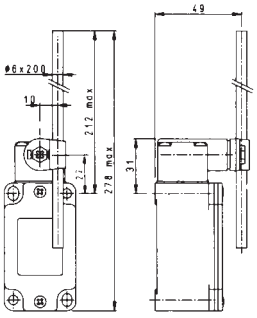


Actuator type 32
Adjustable round steel rod lever
Actuator type 33
Adjustable square steel rod lever (rod 3x3x125)
OF 1530gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s
Note: Lever position adjustable over 360˚ in 10˚ increments

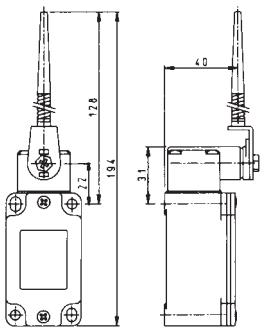
Standard actuator options – FD and FP series



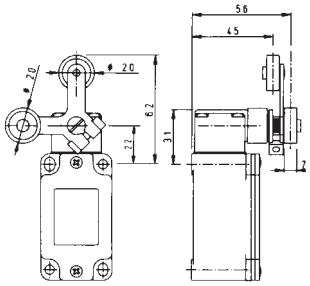
Actuator type 35
Adjustable roller lever
OF 1530gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s using a 30˚ cam
Notes: 1. ø20mm plastic roller as standard, ø20mm metal roller actuator part no.:351; ø35mm plastic roller actuator part no.:352; ø50mm rubber roller actuator part no.:353. 2. Lever position adjustable over 360˚ in 10˚ increments



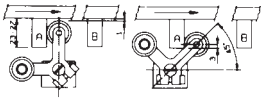
Actuator type 36
Adjustable glass-fibre rod lever
OF 1530gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s
Notes: 1. Not suitable for safety circuits. 2. Lever position adjustable over 360˚ in 10˚ increments



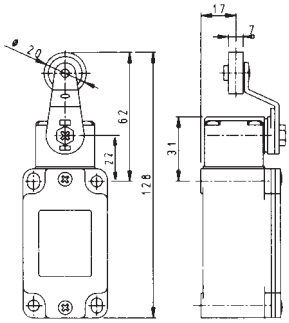
Actuator type 38+L34
Coiled spring lever with flexible rod
OF 1530gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s
Notes: 1. Not suitable for safety circuits. 2. Lever position adjustable over 360˚ in 10˚ increments



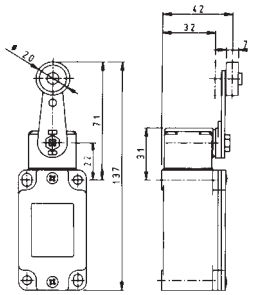
Actuator type 40
Dual roller lever with two stable free positions



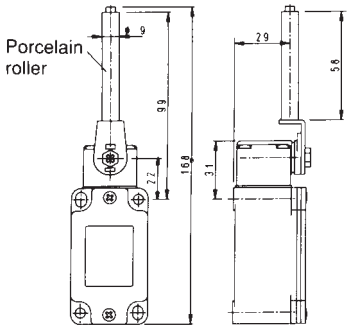
Specify lever type:
Double track (shown above) L42
Single track (not shown) L41
Steel rod lever L43



Actuator type 51
Roller-lever with large offset
OF 920gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s using a 30˚ cam
Notes: 1. ø20mm plastic roller as standard, ø20mm metal roller actuator part no.:511. 2. Lever position adjustable over 360˚ in 10˚ increments

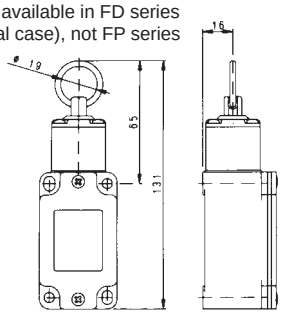


Actuator type 52
Roller lever without offset
OF 920gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s
Notes: 1. ø20mm plastic roller as standard, ø20mm metal roller actuator part no.:521; ø35mm plastic roller actuator part no.:522; ø50mm rubber roller actuator part no.:523. 2. Lever position adjustable over 360˚ in 10˚ increments



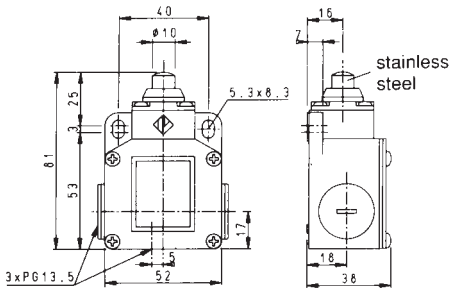
Actuator type 53
Porcelain roller lever
OF 615gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS –
Note: Lever position adjustable over 360˚ in 10˚ increments

Only available in FD series (metal case), not FP series



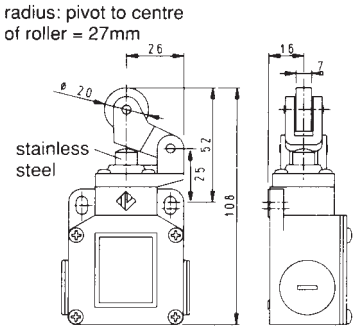
Actuator type 76
Rope
OF 2450g
PT 1.8mm
OT 6.4mm
MD 1mm
OP 66.8mm
OS –
Note: Not suitable for safety circuits. For rope operated safety switches, see Safety Limit Switches data sheet on page 297

Standard actuator options – FL series



Actuator type 01
Piston plunger

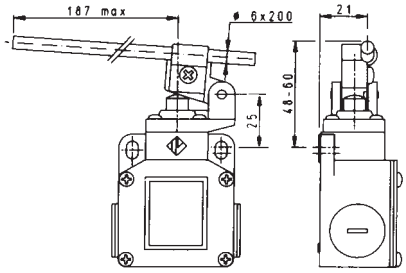
OF	820g
PT	2mm
OT	4mm
MD	1mm
OP	23mm
OS	0.5m/s



Actuator type 02
One-way roller - top actuated

OF	615g
PT	2.9mm
OT	5.6mm
MD	1.6mm
OP	49.1mm
OS	0.5m/s using a 30˚ cam

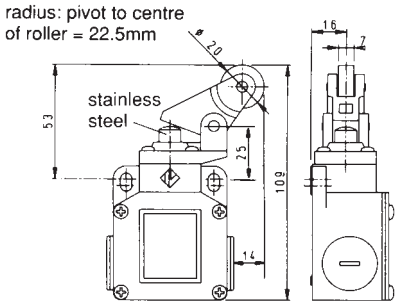
Note: ø20mm plastic roller as standard, ø20mm metal roller actuator part no.:021



Actuator type 04
Piston plunger with adjustable glass-fibre rod lever

OF
PT
OT
MD
OP
OS

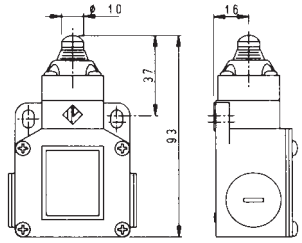
} Variable – dependent on glass-fibre rod position



Actuator type 05
One-way roller - side actuated

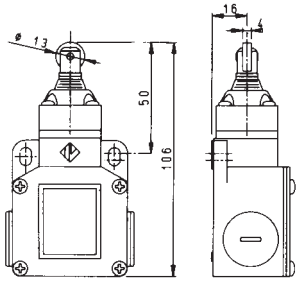
OF	615g
PT	2.9mm
OT	5.6mm
MD	1.6mm
OP	–
OS	0.5m/s using a 30˚ cam

Note: ø20mm plastic roller as standard, ø20mm metal roller actuator part no.:051



Actuator type 10
Sealed piston plunger

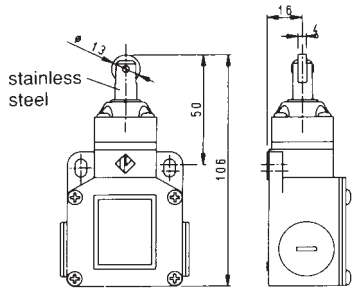
OF	1125g
PT	2mm
OT	4mm
MD	1mm
OP	35mm
OS	0.5m/s



Actuator type 15
Sealed roller piston plunger

OF	1125g
PT	2mm
OT	4mm
MD	1mm
OP	48mm
OS	0.5m/s using a 30˚ cam

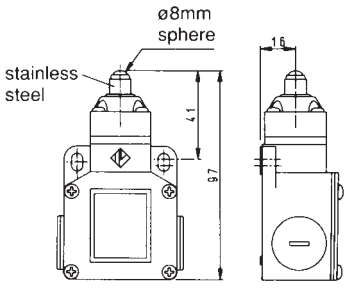
Note: ø13mm metal roller only



Actuator type 16
Roller piston plunger

OF	820g
PT	2mm
OT	4mm
MD	1mm
OP	48mm
OS	0.5m/s using a 30˚ cam

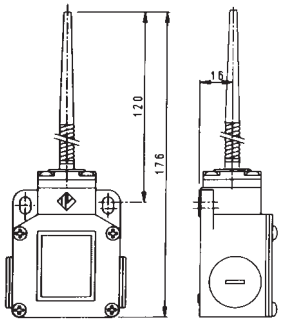
Note: ø13mm metal roller only



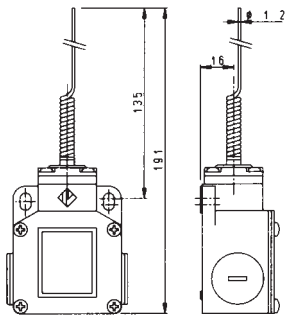
Actuator type 18
Rolling ball piston plunger

OF	820g
PT	2mm
OT	4mm
MD	1mm
OP	39mm
OS	0.5m/s

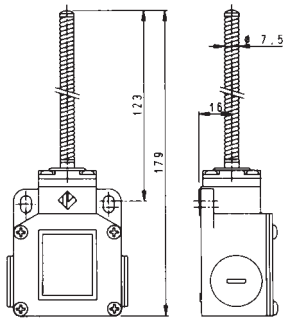
Standard actuator options – FL series



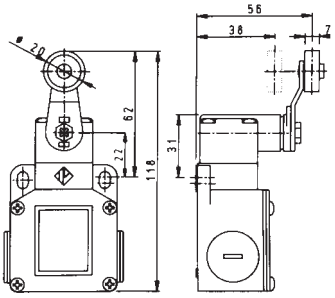
Actuator type 20
Sealed coil spring with flexible rod
OF 125g at 2/3 the length of the actuator
PT 14˚
OT –
MD 7˚
OP –
OS 1m/s
Notes: Not suitable for safety circuits
Not suitable for use with contact blocks 20, 21 or 22



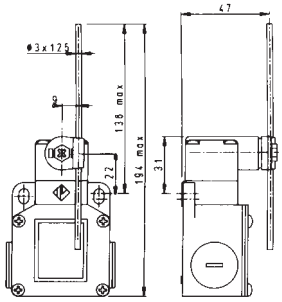
Actuator type 21
Sealed coil spring with cat's whisker
OF 92g at 2/3 the length of the actuator
PT 14˚
OT –
MD 7˚
OP –
OS 1m/s
Notes: Not suitable for safety circuits
Not suitable for use with contact blocks 20, 21 or 22



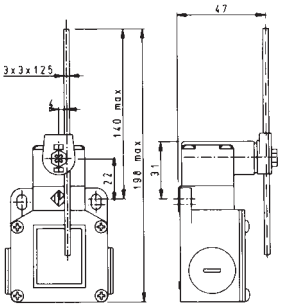
Actuator type 25
Sealed coil spring
OF 195g at 2/3 the length of the actuator
PT 14˚
OT –
MD 7˚
OP –
OS 1m/s
Notes: Not suitable for safety circuits
Not suitable for use with contact blocks 20, 21 or 22



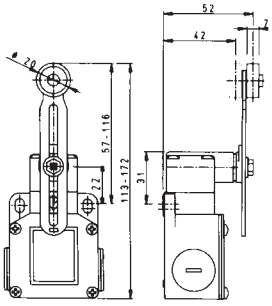
Actuator type 31
Roller lever with small offset
OF 1530gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s using a 30˚ cam
Notes: 1. ø20mm plastic roller as standard, ø20mm metal roller actuator part no.:311; ø35mm plastic roller actuator part no.:312; ø50mm rubber roller actuator part no.:313. 2. Lever position adjustable over 360˚ in 10˚ increments



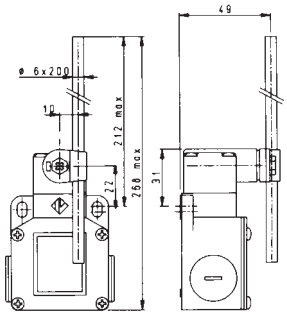
Actuator type 32
Adjustable round steel rod lever
OF 1530gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s
Note: Lever position adjustable over 360˚ in 10˚ increments



Actuator type 33
Adjustable square steel rod lever
OF 1530gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s
Note: Lever position adjustable over 360˚ in 10˚ increments

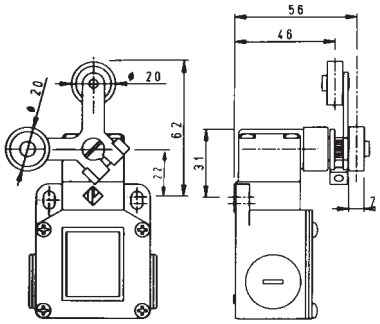


Actuator type 35
Adjustable roller lever
OF 1530gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s using a 30˚ cam
Notes: 1. ø20mm plastic roller as standard, ø20mm metal roller actuator part no.:351; ø35mm plastic roller actuator part no.:352; ø50mm rubber roller actuator part no.:353. 2. Lever position adjustable over 360˚ in 10˚ increments

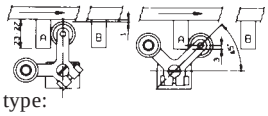


Actuator type 36
Adjustable glass-fibre rod lever
OF 1530gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s
Notes: 1. Not suitable for safety circuits.
2. Lever position adjustable over 360˚ in 10˚ increments

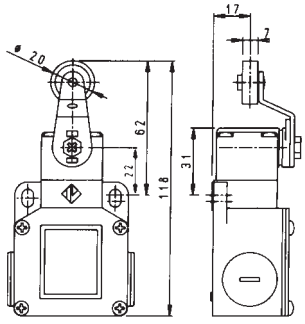
Standard actuator options – FL series



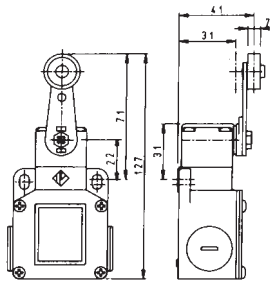
Actuator type 40
Dual roller lever with two stable free positions



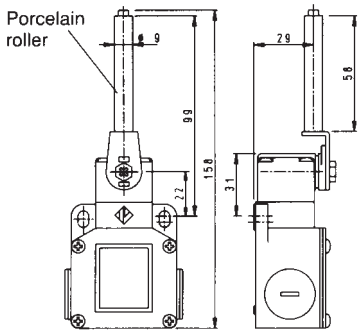
Specify lever type:
Double track (shown above) L42
Single track (not shown) L41
Steel rod lever L43



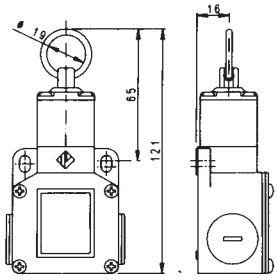
Actuator type 51
Roller lever with large offset
OF 920gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s using a 30˚ cam
Notes: 1. ø20mm plastic roller as standard, ø20mm metal roller actuator part no.: 511.
2. Lever position adjustable over 360˚ in 10˚ increments



Actuator type 52
Roller lever without offset
OF 920gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s using a 30˚ cam
Notes: 1. ø20mm plastic roller as standard, ø20mm metal roller actuator part no.: 521; ø35mm plastic roller actuator part no.: 522; ø50mm rubber roller actuator part no.:523.
2. Lever position adjustable over 360˚ in 10˚ increments



Actuator type 53
Porcelain roller lever
OF 615gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS –
Note: Lever position adjustable over 360˚ in 10˚ increments



Actuator type 76
Rope
OF 2450g
PT 1.8mm
OT 6.4mm
MD 1mm
OP 66.8mm
OS –
Note: Not suitable for safety circuits. For rope operated safety switches, see Safety Limit Switches data sheet on page 217

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.

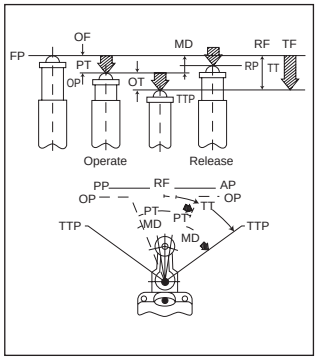
Total travel position (TTP)
The position of the actuator when it reaches the limit of travel – must not be exceeded.

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.

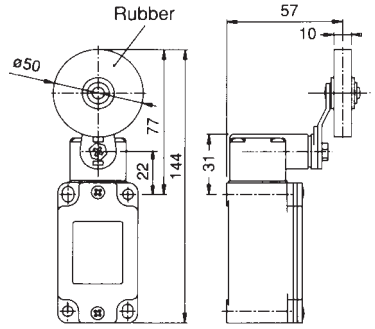
Movement differential (MD)
The distance or angle from the operating position to the releasing position.

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

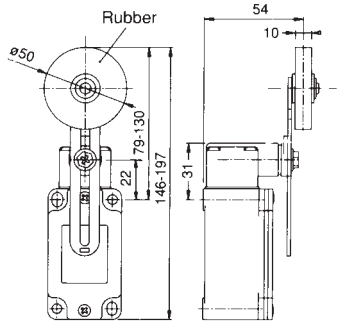


Lift-style switches

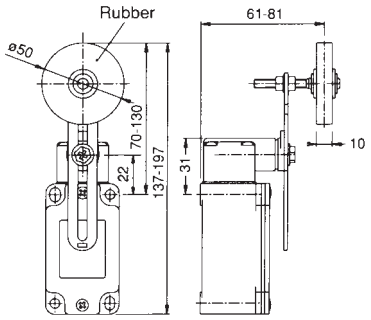
EXAMPLES



FD538 or FD5385 or FD938 + L313
FP538 or FP938 + L313
Turret type 38
Lever type L313 (fixed position roller)



FD538 or FD5385 or FD938 + L353
FP538 or FP938 + L353
Turret type 38
Lever type L353 (single adjustment roller)



FD538 or FD5385 or FD938 + L354
FP538 or FP938 + L354
Turret type 38
Lever type L354 (dual adjustment roller)

- Three lever options.
- FL model also available with a choice of lever.
- Age-resistant and oil-resistant rubber rollers.
- Lever position adjustable over 360˚ in 10˚ increments.
- Head rotatable in 90˚ increments.
- User-selectable to switch by clockwise movement only, anti-clockwise only, or both.
- Glass-reinforced thermoplastic resin model (FP) double insulated for electrical safety.
- Die-cast metal alloy models (FD and FL) include earth terminal.

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

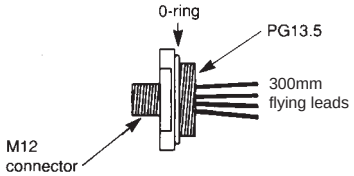
Replacement contact blocks

B5	1NO+1NC 13 21 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 B14	2NC 11 21 12 22	Positive break *Slow action*, contacts 11-12, 21-22 open at the same time Positive break *Slow action*, contacts 11-12 open first, further actuator travel causes contacts 21-22 to open	Zb
B10 B15	2NO 13 23 14 24	*Slow action*, contacts 13-14, 23-24 close at the same time *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 FD/FP/FL 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. Three sizes are possible:

Part number PG13.5 Cable size ø9-12mm **Part number PG13.5/6** Cable size ø6-9mm
Part number G13.5 Cable size ø9-12mm (type FD only)