Standard Heavy Duty Limit Switches FD/FP/FL

IMO

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
- UL and CUL approved

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

-	Standard actuators - see following pages for type options	
38	Specify lever type for lift-style switches	
	VFL313	Fixed position roller
	VFL353	Single adjustment roller
	VFL354	Dual adjustment roller
-	Standard actuators - see following pages for type options	
385	Specify lever type for life-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

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 (8Kgcm)

Standard Heavy Duty Limit Switches
FD/FP/FL 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	FD/FL die-cast metal alloy, FP: self-extinguishing, glass-reinforced, thermoplastic resin
Conduit entry	PG 13.5

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.

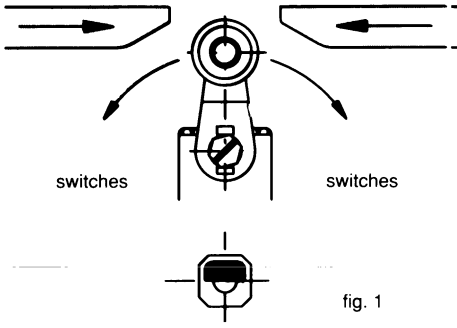


fig. 1

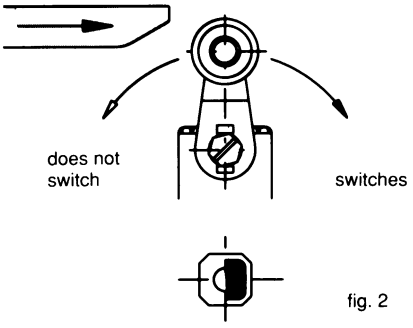


fig. 2

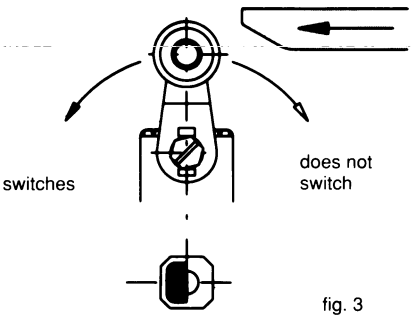
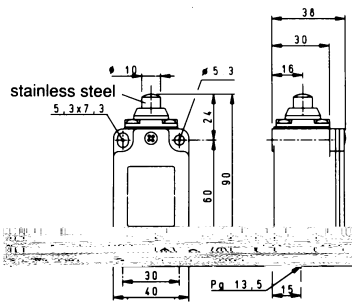


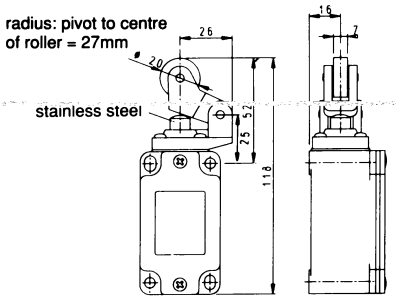
fig. 3

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



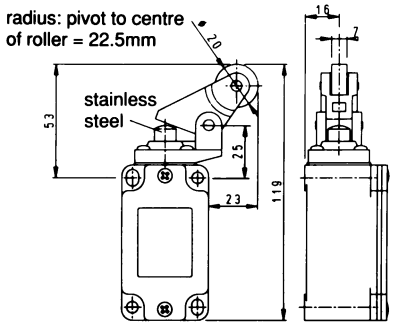
Actuator type 02
One-way roller - top actuated

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

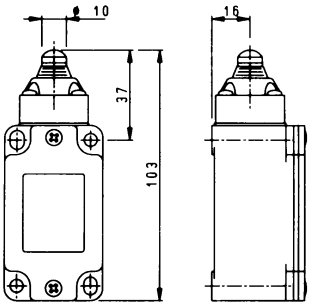
Note: ø20mm plastic roller as standard, ø20mm metal roller actuator part no.: 021

Standard Heavy Duty Limit Switches
FD/FP/FL continued

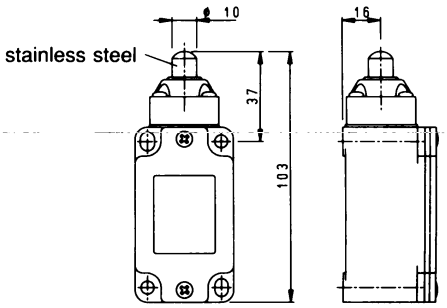
Standard actuator options – FD and FP series continued



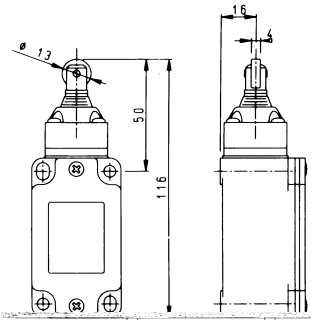
Actuator type 05
One-way roller-side actuated
OF 615g
PT 2.9mm
OT 5.6mm
MD 1.6mm
OP –
OS 0.5m/s using a 30˚ cam
Note: ø20mm plastic roller as standard, ø20mm metal roller actuator part no.: 051



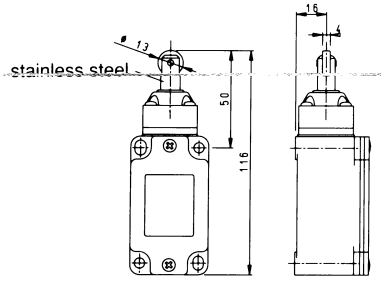
Actuator type 10
Sealed piston plunger
OF 1125g
PT 2mm
OT 4mm
MD 1mm
OP 35mm
OS 0.5m/s



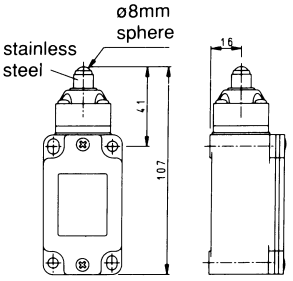
Actuator type 11
Long piston plunger
OF 820g
PT 2mm
OT 4mm
MD 1mm
OP 35mm
OS 0.5m/s



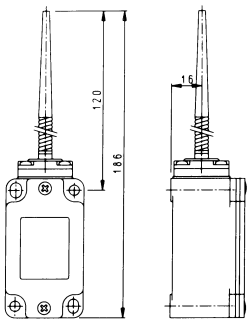
Actuator type 15
Sealed roller piston plunger
OF 1125g
PT 2mm
OT 4mm
MD 1mm
OP 48mm
OS 0.5m/s using a 30˚ cam
Note: ø13mm metal roller only



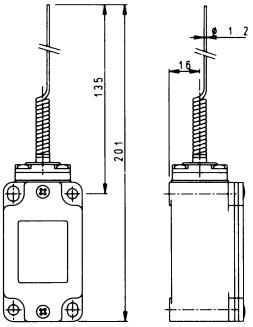
Actuator type 16
Roller piston plunger
OF 820g
PT 2mm
OT 4mm
MD 1mm
OP 48mm
OS 0.5m/s using a 30˚ cam
Note: ø13mm metal roller only



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

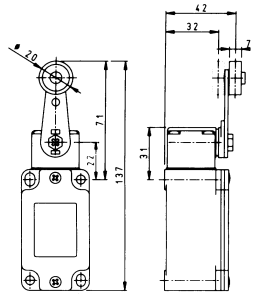


Actuator type 21
Sealed coil spring with cat's whisker
OF 92g at 2/3 the length of the actuator
PT 14˚
OT –
MD 7˚
OP –
OS 1m/s
Notes: Not suitable for safety circuits
Not suitable for use with contact blocks 20, 21 or 22

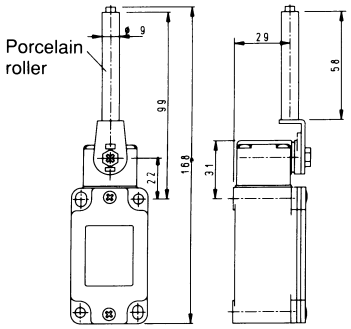
I

Standard Heavy Duty Limit Switches
FD/FP/FL continued

Standard actuator options – FD and FP series continued

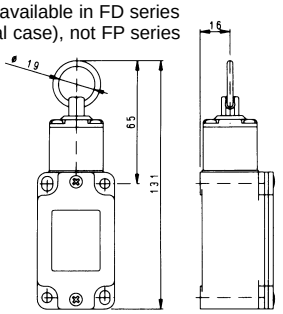


Actuator type 52
Roller lever without offset
OF 920gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s
Notes: 1. ø20mm plastic roller as standard, ø20mm metal roller actuator part no.:521; ø35mm plastic roller actuator part no.:522; ø50mm rubber roller actuator part no.:523.
2. Lever position adjustable over 360˚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



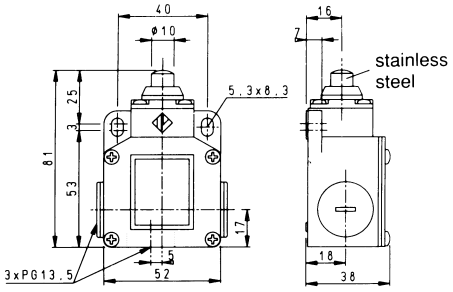
Actuator type 53
Porcelain roller lever
OF 615gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS –
Note: Lever position adjustable over 360˚ in 10˚ increments

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

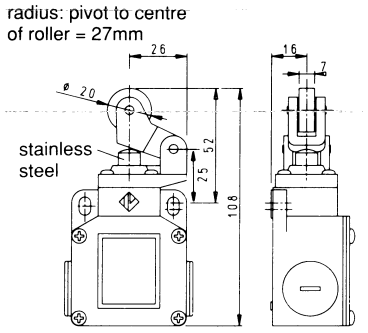


Actuator type 76
Rope
OF 2450g
PT 1.8mm
OT 6.4mm
MD 1mm
OP 66.8mm
OS –
Note: Not suitable for safety circuits. For rope operated safety switches, see Safety Limit Switches data sheet on page 297

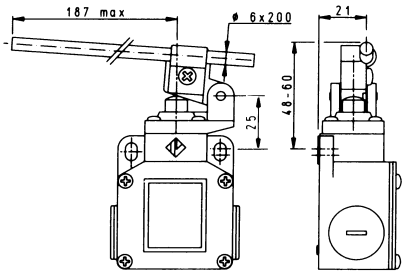
Standard actuator options – FL series



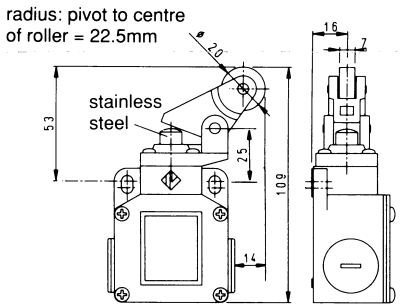
Actuator type 01
Piston plunger
OF 820g
PT 2mm
OT 4mm
MD 1mm
OP 23mm
OS 0.5m/s



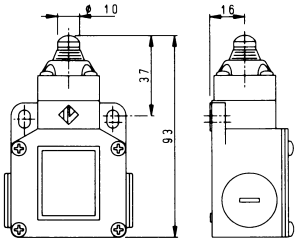
Actuator type 02
One-way roller - top actuated
OF 615g
PT 2.9mm
OT 5.6mm
MD 1.6mm
OP 49.1mm
OS 0.5m/s using a 30˚ cam
Note: ø20mm plastic roller as standard, ø20mm metal roller actuator part no.:021



Actuator type 04
Piston plunger with adjustable glass-fibre rod lever
OF
PT
OT
MD
OP
OS
} Variable – dependent on glass-fibre rod position



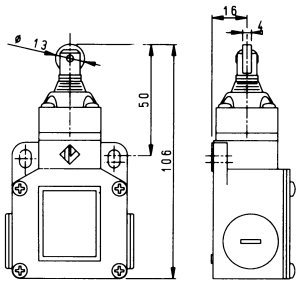
Actuator type 05
One-way roller - side actuated
OF 615g
PT 2.9mm
OT 5.6mm
MD 1.6mm
OP –
OS 0.5m/s using a 30˚ cam
Note: ø20mm plastic roller as standard, ø20mm metal roller actuator part no.:051



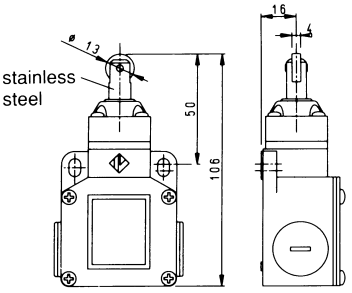
Actuator type 10
Sealed piston plunger
OF 1125g
PT 2mm
OT 4mm
MD 1mm
OP 35mm
OS 0.5m/s

Standard Heavy Duty Limit Switches
FD/FP/FL continued

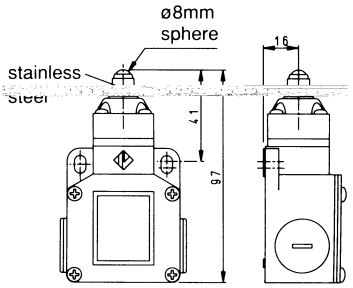
Standard actuator options – FL series continued



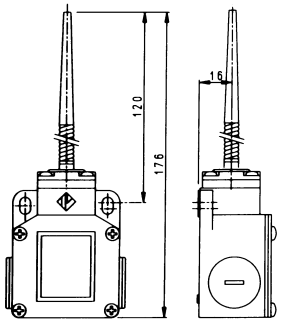
Actuator type 15
Sealed roller piston plunger
OF 1125g
PT 2mm
OT 4mm
MD 1mm
OP 48mm
OS 0.5m/s using a 30˚ cam
Note: ø13mm metal roller only



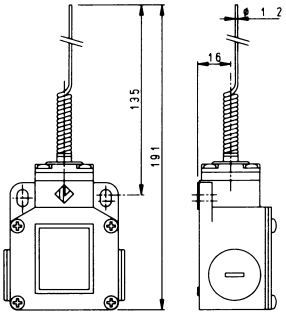
Actuator type 16
Roller piston plunger
OF 820g
PT 2mm
OT 4mm
MD 1mm
OP 48mm
OS 0.5m/s using a 30˚ cam
Note: ø13mm metal roller only



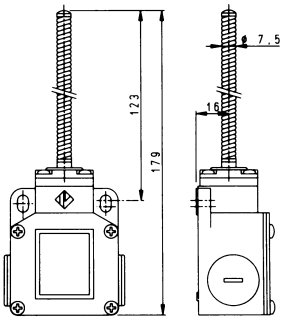
Actuator type 18
Rolling ball piston plunger
OF 820g
PT 2mm
OT 4mm
MD 1mm
OP 39mm
OS 0.5m/s



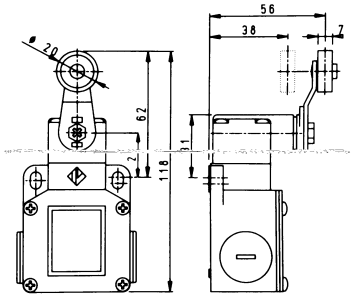
Actuator type 20
Sealed coil spring with flexible rod
OF 125g at 2/3 the length of the actuator
PT 14˚
OT –
MD 7˚
OP –
OS 1m/s
Notes: Not suitable for safety circuits
Not suitable for use with contact blocks 20, 21 or 22



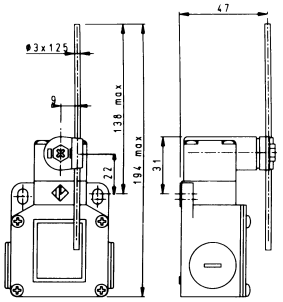
Actuator type 21
Sealed coil spring with cat's whisker
OF 92g at 2/3 the length of the actuator
PT 14˚
OT –
MD 7˚
OP –
OS 1m/s
Notes: Not suitable for safety circuits
Not suitable for use with contact blocks 20, 21 or 22



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



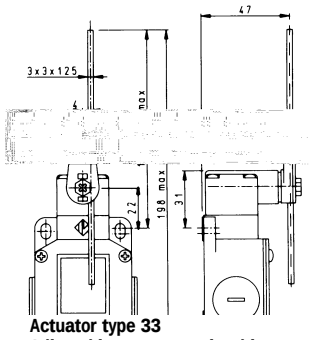
Actuator type 31
Roller lever with small offset
OF 1530gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s using a 30˚ cam
Notes: 1. ø20mm plastic roller as standard, ø20mm metal roller actuator part no.:311; ø35mm plastic roller actuator part no.:312; ø50mm rubber roller actuator part no.:313. 2. Lever position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



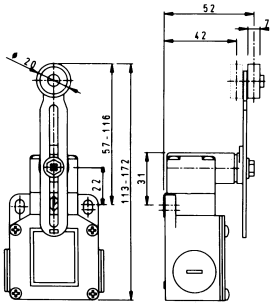
Actuator type 32
Adjustable round steel rod lever
OF 1530gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s
Note: Lever position adjustable over 360˚ in 10˚ increments

Standard Heavy Duty Limit Switches
FD/FP/FL continued

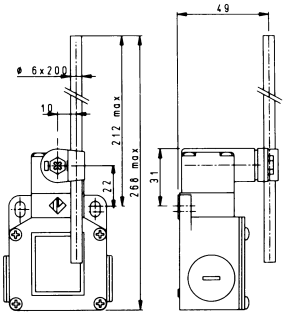
Standard actuator options – FL series continued



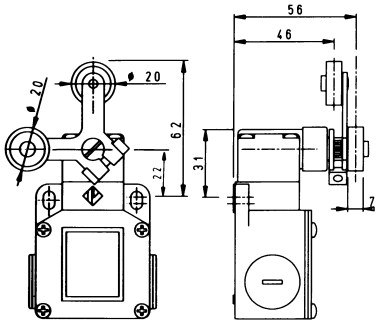
Actuator type 33
Adjustable square steel rod lever
OF 1530gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s
Note: Lever position adjustable over 360˚ in 10˚ increments



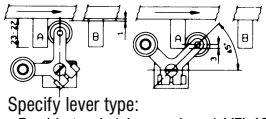
Actuator type 35
Adjustable roller lever
OF 1530gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s using a 30˚ cam
Notes: 1. ø20mm plastic roller as standard, ø20mm metal roller actuator part no.:351; ø35mm plastic roller actuator part no.:352; ø50mm rubber roller actuator part no.:353.
2. Lever position adjustable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



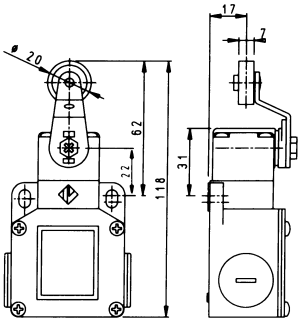
Actuator type 36
Adjustable glass-fibre rod lever
OF 1530gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s
Notes: 1. Not suitable for safety circuits.
2. Lever position adjustable over 360˚ in 10˚ increments



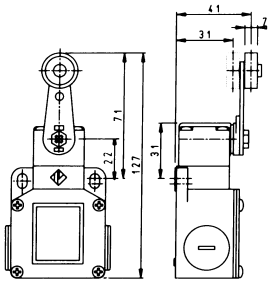
Actuator type 40
Dual roller lever with two stable free positions



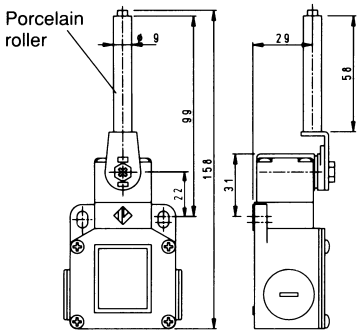
Specify lever type:
Double track (shown above) VFL42
Single track (not shown) VFL41
Steel rod lever VFL43



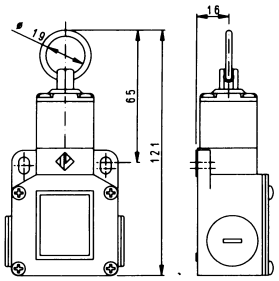
Actuator type 51
Roller lever with large offset
OF 920gcm
PT 30˚
OT 45˚
MD 14˚
OP –
OS 1.5m/s using a 30˚ cam
Notes: 1. ø20mm plastic roller as standard, ø20mm metal roller actuator part no.: 511. 2. Lever position adjustable over 360˚ in 10˚ increments



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 ????

Standard Heavy Duty Limit Switches
FD/FP/FL 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.

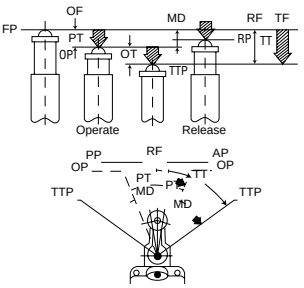
Total travel position (TTP)
The position of the actuator when it reaches the limit of travel – must not be exceeded.

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.

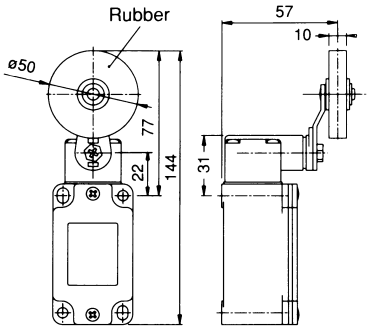
Movement differential (MD)
The distance or angle from the operating position to the releasing position.

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

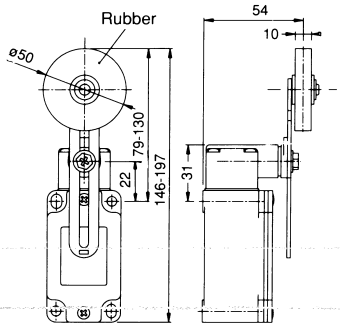


Lift-style switches

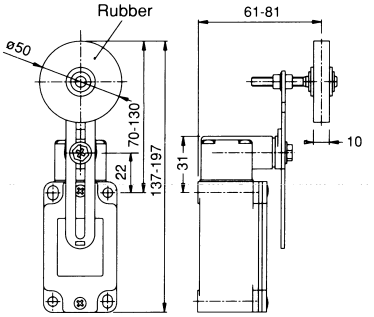
EXAMPLES



FD538 or FD5385 or FD938 + VFL313
FP538 or FP938 + VFL313
Turret type 38
Lever type VFL313 (fixed position roller)



FD538 or FD5385 or FD938 + VFL353
FP538 or FP938 + VFL353
Turret type 38
Lever type VFL353 (single adjustment roller)



FD538 or FD5385 or FD938 + VFL354
FP538 or FP938 + VFL354
Turret type 38
Lever type VFL354 (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 VFL353 and have a location slot at the end to lock the levers at full extension if required.

Standard Heavy Duty Limit Switches
FD/FP/FL continued

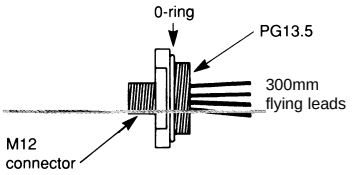
Replacement contact blocks

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