

# MICRO-LIMIT SWITCHES

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE



# MICRO-LIMIT SWITCHES

**Micro-limit pushbutton switches** are used in many applications including microwave ovens, vending machines, copy and fax machines, medical and security equipment, computer peripherals and many others. They are characterized by close tolerance precision switching positions and long service life. APEM micro-limit switches are 100% electronic tested prior to shipment to insure proper operation and conformance with specifications.

## DEFINITIONS OF TERMS

### Free position

Position of the switch actuator when no force is applied.

### Operating position

The position of the actuator when the contact snaps.

### Overtravel position

The final position of the actuator.

### Release position

The position of the actuator when the contact snaps back from the operating position to original position.

### Contact opening gap

The distance between the open contact pair.

### Pretravel

The distance between free and operating positions.

### Overtravel

The distance the actuator travels after the contact actuates.

### Movement differential

The distance from the operating to release position of the actuator.

### Free travel

The distance between the release and free positions.

### Back travel

The distance between the overtravel and release positions.

### Total travel

The sum of pretravel and overtravel.

### Operating force

The force required to cause snap action of contact.

### End operating force

The force to be applied to keep the actuator in the allowed final position.

### Release force

The force applied to the actuator at the moment the contact snaps back from the operating position.

### Differential force

The difference between the operating force and the release force.

### Mechanical life

The minimum number of actuations with no load on the switch.

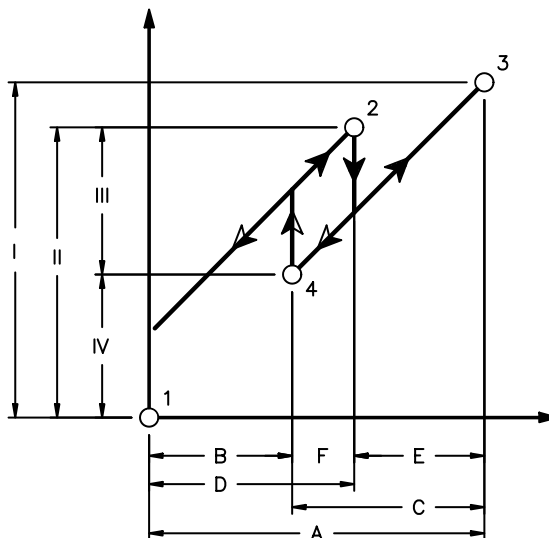
### Electrical life

The minimum number of actuations at rated voltage, rated current and resistive load at 20°C ambient temperature.

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- |     |                       |
|-----|-----------------------|
| 1   | free position         |
| 2   | operating position    |
| 3   | overtravel position   |
| 4   | release position      |
| A   | total travel          |
| B   | free travel           |
| C   | back travel           |
| D   | pretravel             |
| E   | overtravel            |
| F   | movement differential |
| I   | total force           |
| II  | operating force       |
| III | differential force    |
| IV  | release force         |



**FORCE vs.  
TRAVEL  
DIAGRAM**

## MA SERIES - MICRO-LIMIT SWITCHES



### FEATURES

- **Ratings: 16 Amps 250 VAC (resistive load). 4 Amps 250 VAC (motor load) or 3 Amps 250 VAC (resistive load). 0.1 Amps 250 VAC (motor load).**
- **Single pole CO (change-over or alternate action), NC (normally closed momentary) and NO (normally open momentary) configurations.**
- **Close tolerance switching action with long life (10,000,000 mechanical cycles min.).**
- **Pin plunger, hinge lever or roller lever actuator options.**

### MATERIALS

<b>Contacts:</b>	Stationary: Nicker silver    Shorting: Beryllium copper
<b>Actuator:</b>	FS 161 (UL94V-O)
<b>Case &amp; cover:</b>	PBT (UL94V-O)
<b>Terminals:</b>	Silver plated copper/zinc

### AGENCY RECOGNITION



Approval pending.

### SPECIFICATIONS

Operating force:	$\leq 12.59$ oz. (343 grams) approx. for 16 Amp models $\leq 0.72$ oz. (20 grams) approx. for 3 Amp models
Pretravel:	$\leq .047$ " (1.2mm)
Overtravel:	$\geq .059$ " (1.5mm) min.
Movement differential:	$\leq .016$ " (0.4mm)
Free position:	$\leq .649$ " (16.5mm)
Operating position:	$.578$ " $\pm$ $.020$ " (14.7mm $\pm$ 0.5mm)
Operating temperature:	-40°C to +85°C
Contact gap:	less than $.118$ " (3mm)
Tracking resistance:	> PTI 175

# MA SERIES - MICRO-LIMIT SWITCHES

## ORDER FORMAT

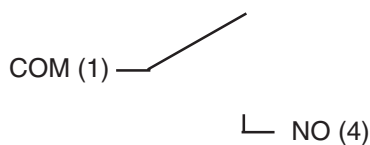
**M A A 6 B**

Series	Circuit & quick-connect terminals	Switch rating	Actuator style
<b>MA</b>	<b>A</b> Normally open (standard) .031 x .248" (0.8x6.3mm) <b>B</b> Normally closed (standard) .031 x .248" (0.8x6.3mm) <b>C</b> Change-over (standard) .031 x .248" (0.8x6.3mm) <b>D</b> Normally open, .031 x .248" (0.8x6.3mm), spacing .197" (5mm) <b>E</b> Normally closed, .031 x .248" (0.8x6.3mm), spacing .197" (5mm) <b>F</b> Change-over, .031 x .248" (0.8x6.3mm), spacing .197" (5mm) <b>G</b> Normally open, .020 x .189" (0.5x4.8mm) <b>H</b> Normally closed, .020 x .189" (0.5x4.8mm) <b>I</b> Change-over, .020 x .189" (0.5x4.8mm) <b>J</b> Normally open, .031 x .189" (0.8x4.8mm) <b>K</b> Normally closed, .031 x .189" (0.8x4.8mm) <b>L</b> Change-over, .031 x .189" (0.8x4.8mm)	<b>6</b> 16(4)A 250 VAC <b>7</b> 3(0.1)A 250 VAC	<b>A</b> Pin actuator <b>B</b> Hinge actuator <b>C</b> Roller actuator

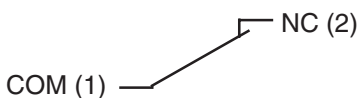
## STANDARD MODELS

Quick-connect terminal		.031x.248" (0.8x6.3mm)		.031x.248" (0.8x6.3mm) pin spacing - .197"(5mm)		.020x.189" (0.5x4.8mm)		.031x.189" (0.8x4.8mm)	
Switching capacity		16(4)A	3(0.1)A	16(4)A	16(4)A	3(0.1)A	16(4)A	3(0.1)A	
Pin plunger	NO	<b>MAA6A</b>	<b>MAA7A</b>	<b>MAD6A</b>	<b>MAG6A</b>	<b>MAG7A</b>	<b>MAJ6A</b>	<b>MAJ7A</b>	
	NC	<b>MAB6A</b>	<b>MAB7A</b>	<b>MAE6A</b>	<b>MAH6A</b>	<b>MAH7A</b>	<b>MAK6A</b>	<b>MAK7A</b>	
	CO	<b>MAC6A</b>	<b>MAC7A</b>	<b>MAF6A</b>	<b>MAI6A</b>	<b>MAI7A</b>	<b>MAL6A</b>	<b>MAL7A</b>	
Hinge lever	NO	<b>MAA6B</b>	-	<b>MAD6B</b>	<b>MAG6B</b>	-	<b>MAJ6B</b>	-	
	NC	<b>MAB6B</b>	-	<b>MAE6B</b>	<b>MAH6B</b>	-	<b>MAK6B</b>	-	
	CO	<b>MAC6B</b>	-	<b>MAF6B</b>	<b>MAI6B</b>	-	<b>MAL6B</b>	-	
Roller lever	NO	<b>MAA6C</b>	-	<b>MAD6C</b>	<b>MAG6C</b>	-	<b>MAJ6C</b>	-	
	NC	<b>MAB6C</b>	-	<b>MAE6C</b>	<b>MAH6C</b>	-	<b>MAK6C</b>	-	
	CO	<b>MAC6C</b>	-	<b>MAF6C</b>	<b>MAI6C</b>	-	<b>MAL6C</b>	-	

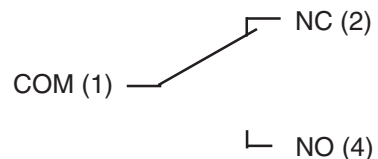
NO =  
NORMALLY OPEN:



NC =  
NORMALLY CLOSED:



CO =  
CHANGE-OVER:



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# MA SERIES - MICRO-LIMIT SWITCHES

## MECHANICAL OUTLINES

Models with quick-connect terminal .031x.248" (0.8x6.3mm)

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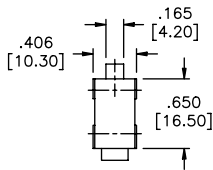
**Normally open**



**Change-over**



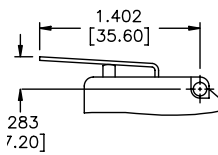
**Normally closed**



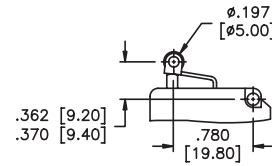
**Side view**



**Quick-connect terminal**



**Hinge lever**



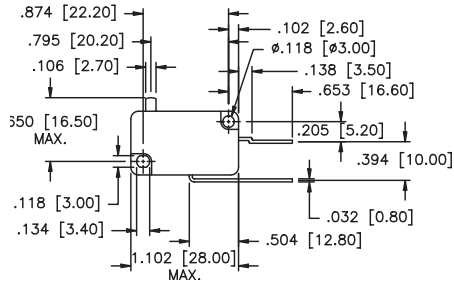
**Roller lever**

H

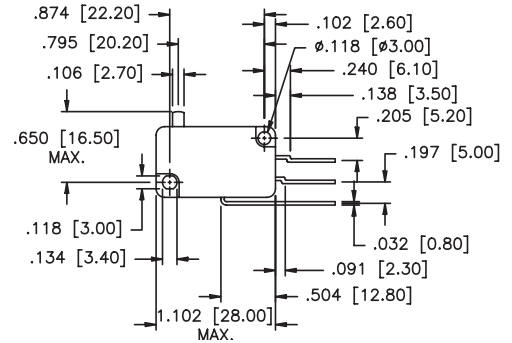
# MA SERIES - MICRO-LIMIT SWITCHES

## MECHANICAL OUTLINES

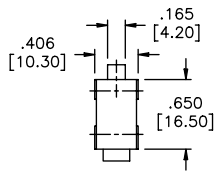
Models with quick-connect terminal .031x.248" (0.8x6.3mm) & pin spacing .197" (5mm)



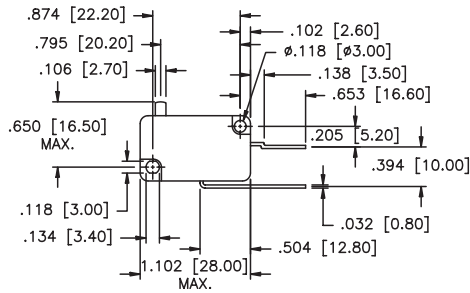
Normally open



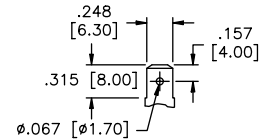
Change-over



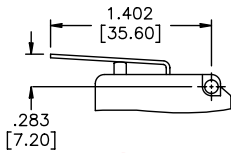
Side view



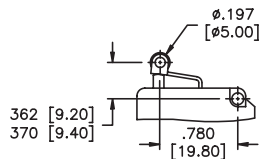
Normally closed



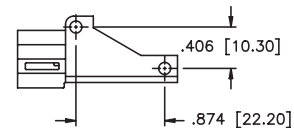
Quick-connect terminal



Hinge lever



Roller lever



Adaptor element

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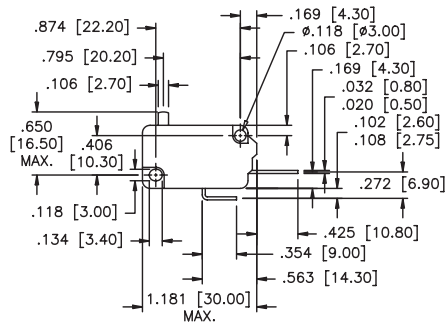
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# MA SERIES - MICRO-LIMIT SWITCHES

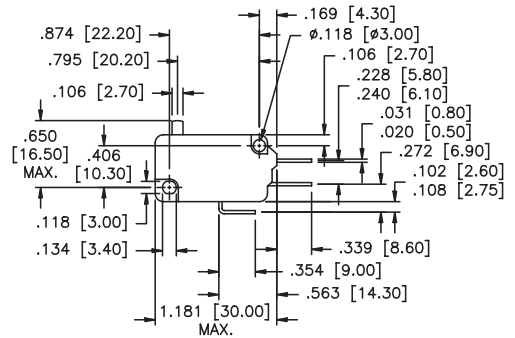
## MECHANICAL OUTLINES

Models with quick-connect terminal .020 or .031x.248" (0.8 or 0.8x6.3mm)

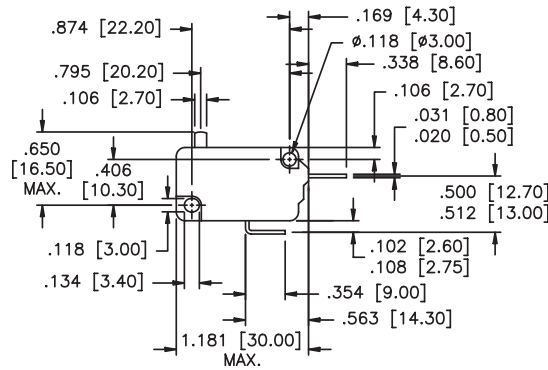
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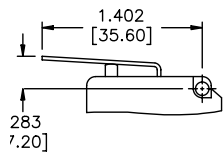
**Normally open**



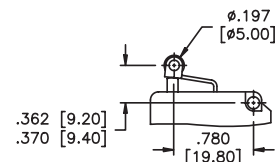
**Change-over**



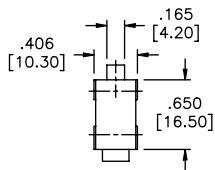
**Normally closed**



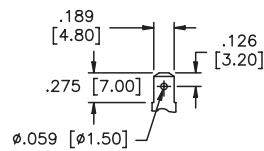
**Hinge lever**



**Roller lever**



**Side view**



**Quick connect terminal**

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## MB SERIES - MICRO-LIMIT SWITCHES



### FEATURES

- Ratings: 10 Amps 250 VAC (resistive load). 1.5 Amps 250 VAC (motor load).
- Single pole CO (change-over or alternate action), NC (normally closed momentary) and NO (normally open momentary) configurations.
- Close tolerance switching action with long life (10,000,000 mechanical cycles min.).
- Pin plunger, hinge lever or roller lever actuator options.

### MATERIALS

<b>Contacts:</b>	Stationary: Nickel silver    Shorting: Beryllium copper
<b>Actuator:</b>	POM (UL94HB)
<b>Case &amp; cover:</b>	PBT (UL94V-O)
<b>Terminals:</b>	Silver plated copper/zinc

### AGENCY RECOGNITION



### SPECIFICATIONS

Operating force:	≤ 10 oz. (274 grams) approx.
Pretravel:	≤ .039" (1mm)
Overtravel:	≥ .024" (0.6mm)
Movement differential:	≤ .005" (0.13mm)
Free position:	≤ .366" (9.3mm)
Operating position:	.331" ± .012" (8.4mm ± (0.3mm))
Operating temperature:	-40°C to +85°C
Contact gap:	< .118" (3mm)
Tracking resistance:	>PTI 175



# MB SERIES - MICRO-LIMIT SWITCHES

## ORDER FORMAT

**M B D 5 B 1**

Series	Circuit & quick-connect terminals	Switch rating	Actuator style	Length
<b>MB</b>	<b>D</b> Normally open (solder terminal) <b>E</b> Normally closed (solder terminal) <b>F</b> Change-over (solder terminal) <b>G</b> Normally open (p.c. terminal) <b>H</b> Normally closed (p.c. terminal) <b>J</b> Change-over (p.c. terminal)	<b>5</b> 10(1.5)A 250 VAC	<b>A</b> Pin actuator <b>B</b> Hinge actuator <b>C</b> Roller actuator	Actuator length and fixed position- (see table below)

## STANDARD MODELS

Circuit			Normally open		Normally closed		Change-over	
Terminals			Solder	P.C.	Solder	P.C.	Solder	P.C.
Pin plunger with radius			<b>MBD5A</b>	<b>MBG5A</b>	<b>MBE5A</b>	<b>MBH5A</b>	<b>MBF5A</b>	<b>MBJ5A</b>
Pin plunger, spherical form			<b>MBD5D</b>	<b>MBG5D</b>	<b>MBE5D</b>	<b>MBH5D</b>	<b>MBF5D</b>	<b>MBJ5D</b>
Lever type	Fix	Act. length						
Hinge lever	EH	.189" (4.8mm)	<b>MBD5B</b>	<b>MBG5B</b>	<b>MBE5B</b>	<b>MBH5B</b>	<b>MBF5B</b>	<b>MBJ5B</b>
	EV	.276" (7.0mm)	<b>MBD5B2</b>	<b>MBG5B2</b>	<b>MBE5B2</b>	<b>MBH5B2</b>	<b>MBF5B2</b>	<b>MBJ5B2</b>
	EH	.276" (7.0mm)	<b>MBD5B1</b>	<b>MBG5B1</b>	<b>MBE5B1</b>	<b>MBH5B1</b>	<b>MBF5B1</b>	<b>MBJ5B1</b>
	EV	.370" (9.4mm)	<b>MBD5B3</b>	<b>MBG5B3</b>	<b>MBE5B3</b>	<b>MBH5B3</b>	<b>MBF5B3</b>	<b>MBJ5B3</b>
Roller lever	EH	.098" (2.5mm)	<b>MBD5C</b>	<b>MBG5C</b>	<b>MBE5C</b>	<b>MBH5C</b>	<b>MBF5C</b>	<b>MBJ5C</b>
	EV	.185" (4.7mm)	<b>MBD5C2</b>	<b>MBG5C2</b>	<b>MBE5C2</b>	<b>MBH5C2</b>	<b>MBF5C2</b>	<b>MBJ5C2</b>
	EH	.185" (4.7mm)	<b>MBD5C1</b>	<b>MBG5C1</b>	<b>MBE5C1</b>	<b>MBH5C1</b>	<b>MBF5C1</b>	<b>MBJ5C1</b>
	EV	.280" (7.1mm)	<b>MBD5C3</b>	<b>MBG5C3</b>	<b>MBE5C3</b>	<b>MBH5C3</b>	<b>MBF5C3</b>	<b>MBJ5C3</b>
Simulated roller lever	EH	.098" (2.5mm)	<b>MBD5E</b>	<b>MBG5E</b>	<b>MBE5E</b>	<b>MBH5E</b>	<b>MBF5E</b>	<b>MBJ5E</b>
	EV	.185" (4.7mm)	<b>MBD5E2</b>	<b>MBG5E2</b>	<b>MBE5E2</b>	<b>MBH5E2</b>	<b>MBF5E2</b>	<b>MBJ5E2</b>
	EH	.185" (4.7mm)	<b>MBD5E1</b>	<b>MBG5E1</b>	<b>MBE5E1</b>	<b>MBH5E1</b>	<b>MBF5E1</b>	<b>MBJ5E1</b>
	EV	.280" (7.1mm)	<b>MBD5E3</b>	<b>MBG5E3</b>	<b>MBE5E3</b>	<b>MBH5E3</b>	<b>MBF5E3</b>	<b>MBJ5E3</b>



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# MB SERIES - MICRO-LIMIT SWITCHES

## ACTUATORS AND SPECIFICATIONS



Hinge lever



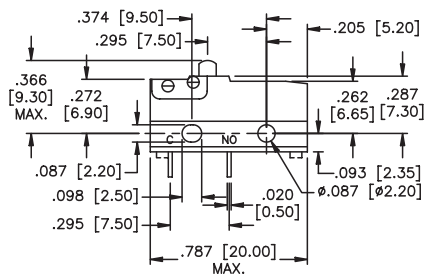
Roller lever



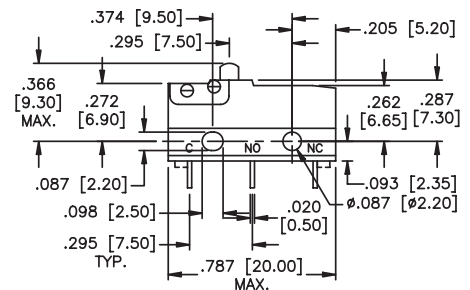
Simulated roller lever

Actuator	Hinge lever				Roller lever				Simulated roller lever			
	EH	EV	EH	EV	EH	EV	EH	EV	EH	EV	EH	EV
Actuator length, inches $\pm .031"$ $\pm 0.8\text{mm}$	.189	.276	.276	.370	.098	.185	.185	.280	.098	.185	.185	.280
Fixed position, EH=rear EV=front	EH	EV	EH	EV	EH	EV	EH	EV	EH	EV	EH	EV
Operating force, $\leq$ grams $\leq ???$	100	45	85	40	110	50	95	40	115	60	95	50
Pre-travel, $\leq$ inches $\leq$ mm	.177	.354	.197	.394	.177	.354	.197	.394	.177	.354	.197	.394
Overtravel, min. inches min. mm	.030	.049	.030	.059	.030	.049	.030	.059	.030	.049	.030	.059
Overtravel, max. inches max. mm	.059	.098	.059	.118	.059	.098	.059	.118	.059	.098	.059	.118
Movement diff. $\leq$ inches $\leq$ mm	.035	.059	.047	.071	.028	.059	.039	.071	.028	.059	.039	.071
Free position, $\leq$ inches $\leq$ mm	.551	.709	.591	.787	.748	.866	.787	.945	.748	.866	.787	.945
Operating position, inches Tolerance inches $\pm$	.421	.472	.437	.492	.622	.669	.638	.689	.630	.677	.646	.697
Operating position, mm Tolerance mm $\pm$	10.7	12	11.1	12.5	15.8	17	16.2	17.5	16	17.2	16.4	17.7
Order code	B	B2	B1	B3	C	C2	C1	C3	E	E2	E1	E3

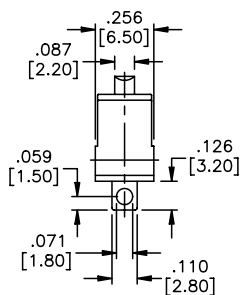
## MECHANICAL OUTLINES



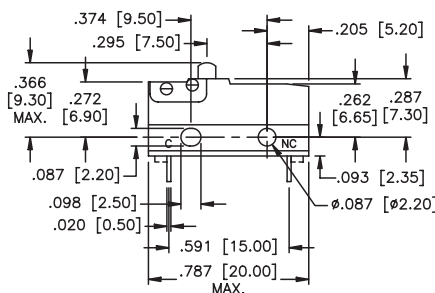
Normally open



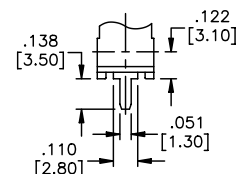
Change-over



Side view (w/solder terminal)



Normally closed



P.C. terminal

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