

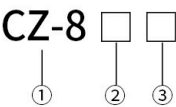


特点 Features

- 双回路型限位开关
- 结构坚固, 由锌合金及强化塑胶组成
- 体积小, 可防水、防油
- 内藏触点座有双簧片设计, 机械寿命长
- 具有较大的过行程
- 引动器种类多, 方便使用
- 优化尾部出线设计, 以提高密封性能
- Double circuit type of limit switch
- High mechanical strength, consists of intensive plastic and aluminum cast
- Small size, water-proof and oil proof construction
- Built-in contact box has double-spring and long mechanical life
- Smooth operation with larger over travel distance
- Various actuators for different application
- Optimize tail line design to improve sealing performance



选型说明 Model Designation



序号 No	项目 Item	代号 Code	说明 Description	强制断开有 / 无 Forced disconnection Yes/No
①	产品系列 Product series	CZ-8	设计代号 Design code	
②	头部结构 Head structure	104	塑胶滚轮摆杆型 Plastic roller swing rod type	仅 NC 端有强制断开 Only NC end has forced disconnection
		105	金属滚轮摆杆型 Metal roller swing rod type	仅 NC 端有强制断开 Only NC end has forced disconnection
		107	可调棒式摆杆型 Adjustable rod swing rod type	仅 NC 端有强制断开 Only NC end has forced disconnection
		108	可调摆杆塑胶滚轮型 Adjustable swing rod plastic roller type	仅 NC 端有强制断开 Only NC end has forced disconnection
		109	可调摆杆金属滚轮型 Adjustable swing rod metal roller type	仅 NC 端有强制断开 Only NC end has forced disconnection
		111	柱塞型 Plunger type	
		111M	柱塞型 (金属头部) Plunger type(Metal head)	
		112	横轮柱塞型 Cross wheel plunger type	
		112M	横轮柱塞型 (金属头部) Cross wheel plunger type (Metal head)	
		122	竖轮柱塞型 Vertical wheel plunger type	
		122M	竖轮柱塞型 (金属头部) Vertical wheel plunger type (Metal head)	
		166	塑料杆盘簧型 Plastic rod coil spring type	
		167	盘簧型 Coil spring type	
		168	金属杆盘簧型 Metal rod coil spring type	
③	出线类型 Outgoing type	169	触须型 Tentacle type	
		108H	可调摆杆橡胶滚轮型 Adjustable swing rod rubber roller type	仅 NC 端有强制断开 Only NC end has forced disconnection
		无 None	橡胶尾套 Rubber tail sleeve	

特性 Characteristics

操作速度 Operation speed	5mm 至 0.5m/s 5mm-0.5m/s
动作频率 Operating frequency	电气:30次/分 Electical: 30 operations/min
接触电阻 Contact resistance	25mΩ 以下 (初期) 25mΩmax. (initial value)
绝缘电阻 Insulation resistance	100MΩ 以上 (在 500VDC 以下) 100MΩ min. (at 500VDC)
最小使用负载 Minimum working load	DC24V 10mA 以上 Min DC24V 10mA
额定绝缘电压UI Rated insulation voltage	300V
额定冲击耐受电压Uimp Rated impulse withstand voltage	4kV
约定自由空气发热电流Ith Convention free air heating current	10A
电介强度 Dielectric strength	非连续端子间1000VAC, 50/60Hz持续1分钟 1000VAC, 50/60 Hz for 1 minute between terminals of the same polarity
	载电流与无载电流零件间1500VAC, 50/60Hz持续1分钟 1500VAC, 50/60 HZ for 1 minute between current-carrying and non-current-carrying metal parts
	端子 and 接地之间1500VAC, 50/60Hz持续1分钟 1500VAC, 50/60 HZ for 1 minute between each terminal and ground
振动 Vibration	10至55Hz, 1.5mm双振幅 10-55Hz, 1.5mm double amplitude
冲击 Shock	机械耐久 :1,000m/Sec ² (约 100G' S) 误动作耐久 :300m/Sec ² (约 30G' S)*1 Mechanical durable: 1, 000m/Sec ² (about 100G' S) Malfunction: 300m/Sec ² (about 30G' S)*1
周围温度 Ambient temperature	使用时 : -20~+70°C (没有结冰) Using: -20~+70°C (With no icing)
湿度 Humidity	95%RH 以下 <95% RH
电气寿命 Electrical life	500000次以上(250V/6A 阻性负载时) More than 500,000 times (250V/6A resistive load)
保护构造 Degree of protection	IP65

*1: 盘簧型除外
*1: Except coil spring type

额定值 Ratings

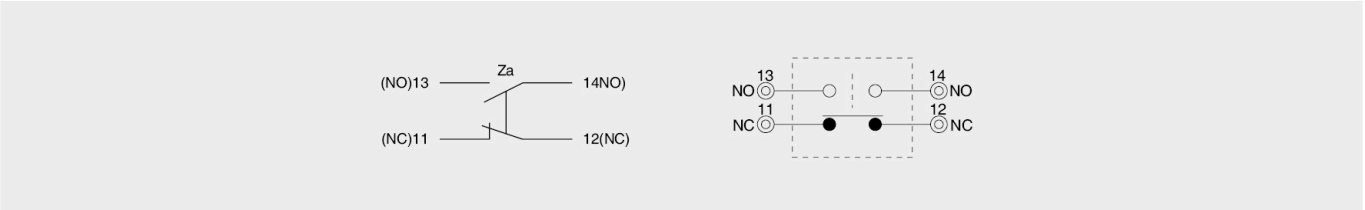
额定电压 Rated Voltage	非电感性负载 Noninductive Load (A)				电感性负载 Inductive Load (A)			
	电阻性负载 Resistance Load		灯泡负载 Lamp Load		电感性负载 Inductive Load		马达负载 Motor Load	
	NC	NO	NC	NO	NC	NO	NC	NO
AC125		6		1.5		3		1
AC250		6		1		3		0.8
DC12		6		3		4		3
DC24		6		3		4		3
DC125	0.4	0.2		-		-		-
DC50	0.4	0.2		-		-		-

浪涌电流 Surge current	NC	Max. 24A
	NO	Max. 12A

- 注意事项:
- 1、左侧提到的数值代表稳定电流。
 - 2、感性负载是指在交流条件下功率因数为0.4, 或在直流条件下时间常数低于7ms的负载。
 - 3、灯负载指的是有10倍浪涌电流的负载。
 - 4、电动机负载是指负载有6倍浪涌电流的情况。

- NOTES:
- 1.The figures mentioned initially denote the consistent current levels.
 - 2.The term 'inductive load' applies to loads where the power factor is 0.4 in AC conditions or when the time constant is less than 7ms for DC.
 - 3.Lamp load' is used to describe loads that experience surge currents up to 10 times their normal rate.
 - 4.Motor load' indicates loads that undergo up to 6 times their regular surge current.

接点型式 Contact Form



国际认证规格 International Certification Specifications

认证规格 Certification specifications	规格 Specifications	文件No. Document
CCC	GB/T 14048.5	请咨询昌得代表处 Please consult the CNTD Representative Office
TUV	EN 60947-5-1	
CE		

安全规格认证额定值 Safety Specification Certification Rating

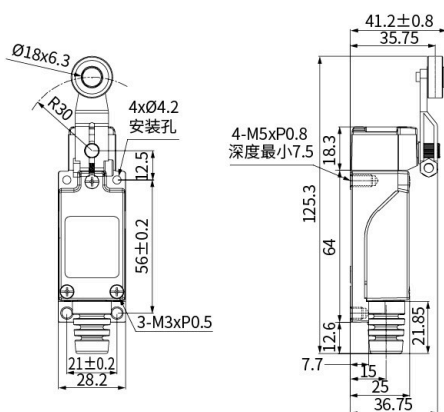
CCC(GB/T 14048.5)、TUV(EN 60947-5-1)

类型与额定值 Type and Rating	
AC-15	6A/250V
DC-13	0.3A/220V

外观和尺寸 Appearance and Dimension

CZ-8104

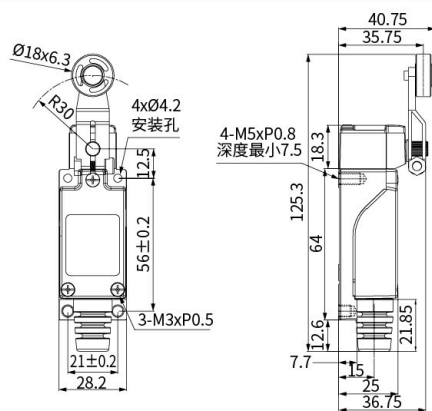
塑胶滚轮摆杆型
Plastic roller
swing rod type



动作特性 Operating Characteristics	CZ-8104
动作力 OF (最大Max.)	7.5N
释放力 RF (最小Min.)	1N
预行程 PT (最大Max.)	20°
过行程 OT (最小Min.)	75°
运动差异 MD (最大Max.)	12°
总行程TT(最小Min)	95°
动作位置 OP(mm.)	-

CZ-8105

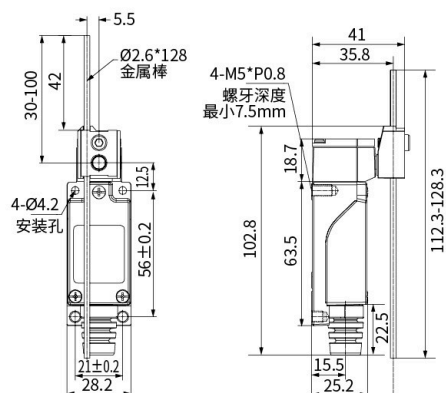
金属滚轮摆杆型
Metal roller
swing rod type



动作特性 Operating Characteristics	CZ-8105
动作力 OF (最大Max.)	7.5N
释放力 RF (最小Min.)	1N
预行程 PT (最大Max.)	20°
过行程 OT (最小Min.)	75°
运动差异 MD (最大Max.)	12°
总行程TT(最小Min)	95°
动作位置 OP(mm.)	-

CZ-8107

可调棒式摆杆型
Adjustable rod
swing rod type

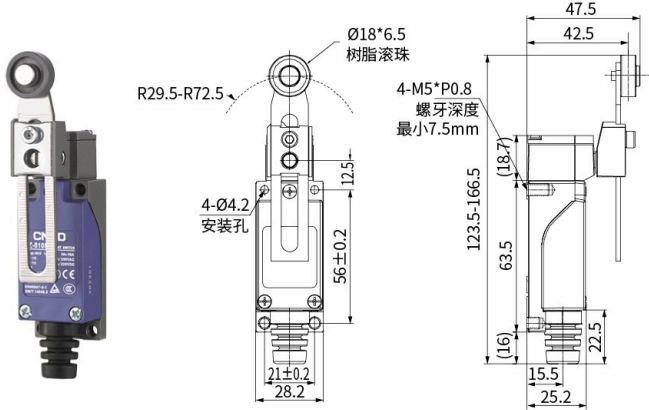


动作特性 Operating Characteristics	CZ-8107
动作力 OF (最大Max.)	7.5N
释放力 RF (最小Min.)	1N
预行程 PT (最大Max.)	20°
过行程 OT (最小Min.)	75°
运动差异 MD (最大Max.)	12°
总行程TT(最小Min)	95°
动作位置 OP(mm.)	-

外观和尺寸 Appearance and Dimension

CZ-8108

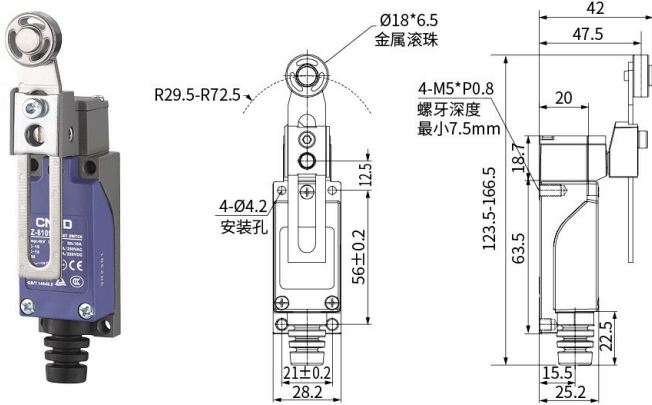
可调摆杆塑胶滚轮型
Adjustable swing
rod plastic
roller type



动作特性 Operating Characteristics	CZ-8108
动作力 OF (最大Max.)	7.5N
释放力 RF (最小Min.)	1N
预行程 PT (最大Max.)	20°
过行程 OT (最小Min.)	75°
运动差异 MD (最大Max.)	12°
总行程 TT (最小Min)	95°
动作位置 OP(mm.)	-

CZ-8109

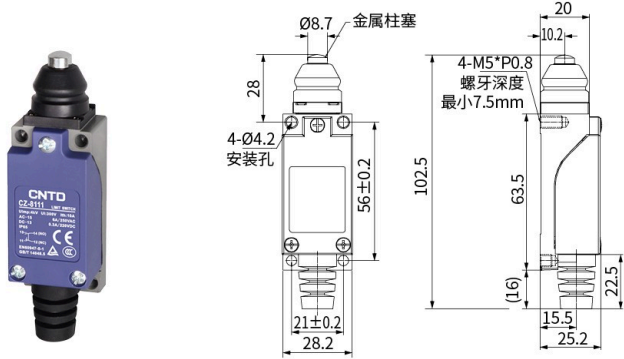
可调摆杆金属
滚轮型
Adjustable
swing rod metal
roller type



动作特性 Operating Characteristics	CZ-8109
动作力 OF (最大Max.)	7.5N
释放力 RF (最小Min.)	1N
预行程 PT (最大Max.)	20°
过行程 OT (最小Min.)	75°
运动差异 MD (最大Max.)	12°
总行程 TT (最小Min)	95°
动作位置 OP(mm.)	-

CZ-8111

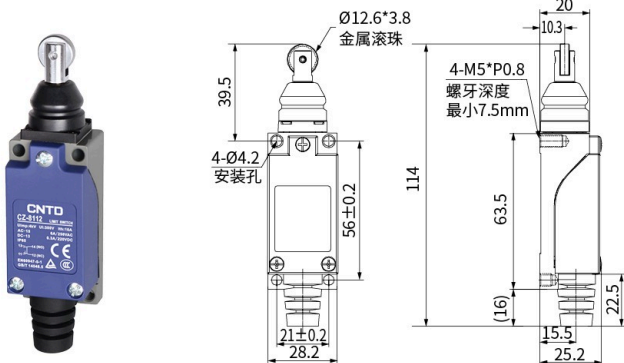
柱塞型
Plunger type



动作特性 Operating Characteristics	CZ-8111
动作力 OF (最大Max.)	9N
释放力 RF (最小Min.)	1N
预行程 PT (最大Max.)	1.8mm
过行程 OT (最小Min.)	4mm
运动差异 MD (最大Max.)	1mm
总行程 TT (最小Min)	5.5mm
动作位置 OP(mm.)	26±0.8mm

CZ-8112

横轮柱塞型
Cross wheel
plunger type

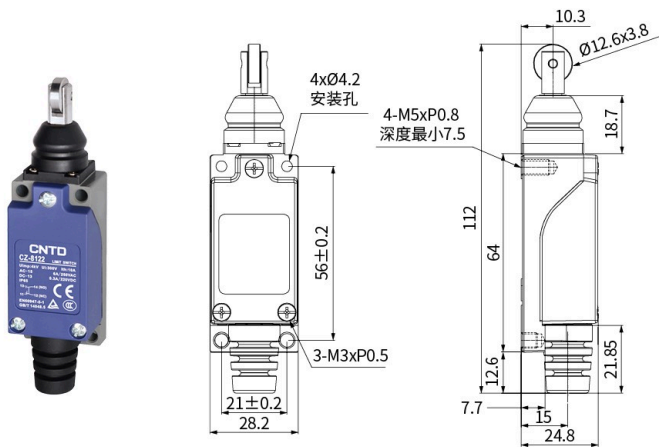


动作特性 Operating Characteristics	CZ-8112
动作力 OF (最大Max.)	9N
释放力 RF (最小Min.)	1.5N
预行程 PT (最大Max.)	1.8mm
过行程 OT (最小Min.)	4mm
运动差异 MD (最大Max.)	1mm
总行程 TT (最小Min)	5.5mm
动作位置 OP(mm.)	37±0.8mm

外观和尺寸 Appearance and Dimension

CZ-8122

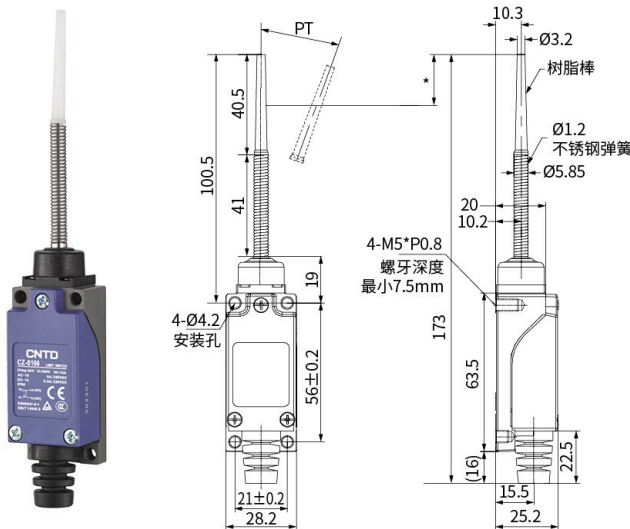
竖轮柱塞型
Vertical wheel
plunger type



动作特性 Operating Characteristics	CZ-8122
动作力 OF (最大Max.)	9N
释放力 RF (最小Min.)	1.5N
预行程 PT (最大Max.)	1.8mm
过行程 OT (最小Min.)	4mm
运动差异 MD (最大Max.)	1mm
总行程TT(最小Min)	5.5mm
动作位置 OP(mm.)	37±0.8mm

CZ-8166

塑料杆盘簧型
Plastic rod coil
spring type

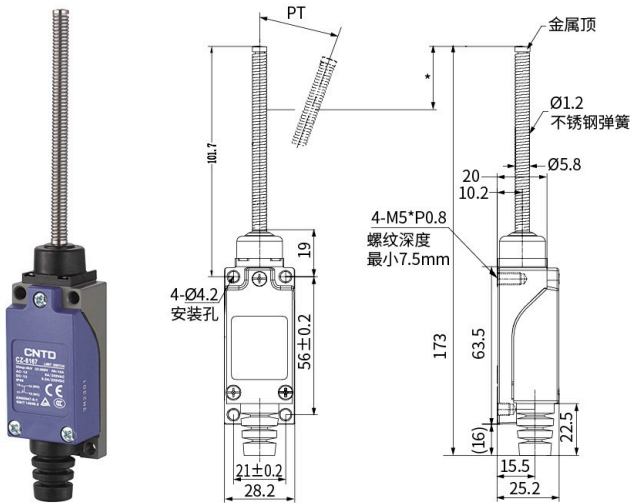


动作特性 Operating Characteristics	CZ-8166
动作力 OF (最大Max.)	1.5N
释放力 RF (最小Min.)	-
预行程 PT (最大Max.)	15°±5°
过行程 OT (最小Min.)	-
动作位置 OP(mm.)	-

* 操作杆的使用范围是从尖端到引动器全长的 1/3 内。
*The range of use for the operating lever is from the tip of the operating rod to within one third of the full length of the actuator.

CZ-8167

盘簧型
Coil spring type

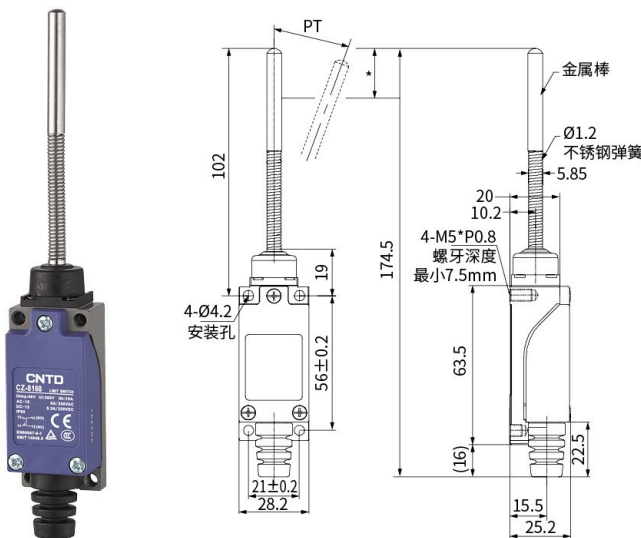


动作特性 Operating Characteristics	CZ-8167
动作力 OF (最大Max.)	1.5N
释放力 RF (最小Min.)	-
预行程 PT (最大Max.)	15°±5°
过行程 OT (最小Min.)	-
动作位置 OP(mm.)	-

* 操作杆的使用范围是从尖端到引动器全长的 1/3 内。
*The range of use for the operating lever is from the tip of the operating rod to within one third of the full length of the actuator.

外观和尺寸 Appearance and Dimension

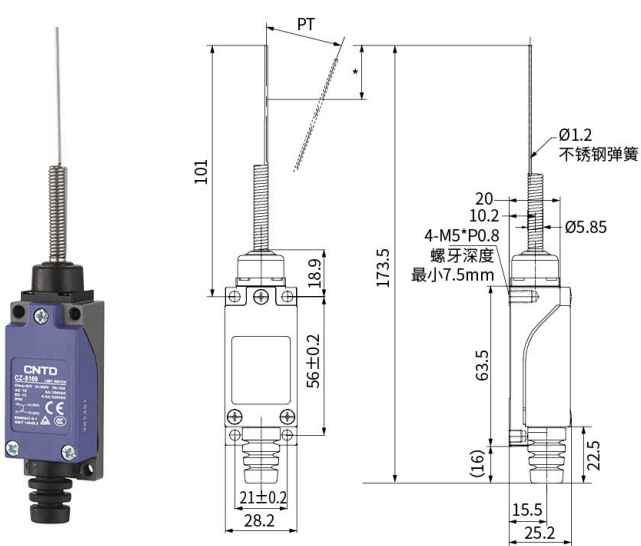
CZ-8168
金属杆盘簧型
Metal rod coil
spring type



动作特性 Operating Characteristics	CZ-8168
操作力 OF (最大Max.)	1.5N
回弹力 RF (最小Min.)	-
预行程 PT (最大Max.)	15°±5°
过行程 OT (最小Min.)	-
回差 MD (最大Max.)	10°±2°
动作位置 OP(mm.)	-

操作杆的使用范围是从尖端到引动器全长的 1/3 内。
The range of use for the operating lever is from the tip of the operating rod to within one third of the full length of the actuator.

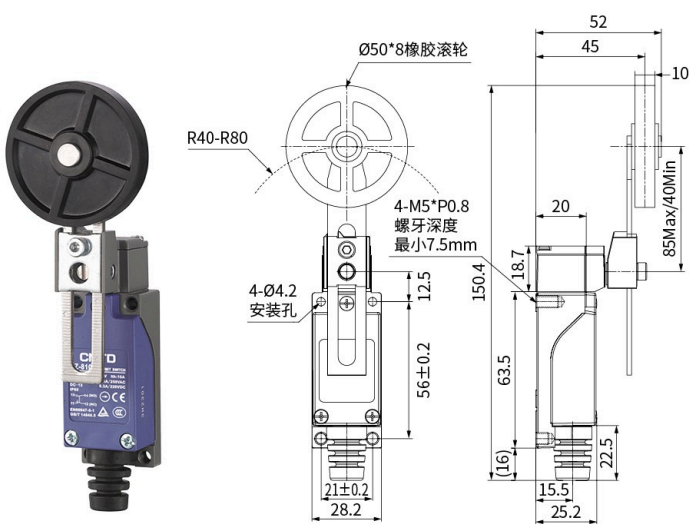
CZ-8169
触须型
Tentacle type



动作特性 Operating Characteristics	CZ-8169
动作力 OF (最大Max.)	1.5N
释放力 RF (最小Min.)	-
预行程 PT (最大Max.)	15°±5°
过行程 OT (最小Min.)	-
运动差异 MD (最大Max.)	10°±2°
动作位置 OP(mm.)	-

* 操作杆的使用范围是从尖端到引动器全长的 1/3 内。
*The range of use for the operating lever is from the tip of the operating rod to within one third of the full length of the actuator.

CZ-8108H
可调摆杆橡胶
滚轮型
Adjustable
swing rod rubber
roller type



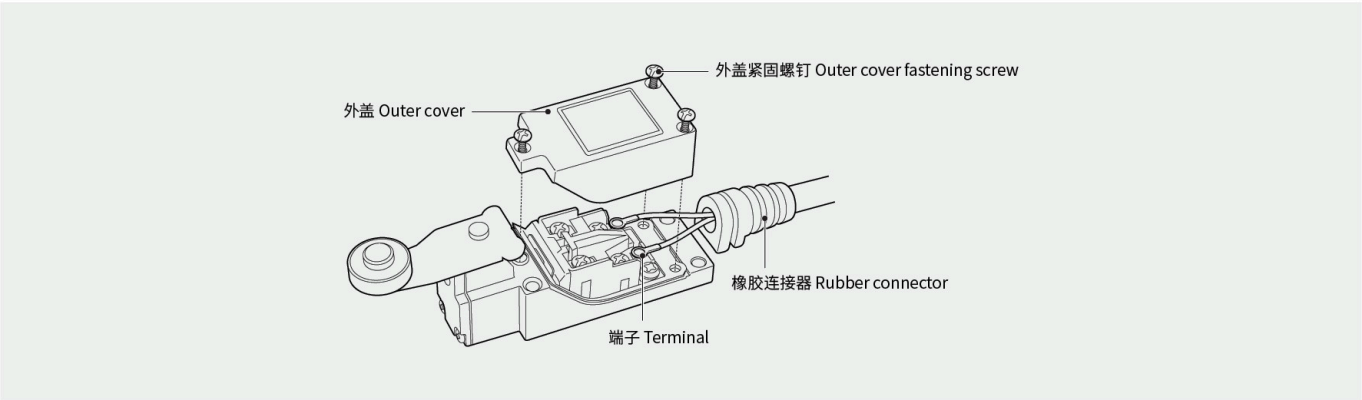
动作特性 Operating Characteristics	CZ-8108H
动作力 OF (最大Max.)	7.5N
释放力 RF (最小Min.)	1N
预行程 PT (最大Max.)	20°
过行程 OT (最小Min.)	75°
运动差异 MD (最大Max.)	12°
总行程 TT (最小Min.)	95°
动作位置 OP(mm.)	-

安全注意事项 Safety Precautions

关于布线 About Wiring

布线步骤 Wiring steps

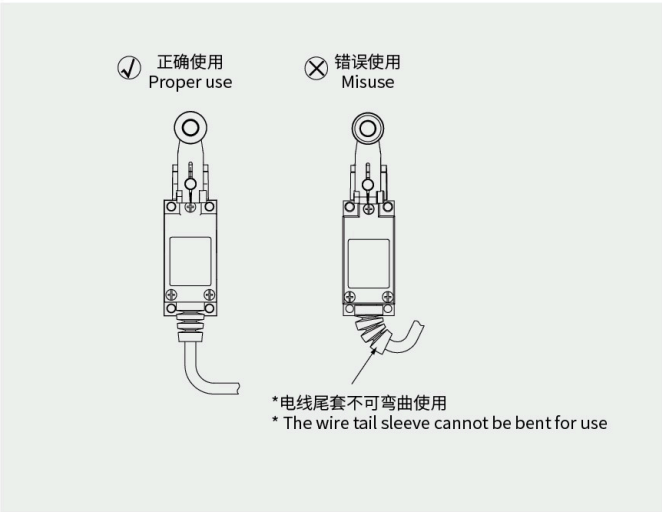
- 先旋松外壳螺钉，取下开关的外壳。
- 通过外壳侧面的橡胶孔将电线引入，紧接着将适合的端子稳固地安装上（选用端子时请参考推荐型号）。
- 把端子安置进开关的接口中，用力拧紧保护端子的螺钉。
- 重新装回外壳，确保橡胶接头对准并嵌入专用槽中。均匀拧紧三个螺丝，扭矩为 0.49-0.59N·m。
- Loosen the screws of the housing and remove the cover of the switch.
- Lead the wire through the rubber hole on the side of the cover and then securely fit the appropriate terminal (refer to recommended models for terminal selection).
- Place the terminal into the switch interface and tighten the screws securing the terminal.
- Refit the cover, ensuring that the rubber connector aligns perfectly and fits into the dedicated groove of the cover. Apply uniform torque to the three screws, maintaining a torque of 0.49-0.59N·m.



尾套使用注意事项 Tail Sleeve Using Precautions

在离开关底部5厘米的位置固定电缆，避免电缆承受过大压力。
弯曲电缆时，确保至少有45毫米的弯曲半径，以防止损害电缆的绝缘层或外皮。
过分弯曲电缆可能会导致电缆发热或电流泄漏。

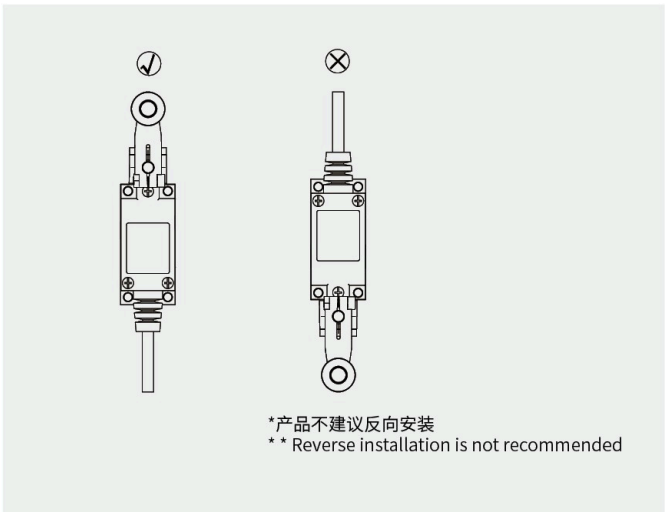
Fasten the cable at a spot 5 cm above the base of the switch to mitigate undue stress on it.
Ensure a minimum bending radius of 45mm when curving the cable to avoid compromising the insulation or the outer sheath.
Excessively bending the cable may result in overheating or current leakage.



安装方向使用注意事项 Installation Direction Precautions

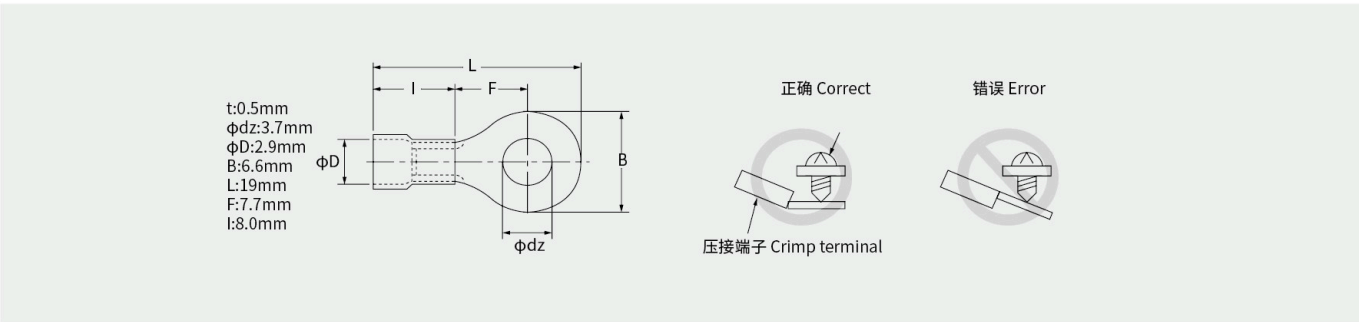
若安装方向错误，可能会使产品无法达到预期的防护效果。需特别注意防止水珠沿电缆线滑入开关内部，这可能导致开关的内部结构受损。
请确保正确安装，以防止水分侵入开关内部，避免潜在的损害风险。

Incorrect installation orientation may compromise the product's protective capabilities. Be vigilant against water droplets entering the switch along the cable, as this can damage the internal components of the switch.
Ensure proper installation to prevent moisture ingress into the switch and avert potential damage risks.



接线注意事项 Wiring Precautions

请在断电状态下进行开关接线操作，通电状态下接线可能会造成触电危险。
接线时务必注意，不要让导线的细小碎片或其他微粒进入开关内部。
使用绝缘管和 M3.5 压接端子连接时，按照图示正确放置压接端子，避免压迫到外壳或外盖。适用的导线尺寸为 AWG20 至 AWG18 或 0.5 至 0.75mm²。
选用适当长度的导线以确保外盖平整关闭且牢固。切勿将压接端子塞进外壳缝隙，这可能导致外壳损坏或变形。
为防止端子与开关外壳内部接触，使用厚度不超过 0.5mm 的端子。
Always wire the switch with the power off to avoid the risk of electric shock.
Ensure no small wire fragments or particles enter the switch during wiring.
When connecting with an insulated tube and M3.5 crimp terminals, position the terminals as shown in the diagram to avoid pressing against the casing or cover. The suitable wire size is AWG20 to AWG18 or 0.5 to 0.75mm².
Use wires of appropriate length to ensure the cover closes smoothly and securely. Do not stuff the crimp terminals into gaps in the casing, as this may cause damage or deformation.
To prevent contact between the terminals and the interior of the switch housing, use terminals with a thickness of no more than 0.5mm.



适用导线 Applicable Conductor

电线名称 Wire name	推荐使用电线 Wire is recommended		
	线芯数 Number of cores	导体 Conductor	成品外径 Nom OD
塑料橡皮绝缘软电线 Plastic rubber insulated flexible wire	2芯 2-core 3芯 3-core 4芯 4-core	0.5~0.75mm ²	圆形 Circular φ6~φ9
600V 塑料绝缘 塑料外皮电缆(VVF) 600V plastic insulation Plastic sheathed cable	2芯 2-core	φ1/φ1.2/φ1.6	

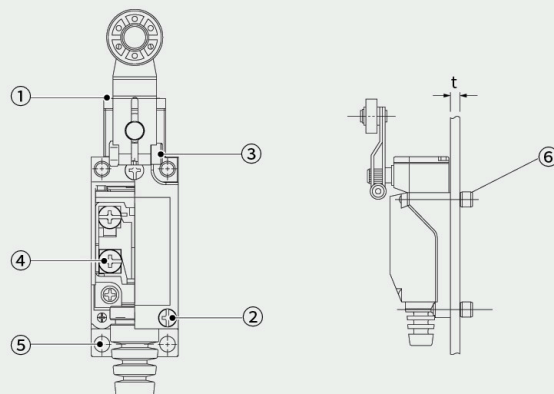
若电线含有硅油，可能会导致接触不良。为确保电气设备的正常运行，请避免使用含硅油的产品。
The presence of silicone oil in wire may result in inadequate contact. To ensure the proper functioning of electrical equipment, please refrain from using products containing silicone oil.

正确的固定扭矩 Correct Fixing Torque

松动的螺丝可能导致设备提前故障。请确保各部件的螺丝根据规定的扭矩紧固，以保障设备的稳定性和安全性。
Loose screws may lead to premature equipment failure. Ensure that screws on each component are tightened to the specified torque for stability and safety.

NO.	种类 Type	正确的固定扭矩 Correct fixing torque
①	头部安装螺丝 Head mounting screws	0.19~0.29N·m
②	外壳安装螺丝 Housing mounting screws	0.49~0.59N·m
③	摆杆安装螺丝 Swing rod installation screw	2.45~2.94N·m
④	端子螺丝(M3) Terminal screw (M3)	0.49~0.59N·m
⑤	本体安装螺丝(M4带六角孔螺母) Body installation screw (M4 with hexagonal hole nut)	2.45~2.94N·m
⑥	本体背面安装螺丝(M5带六角孔螺母) Installation screws on the back of the body (M5 with hexagonal hole nut)	4.90~5.88N.m

特别是在改变头部方向时，必须重新确认上述扭矩，并保证所有螺丝均匀紧固。同时，要注意防止异物进入内部。
It is crucial to reconfirm the specified torque and ensure that all screws are evenly tightened, especially after adjusting the orientation of the head. Additionally, take precautions to prevent the entry of foreign objects into the product.



操作 Operate

开关底部的电缆出口处配有橡胶护套，固定点应在距开关底部5厘米处，以避免对电缆造成过度拉力。弯曲电缆时，必须确保至少45毫米的最小弯曲半径，以免损坏电缆的绝缘层或外皮。过度弯曲可能会引起电缆过热或电流泄漏。

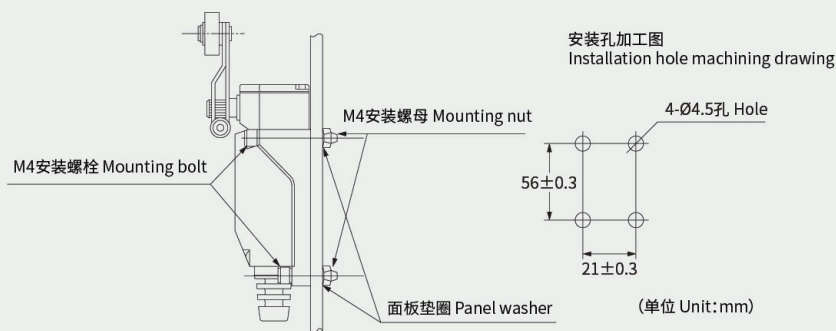
The cable outlet at the bottom of the switch is equipped with a rubber tail for protection. The cable should be secured 5cm from the base of the switch to avoid undue tension. When bending the cable, maintain a minimum bend radius of 45mm to prevent damage to the cable's insulation or outer layer. Over-bending may lead to overheating or current leakage.

关于安装 About Installation

正面安装 Front mounting

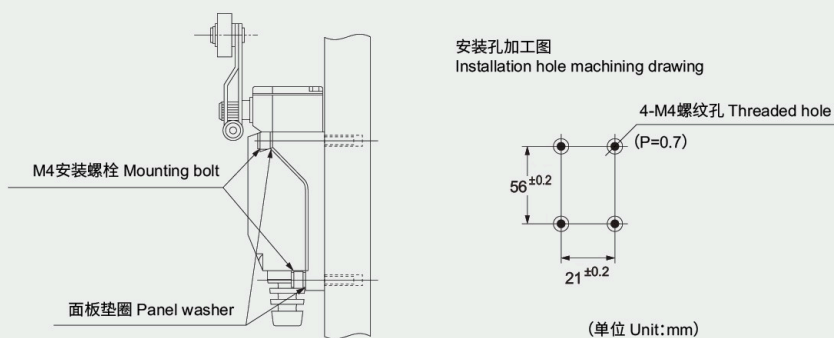
① 通过面板上的孔进行安装

① The panel is installed through holes

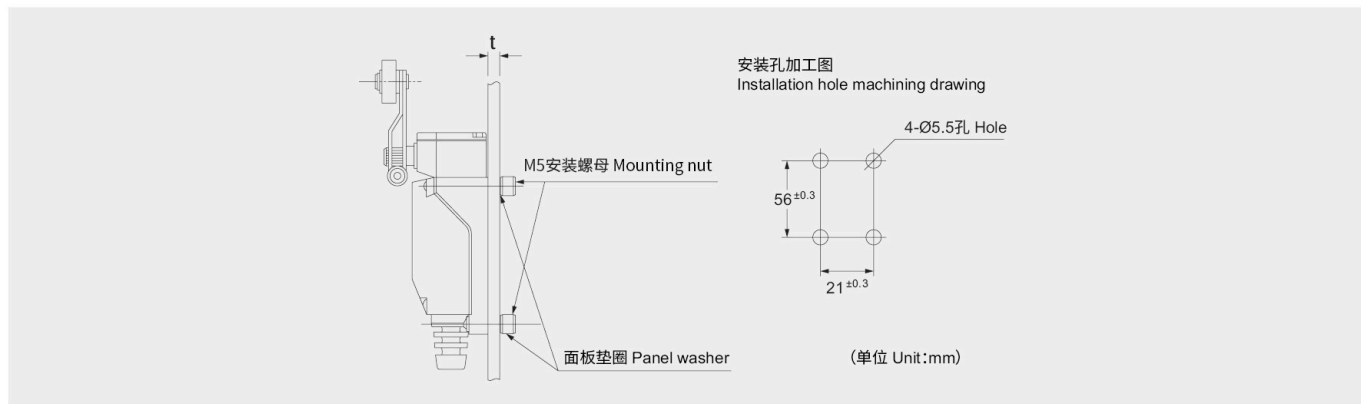


② 安装板通过螺纹孔安装

② The mounting panel is installed using threaded holes



背面安装 Back mount



注: 本体的螺纹孔为M5 P=0.8, 最小深度为7.5mm。使用的螺钉长度不应大于面板厚度加7mm。

The threaded hole of the body is M5 with a pitch of 0.8 and a minimum depth of 7.5mm. The length of the screw used should not exceed the panel thickness plus 7mm.

关于传动器的安装位置更改

Change of Mounting Position of the Actuator

(CZ-8104、CZ-8105、CZ-8108、CZ-8109、CZ-8107、CZ-8108H) 松开在摆动杆上的六角螺母, 即可在360°任意角度上设定传动的位置。

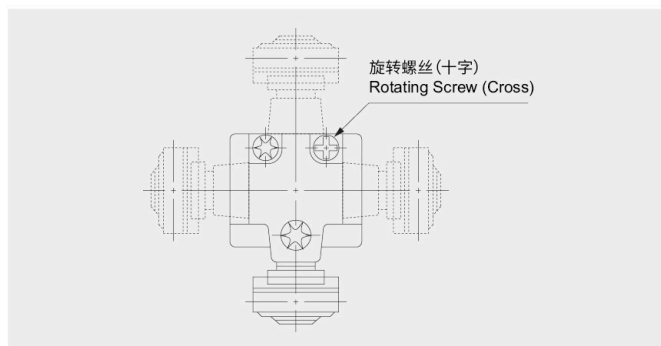
(CZ-8104, CZ-8105, CZ-8108, CZ-8109, CZ-8107, CZ-8108H) Loosen the hexagonal nut on the swing rod of the actuator to set the position of the transmission at any angle of 360°.



关于开关头部的更改方向 Changes to Head Orientation

(CZ-8104、CZ-8105、CZ-8108、CZ-8109、CZ-8107、CZ-8108H) 要改变头部的位置, 只需松开(+)十字螺钉即可轻松设定四个方向的位置, 有90°间隔。

(CZ-8104, CZ-8105, CZ-8108, CZ-8109, CZ-8107, CZ-8108H) To change the direction of the head, just one screw (Cross) is needed to easily set the position in four directions at 90° intervals.



关于操作 About Operations

- 盘簧型、触须型操作方向为传动总长度的1/3以内, 执行水平操作。
- 在传动根部操作及过度压迫操作头, 容易产生折断、变形、误操作以及寿命降低等问题。
- 可能会出现接点跳动、振荡及反弹现象。

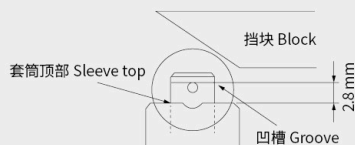
反弹现象是指传动操作后, 操作体通过传动反弹, 移动至相反动作点, 存在接点动作现象。

- The operating direction of the coil spring type and the tentacle type is within 1/3 of the total length of the transmission from the tip of the transmission, and horizontal operation is carried out.
 - Operation at the root of the transmission and excessive pressing of the tip can easily cause problems such as breakage, deformation, misoperation, and reduced lifespan.
 - Possible contact jumping, oscillation, and rebound may occur.
- ‘Rebound’ refers to the operation of the transmission, the operation body through the transmission after the rebound, move to the opposite action point, there is a phenomenon of contact action.

挡块角度 Stop Angle

对于滚轮柱塞型(CZ-8112、CZ-8122)，应使用 θ 为 30° 以下的挡块。

For the roller plunger type (CZ-8112, CZ-8122), the θ Stop below 30° .



使用 Use

在使用过程中，若发生跌落，可能会对传动杆施加超出正常范围的外力，这可能导致传动杆损坏或运动不顺畅。

During operation, if the product is dropped, an excessive force may be exerted on the transmission rod, potentially resulting in damage or compromised functionality.

微小负载型的使用 Applications Under Minimal Load

开关接点可用于一般负载或微小负载。但是，已经连接过一般负载的接点，就不能用于连接更小容量的负载。否则，可能导致接触面的糙化，而且可能失去接触可靠性。

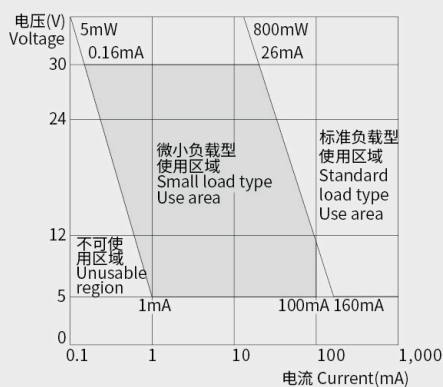
如果在开关微小负载电路时使用一般负载用开关，可能会引起接触不良。下图为开关负载区域范围定义。本目录册内产品适用于 DC24V 10mA 以上范围，当使用负载小于 DC24V 10mA 以下时，可能存在由于电流过小无法击破触点表面氧化膜或硫化膜的现象，从而导致开关接触不良。所以当使用负载小于 DC24V 10mA 以下时，请咨询昌得电气科技有限公司进行产品定制。

请设置 CR 电路等吸收电路，防止震荡和抖动所导致的噪声和脉冲缺失，对于开关时会产生冲击电流的负载，请插入接点保护电路，以免导致耐久性降低。

Switch contacts can be used for general loads or small loads. However, contacts that have already been connected to general loads cannot be used to connect smaller capacity loads. Otherwise, it may lead to roughness of the contact surface and loss of contact reliability.

If a general load switch is used when switching a small load circuit, poor contact may be caused. The following diagram shows the switching load area range definition. The products in this catalog are suitable for DC24V 10mA or above. When the load is less than DC24V 10mA or below, the oxidized film or vulcanized film on the contact surface may be unable to be broken due to too small current, resulting in poor switch contact. Therefore, when the load is less than DC24V 10mA, please consult CNTD Electrical Technology Co., Ltd. for product customization.

Please set the absorption circuit such as CR circuit to prevent noise and pulse loss caused by shock and jitter, for the load that will produce impulse current on the switch, please insert the contact protection circuit to avoid reducing durability.



使用注意事项 Using Precautions

本公司产品是作为工业产品而设计生产，严格遵守工业产品标准。我司明确声明，除非经过特殊设计并得到我司明确书面确认，我司产品不适用于以下应用场合：

- 要求极高可靠性的应用场合，包括核能、燃气、电力等要求长期稳定运行的系统。
- 要求极高安全性的应用场合，涉及人身安全与财产的情况。
- 苛刻条件、严酷环境的应用场合，包括室外、存在化学污染、电磁、振动或冲击影响的环境。
- 有火灾或爆炸风险的应用场合，包括存在易燃易爆性气体、强酸强碱化学品等物质的环境。
- 涉及军工用途、航天航空项目的应用场合。

The company's products are designed and produced as industrial products, in strict compliance with industrial product standards. We expressly declare that, unless specifically designed and expressly confirmed by us in writing, our products are not intended for the following applications:

- Applications that require high reliability, including nuclear, gas, electric and other systems that require long-term stable operation.
- Applications requiring very high security, situations involving personal safety and property.
- Applications in harsh conditions, harsh environments, including outdoor, chemical contamination, electromagnetic, vibration or shock effects.
- Applications where there is a risk of fire or explosion, including environments where flammable and explosive gases, strong acids and alkali chemicals are present.
- Applications involving military use and aerospace projects.