Axial Guard

Features

The Axial Guard is a new type of mechanical type overload protection device for mechanisms where the load acts linearly, such as pushers or cranks.

Highly accurate trip load

Even with repeated loads, the fluctuating trip load variation is always within ±15%.

Non-backlash

High rigidity means no backlash for overweight axial loads.

Easy load adjustment

By simply turning the adjustable screw, load can be adjusted. In the tensile or compression direction, the Axial Guard trips at almost the same load.

Release type

When overload occurs, the Axial Guard immediately trips and the connection between the drive side and load side is shut off. The drive side's thrust does not transmit.
The resetting requires a small load, making it easy to reset.

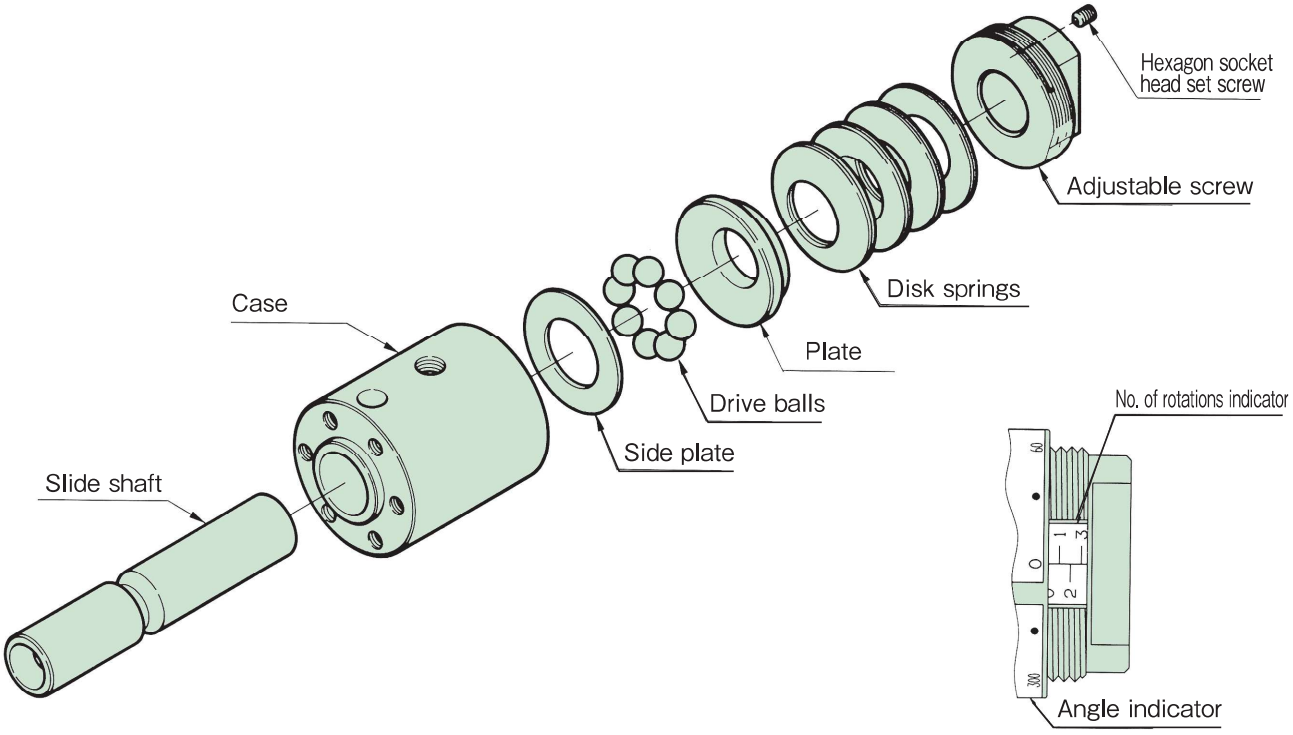
Easy installation

The end faces of the case and slide shaft have tap holes for easy built-in design.

Standard stock

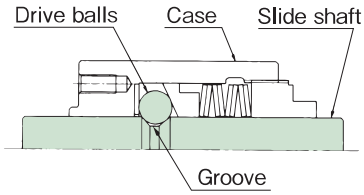
All Axial Guards are in stock.

Construction



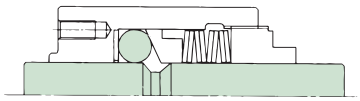
Operating principles

During normal operation (engagement)



Because the drive ball is held in the groove, thrust from the case (or slide shaft) is transmitted to the load side.

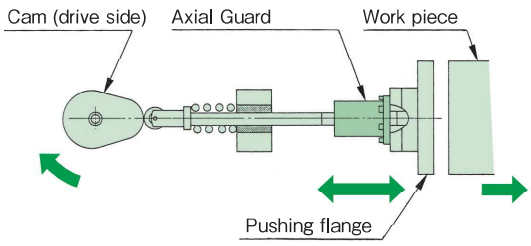
During overload (tripped)



When the load exceeds the pre-set value, the drive ball pops out of the groove; the connection between the slide shaft and the case disengages, and moves in a free state.

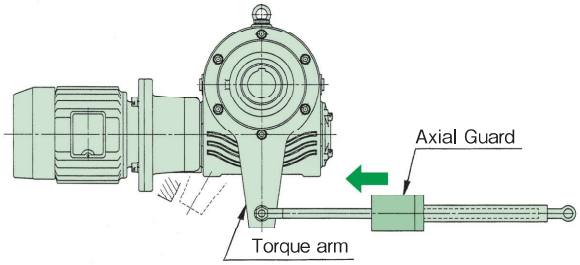
Applications

Pusher



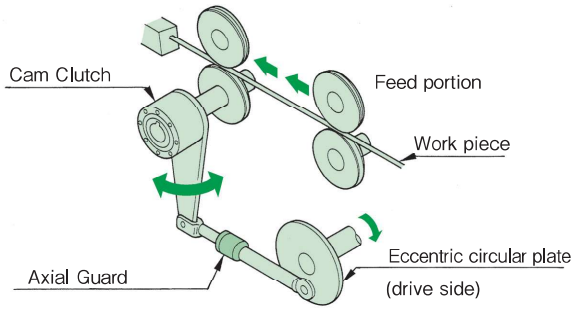
The cam pushes the work piece.
When overload occurs due to the over-weighted work piece or jamming, the Axial Guard trips and protects the machine.

Tie-rod of the shaft-mounted reducer



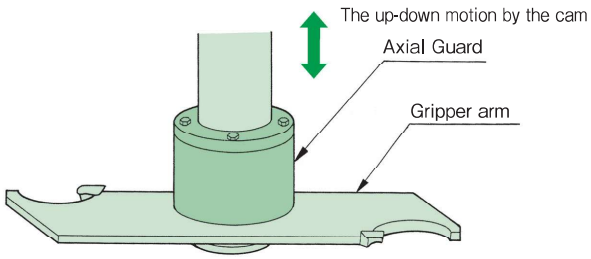
It is installed at the torque arm rotation-prevention portion of the shaft-mounted reducer.
When overload occurs and the moment is higher than the preset value, the Axial Guard trips.

Crank mechanism



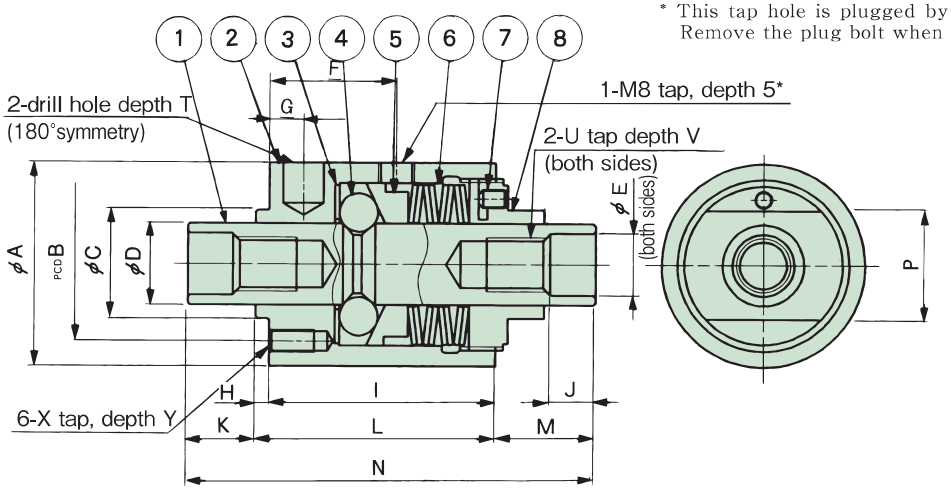
The combination of the crank and Cam Clutch motion sends the wire rod. When a foreign object gets caught up in the machine or the wire rod is deformed, overload occurs and the Axial Guard trips, thus protecting the feed portion.

The machining center's gripper

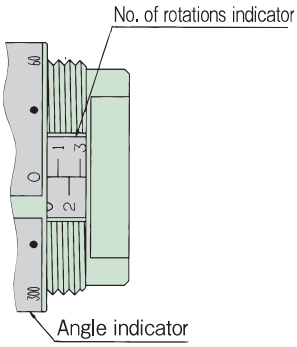


When a tool is being changed, the gripper portion is driven in the axial direction by the cam mechanism. When a tool gets caught up or the gripper hits the obstacle, the Axial Guard trips, thus protecting the cam and gripper from damage.

Transmissible capacity/dimensions



* This tap hole is plugged by plug bolt before shipment. Remove the plug bolt when installing the sensor.



This diagram displays the min. load (O point).

① Slide shaft ⑤ Plate
② Case ⑥ Disk spring
③ Side plate ⑦ Hexagon socket head set screw (TGA65 is M3X5, TGA 150 to 350 is M4X8)
④ Drive ball ⑧ Adjustable screw

Model No.

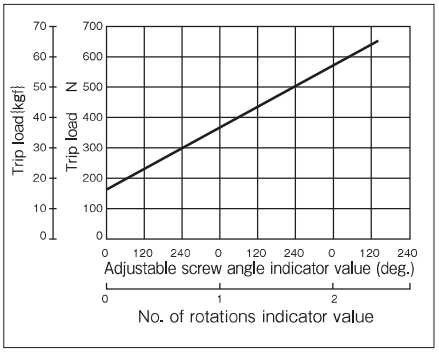
TGA 65

- Max. set load(kgf): 65, 150, 250, 350 (4 types)
- Series name

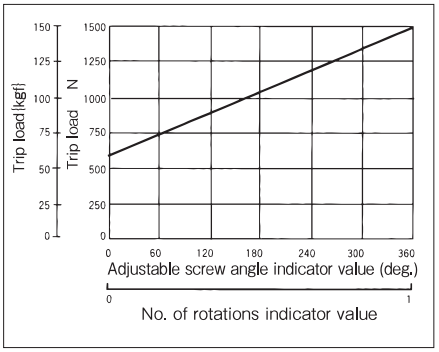
Unit : mm

Model No.	Trip load set range N	A	B	C h7	D	E H7	F	G	H	I	J	K	L	M	N	P	S	T	U	V	X	Y	Mass kg
TGA65	147 to 637	33	23	14	10	7	22.5	5	2	40	5	5	42	11	58	16	5	7.5	M 6	7	M3	6	0.2
TGA150	588 to 1470	38	28	18	14	10	24	6	2	43	7	8	45	19	72	21	7	8	M 8	10	M4	8	0.4
TGA250	735 to 2450	45	34	24	18	14	28	7.5	3	50	10	15	53	22	90	24	8	9	M12	14	M5	10	0.7
TGA350	980 to 3430	56	44	28	22	16	34	9	3	63	10	20	66	24	110	30	10	12	M14	15	M6	10	1.2

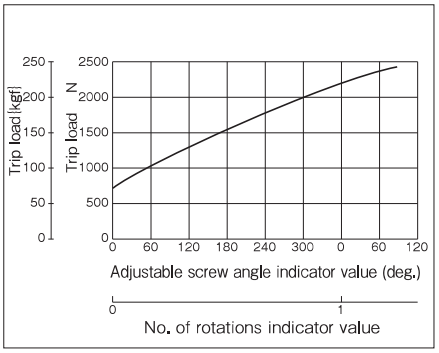
Load Curve (Tightening Amount-Load Correlation Diagram)



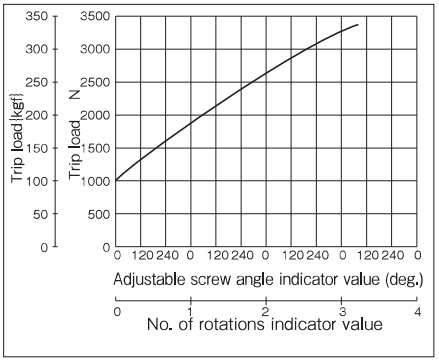
TGA65



TGA150



TGA250



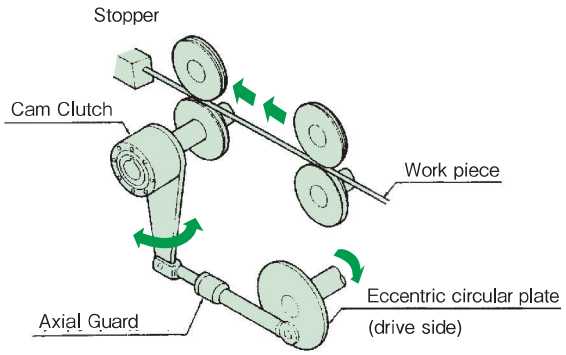
TGA350

Guide to calculating load

In order for the Axial Guard to be most effective as a safety protection device, install it on the driven side in the area where overload is most likely to occur.

Determining trip load

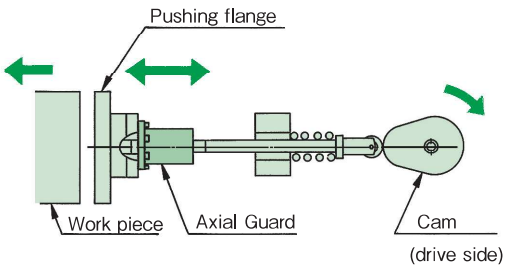
From the machine's strength and load, as well as other information, set the trip load at the point where it should not go any higher. When the limit value is not clear, it is decided by the load calculation (refer to the example below). As the low load on the equipment gradually increases, determine the appropriate set load.



This is an example of the combination of the crank and Cam Clutch motion sending the wire rod intermittently.
The following is a checklist of items for calculating load:

- The generated load due to the acceleration velocity of the drive side's crank motion.
- The impact load when hitting the work piece
- The load when machining the work piece
- Friction between each part

In addition, after checking the strength of each part, carry out a working load estimation for the Axial Guard.



This is an example of pusher actuation by the cam mechanism.

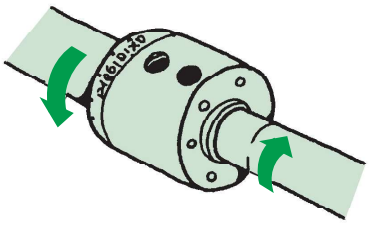
- The generated load is due to drive side cam acceleration velocity
- The impact load when hitting the work piece
- The generated load when pushing the work piece
- The friction when pushing the work piece

In addition, after checking if the work piece has been deformed and verifying the strength of each part, carry out a working load estimation for the Axial Guard.

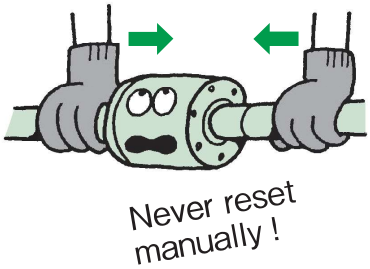
Caution

1 For most situations, avoid using the Axial Guard with human transportation or lifting devices. If you decide to use an Axial Guard with these devices, take the necessary precautions on the equipment side to avoid serious injury or death from falling objects.

2 For the Axial Guard, the case and slide shaft can rotate independently based on each shaft center. In the case that the prevention of independent rotation during operation is required, refer to page 73.

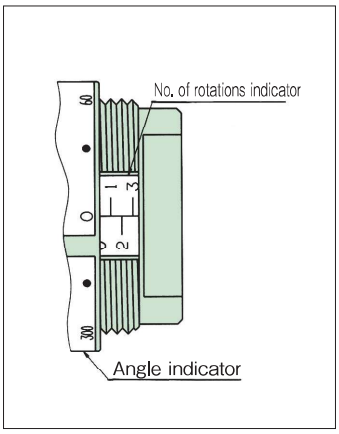


3 When resetting, the slide shaft or case rapidly/suddenly moves in the shaft direction, causing mechanical shock. Therefore, do not reset the Axial Guard by hand or touch it directly.



How to set the trip load

1 All Axial Guards are shipped with the load set at the minimum point (min. load). Confirm that the number of rotations indicator and angle indicator are set at "0". (Refer to the diagram on the right)



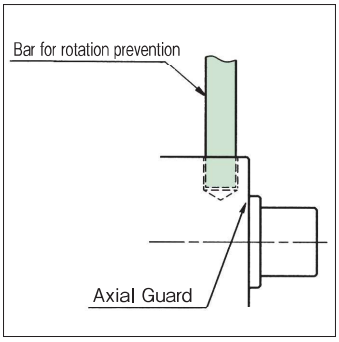
The No. of rotations indicator displays how many times the adjustable screw has rotated from the minimum load. If the end face of case is between 0 and 1, it indicates less than 1 rotation (less than 360°). As well, the angle indicator indicates how many degrees the adjustable screw has turned. The degree amount is indicated by the center line of the No. of rotations indicator. The total of the adjustable screw's number of rotations (1 rotation=360°) and angle indicator is the rotation angle of the adjustable screw.
(Example)
If the No. of rotations indicator is between 0 and 1, and the angle indicator shows 180°, the adjustable screw is turned to 180° position from minimum torque.

2 Loosen the hexagon socket head set screw to prevent loosing of adjustable screw.

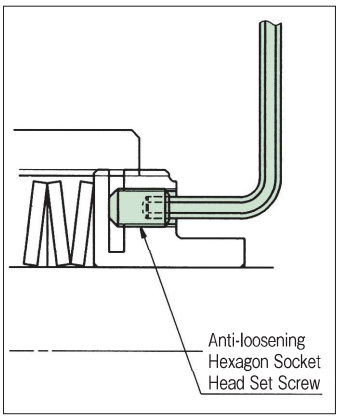
3 From the information in the "Tightening Amount - Load Correlation Diagram" on page 100, find the tightening angle of an equivalent adjustable screw for the predetermined trip load. Tighten to 60° less than the predetermined angle.

4 Next, carry out a load trip test. Gradually tighten to optimal trip load and set.

5 When the load has been set, tighten the hexagon socket head set screw to prevent loosing of adjustable screw portion, and verify that the adjustable screw is locked. (Refer to the diagram on the right)



When turning the adjustable screw, to prevent the Axial Guard from turning together with the adjustable screw, insert the bar into the drilled hole at the outer diameter of the cover.

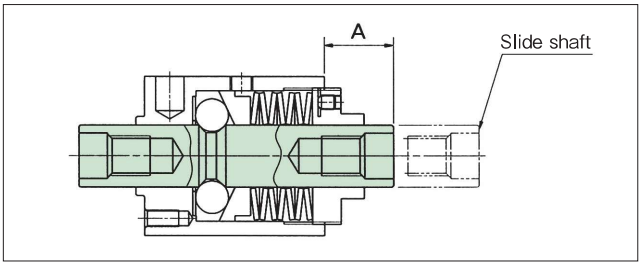


Reset

1 Before resetting, stop the machine and remove the cause of overload.
2 It is reset automatically when restarting the drive side (motor) to reverse load direction of trip direction. Turn the input (motor) using low rpm or inching. The axial load that is necessary for resetting is listed in the chart on the right.
3 When the Axial Guard resets, it makes a distinct "click" sound. To check whether the Axial Guard has reset, refer to dimension A in the diagram on the right.

Model No.	* Axial direction load for reset	Dimension A when resetting
TGA 65	83 N{8.5 kgf}	11
TGA150	196 N{20 kgf}	19
TGA250	343 N{35 kgf}	22
TGA350	490 N{50 kgf}	24

* At Max. load

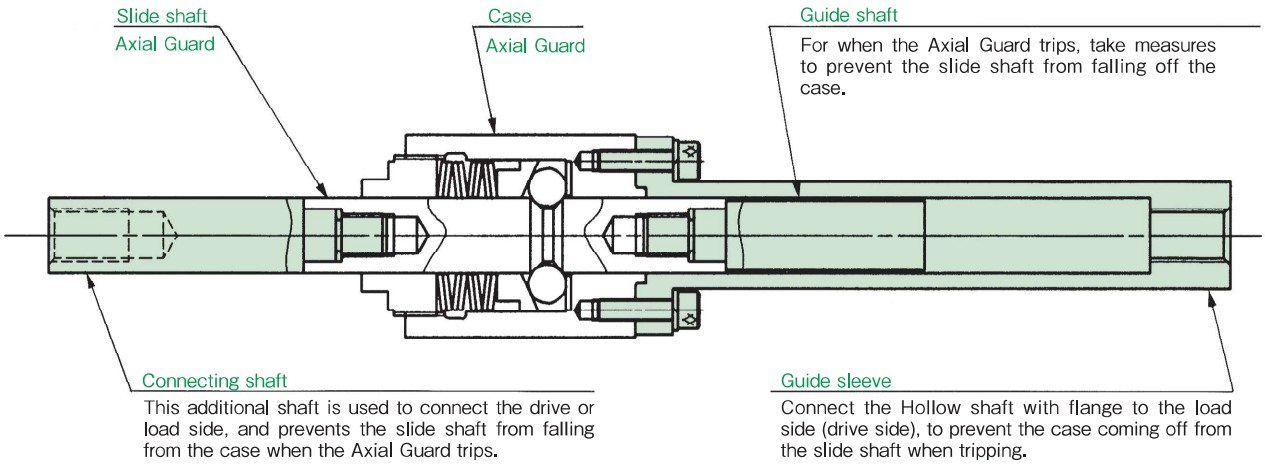


Caution

When resetting, the slide shaft or cover rapidly moves in the axial direction, causing mechanical shock. Therefore, do not reset by hand or directly touch the Axial Guard.

Auxiliary parts

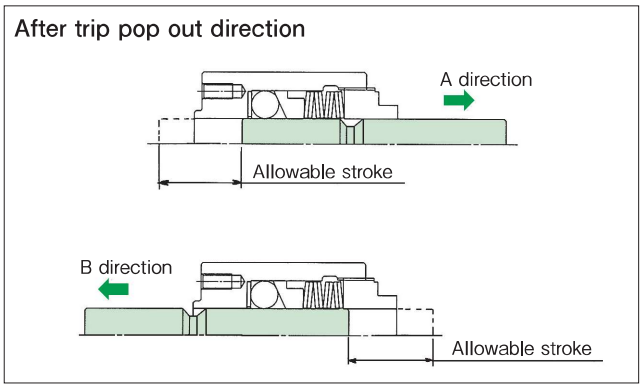
By incorporating the auxiliary parts in the below diagram, it is easier to use the Axial Guard.

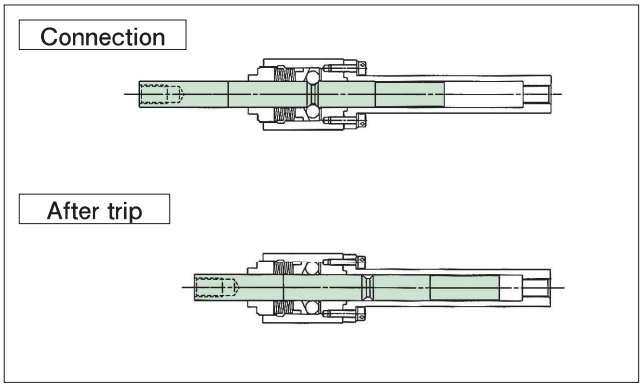


Axial Guard allowable stroke (Axial Guard unit only)

If the Axial Guard exceeds the stroke limits from the table below, the slide shaft will come out. In this case, the ball will fall out and the Axial Guard's functions will be lost. If after tripping the stroke is more than what is listed in the below table, connect the connecting and guide shafts.

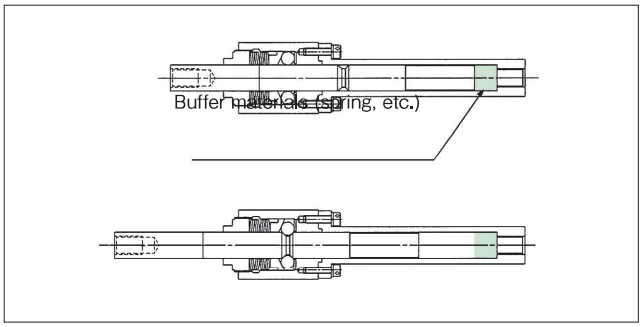
Model No.	TGA65	TGA150	TGA250	TGA350
A direction allowable stroke	14	20	30	38
B direction allowable stroke	14	22	24	26





1. The mechanical stop limits stroke after trip

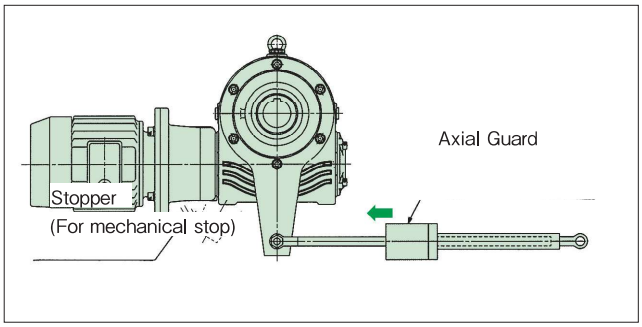
In the case of stopping the stroke at a certain position by sensor detection when tripping, it will become necessary to use a backup mechanism for stopping.
Install a spring or other such buffer material to absorb the stroke.



2. When installing at shaft-mounted reducer tie rod

This is an example of the application being used for shaft-mounted reducer torque arm as an overload protection device. Load direction is rotational direction, and the reducer rotates when tripping. Because of the reducer rotation, after the sensor detects overload and stops the motor, it stops mechanically at a certain position.

* For possible applications and model numbers, contact TEM.

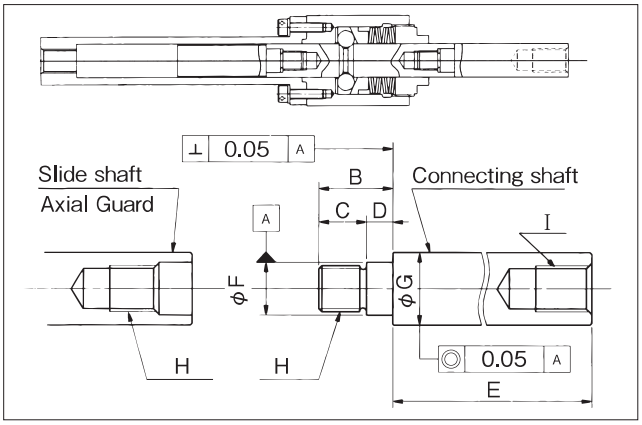


Recommended manufacturing dimensions for auxiliary devices

When installing a connecting shaft, guide shaft, guide sleeve or bolt to an Axial Guard, apply an adhesive for metal to the threaded portion to prevent loosening. (Loctite, etc.) (TEM recommends Loctite 262.)

1. Guide shaft, connecting shaft

Use the tap hole at the end face of the slide shaft to connect the guide and connecting shafts. The recommended dimensions of the connecting portion are in the diagram below.

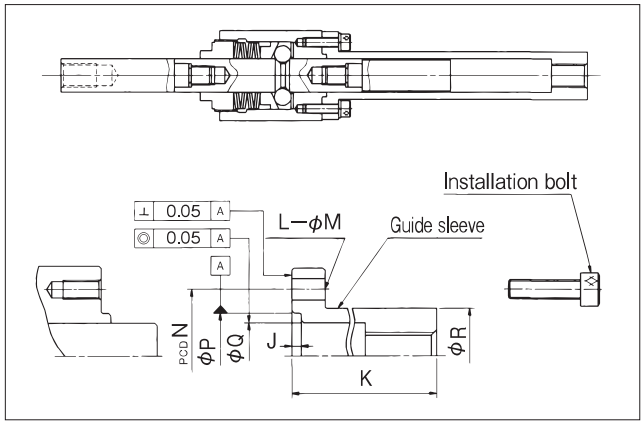


Model No.	B (0 / −0.2)	C (0 / −0.2)	D	E	F (h7)	G (h9)	H screw size	I * screw size
TGA65	10	6	4	Select by installation length, stroke, etc.	7	10	M6 × P1.0	M6 × P1.0
TGA150	15	9	6		10	14	M8 × P1.25	M8 × P1.25
TGA250	22	13	9		14	18	M12 × P1.75	M12 × P1.75
TGA350	23	14	9		16	22	M14 × P2.0	M14 × P2.0

* Not necessary for guide shaft

2. Guide sleeve

Use the tap holes at the end face of the case to connect the case and guide sleeve. The recommended dimensions of the connecting portion are in the diagram below.



Model No.	J (+0.2 / 0)	K	L	M	N	P (H7)	J (+0.2 / 0)	C (0 / −0.2)
TGA65	2.5	Select by installation length, stroke, etc.	6	3.4	23	14	10.5	16
TGA150	2.5		6	4.5	28	18	14.5	20
TGA250	3.5		6	5.5	34	24	18.5	24.5
TGA350	3.5		6	6.6	44	28	22.5	31

Installation

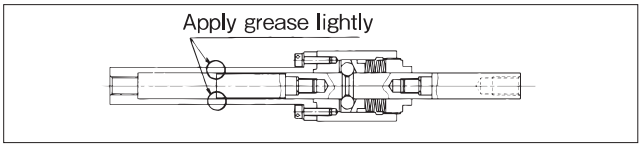
1. Installing to the machine

(1) Before installing the Axial Guard to the machine, completely wipe off any dust or dirt from the slide shaft, the spigot facing of the case and taps.

(2) Next, connect the slide shaft and the case tap portion. TEM recommends an adhesive for metals be applied to the tap portion or the bolt outer diameter to prevent any loosening. (Loctite 262 recommended)

(3) Make sure not to fix both the Axial Guard slide shaft side and the case side when installing the Axial Guard. The Axial Guard has no coupling function, so if it is installed too rigidly it will not properly function, potentially causing a malfunction or machine damage.

(4) When the guide sleeve and guide shaft are connected to the Axial Guard there is a possibility that the inner diameter of the guide sleeve and the outer diameter of the guide shaft end face may interfere. Just in case, apply grease to the portion on the diagram below. (Refer to the maintenance section on page 106 for information about grease brands.)



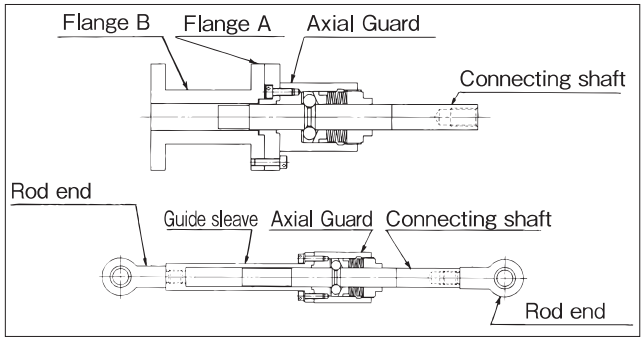
* When the Axial Guard is installed vertically, (lengthwise direction) grease may leak through the gap between the slide shaft and case or the adjustable screw. To avoid any problems, make sure to replenish grease at frequent intervals. (Refer to page 106 for maintenance information)

* Do not use the Axial Guard if there is a possibility that a falling accident of the drive or load side may occur when tripping. Such an accident may lead to serious injury or machine damage.

2. Overload detection

When using the Axial Guard, make sure to combine it with the sensor mechanism to ensure that overload can be properly detected. (Refer to page 105 for overload detection information)

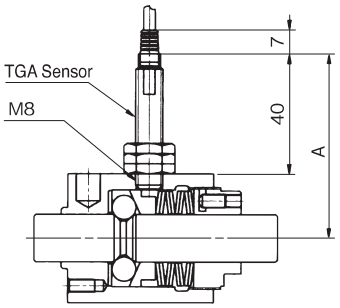
Installation example



Overload detection

When using the Axial Guard make sure to use the TGA Sensor to detect trip during overload.

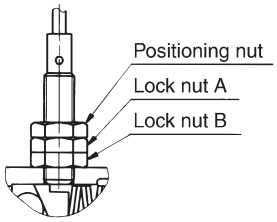
TGA Sensor installation example



Unit : mm

Model No.	A	Thread depth
TGA65	52	4.5
TGA150	54.5	
TGA250	58	
TGA350	63.5	

* This tap hole is plugged by plug bolt before shipment. Remove the plug when installing the sensor.



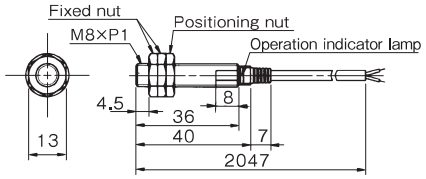
Fix the TGA Sensor to the case by screwing it into the tap holes. After fixing the sensor to the case, screw on lock nut A last to make it lock in place (double nut).
(The positioning nut is glued with an adhesive, so do not forcibly rotate it.)

■ TGA Sensor Specifications

		AC type	DC type
Model No.		TGA − S8	TGA − S8D
Power supply voltage	Rating	AC24 to 240V	DC12 to 24V
	Possible use range	AC20 to 264V(50/60Hz)	DC10 to 30V
Current consumption		Less than 1.7mA(at AC200V)	Less than 13mA
Control output (open, close capacity)		5 to 100mA	Max. 200mA
Indicator lamp		Operation indicator	
Ambient operating temperature		− 5 to + 70℃ (no condensation)	
Ambient operating humidity		35 to 95% RH	
Output form		NC (Output open/close condition when not detecting sensor plate)	
Operation form		—	NPN
Insulation resistance		More than 50M Ω (at DC500V mega) Charge portion - Case	
Mass		Approx. 45g (with 2m cord)	
Residual voltage		Refer to characteristic data	Less than 2.0V (Load current 200mA, 2m cord length)

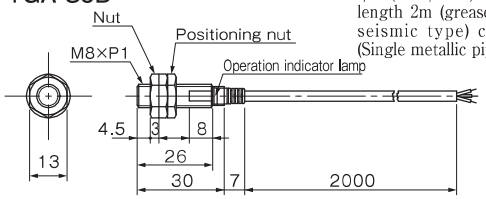
■ Measurement Diagram

●AC type TGA-S8



* Plastic insulation circle type cord φ 4 (60/ φ 0.08) 2 cores, standard length 2m (grease resistant, anti-seismic type) cord extension (Single metallic piping) max. 200m

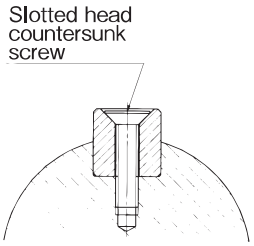
●TGA-S8D



* Plastic insulation circle type cord φ 4 (60/ φ 0.08) 3 cores, standard length 2m (grease resistant, anti-seismic type) cord extension (Single metallic piping) max. 200m

When using the TGA Sensor it is necessary to stop the slide shaft side and case side rotation. As in the diagram below, stop rotation by putting the slide key (JIS1303 - 1916) between the guide sleeve and the guide shaft. For other methods, contact TEM for more information.

Reference drawing



Like the diagram on the left, fix the slide key to the shaft with a slotted head countersunk screw (JISB1101). Screw sizes are listed below.

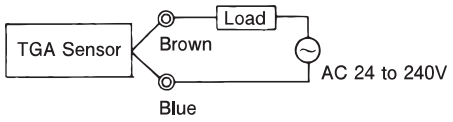
Model No.	Screw size
TGA65	M2
TGA150	M2
TGA250	M2
TGA350	M3

■ TGA Sensor handling

Refrain from striking, swinging or putting excessive force on the detecting portion.

AC type TGA-S8

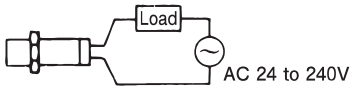
■ Circuit diagram



Not necessary to consider TGA Sensor's polarity (brown, blue)

■ Precautions for wiring

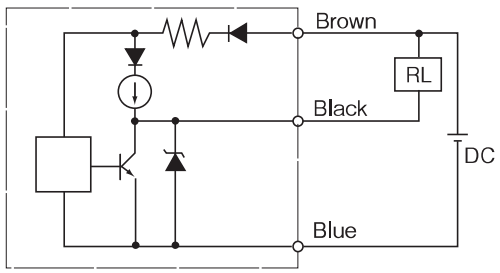
- Make sure to connect the load at first, then turn on the power. If the power is turned on without connecting the load, it will be damaged.



- In order to prevent malfunction or damage due to surge or noise, insert the TGA sensor code in a individual piping when it runs close to the power cable.

DC type TGA-S8D

■ Circuit diagram



■ About choosing load and wiring

• Connecting to the power source

Make sure to connect to the power source through load. A direct connection will break the elements inside.

• Metal piping

In order to prevent malfunction or damage, insert the proximity switch code inside a metal pipe when it runs close to the power cable.

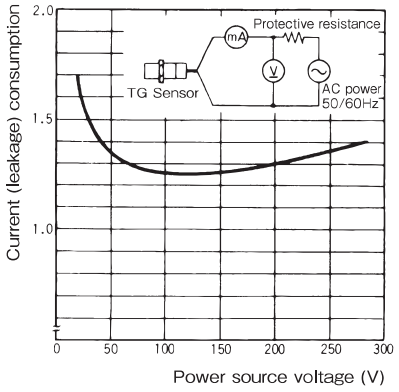
• Surge protection

In the case where the TGA Sensor is near a device that generates a large surge (motor, welding machine, etc.), the TG Sensor contains a surge absorption circuit, but also insert a varistor to the source.

• The effect of current consumption (leakage)

Even when the TGA Sensor is OFF a small amount of current continues to flow to keep the circuit running. (Refer to the "Current Consumption (leakage) Graph".) Because of this, a small voltage occurs in the load that can sometimes lead to reset malfunction. Therefore, confirm that the voltage of the load is less than the reset voltage before use. As well, if using the relay as load, depending on the construction of the relay, a resonance may occur due to the current leaks when the sensor is OFF.

Current (leakage) Consumption Characteristics



• When power voltage is low

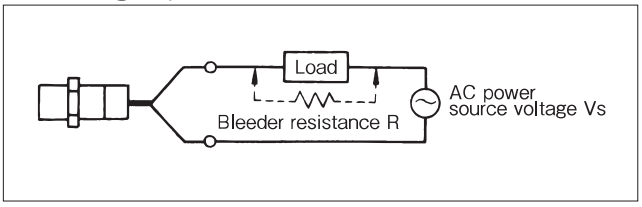
When power source voltage is lower than AC48V and load current is less than 10mA, the output residual voltage when the TGA Sensor is ON becomes large. When it is OFF, the residual voltage of load becomes large. (Refer to "Residual Voltage Characteristics of Load".) Take caution when using the load such as a relay operated by voltage.

• When load current is small

When load current is smaller than 5mA, residual voltage of load becomes large in the TGA Sensor. (Refer to "Residual Voltage Characteristics of Load".) In this case, connect the breeder resistance with load parallel, apply load current at more than 5mA, and set the residual voltage less than return voltage of load. Calculate the breeder resistance and allowable power using the following calculations. TEM recommends to use 20k Ω at AC100V and more than 1.5W (3W), and 39k Ω at AC200V and more than 3W (5W) for safe. (If heat generation becomes a problem, use the Wattage shown in ( ).

$$R \leqq \frac{V}{5-i}\ (k\Omega) \qquad P \geqq \frac{V^2 s}{5-i}\ (mW)$$

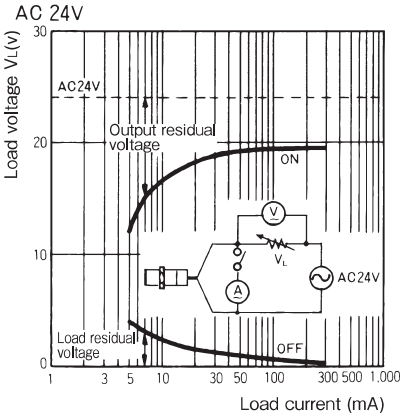
P : Wattage of breeder resistance
i : Current applied to the load (mA)

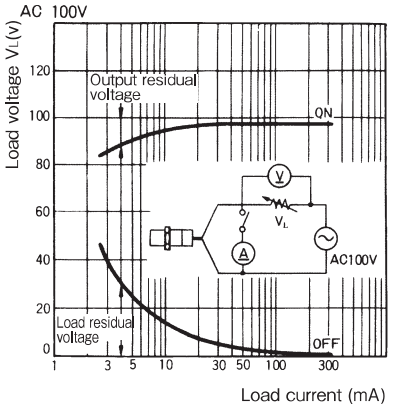


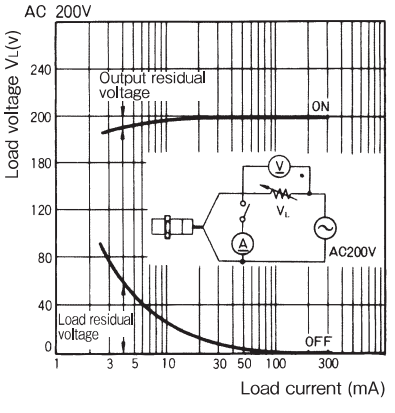
• Load with large inrush current

As for the load with large inrush current (1.8A and above) such as a lamp or motor, the opening and closing element can be deteriorated or be broken. In this case, use along with a relay.

Load Residual Voltage Characteristics







Maintenance

The Axial Guard is packed in grease for shipment. Add the grease shown in the right table once a year or every 100 trips.

Kyodo Oil	Sumitomo Lubricant	Dow Corning Toray	STT
Grease HD	Low temp grease	Molykote 44MA Grease	Solvest 832

MEMO