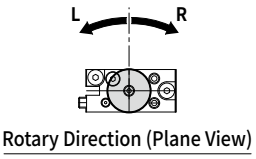
## Specification

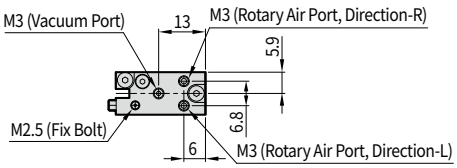
| Item Name | PPR10 | PPR13 |
|---|---|---|
| CYL Bore Size(mm) | 10 | 13 |
| Rotating Angle(° ) | 90, 180 | |
| Theoretical Torque(kgf·cm)<br>P : Air Pressure(kgf/㎠) | 0.17×P | 0.4×P |
| Fitting Size | M3 | M5 |
| Weight(kgf) | 0.065 | 0.19 |
| Buffering Stroke(mm) | 2 | 2 |
| Fluid | Clean Air Note 1) | |
| Pressure Range(kgf/㎠) | 3.5 ~ 7 Note 2)<br>(Guaranteed Resist Pressure : 10.5) Note 3) | |
| Lubrication | Not Need (If need, use one sort of turbine oil : SPEC ISOVG 32) | |
| Temperature Range(℃) | 5 ~ 60 | |
| Operation Type | Double Acting | |
| Rotation Accuracy(° ) | ± 0.5 | |

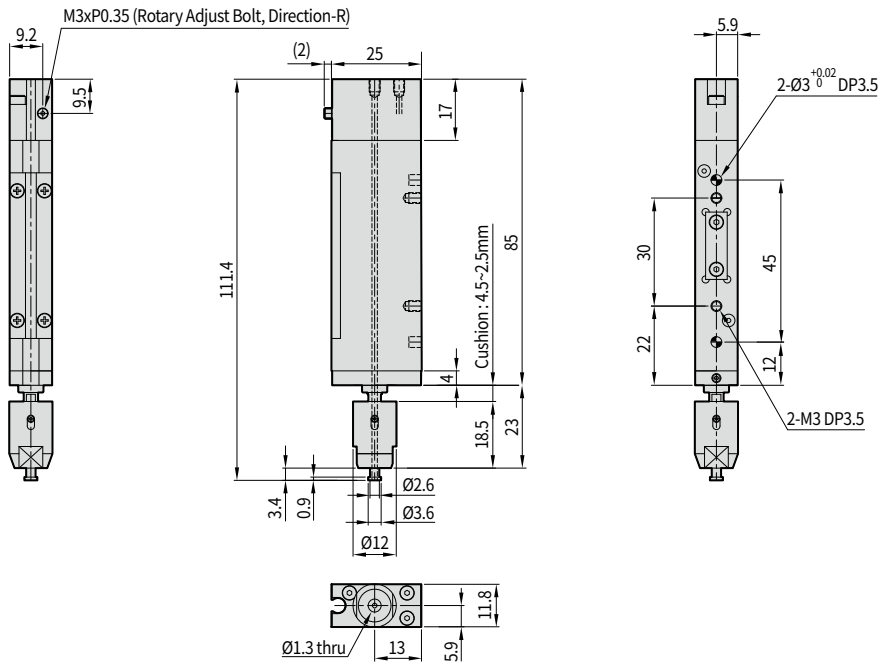
Note 1) Clean Air : Fresh air containing solid matters with 0.3% of supersaturated moisture and 99.9% of liquid oil that passed through the 3~10㎛ degree of filtering.
Note 2) Using less than 3.5kgf/㎠ air pressure might not normally operate. Make sure to observe the operating air pressure.
Note 3) Guaranteed Resist Pressure : A pressure that does not cause an abnormality in parts when it is applied for 1 minute without any weight loaded.

## PPR10

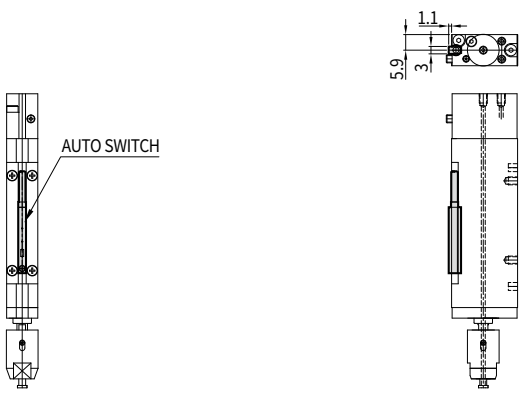



Rotary Direction (Plane View)

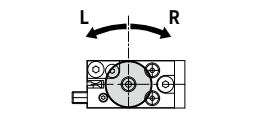


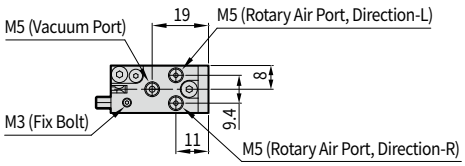

## PPR10 Example of Auto Switch installation

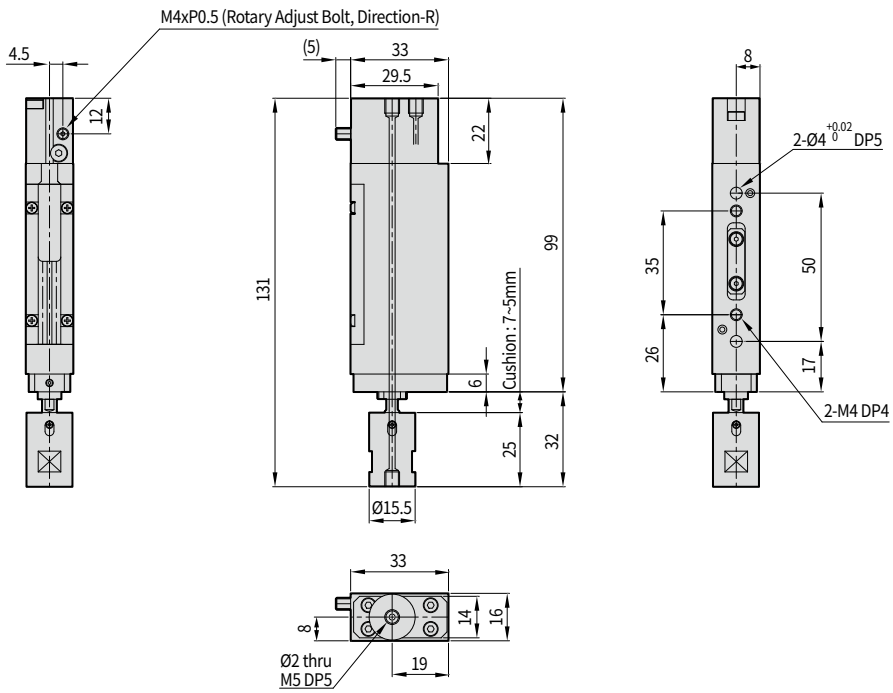


## PPR13




Rotary Direction (Plane View)

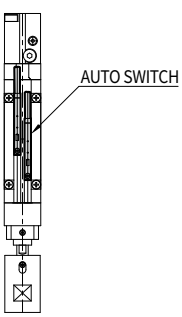


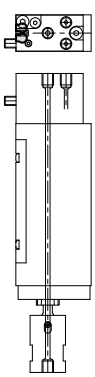







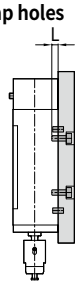
## PPR13 Example of Auto Switch installation



## Installation Information

### 1. Installation by body tap holes




| Item | Fastening Bolt | Max Torque (kgf·cm) | Max Bolt Length L (mm) |
|---|---|---|---|
| PPR10 | M3×P0.5 | 11 | 3.5 |
| PPR13 | M4×P0.7 | 25 | 4 |

### 2. Connector assembling part


| Item | Fastening Bolt | Max Torque (kgf·cm) |
|---|---|---|
| PPR10 | M4×P0.7 | 25 |
| PPR13 | M5×P0.8 | 51 |

MEMO

PICK UP CYLINDER / LINEAR GUIDE

# PPRL Series

New release! Ø6 model & Long Stroke!

## Features

- Miniature pick up cylinder with rotary and up-down function by compressed air.
- Suitable for handling which required pickup and rotate for small workpiece such as IC chips and electronic components .
- Miniaturization, lighten and generalization type by slim body.
- Minimized backlash by external stopper mount.
- Simplified structure can be composed by adding Up & Down function to PPR series.
- Auto Switch installation. (Optional)

## Order Form

**PPRL 10 A - 90 - 10 - A2N L S**

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

① Series Name

② Cylinder Bore Size

⑤ Standard Strokes

⑥ Available Auto Switches

| Order | CYL Bore(mm) | Order (=Standard Strokes(mm)) | Order | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | A2C | A2N | A2V | B2 | B2B | B3B | B3C | PC |
| 06 | 6 | 10, 20 | | | | | | | | ○ |
| 10 | 10 | 10, 20, 30 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | |
| 13 | 13 | 10, 20, 30 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | |

※ For "Blank", no Auto Switch is provided.

③ Magnetic Position for Linear Motion

| Order | Magnetic Position |
|---|---|
| A | Lower position |
| B | Upper position |

* This option is for minimize interruption of magnetic trouble when using more than 2 PCS of products usage as close installation.
* It is recommended different magnetic position select to avoid sensing error.

④ Rotating Angle

| Order | Rotating Angle(°) |
|---|---|
| 90 | 90 |
| 180 | 180 |

⑦ Magnetic Auto Switch Cable Length

| Order | Cable Length |
|---|---|
| Blank | 1M |
| L | 3M |

⑧ Auto Switch Quantity

| Order | Quantity |
|---|---|
| Blank | 2PCS |
| S | 1PCS |
| 3 | 3PCS |
| 4 | 4PCS |

※ Maximum Auto switch quantity for each models

| Model | Sensing for | | Maximum Qty |
|---|---|---|---|
| | Rotate | Up-Down | |
| PPRL06 | 1PCS | 1PCS | 2PCS |
| PPRL10 | 1PCS | 2PCS | 3PCS |
| PPRL13 | 2PCS | 2PCS | 4PCS |

* Using less than 90°, only one(1) auto switch can be used for rotation sensing.

※ Magnetic Auto Switch Specification

| Order | Sensing Type | Cable Spec | | Voltage | | Current | | Protect Level | Operation Time |
|---|---|---|---|---|---|---|---|---|---|
| | | Wires | Direction | AC | DC | AC | DC | | |
| A2C | Magnetic reed switch | 2-Wire | Horiz | 100V | 24V | 5~20mA | 5~40mA | IP 67 | 1ms |
| A2N | Magnetic reed switch | 2-Wire | Horiz | 100V | 24V | 5~20mA | 5~40mA | IP 67 | 1ms |
| A2V | Magnetic reed switch | 2-Wire | Ver | 100V | 24V | 5~20mA | 5~40mA | IP 67 | 1ms |
| B2 | Magnetic solid state | 3-Wire | Horiz | - | 24V (5~28V) | - | Less than 50mA | IP 67 | 1ms |
| B2B | Magnetic solid state | 2-Wire | Horiz | - | 24V (10~28V) | - | Less than 50mA | IP 67 | 1ms |
| B3B | Magnetic solid state | 2-Wire | Ver | - | 24V (10~28V) | - | Less than 50mA | IP 67 | 1ms |
| B3C | Magnetic solid state | 3-Wire | Ver | - | 24V (5~28V) | - | Less than 50mA | IP 67 | 1ms |

* Be careful of projection for vertical wire exposed type Auto Switch model. (Please refer technical information of Auto Switch)

※ Proximity Auto Switch Specification

| Order | Sensing Type | Cable Spec | | Voltage | Current | Body Length | Sensing Distance | Frequency | Protect Level |
|---|---|---|---|---|---|---|---|---|---|
| | | Wires | Direction | DC | | | | | |
| PC | Proximity | 3-Wire | Horiz | 10~30V | Max 50mA | 27.1mm | 0.8mm±10% | 5kHz | IP 67 |



## Specification

| Item Name | | PPRL06 | | PPRL10 | | | PPRL13 | | |
|---|---|---|---|---|---|---|---|---|---|
| CYL Bore Size(mm) | Rotate | 6 | | 10 | | | 13 | | |
| | Up-Down | 6 | | 8 | | | 8 | | |
| Stroke(mm) | | 10 | 20 | 10 | 20 | 30 | 10 | 20 | 30 |
| Rotating Angle(°) | | 90, 180 | | | | | | | |
| Theoretical Thrust for Up-Down(kgf) P : Air Pressure(kgf/㎠) | Forward | 0.28×P | | 0.50×P | | | 0.78×P | | |
| | Backward | 0.21×P | | 0.37×P | | | 0.50×P | | |
| Theoretical Torque(kgf·cm) P : Air Pressure(kgf/㎠) | | 0.03×P | | 0.17×P | | | 0.4×P | | |
| Fitting Size | | M3 | | | | | M5 | | |
| Weight(kgf) | | 0.11 | | 0.15 | | | 0.28 | | |
| Buffering Stroke(mm) | | 2 | | 2.5 | | | 2 | | |
| Fluid | | Clean Air Note 1) | | | | | | | |
| Pressure Range(kgf/㎠) | | 4 ~ 7 | | 3.5 ~ 7 Note 2) | | | | | |
| Lubrication | | Not Need (If need, use one sort of turbine oil : SPEC ISOVG 32) | | | | | | | |
| Temperature Range(℃) | | 5 ~ 60 | | | | | | | |
| Operation Type | | Double Acting | | | | | | | |
| Type of Guide | | L.M Guide | | | | | | | |
| Rotation Accuracy(°) | | ± 0.5 | | | | | | | |

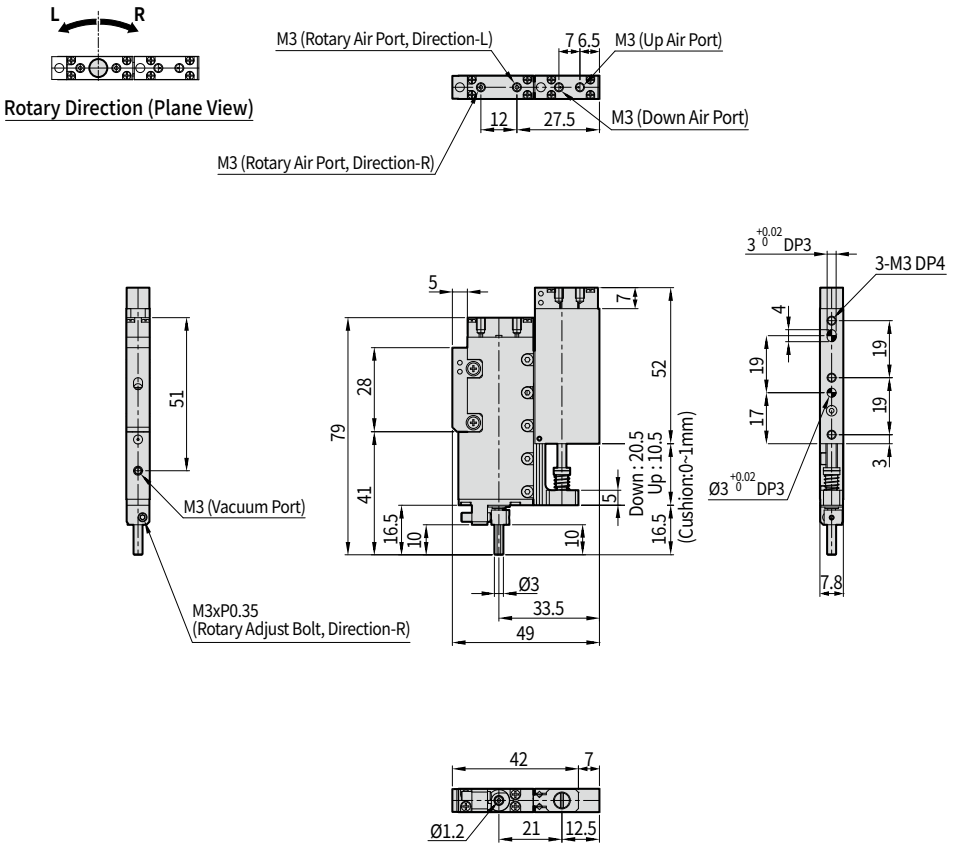
Note 1) Clean Air : Fresh air containing solid matters with 0.3% of supersaturated moisture and 99.9% of liquid oil that passed through the 3~10㎛ degree of filtering.

Note 2) Using less than operating air pressure might not normally operate. Make sure to observe the operating air pressure.

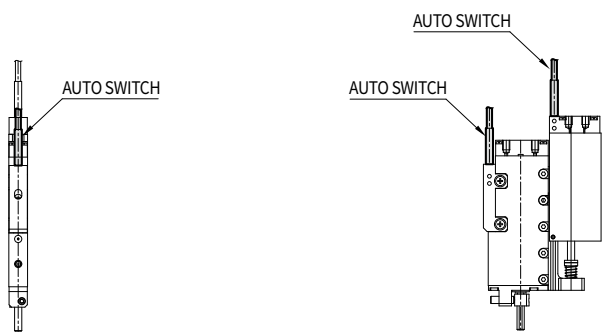
# PPRL Series



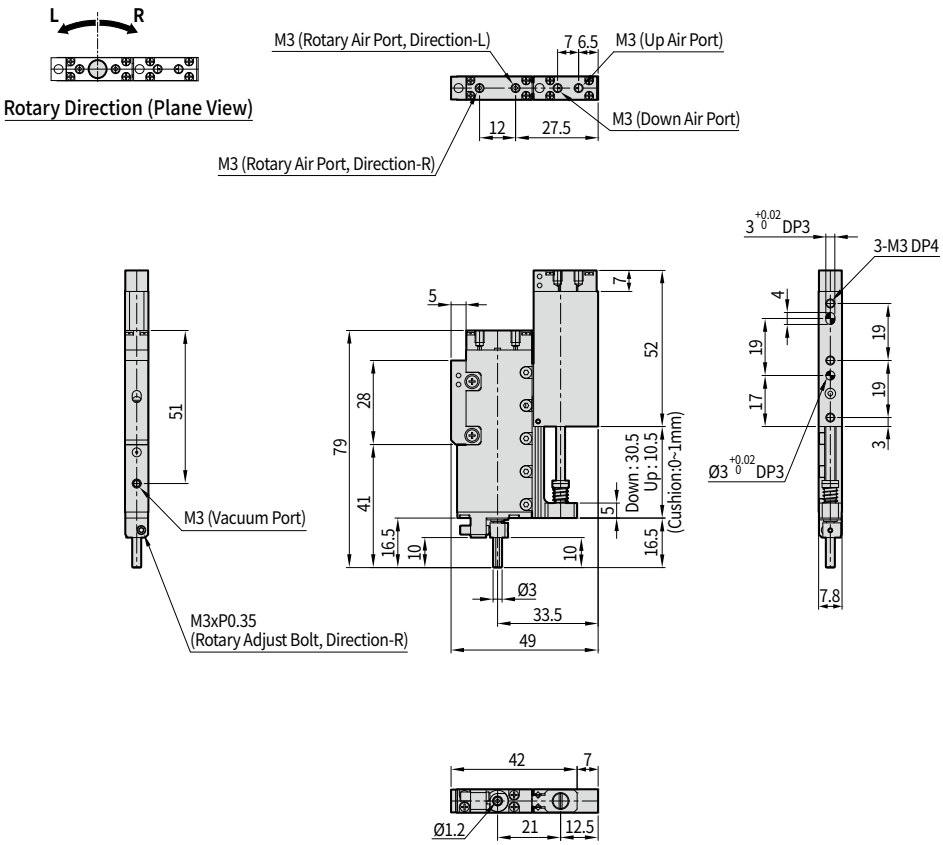
## PPRL06-10



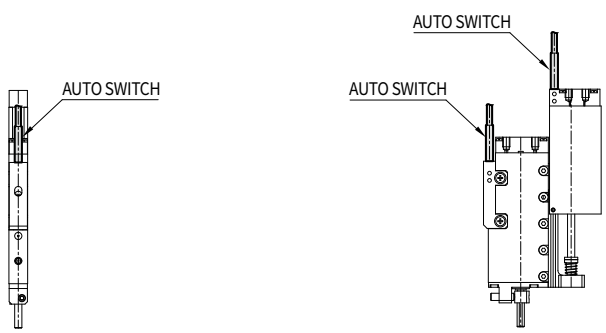

## PPRL06-10 Example of Auto Switch installation



## PPRL06-20



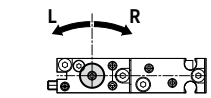

## PPRL06-20 Example of Auto Switch installation



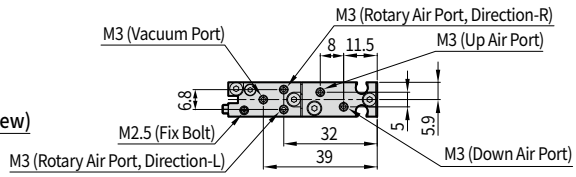
# PPRL Series

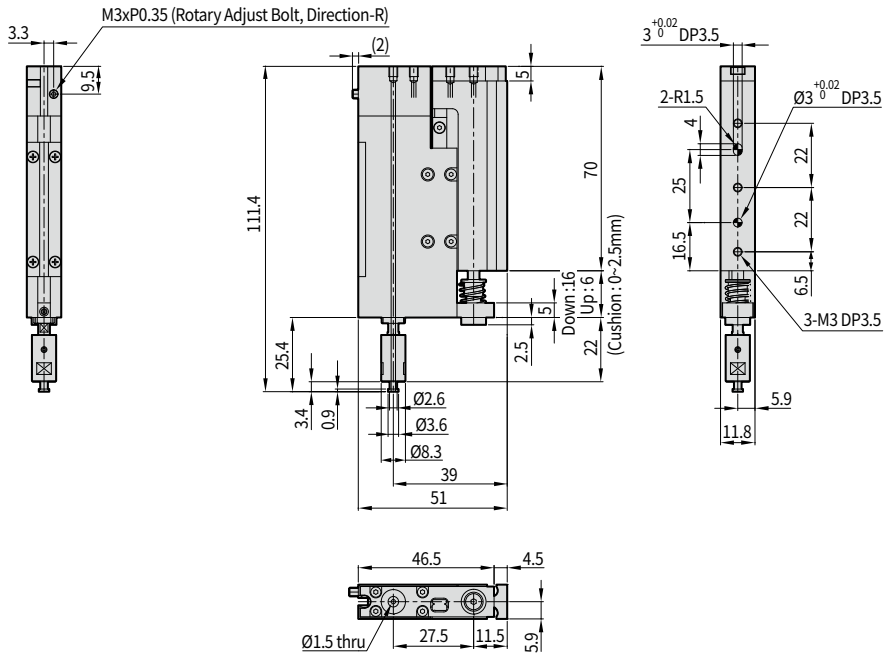


## PPRL10-10

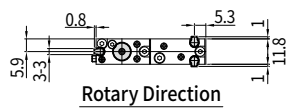



Rotary Direction (Plane View)

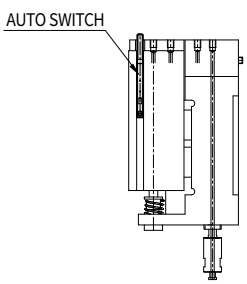


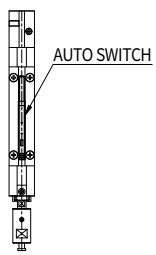

## PPRL10-10 Example of Auto Switch installation

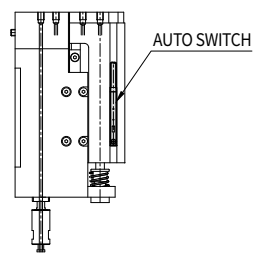



Rotary Direction



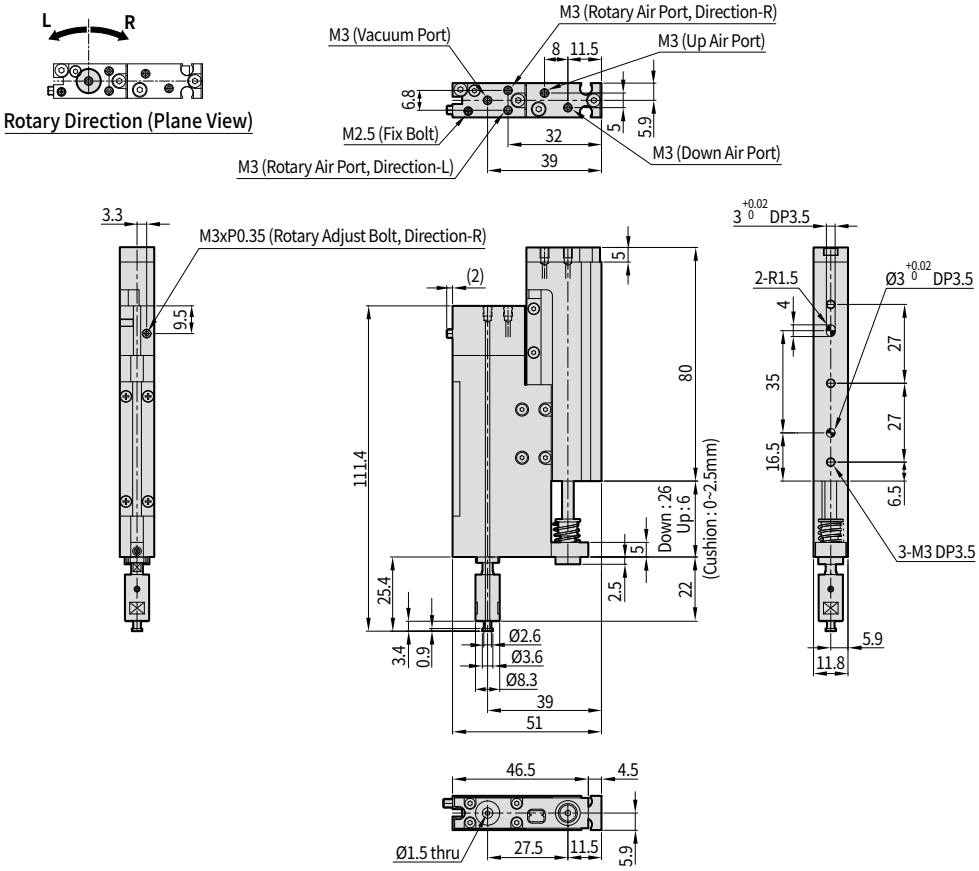

PPRL10B-10



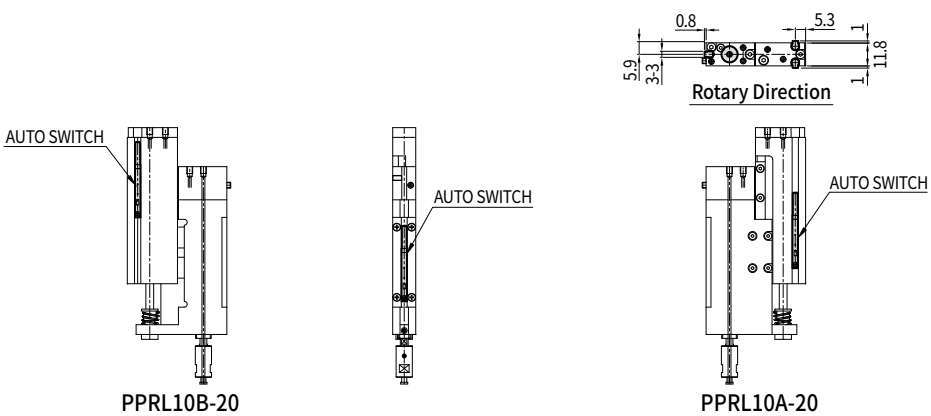




PPRL10A-10

## PPRL10-20




## PPRL10-20 Example of Auto Switch installation



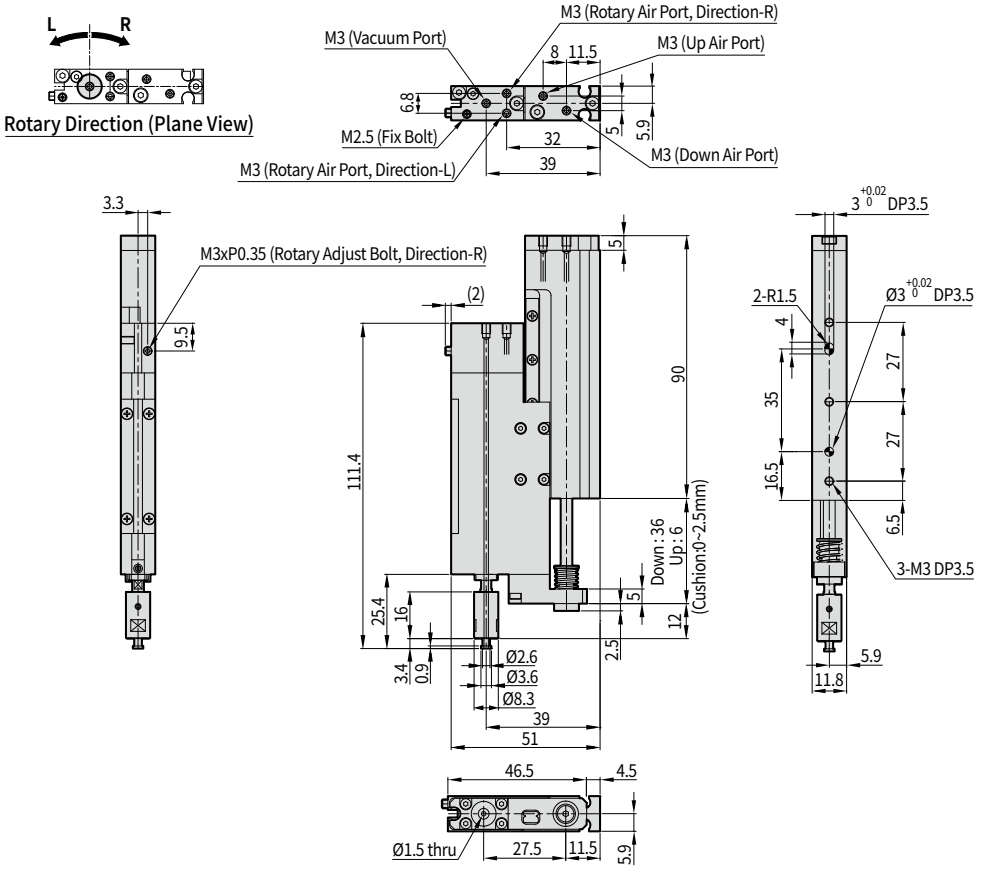

PPRL10B-20

PPRL10A-20

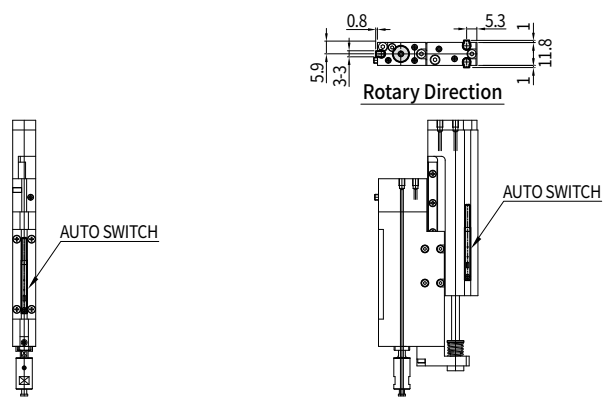
# PPRL Series

06 10 13
10 20 30

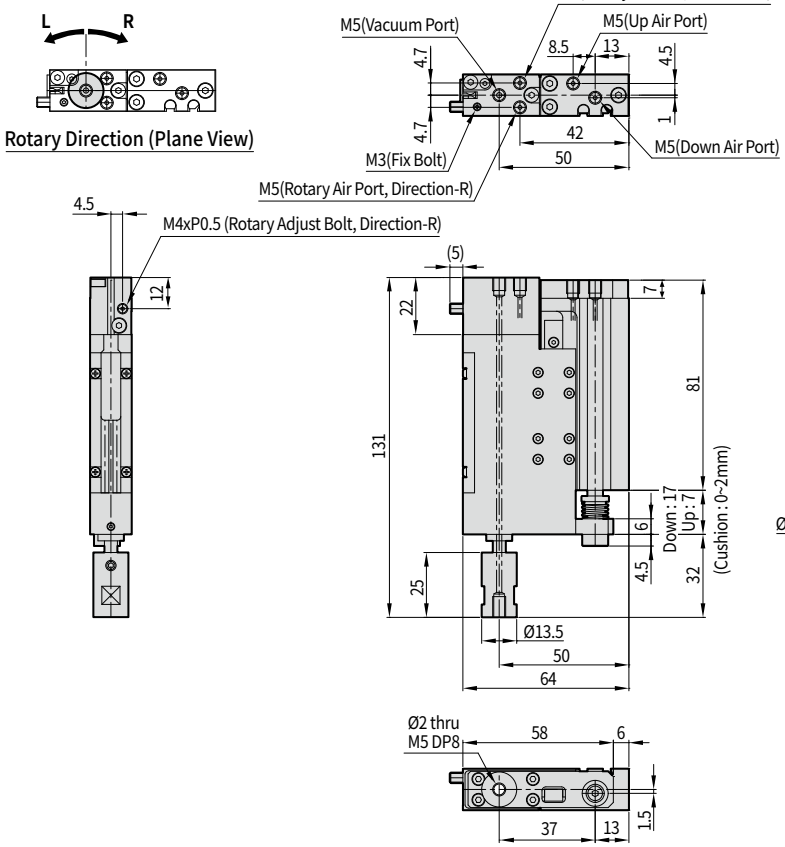
## PPRL10-30



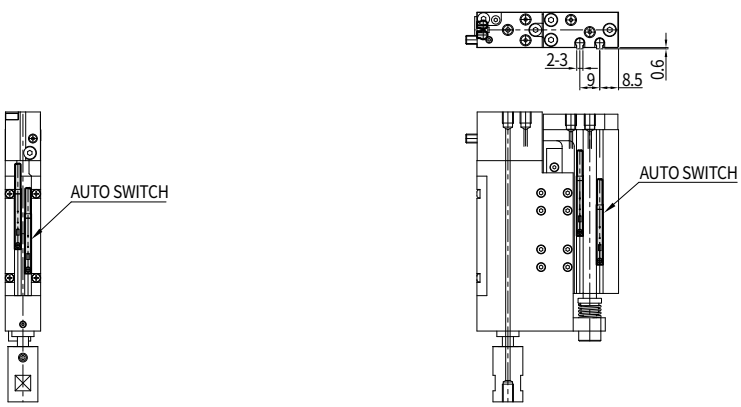

## PPRL10-30 Example of Auto Switch installation



## PPRL13-10



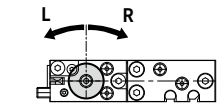

## PPRL13-10 Example of Auto Switch installation



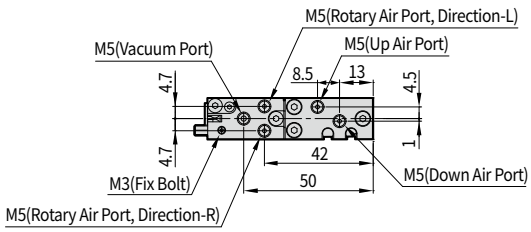
# PPRL Series

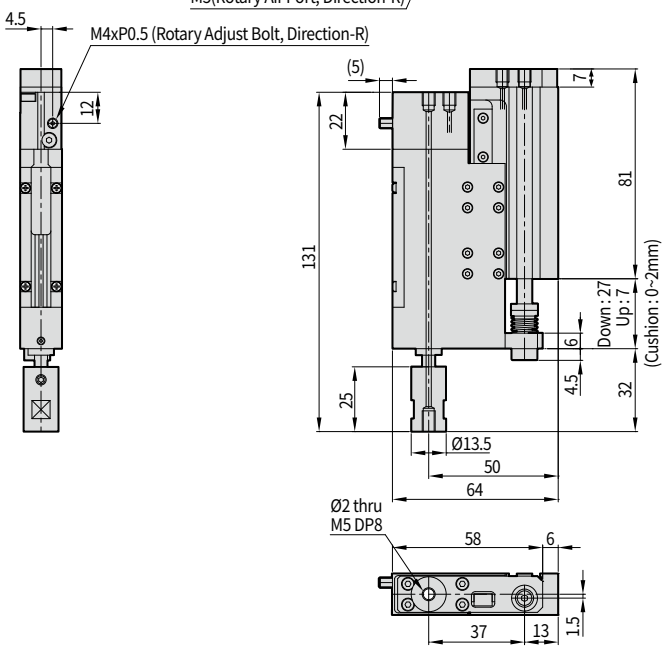


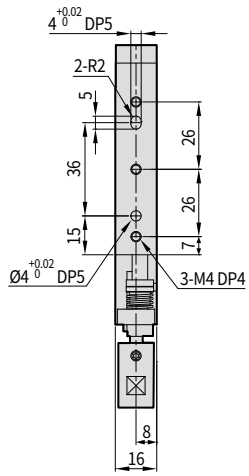
## PPRL13-20



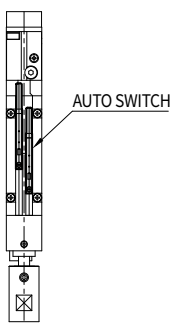

Rotary Direction (Plane View)

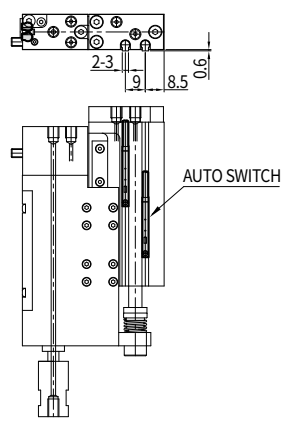


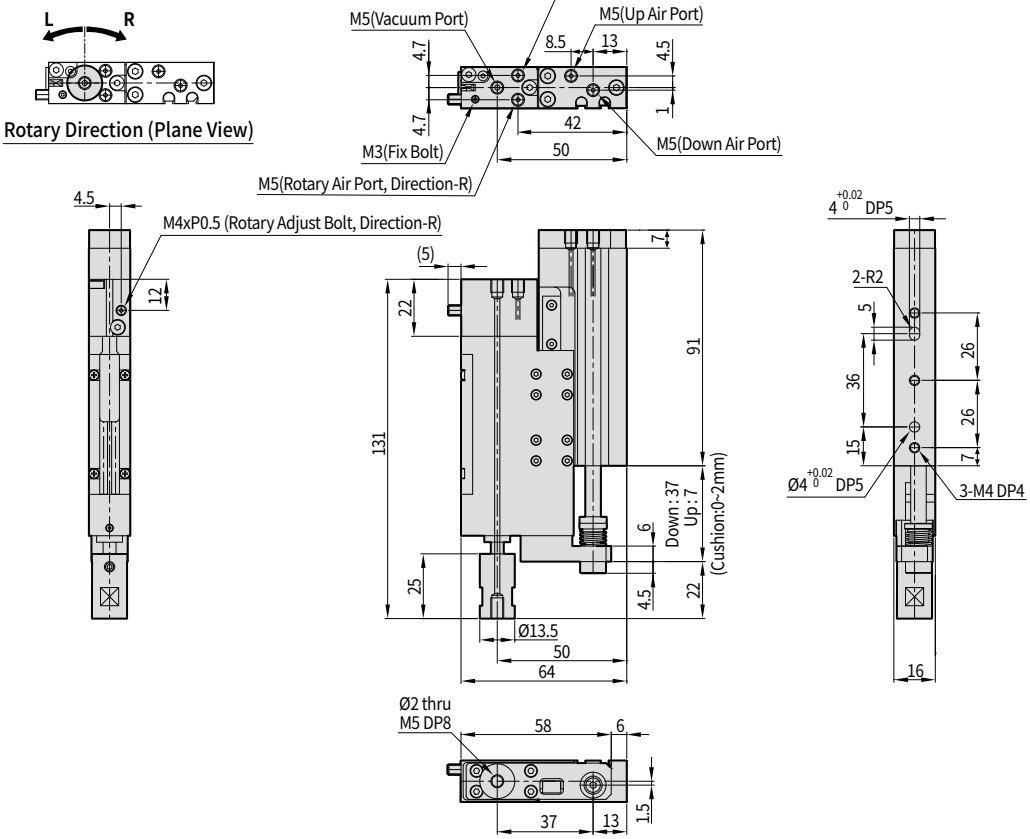




## PPRL13-20 Example of Auto Switch installation

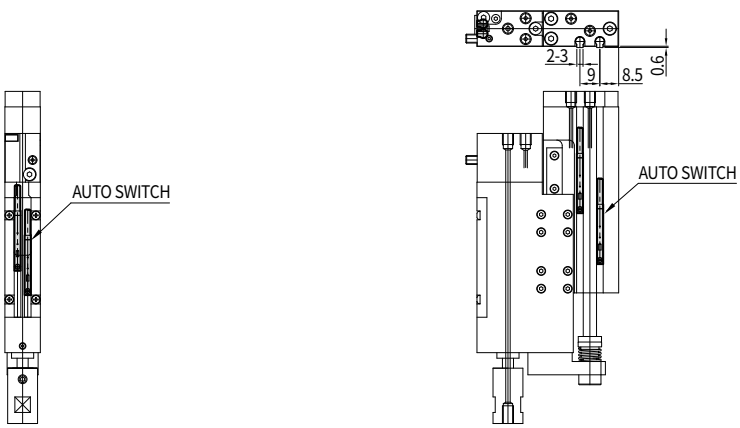


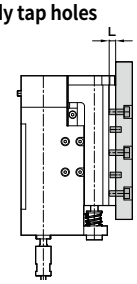
## PPRL13-30




## PPRL13-30 Example of Auto Switch installation

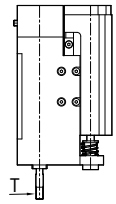


### 1. Installation by body tap holes




| Item | Fastening Bolt | Max Torque (kgf·cm) | Max Bolt Length L (mm) |
|---|---|---|---|
| PPRL06 | M3×P0.5 | 11 | 4 |
| PPRL10 | M3×P0.5 | 11 | 3.5 |
| PPRL13 | M4×P0.7 | 25 | 4 |

### 2. Connector assembling part




| Item | Fastening Bolt | Max Torque (kgf·cm) |
|---|---|---|
| PPRL06 | Not usable | |
| PPRL10 | M4×P0.7 | 25 |
| PPRL13 | M5×P0.8 | 51 |

MEMO

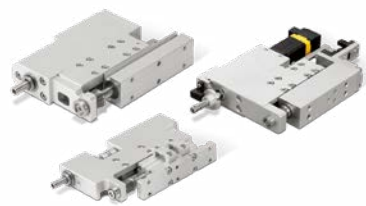
ROTARY PICK UP CYLINDER / HIGH PRECISION GUIDE

# PPRM Series

New release ! Servo Motor option & Long Stroke!

## Features

- Pick up cylinder having pneumatic based up-down function and electric motor based rotate function.
- Miniaturization, lighten and generalization type by slim body.
- Positioning and buffering function when picking up by buffer function on the end of picker.
- Able to control torque, rotating angle and speed by electrical rotate motion.
- High precise rotation by high resolution.
- Closed loop control system by encoder equipped stepping motor application.
- Basically mounted home sensor for rotary position.
- Various Auto Switch installation. (Optional)



## Order Form

| PPRM | 12 | S | - | 10 | - | 20 | E | - | A2N | L | S | - | D | - | BM2 | SS2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ① | ② | ③ | | ④ | | ⑤ | ⑥ | | ⑦ | ⑧ | ⑨ | | ⑩ | | ⑪ | ⑫ |

① Series Name

② Cylinder Bore Size

| Order | CYL Bore(mm) |
|---|---|
| 10 | 10 |
| 12 | 12 |
| 16 | 16 |

④ Standard Strokes

| Order (=Standard Strokes(mm)) |
|---|
| 10, 20 |
| 10, 20, 30 |
| 10, 20, 30 |
| 10, 20, 30 |

⑤ Motor Option

| Order | Motor Specification |
|---|---|
| 15S | 5.5W Servo Motor |
| 20 | □20 Stepping Motor |
| 28 | □28 Stepping Motor |
| 28 | □28 Stepping Motor |

③ Auto Switch Mounting Bracket

| Order | Available Auto Switches |
|---|---|
| S | Magnetic auto switch |
| P | Micro photo auto switch |

※ Magnetic Auto Switch can be installed in the sensor slot of body without external bracket.

⑥ Encoder Option

| Order | Encoder |
|---|---|
| Blank | Non-Mounted |
| E | Mounted |

* PPRM10 : Servo motor equipped model - Cannot select Encoder option.

⑦ Auto Switch Specification

※ Magnetic Auto Switch Specification

| Order | Sensing Type | Cable Spec | | Voltage | | Current | | Protect Level | Operation Time |
|---|---|---|---|---|---|---|---|---|---|
| | | Wires | Direction | AC | DC | AC | DC | | |
| Blank | No Auto Switch provided | | | | | | | | |
| A2C | Magnetic reed switch | 2-Wire | Horiz | 100V | 24V | 5~20mA | 5~40mA | IP 67 | 1ms |
| A2N | Magnetic reed switch | 2-Wire | Horiz | 100V | 24V | 5~20mA | 5~40mA | IP 67 | 1ms |
| A2V | Magnetic reed switch | 2-Wire | Ver | 100V | 24V | 5~20mA | 5~40mA | IP 67 | 1ms |
| B2 | Magnetic solid state | 3-Wire | Horiz | - | 24V (5~28V) | - | Less than 50mA | IP 67 | 1ms |
| B2B | Magnetic solid state | 2-Wire | Horiz | - | 24V (10~28V) | - | Less than 50mA | IP 67 | 1ms |
| B3B | Magnetic solid state | 2-Wire | Ver | - | 24V (10~28V) | - | Less than 50mA | IP 67 | 1ms |
| B3C | Magnetic solid state | 3-Wire | Ver | - | 24V (5~28V) | - | Less than 50mA | IP 67 | 1ms |

* Be careful of projection for vertical wire exposed type Auto Switch model. (Please refer technical information of Auto Switch)

※ Micro Photo Auto Switch Specification

| Order | Sensing Type | Cable Spec | | Voltage | | Current | | Frequency |
|---|---|---|---|---|---|---|---|---|
| | | Wires | Direction | AC | DC | AC | DC | |
| Blank | No Auto Switch provided | | | | | | | |
| PM | Micro photo | 4-Wire | Refer individual diagram | - | 24V (5~24V) | - | 50mA | 3kHz |

※ Above listed specification is for up-down sensing sensor. (Applied micro photo sensor : PRO-PM-L)
※ Home sensor for rotate is basically supplied. (Applied micro photo sensor : PRO-PM-U)

⑧ Magnetic Auto Switch Cable Length

| Order | Cable Length |
|---|---|
| Blank | 1M |
| L | 3M |

* Cable length for micro photo is 1M only.

⑨ Num of Magnetic Auto Switches

| Order | Quantity |
|---|---|
| Blank | 2PCS |
| S | 1PCS |

* For micro photo auto switch, 2 PCS selection only.

⑩ Exclusive Driver Option

| Order | Driver |
|---|---|
| Blank | Without exclusive driver |
| D | With exclusive driver |

⑪ Cable for Motor

| Order | Cable Specification | |
|---|---|---|
| Blank | No cable | |
| AF□ | Non-Flexible cable | Without encoder option |
| AM□ | Flexible cable | |
| BF□ | Non-Flexible cable | With encoder option |
| BM□ | Flexible cable | |

* □ refers length of cable. 1m increments and up to 10m.
* When cable not selected, connectors for cable assembling are supplied separately. (Only for <⑩ Exclusive Driver Option> "D" is selected)
* PPRM10 : Only can select cable option with encoder.

⑫ Cable for Controller

| Order | Cable Specification | |
|---|---|---|
| Blank | No cable | |
| ES□ | Non-Flexible cable | Without encoder option |
| SS□ | Non-Flexible cable | With encoder option |

* □ refers length of cable. 1m increments and up to 2m.
* When cable not selected, connectors for cable assembling are supplied separately. (Only for <⑩ Exclusive Driver Option> "D" is selected)
* PPRM10 : Only can select cable option with encoder.

## Specification

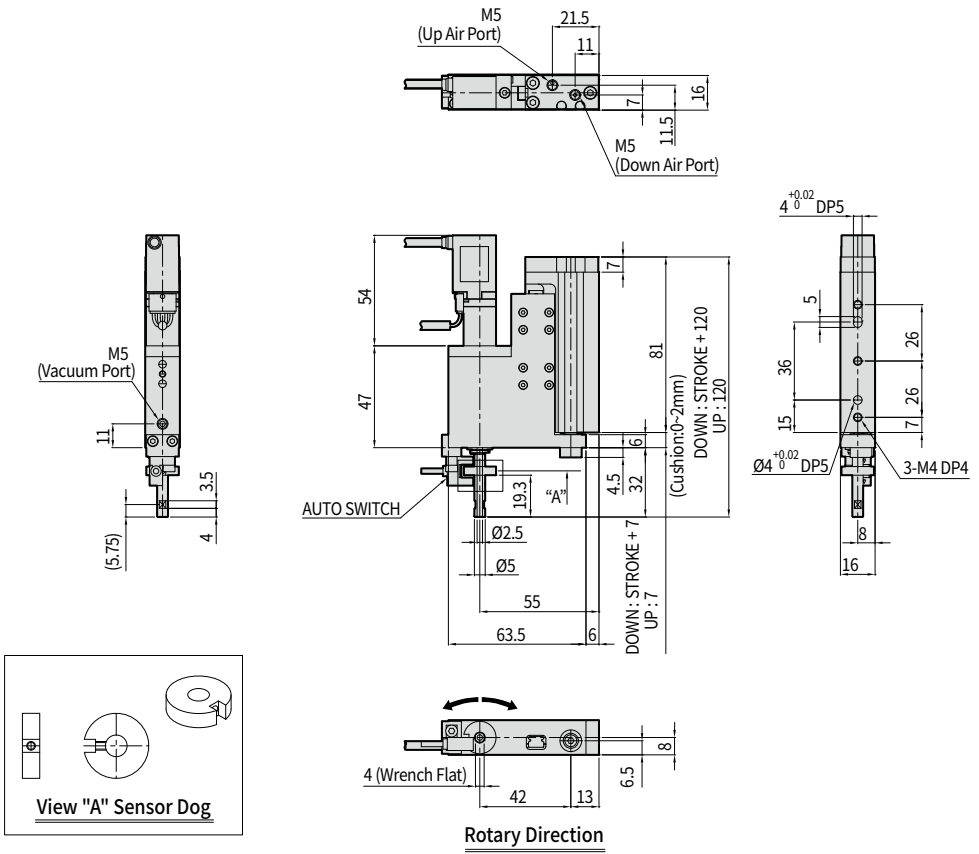
| Item Name | | | PPRM10 | | PPRM12 | | | PPRM16 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Up-Down | CYL Bore Size(mm) | | 10 | | 12 | | | 16 | | |
| | Stroke(mm) | | 10 | 20 | 10 | 20 | 30 | 10 | 20 | 30 |
| | Theoretical Thrust for Up-Down(kgf) P : Air Pressure(kgf/㎠) | Forward | 0.78×P | | 1.13×P | | | 2×P | | |
| | | Backward | 0.5×P | | 0.84×P | | | 1.5×P | | |
| | Fitting Size | | M5 | | | | | | | |
| | Buffering Stroke(mm) | | 2 | | 2.5 | | | | | |
| | Fluid | | Clean Air Note 1) | | | | | | | |
| | Pressure Range(kgf/㎠) | | 3.5 ~ 7 | | | | | | | |
| | Lubrication | | Not Need (If need, use one sort of turbine oil : SPEC ISOVG 32) | | | | | | | |
| | Operation Type | | Double Acting | | | | | | | |
| | Type of Guide | | Linear Guide | | | | | | | |
| Rotate | Motor for Rotation | | Servo Motor | | Stepping Motor | | | | | |
| | Torque(mNm) | | 정격 17 | | □20 37 Note 3) | | | | | |
| | | | 최대 43 | | □28 118 Note 3) | | | | | |
| | Motor Holding Torque(mNm) | | 17.5 | | 70.8 | | | | | |
| Temperature Range(℃) | | | 5 ~ 40 | | 5 ~ 60 | | | | | |
| Weight(kgf) Note 2) | | | 0.35 | | 0.64 (0.78) | 0.94 (1.08) | 1.24 (1.38) | 1.5 | 1.9 | 2.3 |

Note 1) Clean Air : Fresh air containing solid matters with 0.3% of supersaturated moisture and 99.9% of liquid oil that passed through the 3~10㎛ degree of filtering.
Note 2) PPRM12 ( ) : Specification for □28 motor selection.
Note 3) Torque of stepping motor refers holding torque for static status.

# PPRM Series

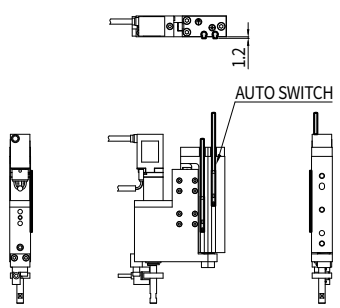
10 12 16
10-15S 20-15S

## PPRM10-10-15S / PPRM10-20-15S

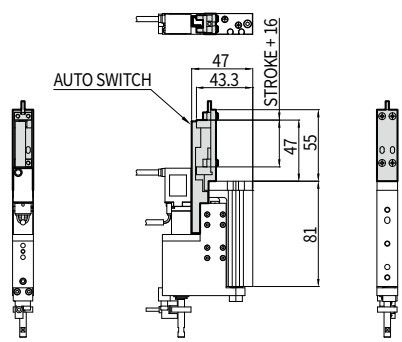



## PPRM10-10-15S / PPRM10-20-15S Example of Auto Switch installation

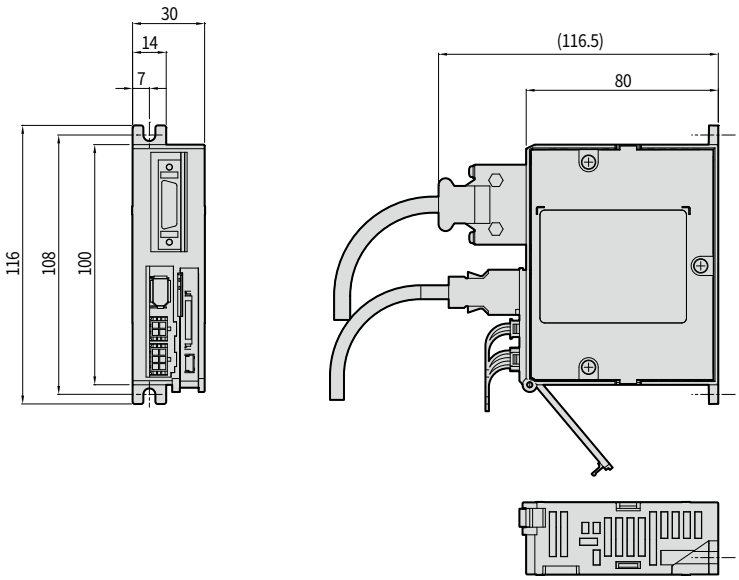
### 1. MAGNETIC SENSOR TYPE




### 2. PHOTO SENSOR TYPE



## PPRM10 - DRIVER






## PPRM10 - Specification of Exclusive Driver

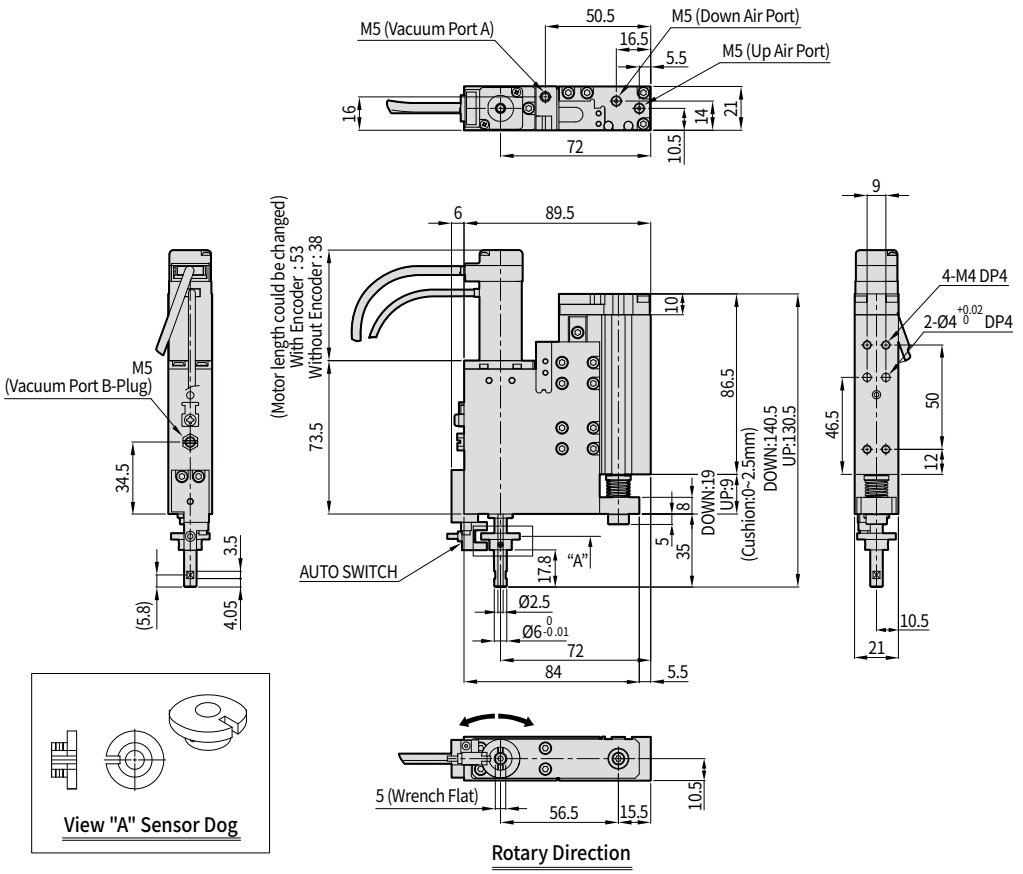
| Item | PPRM10 |
|---|---|
| Control Circuit(VDC) | Control Circuit: 24<br>Main Circuit : 24, 48 |
| Control Method | CLOSE LOOP |
| Output Current(A) | MAX 4.1 |
| Operating Condition | Temperature : 0 ~ 55 °C<br>Humidity : 90% RH or less (With no freezing or condensation) |
| Mounting | Base-Mounted |
| Speed Control Range | 1 : 5000 |
| Protective Functions | Over current, Over voltage, overload, etc. |
| Input Signals | Servo On, Run prohibited, Alarm reset, Control selection |
| Output Signals | Encoder output pulses, Positioning completion, limit detection, Alarm, etc. |
| Weight(kgf) | 0.3 kgf |

* Please contact to office for the selection of control method or detailed functions.

# PPRM Series

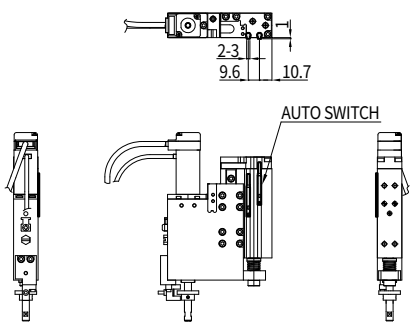


## PPRM12-10-20

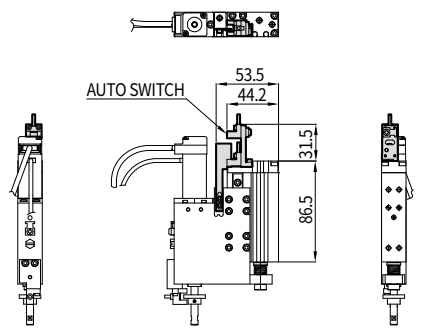



## PPRM12-10-20 Example of Auto Switch installation

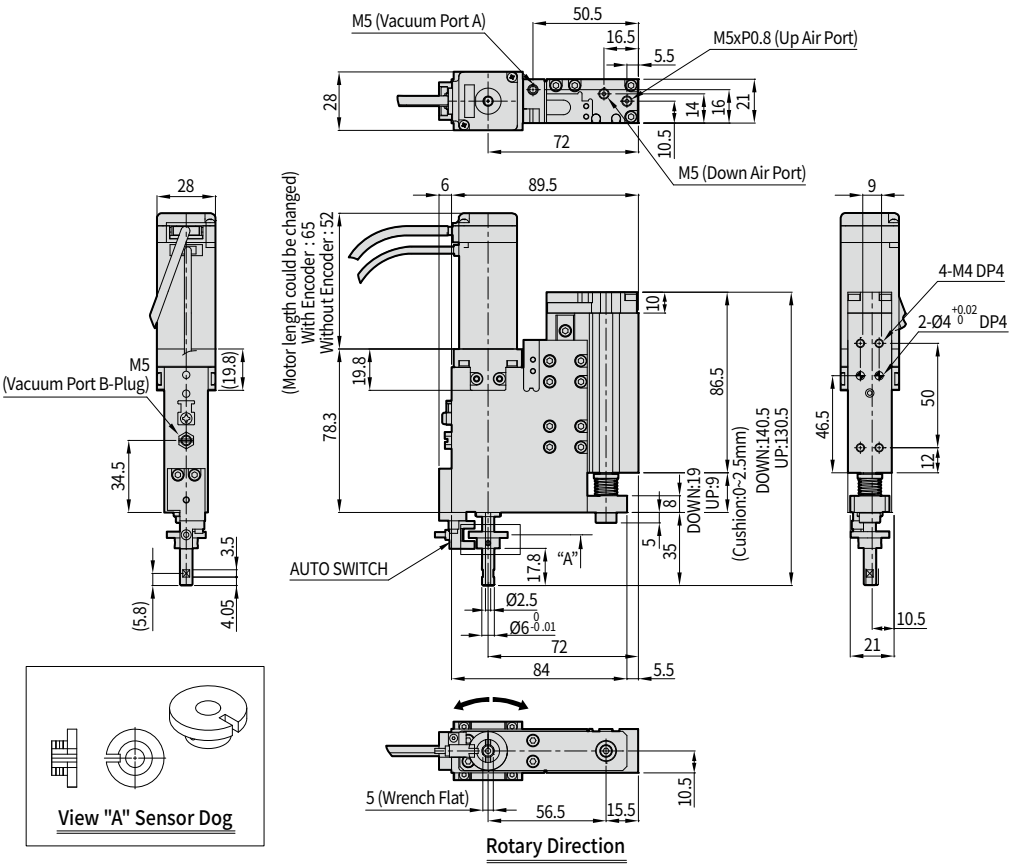
### 1. MAGNETIC SENSOR TYPE




### 2. PHOTO SENSOR TYPE

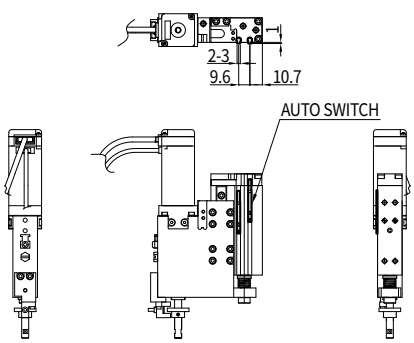


## PPRM12-10-28

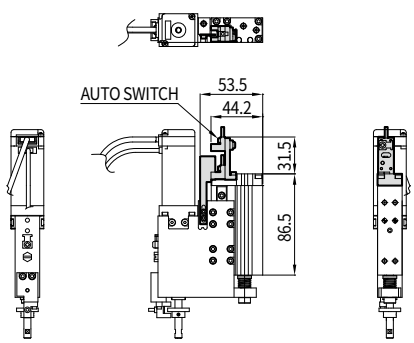



## PPRM12-10-28 Example of Auto Switch installation

### 1. MAGNETIC SENSOR TYPE




### 2. PHOTO SENSOR TYPE

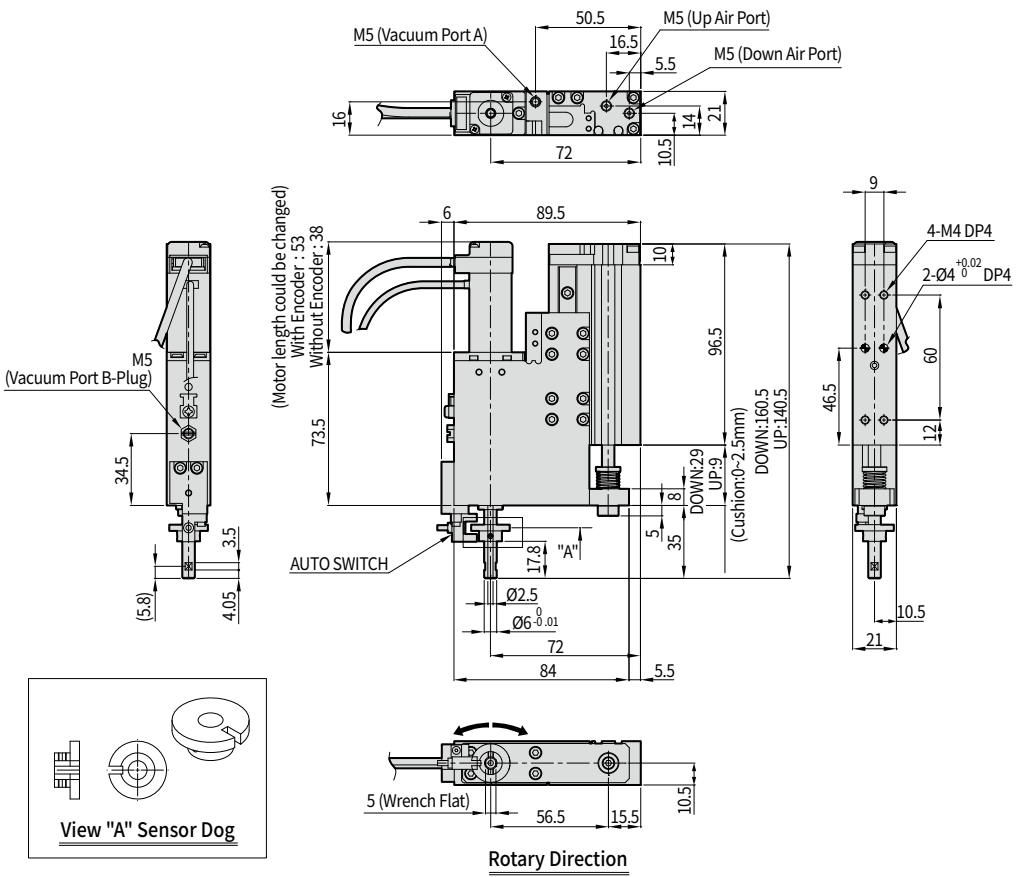


# PPRM Series

10 | 12 | 16

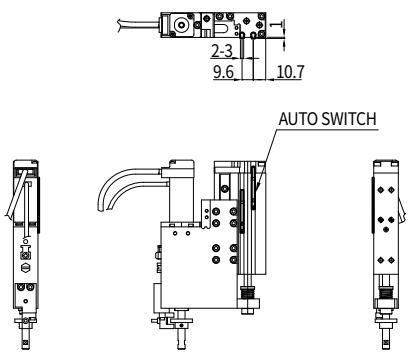
10-20 | 10-28 | 20-20 | 20-28 | 30-20 | 30-28

## PPRM12-20-20

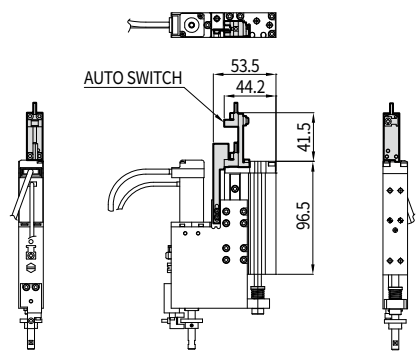



## PPRM12-20-20 Example of Auto Switch installation

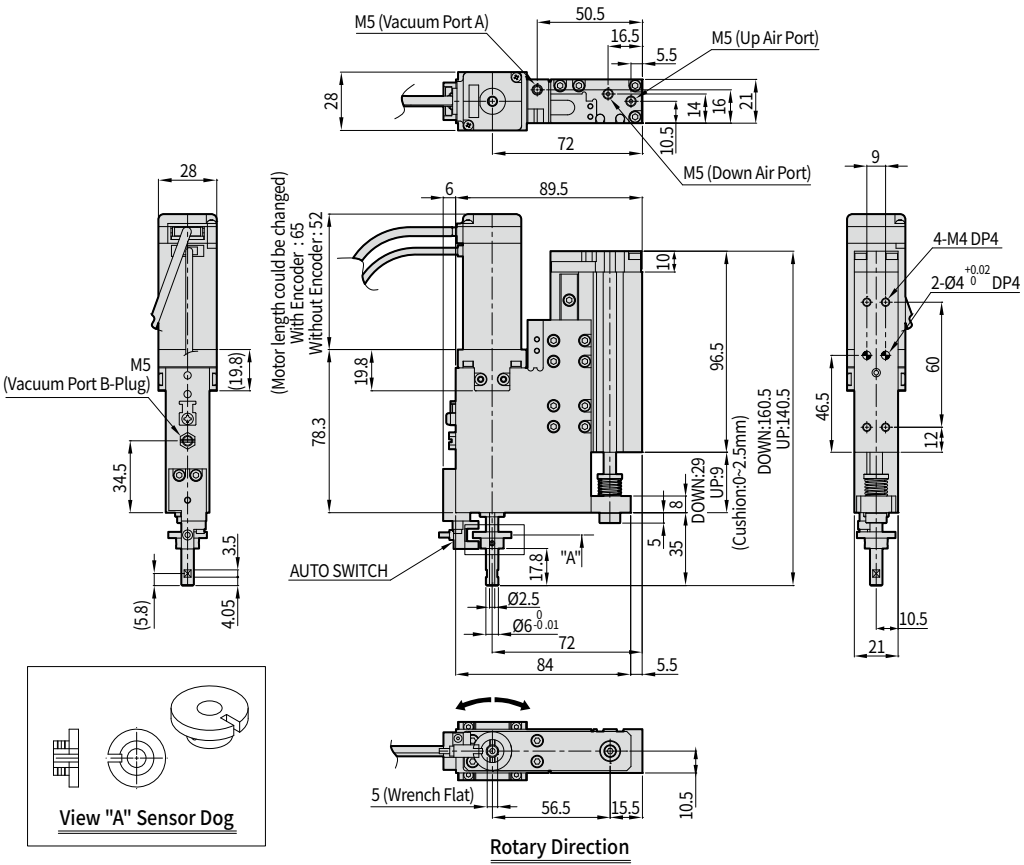
### 1. MAGNETIC SENSOR TYPE




### 2. PHOTO SENSOR TYPE

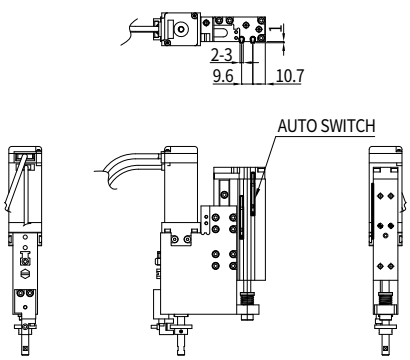


## PPRM12-20-28

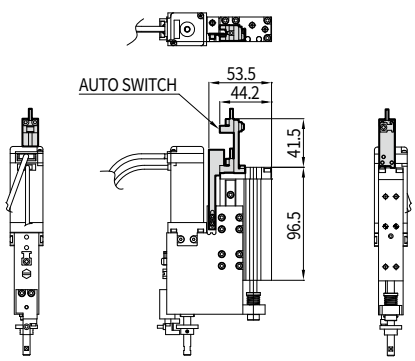



## PPRM12-20-28 Example of Auto Switch installation

### 1. MAGNETIC SENSOR TYPE



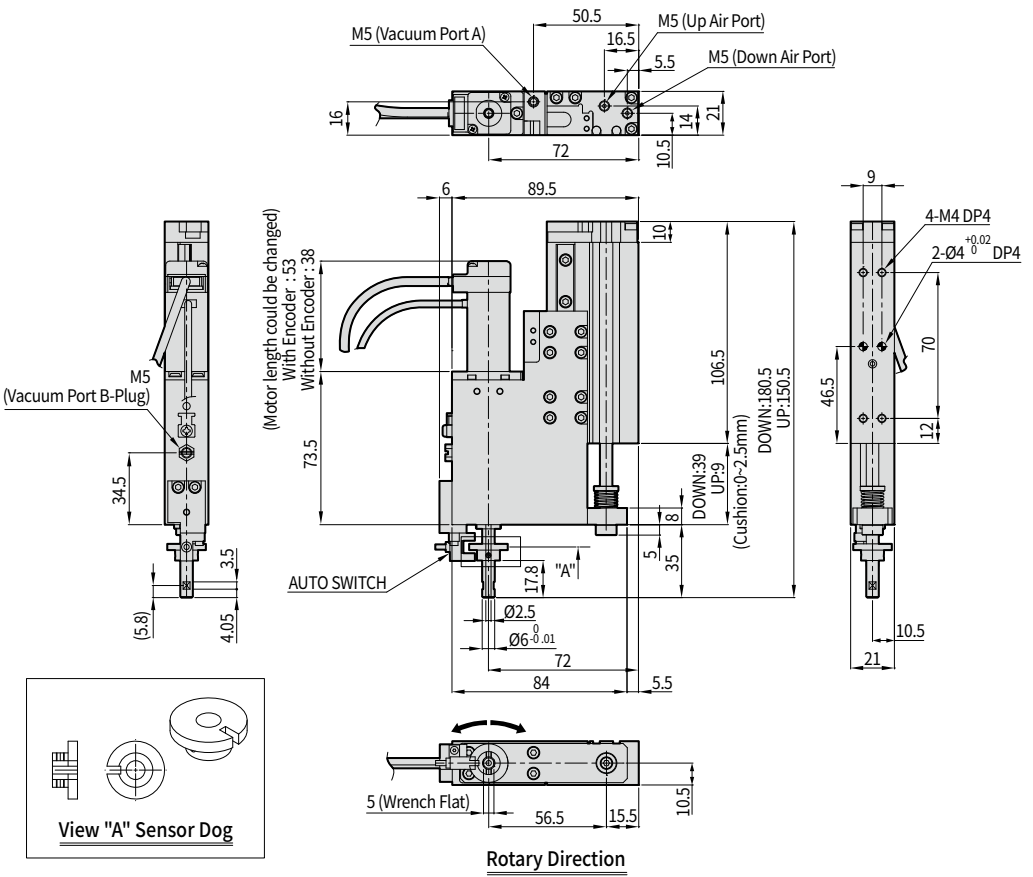

### 2. PHOTO SENSOR TYPE



# PPRM Series

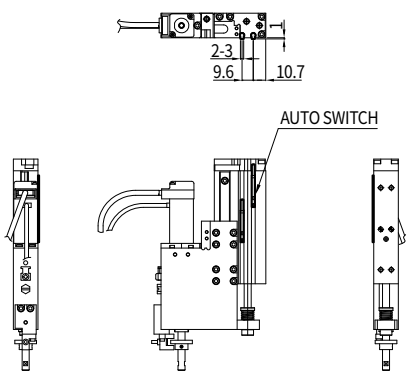


## PPRM12-30-20

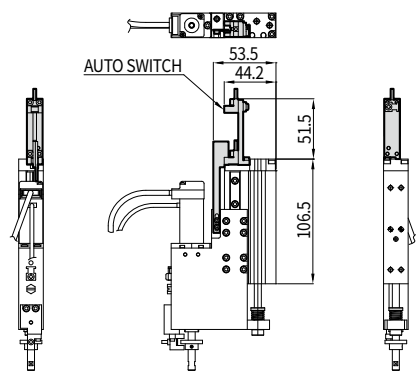



## PPRM12-30-20 Example of Auto Switch installation

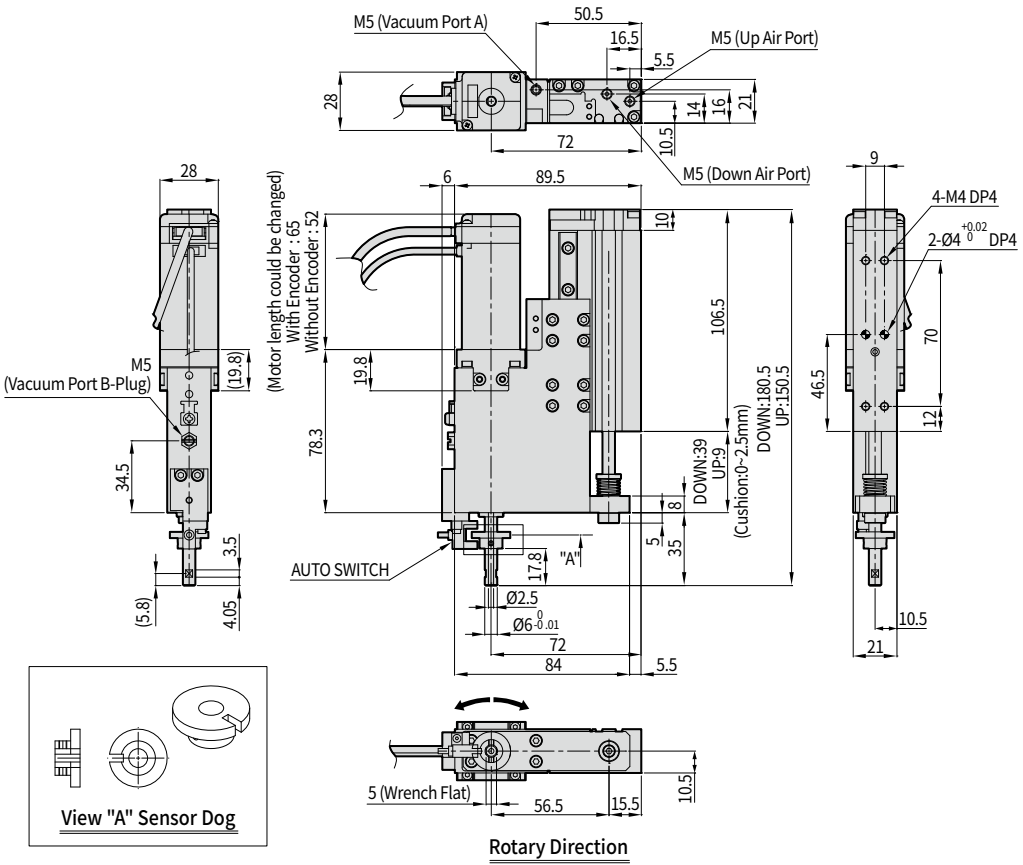
### 1. MAGNETIC SENSOR TYPE




### 2. PHOTO SENSOR TYPE

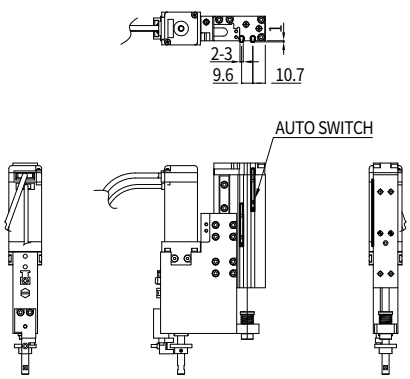


## PPRM12-30-28

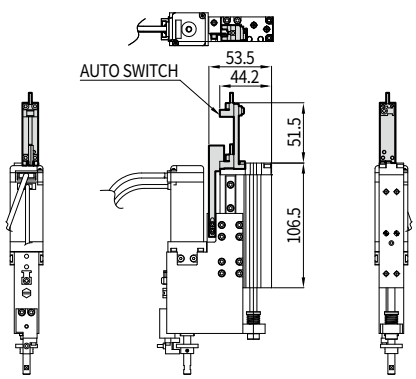



## PPRM12-30-28 Example of Auto Switch installation

### 1. MAGNETIC SENSOR TYPE



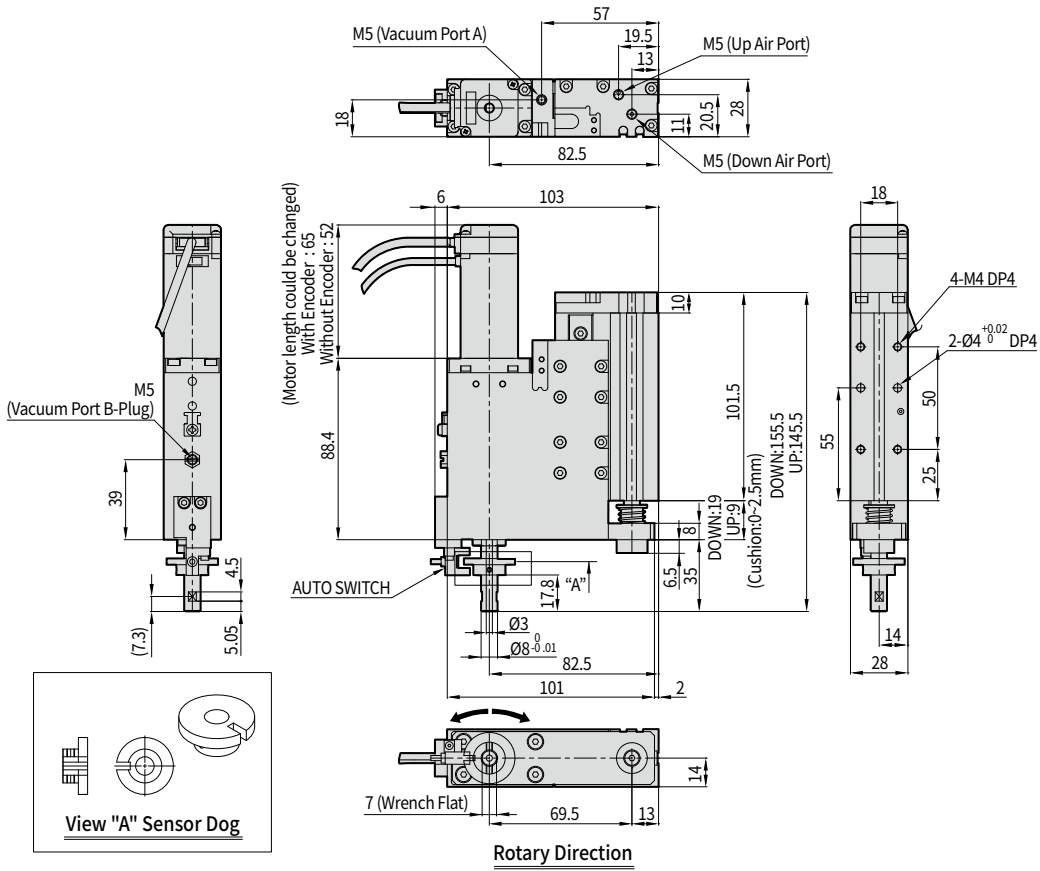

### 2. PHOTO SENSOR TYPE



# PPRM Series

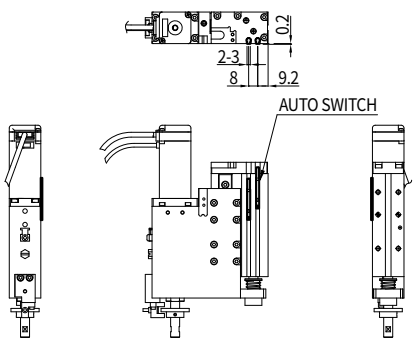


## PPRM16-10-28

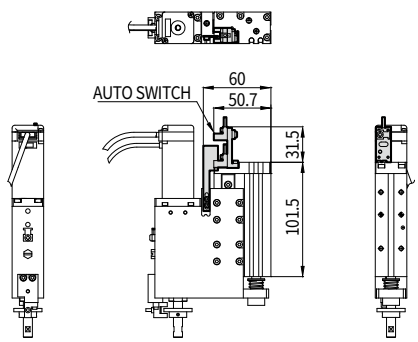



## PPRM16-10-28 Example of Auto Switch installation

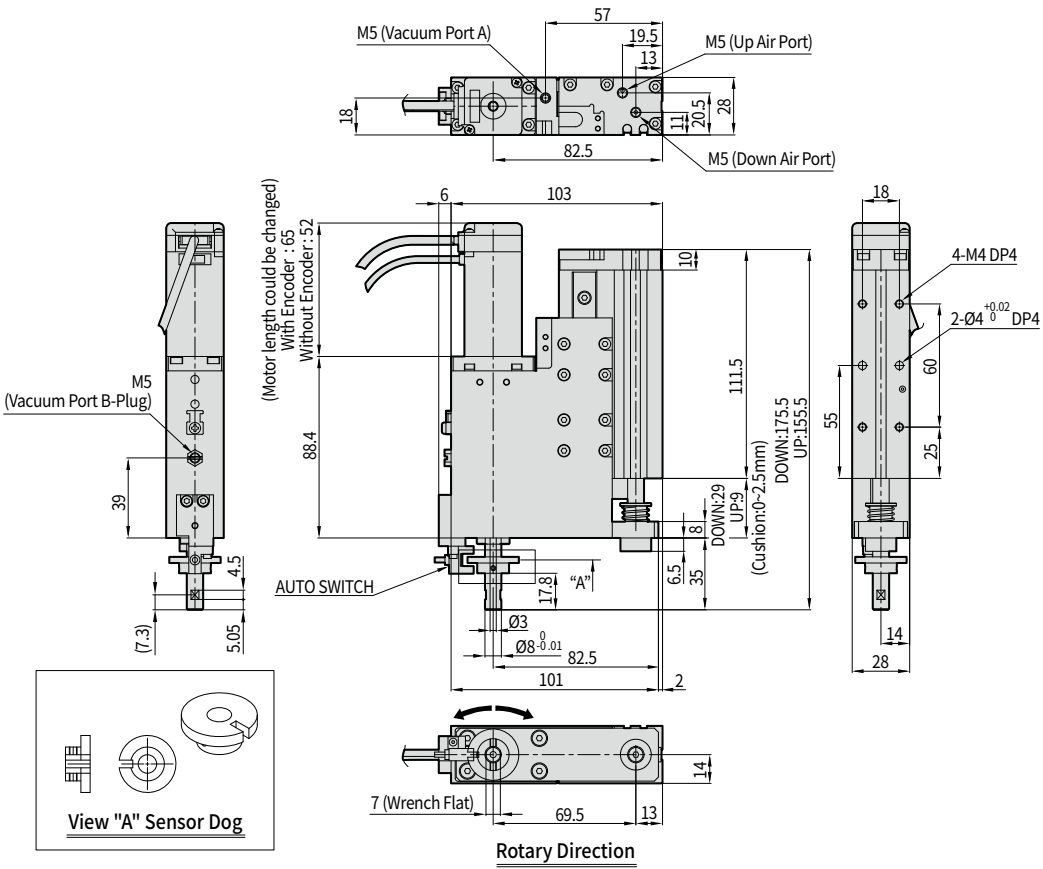
### 1. MAGNETIC SENSOR TYPE




### 2. PHOTO SENSOR TYPE

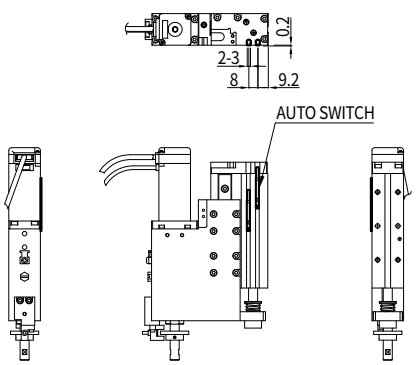


## PPRM16-20-28

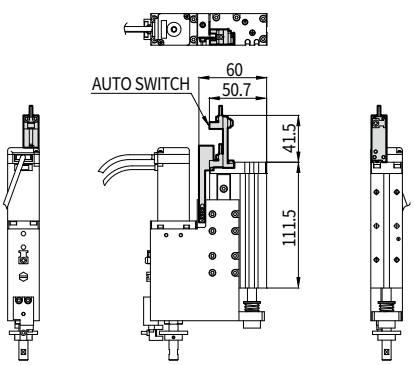



## PPRM16-20-28 Example of Auto Switch installation

### 1. MAGNETIC SENSOR TYPE



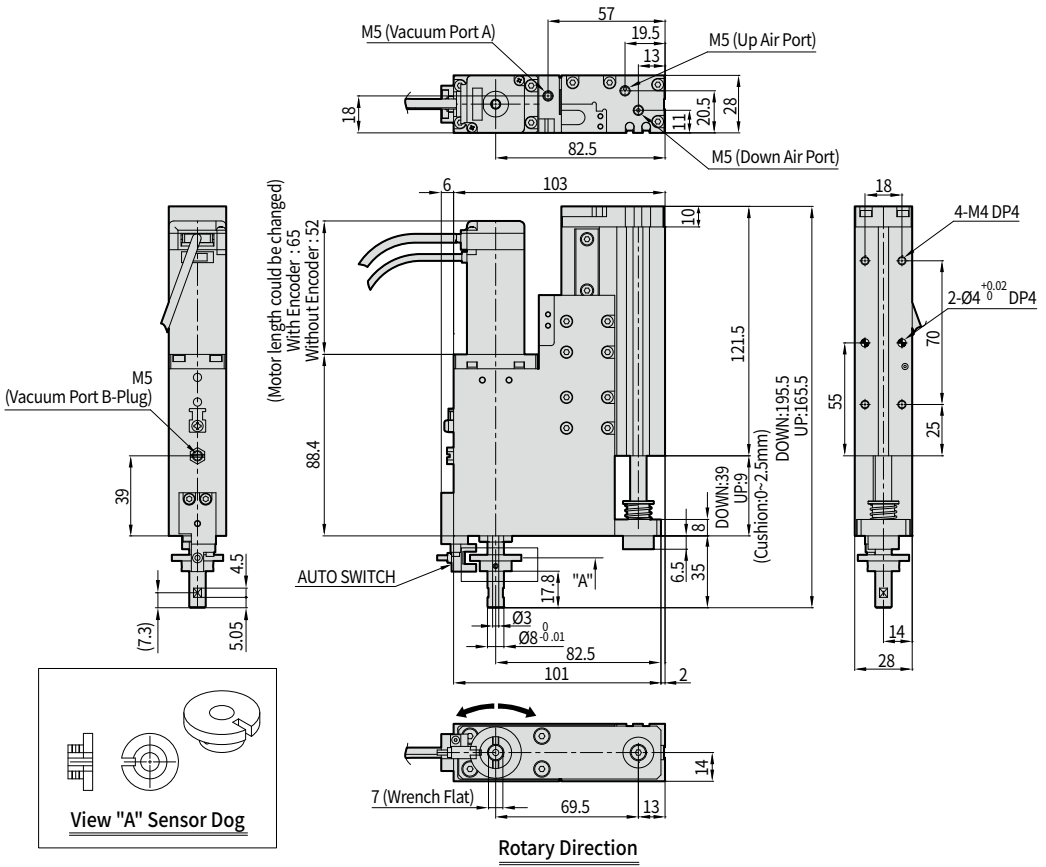

### 2. PHOTO SENSOR TYPE



# PPRM Series

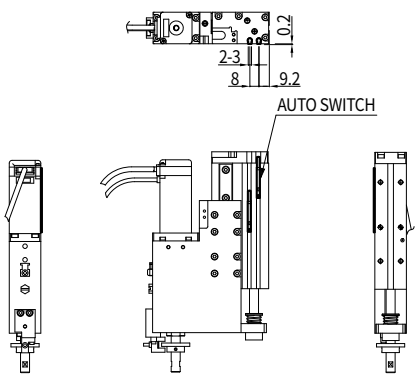


## PPRM16-30-28

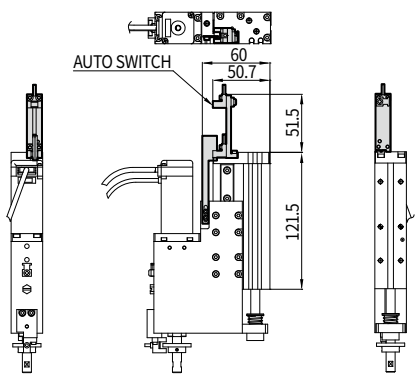



## PPRM16-30-28 Example of Auto Switch installation

### 1. MAGNETIC SENSOR TYPE

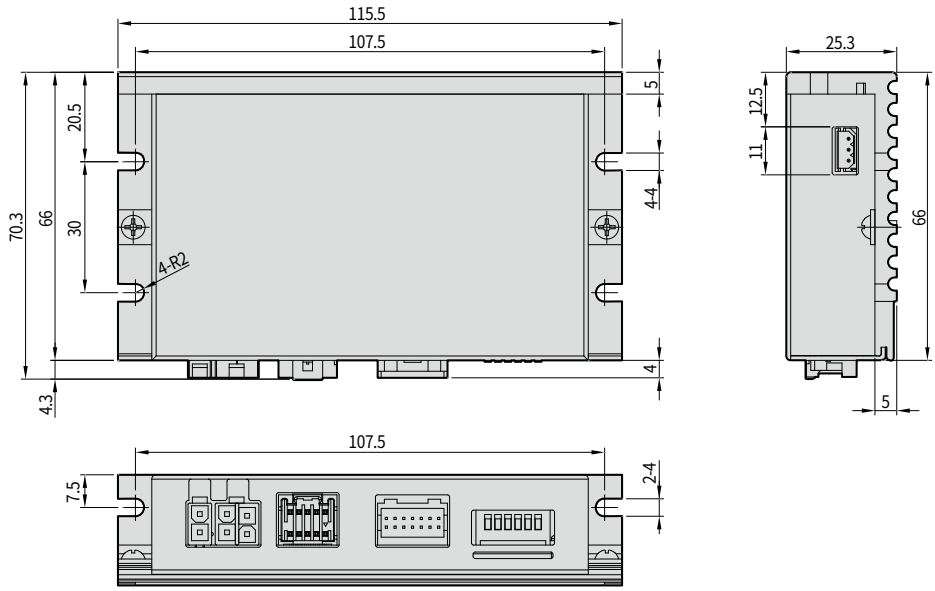



### 2. PHOTO SENSOR TYPE

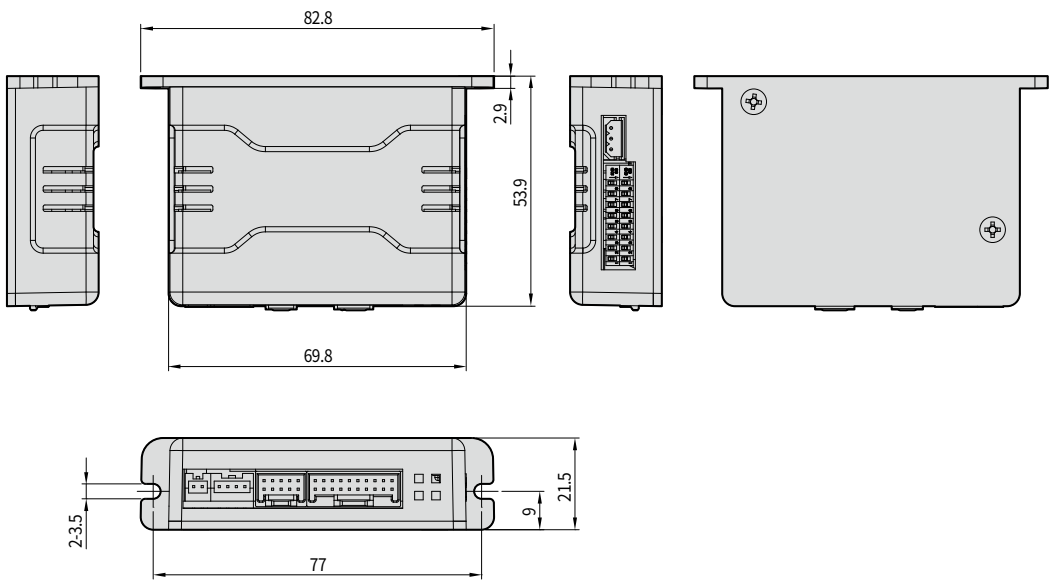


## PPRM12, 16 - DRIVER

### ■ With Encoder




### ■ Without Encoder

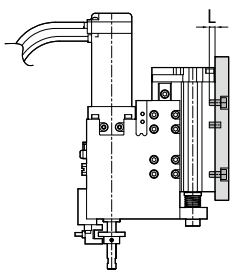


## PPRM12, 16 - Specification of Exclusive Driver

| Item | PPRM 12, 16 | |
|---|---|---|
| | Without Encoder | With Encoder |
| Control Method | OPEN LOOP | CLOSE LOOP |
| Control Circuit(VDC) | 22 ~ 26 | |
| Current Consumption(A) | Max 0.5 | |
| Operating Condition | Temperature : 0 ~ 50 °C<br>Humidity : 35 ~ 85% RH (With no freezing or condensation) | |
| Micro Steps | 500 ~ 50,000 (Set by DIP Switch) | |
| Max. Input Frequency(kHz) | 500 | |
| Protective Functions | Over current, Over speed, Over temperature,<br>Over regenerated voltage, Motor connect, ROM | |
| | Loss of position, Motor voltage, System | Position tracking, Overload,<br>Encoder connect, In-position, Position overflow |
| LED Display | Power Status, Alarm Status | |
| | Rotation direction | In-Position Status, Servo ON Status |
| Current Setting(%) | RUN: Auto Set<br>STOP: 10 ~ 100 (Set by DIP Switch) | RUN: 50~150<br>STOP: 20~100 (Set by GUI) |
| Pulse Input Mode | 1-PULSE / 2-PULSE | |
| Speed/Position Control Command | Pulse input mode | |
| Input Signals | Position command pluse, Enable, Alarm reset | |
| Output Signals | In-Position Status, Alarm | |

## Installation Information

**1. Installation by body tap holes**




| Item | Fastening Bolt | Max Torque (kgf·cm) | Max Bolt Length L (mm) |
|---|---|---|---|
| PPRM10 | M4×P0.7 | 25 | 4 |
| PPRM12 | M4×P0.7 | 25 | 4 |
| PPRM16 | M4×P0.7 | 25 | 4 |

MEMO

PROTEC

P&M Catalogue

# PRECISION STAGE

P & M INCORPORATED

Please read it before use, with individual notes for each series as well, for your safe use.

# ⚠ Individual notes for Precision Stage ❶

## ⚠ Caution — Notes in Installation

■ **Be careful to protect "V" groove from damage which the cross roller is rubbed.**

■ **Be careful to avoid any finger or human body jam when cylinder is in operation.**

■ **Be careful not to cause scratch or shock on the mounting surfaces of stage body, slide table.**

Damage in mounting surfaces makes worse the flatness, and cause work failure due to the increased swing of guide unit and/or friction resistance.

■ **Be careful of bad flatness on the stage upper table or mounting surface could be the reason of deformation on the mounting surface and it could be bad effect of precision.**

## ⚠ Caution — Notes in Selection

■ **Do not exceed the specified load when selecting the product.**

Select model based on the specified maximum load factor according to each stage size. Otherwise, it may result in distorted load of the guide unit, which may cause swing to guide unit, deterioration, and adverse effects of lifespan.

■ **Avoid excessive external force or shock.**

## ⚠ Caution — Notes in operating Environment and Handling

■ **Be careful of using in the place where vibration or shock occurs frequently, it may cause a failure.**

■ **Do not operate table by forcibly which could be the reason of malfunction.**

■ **Be care of corrosion resistance for the stability in cross roller guide unit.**

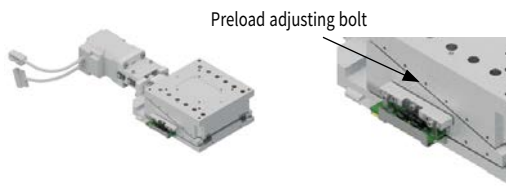
Be care of corrosion resistance in humid environment as water drop can be created in guide unit and it can get rusty in such environment.

■ **When used around heat source of high temperature, product can be heated by radiant heat and cause failure. Therefore, install protective covers to block heat source.**

■ **Do not use in the environment that can be affected by foreign substances such as dust and chip, and cutting oil.**

It may cause vibration, increase of frictional resistance, and air leakage. In such environment, please install appropriate protective covers after the consultation with our company.

■ **Do not manually adjust the preload. If the preload is unstable or mounting surface is operated with poor precision, it would be the reason of table bending by decrease in motion accuracy and it will be effect of bad lifespan.**

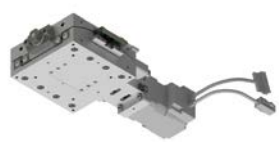



■ **Do not attach magnet or magnetic substance on the table.**

The table is made of a magnetic material. Attaching a magnet leads to magnetization of the table, which may cause auto switch malfunction.

■ **Note for stage installation**

For the stage which cross roller guide equipped, do NOT apply over than catalogue specified payload if it installed as inverted position shown as below fig. Otherwise, the precision might be bad affected.



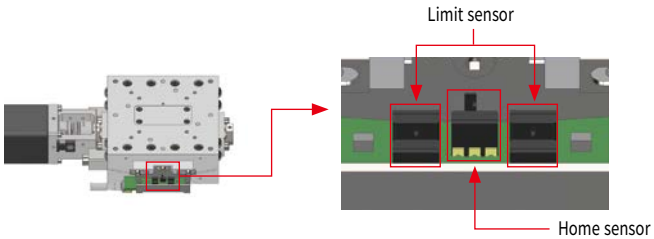
Please read it before use, with individual notes for each series as well, for your safe use.

# ⚠ Individual notes for Precision Stage ❷

**⚠ Caution** **Notes in operating Environment and Handling**

■ **Assembled sensor consisted Limit and Home sensor. Limit sensor works for prevent over stroke of table and home sensor works for reproduces of initial position.**

If the stage is moved over the standard stroke, parts may collide and be damaged.
Do not move or transform the sensor and sensor dog.




## [ Technical information of Photo Sensor ]

■ **Voltage** : 24 VDC

■ **Output type** : Open Collector, NPN Normal close (H when shading)

■ **Current consumption** : Less than 15mA

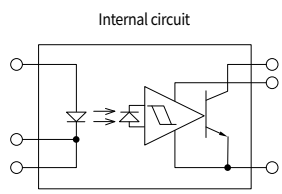
■ **Temperature** : -30 ~ 85℃

■ **Cable length** : 1M

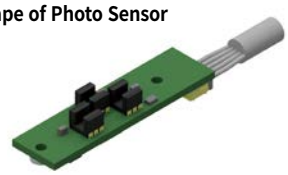
■ **Wire connection**

| No. | Color | Function |
|---|---|---|
| 1 | Red | Vin |
| 2 | Blue | Out3 |
| 3 | Yellow | Out2 |
| 4 | Black | Out1 |
| 5 | Green | GND |

■ **Circuit of Photo Sensor**



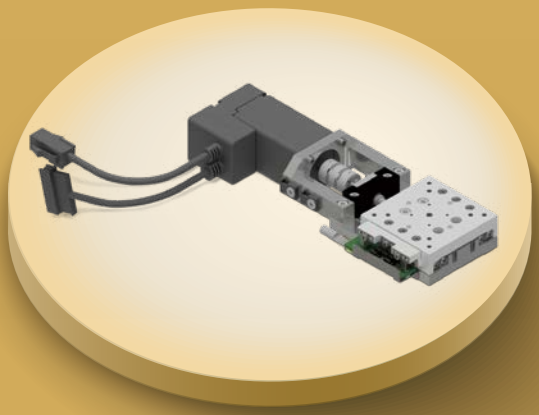

■ **Shape of Photo Sensor**



PRECISION STAGE

# GNY Series

## Motorized precise stage
## Line up for X-Y, Z, θ, TILT axis



## Motorized precision stage

- Stepping motor and ball screw combined structure.
- 4 directions line up. (X-Y, Z, θ, TILT)

X-Y Axis

Z Axis

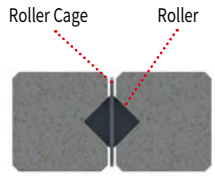
θ Axis

Tilt

※ If need to use by multi axis stacked structure, it is recommended to assembly in factory by order made.

## Cross Roller Guide application

- High reliability of cross roller seated in cage.
- 2~3 times higher solidity and superior precision by 4-surface contact roller guide compare than linear contact ball bearing type.



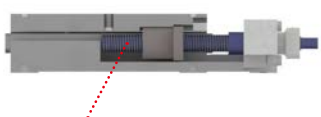

Cross Roller : 4-surface contact

Linear Guide Type

Tilt Guide Type

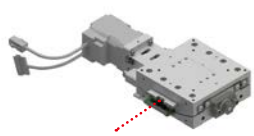
## Ball Screw structure

- By the transfer method of ball screw, the slip friction convert to the rolling friction reduced wear out and increased precision and durability.
- Because of the rolling property of ball is used and due to high transfer efficiency, the difference between static and dynamic friction is small, Stick slip phenomenon is minimized.




## High precise position feedback (GNT Series)

- Possible to check the amount of tilt stage motion by external angular scaler.
- Photo sensor for position detect. (Optional)




PRECISION STAGE / X-Y LINEAR STAGE

# GNY Series

## Features

NEW

- X-Y motion precision stage with by stepping motor. (Motor is basically mounted)
- Excellent responsiveness to external moment by Cross Roller Guide application.
- High accuracy performance by application of high precision ball screw.
- Lighten body weight by aluminum table structure.
- Excellent table moving parallelism and solidity by linear guide application.

## Order Form

**GNY 50 - M - D - C3**

① ② ③ ④ ⑤

① Series Name

② Table Size

| Order | Table Size(mm) |
|---|---|
| 50 | 50×50 |
| 70 | 70×70 |
| 100 | 100×100 |

③ Mirror Option

| Order | Mirror Option |
|---|---|
| Blank | Standard model |
| M | Mirror model |

④ Driver

| Order | Driver |
|---|---|
| Blank | Without driver |
| D | With driver |

* If driver option selected, Non-Flexible driver cable (1m) will be supplied together.

⑤ Cable for Motor

| Order | Cable Length(m) |
|---|---|
| Blank | No cable |
| C3 | 3 |
| C5 | 5 |
| C10 | 10 |

* Cable will be supplied as Flexible cable.

## Specification

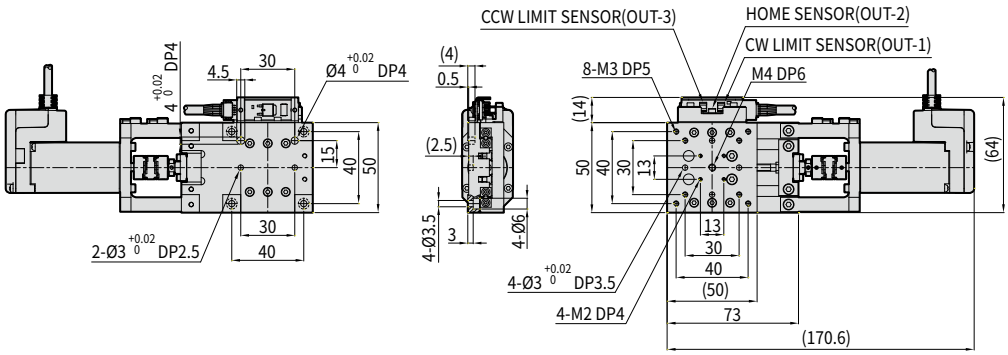
| Item Name | | GNY50 | GNY70 | GNY100 |
|---|---|---|---|---|
| Table Size(mm) | | 50×50 | 70×70 | 100×100 |
| Stroke(mm) | | ± 7.5 | ± 10 | ± 12.5 |
| Weight(Kgf) Note 1) | | 0.6 | 0.8 | 1.6 |
| Maximum Load Weight(Kgf) | | 5 | 10 | 20 |
| Repeatability(mm) | | ≤ ± 0.001 | | |
| Straightness(mm) | Horizontal | ≤ 0.003 | | |
| | Vertical | | | |
| Motor Specification | | 2-Phase □28 stepping motor (Encoder equipped) | | 2-Phase □42 stepping motor (Encoder equipped) |
| Temperature Range(℃) | | 5 ~ 60 | | |
| Max. Speed(mm/sec) | | 5 | | |
| Moving Structure | | Ball Screw (Lead : 1mm) | | |
| Guide Mechanism | | Cross Roller Guide | | |
| Position Sensor | | Home (1EA), Limit (2EA) | | |

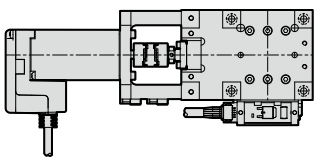
Note 1) Weight of motor and motor bracket involved.

# GNY Series

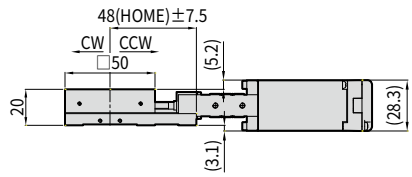
50 70 100

## GNY50

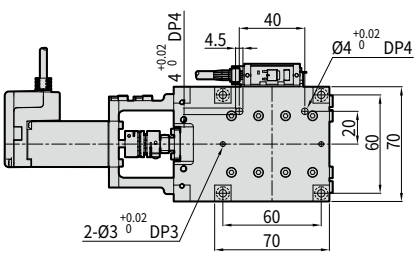


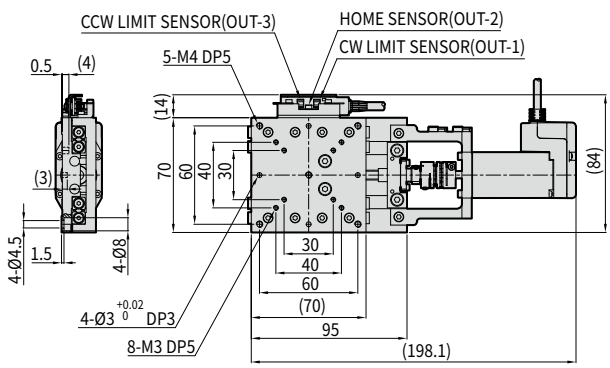



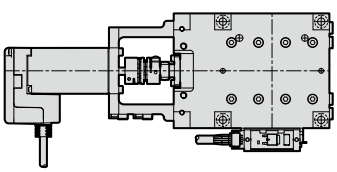
GNY50-M TYPE



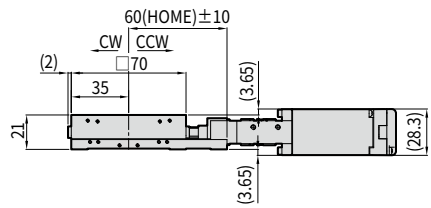

## GNY70



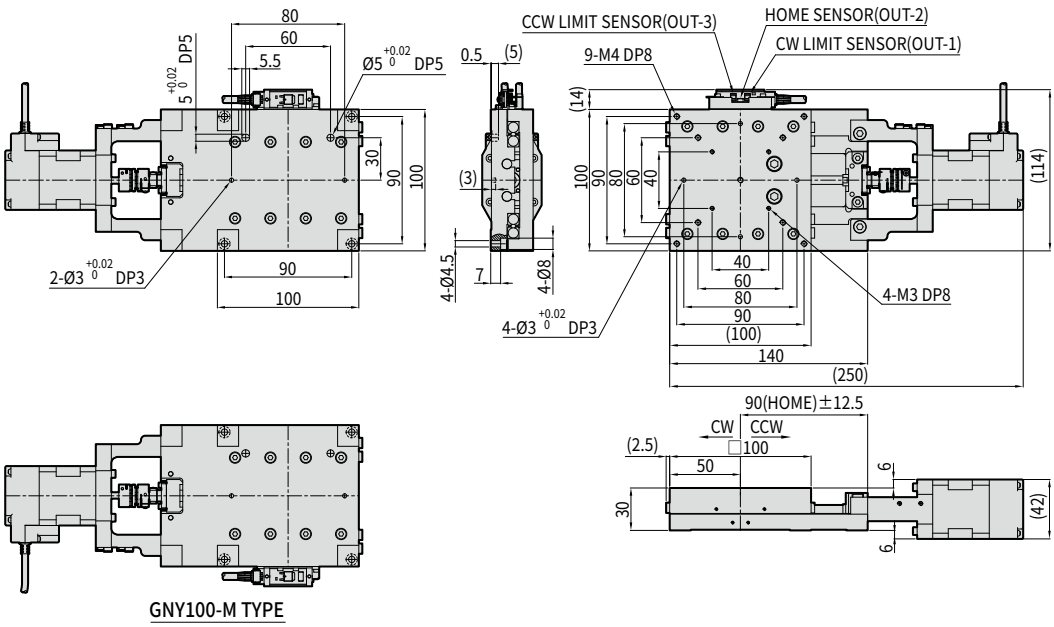



GNY70-M TYPE



## GNY100




GNY100-M TYPE

PRECISION STAGE / ROTARY STAGE

# GNR Series

## Features

NEW

- Rotary motion precision stage with by stepping motor. (Motor is basically mounted)
- Excellent responsiveness to external moment by Cross Roller Guide application.
- High accuracy performance by application of high precision ball screw.
- Lighten body weight by aluminum table structure.
- Excellent table moving parallelism and solidity by linear guide application.

## Order Form

**GNR 50 - M - D - C3**

① ② ③ ④ ⑤

① Series Name

② Table Size

| Order | Table Size(mm) |
|---|---|
| 50 | 50×50 |
| 70 | 70×70 |
| 100 | 100×100 |

③ Mirror Option

| Order | Mirror Option |
|---|---|
| Blank | Standard model |
| M | Mirror model |

④ Driver

| Order | Driver |
|---|---|
| Blank | Without driver |
| D | With driver |

* If driver option selected, Non-Flexible driver cable (1m) will be supplied together.

⑤ Cable for Motor

| Order | Cable Length(m) |
|---|---|
| Blank | No cable |
| C3 | 3 |
| C5 | 5 |
| C10 | 10 |

* Cable will be supplied as Flexible cable.

## Specification

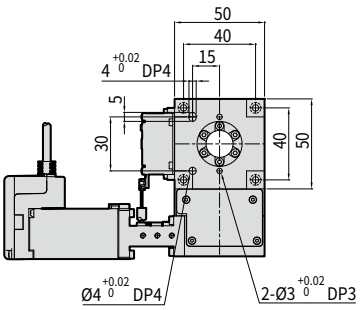
| Item Name | GNR50 | GNR70 | GNR100 |
|---|---|---|---|
| Table Size(mm) | 50×50 | 70×70 | 100×100 |
| Rotate Range(°) | | ± 5 | |
| Weight(Kgf) Note 1) | 0.7 | 0.9 | 1.4 |
| Maximum Load Weight(Kgf) | 3 | 5 | 8 |
| Angle Per Cycle(°) Note 2) | ≒1.848 | ≒1.397 | ≒1.023 |
| Repeatability(°) | | ≤ 0.01 | |
| Surface Runout(mm) | | ≤ 0.005 | |
| Eccentricity(mm) | | ≤ 0.005 | |
| Motor Specification | | 2-Phase □28 stepping motor (Encoder equipped) | |
| Temperature Range(℃) | | 5 ~ 60 | |
| Max. Speed(mm/sec) | | 2.5 | |
| Moving Structure | | Ball Screw (Lead : 1mm) | |
| Guide Mechanism | | Cross Roller Guide | |
| Position Sensor | | Home (1EA), Limit (2EA) | |

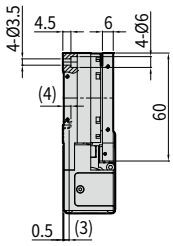
Note 1) Weight of motor and motor bracket involved.
Note 2) Operating angle per 1 cycle of motor.
• Because rotary stages work by converting linear motion into rotation, the ball screw stroke and rotation angle do not match.

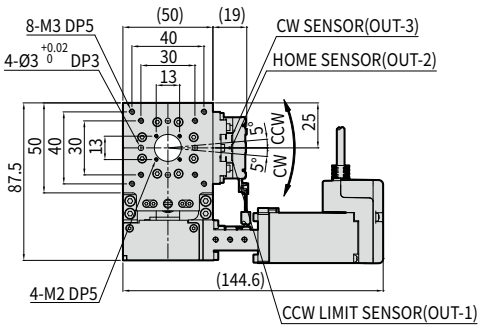
# GNR Series

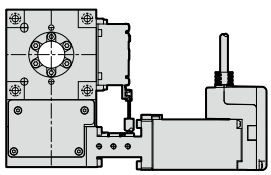
50 70 100

## GNR50

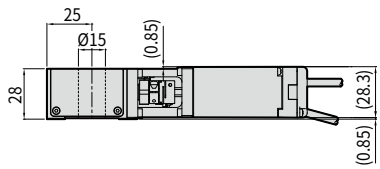


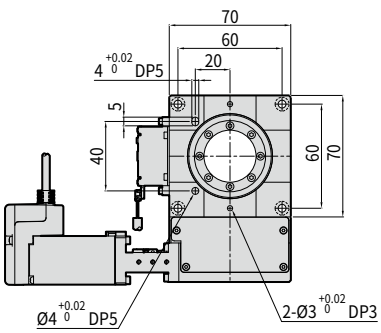



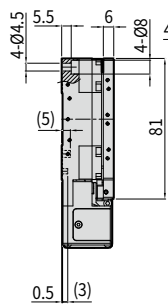



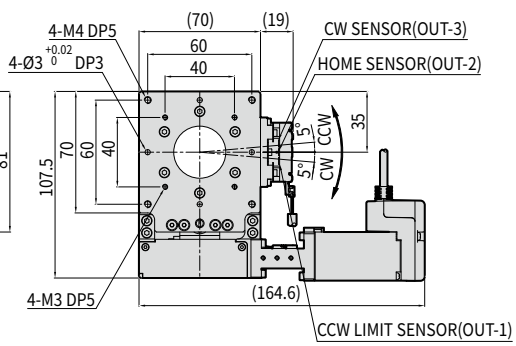
GNR50-M TYPE

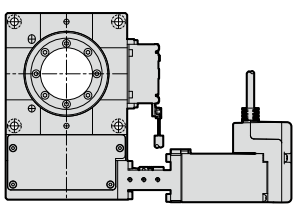



## GNR70

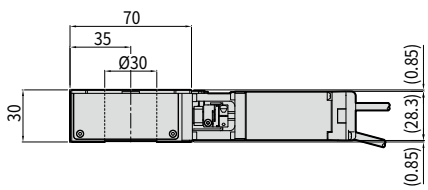


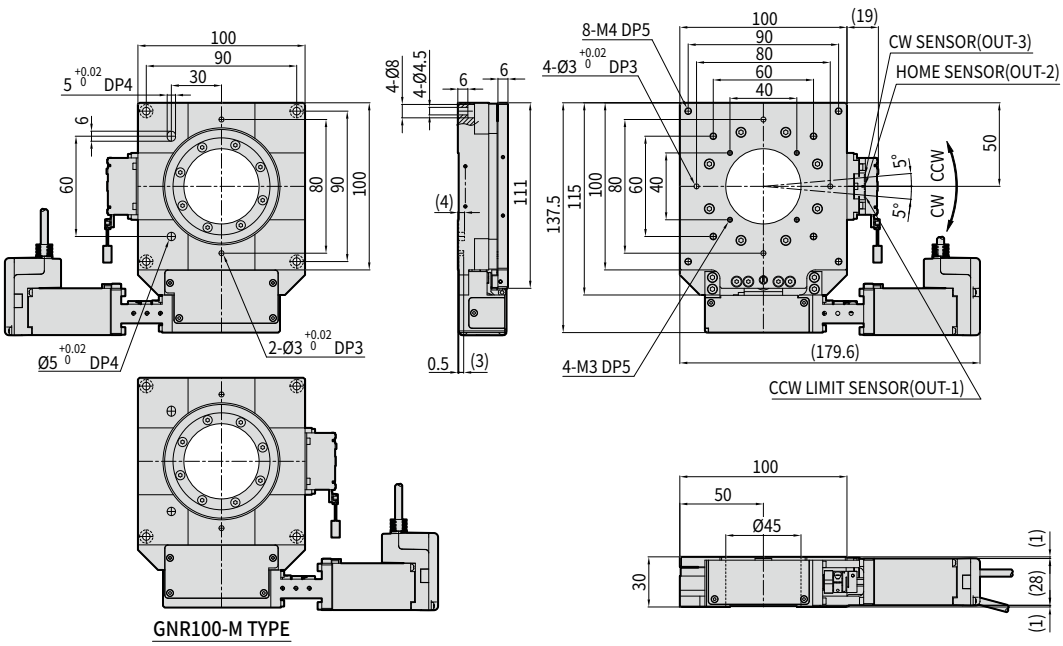



GNR70-M TYPE



## GNR100


100
90
30
5 +0.02 0 DP4
6
60
80
90
100
Ø5 +0.02 0 DP4
2-Ø3 +0.02 0 DP3
4-Ø8
4-Ø4.5
6
6
(4)
111
0.5
(3)
8-M4 DP5
4-Ø3 +0.02 0 DP3
100
90
80
60
40
(19)
CW SENSOR(OUT-3)
HOME SENSOR(OUT-2)
137.5
115
100
80
60
40
5°
5°
CW
CCW
50
4-M3 DP5
(179.6)
CCW LIMIT SENSOR(OUT-1)
GNR100-M TYPE
100
50
Ø45
30
(1)
(28)
(1)

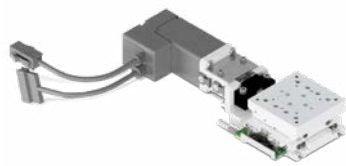
PRECISION STAGE / VERTICAL STAGE

# GNZ Series

## Features

NEW

- Z-axis motion precision stage with by stepping motor. (Motor is basically mounted)
- Excellent responsiveness to external moment by Cross Roller Guide application.
- High accuracy performance by application of high precision ball screw.
- Lighten body weight by aluminum table structure.
- Excellent table moving parallelism and solidity by linear guide application.



## Order Form

**GNZ 50 - M - D - C3**

① ② ③ ④ ⑤

① Series Name

② Table Size

| Order | Table Size(mm) |
|---|---|
| 50 | 50×50 |
| 70 | 70×70 |
| 100 | 100×100 |

③ Mirror Option

| Order | Mirror Option |
|---|---|
| Blank | Standard model |
| M | Mirror model |

④ Driver

| Order | Driver |
|---|---|
| Blank | Without driver |
| D | With driver |

* If driver option selected, Non-Flexible driver cable (1m) will be supplied together.

⑤ Cable for Motor

| Order | Cable Length(m) |
|---|---|
| Blank | No cable |
| C3 | 3 |
| C5 | 5 |
| C10 | 10 |

* Cable will be supplied as Flexible cable.

## Specification

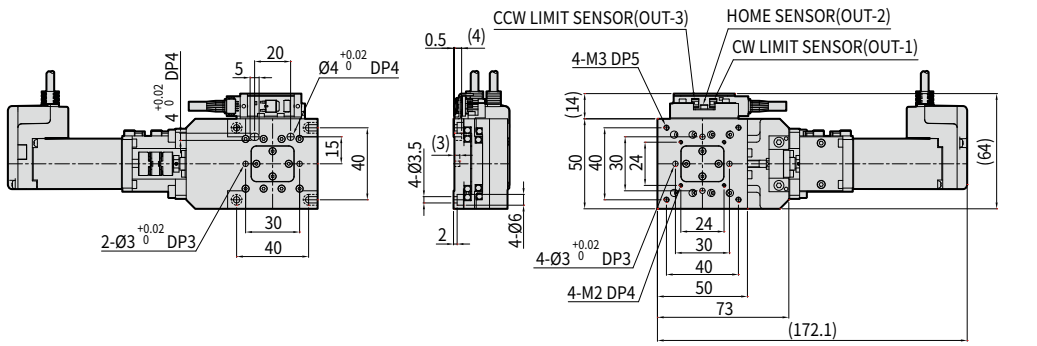
| Item Name | GNZ50 | GNZ70 | GNZ100 |
|---|---|---|---|
| Table Size(mm) | 50×50 | 70×70 | 100×100 |
| Stroke(mm) | ± 1.5 | ± 2.5 | ± 2.5 |
| Weight(Kgf) Note 1) | 0.7 | 1.1 | 1.8 |
| Maximum Load Weight(Kgf) | 4 | 5 | 7 |
| Repeatability(mm) | ≤ ± 0.001 | | |
| Straightness(mm) | ≤ 0.01 | | |
| Motor Specification | 2-Phase □28 stepping motor (Encoder equipped) | 2-Phase □42 stepping motor (Encoder equipped) | |
| Temperature Range(℃) | 5 ~ 60 | | |
| Max. Speed(mm/sec) | 1.25 | | |
| Moving Structure | Ball Screw (Lead : 1mm) | | |
| Guide Mechanism | Cross Roller Guide | | |
| Position Sensor | Home (1EA), Limit (2EA) | | |

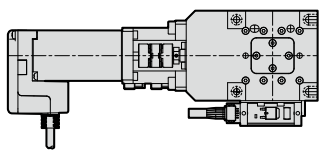
Note 1) Weight of motor and motor bracket involved.

# GNZ Series

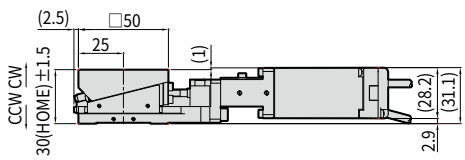
50 70 100

## GNZ50

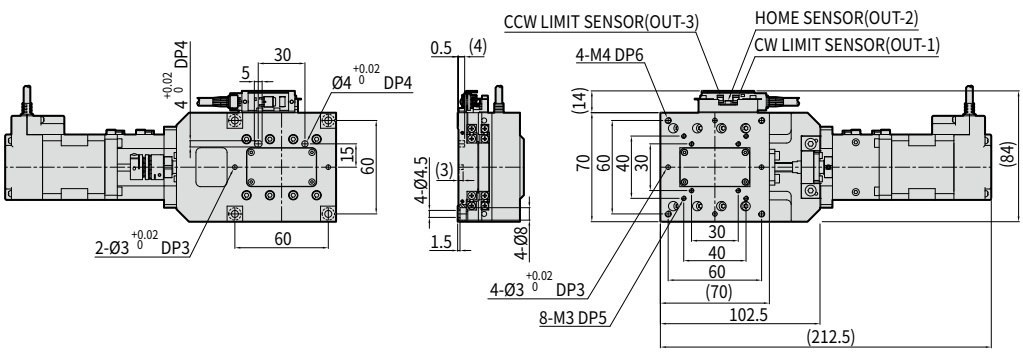


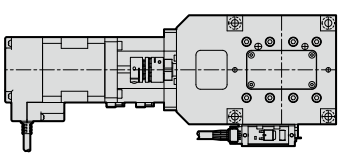



GNZ50-M TYPE

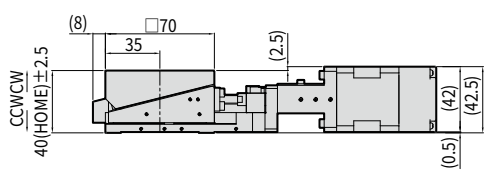



## GNZ70

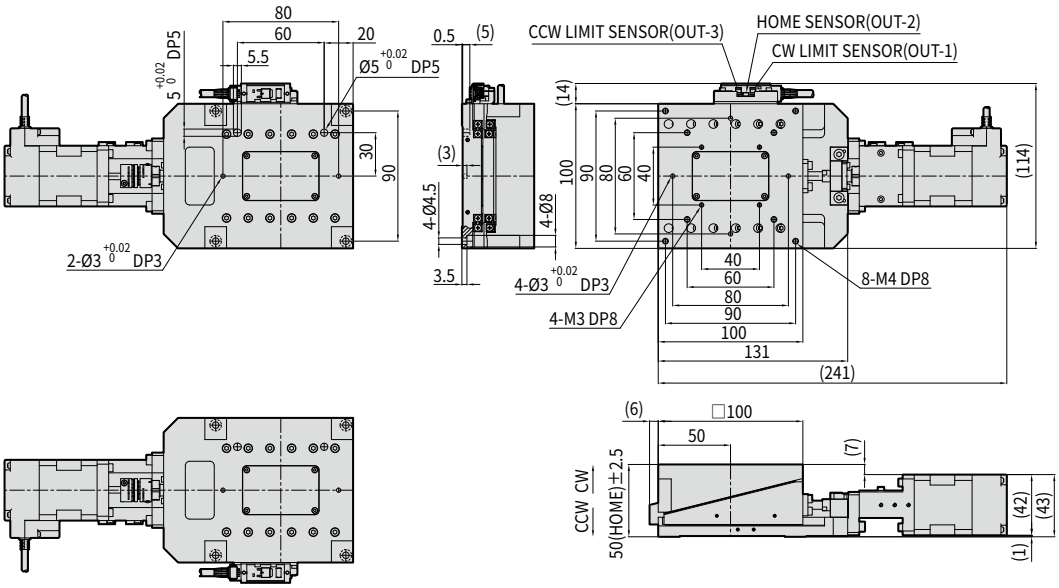


GNZ70-M TYPE



## GNZ100




GNZ100-M TYPE

PRECISION STAGE / TILT STAGE

# GNT Series

## Features

NEW

- Arc direction movement precision stage with by stepping motor. (Motor is basically mounted)
- Excellent responsiveness to external moment by Cross Roller Guide application.
- High accuracy performance by application of high precision ball screw.
- Lighten body weight by aluminum table structure.
- Excellent table moving parallelism and solidity by linear guide application.

## Order Form

**GNT 50 - 68 - M - D - C3**

① ② ③ ④ ⑤ ⑥

① Series Name

② Table Size / ③ Work Distance

| Order | Table Size(mm) | Work Distance(mm) |
|---|---|---|
| 50 | 50×50 | 50, 68, 86 |
| 70 | 70×70 | 70, 96, 122 |
| 100 | 100×100 | 95, 134, 172 |

④ Mirror Option

| Order | Mirror Option |
|---|---|
| Blank | Standard model |
| M | Mirror model |

⑤ Driver

| Order | Driver |
|---|---|
| Blank | Without driver |
| D | With driver |

* If driver option selected, Non-Flexible driver cable (1m) will be supplied together.

⑥ Cable for Motor

| Order | Cable Length(m) |
|---|---|
| Blank | No cable |
| C3 | 3 |
| C5 | 5 |
| C10 | 10 |

* Cable will be supplied as Flexible cable.

## Specification

| Item Name | GNT50 | | | GNT70 | | | GNT100 | | |
|---|---|---|---|---|---|---|---|---|---|
| Table Size(mm) | 50×50 | | | 70×70 | | | 100×100 | | |
| Work Distance(mm) | 50 | 68 | 86 | 70 | 96 | 122 | 95 | 134 | 172 |
| Work Distance Accuracy(mm) | ± 0.2 | | | | | | | | |
| Rotate Range(°) | ± 5 | ± 4.5 | ± 4 | ± 5 | ± 4.5 | ± 4 | ± 5 | ± 4 | ± 3 |
| Angle Per Cycle(°) Note 1) | ≒1.067 | ≒0.799 | ≒0.636 | ≒0.754 | ≒0.562 | ≒0.448 | ≒0.546 | ≒0.401 | ≒0.317 |
| Weight(Kgf) Note 2) | 0.54 | | | 0.74 | | | 2 | | |
| Maximum Load Weight(Kgf) | 3 | | | 5 | | | 7 | | |
| Repeatability(°) | ≤ ± 0.003 | | | | | | | | |
| Rotation Center Error(mm) | ≤ 0.01 | | | | | | | | |
| Motor Specification | 2-Phase □28 stepping motor (Encoder equipped) | | | | | | 2-Phase □42 stepping motor (Encoder equipped) | | |
| Temperature Range(°C) | 5 ~ 60 | | | | | | | | |
| Max. Speed(mm/sec) | 5 | | | | | | | | |
| Moving Structure | Ball Screw (Lead : 1mm) | | | | | | | | |
| Guide Mechanism | Cross Roller Guide | | | | | | | | |
| Position Sensor | Home (1EA), Limit (2EA) | | | | | | | | |

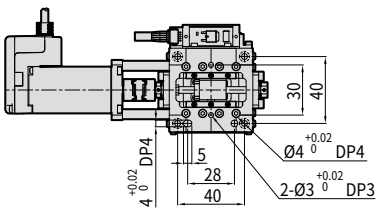
Note 1) Operating angle per 1 cycle of motor.
Note 2) Weight of motor and motor bracket involved.
• Because tilt stages work by converting linear motion into rotation, the ball screw stroke and rotation angle do not match.

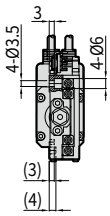
# GNT Series

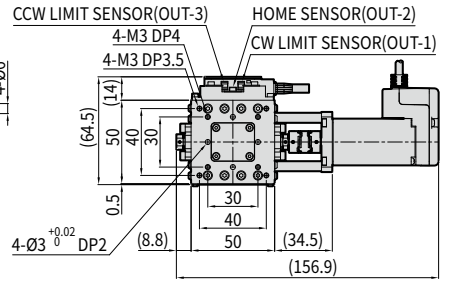
50 70 100

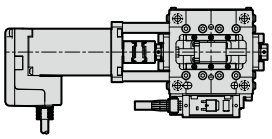
50 68 86

## GNT50-50

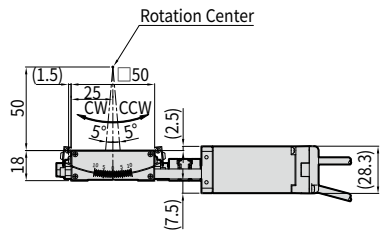


GNT50-50-M TYPE

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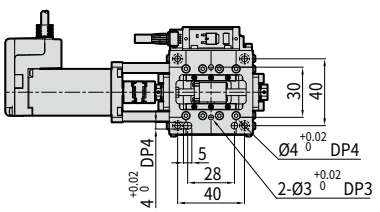


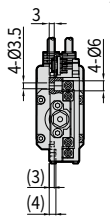


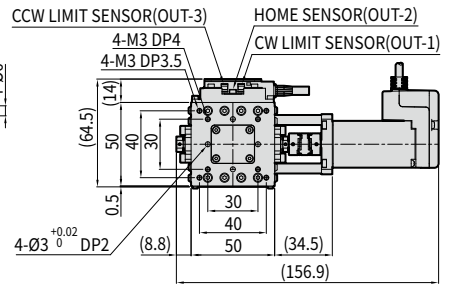


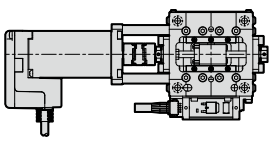

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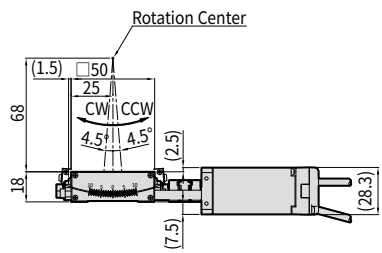

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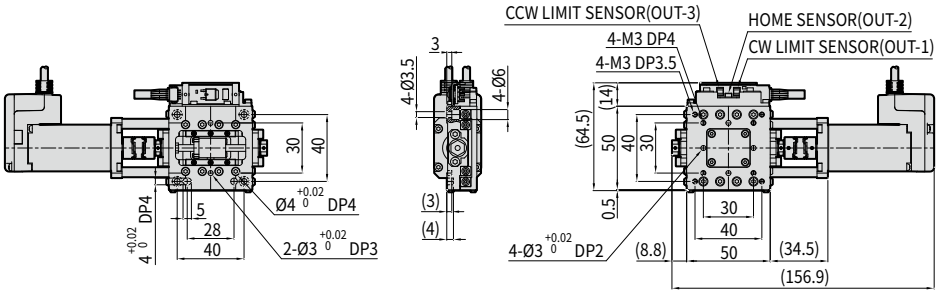


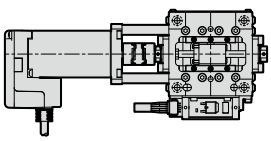

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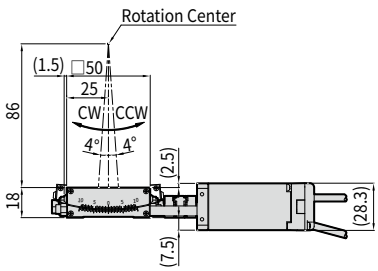
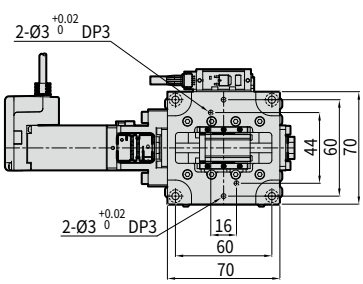


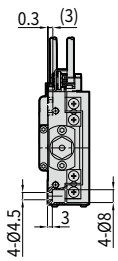
# GNT Series

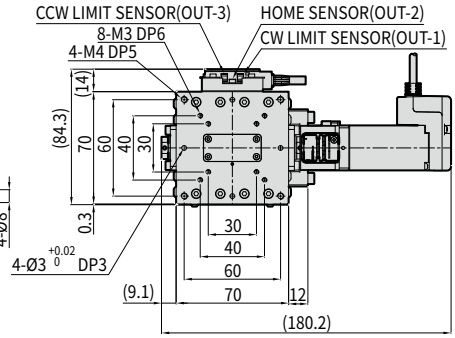
50 | 70 | 100

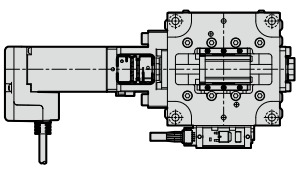
70 | 96 | 122

## GNT70-70



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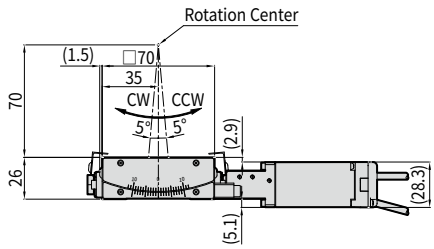


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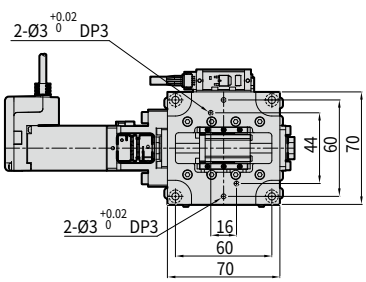


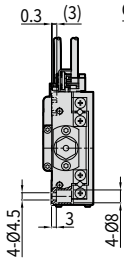


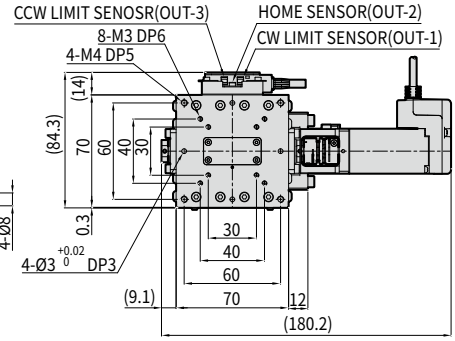


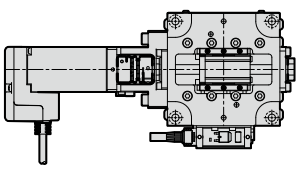

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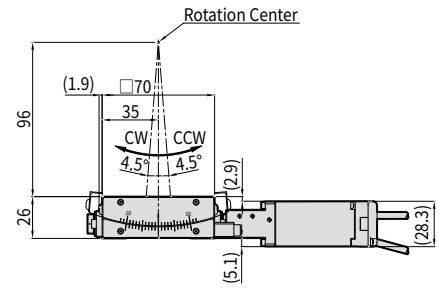

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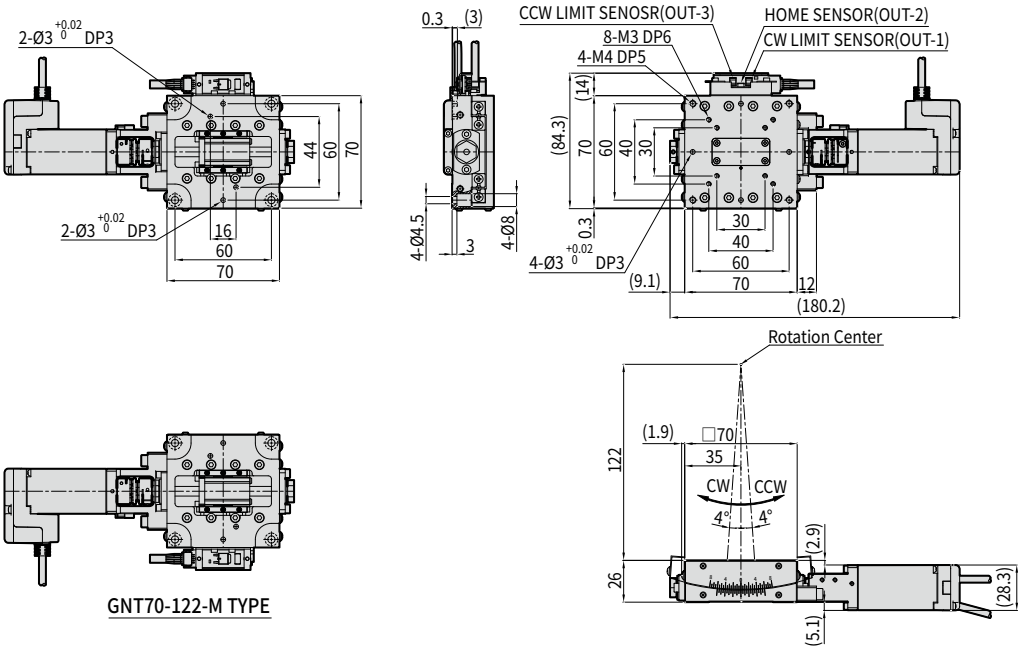
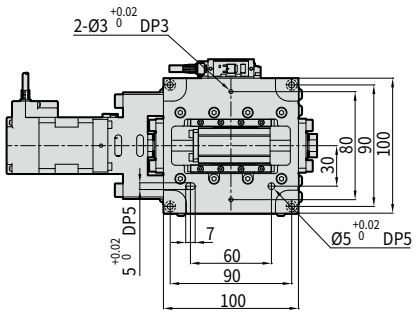


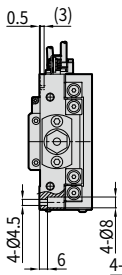

GNT70-122-M TYPE

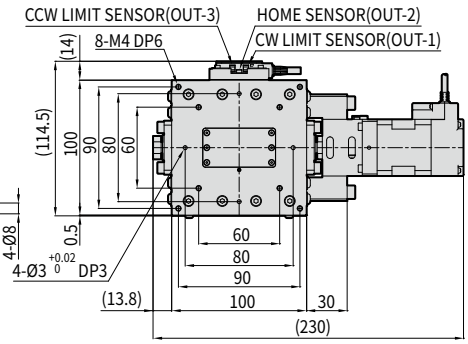
# GNT Series

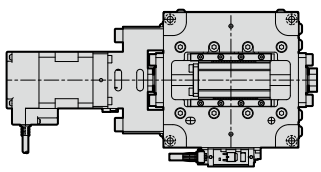
50 70 100
95 134 172

## GNT100-95



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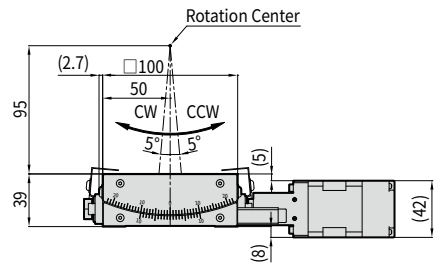


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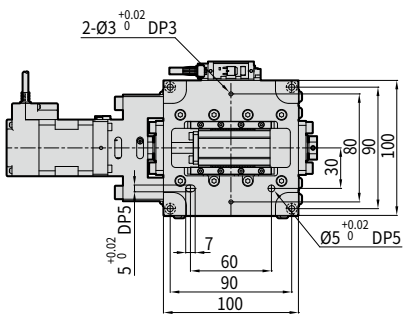


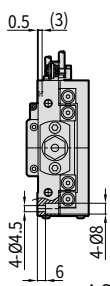


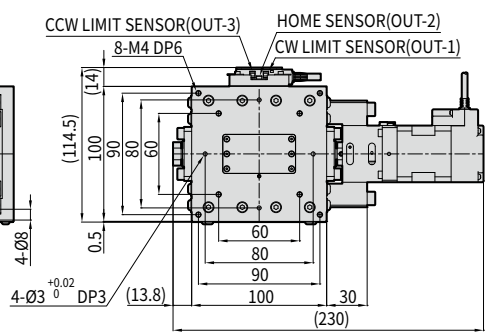


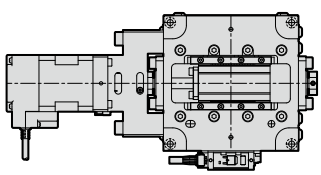

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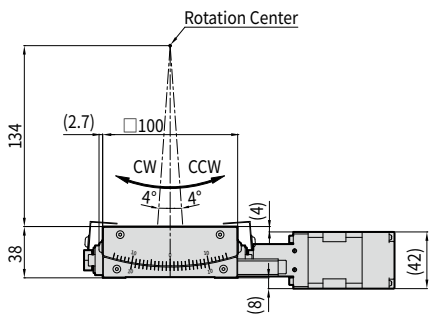

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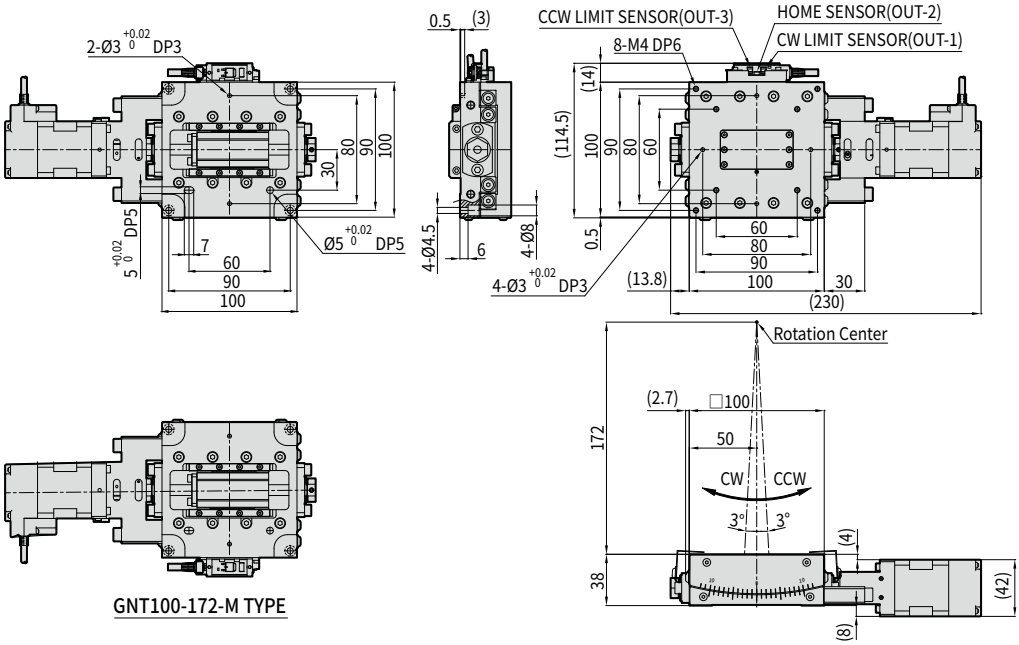



GNT100-172-M TYPE

PROTEC

P&M Catalogue

# AUTO PITCH CHANGER

P & M INCORPORATED

Please read it before use, with individual notes for each series as well, for your safe use.

# ⚠ Basic Safety Notes for AUTO PITCH CHANGER ❶

## ⚠ Caution — Notes in Installation

■ **When human body risk or damage is expected, make sure to safety measure such as protection cover.**

Motion or operation of workpiece or auto pitch changer could be a reason of human risk or damage, when any risks are expected, make sure to safety measure such as protection over.

■ **Make sure to use this product within specified usage range on this catalogue.**

Any usage over specified usage range of this catalogue or damage on stopper could be a reason of damage on product or shorten lifespan or bad of precision.

■ **Establish measures for power failure.**

Set up safety measures in case of power failure, for devices powered by air pressure or electricity.

■ **Emergency stop should be considered for auto pitch changer.**

When the machine makes an emergency stop, it may cause risk to mechanical equipment depending on usage environment, so appropriate measures should be taken.

■ **Re-operation of auto pitch changer after emergency stop needs to be considered.**

Re-operation after emergency stop may cause damage to human body or machine, so appropriate measures shall be taken.

■ **Do not allow excessive external force or shock.**

Auto pitch changer has electric motor inside and produced by precise tolerance. Impractical operation may cause failure in auto pitch changer or adverse effect on mechanical equipment.

■ **Be careful not to damage on the cable line of auto switch.**

Over bending or scar, damage on the cable of auto switch will cause of current leakage or defect on connection may lead electric shock and/or fire, abnormal motion.

■ **Depend on the specification of motor, torque could be not enough at high speed operation.**

■ **For motor installed products, electrical signal noise should be considered.**

Any electrical noise could be a reason of malfunction of actuator.

## ⚠ Caution — Notes in Selection

■ **For item selection, refer specification of each series in this catalogue.**

For auto pitch changer selection, refer each specification in this catalogue. To reduce malfunction and defect, use it within the range of usage way and temperature and others.

■ **Install and operate this product after fully understood motor and driver manual supplied with product.**

■ **Each pitch plates cannot move separately.**

All pitch plates are move in always same pitches within usage range.

■ **Multi pitches control available with motor application.**

Within usage range, the pitch of each pitch plates could be controlled by rotation times(pulse counts).

Please read it before use, with individual notes for each series as well, for your safe use.

# ⚠ Basic Safety Notes for AUTO PITCH CHANGER ❷

**⚠ Caution** **Notes in Installation**

■ **Be careful if any external force on transfer plate and pick up cylinder such as crash or grabbing and shake could bring bad of position precision.**

This product cannot be changed the pitch by external force. Only it changed by rotation of ball screw.

■ **Pay attention not to apply external force on pick up cylinder when exchanging one-touch connector of pick up cylinder.**

■ **Pay attention torsion on pitch plate or pick up cylinder when piping or wiring work.**

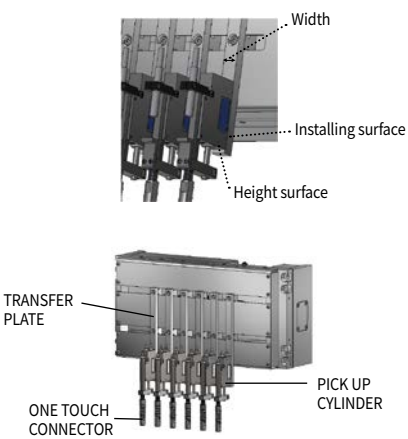
■ **The positioning accuracy of this product is adjusted by a skilled worker using a dedicated tool, so warehousing and repairing by the company is essential.**

■ **When operating this model, not to use it exceed the usage range set by limit sensor.**

Make sure to prepare safety circuit of emergency stop using limit sensor.

■ **For any manual disassembling or reassembling, position accuracy and repeatability cannot be guaranteed.**

■ **For pick up cylinder combination products : When exchanging pick up cylinder, set it by surface matching of transfer plate and pick up cylinder.**




Explanation of Terms

■ **Be careful not to make any transform on the pitch plates when mounting pick up cylinder onto auto pitch changer.**

Any transform of pitch plate could be a reason of malfunction or defect.

■ **Pay attention any dust or metalworking chips go inside of auto pitch changer if auto pitch changer is installed in working site.**

■ **Be careful drop or damage by shock when installing auto pitch changer.**

Any transform of pitch plate could be a reason of malfunction or defect.

■ **Operate the system after confirming the smooth operation of auto pitch changer.**

Check smooth operation of auto pitch changer for performance and functional check after it installed.

■ **Make sure to not damage or scar on operation part by overwhelming force.**

It could be a reason of malfunction or damage.

■ **When installing auto pitch changer or mounting certain bracket or actuator on the auto pitch changer, fasten fixing bolt within specified torque listed on this catalogue.**

Any exceeding of specified range could be a reason of malfunction and lack of torque could be danger such as drop or loosen.

■ **Do not connect or disconnect of connector and cable during electric supplied.**

It could be a reason of malfunction and fire

■ **Make sure sufficient space to doing test and maintenance.**

Please read it before use, with individual notes for each series as well, for your safe use.

# ⚠ Basic Safety Notes for AUTO PITCH CHANGER ❸

## ⚠ Caution — Notes for usage environment and handling

■ **Using in frequent vibration or shock could be a reason of malfunction or defect so be careful.**

■ **Do not use in the environment that can be affected by foreign substances such as dust and chip, and cutting oil.**

It may cause vibration, frictional resistance, and air leakage. In such environment, please install appropriate protective cover through the consultation with our company.

■ **Be careful with corrosion resistance for the stability in guide part.**

Humid environment may cause water drop and rust in guide unit.

■ **Do not approach working area during system operating.**

Human body can be damaged by any electric shock, stricture, shock or etc...

■ **For installation and maintenance should be done after cut of power supply.**

Malfunction or electric shock could be occurred. Also, unexpected power supply needs to be considered.

■ **When used around heat source of high temperature, product can be heated by radiant heat and cause failure. Therefore, install protective covers to block heat source.**

■ **When auto pitch changer returning to origin position, do not apply and extra weight or shock except installed load.**

Origin position could be not matched with original position.

■ **Make sure tight fasten not to loosen any installed or linked point.**

Make sure tight installation not to loosen when it used in vibration place or many frequent operations.

■ **Be careful not to damage on the cable line of auto switch.**

Over bending or scar, damage on the cable of auto switch will cause of current leakage or defect on connection may lead electric shock and/or fire, abnormal motion.

## ⚠ Caution — Notes in maintenance

■ **Add lubricant at the frictional surfaces of auto pitch changer periodically.**

Adding lubricant periodically at the frictional surfaces of auto pitch changer can extend lifespan.

■ **Do NOT disassemble or remodel to auto pitch changer.**

Do NOT disassemble or remodel to auto pitch changer for other purpose. It could bring human injury or electrical shocks, fire due to abnormal operation.

■ **Checklists before maintenance.**

Check if there is preventive measure for load from drop, deflection, and projection, and conduct inspection after block compressed air and power, and exhaust remained air in system. If air pressure is remained in cylinder, the actuator may cause injury to human body due to accidental operation.

■ **Checklists after maintenance.**

Check anti-protrusion action for re-starting, and inspect leakage and appropriate function by supplying compressed air or power to the pneumatic system. If the machine is not operated due to leakage, stop using it and check if the installation is correct.

■ **Frequent inspection item.**

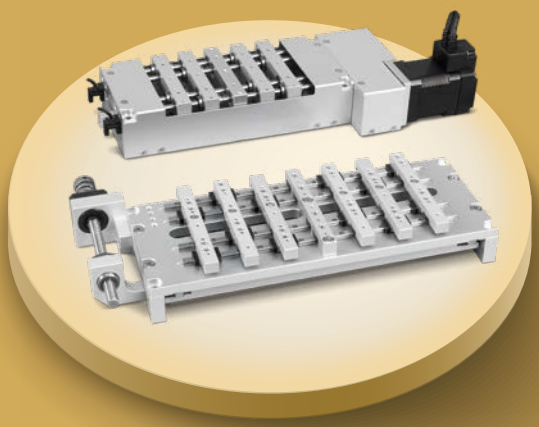
With daily frequent inspection, check the deterioration of durability and function in pneumatic devices to prevent accident in advance.

MEMO

## AUTO PITCH CHANGER

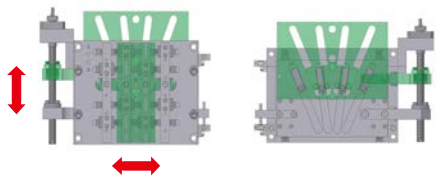
# PDCM Series

### PLATE CAM structure



## Auto Pitch Changer by PLATE CAM structure

- Auto Pitch Changer by Plate CAM structure.
- Miniature size and light weight by innovative design of Roller CAM.
  Manufacturing price reduced by standardized Pitch Plate.



## Various pitch control ways

- Motor Control : Multi pitch control within stroke range.
- Pneumatic Cylinder Control : 2 position control. (Optional)

Motor Control

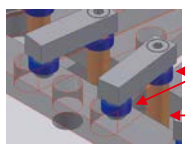
Pneumatic Cylinder Control

* Please contact to office to select pneumatic cylinder control type.

## Specialized design structure

- Minimized size with specialized design with one Link Shaft and two roller CAM.
- Minimized shake by applying tension at the two bearings.

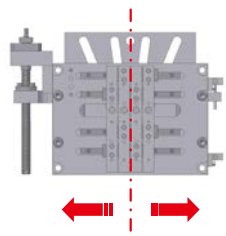
| Specification | Degree of shake (Unit : mm) |
|---|---|
| Single Cam | ±0.2 |
| Double Cam | ±0.07 |
| Tension Cam | ±0.02 |



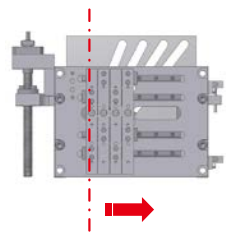

## Various pitch change points

- Can make the changing point of pitch change as center(Standard) or side(Optional).

* At the case of make it at the side point, OPEN & CLOSE stroke will be shorter than central basis.



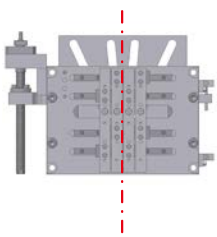
Central Basis Type



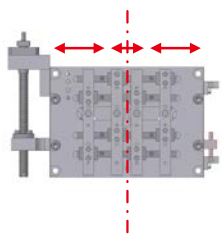
Side Basis Type

## Setting of irregular pitch

- Can set irregular pitches for open and close moving not regular pitches(Optional).



Before Pitch Change

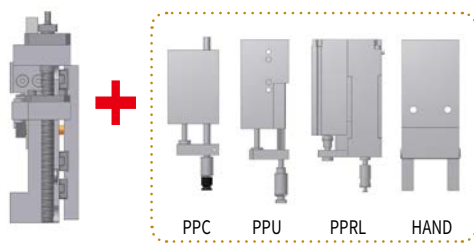


After Pitch Change

※ Please contact to office for irregular pitches application.

## Various applications

- Can apply various actuators except picker cylinder.




※ Please contact to office for more details.

AUTO PITCH CHANGER / PLATE CAM STRUCTURE

# PDCM Series

## Features

NEW

- Auto Pitch Changer by PLATE CAM.
- Light weight and minimized size.
- Can set needed pitches by using ball screw.
- Minimized shake by extended support surface and applying tension.
- Various pick up cylinder or hand can be attached.
  (need assembly bracket)
- Basically applied the home sensor(limit sensor) for open and close.

## Order Form

**PDCM 1122 - M5**

① ② ③

① Series Name

② Min and Max Pitches

| Order | Standard Pitches(mm) |
|---|---|
| 1122 | 11 ~ 22 |
| 1428 | 14 ~ 28 |

③ Num of Heads

| Order | Num of Heads |
|---|---|
| M4 | 4 |
| M5 | 5 |
| M6 | 6 |
| M7 | 7 |

* If you need certain pitches and number of heads, which except listed above sheet, please contact to office.

## Specification

| Item Name | PDCM1122-M4 | PDCM1122-M5 | PDCM1428-M6 | PDCM1428-M7 |
|---|---|---|---|---|
| Range of Pitches(mm) | 11 ~ 22 | 11 ~ 22 | 14 ~ 28 | 14 ~ 28 |
| Num of Heads(Unit) | 4 | 5 | 6 | 7 |
| Weight(kgf) | 1.1 | 1.2 | 1.5 | 1.6 |
| Operation Type | By Motor (Motor is not supplied) | | | |
| Specification of Ball Screw | Outer Diameter: Ø8, Lead: 2, Rolled C7 Grade | | | |
| Minimum Input Torque for Operation (Nm) | 0.06 | | | |
| Position Repeatability(mm) Note 1) | ±0.03 | | | |
| Position Accuracy Between Pitches (mm) Note 2) | ±0.1 | | | |
| Maximum Operating Speed(CPM) Note 3) | 20 | | | |
| Temperature Range(℃) | 5 ~ 60 | | | |
| Home Sensor | Basically supplied for two position (Open, Close – photo sensor type) | | | |

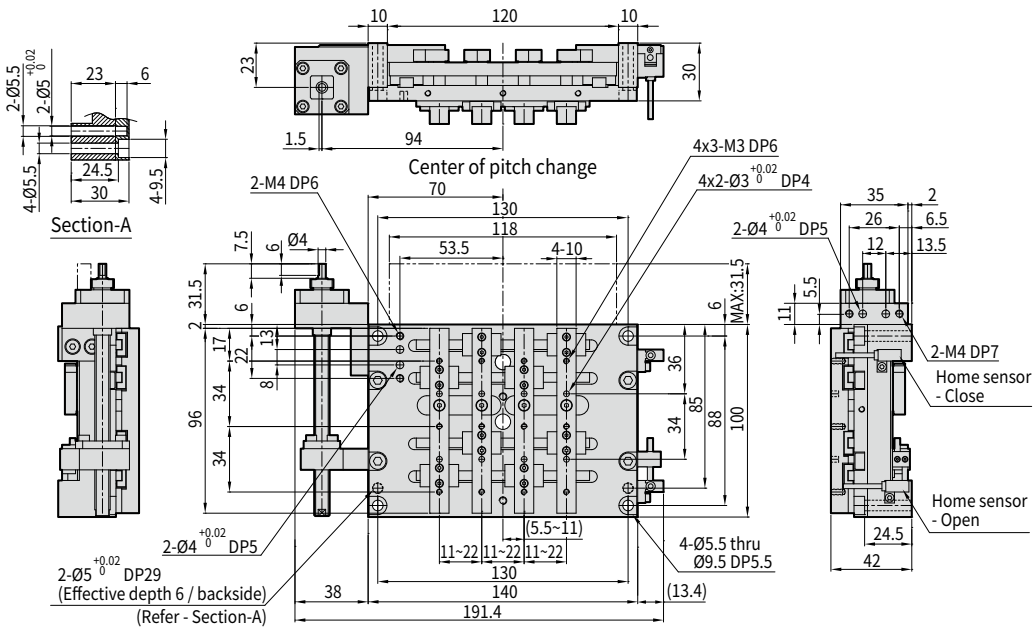
Note 1) It is reference value which is measured at the center of link(Location at the middle of pitch plate) after 50 times operated without load condition.
Note 2) It is reference value of difference between each pitches at the center of link for stopped position with assembly bracket installed.
Note 3) CPM : Cycle time Per Minute.

# PDCM Series

1122 1428

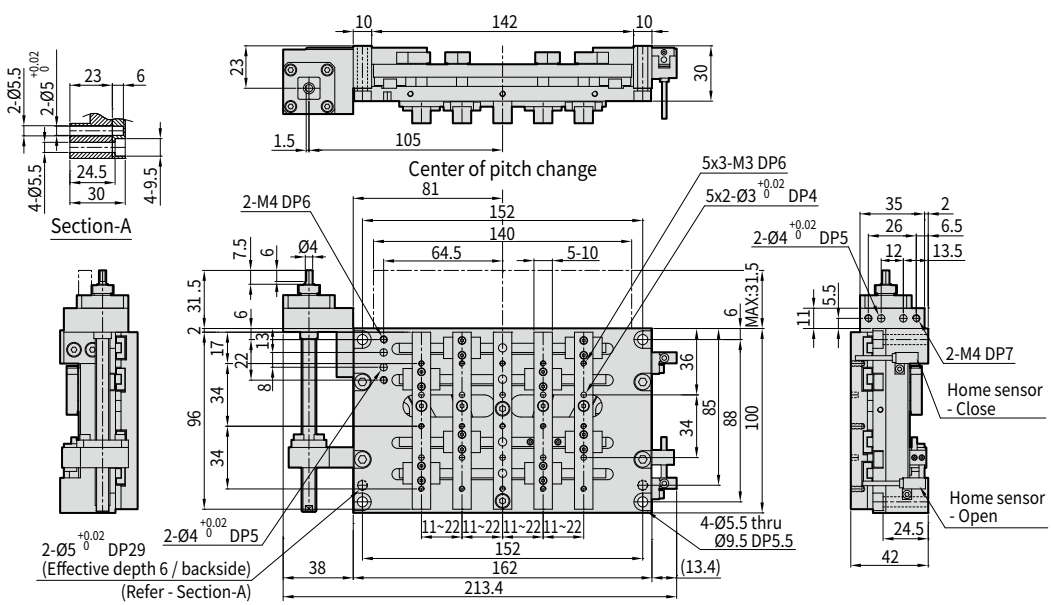
M4 M5

## PDCM1122-M4




※ Ball Screw Spec : Bore Ø8, Lead2 (Rolled C7 Grade) ※ Pitch Change Range(mm) : 11 ~ 22

## PDCM1122-M5



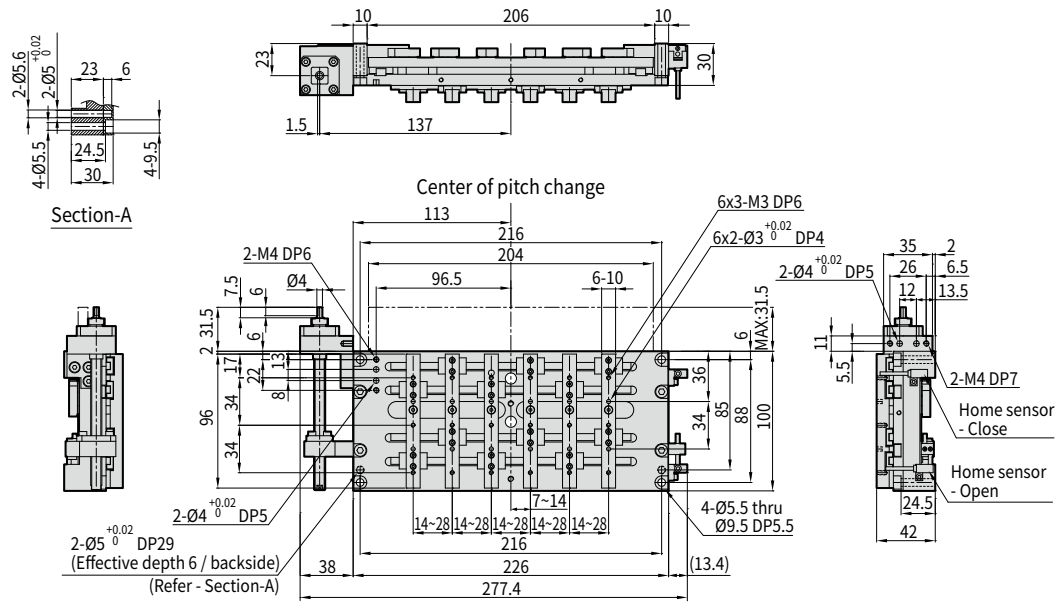

※ Ball Screw Spec : Bore Ø8, Lead2 (Rolled C7 Grade) ※ Pitch Change Range(mm) : 11 ~ 22

# PDCM Series

1122 1428

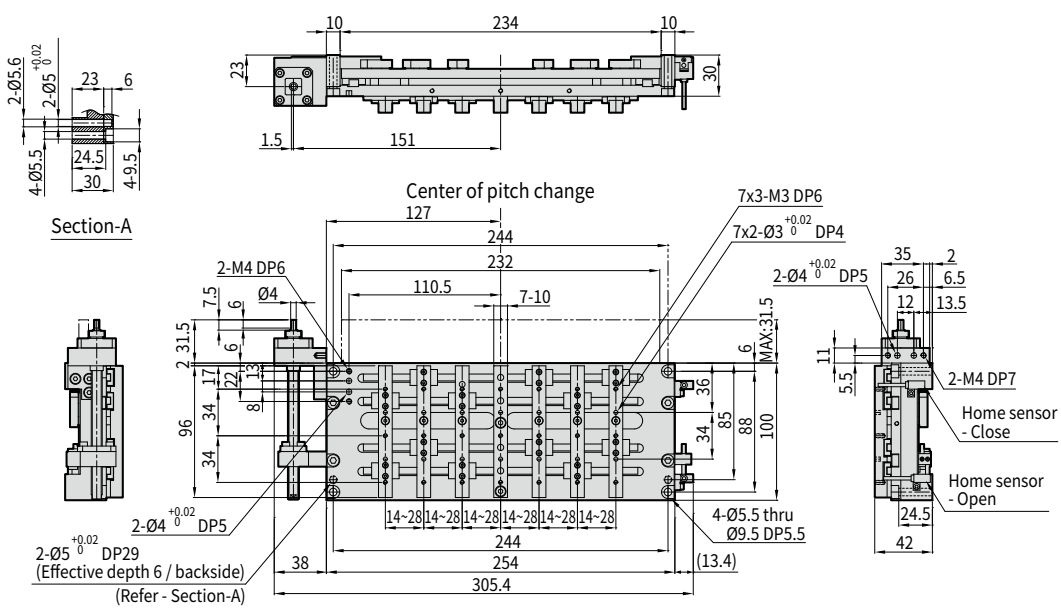
M6 M7

## PDCM1428-M6




※ Ball Screw Spec : Bore Ø8, Lead2 (Rolled C7 Grade) ※ Pitch Change Range(mm) : 14 ~ 28

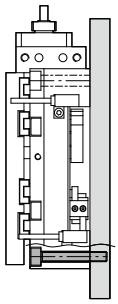
## PDCM1428-M7




※ Ball Screw Spec : Bore Ø8, Lead2 (Rolled C7 Grade) ※ Pitch Change Range(mm) : 14 ~ 28

## Installation Information

### 1. Installation by Auto Pitch Changer body through holes



| Item | Fastening Bolt | Max Torque (kgf·cm) |
|---|---|---|
| PDCM | M5×P0.8 | 51 |

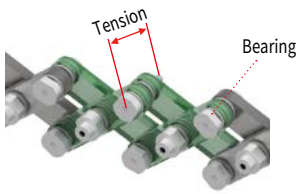
## AUTO PITCH CHANGER

# PDLM Series

### LINK structure

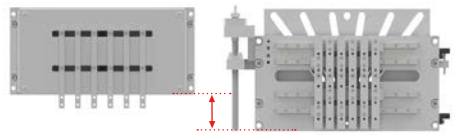
## Smooth and precise pitch conversion

- High precision pitch convert by optimized link structure.
- Smooth and stable movement by bearing application.
- High Precision - Location : ±0.07 mm,
  Repeatability : ±0.02 mm




## Maximize of vertical space utility

- Vertical space is ensured by locating motor in the horizontal direction.
- Maximized space utility with the character of the link structure.



< PDLM Series > < PDCM Series >

## Diversity pitch convert range

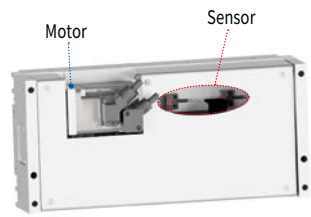
- Various optional pitches.
- Multi pitch position control by motor and driver control.

| Num of Heads | Pitch Convert Range(mm) |
|---|---|
| 6, 8, 10 | 10 ~ 22 |
| 6, 8, 10 | 14 ~ 32 |

※ For the alternative pitches, contact to office.

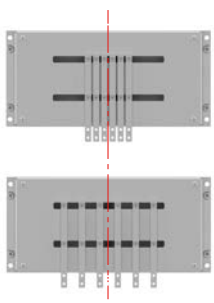
## Improved Customer Convenience

- Standard motor mounted. (Optional for driver and cable)
- Limit sensor installed for open and close.
- Simple design by application of external cover.




## Pitch convert from center

- Suitable for various transfer application by center based pitch convert.




## Various actuator application

- Applicable installation of pickup cylinder or hand on PDLM series.

※ We highly recommend factory assembly.

※ For pick up cylinder mounting options, please contact to office.

AUTO PITCH CHANGER / LINK STRUCTURE

# PDLM Series

## Features

NEW

- Auto pitch changer by link structure.
- Simple and light structure.
- Multi pitch control by motor control.
- Basic mount of motor and limit sensors.
- High precise position and repeat accuracy by optimized link structure.
- Stable and smooth operation.
- Diversity application of various actuators.
  (Need to install each installation bracket)
- Various installation direction.

## Order Form

**PDLM 1022 - M8 - PU - D - C5**

① ② ③ ④ ⑤ ⑥

① Series Name

② Range of Pitch Change

| Order | Standard Pitch Change Range(mm) |
|---|---|
| 1022 | 10 ~ 22 |
| 1432 | 14 ~ 32 |

③ Num of Heads

| Order | Num of Heads |
|---|---|
| M6 | 6 |
| M8 | 8 |
| M10 | 10 |

④ Bracket Options for Pick Up Cylinder Mounting

| Order | Applicable Actuators Pick Up Cylinder |
|---|---|
| PU | PPU06F |
| PC | PPC06 |

* Please refer < Table A Standard Pick Up Cylinder Brackets> for the specification of brackets.
* Please contact to office for another applications.

⑤ Driver

| Order | Driver |
|---|---|
| Blank | Without driver |
| D | With driver |

* With selection of Driver option, basic cable will be included. (IO Cable 1M)
* 50W grade servo motor for standard option. Please contact to office for the change or private supply.

⑥ Motor Cable

| Order | Motor Cable |
|---|---|
| Blank | Without cable |
| C3 | 3 M |
| C5 | 5 M |
| C10 | 10 M |

* Cable for operation and encoder for 1 set.

* Please contact to office for alternative pitches or num of head is required.

## Specification

| Item Name | PDLM1022-M6 | PDLM1022-M8 | PDLM1022-M10 | PDLM1432-M6 | PDLM1432-M8 | PDLM1432-M10 |
|---|---|---|---|---|---|---|
| Range of Pitches(mm) | 10 ~ 22 | | | 14 ~ 32 | | |
| Num of Heads(EA) | 6 | 8 | 10 | 6 | 8 | 10 |
| Weight(kgf) | 2.6 | 3.2 | 3.4 | 3.3 | 3.7 | 3.9 |
| Operation Type | Motor (Servo Motor Supplied) | | | | | |
| Minimum Input Torque For Operation(Nm) | 0.1 | | | | | |
| Repeatability(mm) Note 1) | ±0.02 | | | | | |
| Position Accuracy Between Pitches(mm) Note 2) | ±0.07 | | | | | |
| Maximum Operating Speed(mm/s) Note 3) | 70 (2,100 RPM) | | | | | |
| Temperature Range(℃) | 5 ~ 60 | | | | | |
| Home Sensor | Basically supplied for two position (Open, Close – Photo Sensor Type) | | | | | |

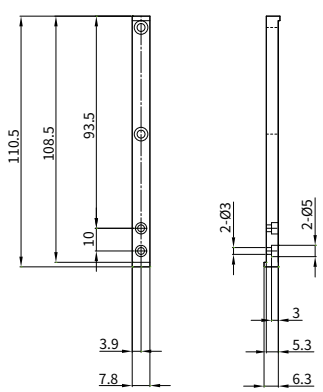
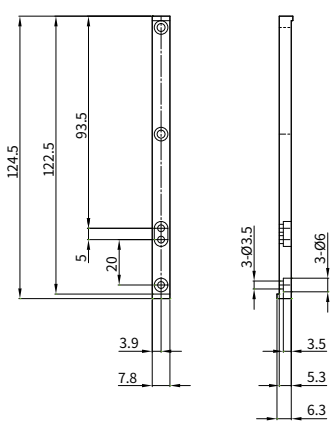
Note 1) It is reference value which is measured at the center of link (Location at the middle of pitch plate) after 100 times operated without load condition.
Note 2) Position precision means different of distance between each transfer plate at static state before picker or gripper mounted.
Note 3) It is speed of Last or first pitch plate.

## Bracket options for Pick Up Cylinder mounting

### ■ Standard Pick Up Cylinder Brackets <Table A>

Table A

- We recommend to assembly and supply with pickup cylinder or hand cylinder on auto pitch changer in factory.
  For other actuator or structure need to be installed, please contact to office.

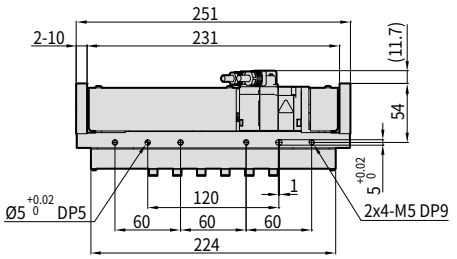
| Name | PU | PC |
|---|---|---|
| Actuator | PPU06F | PPC06 |
| Drawing |  |  |

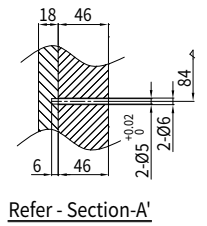
# PDLM Series

1022 1432

M6 M8 M10

## PDLM1022-M6



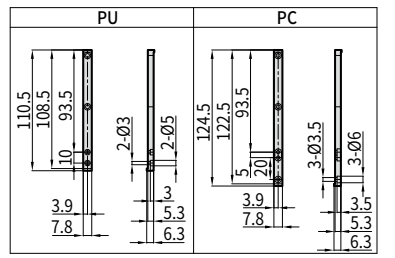
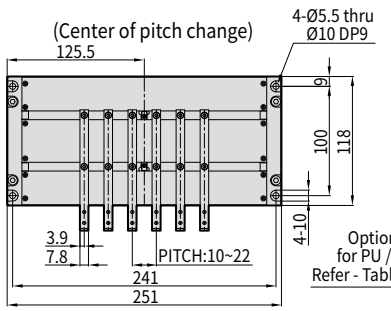
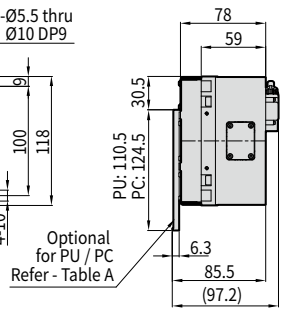
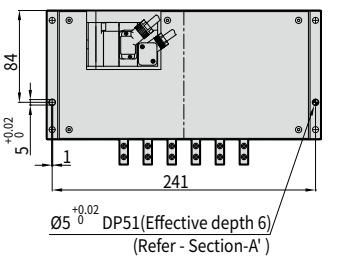



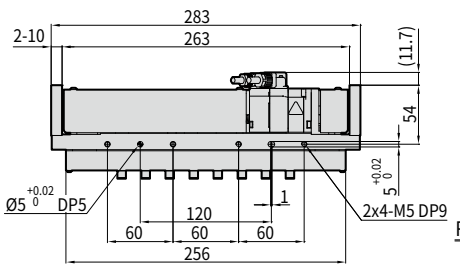

Table A

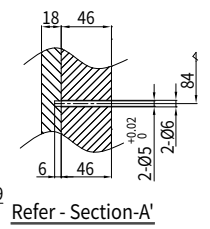



## PDLM1022-M8



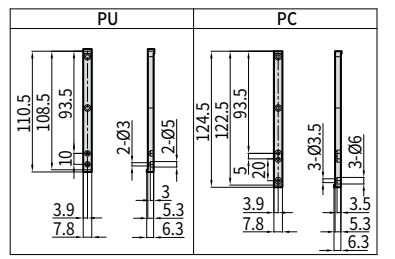
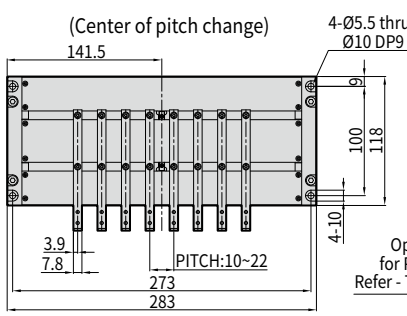
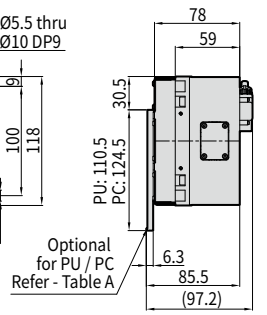
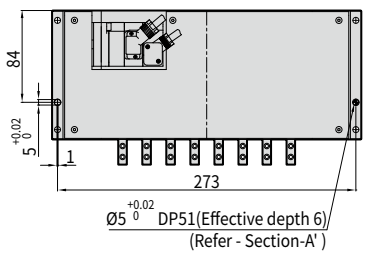



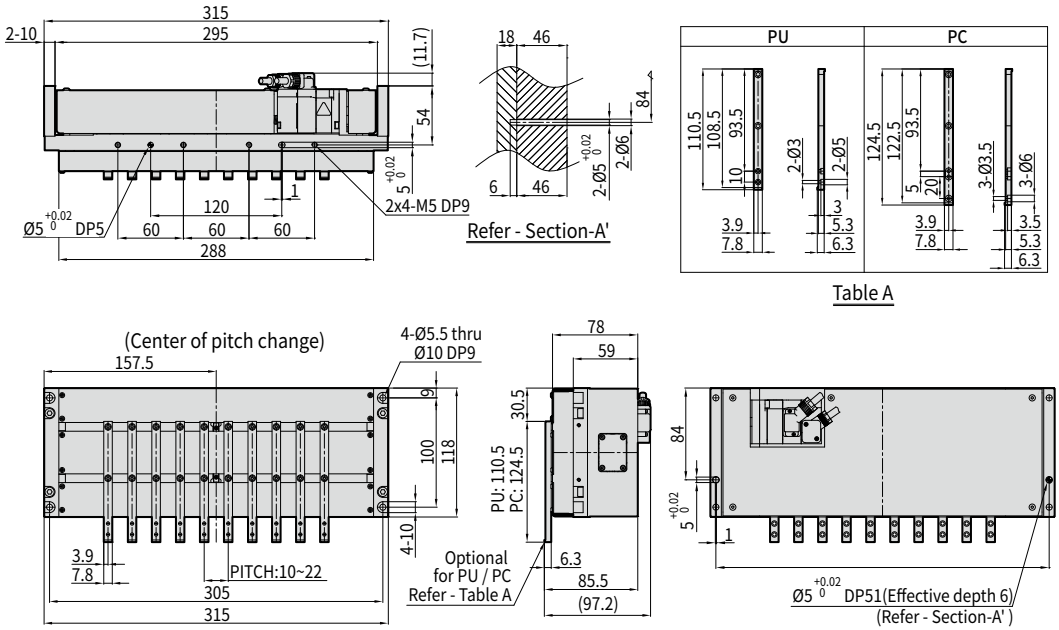

Table A



## PDLM1022-M10

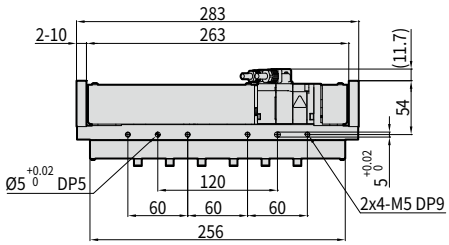


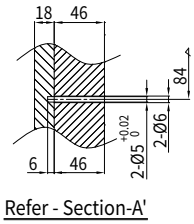
# PDLM Series

1022 1432

M6 M8 M10

## PDLM1432-M6



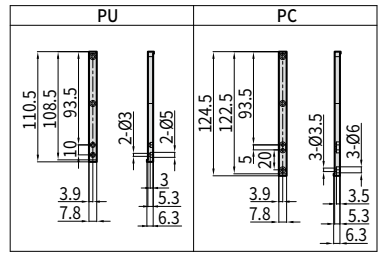
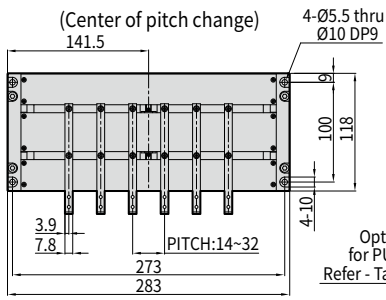
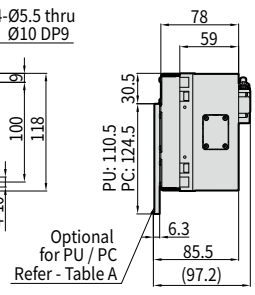
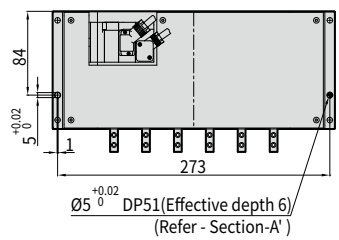



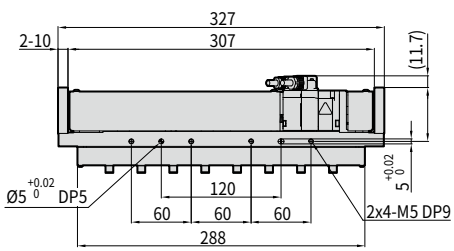

Table A

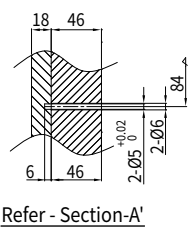



## PDLM1432-M8



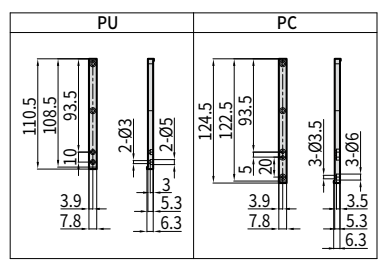
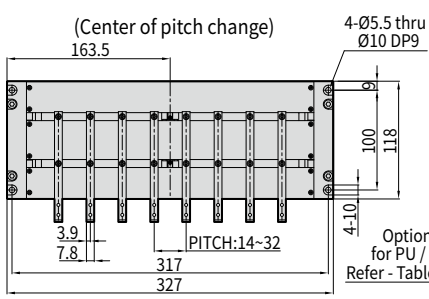
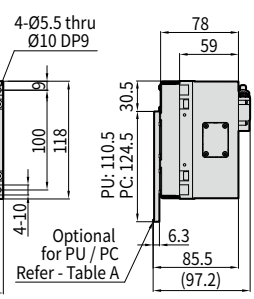
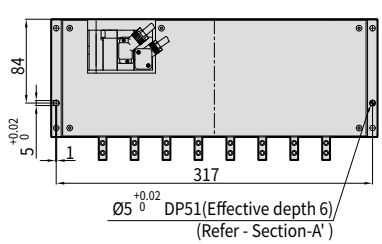




Table A



## PDLM1432-M10

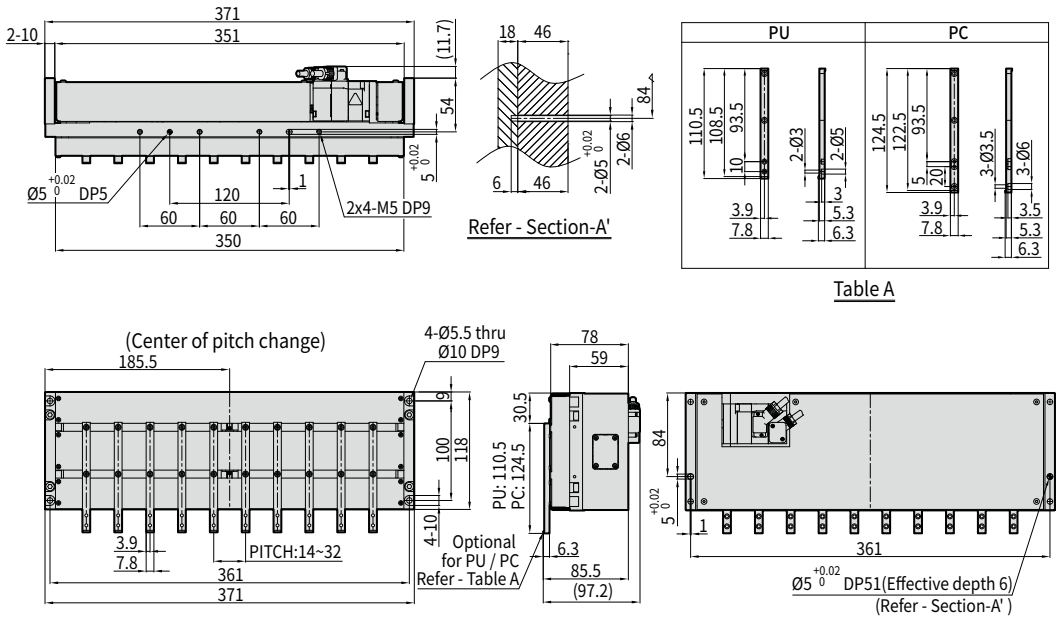
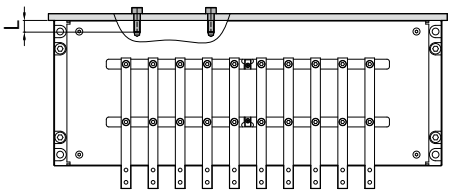



Table A

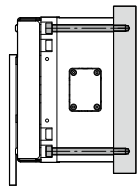
## Installation Information

### 1. Installation by Auto Pitch Changer body tap holes



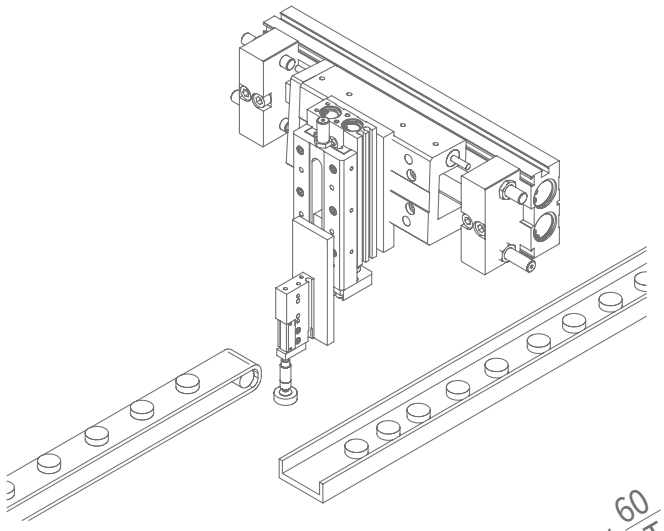

| Item | Fastening Bolt | Max Torque (kgf·cm) | Max Bolt Length L (mm) |
|---|---|---|---|
| PDLM | M5×P0.8 | 51 | 10 |

### 2. Installation by Auto Pitch Changer body through holes



| Item | Fastening Bolt | Max Torque (kgf·cm) |
|---|---|---|
| PDLM | M5×P0.8 | 51 |

MEMO



$$V = \frac{\pi}{4} \times D^2 \times \ell \times 10^{-6} \left( \frac{P + 1.033}{1.033} \right) \times \frac{60}{T} \text{ (N}\ell\text{/min)}$$

PROTEC

# P&M Catalogue

Basic Safety Notes for AUTO SWITCH • Technical data of Auto Switch
Air Consumption • Required Air Volume • Application examples
Engineering Unit Conversion Table

# SUPPLEMENT

P & M INCORPORATED

Please read it before use, with individual notes for each series as well, for your safe use.

# ⚠ Basic Safety Notes for AUTO SWITCH

**⚠ Warning** **Notes in operating Environment and Handling**

■ **Pay attention to the environment for using auto Switch.**

Do not use auto switch outdoor and not specified temperature for position detecting reliability and lifetime. Usage with protection cover not to direct spay such as water or coolant on auto switch could make longer lifetime and stable operation. Also, avoid using it where chemicals place that generate a lot of heat, such as acetic acid and strong alkali.

■ **Check the specification of auto switch before mount on actuator.**

Exceeding using range of voltage, current and temperature (higher than 50°C) could be the reason of malfunction and defect so using range should be deeply reviewed before.

■ **Pay attention mutual interruption of actuators mounted auto switches.**

At the case of parallel installation of auto switch mounted actuators, significant distance between those cylinders is needed. (To avoid those interruption, make sure significant distance which is specified each actuator models in this catalogue)

■ **Pay attention to leakage current.**

For 2-wire DSC auto switch has current leakage on load to operate internal circuit even in OFF state. If those current leakage not enough, it may the reason of poor return so if the specification is not satisfied, use 3-wire type auto switch. Also, parallel connection will have multiple current leakage on load by n times.

■ **Do not make repeatable bending or pulling on the lead cable of auto switch.**

Any damage on lead cable or excessive pulling or bending may cause of current leakage or poor connection. It could be the reason of electric shock or abnormal operation.

■ **Avoid to use the load what generates surge voltage.**

DSC - When you use it for the load that generates surge voltage such as reply, use the switch equipped with junction protective circuit inside or install protective box to protect the junction.

PLC - At the output of PLC auto switch has zener diode to protect surge but it may break if repeatable surge applied. So, if you need to operate generating surge such as electronic vales, please select surge absorption element equipped auto switch.

Proximity switch - Although surge absorption circuit is built in magnetic switch, insert an absorption element such as varistor into the surge source, when there is large surge generating equipment (motor, welding machine).

■ **Be careful to close magnetic material.**

When there are magnetic materials like steel plate near the switch in cylinder, the magnet installed on the cylinder may lost the magnetic and it could be the reason of abnormal operation of auto switch. Also, if there has any magnetic material in close to air cylinder, the character of magnetic of magnet inside of cylinder may change would be the reason of abnormal operation.

# ⚠ Basic Safety Notes for AUTO SWITCH

## ⚠ Caution — Notes in Installation

■ **Do not handle air cylinder by holding auto switch wire which is mounted on air cylinder.**

If handle the cylinder by holding leads when the auto switch is attached to the cylinder, it may cause cut of cable to the leads and stress to the inside of auto switch would be the result in damage to internal element.

■ **Be careful with incorrect wiring.**

Incorrect connection may cause a failure to auto switch.

■ **Do not apply excessive shock.**

Excessive shock may cause malfunction of junction and lead to inconsistent signaling. The inside of auto switch can be damaged even the body of auto switch is not damaged.

■ **Fasten the fixing screw in auto switch in compliance with appropriate fastening torque.**

Only, fastening in compliance with appropriate fastening torque can prevent damage on the attaching position of auto switch and installation fixing screws.

| Bolt | Fasten torque (kgf·cm) |
|---|---|
| M2×0.4 | 1 |
| M2.3×0.4 | 1.5 |
| M2.5×0.45 | 2.5 |
| M3×0.5 | 5 |

■ **Always use stainless bolts when mounting auto switch to cylinder in order to prevent switch malfunction. If unavoidable, use commercial bolts after removing the magnetic properties.**

## ⚠ Caution — Notes in Circuit configuration and installation

■ **Before wiring, check the specification and voltage at using environment, load current and others of auto switch.**

Do not apply main power to the both side of auto switch directly. Direct power supply on the 2-wire auto switch makes broken momentarily. Make sure to connect power to load as serial connection.

■ **Connect the lead wire polarity correctly.**

Any wrong polarity connection makes malfunction. For multiple connection of auto switches as serial, could be failure due to voltage drop so, please review internal voltage drop of auto switch and signal voltage level of input device.

■ **Direct connection of high current consumption device to auto switch may the reason of damage on auto switch.**

For loads with large current consumption, construct an indirect control circuit through a controller such as a relay or PLC.

■ **Detection position adjustment.**

To set auto switch at the desired position of air cylinder, check the bandwidth of auto switch detection by moving it to forward and backward side of sensor slot and fasten it at the middle of bandwidth. If auto switch mounted at the end of bandwidth, it could be the reason of miss detection due to the environment changes.

## [ Glossary ]

■ **Voltage : The voltage of the power applied to the auto switch and the load circuit.**

If supplied voltage bigger than specified voltage, auto switch and load could be broken and if supplied voltage smaller, auto switch and load not operate normally.

■ **Current : The maximum current which is could be used in auto switch**

If the loaded current bigger than specified current, auto switch would be broken.

■ **Response speed.**

The response speed means the speed(time) for detect the position and feedback to system.

■ **Hysteresis.**

The hysteresis meaning for auto switch is the status of overlapping of ON and OFF range.

For example, in the case of a auto switch that is turned on when the distance between the magnetic material and the auto switch approaches 5 mm, it does not turn off immediately when the distance becomes 5.1 mm or more in the ON state, but turns off only when the distance is 6 mm or more. If the hysteresis is too large, chattering (signal shaking) occurs, and if the hysteresis is too large, the detection range becomes wider than necessary.

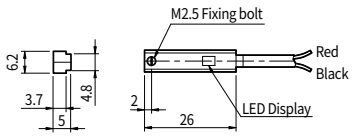
■ **Internal voltage drop: Voltage consumed by Auto Switch.**

Ex) In a 24VDC circuit, when using an auto switch with a drop voltage of 3V to control a relay with a minimum driving voltage of 20V, the voltage applied to the load is 21V, so it operates normally. When configuring a circuit through multiple auto switches in series, the voltage drop is duplicated. When three auto switches are connected in series, the drop voltage is 3V×3=9V, so the voltage applied to the load is 15V and the relay does not operate.

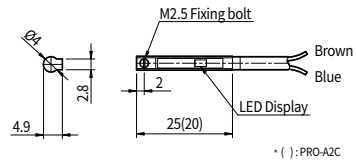
# Technical data of Auto Switch

## Magnetic Reed Switch (2-Wire)

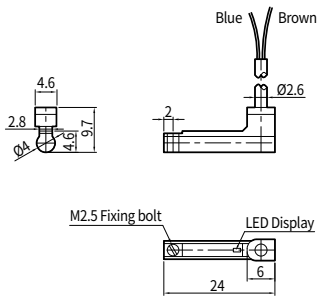
### PRO-A1



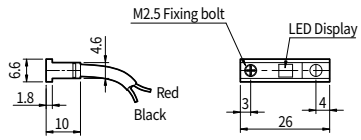

### PRO-A2, PRO-A2N, PRO-A2C



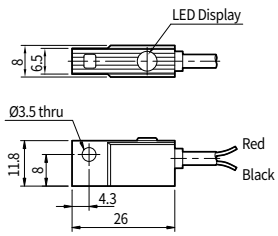

### PRO-A2V




### PRO-A3



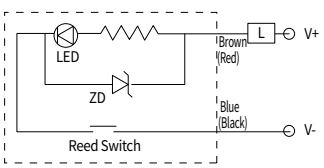

### C73K



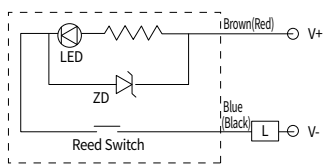

■ Common specification of magnetic reed switch

| Classification | | Specification | Classification | Specification |
|---|---|---|---|---|
| Voltage | DC | 24V | Temperature | -10 ~ 60°C |
| | AC | 100V | Enclosure Rating | IP 67 |
| Current | DC | 5 ~ 40mA | Shock Resistance | 30G |
| | AC | 5 ~ 20mA | Contact Protect Circuit | None |
| Endurance Voltage | | AC 1,500V during 1 min (Between lead and the case) | Operation Lamp | Red LED on for "ON" state |
| Voltage Drop | | Less than 3V | Length of Cable | Standard : 1M, L option : 3M |
| Leakage Current | | None | Cable Material | Oil resistant vinyl jacket (Flame Retardant VW-1) |
| Response Speed | | Less than 1ms | | |

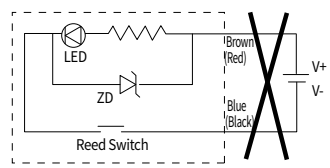
■ Common circuit diagram of magnetic reed switch




For NPN circuit




For PNP circuit



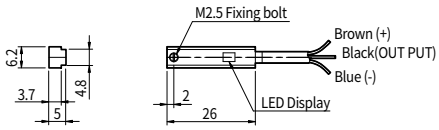

Do not apply power to both polarity directly

# Technical data of Auto Switch

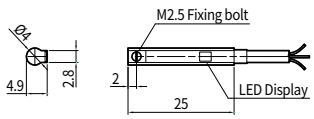


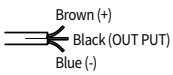
## Magnetic Solid State Switch (2-Wire, 3-Wire)

### PRO-B1

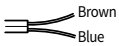



### PRO-B2 / PRO-B2B



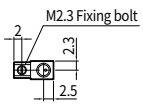



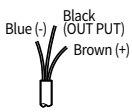

PRO-B2 CABLE



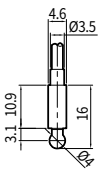

PRO-B2B CABLE

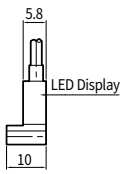
### PRO-B3C / PRO-B3B

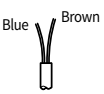



PRO-B3C CABLE



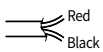



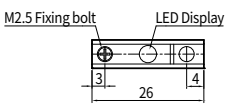

PRO-B3B CABLE

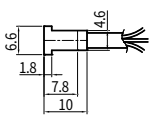
### PRO-B4 / PRO-B4B


PRO-B4 CABLE




PRO-B4B CABLE

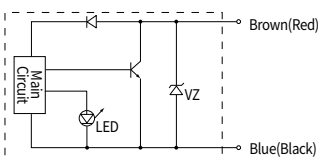


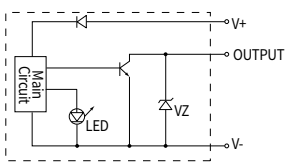

■ Common specification of magnetic solid state switch

| Classification | | Specification | Classification | Specification |
|---|---|---|---|---|
| Voltage | 2-Wire | DC 24V (10 ~ 28V) | Temperature | -10 ~ 60°C |
| | 3-Wire | DC 24V (5 ~ 28V) | Enclosure Rating | IP 67 |
| Current | | Less than 50mA | Shock Resistance | 30G |
| Endurance Voltage | | AC 1,500V during 1 min (Between lead and the case) | Response Speed | Less than 1ms |
| Voltage Drop | 2-Wire | Less than 5V | Operation Lamp | Red LED on for "ON" state |
| | 3-Wire | Less than 0.8V | Length of Cable | Standard : 1M, L option : 3M |
| Leakage Current | 2-Wire | Less than 1mA | Cable Material | Oil resistant vinyl jacket (Flame Retardant VW-1) |
| | 3-Wire | Less than 0.1mA | | |

■ Common circuit diagram of magnetic solid state switch




Solid State 2-Wire

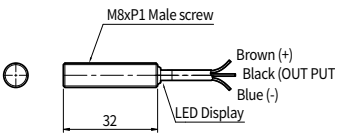



Solid State 3-Wire

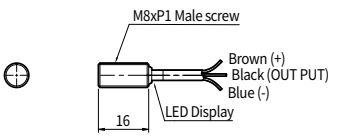
# Technical data of Auto Switch

## Proximity Auto Switch (DC 3-Wire)

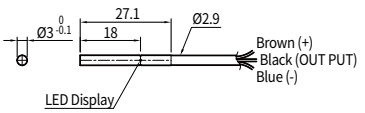
### PRO-P



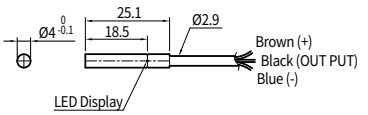

### PRO-P2




### PRO-PC



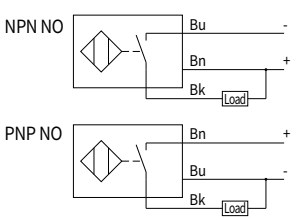

### PRO-PD

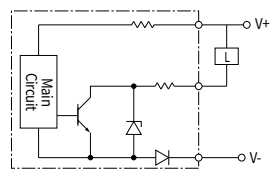



■ Specification of Proximity Auto Switch

| Classification | P, P2 | PC | PD |
|---|---|---|---|
| Voltage | DC 10V ~ DC 30V | | |
| Output Current | MAX 200mA | MAX 50mA | MAX 100mA |
| Output Type | NPN, PNP | NPN (For PNP, contact to office) | |
| Sensing Distance | 1mm ± 10% | 0.8mm | 1.2mm |
| Response Frequency | 800Hz | 5kHz | 4kHz |
| Endurance Voltage | AC 2,000V during 1 min (Between charged parts and the case) | AC 500V during 1 min (Between charged parts and the case) | |
| Enclosure Rating | IP 67 | | |
| Temperature | -25 ~ 70 °C | | |
| Operation Lamp | Red LED on for "ON" state | Yellow LED on for "ON" state | |
| Length of Cable | 2M | | |
| Cable Material | PUR | Oil resistant PVC | |

■ Circuit diagram of Proximity auto swtich



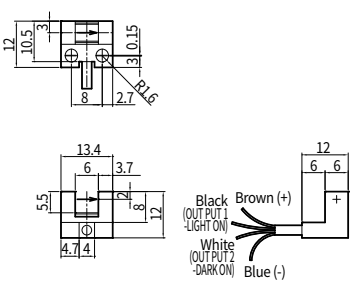

PRO-PC, PRO-PD

# Technical data of Auto Switch

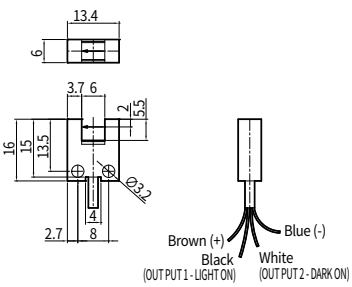


## Micro Photo Auto Switch (NPN output type)

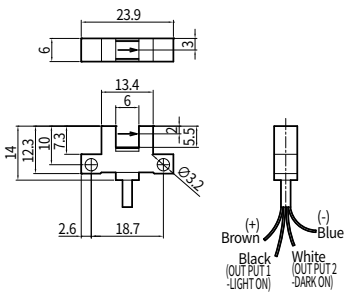
### PRO-PM-L



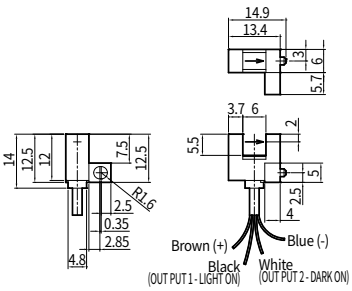

### PRO-PM-U



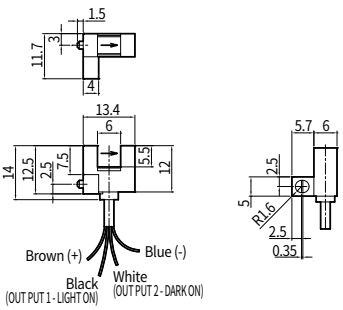

### PRO-PM-K



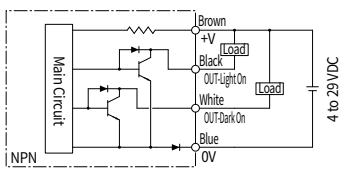

### PRO-PM-R




### PRO-PM-F




### ■ Circuit diagram of Micro Photo auto switch



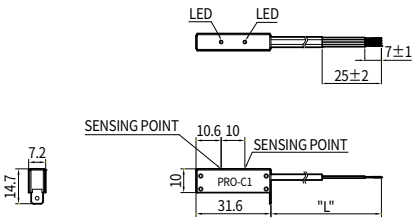

### ■ Specification of Micro Photo Auto Switch

| Classification | PM | Classification | PM |
|---|---|---|---|
| Sensing Distance | 6mm (Fixed) | Response Time | When receiving light : 20 μs or less,<br>When light is blocked : 80 μs or less<br>MAX response frequency : 3kHz |
| Minimum Sensing Size | 0.8×1.2mm opaque | | |
| Voltage | DC 5 ~ 24V ±10% | Operation Lamp | Yellow LED on for "ON" state |
| Current | Less than 15mA | Temperature | -25 ~ 55 °C |
| Output | NPN Open collector<br>•Maximum consumption current : 50mA<br>LIGHT ON, DARK ON 2 outputs<br>* For PNP, contact to office. | Endurance Voltage | AC 1,000V during 1 min<br>(Between charged parts and the case) |
| | | Insulation Resistance | At DC 250V, more than 20MΩ<br>(Between charged parts and the case) |
| | | Cable Specification | 4-wire cap tire cable PVC 1M<br>* For anti-bending type, contact to office. |

# Technical data of Auto Switch

## Micro Photo Auto Switch

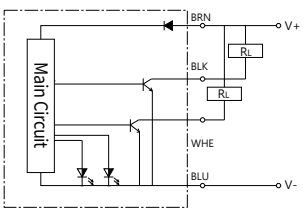
PRO-C1




■ Specification of Micro Photo Auto Switch

| Classification | C1 | Classification | C1 |
|---|---|---|---|
| Sensing Method | Photo Sensor | Voltage Drop | 1V |
| Output | NPN/PNP Current Sinking | Operation Lamp | Red LED |
| Voltage | DC 12 ~ 24V | Length of Cable | 4.4×2.4, 4C, 1m |
| Output Watt | Max 5W | Cable Specification | PVC |
| Current | Max 20mA | Response Frequency | 3kHz Max |

■ Circuit diagram of Micro Photo auto switch




(For NPN circuit)

# Air Consumption & Required Air Volume



## Air Consumption

■ Air consumption refers to the air volume consumed at the pipe between valve and cylinder or inside cylinder according to the operational frequency of solenoid valve in the equipment. It is required for the selection and operation cost and calculation of the compressor.

The air consumption of cylinder is $V_1 = \frac{\pi}{4} \times D^2 \times \ell \times 10^{-6} \left( \frac{P + 1.033}{1.033} \right)$

$V_2 = \frac{\pi}{4} \times (D^2 - d^2) \times \ell \times 10^{-6} \left( \frac{P + 1.033}{1.033} \right)$

And the air consumption of pipe is $Vp = \frac{\pi}{4} \times dp^2 \times \ell p \times 10^{-6} \left( \frac{P + 1.033}{1.033} \right)$

Thus, the air consumption for one cycle reciprocating of cylinder is $VT = V_1 + V_2 + 2 \times Vp\ (N\ell)$

※ Unit for used

$V_1$ : Air consumption in backward moving(Nℓ)
$V_2$ : Air consumption in forward moving(Nℓ)
D : Cylinder inner diameter(mm)
d : Cylinder rod dize(mm)
ℓ : Cylinder stroke(mm)
P : Applied compressed air(kgf/㎠)
Vp : Air consumption in pipe(Nℓ/min)
dp : Pipe inner diameter(mm)
ℓp : Distance between cylinder and valve(mm)
VT : Air consumption for one cycle(Nℓ)

## Required Air Volume

■ This refers to the air volume required to operate constant load in constant speed. It is required for the selection of F.R.L., devices and pipe size.

$$V = \frac{\pi}{4} \times D^2 \times \ell \times 10^{-6} \left( \frac{P + 1.033}{1.033} \right) \times \frac{60}{T}\ (N\ell/min)$$

The required air volume for cylinder at backward moving is $V_A = V_1 \times \frac{60}{T}$

The required air volume for cylinder at forward moving is $V_B = V_2 \times \frac{60}{T}$

The required air volume of pipe is $V_C = V_p \times \frac{60}{T}$

This air consumption for the backward motion is $V_A + V_C$, and that for forward is $V_B + V_C$.

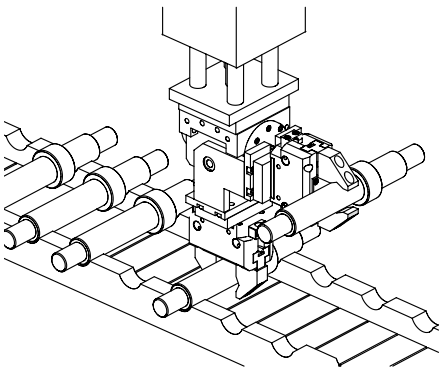
Air consumption can be interpreted as the concept of time for operational frequency. Required air volume can be interpreted as the concept of speed required for operation.

※ Unit for used

V : Required air volume(Nℓ/min)
D : Cylinder bore size(mm)
ℓ : Cylinder stroke(mm)
P : Applied compressed air(kgf/㎠)
T : Required time for stroke(sec)
$V_1$ : Air consumption for backward(Nℓ)
$V_2$ : Air consumption for forward(Nℓ)

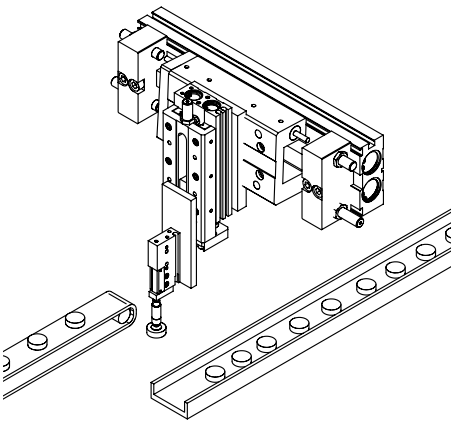
# Application examples ❶

## APPLICATION 1



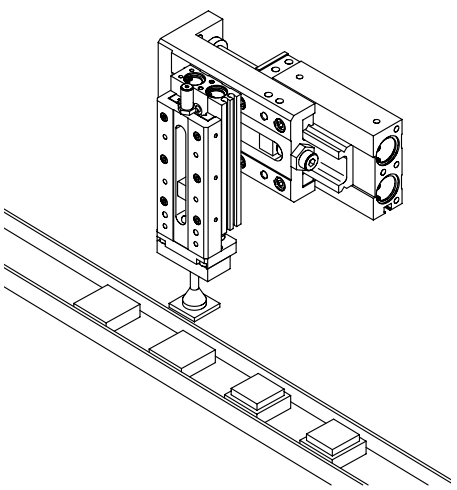
| | |
|---|---|
| UP DOWN | PQG |
| SWIVEL | ASU-N |
| HAND | PH15-S |

## APPLICATION 2



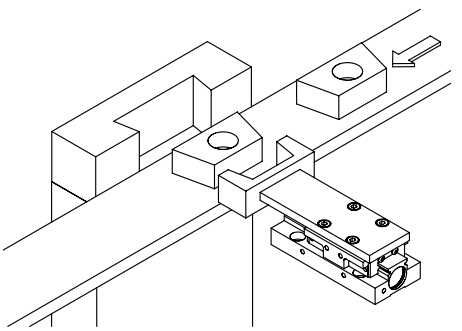
| | |
|---|---|
| TRANSFER | PST |
| UP DOWN | PST-NS |
| VACUUM | PPU-B |

## APPLICATION 3



| | |
|---|---|
| TRANSFER1 | PST-NS |
| TRANSFER2 | PST-NS |

## APPLICATION 4

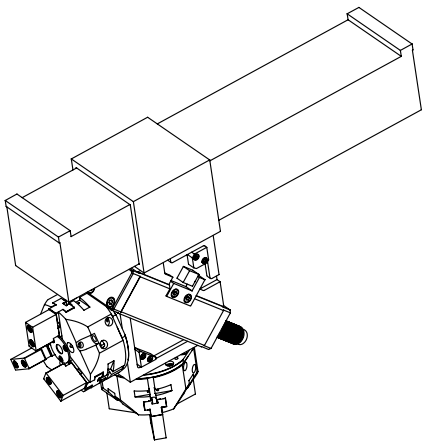


| | |
|---|---|
| TRANSFER | ST |

# Application examples ❷

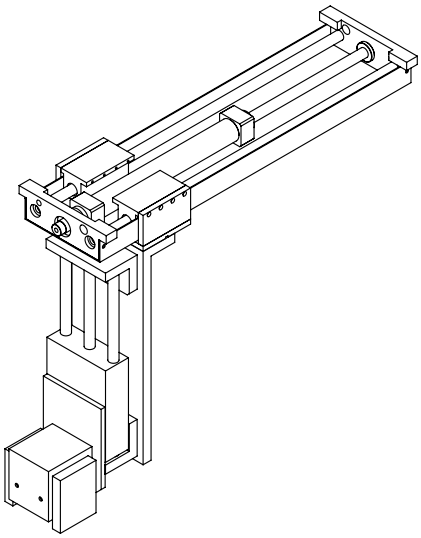


## APPLICATION 5



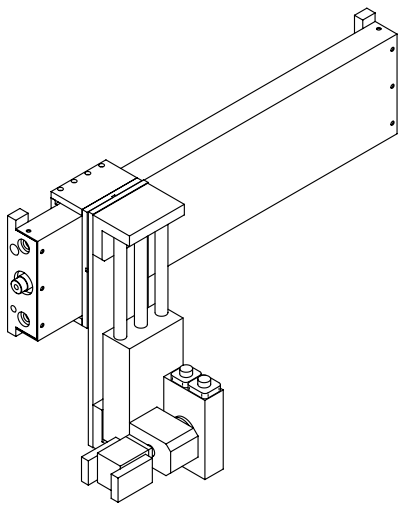
| | |
|---|---|
| TRANSFER | PSC |
| SWIVEL | ASU-R |
| HAND | PH14-S |

## APPLICATION 6



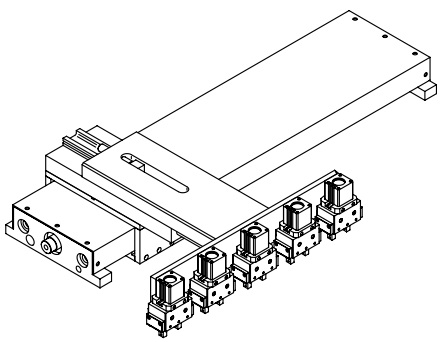
| | |
|---|---|
| TRANSFER | PSC-N |
| UP DOWN | PBF |
| HAND | PH06 |

## APPLICATION 7



| | |
|---|---|
| TRANSFER | PSC-NC |
| UP DOWN | PBF |
| ROTARY | PRC |
| HAND | PH06 |

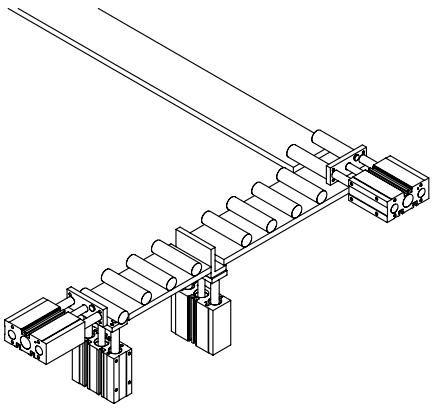
## APPLICATION 8



| | |
|---|---|
| TRANFER1 | PSC-NC |
| TRANFER2 | PST-NS |
| HAND | PH01K |

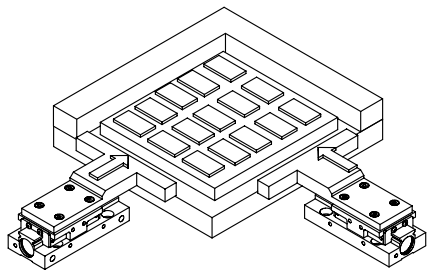
# Application examples ❸

## APPLICATION 9



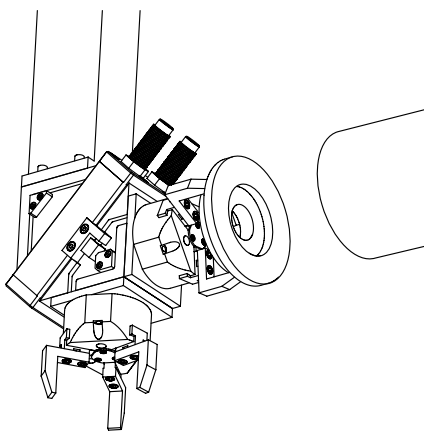
| | |
|---|---|
| TRANSFER | PBM-N |
| UP DOWN | PBM-N |

## APPLICATION 10



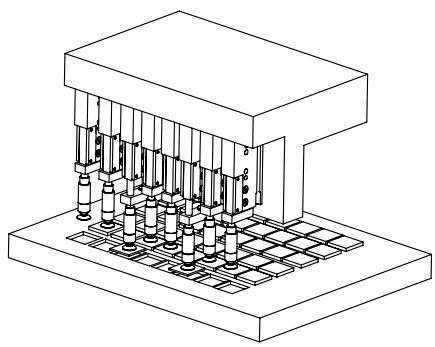
| | |
|---|---|
| TRANSFER | ST |

## APPLICATION 11



| | |
|---|---|
| SWIVEL | ASU-R |
| HAND | PH14-S |

## APPLICATION 12

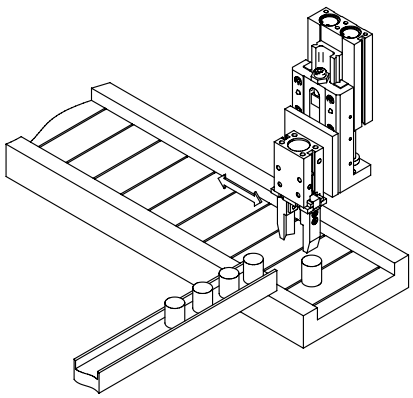


| | |
|---|---|
| VACUUM | PPU-B |

# Application examples ❹

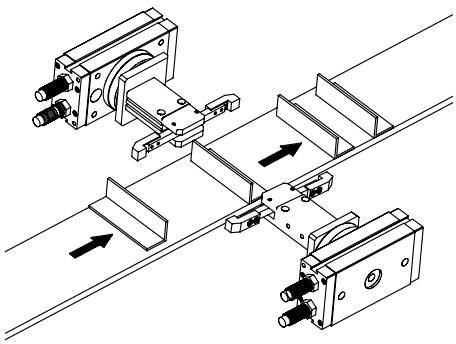


## APPLICATION 13



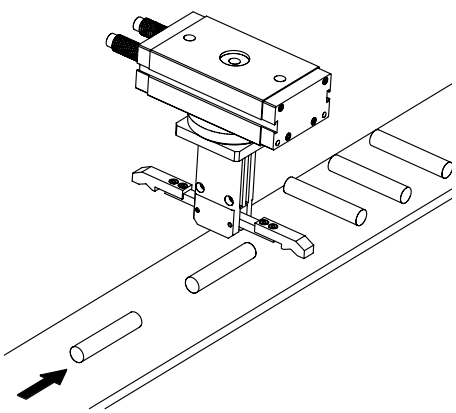
| | |
|---|---|
| UP DOWN | PST-NS |
| HAND | PH01-A |

## APPLICATION 14



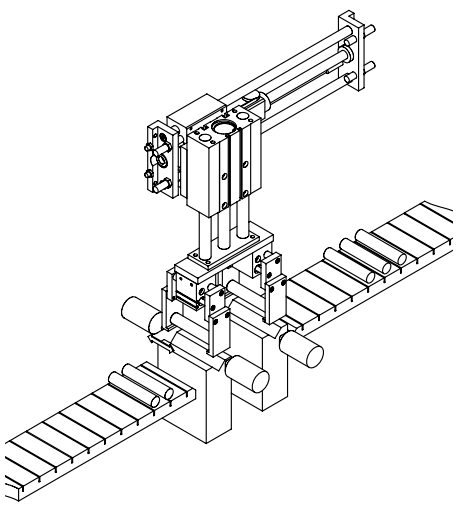
| | |
|---|---|
| ROTARY | PRC-ST |
| HAND | PH05 |

## APPLICATION 15



| | |
|---|---|
| ROTARY | PRC-ST |
| HAND | PH05 |

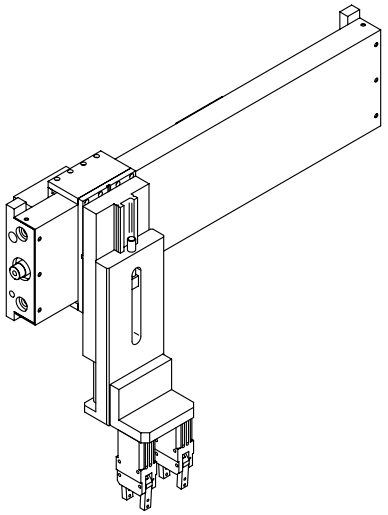
## APPLICATION 16



| | |
|---|---|
| TRANSFER | PSC-N |
| UP DOWN | PBM-N |
| HAND | PH06 |

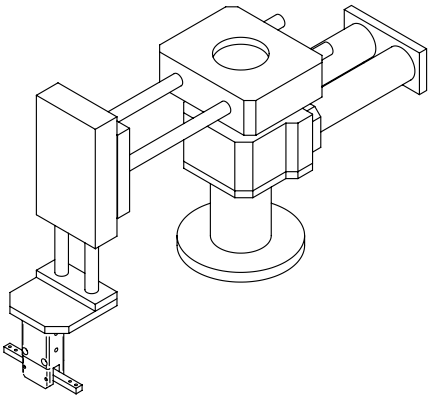
# Application examples ❺

## APPLICATION 17



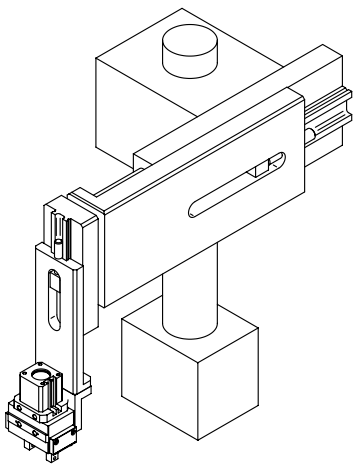
| | |
|---|---|
| TRANSFER | PSC-NC |
| UP DOWN | PST-NS |
| HAND | PH05 |

## APPLICATION 18



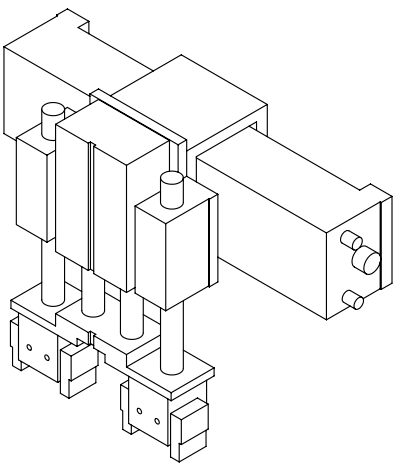
| | |
|---|---|
| ROTARY | PRC-H |
| UP DOWN | PT |
| HAND | PH05 |

## APPLICATION 19



| | |
|---|---|
| TRANSFER | PST-NS |
| UP DOWN | PST-NS |
| HAND | PH01K |

## APPLICATION 20

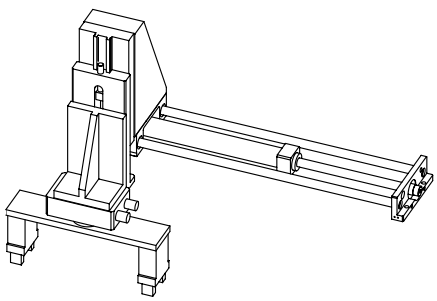


| | |
|---|---|
| TRANSFER | PSC |
| UP DOWN | PT |
| HAND | PH06 |

# Application examples ⑥

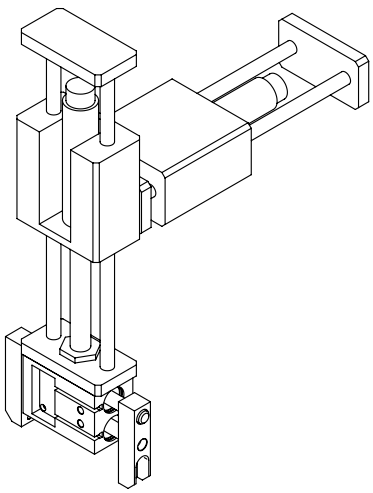


## APPLICATION 21



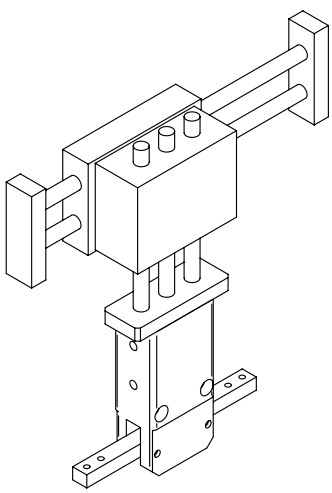
| | |
|---|---|
| TRANSFER | PSC-N |
| UP DOWN | PST-NS |
| ROTARY | PRC-S |
| HAND | PH01-A |

## APPLICATION 22



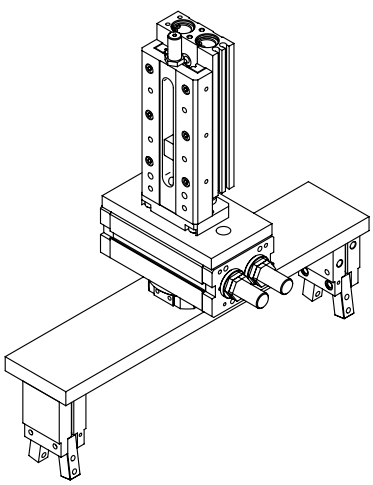
| | |
|---|---|
| TRANFER1 | PGC |
| TRANFER2 | PGC |
| HAND | PH07 |

## APPLICATION 23



| | |
|---|---|
| TRANSFER | PB |
| UP DOWN | PBM-N |
| HAND | PH05 |

## APPLICATION 24



| | |
|---|---|
| UP DOWN | PST-NS |
| ROTARY | PRC-ST |
| HAND | PH09 |

# Engineering Unit Conversion Table

(1) Length

| cm | m | in | ft |
|---|---|---|---|
| 1 | 0.01 | 0.3937 | 0.03281 |
| 100 | 1 | 39.37 | 3.281 |
| 2.540 | 0.0254 | 1 | 0.08333 |
| 30.48 | 0.3048 | 12 | 1 |

(2) Area

| $cm^2$ | $m^2$ | $in^2$ | $ft^2$ |
|---|---|---|---|
| 1 | 0.0001 | 0.155 | 0.001076 |
| $1\times10^4$ | 1 | 1550 | 10.76 |
| 6.452 | 0.000645 | 1 | 0.006944 |
| 929.0 | 0.09290 | 144 | 1 |

(3) Angular speed

| rpm | rad/s |
|---|---|
| 1 | 0.1047 |
| 9.549 | 1 |

Note) 1 rad = 57.296°, rpm = r/min

(4) Mass

| kg | t | lb | ton | sh tn |
|---|---|---|---|---|
| 1 | 0.001 | 2.20462 | 0.0009842 | 0.0011023 |
| 1000 | 1 | 2204.62 | 0.9842 | 1.1023 |
| 0.45359 | 0.00045359 | 1 | 0.0004464 | 0.00055 |
| 1016.05 | 1.01605 | 2240 | 1 | 1.12 |
| 907.185 | 0.907185 | 2000 | 0.89286 | 1 |

Note) t : ton, ton : English ton(long ton), sh tn : US ton(Short ton)

(5) Speed

| m/s | km/h | kn (Metric system) | ft/s | mile/h |
|---|---|---|---|---|
| 1 | 3.6 | 1.944 | 3.281 | 2.237 |
| 0.2778 | 1 | 0.5400 | 0.9113 | 0.6214 |
| 0.5144 | 1.852 | 1 | 1.688 | 1.151 |
| 0.3048 | 1.097 | 0.5925 | 1 | 0.6818 |
| 0.4470 | 1.609 | 0.8690 | 1.467 | 1 |

Note) kn: knot, meteoric system 1 knot = 1852 m/h

(6) Density

| $g/cm^3$ | $kg/m^3$ | $lb/in^3$ | $lb/ft^3$ |
|---|---|---|---|
| 1 | 1000 | 0.03613 | 62.43 |
| 0.001 | 1 | 0.00003613 | 0.06243 |
| 27.68 | 27680 | 1 | 1728 |
| 0.01602 | 16.02 | 0.0005787 | 1 |

(7) Force

| N | dyn | kgf | lbf | pd |
|---|---|---|---|---|
| 1 | 1E5 | 0.101972 | 0.2248 | 7.233 |
| 1E-5 | 1 | 1.01972E-6 | 2.248E-6 | 7.233E-5 |
| 9.80665 | 9.80665E5 | 1 | 2.205 | 70.93 |
| 4.44822 | 4.44822E5 | 0.4536 | 1 | 32.17 |
| 0.138255 | 1.38255E4 | 0.01410 | 0.03108 | 1 |

Note) 1 dyn = 1E-5N, 1 pdl(poundal) = $1ft\cdot lb/s^2$

(8) Stress

| $kgf/cm^2$ | $kgf/mm^2$ | Pa | $N/mm^2$ | $lbf/ft^2$ |
|---|---|---|---|---|
| 1 | 1E-2 | 0.980665E5 | 0.0980665 | 2048 |
| 1E2 | 1 | 0.980665E7 | 9.80665 | 2.048E5 |
| 1.0197E-5 | 1.0197E-7 | 1 | 1E-6 | 0.02089 |
| 10.1972 | 0.101972 | 1E6 | 1 | 2.089E4 |
| 0.0004882 | 4.882E-6 | 47.86 | 4.788E-5 | 1 |

Note) 1 $N/mm^2$= 1MPa

(9) Viscosity

| cP | P | Pa·s | $kgf\cdot s/m^2$ | $lbf\cdot s/in^2$ |
|---|---|---|---|---|
| 1 | 0.01 | 0.001 | 0.00010197 | 1.449E-7 |
| 100 | 1 | 0.1 | 0.0101973 | 1.449E-5 |
| 1000 | 10 | 1 | 0.101973 | 1.449E-4 |
| 9806.65 | 98.0665 | 9.80665 | 1 | 0.001422 |
| 6.9E6 | 6.9E4 | 6.9E3 | 7.03E2 | 1 |

Note) 1P = $1dyn\cdot s/cm^2$ = $1g/cm\cdot s$, $1Pa\cdot s = 1N\cdot s/m^2$
1cP = 1mPa·s, $1lbf\cdot s/in^2$ = 1Reyn = 6.9E6cP

(10) Dynamic viscosity

| cSt | St | $m^2/s$ | $ft^2/s$ |
|---|---|---|---|
| 1 | 1E-2 | 1E-6 | 0.00001076 |
| 100 | 1 | 1E-4 | 0.001076 |
| 1E6 | 1E4 | 1 | 10.76 |
| 929.0 | 0.09290 | 144 | 1 |

Note) 1 St = 1 $cm^2/s$

# Engineering Unit Conversion Table



(11) Pressure

| kgf/㎠ | bar | Pa | atm | $mH_2O$ | mHg | $lbf/in^2$ |
|---|---|---|---|---|---|---|
| 1 | 0.980665 | 0.980665E5 | 0.9678 | 10.000 | 0.7356 | 14.22 |
| 1.0197 | 1 | 1E5 | 0.9869 | 10.197 | 0.7501 | 14.50 |
| 1.0197E-5 | 1E-5 | 1 | 0.9869E-5 | 1.0197E-4 | 7.501E-6 | 1.450E-4 |
| 1.0332 | 1.01325 | 1.01325E5 | 1 | 10.33 | 0.760 | 14.70 |
| 0.10000 | 0.09806 | 9.80665E3 | 0.09678 | 1 | 0.07355 | 1.422 |
| 1.3595 | 1.3332 | 1.3332E5 | 1.3158 | 13.60 | 1 | 19.34 |
| 0.07031 | 0.06895 | 6.895E3 | 0.06805 | 0.7031 | 0.05171 | 1 |

Note) 1 Pa = 1 $N/m^2$, 1 bar= 1E5 Pa, 1 $lbf/in^2$= 1 psi, 1 Pa = 7.5 E-3 torr
Note) 1ksi = 1000psi (EN ksi : kips per square inch )

(12) Volume flow

| ℓ/s | ℓ/min | ㎥/s | ㎥/min | ㎥/h | $ft^3/s$ |
|---|---|---|---|---|---|
| 1 | 60 | 1E-3 | 0.06 | 3600 | 0.03532 |
| 0.01666 | 1 | 1.66666E-5 | 1E-3 | 6E-2 | 0.00059 |
| 1E3 | 6E4 | 1 | 60 | 3600 | 35.31 |
| 1.66666E1 | 1E3 | 1.66666E-2 | 1 | 60 | 0.5885 |
| 2.77777E-4 | 1.66666E1 | 2.77777E-4 | 1.66666E-2 | 1 | 0.00981 |
| 2.832E1 | 1.69833E3 | 2.832E-2 | 1.69833 | 101.9 | 1 |

(13) Work, Energy, Calory

| J | kgf·m | kW·h | kcal | ft·lbf | Btu |
|---|---|---|---|---|---|
| 1 | 0.10197 | 2.778E-7 | 2.389E-4 | 0.7376 | 9.480E-4 |
| 9.807 | 1 | 2.724E-6 | 2.343E-3 | 7.233 | 9.297E-3 |
| 3.6E6 | 3.671E5 | 1 | 860.0 | 2.655E6 | 3413 |
| 4186 | 426.9 | 1.163E-3 | 1 | 3087 | 3.968 |
| 1.356 | 0.1383 | 3.766E-7 | 3.239E-4 | 1 | 1.285E-3 |
| 1055 | 107.6 | 2.930E-4 | 0.2520 | 778.0 | 1 |

Note) 1J = 1W·s, 1kgf·m = 9.80665J, 1 W·h = 3600 W·s, 1 cal = 4.18605 J

(14) Power

| kW | kgf·m/s | PS | HP | kcal/s | ft·lbf/s | Btu/s |
|---|---|---|---|---|---|---|
| 1 | 101.97 | 1.3596 | 1.3405 | 0.2389 | 737.6 | 0.9480 |
| 9.807E-3 | 1 | 1.333E-2 | 1.315E-2 | 2.343E-3 | 7.233 | 9.297E-3 |
| 0.7355 | 75 | 1 | 0.9859 | 0.1757 | 542.5 | 0.6973 |
| 0.746 | 76.07 | 1.0143 | 1 | 0.1782 | 550.2 | 0.7072 |
| 4.186 | 426.9 | 5.691 | 5.611 | 1 | 3087 | 3.968 |
| 1.356E-3 | 0.1383 | 1.843E-3 | 1.817E-3 | 3.239E-4 | 1 | 1.285E-3 |
| 1.055 | 107.6 | 1.434 | 1.414 | 0.2520 | 778.0 | 1 |

Note) W : SI Unit, 1 W=1J/s, 1kgf·m/s = 9.80665W, PS:(F)Pouvoir magique, HP : (E)Horse power

※ Unit system used for pressure

1) Atmospheric pressure(Atmosphere, at) Used as the absolute pressure in engineering unit
1 at = 1 kgf / ㎠
= 0.981 bar (98.1 kPa)

2) Pascal Pa
Bar (absolute pressure in SI)

1Pa = 1N / $m^2$
= $10^n$bar (n= -5)

1 bar = $10^2$kPa
= $10^n$Pa(n=5) = 1.02 at

3) atm (Absolute pressure in physical system of unit)
1 atm = 1.033 at = 1.013 bar

4) Water gauge(mm water gauge, mmWG)
10,000 mmWG = 1 at
= 0.981 bar

5) Mercury (mmHg) (Equal to the unit of Torr)
1 mmHg = 1 Torr
1at = 736 Torr
1 bar = 750 Torr

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