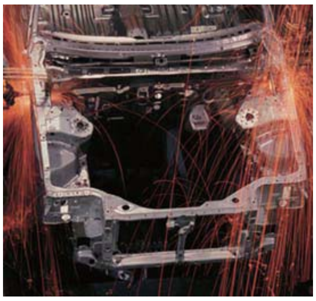
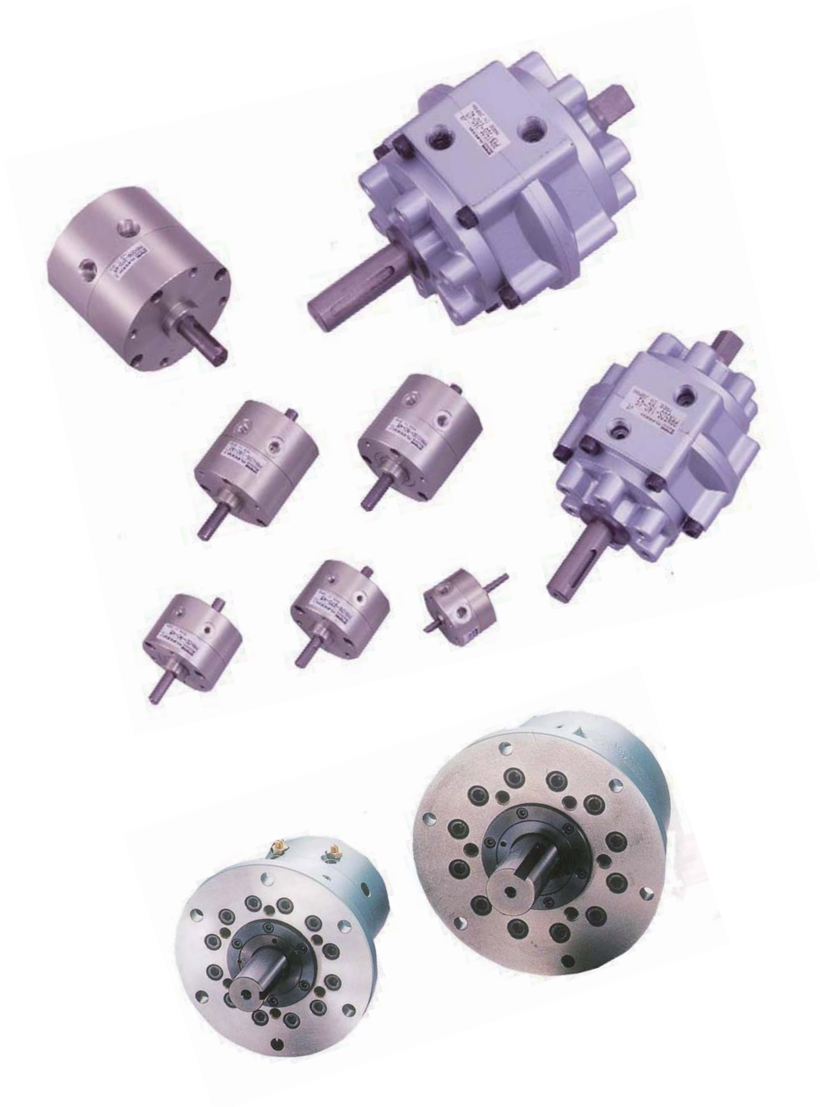
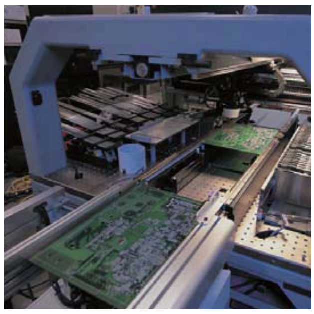


aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding



Pneumatic Vane Type Rotary Actuator
PRO-PRN Series

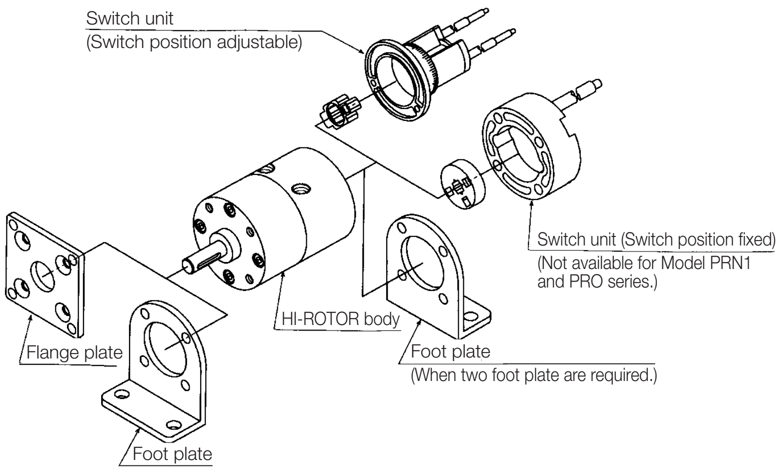


ENGINEERING YOUR SUCCESS.

Pneumatic HI-ROTOR

Vane Type Rotary Actuator

Miniature HI-ROTOR



New models PRNA1, 3, 10, 20

Double vane type is added as a new model.
(Its effective torque doubles single vane type.)

Full series line-up

A full line of 1, 3, 10, 20, 30, 50, 150, 300, 800 is available. For PRNA1 and bigger models, single and double vane type (with double the effective torque) are available. For PRN50 and bigger models, a series of specially made cushion units (CRN) are available. In addition, there are HI-PAL HI-ROTORs of PRHA10 and bigger (incorporating solenoid valve).

Easy-to-use oscillating angle

Three oscillation reference points of 40˚, 45˚ and 90˚ and five oscillating angles of 90˚, 100˚, 180˚, 270˚ and 280˚ are featured. Oscillating angles that are frequently used are standardized for wide selection. Non-standard oscillating angles are available on request.

Stable operation

Uniquely designed sealing mechanism minimizes leakage, assuring low speed oscillating and stable, smooth operation at low pressures and speeds.

Durability to high temperature (PRNA1～20)

Use of dry air dehumidified through an air dryer makes it possible to use HI-ROTOR within a surrounding temperature range of −5˚C～80˚C. (PRN : Usable at a maximum of 60˚C)

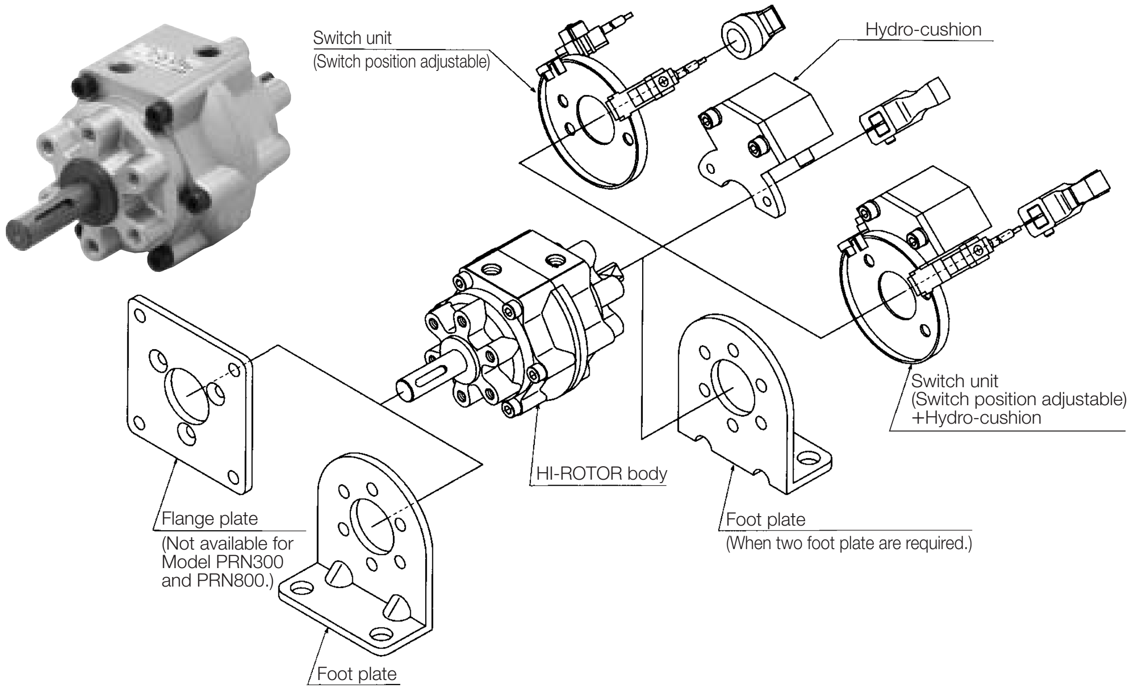
Outstanding durability

A solid vane shaft and built-in damper are combined with a unique sealing mechanism to assure outstanding durability. PRN50 and bigger models are capable of operating a greater load with the incorporation of a Hydro-cushion.

Flexibility to meet special shape of shaft

Designed to meet special shape of shafts such as hollow shafts and lead screws. (See Page 65.)

HI-ROTOR



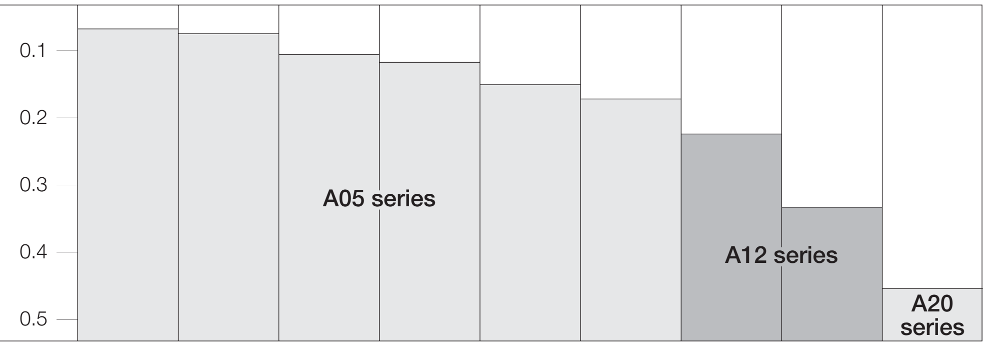
CONTENTS

Sizing map

The sizing map helps you to easily find the optimum combination of HI-ROTOR and pneumatic valves. It shows the standard combination of each model of HI-ROTOR with pneumatic valves and the oscillation time obtainable with a particular combination.

Model of HI-ROTOR		1	3	10	20	30	50	150	300	800
Port size		M5	M5	M5	Rc⅛	Rc⅛	Rc⅛	Rc¼	Rc⅜	Rc½
Effective output torque(N·cm) at 0.5MPa	Single vane	12.9	31	98	170	319	479	1500	2850	10200
	Double vane	28.6	71	211	388	770	1040	3500	6800	20600

Oscillating time (s) At oscillating angle of 180°, unloaded



Recommended solenoid valves ADEX VALVE	1	3	10	20	30	50	150	300	800
A05 series	✓	✓	✓	✓	✓	✓			
A12 series				✓	✓	✓	✓	✓	
A20 series							✓	✓	✓

Recommended speed controllers	1, 3, 10	20, 30	50	150	300	800
Standard type	SP-H-M5 SPER-H-M5	SP-2H-1 SPE-2H-1	SP-06-1 SPE-06-1	SP-06-2 SPE-06-2	SP-15-3 SPE-10-3	SP-15-4 SPE-15-34
With fitting	MB4R-M5 M4R-M5	B6R-01SC-0 6R-01SC-0	B6R-01SC-0 6R-01SC-0	B8R-02SC-0 8R-02SC-0	B8R-03SC-0 8R-03SC-0	B10R-04SC-0 10R-04SC-0

(Note) •The above-mentioned oscillating time is an approximate value based on the assumption that a tube 1 m long is used for piping and the HI-ROTOR is unloaded. The oscillating time varies if the HI-ROTOR is loaded or different size tubes and fitting are used.
•The above-mentioned oscillating time is 180°. For and oscillating time at other angles, estimate on the basis of the above.

⚠ FOR SAFETY USE

Be sure to read the following instructions before use.
For common and individual instructions, refer to the text of this catalogue.

The following safety precautions are provided to prevent damage and danger to personnel and to provide instructions on the correct usage of this product. These precautions are classified into 3 categories; **"CAUTION"**, **"WARNING"** and **"DANGER"** according to the degree of possible injury or damage and the degree of impendence of such injury or damage.
Be sure to comply with all precautions along with JIS B8370(※1) and ISO 4414(※2), as they include important content regarding safety.

⚠CAUTION :	Indicates a potentially hazardous situation which may arise due to improper handling or operation and could result in personal injury or property-damage-only accidents.
⚠WARNING :	Indicates a potentially hazardous situation which may arise due to improper handling or operation and could result in serious personal injury or death.
⚠DANGER :	Indicates an impending hazardous situation which may arise due to improper handling or operation and could result in serious personal injury or death.

(※1) JIS B8370 : General Rules for Pneumatic Systems
(※2) ISO 4414 : Pneumatic fluid power-General rules relating to systems

⚠WARNING

●The applicability of pneumatic equipment to the intended system should be judged by the pneumatic system designer or the personnel who determined specifications for such system.

As operating conditions for products contained in this catalogue are diversified, the applicability of pneumatic equipment to the intended system should be determined by the pneumatic system designer or the personnel who determined specifications for such system after conducting an analysis or testing as necessary.
The system designer shall be responsible for assuring the intended system performance and safety.
Before making a system, the system designer should thoroughly examine all specifications for such a system and also take into consideration the possibility of any trouble with the equipment.

●The pneumatic equipment should be handled by persons who have sufficient knowledge and rich experience.

Inproper handling of compressed air will result in danger.
Assembling, operation and maintenance of machinery using pneumatic equipment should be performed by persons who have sufficient knowledge and rich experience.

●Never operate machinery nor remove the equipment until safety is assured.

- Before checking or servicing machinery and equipment, be sure to check that steps for prevention of dropping or runaway of the driven component have been completely taken.
- When removing the equipment, make sure that the above-mentioned safety measures have been done beforehand.
  Then turn off air supply and power to the system and purge compressed air in the system.
- When restarting machinery and equipment, check that proper prevention of malfunction has been provided for and then restart carefully.

●When using the pneumatic equipment in the following conditions or environments, take the proper safety measures and consult KURODA beforehand.

- Conditions and environments other than specified and outdoor use.
- Applications to nuclear power equipment, railroads, aircraft, vehicles, medical equipment, equipment connected with food and drink, amusement facilities and safety devices such as emergency interruption devices, clutch/brake circuits for a press and the likes.
- Applications which require extreme safety and will also greatly affect men and property.

HI-ROTOR/COMMON INSTRUCTIONS ①

Be sure to read them before use.
Also refer to Par. "For Safety Use" and instructions mentioned for each series.

DESIGN

WARNING

- **When HI-ROTOR is subject to load fluctuation, up/down movement and fluctuating frictional resistance, make a safty design in due consideration of such factors.**
  Operating speed of HI-ROTOR will increase, causing a damage to machine and an injury to human body.
- **Especially when there is the possibility that the human body is endangered, fit a protective cover.**
  When there is the possibility that applied load or the moving part of the HI-ROTOR endangers the human body, design the system so that the human body cannot directly touch these parts.
- **Speed-reducing circuit or shock absorber will be required according to circumstances.**
  Set inertial energy to less than allowable value. When load speed is high or mass is large, inertial energy of load exceeds allowable value, making it difficult for HI-ROTOR to absorb shocks.
  In this case, provide a speed-reducing circuit or a shock absorber on the load side and also thoroughly examine the rigidity of machine.
- **Take into consideration the possibility of pressure failure in the circuit due to outage etc.**
  For an HI-ROTOR used in the clamping mechanism, if clamping pressure in the circuit lowers due to outage etc., clamping force will reduce, so that the load may sometimes come off. To avoid such danger, design the system to incorporate a safety device to protect the human body and machine. Also provide the hanger and lift with proper prevention against dropping.
- **Take into consideration the possibility of power failure.**
  Take proper countermeasures against equipment controlled by air pressure, electricity, hydraulic pressure, etc. so as to protect the human body and machine even if these power sources are faulty.
- **Use prevention against runaway of load in designing a circuit.**
  If compressed air is supplied to one side of vane without residual air in HI-ROTOR, (for example, HI-ROTOR is operated by 3-position exhaust center type solenoid valve or restarted after residual air in circuit is exhausted), HI-ROTOR will suddenly actuate, causing a damage to machine and an injury to human body.
- **Take into consideration the action of HI-ROTOR in an emergency.**
  When the machine is stopped by a person in an emergency or stopped by the safety device due to the occurrence of outage, system trouble, etc., the HI-ROTOR may catch the human body or damage the machine according to circumstances. To avoid such an accident, take into consideration the action of HI-ROTORs in designing a system so as to prevent an injury to the human body and a damage to the machine.

DESIGN

WARNING

- **Take into consideration the action of an HI-ROTOR when it restarts from stoppage in an emergency or abnormal state.**
  Make a design to prevent an injury to the human body and a damage to the machine when the HI-ROTOR is restarted.
  When it is necessary to reset the HI-ROTOR to the starting position, make a design to incorporate a safety manual control unit.
- **Do not use HI-ROTOR as a shock absorber.**
  When abnormal pressure is applied or air leak occurs, speed-reducing effect is considerably lost, sometimes resulting in a damage to machine and an injury to human body.
- **Do not stop HI-ROTOR halfway only by means of directional control valve or do not leave HI-ROTOR stopped there.**
  HI-ROTOR and directional control valve are designed to tolerate a certain degree of air leak. Even if HI-ROTOR is stopped halfway by shutting in air using directional control valve without an external stopper provided for HI-ROTOR, the stop position cannot be held due to air leak; this may result in a damage to machine and an injury to human body.
- **Firmly tighten fixed part and joint.**
  When using HI-ROTOR for heavy-duty purposes such as continuous operation or using in vibratory place, apply a secure tightening method.
- **Remodeling HI-ROTOR**
  Do not remodel HI-ROTOR.

CAUTION

- **Use HI-ROTOR within specified oscillation time.**
  If used in lower speed range than specified, HI-ROTOR will not smoothly operate due to a stick and slip phenomenon.
- **Do not apply torque exceeding rated output to HI-ROTOR from the outside.**
  If HI-ROTOR receives external force over rated output, it may be broken according to circumstances.
- **When repeatability acuracy for oscillating angle is required, provide a stopper on the outside to stop load directly.**
- **When adjusting the driving speed of an HI-ROTOR, install a speed controller.**
  Adjust the driving speed on the low speed side and then adjust it gradually until the prescribed speed is attained.

HI-ROTOR/COMMON INSTRUCTIONS ②

Be sure to read them before use.
Also refer to Par. "For Safety Use" and instructions mentioned for each series.

SELECTION

WARNING

- **Refer to specifications.**
  HI-ROTOR listed in this catalogue are designed for compressed air.
  When using other fluid than compressed air, contact KURODA beforehand.
  Do not use the HI-ROTOR outside the specified pressure and temperature range; this may result in a breakdown or faulty operation.

INSTALLATION

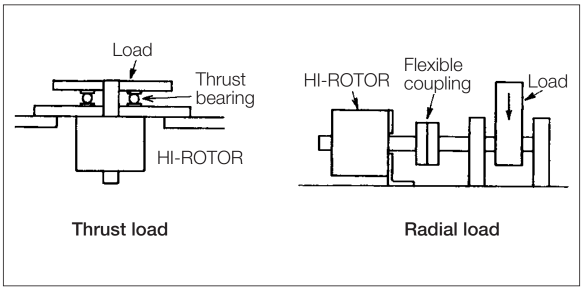
WARNING

- **Do not start the system before making sure that equipment is properly operated.**
  After installing the HI-ROTOR, connect compressed air and power supply.
  Perform functional test and leak test properly and check that the system is correctly operated with safety. Then start the system.
- **Coating with paint**
  When coating the resin portion with paint, it may be adversely affected by paint and solvent. For the propriety of painting, contact KURODA beforehand.
  Do not peel off the nameplate affixed on the HI-ROTOR and do not erase or smear out the letter on it.
- **When adjusting the oscillation angle of HI-ROTOR by applying pressure, take proper means to prevent HI-ROTOR from rotating beyond required level.**
  If HI-ROTOR is rotated beyond required level, it will sometimes cause a hazardous situation.
- **Do not loosen the angle adjust screw of HI-ROTOR over adjustable range.**
  If it is loosened over adjustable range, the angle adjust screw will come off, causing a damage to machine and an injury to human body.
- **When using a shaft coupling, select one with degree of freedom.**
  If a shaft coupling without degree of freedom is used, a kink will occur due to eccentricity, causing a malfunction or damage to products; this sometimes result in a damage to machine and injury to human body.
- **Provide space for maintenance and inspection.**

INSTALLATION

WARNING

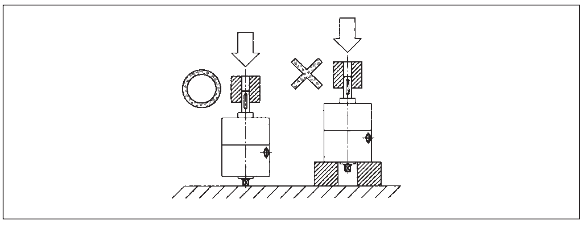
- **Do not apply excessive load to shaft.**
  If excessive load over allowable value is applied to shaft, it will cause a malfunction or breakdown, sometimes resulting in a damage to machine and an injury to human body.
  HI-ROTOR is capable of receiving up to allowable radial thrust load prescribed in specifications in a state where no inertial load occur. However, avoid using HI-ROTOR in such a manner that load is directly applied to the shaft.
  In order to improve operating conditions, it is recommended that no load be directly applied to the shaft by using a method shown in Fig. below:



- **Install an external stopper in a separate place from the shaft.**
  If a stopper is located near the shaft, reaction force exerted on the stopper due to torque of HI-ROTOR itself is applied to the shaft and thus damages the shaft and bearing. The reaction force will also break machine and injure human body.

CAUTION

- **Do not wipe off the model name inscribed on a name-plate etc. with organic solvent.**
  The inscribed indication may be erased.
- **Do not step your foot directly on the shaft and equip-ment fitted to the shaft.**
  Stepping on the shaft directly will cause a damage to bearing etc.
- **Do not hit the shaft with the body fixed or do not hit the body with the shaft fixed; otherwise causing to bend the shaft and damage the bearing.**
  When mounting a load on the shaft, set HI-ROTOR in such a manner that the body does not receive force as shown in Fig. below:



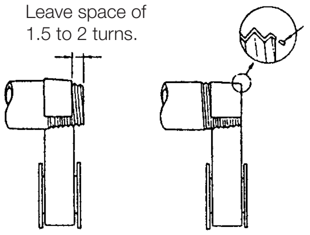
HI-ROTOR/COMMON INSTRUCTIONS ③

Be sure to read them before use.
Also refer to Par. "For Safety Use" and instructions mentioned for each series.

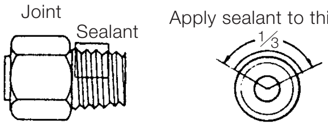
PIPING

CAUTION

- **Before piping**
  Thoroughly flush the inside of each pipe to remove chips, coolant, dust, etc. before piping.
- **How to wind a seal tape**
  When winding a seal tape around the threaded portion, leave space of 1.5 to 2 thread turns.



- **How to apply liquid sealant**
  When applying liquid sealant to the threaded portion, apply a proper amount to about ⅓ of the periphery of the threaded portion and then screw it.



PIPING

CAUTION

- **Screw of pipe and joint**
  When screwing the pipe and joint, use care to prevent chips and sealant from entering the pipe and joint.
  Tighten them within a proper range of clamping torque.

Port size	Clamping torque (N·m)
M5	1.5～ 2.0
R, Rc⅛	7.0～ 9.0
R, Rc¼	12.0～14.0
R, Rc⅜	22.0～24.0
R, Rc½	28.0～30.0

- **Avoid wrong piping.**
  When connecting a pipe to a Rotary Actuator, be careful not to mistake the supply port by referring to the nameplate affixed to the product or the product catalogue.

LUBRICATION

CAUTION

- **HI-ROTOR listed in this catalogue are non-lubrication.**
  The non-lubricated HI-ROTOR can be used without lubrication, but can be used with lubrication.
  When using it with lubrication, do not discontinue supplying oil. Otherwise, the applied lubricant may run off, sometimes resulting in an operation failure.
  When using a lubricant, Class 1 turbine oil ISO VG 32 (containning additive) is recommended.
  Do not use spindle oil and machine oil. Otherwise, the seal and packing may be damaged.

HI-ROTOR/COMMON INSTRUCTIONS ④

Be sure to read them before use.
Also refer to Par. "For Safety Use" and instructions mentioned for each series.

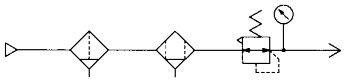
QUALITY OF AIR

WARNING

- **Use pure air**
  Compressed air containing corrosive gases, chemicals, salt, etc. causes a breakdown or operation ailure. So do not use such air.

CAUTION

- **Fit an air filter with filtration of 5 μm or fine.**
- **Install an air dryer.**
  Compressed air containing much drainage causes the operation failure of pneumatic equipment. Install an air dryer, lower the temperature and reduce drainage.
- **Take proper countermeasures against sludge.**
  If sludge produced in compressor oil enters pneumatic equipment, it will cause the operation failure of pneumatic equipment.
  It is recommendable to use compressor oil (NISSEKI FAIRCALL A68, IDEMITSU DAPHUNY SUPER CS68) featuring minimized sludge production or use a sludge filter or mist cleaner to prevent sludge from entering the pneumatic equipment.



- **Use at low temperature**
  When using pneumatic equipment at temperature of 5 ℃ or below, install an air dryer or take other countermeasures to prevent drainage and moisture in compressed air from freezing or solidifying.

OPERATING ENVIRONMENT

DANGER

- **Do not use HI-ROTOR in a explosive environment.**

WARNING

- **Do not use HI-ROTOR in a corrosive environment.**
- **Do not use HI-ROTOR in a place attended with much dust, water drops or oil drops.**

MAINTENANCE AND INSPECTION

WARNING

- **Inspection before doing maintenance**
  Check that proper prevention against drop of load and runaway have been taken, before turning off air and power supply to equipment and discharging air remaining in the system.
  For 3-position all port block (closed center) type, compressed air is sealed in between solenoid valve and Rotary Actuator.
  So purge the residual air.
- **Inspection after finishing maintenance**
  When connecting the system to compressed air supply and power supply, HI-ROTOR may sometimes suddenly actuate. Therefore, when restarting the system, thoroughly check the safety of surrounding conditions before connecting the pneumatic system to compressed air supply and power supply. Furthermore, perform a proper functional test and a leak test to check that the system normally operates.
- **Disassembling HI-ROTOR**
  When disassembling HI-ROTOR, consult our company beforehand.

CAUTION

- **Draining**
  To maintain constant air quality, drain the air filter periodically.

MAGNETIC PROXIMITY SWITCH/COMMON INSTRUCTIONS ①

Be sure to read them before use.
Also refer to Par. "For Safety Use" and instructions mentioned for each series.

DESIGN AND SELECTION

⚠ WARNING

- **Use the switch within the range of specifications described in this catalogue.**
  Applying load current, voltage, temperature and shock exceeding the range of specifications will cause a damage to the switch and a faulty operation.
  Thoroughly read the specifications and use the switch within the range of the specifications.
  Especially, be sure to use the switch within the maximum contact capacity and operating current range.

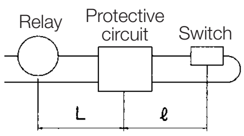
- **Be careful of distance between adjacent HI-ROTOR.**
  When 2 or more HI-ROTORs, each of switch is equipped with a switch are close installed or a magnetic material moves very close to the HI-ROTOR, there is the possibility that the switch malfunctions due to magnetic interference between the switch and magnetic material.

- **Pay attention to switch-on time at the center of stroke.**
  Example : The vane is set at the center of stroke and load is driven when the vane passes the switch. In this case, if oscillating speed is extremely high, operating time is short even when the switch is turned on.
  As a result, load cannot be fully moved according to circumstances.
  In this case, oscillating speed is expressed as follows :

$$V = \frac{\text{Operating range of switch (mm)}}{\text{Operating time of load (ms)}} \times 1000 \quad \text{(mm/s)}$$

- **Reduce the length of wiring as much as practicable.**
  〈Reed switch〉
  When capacitive load is driven or the wiring from switch to load is long, inrush current increases due to line floating capacty at the time of switch-on ; this results in a damage to the switch or shortens the switch service life.
  - In designing a system, provide a distance of more than 40 mm between the HI-ROTOR. (When a permissible distance is specified for each HI-ROTOR, follow the specified distance.)

In case of capacitive load.



When "L" is longer than 10 m, set " ℓ " at 100 to 200 mm.

  - Even when using a switch with built-in contact protective circuit and length of wiring is more than 30 m, the protective circuit may not fully absorb inrush current according to circumstances ; this sometimes shortens the switch service life.
    For how to connect a protective circuit contact KURODA.

  〈Proximity switch〉
  When inrush current caused by line floating capacity occures, take a proper countermeasure to absorb the rush current.

DESIGN AND SELECTION

⚠ WARNING

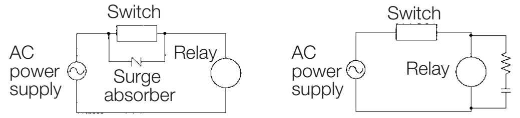
- **Be careful of leak current.**
  For a 2-wire proximity switch, current (leak current) flows in it to operate the internal circuit even if the switch is turned off.
  When 2 or more switches are connected in parallel, leak current increases corresponding to the number of connected switches.
  When leak current is larger than operating current for turning off load, the load is not turned off.

- **Be careful of internal voltage drop of switch.**
  〈Reed switch〉
  When 2 or more switches with LED are connected in series, voltage drop occurs by the number of connected switches due to the resistance of light emitting diode. (Refer to "Internal Voltage Drop" described in "Specifications for Switch".)
  Note that load may not be sometimes moved even if the switch operates normally.
  When the voltage drop of light emitting diode becomes a problem, use a switch without LED.
  〈Proximity switch〉
  When connecting 2-wire proximity switches in series, pay attention to the same points as those for connecting reed switches. However, note that the internal voltage drop is generally larger than that of reed switches.

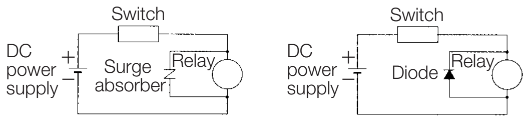
- **Do not use load that produces surge voltage.**
  〈Reed switch〉
  When driving a relay or other load that produces surge voltage, use a switch with built-in contact protective circuit or connect a protective circuit to the switch.

In case of inductive load

Load at 100 V AC



Load at DC



  〈Proximity switch〉
  A zener diode for surge protection is connected to the output side of a proximity switch. However, it may be broken if surge is repeatedly applied to it.
  When directly driving a relay, solenoid valve or other load that produces surge, use a switch with built-in surge absorbing element.

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MAGNETIC PROXIMITY SWITCH / COMMON INSTRUCTIONS ②

Be sure to read them before use.
Also refer to Par. "For Safety Use" and instructions mentioned for each series.

DESIGN AND SELECTION

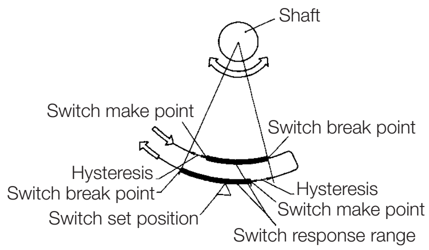
WARNING

- **When using the switch in an interlock circuit, pay attention to the following points;**
  When a switch for HI-ROTOR is used for interlock signals requiring high degree of reliability, provide the switch with a mechanical protective function against trouble and malfunction or use a double-interlock system by using the switch together with other switch (sensor etc.).
  In addition, check the switch periodically to make sure that it works normally.
- **Provide space for maintenance.**
  In designing a system, take into account space for maintenance and inspection.

INSTALLATION AND ADJUSTMENT

WARNING

- **Do not drop or hit the switch.**
  When handling the switch, do not drop or hit it or do not apply an excessive shock to it (refer to specification for each switch).
- **Do not swing around the switch while holding the lead wire.**
  If excessive tensile force is applied to the lead wire, the inside wire may be broken or the internal mechanism of the switch may suffer a damage.
- **Fix the switch with prescribed clamping torque.**
  When the switch is fixed with clamping torque exceeding the prescribed value, the set screw, metal fixture, switch, etc. may be broken.
- **Set switch to center of working range.**
  When magnet on the shaft rotats in one direction to a point at which the switch is turned on and then rotats in opposite direction to a point at which the switch is turned off, the angle of shaft rotation between these two points is called hysteresis.
  When the switch is installed within this range, operation may be unstable according to circumstances.
  Install the switch so that magnet is located at the center of working range (within which the switch is turned on.).



CAUTION

- **Do not wipe off the model name inscribed on a nameplate etc. with organic solvent.**
  The inscribed indication may be erased.

MAGNETIC PROXIMITY SWITCH/COMMON INSTRUCTIONS ③

Be sure to read them before use.
Also refer to Par. "For Safety Use" and instructions mentioned for each series.

WIRING

⚠ WARNING

- **Properly wire in accordance with each lead wire color or terminal No.**
  In this case, be sure to turn off power to the electric circuit on the connection side.

- **Do not make wrong wiring.**
  As DC current has polarity, do not confuse (+) with (−).
  〈Reed switch〉
  When the connection of wiring is reversed, the switch is operated but the lamp is not on.
  If current exceeding the prescribed operating range flows to the switch, the lamp will be broken and the switch fails.
  〈Proximity switch〉
  Even if the connection of wiring of a 2-lead wire switch is reversed, the protective circuit prevents the breakdown of the switch. In this case, however, the switch is left turned on. Note that, if the connection of wiring of a 2-lead wire switch is reversed with load short-circuited, the switch will be broken.
  If the power line of a 3-lead wire switch is reversely wired ("+" replaces with "−"), the protective circuit will protect the switch. However, note that, if the power line is replaced with the output line by mistake, the switch will be broken.

- **Do not wire the switch together with the power line and high voltage line.**
  Wire the switch by keeping away from the power line and high voltage line.
  Otherwise, the control circuit including the switch may malfunction due to noise.

- **Avoid applying repetitive bending stress and tensile force to the lead wire.**
  When setting the switch in a moving part, sag the wiring so that repetitive stress and tensile force will not be applied to the lead wire.
  Wiring that produces repetitive bending stress and tensile force cause the breaking of wire.

- **Check for poor insulation.**
  Check lead wire connection, extension cable and terminal base for poor insulation. If poor insulation occurs, excess current will flow to the switch, sometimes resulting in a damage to the switch.

- **Be sure to connect load before turning on power supply.**
  When a 2-lead wire switch is turned on without connecting load such as relay, PLC, etc., excess current will momentarily flow to the switch, resulting in a damage to the switch.

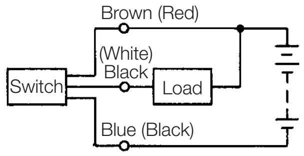
- **Do not turn on the switch with load short-circuited.**
  If the switch is turned on with load short-circuited, excess current will flow to the switch, sometimes resulting in a damage to the switch.

WIRING

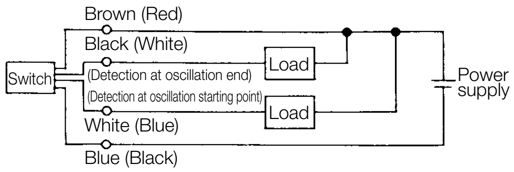
⚠ WARNING

- **It is possible to provide power supply to load and power supply to switches individually and also to use them in common.**
  When power supplies are individually provided, they should have the same voltage.

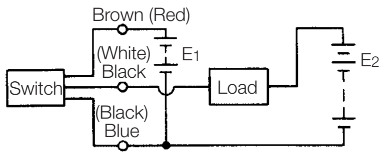
Where power supply to load and power supply to switch are commonly used :



(SR type switch unit)



Where power supply to load and power supply to switch are not commonly used :



E_1 and E_2 should be the same voltage.

Bracketed ( ) color is former color.

MAGNETIC PROXIMITY SWITCH/COMMON INSTRUCTIONS ④

Be sure to read them before use.
Also refer to Par. "For Safety Use" and instructions mentioned for each series.

OPERATING ENVIRONMENT

DANGER

- **Never use the switch in an explosive or ignitable atmosphere.**
  As the switch is not proof against explosion, never use it in an explosive gas atmosphere or ignitable atmosphere ;
  otherwise causing an explosion or fire.

WARNING

- **Do not use the switch in a place where there is a strong magnetic field or a large current.**
  If the switch is used in a place where there is a strong magnetic field or a large current (large magnet, spot welding machine, etc.), the switch will malfunction or the magnet will be demagnetized.
- **Do not use the switch in a place where it is always splashed with water.**
  Excepting some type of switch, these switches meet structural specifications IP65 prescribed by IEC Standard (refer to specifications for each switch). However, do not use the switch in a place where water is always poured on it; otherwise causing insulation failure and malfunction.
- **Do not use the switch in an environment containing oil and chemicals.**
  When the switch is used in an environment containing coolant, washings, oils and chemicals, the inside of the switch is adversely affected even if it is used for a short period of time.
  When it is necessary to use the switch in such an environment, contact KURODA.
- **Do not use the switch in a place where an extreme temperature change occurs.**
  Using the switch in a place attended with an unusual temperature change will adversely affect the inside of the switch.
  When it is necessary to use the switch in such an environment, contact KURODA.
- **Do not use the switch in a place where an excessive shock occurs.**
  〈Reed switch〉
  For a reed switch, if an excessive shock (over 980m/s^2) is applied to it during operation, the contact may malfunction according to circumstances.
  When a proximity switch is used in place of a reed switch, the deficiency can be reduced. In this case, check shock resistance given in specifications.
- **Do not use the switch in a place where surge is produced.**
  〈Proximity switch〉
  When there is a large surge source around the proximity switch, the circuit element in the switch may be adversely affected.

OPERATING ENVIRONMENT

WARNING

- **Be careful of adjacent magnetic material. Keep the switch away from magnetic material by more than 3.5 mm.**
  When there is magnetic material such as iron close to the HI-ROTOR with a built-in magnet is absorbed and thus the switch may not operate according to circumstances.
  Note that, when chips and iron powder such as weld spatters accumulate during operation, the same situation as above-mentioned will also occur.

MAINTENANCE AND INSPECTION

DANGER

Perform the following maintenance and inspection periodically.

- **Check the switch set screw and metal fixture for looseness and retighten as necessary.**
  If the switch set screw and metal fixture are loosened, the switch set position will shift, resulting in an unstable operation or malfunction.
  Readjust the set position and tighten the set screw and fixture.
- **Check the lead wire for damage.**
  A damage to the coating of the lead wire may lead to insulation failure and breaking of wire.
  When a damage is found, change the switch and repair the lead wire immediately.

Miniature HI-ROTOR / Standard type
PRNseries
1S, 3S, 10S, 20S, 30S, 1D, 3D, 10D, 20D, 30D

ORDERING INSTRUCTIONS

PRNA20S – 90 – 90 S – P – FR – [ ]

Model No. ① ② ③ ④ ⑤ ⑥

Single vane	Double vane
PRNA1S	PRNA1D
PRNA3S	PRNA3D
PRNA10S	PRNA10D
PRNA20S	PRNA20D
PRN30S	PRN30D

①Oscillating angle

90	90°
180	180°
270	270°

②Oscillating reference point

90	90°
45	45°

③Port position

No mark	Standard
S	On the rear cover

(Note) S is not available for Models PRN30S and 30D.

④Mounting hardware

No mark	No mounting hardware
P	With flange plate
L1	With one foot plate
L2	With two foot plates

⑤Type of switch units

No mark	No switch	
FR	With CT-3 switch	Switch position adjustable
FU	With CT-3U switch	
FP	With CTP-3 switch	
SR	With SR switch	Switch position fixed
SU	With SU switch	

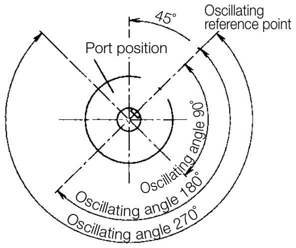
(Note) •Two switches are provided.
•Only FR and FU are available for PRNA1.
•FP is made-to-order

⑥Custom-made shafts (Refer to P.53)

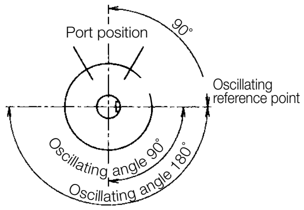
(Note) •Switch units and mounts with two foot plate are not available on “S” (Ports on the rear cover) model.
•Switch units cannot be mounted on HI-ROTORs with two foot plates (L2).
•Mounting hardware comes being not fabricated.

OSCILLATION STARTING POINT AND OSCILLATION ANGLE

PRNA1S/D, PRNA3S/D, PRNA10S/D, PRNA20S/D, PRN30S/D
Oscillating reference point at 45°



PRNA1S, PRNA3S PRNA10S, PRNA20S
Oscillating reference point at 90°



Oscillating angle and oscillating reference point

Model No.	Oscillating angle 90°	180°	270°	Oscillating reference point 45°	90°
PRNA1S	○	○	○	○	—
	△	△	—	—	△
PRNA3S	○	○	○	○	—
	△	△	—	—	△
PRNA10S	○	○	○	○	—
	△	△	—	—	△
PRNA20S	○	○	○	○	—
	△	△	—	—	△
PRN30S	○	○	○	○	—
PRNA1D	○	—	—	○	—
PRNA3D	○	—	—	○	—
PRNA10D	○	—	—	○	—
PRNA20D	○	—	—	○	—
PRN30D	○	—	—	○	—

○: Standard △: Custom-made

Model Nos. of mounting hardware

Applicable HI-ROTOR	Flange plate	Foot plate
PRNA1S/D	PRN1-P	PRN1-L
PRNA3S/D	PRN3-P	PRN3-L
PRNA10S/D	PRN10-P	PRN10-L
PRNA20S/D	PRN20-P	PRN20-L
PRN30S/D	PRN30-P	PRN30-L

(Note) These hardware are provided with set screws.

Miniature HI-ROTOR/PRN series

SPECIFICATIONS

Model No.	Unit	PRNA1S			PRNA3S			PRNA10S			PRNA20S			PRN30S		
Vane		Single vane														
Fluid		Non-lubricated air (Lubricated air)														
Oscillating angle	Degree	90^{+4}_{0}	180^{+4}_{0}	270^{+4}_{0}	90^{+4}_{0}	180^{+4}_{0}	270^{+4}_{0}	90^{+4}_{0}	180^{+4}_{0}	270^{+4}_{0}	90^{+4}_{0}	180^{+4}_{0}	270^{+4}_{0}	90^{+3}_{0}	180^{+3}_{0}	270^{+3}_{0}
Oscillating reference point	Degree	45,90		45	45,90		45	45,90		45	45,90		45	45		
Port size		M5												Rc⅛		
Minimum working pressure	MPa	0.1									0.08			0.1		
Operation pressure range	MPa	0.2～0.7									0.2～1					
Proof withstanding pressure	MPa	1.05									1.5					
Temperature range	℃	−5～80												−5～60		
Maximum frequency of use	Hz	5	3	1.6	4	2.5	1	4	2.5	1.5	3.5	2	1	3	1.5	1
Internal volume	cm^3	1.4	1.4	1.5	3.4	3.4	4	9.8	9.8	12	17	17	21	37	37	43
Allowable radial load	N	30			40			50			300			400		
Allowable thrust load	N	3			4			4			25			30		
Allowable energy	mJ	0.6			1.5			3			15			25		
Mass	kg	0.036			0.07			0.14			0.25			0.47		0.46

Model No.	Unit	PRNA1D	PRNA3D	PRNA10D	PRNA20D	PRN30D
Vane		Double vane				
Fluid		Non-lubricated air (Lubricated air)				
Oscillating angle	Degree	90^{+4}_{0}	90^{+4}_{0}	90^{+4}_{0}	90^{+4}_{0}	90^{+3}_{0}
Oscillating reference point	Degree	45	45	45	45	45
Port size		M5				Rc⅛
Minimum working pressure	MPa	0.08	0.07		0.06	0.08
Operation pressure range	MPa	0.2～0.7			0.2～1	
Proof withstanding pressure	MPa	1.05			1.5	
Temperature range	℃	−5～80				−5～60
Maximum frequency of use	Hz	5	4	4	3	3
Internal volume	cm^3	1.1	2.8	8.1	15	34
Allowable radial load	N	30	40	50	300	400
Allowable thrust load	N	3	4	4	25	30
Allowable energy	mJ	0.6	1.5	3	15	25
Mass	kg	0.037	0.072	0.14	0.26	0.48

(Note) •Maximum frequency of use at the supply pressure of 0.5 MPa (Unloaded).
•Make sure to use the HI-ROTOR within allowable energy. Refer to page 68 for the allowable energy calculation.
•HI-ROTORs with keyways are provided with keys.
•For HI-ROTORs other than standard, consult KURODA.

Output (Effective torque)

(Unit : N·cm)

Model No.		Supply pressure (MPa)								
		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Single vane	PRNA1S	4.9	7.6	10.1	12.9	15.6	18.5	—	—	—
	PRNA3S	10	17	24	31	38	45	—	—	—
	PRNA10S	35	56	75	98	120	139	—	—	—
	PRNA20S	59	95	133	170	210	249	287	326	368
	PRN30S	110	180	250	319	410	480	580	650	720
Double vane	PRNA1D	10.4	16.5	22.5	28.6	34.7	41.1	—	—	—
	PRNA3D	25	39	54	71	86	101	—	—	—
	PRNA10D	76	117	162	211	254	303	—	—	—
	PRNA20D	140	222	306	388	470	553	633	717	807
	PRN30D	270	440	600	770	950	1120	1299	1480	1660

Miniature HI-ROTOR/PRN series

OSCILLATING TIME RANGE

(Unit : s)

Model No.	Oscillating angle		
	90°	180°	270°
PRNA1S, 1D	0.03～0.6	0.06～1.2	0.09～1.8
PRNA3S, 3D	0.04～0.8	0.08～1.6	0.12～2.4
PRNA10S, 10D	0.045～0.9	0.09～1.8	0.135～2.7
PRNA20S, 20D	0.05～1.0	0.1～2.0	0.15～3.0
PRN30S, 30D	0.07～0.7	0.14～1.4	0.21～2.1

(Note) Operate the HI-ROTOR within the oscillating time range prescribed in the above table. Otherwise, the HI-ROTOR will be perform in stick-slip motions.

HI-ROTOR with switch/For details, see pages 52 to 54.

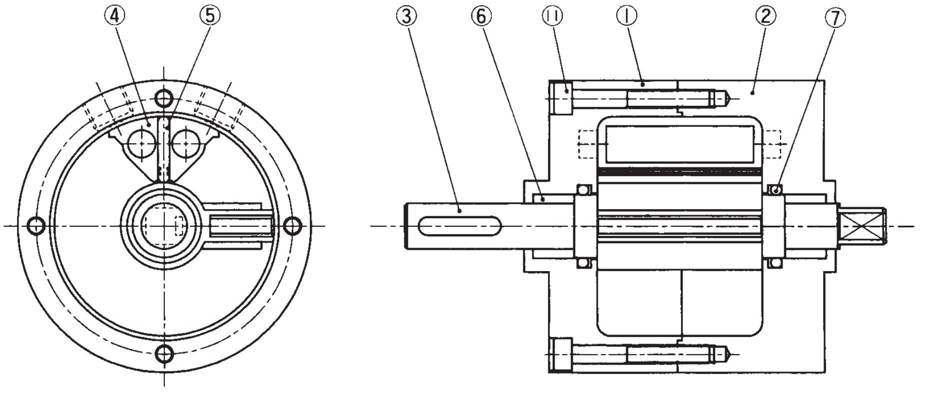
CT AND SR TYPE PROXIMITY SWITCHES

Type of switch	Mounting	Load voltage (V)	Load current (mA)	Indicating lamp (Lights up at ON)	Applications
CT-3 CT-3U CTP-3	Switch position adjustable	DC5～30	5～200	○	Relay PLC IC circuit
SR SU	Switch position fixed				

(Note) CTP-3 is made-to-order

STRUCTURE

PRNA1S, PRNA3S, PRNA10S, PRNA20S, PRN30S



MAIN COMPONENTS

No.	Description	Material	
		PRN30S	PRNA1S, PRNA3S, PRNA10S, PRNA20S
①	Body A	Aluminium alloy	
②	Body B	Aluminium alloy	
③	Vane shaft	Steel+Resin+Nitrile rubber	Steel+Resin+Hydrogenated nitrile rubber
④	Shoe	Resin	
⑤	Shoe seal	Nitrile rubber	Hydrogenated nitrile rubber
⑥	Bushing	—	
⑦	O-ring	Nitrile rubber	Hydrogenated nitrile rubber
⑪	Set screw	Steel	

MODEL Nos. OF PACKING KIT

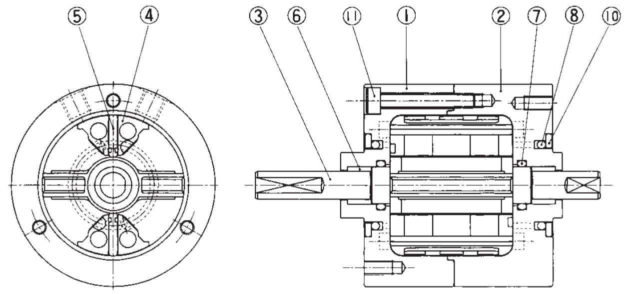
Applicable HI-ROTOR	Model No.
PRNA1S	PRNA1S-PS
PRNA3S, PROA3S	PRNA3S-PS
PRNA10S, PROA10S PRHA10S	PRNA10S-PS
PRNA20S, PROA20S PRHA20S	PRNA20S-PS
PRN30S, PRO30S PRH30S	PRN30S-PS

(Note) A set of packings consists of part Nos. ③, ⑤ and ⑦.

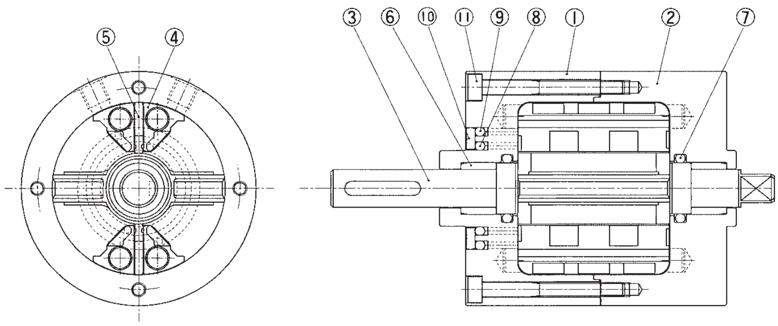
Miniature HI-ROTOR/PRN series

STRUCTURE

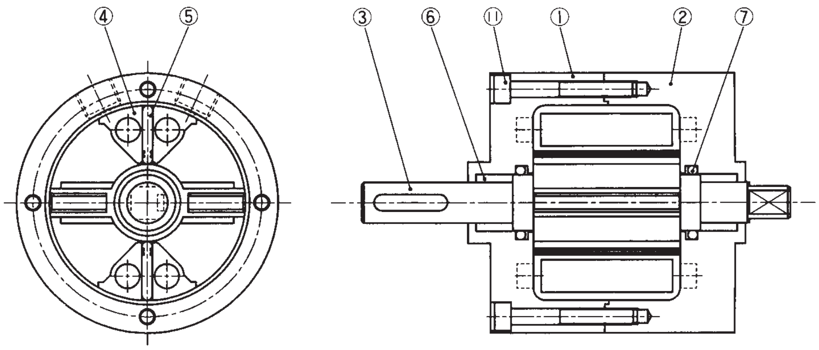
PRNA1D,
PRNA3D,
PRNA10D



PRNA20D



PRN30D



MAIN COMPONENTS

No.	Description	Material	
		PRNA1D, PRNA3D, PRNA10D, PRNA20D	PRN30D
①	Body A	Aluminium alloy	
②	Body B	Aluminium alloy	
③	Vane shaft	Steel+Resin+Hydrogenated nitrile rubber	Steel+Resin+Nitrile rubber
④	Shoe	Resin	
⑤	Shoe seal	Hydrogenated nitrile rubber	Nitrile rubber
⑥	Bushing	—	
⑦	O-ring	Hydrogenated nitrile rubber	Nitrile rubber
⑧	O-ring	Hydrogenated nitrile rubber	Nitrile rubber
⑨	O-ring	Hydrogenated nitrile rubber (PRNA20D only)	—
⑩	Plate	Steel	—
⑪	Set screw	Steel	

MODEL Nos. OF PACKING KIT

Applicable HI-ROTOR	Model No.
PRNA1D	PRNA1D-PS
PRNA3D, PROA3D	PRN3D-PS
PRNA10D, PROA10D PRHA10D	PRNA10D-PS
PRNA20D, PROA20D PRHA20D	PRNA20D-PS
PRN30D, PRO30D PRH30D	PRN30D-PS

(Note) A set of packings consists of part Nos. ③, ⑤ and ⑦.

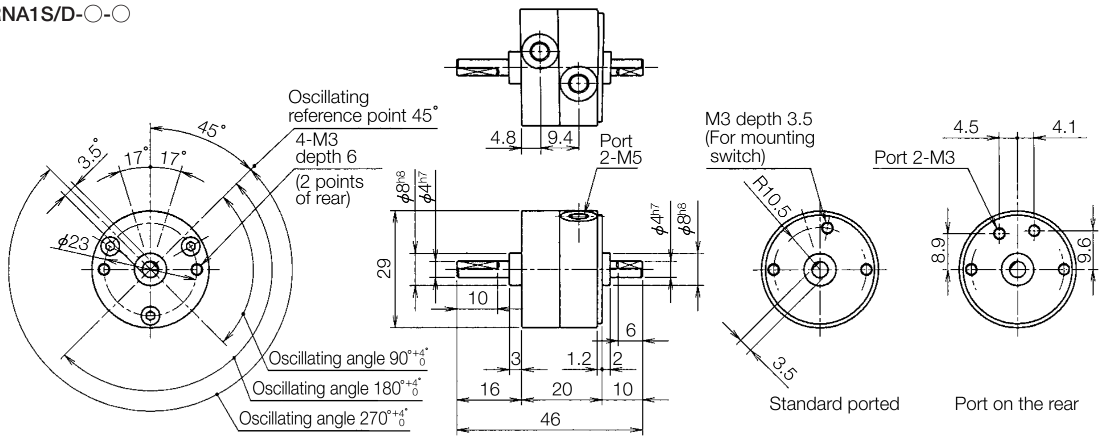
Miniature HI-ROTOR/PRN series

DIMENSIONS

(Unit : mm)

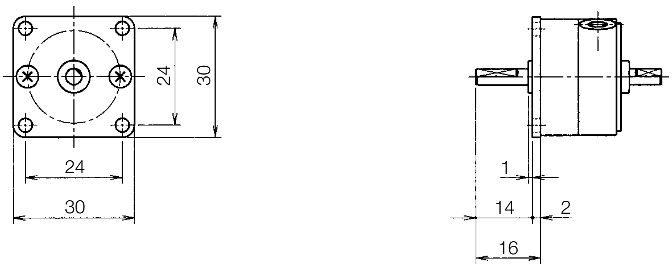
Basic type

PRNA1S/D-◯-◯



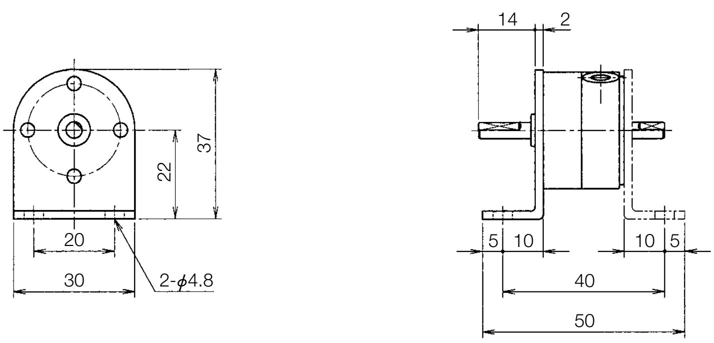
With flange plate

PRNA1S/D-◯-◯-P



With foot plate

PRNA1S/D-◯-◯-L1 (L2)

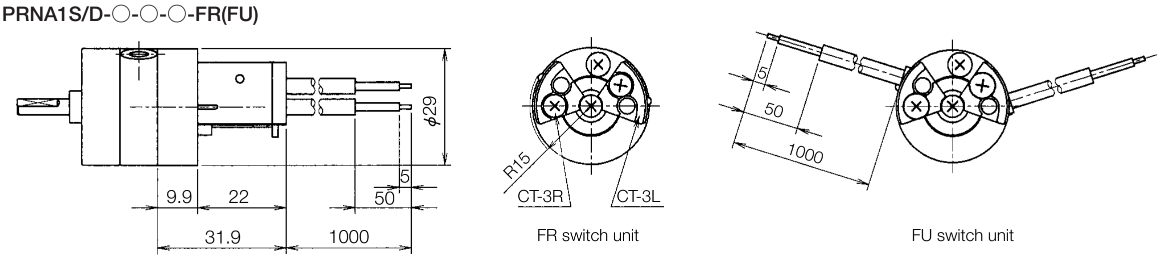


(Note) •A foot plate can be fitted with it turned in steps of 90˚ from the original posture.
•Short shaft side : Example with L2 (2 pcs.)

With switch unit

(Switch position adjustable type)

PRNA1S/D-◯-◯-◯-FR(FU)



(Note) For switch unit-mounting hardware combinations, refer to the required dimensions in each Fig.

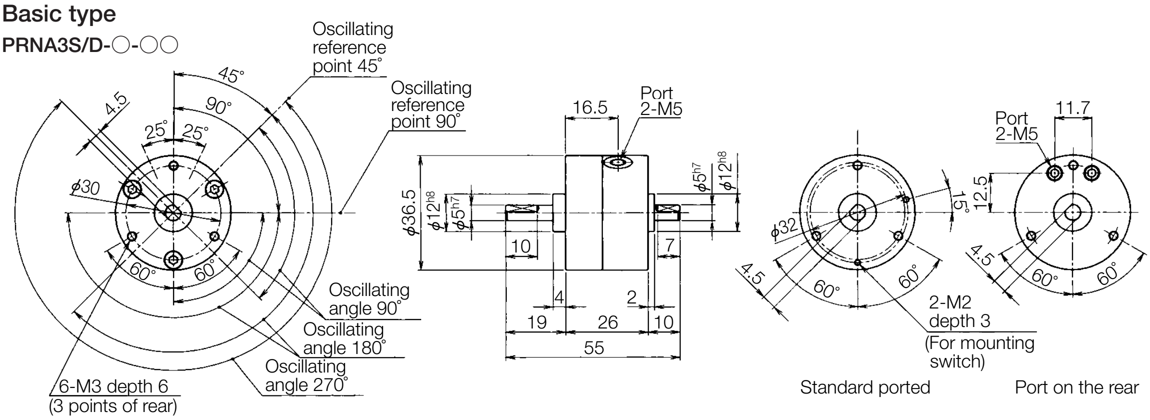
Miniature HI-ROTOR/PRN series

DIMENSIONS

(Unit : mm)

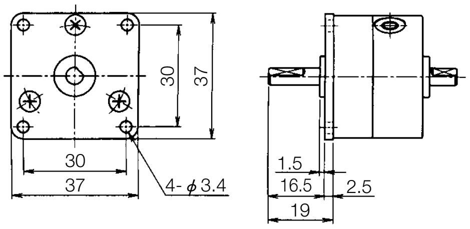
Basic type

PRNA3S/D-○-○○



With flange plate

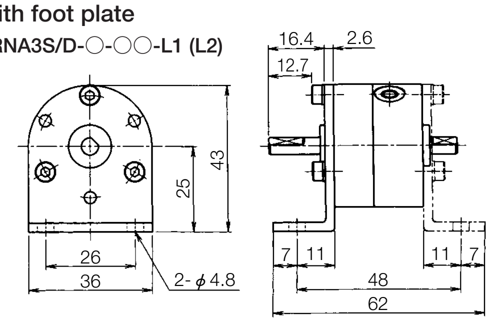
PRNA3S/D-○-○○-P



(Note) A flange plate can be fitted with it turned in steps of 120° from the original posture.

With foot plate

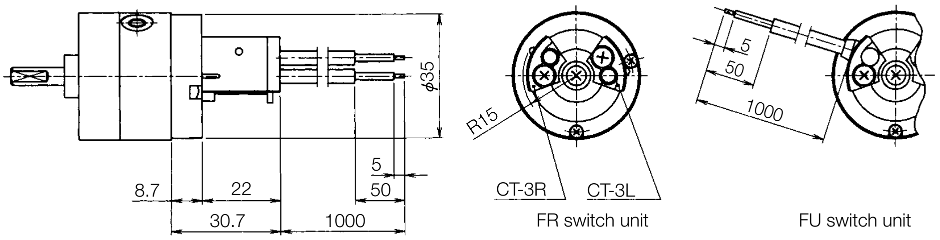
PRNA3S/D-○-○○-L1 (L2)



(Note) •A foot plate can be fitted with it turned in steps of 60° from the original posture.
•Short shaft side : Example with L2 (2 pcs.)

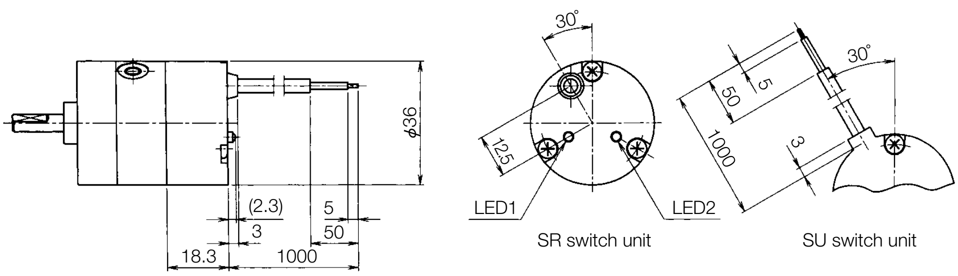
With switch unit (Switch position adjustable type)

PRNA3S/D-○-○-○-FR(FU)



With switch unit (Switch position fixed type)

PRNA3S-○-○-○-SR(SU)



(Note) LED1 comes on at the oscillating reference point and LED2 at the end of oscillation.

(Note) For switch unit-mounting hardware combinations, refer to the required dimensions in each Fig.

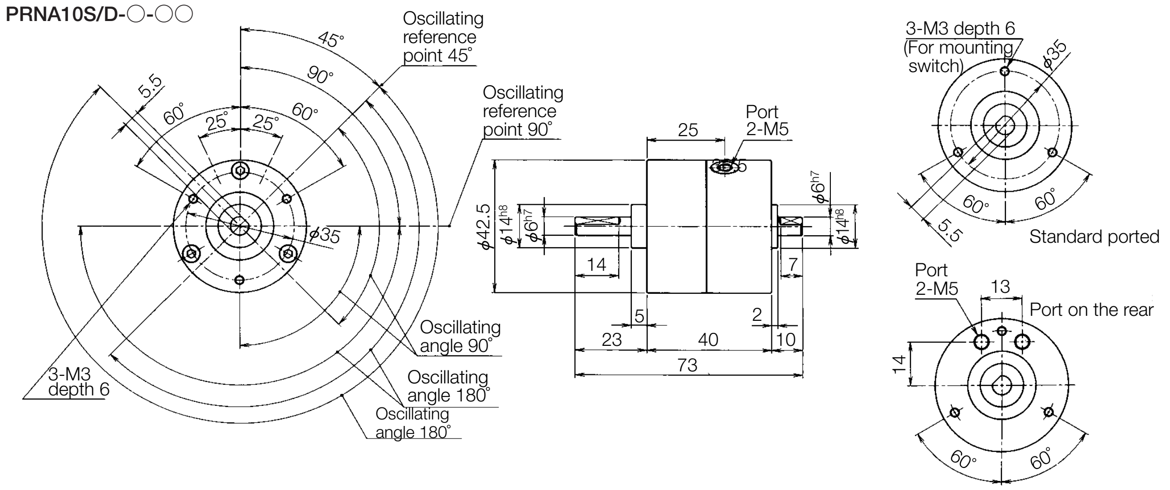
Miniature HI-ROTOR/PRN series

DIMENSIONS

(Unit : mm)

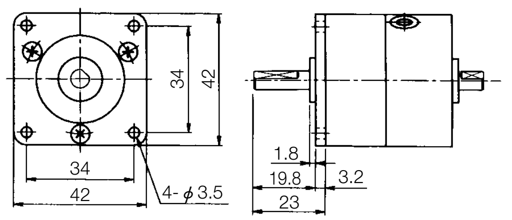
Basic type

PRNA10S/D-○-○○



With flange plate

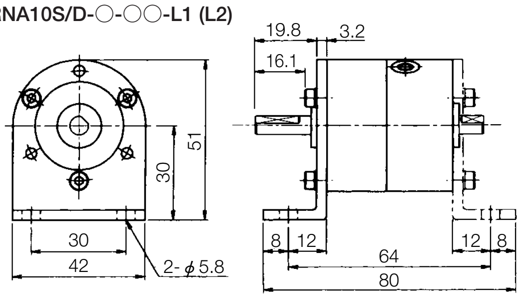
PRNA10S/D-○-○○-P



(Note) A flange plate can be fitted with it turned in steps of 120° from the original posture.

With foot plate

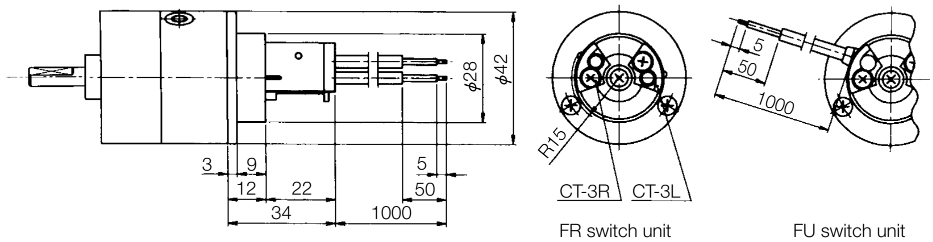
PRNA10S/D-○-○○-L1 (L2)



(Note) •A foot plate can be fitted with it turned in steps of 60° from the original posture.
•Short shaft side : Example with L2 (2 pcs.)

With switch unit (Switch position adjustable type)

PRNA10S/D-○-○-○-FR(FU)

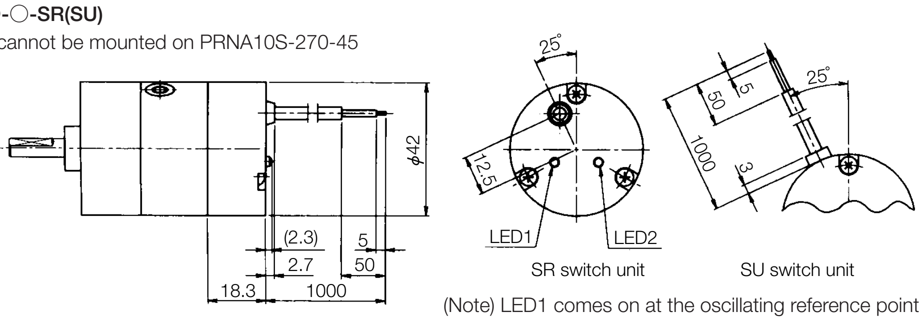


FR switch unit FU switch unit

With switch unit (Switch position fixed type)

PRNA10S/D-○-○-○-SR(SU)

SR and SU switch cannot be mounted on PRNA10S-270-45



SR switch unit SU switch unit

(Note) LED1 comes on at the oscillating reference point and LED2 at the end of oscillation.

(Note) For switch unit-mounting hardware combinations, refer to the required dimensions in each Fig.

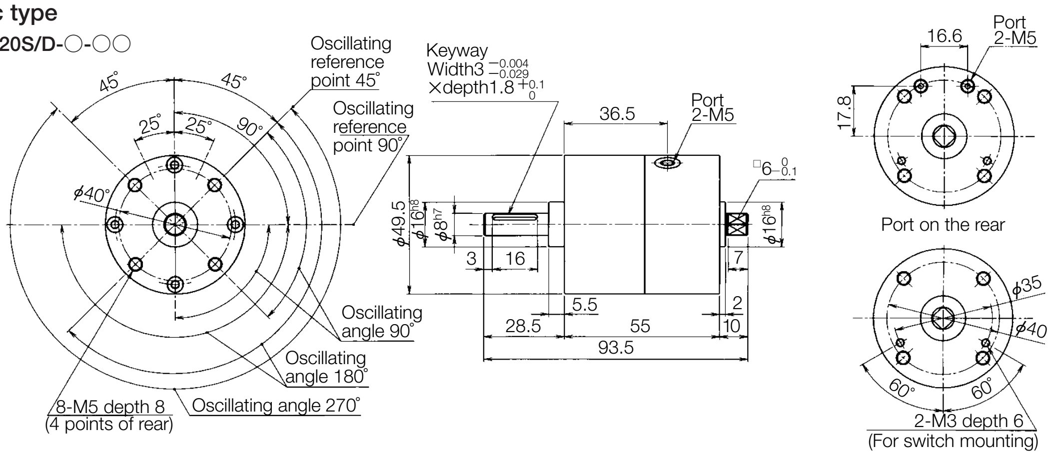
Miniature HI-ROTOR/PRN series

DIMENSIONS

(Unit : mm)

Basic type

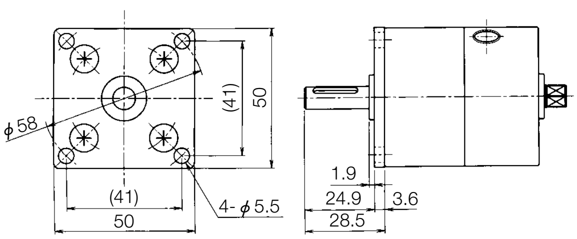
PRNA20S/D-○-○○



Standard ported

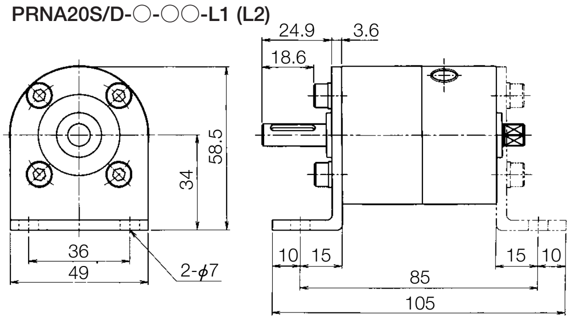
With flange plate

PRNA20S/D-○-○○-P



With foot plate

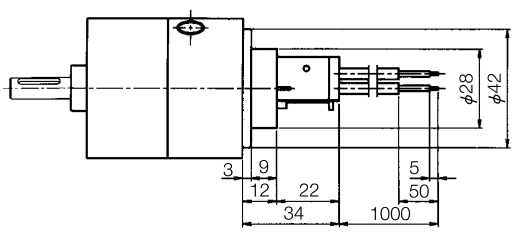
PRNA20S/D-○-○○-L1 (L2)

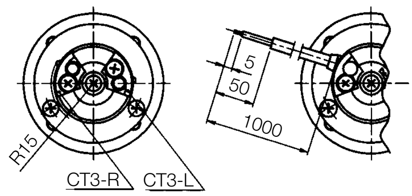


(Note) •A foot plate can be fitted with it turned in steps of 90° from the original posture.
•Short shaft side : Example with L2 (2 pcs.)

With switch unit (Switch position adjustable type)

PRNA20S/D-○-○-○-FR(FU)

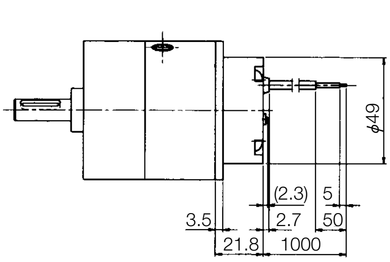


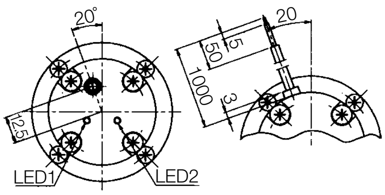


FR switch unit　　FU switch unit

With switch unit (Switch position fixed type)

PRNA20S-○-○-○-SR(SU)





SR switch unit　　SU switch unit

(Note) LED1 comes on at the oscillating reference point and LED2 at the end of oscillation.

(Note) For switch unit-mounting hardware combinations, refer to the required dimensions in each Fig.

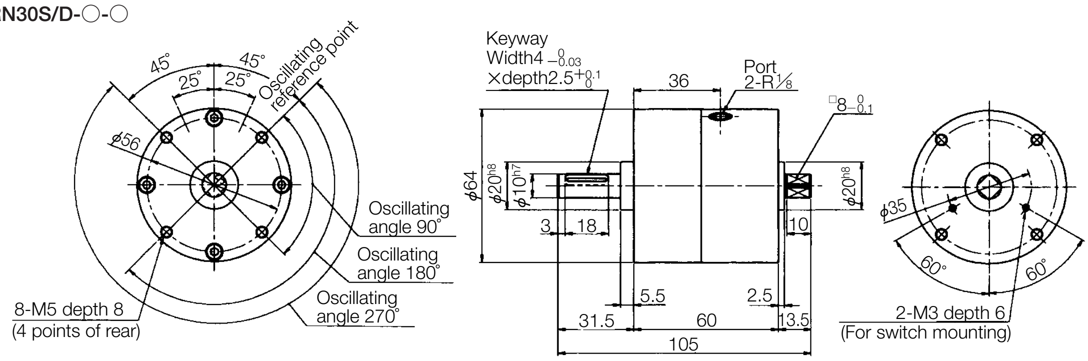
Miniature HI-ROTOR/PRN series

DIMENSIONS

(Unit : mm)

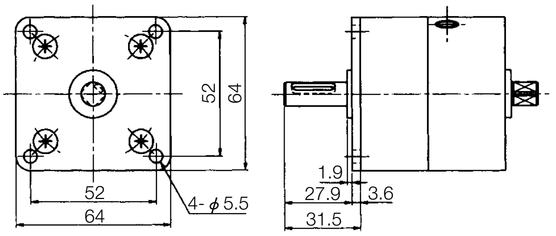
Basic type

PRN30S/D-○-○



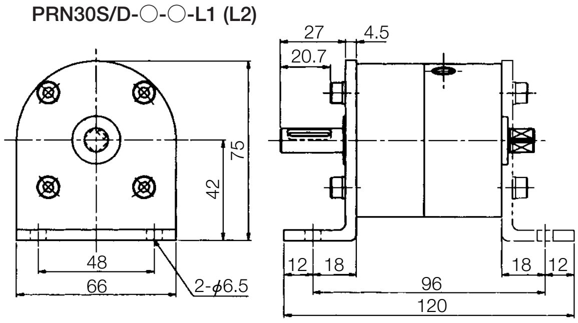
With flange plate

PRN30S/D-○-○-P



With foot plate

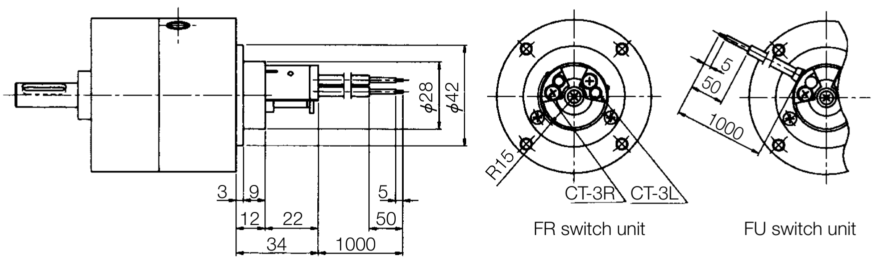
PRN30S/D-○-○-L1 (L2)



(Note) •A foot plate can be fitted with it turned in steps of 90° from the original posture.
•Short shaft side : Example with L2 (2 pcs.)

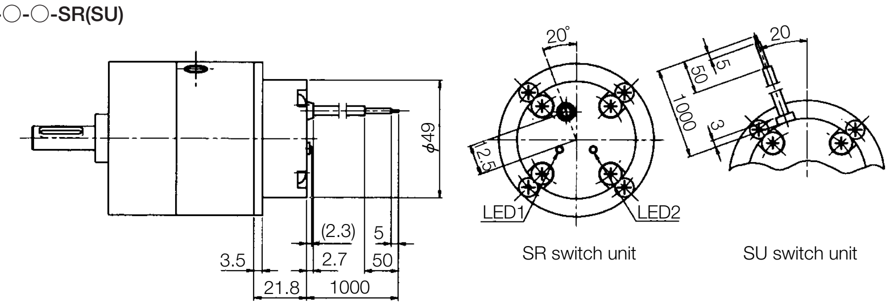
With switch unit (Switch position adjustable type)

PRN30S/D-○-○-○-FR(FU)



With switch unit (Switch position fixed type)

PRN30S/D-○-○-○-SR(SU)



(Note) LED1 comes on at the oscillating reference point and LED2 at the end of oscillation.

(Note) For switch unit-mounting hardware combinations, refer to the required dimensions in each Fig.

Miniature HI-ROTOR / Variable oscillating angle type

PROseries

3S, 10S, 20S, 30S, 3D, 10D, 20D, 30D

ORDERING INSTRUCTIONS

PROA20S – 0 – 90 – P – FR – [ ]

Model No. ① ② ③ ④ ⑤

Single vane	Double vane
PROA3S	PROA3D
PROA10S	PROA10D
PROA20S	PROA20D
PRO30S	PRO30D

①Oscillating angle

0	Angle setting not specified
Desired angle*	Angle setting specified

*Custom-made

②Oscillating reference point

90	90° (PROA3S,10S,20S)
45	45° (PROA3D,10D,20D) (PRO30S/D)

③Mounting hardware

No mark	No mounting hardware
P	With flange plate
L1	With one foot plate

④Type of switch units

No mark	No switch	
FR	With CT-3 switch	Switch position adjustable
FU	With CT-3U switch	
FP	With CTP-3 switch	

(Note) •Two switches are provided.
•FP is made-to-order

⑥Option

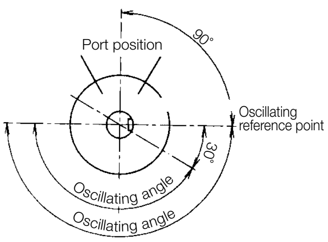
No mark	Without protective cover
K	With protective cover

(Note) For HI-ROTORs with switches, the protective cover cannot be mounted.

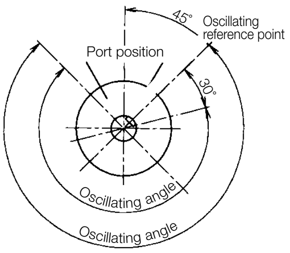
(Note) •HI-ROTORs of which the angle setting is not specified are shipped with fixed the reference point stopper but not the angle setting stopper when delivered. Be sure to attach the accompanying angle setting stopper without fail before use.
•HI-ROTORs of which angle setting is specified (made-to-order) will be delivered with angle setting stopper attached to the approximate position. Be sure to adjust the stopper position with the fine adjust screw before use.
•HI-ROTORs with a switch unit will be delivered together with the switch unit in the package. Assemble them after adjusting the external stopper. For the method of assembly, see Page 54.
•Mounting hardwares are not fabricated to the HI-ROTOR when delivered but are included in the package.

OSCILLATION STARTING POINT AND OSCILLATION ANGLE

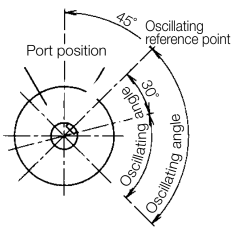
PROA3S, PROA10S, PROA20S
Oscillating reference point at 90°



PRO30S
Oscillating reference point at 45°



PROA3D, PROA10D, PROA20D, PRO30D
Oscillating reference point at 45°



Model Nos. of stopper unit

Applicable HI-ROTOR	Model No.
PROA3S/D	RO3-U
PROA10S/D	RO10-U
PROA20S/D	RO20-U
PRO30S/D	RO30-U

(Note) For details, see page 26.

Model Nos. of protective cover

Applicable HI-ROTOR	Model No.
PROA3S/D	PRO3-K
PROA10S/D	PRO10-K
PROA20S/D	PRO20-K
PRO30S/D	PRO30-K

Model Nos. of mounting hardware

Applicable HI-ROTOR	Flange plate	Foot plate
PROA3S/D	PRN3-P	PRN3-L
PROA10S/D	PRN10-P	PRN10-L
PROA20S/D	PRN20-P	PRN20-L
PRO30S/D	PRN30-P	PRN30-L

(Note) These hardware are provided with set screws.

Miniature HI-ROTOR/PRO series

SPECIFICATIONS

Model No.	Unit	PROA3S	PROA10S	PROA20S	PRO30S
Vane		Single vane			
Fluid		Non-lubricated air (Lubricated air)			
Oscillating angle	Degree	30～180			30～270
Oscillating reference point	Degree	90			45
Port size		M5			Rc⅛
Minimum working pressure	MPa	0.1			
Operation pressure range	MPa	0.2～0.7		0.2～1	
Proof withstanding pressure	MPa	1.05		1.5	
Temperature range	℃	−5～80			−5～60
Maximum frequency of use	Hz	3 (at 180°)	2.5 (at 180°)	2 (at 180°)	1 (at 270°)
Internal volume	cm^3	4	12	21	43
Allowable radial load	N	40	50	300	400
Allowable thrust load	N	4	4	25	30
Allowable energy	mJ	1	2	3	7
Mass	kg	0.085	0.17	0.28	0.51

Model No.	Unit	PROA3D	PROA10D	PROA20D	PRO30D
Vane		Double vane			
Fluid		Non-lubricated air (Lubricated air)			
Oscillating angle	Degree	30～90			
Oscillating reference point	Degree	45			
Port size		M5			Rc⅛
Minimum working pressure	MPa	0.07		0.08	
Operation pressure range	MPa	0.2～0.7		0.2～1	
Proof withstanding pressure	MPa	1.05		1.5	
Temperature range	℃	−5～80			−5～60
Maximum frequency of use	Hz	4 (at 90°)	4 (at 90°)	3 (at 90°)	3 (at 90°)
Internal volume	cm^3	2.8	8.1	15	34
Allowable radial load	N	40	50	300	400
Allowable thrust load	N	4	4	25	30
Allowable energy	mJ	1	2	3	7
Mass	kg	0.087	0.18	0.29	0.53

(Note) •The allowable energy differs from that of the PRN series.
•Maximum frequency of use at the supply pressure of 0.5MPa (Unloaded).
•Make sure to use the HI-ROTOR within allowable energy. Refer to page 68 for the allowable energy calculation.
•HI-ROTORs with keyways are provided with keys.
•For HI-ROTORs other than standard, consult KURODA.

Output (Effective torque)

(Unit : N·cm)

Model No.		Supply pressure (MPa)								
		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Single vane	PROA3S	10	17	24	31	38	45	—	—	—
	PROA10S	35	56	75	98	120	139	—	—	—
	PROA20S	59	95	133	170	210	249	287	326	368
	PRO30S	110	180	250	319	410	480	580	650	720
Double vane	PROA3D	25	39	54	71	86	101	—	—	—
	PROA10D	76	117	162	211	254	303	—	—	—
	PROA20D	140	222	306	388	470	553	633	717	807
	PRO30D	270	440	600	770	950	1120	1299	1480	1660

Miniature HI-ROTOR/PRO series

EXTERNAL STOPPER SPECIFICATIONS

(Unit : Degree)

Model No.	PROA3S	PROA10S	PROA20S	PRO30S	PROA3D	PROA10D	PROA20D	PRO30D
Minimum angel setting	30							
Maximum angle setting	180			270	90			
Pitch for angle setting	15							
Angle fine adjustment range	−9～+6							
Oscillating reference poit fine adjust range	±3				−1～+3	±3		
Fine adjust range at maximum angle setting	−9～+6			−9～+3	−9～+1	−9～+3		

OSCILLATING ANGLE SETTING RANGE AND REFERENCE POINT

Model No.		Oscillation angle setting range	Oscillating reference point
Single vane	PROA3S	30～180°	90°
	PROA10S		
	PROA20S		
	PRO30S	30～270°	45°
Double vane	PROA3D	30～90°	45°
	PROA10D		
	PROA20D		
	PRO30D		

HI-ROTOR with switch/For details, see pages 53.

CT TYPE PROXIMITY SWITCHES

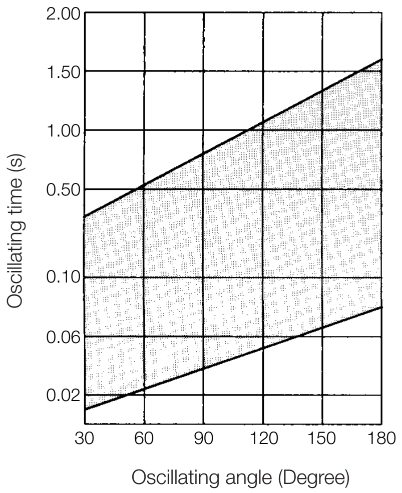
Type of switch	Mounting	Load voltage (V)	Load current (mA)	Indicating lamp (Lights up at ON)	Applications
CT-3 CT-3U CTP-3	Switch position adjustable	DC5～30	5～200	○	Relay PLC IC circuit

(Note) CTP-3 is made-to-order

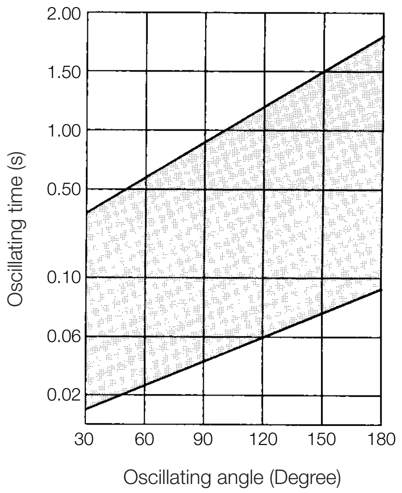
Miniature HI-ROTOR/PRO series

OSCILLATING TIME RANGE

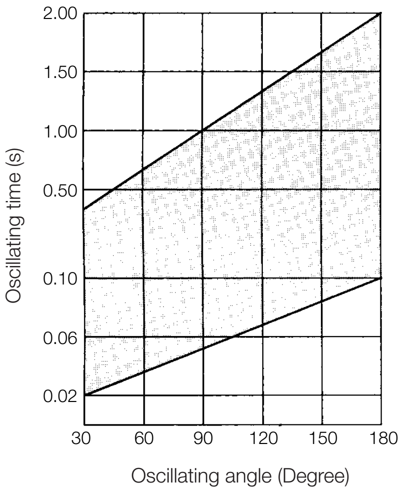
PROA3S,PROA3D



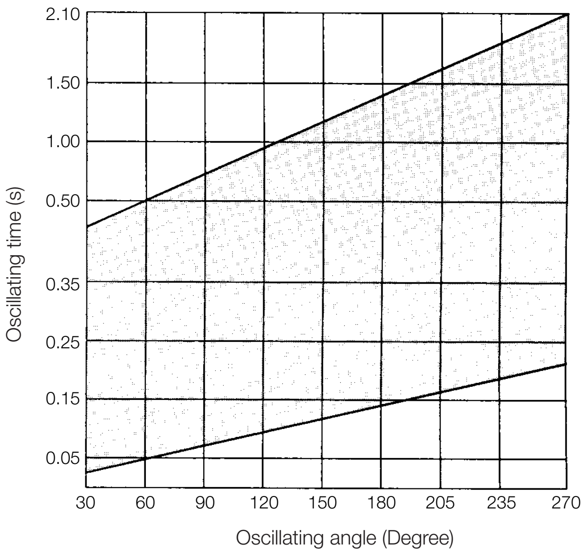
PROA10S,PROA10D



PROA20S,PROA20D



PROA30S,PROA30D

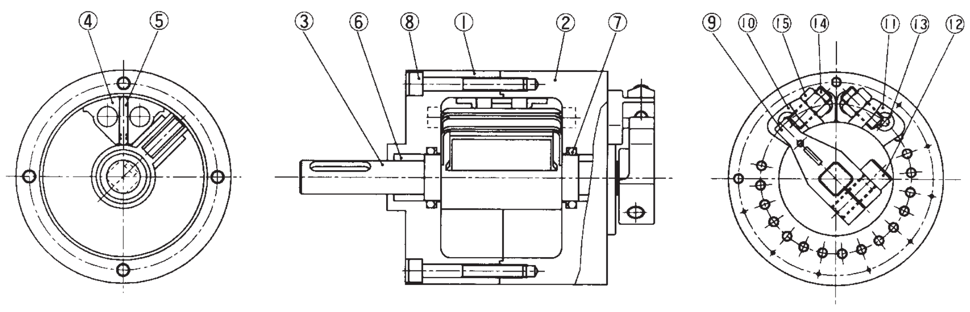


(Note) Operate HI-ROTORs within the range of duration shown in the above charts.
Otherwise, the HI-ROTORs will tend to move in stick-slip motion.

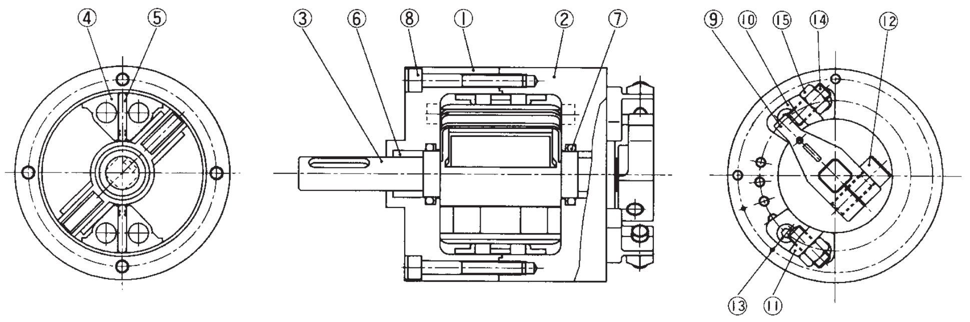
Miniature HI-ROTOR/PRO series

STRUCTURE

PROA3S, PROA10S, PROA20S, PRO30S



PROA3D, PROA10D, PROA20D, PRO30D



(Note) The above figure is the structural drawing of PRO30D.
The body of PROA3D, 10D and 20D has the same structure as standard HI-ROTOR PRNA3D, 10D and 20D. (See Page 16)

MAIN COMPONENTS

No.	Description	Material	
		PROA3, PROA10, PROA20	PRO30
①	Body A	Aluminium alloy	
②	Body B	Aluminium alloy	
③	Vane shaft	Steel+Resin+Hydrogenated nitrile rubber	Steel+Resin+Nitrile rubber
④	Shoe	Resin	
⑤	Shoe seal	Hydrogenated nitrile rubber	Nitrile rubber
⑥	Bushing	—	
⑦	O-ring	Hydrogenated nitrile rubber	Nitrile rubber
⑧	Set screw	Steel	
⑨	Claw	Steel	
⑩	Stopper L	Steel	
⑪	Stopper R	Steel	
⑫	Claw set screw	Steel	
⑬	Stopper set screw	Steel	
⑭	Fine-adjust screw	Steel	
⑮	Locknut	Steel	

COMPONENTS OF STOPPER UNIT

A stopper unit consists of ⑨, ⑩, ⑪, ⑫, ⑬, ⑭ and ⑮ shown in the above list.

MODEL Nos. OF PACKING KIT

Same as those for standard type HI-ROTOR (PRN series), See page 15 to 16.

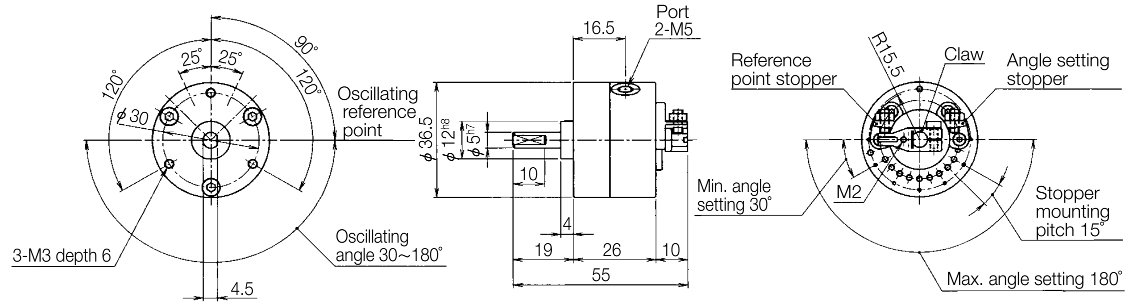
Miniature HI-ROTOR/PRO series

DIMENSIONS

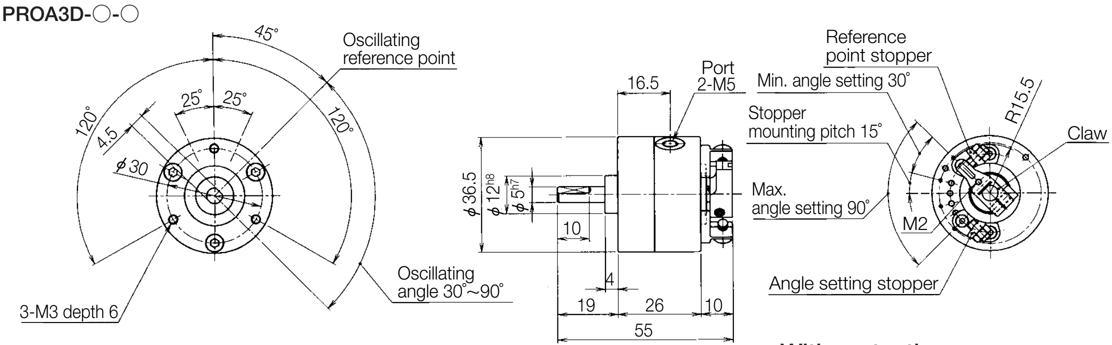
(Unit : mm)

Basic type

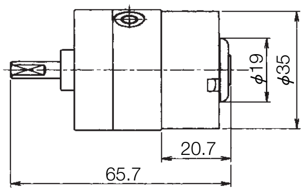
PROA3S-○-○



PROA3D-○-○

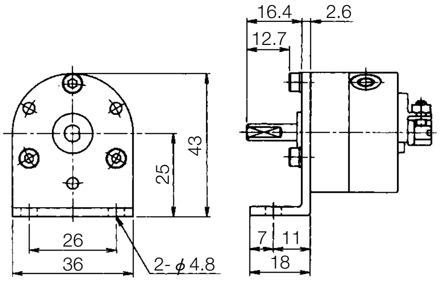


With protection cover



With foot plate

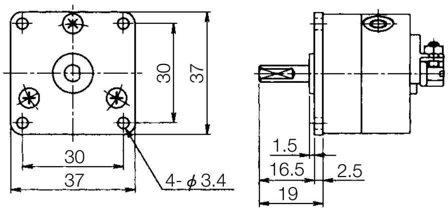
PROA3S/D-○-○-L1



(Note) A foot plate can be fitted with it turned in steps of 60° from the original posture.

With flange plate

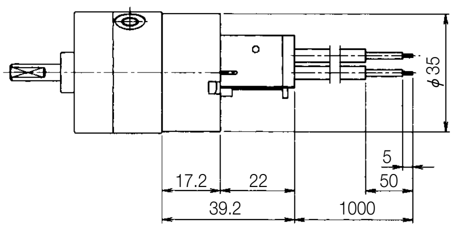
PROA3S/D-○-○-P

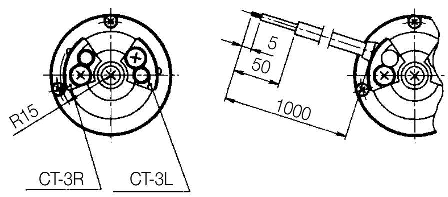


(Note) A flange plate can be fitted with it turned in steps of 120° from the original posture.

With switch unit (Switch position adjustable type)

PROA3S/D-○-○-○-FR(FU)





FR switch unit　　FU switch unit

(Note) For switch unit-mounting hardware combinations, refer to the required dimensions in each Fig.

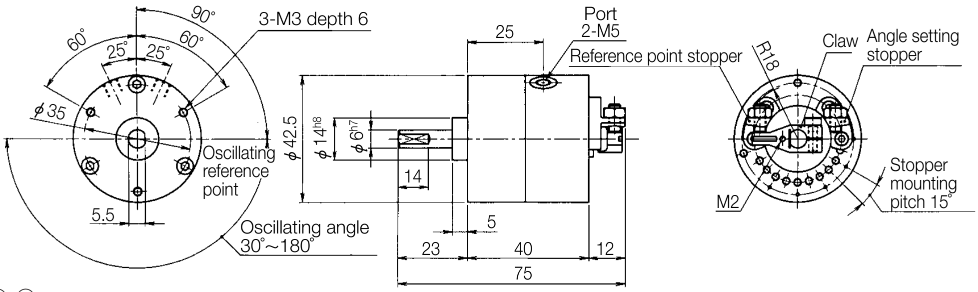
Miniature HI-ROTOR/PRO series

DIMENSIONS

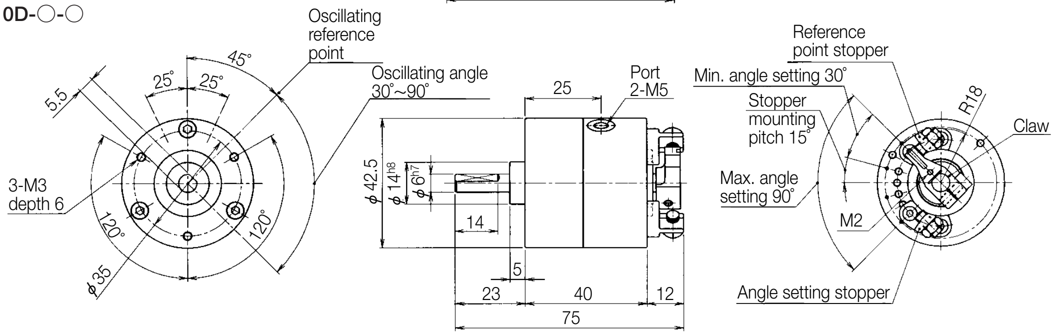
(Unit : mm)

Basic type

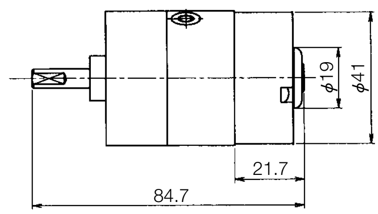
PROA10S-○-○



PROA10D-○-○

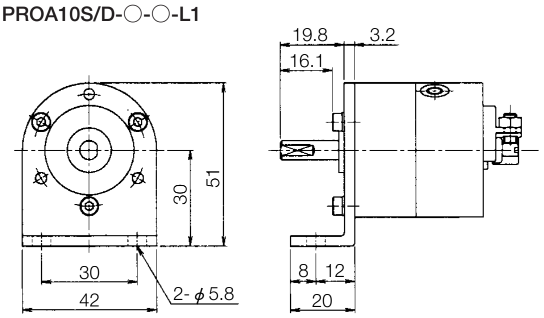


With protection cover



With foot plate

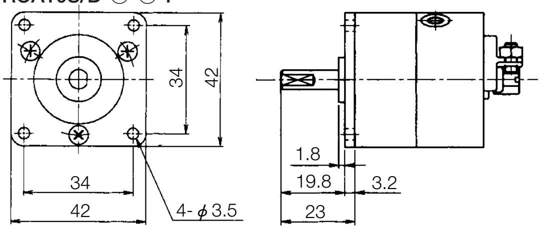
PROA10S/D-○-○-L1



(Note) A foot plate can be fitted with it turned in steps of 60° from the original posture.

With flange plate

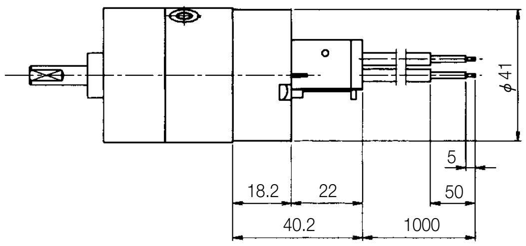
PROA10S/D-○-○-P

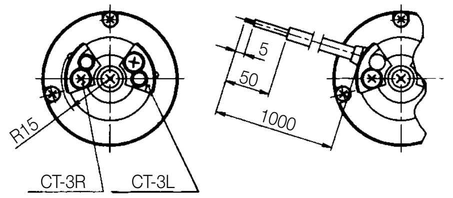


(Note) A flange plate can be fitted with it turned in steps of 120° from the original posture.

With switch unit (Switch position adjustable type)

PROA10S/D-○-○-○-FR(FU)





FR switch unit FU switch unit

(Note) For switch unit-mounting hardware combinations, refer to the required dimensions in each Fig.

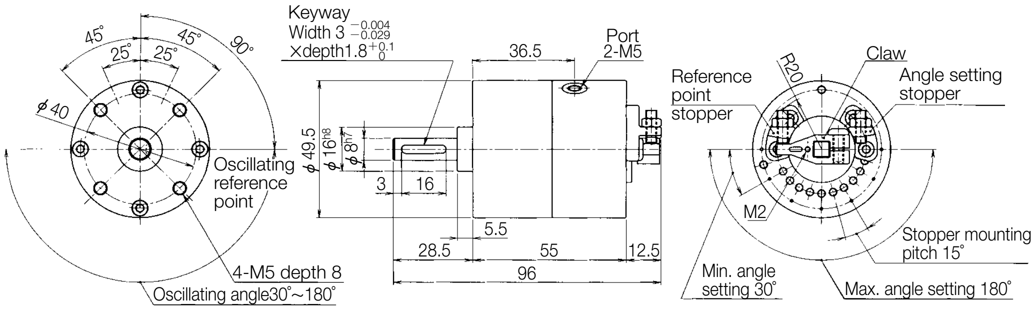
Miniature HI-ROTOR/PRO series

DIMENSIONS

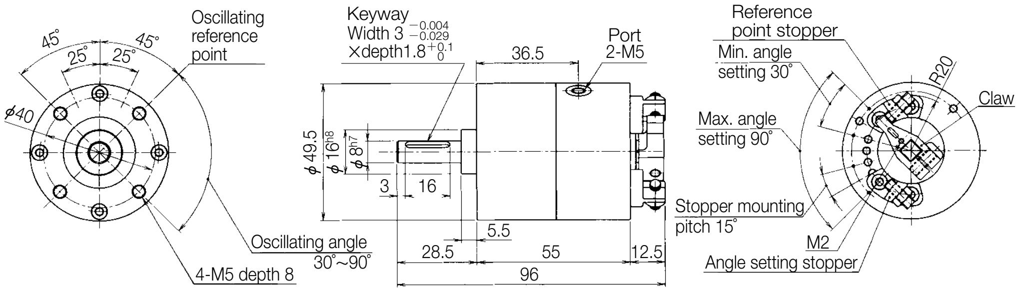
(Unit : mm)

Basic type

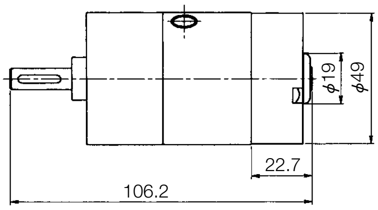
PROA20S-○-○



PROA20D-○-○

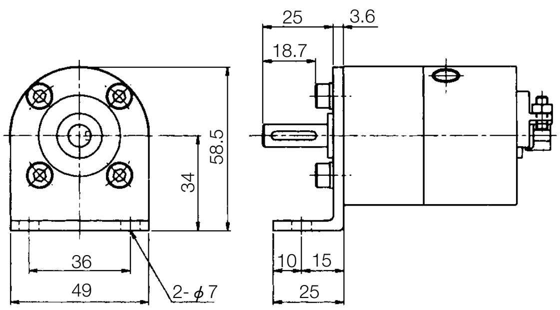


With protection cover



With foot plate

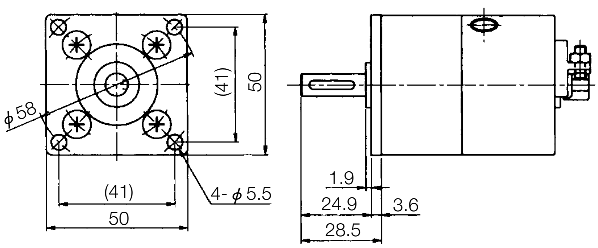
PROA20S/D-○-○-L1



(Note) A foot plate can be fitted with it turned in steps of 90° from the original posture.

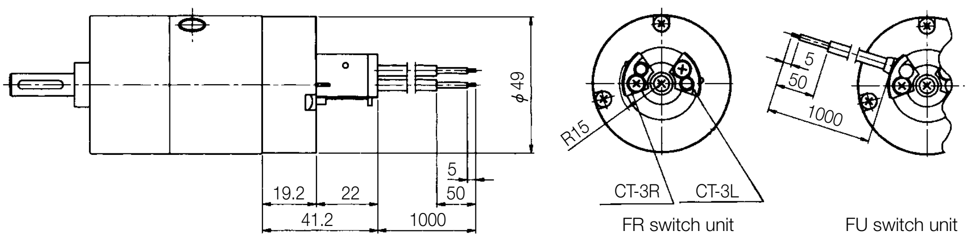
With flange plate

PROA20S/D-○-○-P



With switch unit (Switch position adjustable type)

PROA20S/D-○-○-○-FR(FU)



FR switch unit

FU switch unit

(Note) For switch unit-mounting hardware combinations, refer to the required dimensions in each Fig.

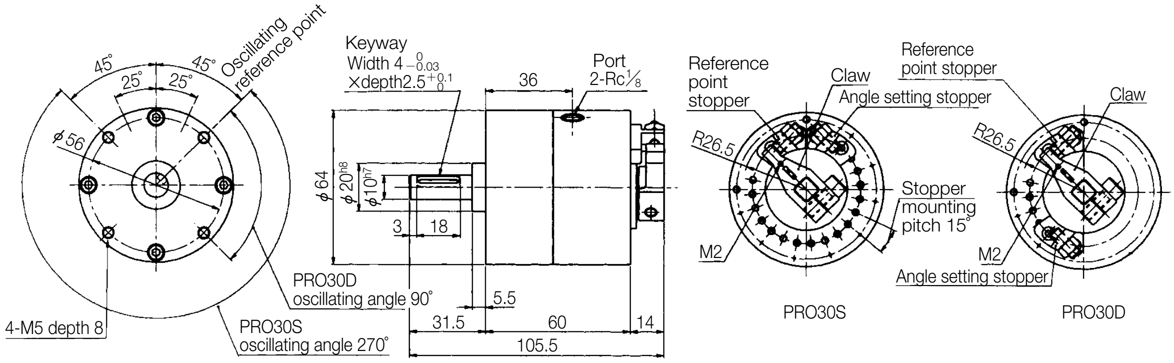
Miniature HI-ROTOR/PRO series

DIMENSIONS

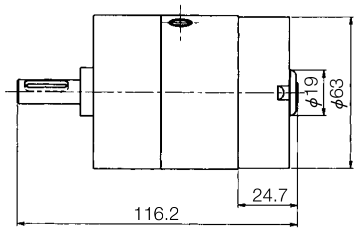
(Unit : mm)

Basic type

PRO30S/D-○-○

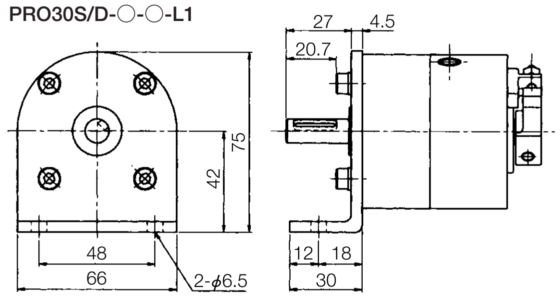


With protection cover



With foot plate

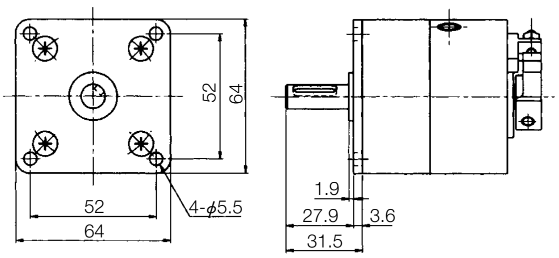
PRO30S/D-○-○-L1



(Note) A foot plate can be fitted with it turned in steps of 90° from the original posture.

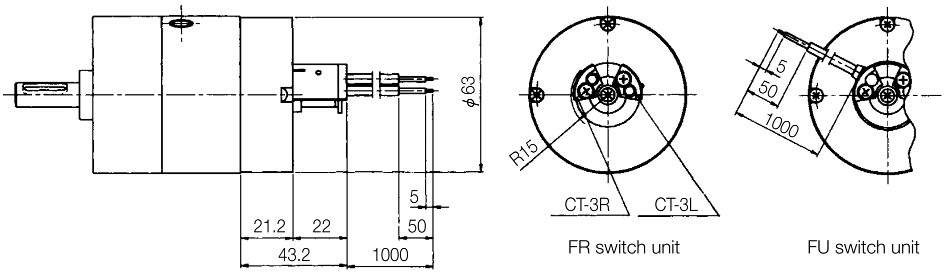
With flange plate

PRO30S/D-○-○-P



With switch unit (Switch position adjustable type)

PRO30S/D-○-○-○-FR(FU)



FR switch unit

FU switch unit

(Note) For switch unit-mounting hardware combinations, refer to the required dimensions in each Fig.

Miniature HI-ROTOR/PRO series

INDIVIDUAL INSTRUCTIONS

Be sure to read them before use.
Also refer to Par. “For Safety Use” and common instructions.

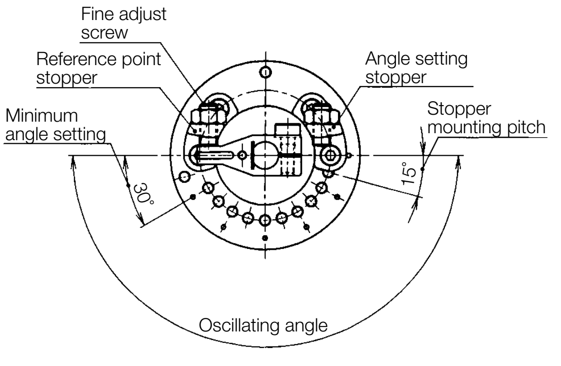
SETTING ANGLE

WARNING

- Be sure to attach the reference point stopper and angle setting stopper before starting the HI-ROTOR.
- When setting the stoppers at the oscillation reference point and at the maximum oscillating angle, be careful not to set them outside the adjustable range. Otherwise, the vane will run against the internal stopper and damage it. Be sure to adjust the angle so that the claw will stop when it touches the external stopper.
- The reference point stopper is fixed and immovable.
- The oscillation angle is determined by the claw when it hits the fine adjust screw of each stopper. The accuracy of the stop angle dose not take into consideration wear from operation. When the oscillation angle has changed to wear, readjust it with the fine adjust screw.

STRUCTURE OF VARIABLE OSCILLATING ANGLE MECHANISM

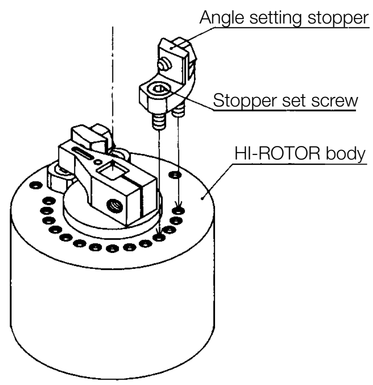
Attach external stoppers to the tapped hole provid on the HI-ROTOR body. Two types of stoppers are provided: a reference point stopper and an angle setting stopper. The reference point stopper has been attached to the fixed position (oscillating reference point). On the other hand, the angle setting stopper is attached to a position where the desired angle can be set. The HI-ROTOR stops when the claw fitted to the shaft run against the stopper. Fine adjustment of the angle can be accomplished with the adjust screw on the stopper.



SETTING THE OSCILLATING ANGLE

CAUTION

- **HI-ROTORs of which the angle setting is not specified (Standard)**
  For these HI-ROTORs, only the reference point stopper has been fixed and the angle setting stopper is shipped with the HI-ROTOR when delivered. Therefore, you are required to attach the angle setting stopper to the position for the desired angle setting. The angle setting stopper can be attached at intervals of 15°. For setting procedures, refer to “How to set the oscillating angle” (Page 20).
- **HI-ROTORs of which the angle setting is specified (Made-to-order)**
  These HI-ROTORs are delivered with the reference point stopper and angle setting stopper fixed at the specified angle. However, you are required to adjust the fine adjust screws provided on each stopper to set the exact angle.



INDIVIDUAL INSTRUCTIONS

Be sure to read them before use.
Also refer to Par. “For Safety Use” and common instructions.

HOW TO SET THE OSCILLATING ANGLE

CAUTION

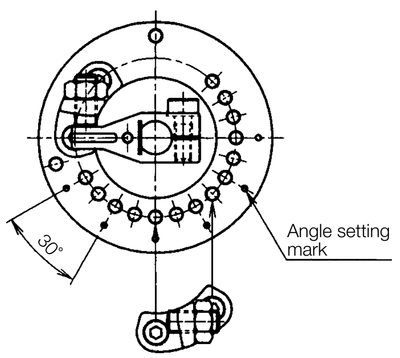
• **When the angle setting equals the stopper mounting pitch (15°)**

①Place the stopper into the tapped hole corresponding to the intended angle and fix it. When mounting the stopper, use the angle setting marks provided, at an interval of 30°, near the tapped hole.

Angle setting

Model No.	Angle setting (at 15° intervals)
PROA3S/D	30°, 45°, 60°, 75°, 90°, 105°, 120°, 135°, 150°, 165°, 180°
PROA10S/D	
PROA20S/D	
PRO30S/D	30°, 45°, 60°, 75°, 90°, 105°, 120°, 135°, 150°, 165°, 180°, 195°, 210°, 225°, 240°, 255°, 270°

In case of 90°



②Then, rotate the fine adjust screws on the reference point stopper and angle setting stoppers until the correct angle is obtained. After completing the angle setting, tighten the locknut without fail.

Angle fine adjust range

Reference point stopper fine adjust range	*±3°
Angle setting stopper fine adjust range	−9°～+6°
Angle setting stopper fine adjust range for maximum angle setting	**−9°～+3°

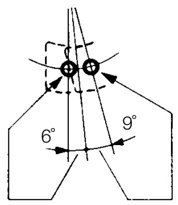
(Note) *PROA3D：−1° to +3°
**PROA3D：−9° to +1°

HOW TO SET THE OSCILLATING ANGLE

CAUTION

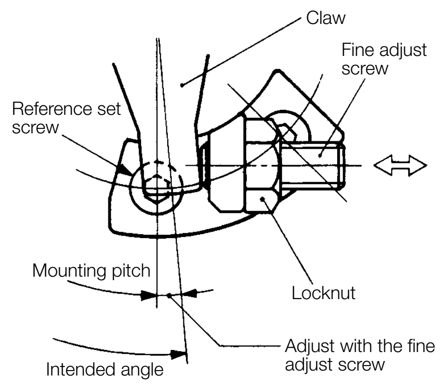
• **When the angle setting lies between two 15° stops:**

①When the desired angle lies between two 15° stops, fix the stopper into the tapped hole with the arrow as shown in the Fig. below and fix it.



When the desired angle lies in the 6° portion on this side (viewing from the reference point) between the stops, insert the stopper so its reference side comes into contact with the set screw on this side. When the intended angle lies in the remaining 9° portion between stops, attach the stopper so that its reference side comes into contact with the set screw on the other side (viewing from the reference point).

②Then, rotate the fine adjust screw fitted to the stopper to obtain the correct angle. After completing the angle setting, tighten the locknut without fail.



HI-ROTOR/Standard type

PRNseries

50S, 150S, 300S, 800S/50D, 150D, 300D, 800D

ORDERING INSTRUCTIONS

PRN50S – 90 – 45 – P – FM – MA 2

Model No. ① ② ③ ④ ⑤ ⑥

Single vane	Double vane
PRN50S	PRN50D
PRN150S	PRN150D
PRN300S	PRN300D
PRN800S	PRN800D

Oscillating angle

90	90°
100	100°
180	180°
270	270°
280	280°

Oscillating reference point

45	45°
40	40°

Mounting hardware

No mark	No mounting hardware
P	With flange plate
L1	With one foot plate
L2	With two foot plates

(Note) P is not available for Models PRN300, 800.

Option

No mark	Standard
CR	Hydro-cushion
FM	Switch unit
FC	Hydro-cushion +Switch unit

(Note) For FM and FC, be sure to specify the type and quantity of switches.

Type of switch

No mark	No switch
MA	MA-1
MB	MD-1
MC	MD-3
MD	MR
MG	MT-3
MH	MT-3U
MJ	MT-2
MK	MT-2U
MP	MTP-3

(Note) MP is made-to-order

Number of switch

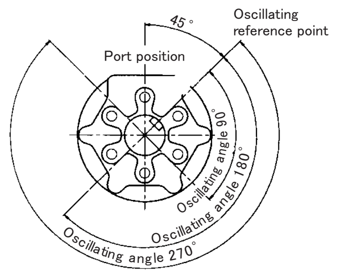
No mark	No switch
1	With one switch
1	With two switches

Custom-made shafts (Refer to Page 65)

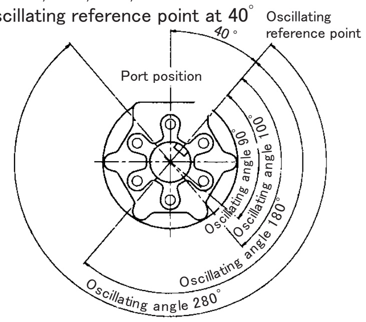
(Note)･Oscillating reference point 40° Kis made-to-order.
Only oscillating reference point 45° is available with FC option.
(Combination of Hydro-cushion and Switch unit.)
･Two foot plates (L2) is not available with CR, FM, FC option.
･Mounting hardware and Hydro-cushion comes being not fabricated.

OSCILLATING REFERENCE POINT AND OSCILLATING ANGLE

PRN50, 150, 300, 800
Oscillating reference point at 45°



PRN50, 150, 300, 800
Oscillating reference point at 40°



Oscillating angle and oscillating reference point

Single vane

Model No.	Oscillating angle				Oscillating reference point	
	90°	180°	270°	280°	45°	40°
PRN50S	○	○	○	—	○	—
	—	—	—	△	—	○
PRN150S	○	○	○	—	○	—
	—	—	—	△	—	○
PRN300S	○	○	○	—	○	—
	—	—	—	△	—	○
PRN800S	○	○	○	—	○	—
	—	—	—	△	—	○

Double vane

Model No.	Oscillating angle		Oscillating reference point	
	90°	100°	45°	40°
PRN50D	○	—	○	—
	—	△	—	○
PRN150D	○	—	○	—
	—	△	—	○
PRN300D	○	—	○	—
	—	△	—	○
PRN800D	○	—	○	—
	—	△	—	○

Model Nos. of mounting hardware

Applicable HI-ROTOR	Flange plate	Foot plate
PRN50	PRN50-P	PRN50-L
PRN150	PRN150-P	PRN150-L
PRN300	—	PRN300-L
PRN800	—	PRN800-L

(Note) These hardware are provided with set screws.

HI-ROTOR/PRN series

SPECIFICATIONS

Model No.	Unit	PRN50S				PRN150S				PRN300S			
Vane		Single vane											
Fluid		Non-lubricated air (Lubricated air)											
Oscillating angle	Degree	90^{+3}_{0}	180^{+3}_{0}	270^{+3}_{0}	280^{+3}_{0}	90^{+3}_{0}	180^{+3}_{0}	270^{+3}_{0}	280^{+3}_{0}	90^{+3}_{0}	180^{+3}_{0}	270^{+3}_{0}	280^{+3}_{0}
Oscillating reference pointt	Degree	45	45	45	40	45	45	45	40	45	45	45	40
Port size		Rc1/8				Rc1/4				Rc3/8			
Minimum working pressure	MPa	0.1				0.08				0.08			
Operation pressure range	MPa	0.2～1											
Proof withstanding pressure	MPa	1.5											
Temperature range	℃	5～60											
Maximum frequency of use	Hz	3	1.5	1		2	1.3	0.8		1.5	1	0.7	
Internal volume	cm^3	51	51	61	62	146	146	179	185	244	283	352	365
Allowable radial load	N	588				1176				1960			
Allowable thrust load	N	44.1				88.2				147			
Allowable energy	mJ	49				225.4				1078			
Mass	kg	0.82	0.79	0.73	0.7	2.0	1.9	1.7	1.6	3.7	3.7	3.7	3.6

Model No.	Unit	PRN800S				PRN50D		PRN150D		PRN300D		PRN800D	
Vane		Single vane				Double vane							
Fluid		Non-lubricated air (Lubricated air)											
Oscillating angle	Degree	90^{+3}_{0}	180^{+3}_{0}	270^{+3}_{0}	280^{+3}_{0}	90^{+3}_{0}	100^{+3}_{0}	90^{+3}_{0}	100^{+3}_{0}	90^{+3}_{0}	100^{+3}_{0}	90^{+3}_{0}	100^{+3}_{0}
Oscillating reference point	Degree	45	45	45	40	45	40	45	40	45	40	45	40
Port size		Rc1/2				Rc1/8		Rc1/4		Rc3/8		Rc1/2	
Minimum working pressure	MPa	0.05				0.08		0.06		0.06		0.05	
Operation pressure range	MPa	0.2～1											
Proof withstanding pressure	MPa	1.5											
Temperature range	℃	5～60											
Maximum frequency of use	Hz	1.1	0.75	0.5		3		2		1.5		1.1	
Internal volume	cm^3	754	869	1036	1046	42	43	127	123	244	271	754	774
Allowable radial load	N	4900				588		1176		1960		4900	
Allowable thrust load	N	490				44.1		88.2		147		490	
Allowable energy	mJ	3920				49		225.4		1078		3920	
Mass	kg	12.7	12.2	11.2	11.0	0.82	0.8	2.0	1.9	4.3	4.1	12.7	12.5

(Note)・Maximum frequency of use at the supply pressure of 0.5 MPa (Unloaded).
・Make sure to use the HI-ROTOR within allowable energy. Refer to page 68 for the allowable energy calculation.
・HI-ROTORs with keyways are provided with keys.
・For HI-ROTORs other than standard, consult KURODA.

Output (Effective torque)

(Unit : N·cm)

Model No.	Supply pressure (MPa) 0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
PRN50S	125	259	369	479	590	700	829	950	1060
PRN50D	330	579	829	1040	1280	1510	1760	2010	2250
PRN150S	550	850	1150	1500	1800	2100	2400	2730	3050
PRN150D	1250	1900	2700	3500	4150	4800	5500	6200	6900
PRN300S	1050	1650	2250	2850	3450	4050	4600	5180	5750
PRN300D	2550	3900	5400	6800	8300	9700	11000	12400	13700
PRN800S	3780	5910	8100	10200	12300	14400	16600	18600	20500
PRN800D	7740	12000	16100	20600	24700	28800	33200	37100	41100

HI-ROTOR/PRN series

OSCILLATING TIME RANGE

(Unit : s)

Model No.	Oscillating angle				
	90°	100°	180°	270°	280°
PRN50	0.08 ～0.8	0.09 ～0.9	0.16 ～1.6	0.24 ～2.4	0.25 ～2.5
PRN150	0.12 ～1.2	0.13 ～1.3	0.24 ～2.4	0.36 ～3.6	0.37 ～3.7
PRN300	0.16 ～1.6	0.17 ～1.7	0.32 ～3.2	0.48 ～4.8	0.49 ～4.9
PRN800	0.22 ～2.2	0.24 ～2.4	0.44 ～4.4	0.66 ～6.6	0.68 ～6.8

(Note) Use HI-ROTORs within the range of the oscillating time range shouwn in the above table.
Otherwise, the HI-ROTOR will tend to occur in a stick-slip motion.
When it is necessary to operate a HI-ROTOR at a low speed which is outside the above-mentioned range, use of a air-hydro HI-ROTOR (see page 40) is recommended.

HI-ROTOR with switch

/For details, see pages 55.

M TYPE REED SWITCHES

Lead wire type

Type of switch	Load voltage (V)	Load current (mA)	Indicating lamp (Lights up at ON)	Applications
MA-1	AC100	5～45	○	Relay PLC
	DC24	5～45		
MD-1	DC24	25～65	○	Relay
MD-3	DC5, 6	50 or less (Inductive load) 300 or less (Resistance load)	○	IC circuit
MR	AC 5～10 DC	50 or less (Inductive load) 300 or less (Resistance load)	Not provided	Relay

M TYPE PROXIMITY SWITCH

Lead wire type

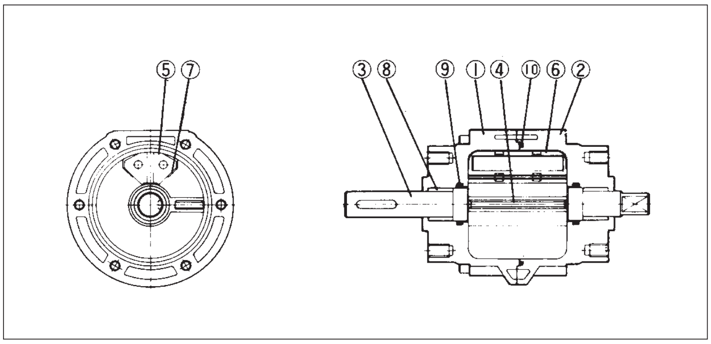
Type of switch	Load voltage (V)	Load current (mA)	Indicating lamp (Lights up at ON)	Applications
MT-2 MT-2U	DC24 (DC10～30)	5～100	○	Relay PLC
MT-3 MT-3U MTP-3	DC5～30	5～200	○	Relay PLC IC circuit

(Note) MTP-3 is made-to-order

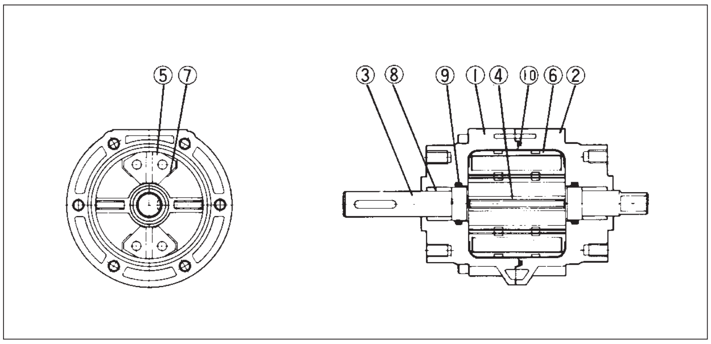
HI-ROTOR/PRN series

STRUCTURE

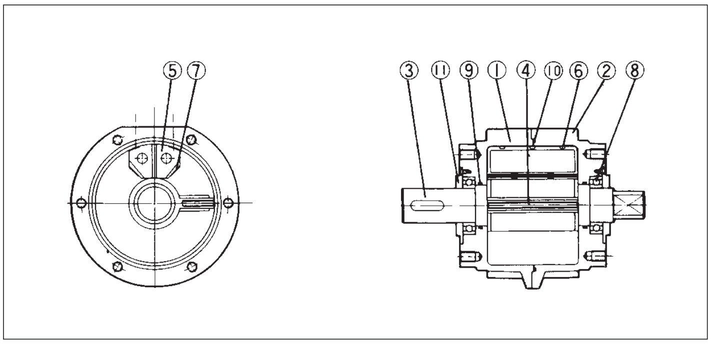
PRN50S, 150S, 300S



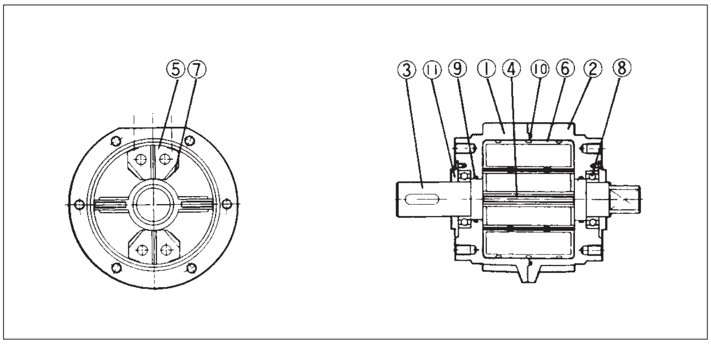
PRN50D, 150D, 300D



PRN800S



PRN800D



MAIN COMPONENTS

No.	Description	Material
	Body A	50, 150 : Aluminum alloy die casting
	Body B	300 : Aluminum alloy casting
	Vane shaft	Structural alloy steel
	Vane seal	Nitrile rubber
	Shoe	Zinc alloy die casting
	Shoe seal	Nitrile rubber
	Damper	Urethane rubber
	Bearing	—
	O-ring	Nitrile rubber
	O-ring	Nitrile rubber

(Note) The vane seal and vane shaft are united in one piece.

MODEL Nos. OF PACKING KIT

Applicable HI-ROTOR	Model No.
PRN50S, PRH50S, PRF50S	PRN50S-PS
PRN50D, PRH50D, PRF50D	PRN50D-PS
PRN150S, PRH150S, PRF150S	PRN150S-PS
PRN150D, PRH150D, PRF150D	PRN150D-PS
PRN300S, PRH300S, PRF300S	PRN300S-PS
PRN300D, PRH300D, PRF300D	PRN300D-PS

(Note) A set of packings consists of part Nos. , , and

PRN800

No.	Description	Material
	Body A	Aluminum alloy casting
	Body B	Aluminum alloy casting
	Vane shaft	Structural alloy steel
	Vane seal	Nitrile rubber
	Shoe	Zinc alloy die casting
	Shoe seal	Nitrile rubber
	Damper	Urethane rubber
	Bearing	Bearing steel
	O-ring	Nitrile rubber
	O-ring	Nitrile rubber
	Cover plate	Structural carbon steel

(Note) The vane seal and vane shaft are united in one piece.

MODEL Nos. OF PACKING KIT

Applicable HI-ROTOR	Model No.
PRN800S, PRH800S, PRF800S	PRN800S-PS
PRN800D, PRH800D, PRF800D	PRN800D-PS

(Note) A set of packings consists of part Nos. , , and

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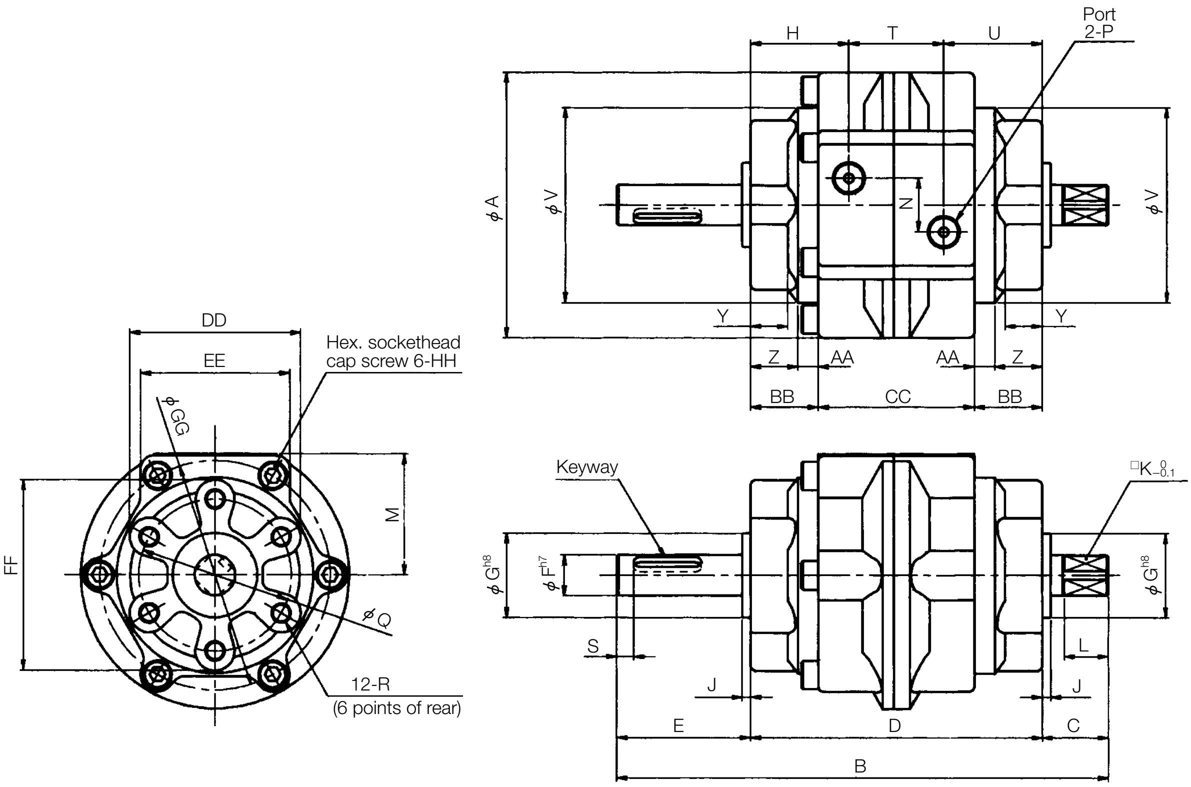
HI-ROTOR/PRN series

DIMENSIONS

(Unit : mm)

Basic type

PRN50, 150, 300, 800



Model No.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T
PRN50	79	145	19.5	86	39.5	12	25	29	2.5	10	13	36	16	Rc⅛	45	M6×1 depth 9	5	28
PRN150	110	180	23.5	103	53.5	17	30	34.5	3	13	16	51	24	Rc¼	70	M8×1.25 depth 12	5	34
PRN300	141.5	220	30	125	65	25	45	41.5	3.5	19	22	66	32	Rc⅜	80	M10×1.5 depth 15	5	42
PRN800	196	285	44.5	171	69.5	40	70	53.5	4.5	32	35	90	44	Rc½	120	M12×1.75 depth 18	10	64

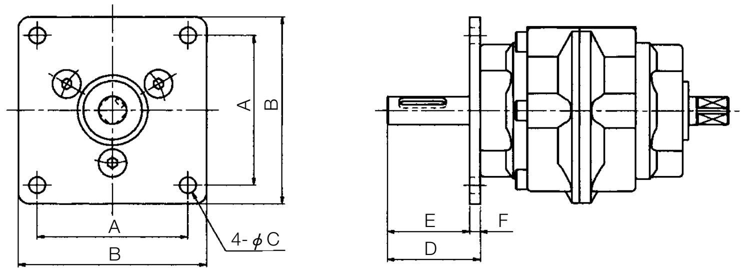
Model No.	U	V	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH	Keyway width×depth×length
PRN50	29	58	11	14	6	20	46	51	44	57	68	M5×30ℓ	$4^{0}_{-0.03} \times 2.5^{+0.1}_{0} \times 20$
PRN150	34.5	85.2	10.5	15.5	8	23.5	56	75	61	85	97	M6×35ℓ	$5^{0}_{-0.03} \times 3^{+0.1}_{0} \times 36$
PRN300	41.5	110	13	17.5	10	27.5	70	88.5	78	98.5	125	M8×45ℓ	$7^{0}_{-0.036} \times 4^{+0.2}_{0} \times 40$
PRN800	53.5	152	14.5	21.1	11.4	32.5	106	130	110	145	173	M12×70ℓ	$12^{0}_{-0.043} \times 5^{+0.2}_{0} \times 40$

DIMENSIONS

(Unit : mm)

With flange plate

PRN50, 150○-○-○-P

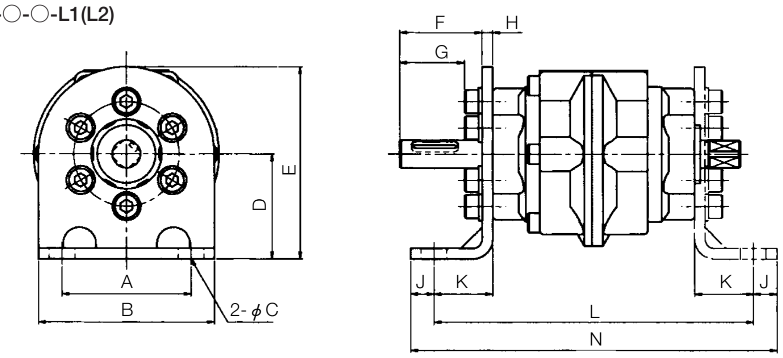


Model No.	A	B	C	D	E	F
PRN50	64	80	7	39.5	35	4.5
PRN150	88	110	9	53.5	47.5	6

(Note) A flange plate can be fitted with it turned in steps of 60° from the original posture.

With foot plate

PRN50, 150, 300, 800○-○-○-L1(L2)

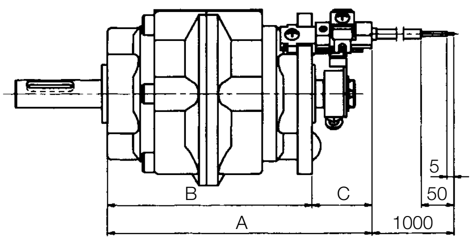


Model No.	A	B	C	D	E	F	G	H	J	K	L	N
PRN50	55	75	11	45	82.5	35	27.5	4.5	10	25	136	156
PRN150	80	110	13	65	115	43.5	33.5	10	12	28	159	183
PRN300	100	140	15	80	135	53	40.5	12	13	32	189	215
PRN800	140	200	15	110	200	54.5	39.5	15	15	35	241	271

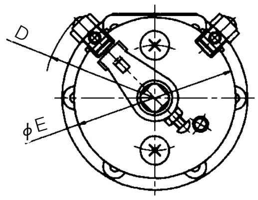
(Note) •A foot plate can be fitted with it turned in steps of 60° from the original posture.
•Short shaft side : Example with L2(2 pcs.)

With switch unit

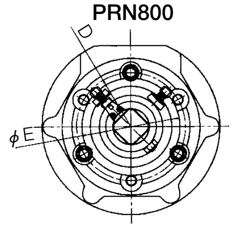
PRN50, 150, 300, 800○-○-○-○-FM-○



PRN50, 150, 300



PRN800



Model No.	A	B	C	D	E
PRN50	115	87.2	25.5	R47	69
PRN150	131.7	104.2	27.5	R61	97
PRN300	161.2	126.2	35	R69	113
PRN800	215.5	174.2	41.3	R60	108

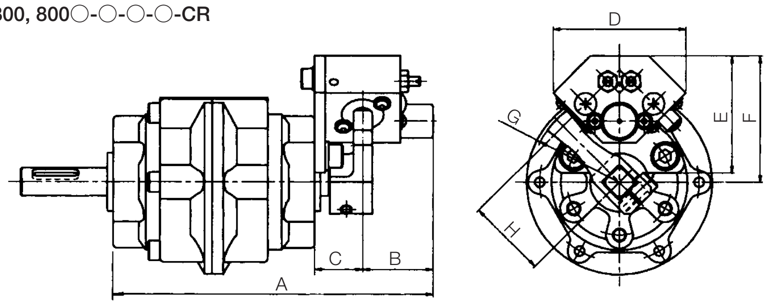
HI-ROTOR/PRN series

DIMENSIONS

(Unit : mm)

With Hydro-cushion

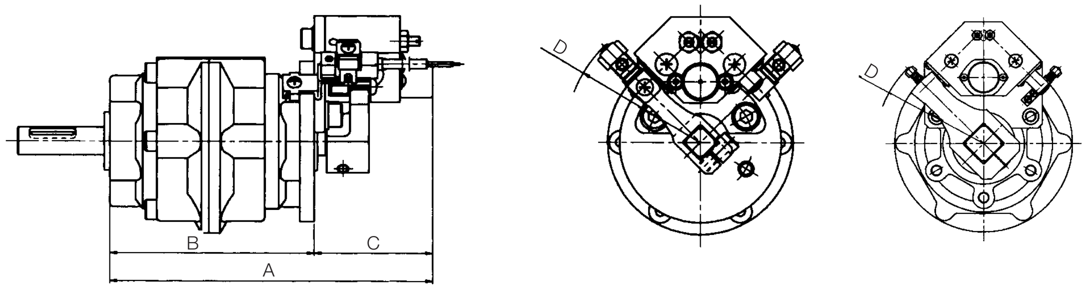
PRN50, 150, 300, 800○-○-○-○-CR



Model No.	A	B	C	D	E	F	G	H
PRN50	136.5	30	20.5	56	50	54	R38	34
PRN150	159.5	34	22.5	80	62	71.5	R51	46
PRN300	187.5	37	25.5	95	87	96	R68	62
PRN800	244	42	31	130	118	135	R78	90

With Hydro-cushion+switch unit

PRN50, 150, 300, 800○-○-○-○-FC



Model No.	A	B	C	D
PRN50	137.7	87.2	50.5	R58.2
PRN150	160.7	104.2	56.5	R72.2
PRN300	188.7	126.2	62.5	R88.2
PRN800	244	174.2	69.8	R118.5

(Note) •Refer on page 37 for the dimensions on basic type HI-ROTOR.
•For switch unit-mounting hardware or hydro-cushion combinations, refer to the required dimensions in each Fig.

Air-hydro HI-ROTOR

PRFseries (Upon request)

50S, 150S, 300S, 800S, 50D, 150D, 300D, 800D

HI-ROTORs of this series are exclusively used for air-hydro systems and are suitable for operation at low speed.

ORDERING INSTRUCTIONS

PRF50S – 90 – 45 – P – FM – MA 2

Model No. ① ② ③ ④ ⑤ ⑥

①Oscillating angle, ②Oscillating reference point, ③Mounting head ware, ④Option, ⑤Type of switch, ⑥Number of switches are same as those of the Standard Type PRN series (see Page 33).

SPECIFICATIONS

Fluid	Unit	Hydraulic oil
Operation pressure range	MPa	0.2~1
Proof withstanding pressure	MPa	1.5
Temperature range	℃	5~60

(Note) •Other specifications are the same as for Standard type PRN series. (see Page 34)
•Use turbine oil Class 1 (ISO VG32) or hydraulic fluid having tha equivalent viscosity. Note that some noncombustible hydraulic fluid are not suitable.

HOW TO USE

Adapt a two-end-control type circuit. A circuit of this type prevents air mixture due to leakage in the HI-ROTOR vane.

Selector valve
Use a solenoid valve with exhaust center type, not to pressure hydro-converter when a HI-ROTOR stops.

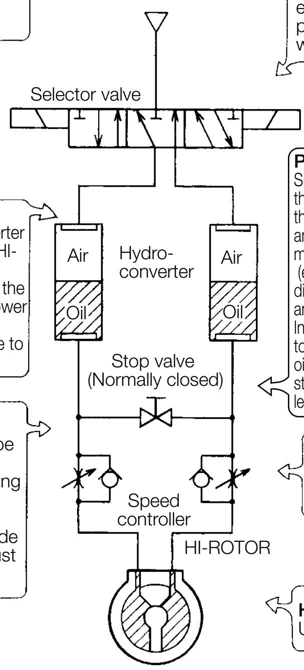
Air bleeding
- Install the air/hydro-converter at a higher level than the HI-ROTOR if practicable.
- When unavoidable, install the air/hydro-converter at a lower level than the HI-ROTOR using an air-bleeding valve to facilitate air bleeding.

Provide a stop valve.
Since a little oil leaks through the sealed portion of the vane, the quantity of oil in the right and left hydraulic converters may sometimes be unbalanced (especially when there is a difference due time to clockwise and counter-clockwise oscillation). In such a case, apply pressure to the converter with a higher oil level and slightly loosen the stop valve to balance the oil level in the right and left converts.

Piping
- Coil hoses should not be used.
- Completely seal the fitting so that air will never be sucked out.
- Throughly flush the inside of pipes to eliminate dust and dirt.

Speed controller
Use the speed controller in a meter-out circuit as shown in the Fig.

HI-ROTOR
Use a air-hydro HI-ROTOR.



HI-ROTORs suffer from internal leakage.
Consult KURODA when using HI-ROTORs of this series.

MINIMUM OSCILLATING TIME

Single vane (Unit :s)

Model No.	Oscillating angle			
	90°	180°	270°	280°
PRF50S	0.3	0.5	0.7	0.7
PRF150S	0.4	0.7	0.9	1.0
PRF300S	0.4	0.7	1.0	1.0
PRF800S	0.7	1.3	1.8	1.8

Double vane (Unit : s)

Model No.	Oscillating angle	
	90°	100°
PRF50D	0.6	0.7
PRF150D	1.3	1.4
PRF300D	1.9	2.1
PRF800D	2.4	2.6

(Note) Dimansions are the same as for standard type PRN series. See Page 37.

Miniature HI-PAL HI-ROTOR/With solenoid valeve
PRHseries
10S, 20S, 30S, 10D, 20D, 30D

ORDERING INSTRUCTIONS

PRHA20S – 90 – 90 – P – FR – D24 L

Model No. ① ② ③ ④ ⑤ ⑥

Single vane	Double vane
PRHA10S	PRHA10D
PRHA20S	PRHA20D
PRH30S	PRH30D

①Oscillating angle

90	90°
180	180°
270	270°

②Oscillating reference point

90	90°
45	45°

③Mounting hardware

No mark	No mounting hardware
P	With flange plate
L1	With one foot plate
L2	With two foot plates

④Type of switch units

No mark	No switch	
FR	With CT-3 switch	Switch position adjucstable
FU	With CT-3U switch	
FP	With CTP-3 switch	
SR	With SR switch	Switch position fixed
SU	With SU switch	

(Note) •Two switches are provided.
•SR and SU are not available for PRHA10S-270-40.
•FP is made-to-order

⑤Solenoid valve voltage

D24	DC24V
100	AC100/110V
200	AC200/220V

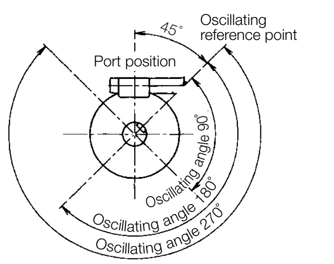
⑥Solenoid valve wiring specifications

L	Lead wire
SP	Plug-in connector with indicator light & surge suppressor
UP	Plug-in connector with indicator light & surge suppressor

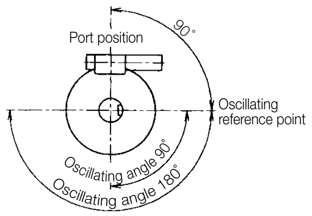
(Note) •Switch units cannot be mounted on HI-ROTORs with two foot plates (L2).
•Mounting hardware comes being not fabricated.

OSCILLATING REFERENCE POINT AND OSCILLATING ANGLE

PRHA10S, 20S, PRH30S
PRHA10D, 20D, PRH30D
Oscillating reference point at 45°



PRHA10S, 20S
Oscillating reference point at 90°



Oscillating angle and oscillating reference point

Model No.	Oscillating angle			Oscillating reference point	
	90°	180°	270°	45°	90°
PRHA10S	○	○	○	○	—
	△	△	—	—	△
PRHA20S	○	○	○	○	—
	△	△	—	—	△
PRH30S	○	○	○	○	—
PRHA10D	○	—	—	○	—
PRHA20D	○	—	—	○	—
PRH30D	○	—	—	○	—

○: Standard △: Custom-made

Model Nos. of mounting hardware

Applicable HI-ROTOR	Flange plate	Foot plate
PRHA10S/D	PRN10-P	PRN10-L
PRHA20S/D	PRN20-P	PRN20-L
PRH30S/D	PRN30-P	PRN30-L

(Note) These hardware are provided with set screws.

Model Nos. of packing kit

Same as those for standard type HI-ROTOR (PRN series). See Page 15.

Miniature HI-PAL HI-ROTOR/PRH series

SPECIFICATIONS

Model No.	Unit	PRHA10S			PRHA20S			PRH30S			PRHA10D	PRHA20D	PRH30D
Vane		Single vane									Double vane		
Fluid		Non-lubricated air (Lubricated air)											
Oscillating angle	Degree	90^{+4}_{0}	180^{+4}_{0}	270^{+4}_{0}	90^{+4}_{0}	180^{+4}_{0}	270^{+4}_{0}	90^{+3}_{0}	180^{+3}_{0}	270^{+3}_{0}	90^{+4}_{0}		90^{+3}_{0}
Oscillating reference point	Degree	45, 90		45	45, 90		45	45			45		
Port size		M5			Rc⅛						M5	Rc⅛	
Operation pressure range	MPa	0.2~0.7			0.2~0.8						0.2~0.7	0.2~0.8	
Temperature range	℃	−5~50											
Solenoid valve mounted		PCS245 (DC24, AC100/110V, AC200/220V)											
Mass	kg	0.23		0.22	0.37			0.58		0.57	0.23	0.38	0.59

(Note) Other specifications are the same as Standard type PRN series. See Page 14.

OUTPUT (Effective torque)

(Unit : cm)

Model No.		Supply pressure (MPa)						
		0.2	0.3	0.4	0.5	0.6	0.7	0.8
Single vane	PRHA10S	35	56	75	98	120	139	—
	PRHA20S	59	95	133	170	210	249	287
	PRH30S	110	180	250	319	410	480	580
Double vane	PRHA10D	76	117	162	211	254	303	—
	PRHA20D	140	222	306	388	470	553	633
	PRH30D	270	440	600	770	950	1120	1299

OSCILLATING TIME RANGE

(Unit : s)

Model No.	Supply pressure (MPa)		
	90°	180°	270°
PRHA10S, 10D	0.045~0.9	0.09~1.8	0.135~2.7
PRHA20S, 10D	0.05~1.0	0.1~2.0	0.15~3.0
PRH30S, 30D	0.07~0.7	0.14~1.4	0.21~2.1

(Note) Operate the HI-ROTOR within the oscillating time range prescribed in the above table. Otherwise, the HI-ROTOR will be perform in stick-slip motions.

SPEED CONTROL

Although HI-PAL HI-ROTORs are not provided with a speed control mechanism, the speed can be easily controlled with the metering valve or speed controller. For the metering valve and speed controller, please instruct.

HI-PAL HI-ROTOR	PRHA10, 20, PRH30
Metering valve	MV-M5
Speed controller	SPF-H-M5, SPER-H-M5, SPSR-H-M5
Speed controller with push-in fitting	MB4R-M5-O, M4R-M5-O MB6R-M5-O, M6R-M5-O

SOLENOID VALVE

Ordering instructions for solenoid valves

PCS245 – NB – 100 SP

Model No. (PCS245) / Without base (NB) / ① (100) / ② (SP)

①Solenoid valve voltage

D24	DC24V
100	AC100/110V
200	AC200/220V

②Solenoid valve wiring specifications

L	Lead wire
SP	Plug-in connector with indicator light & surge suppressor
UP	Plug-in connector with indicator light & surge suppressor

The standard solenoid valve is a 2-position solenoid valve with single solenoid. For specific solenoid valves, consult KURODA.

Type of solenoid valve	Model
2-position solenoid valve with a double solenoid	PCD245
3-position solenoid valve with a double solenoid(Closed center)	PCD345
3-position solenoid valve with a double solenoid(Exhaust center)	PCE345
3-position solenoid valve with a double solenoid(Pressure center)	PCO345

HI-ROTOR with switch/For details, see pages 52 to 54.

CT AND SR TYPE PROXIMITY SWITCHES

Type of switch	Mounting	Load voltage (V)	Load current (mA)	Indicating lamp (Lights up at ON)	Applications
CT-3 CT-3U CTP-3	Switch position adjustable	DC5~30	5~200	○	Relay PLC IC circuit
SR SU	Switch position fixed				

(Note) CTP-3 is made-to-order

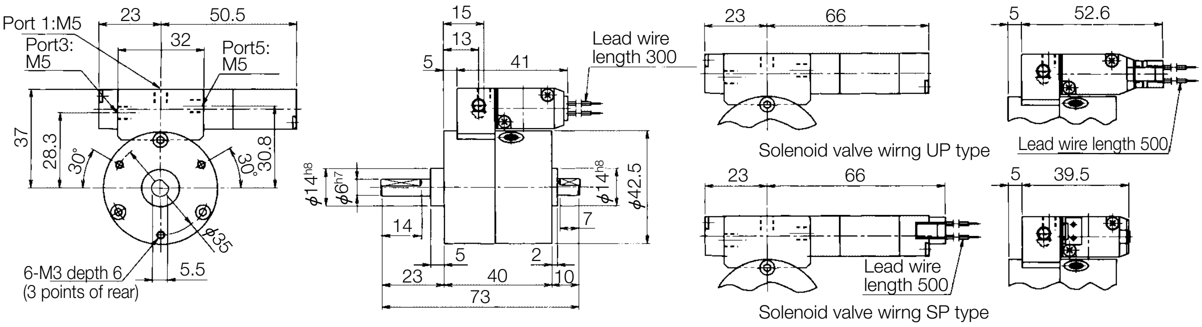
Miniature HI-PAL HI-ROTOR/PRH series

DIMENSIONS

(Unit : mm)

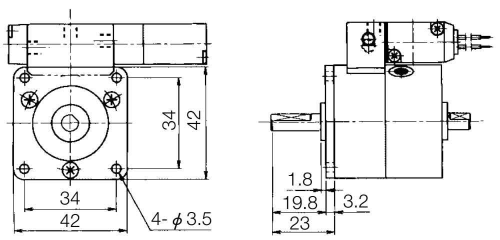
Basic type

PRHA10S/D-○-○-○-○-○-L(SP, UP)



With flange plate

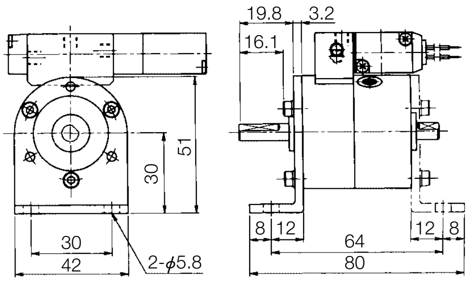
PRHA10S/D-○-○-P



(Note) A flange plate can be fitted with it turned in steps of 120° from the original posture.

With foot plate

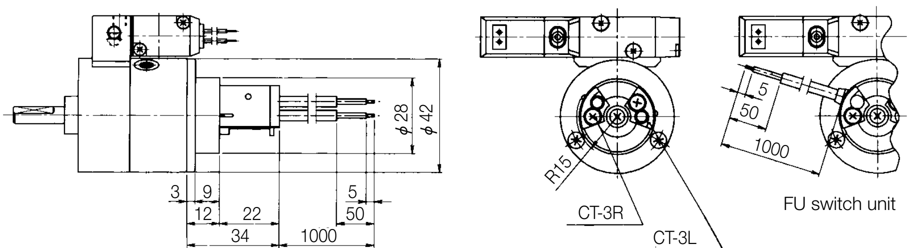
PRHA10S/D-○-○-L1(L2)



(Note) •A foot plate can be fitted with it turned in steps of 60° from the original posture.
•Short shaft side : Example with L2 (2 pcs.)

With switch unit
(Switch position adjustable type)

PRHA10S/D-○-○-○-FR(FU)



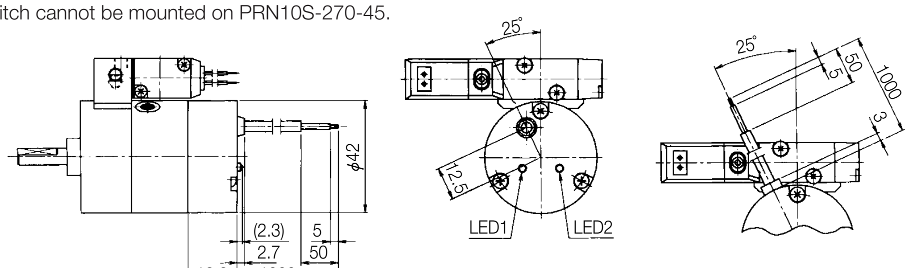
FR switch unit

With switch unit

(Switch position fixed type)

PRHA10S/D-○-○-○-SR(SU)

SR and SU switch cannot be mounted on PRN10S-270-45.



SR switch unit

SU switch unit

(Note) LED1 comes on at the oscillating reference point and LED2 at the end of oscillation.

(Note) For switch unit-mounting hardware combinations, refer to the required dimensions in each Fig.

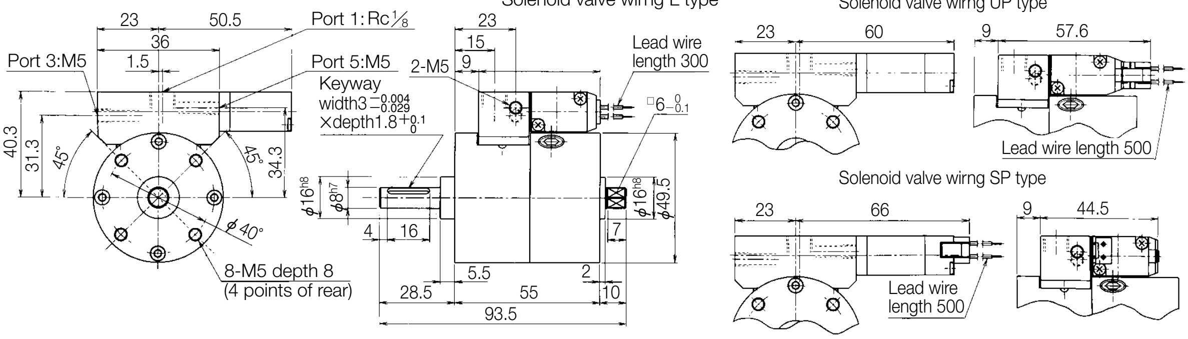
Miniature HI-PAL HI-ROTOR/PRH series

DIMENSIONS

(Unit : mm)

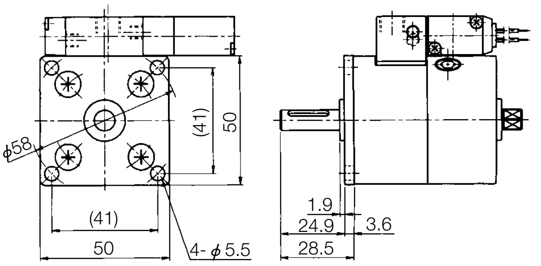
Basic type

PRHA20S/D○-○-○-○-○-L(SP, UP)



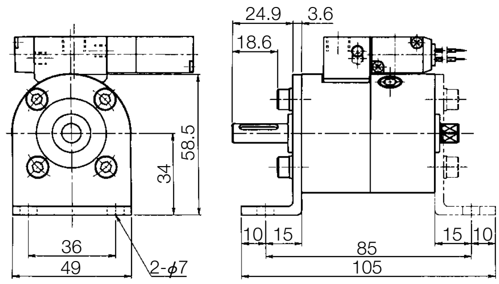
With flange plate

PRHA20S/D-○-○-P



With foot plate

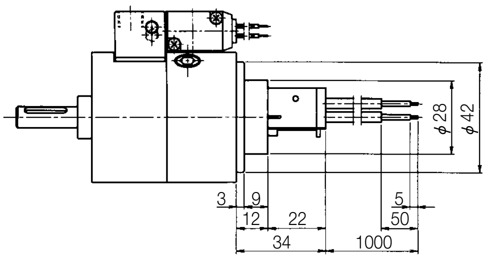
PRHA20S/D-○-○-L1(L2)

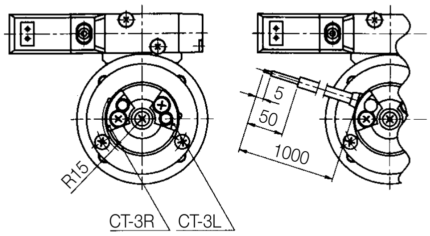


With switch unit
(Switch position adjustable type)

PRHA20S/D-○-○-○-FR(FU)

(Note) •A foot plate can be fitted with it turned in steps of 90° from the original posture.
•Short shaft side : Example with L2 (2 pcs.)

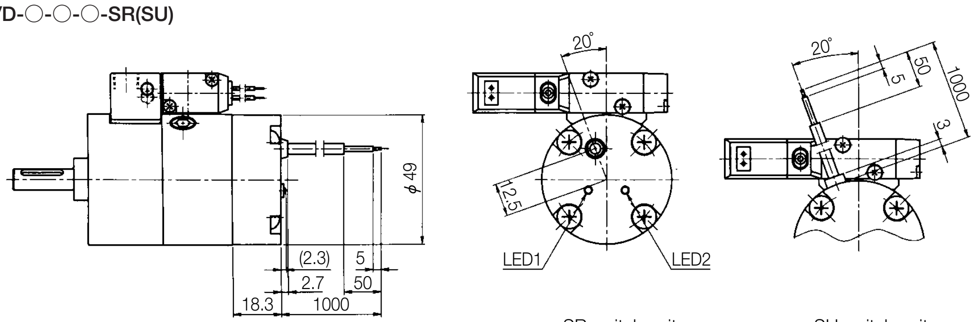




FR switch unit FU switch unit

With switch unit
(Switch position fixed type)

PRHA20S/D-○-○-○-SR(SU)



SR switch unit SU switch unit

(Note) LED1 comes on at the oscillating reference point and LED2 at the end of oscillation.

(Note) For switch unit-mounting hardware combinations, refer to the required dimensions in each Fig.

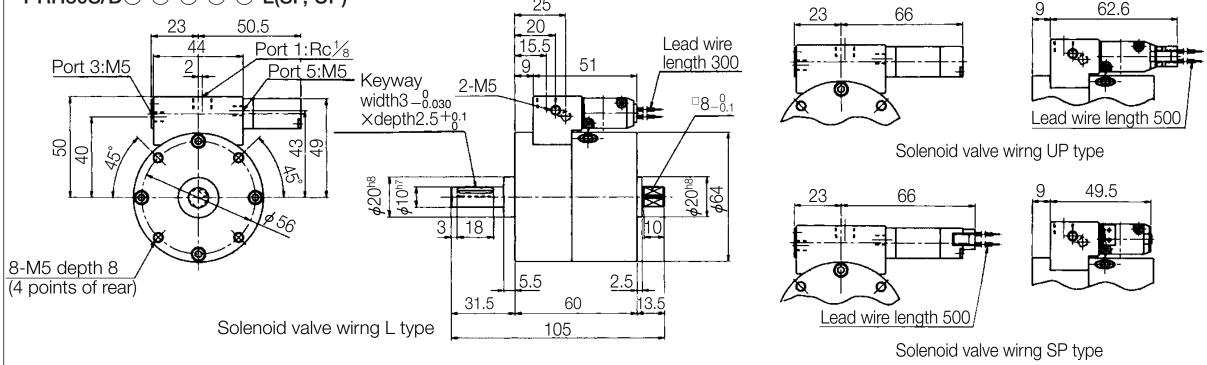
Miniature HI-PAL HI-ROTOR/PRH series

DIMENSIONS

(Unit : mm)

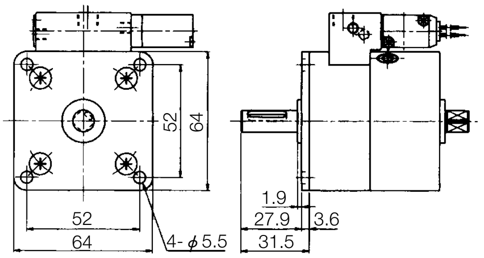
Basic type

PRH30S/D○-○-○-○-○-L(SP, UP)



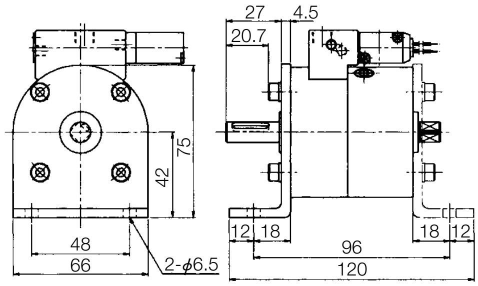
With foot plate

PRH30S/D-○-○-P



With flange plate

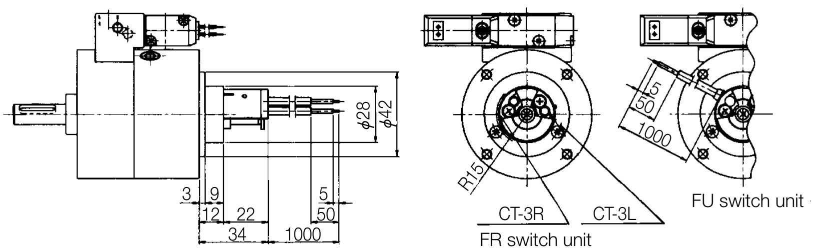
PRH30S/D-○-○-L1(L2)



With switch unit
(Switch position adjustable type)

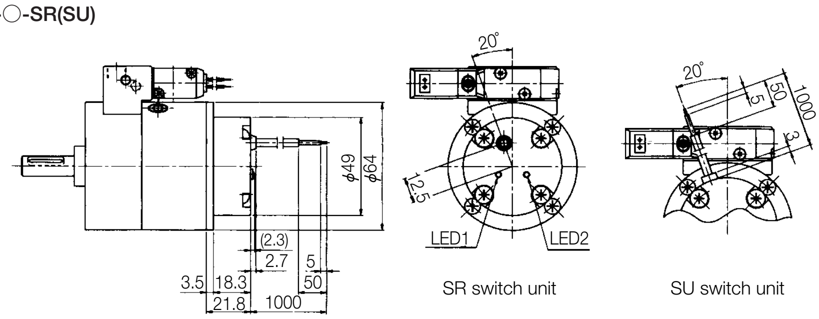
PRH30S/D-○-○-○-FR(FU)

(Note) •A foot plate can be fitted with it turned in steps of 90°
from the original posture.
•Short shaft side : Example with L2 (2 pcs.)



With switch unit
(Switch position fixed type)

PRH30S/D-○-○-○-SR(SU)



(Note) LED1 comes on at the oscillating reference point and LED2 at the end of oscillation.

(Note) For switch unit-mounting hardware combinations, refer to the required dimensions in each Fig.

HI-PAL HI-ROTOR/With solenoid valeve

PRHseries

50S, 150S, 300S, 800S, 50D, 150D, 300D, 800D

ORDERING INSTRUCTIONS

PRH50S – 90 – 45 – P – FM – MA 2 – D24 L

Model No. ① ② ③ ④ ⑤ ⑥ ⑦ ⑧

Single vane	Double vane
PRH50S	PRH50D
PRH150S	PRH150D
PRH300S	PRH300D
PRH800S	PRH800D

①Oscillating angle

90	90°
100	100°
180	180°
270	270°
280	280°

②Oscillating reference point

45	45°
40	40°

③Mounting hardware

No mark	No mounting hardware
P	With flange plate
L1	With one foot plate
L2	With two foot plates

(Note) P is not available for Models PRH300, PRH800.

④Option

No mark	Standard
CR	Hydro-cushion
FM	Switch unit
FC	Hydro-cushion +Switch unit

(Note) For FM and FC, be sure to specify the type and quantity of switches.

⑤Type of switch

No mark	No switch
MA	MA-1
MB	MD-1
MC	MD-3
MD	MR
MG	MT-3
MH	MT-3U
MJ	MT-2
MK	MT-2U
MP	MTP-3

(Note) MP is made-to-order

⑥Number of switch

No mark	No switch
1	With one switch
2	With two switches

⑦Solenoid valve voltage

D24	DC24V
100	AC100/110V
200	AC200/220V

⑧Solenoid valve wiring specifications

PRH50, 150, 300

L	Lead wire
SP	Plug-in connector with indicator light & surge suppressor
UP	Plug-in connector with indicator light & surge suppressor

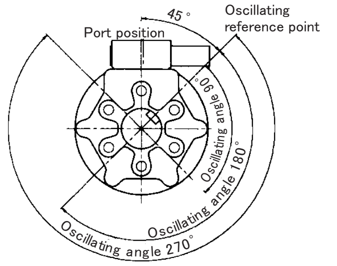
PRH800

L	Lead wire
G	Terminal grommet
C	Terminal conduit

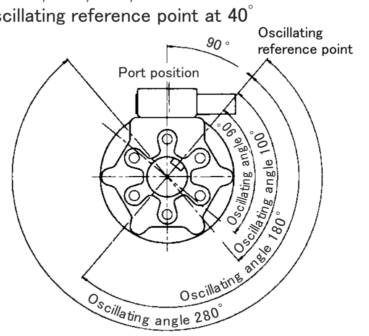
(Note)
- Oscillating reference point 40° is made-to-order.
- Only oscillating reference point 45° is available with FC option. (Combination of Hydro-cushion and Switch unit.)
- Two foot plates (L2) is not available with CR, FM, FC option.
- Mounting hardware and Hydro-cushion come being not fabricated.

OSCILLATING REFERENCE POINT AND OSCILLATING ANGLE

PRH50, 150, 300, 800
Oscillating reference point at 45°



PRH50, 150, 300, 800
Oscillating reference point at 40°



Oscillating angle and oscillating reference point

Single vane

Model No.	Oscillating angle				Oscillating reference point	
	90°	180°	270°	280°	45°	40°
PRH50S	○	○	○	—	○	—
	—	—	—	△	—	○
PRH150S	○	○	○	—	○	—
	—	—	—	△	—	○
PRH300S	○	○	○	—	○	—
	—	—	—	△	—	○
PRH800S	○	○	○	—	○	—
	—	—	—	△	—	○

Double vane

Model No.	Oscillating angle		Oscillating reference point	
	90°	100°	45°	40°
PRH50D	○	—	○	—
	—	△	—	○
PRH150D	○	—	○	—
	—	△	—	○
PRH300D	○	—	○	—
	—	△	—	○
PRH800D	○	—	○	—
	—	△	—	○

Model Nos. of mounting hardware

Applicable HI-ROTOR	Flange plate	Foot plate
PRH50	PRH50-P	PRN50-L
PRH150	PRH150-P	PRN150-L
PRH300	—	PRN300-L
PRH800	—	PRN800-L

(Note) These hardware are provided with set screws.

HI-PAL HI-ROTOR/PRH series

SPECIFICATIONS

Model No.	Unit	PRH50S				PRH150S				PRH300S			
Vane		Single vane											
Fluid		Non-lubricated air (Lubricated air)											
Oscillating angle	Degree	90^{+3}_{0}	180^{+3}_{0}	270^{+3}_{0}	280^{+3}_{0}	90^{+3}_{0}	180^{+3}_{0}	270^{+3}_{0}	280^{+3}_{0}	90^{+3}_{0}	180^{+3}_{0}	270^{+3}_{0}	280^{+3}_{0}
Oscillating reference pointt	Degree	45	45	45	40	45	45	45	40	45	45	45	40
Port size		Rc$^{1}/_{8}$				Rc$^{1}/_{4}$				Rc$^{3}/_{8}$(Port 3, 5 : Rc$^{1}/_{4}$)			
Operation pressure range	MPa	0.2～0.8											
Temperature range	℃	5～50											
Solenoid valve voltage	V	DC24V, AC100/110V, AC200/220V											
Valve mounted		PCS245				PCS2413							
Mass	kg	0.9	0.9	0.84	0.81	2.2	2.2	2.0	1.9	4.1	4.1	4.1	4.0

Model No.	Unit	PRH800S				PRH50D		PRH150D		PRH300D		PRH800D	
Vane		Single vane				Double vane							
Fluid		Non-lubricated air (Lubricated air)											
Oscillating angle	Degree	90^{+3}_{0}	180^{+3}_{0}	270^{+3}_{0}	280^{+3}_{0}	90^{+3}_{0}	100^{+3}_{0}	90^{+3}_{0}	100^{+3}_{0}	90^{+3}_{0}	100^{+3}_{0}	90^{+3}_{0}	100^{+3}_{0}
Oscillating reference pointt	Degree	45	45	45	40	45	40	45	40	45	40	45	40
Port size		Rc$^{1}/_{2}$(Port 3, 5 : Rc$^{3}/_{8}$)				Rc$^{1}/_{8}$		Rc$^{1}/_{4}$		Rc$^{3}/_{8}$ (Port 3, 5 : Rc$^{1}/_{4}$)		Rc$^{1}/_{2}$ (Port 3, 5 : Rc$^{3}/_{8}$)	
Operation pressure range	MPa	0.2～0.8											
Temperature range	℃	5～50											
Solenoid valve voltage	V	DC24V, AC100/110V, AC200/220V											
Valve mounted		PCS2408				PCS245		PCS2413				PCS2408	
Mass	kg	13.2	12.7	11.7	11.5	0.93	0.91	2.3	2.2	4.7	4.5	13.2	13.0

(Note) Other specifications are the same as Standard type PRN series. See Page34.

OUTPUT (Effective torque)

(Unit : N·cm)

Model No.	Supply pressure (MPa)						
	0.2	0.3	0.4	0.5	0.6	0.7	0.8
PRH50S	125	259	369	479	590	700	829
PRH50D	330	579	829	1040	1280	1510	1760
PRH150S	550	850	1150	1500	1800	2100	2400
PRH150D	1250	1900	2700	3500	4150	4800	5500
PRH300S	1050	1650	2250	2850	3450	4050	4600
PRH300D	2550	3900	5400	6800	8300	9700	11000
PRH800S	3780	5910	8100	10200	12300	14400	16600
PRH800D	7740	12000	16100	20600	24700	28800	33200

OSCILLATING TIME RANGE

(Unit :s)

Model No.	Oscillating angle				
	90°	100°	180°	270°	280°
PRH50	0.08～0.8	0.09～0.9	0.16～1.6	0.24～2.4	0.25～2.5
PRH150	0.12～1.2	0.13～1.3	0.24～2.4	0.36～3.6	0.37～3.7
PRH300	0.16～1.6	0.17～1.7	0.32～3.2	0.48～4.8	0.49～4.9
PRH800	0.22～2.2	0.24～2.4	0.44～4.4	0.66～6.6	0.68～6.8

(Note) Operate the HI-ROTOR within the oscillating time range prescribed in the above table. Otherwise, the HI-ROTOR will be perform in stick-slip motions.

HI-PAL HI-ROTOR/PRH series

HI-PAL HI-ROTOR with switch

/For details, see pages 55.

M TYPE REED SWITCHES

Lead wire type

Type of switch	Load voltage (V)	Load current (mA)	Indicating lamp (Lights up at ON)	Applications
MA-1	AC100	5～45	○	Relay PLC
	DC24	5～45		
MD-1	DC24	25～65	○	Relay
MD-3	DC5, 6	50 or less (Inductive load) 300 or less (Resistance load)	○	IC circuit
MR	AC DC 5～100	50 or less (Inductive load) 300 or less (Resistance load)	Not provided	Relay

M TYPE PROXIMITY SWITCH

Lead wire type

Type of switch	Load voltage (V)	Load current (mA)	Indicating lamp (Lights up at ON)	Applications
MT-2 MT-2U	DC24 (DC10～30)	5～100	○	Relay PLC
MT-3 MT-3U MTP-3	DC5～30	5～200	○	Relay PLC IC circuit

(Note) MTP-3 is made-to-order

SOLENOID VALVE

Ordering instructions for solenoid valves

PCS245 – NB – 100 SP

Model No. / Without base / ① / ②

①Voltage

D24	DC24V
100	AC100/110V
200	AC200/220V

②Wiring specifications

PRH50, 150, 300

L	Lead wire
SP	Plug-in connector with indicator light & surge suppressor
UP	Plug-in connector with indicator light & surge suppressor

PRH800

L	Lead wire
G	Terminal grommet
C	Terminal conduit

The standard solenoid valve is a 2-position solenoid valve with single solenoid.
For specific solenoid valves, consult KURODA.

Type of solenoid valve	PRH50	PRH150, 300	PRH800
2-position solenoid valve with a double solenoid	PCD245	PCD2413	PCD2408
3-position solenoid valve with a double solenoid(Closed center)	PCD345	PCD3413	PCD3408
3-position solenoid valve with a double solenoid(Exhaust center)	PCE345	PCE3413	PCE3408
3-position solenoid valve with a double solenoid(Pressure center)	PCO345	PCO3413	PCO3408

For solenoid valve specifications, refer to the catalog of PC series.

SPEED CONTROL

Although HI-PAL HI-ROTORs are not provided with a speed control mechanism, the speed can be easily controlled with the metering valve or speed controller. For the metering valve and speed controller, please instruct.

HI-PAL HI-ROTOR	PRH50		PRH150, 300		PRH800	
Metering valve	MV-M5		MV-1		MV-3	
Speed controller	SPE-H-M5		SPE-2H-2		SPE-10-3	
Speed controller with push-in fitting	M4R-M5-O	MB4R-M5-O	M6R-01-O	MB6R-01-O	8R-03SC-O	B8R-03SC-O
	M6R-M5-O	MB6R-M5-O	6R-01SC-O	B6R-01SC-O	10R-03SC-O	B10R-03SC-O
	6R-M5SC-O	B6R-M5SC-O	8R-01SC-O	B8R-01SC-O	12R-03SC-O	B12R-03SC-O

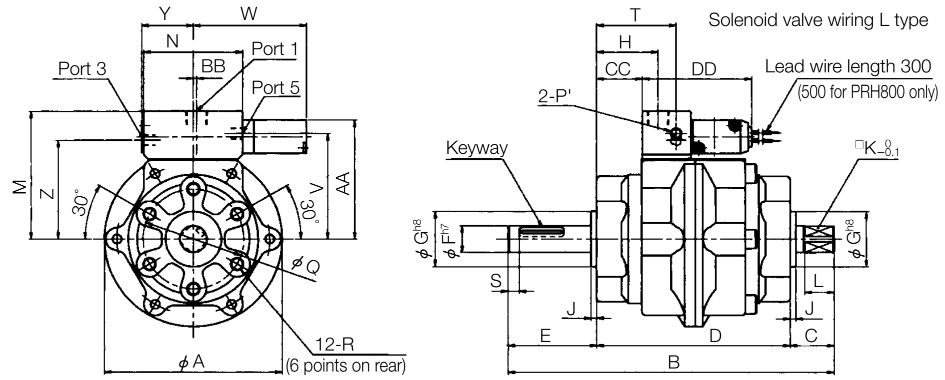
HI-PAL HI-ROTOR/PRH series

DIMENSIONS

(Unit : mm)

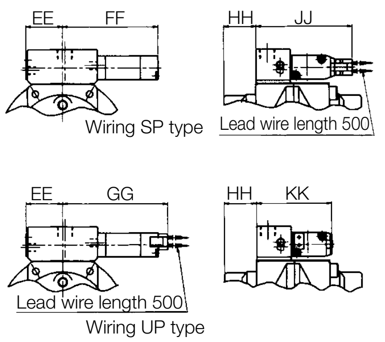
Basic type

PRH50, 150, 300, 800○-○-○



Solenoid valve dimensions

PRH50, 150, 300-SP, UP

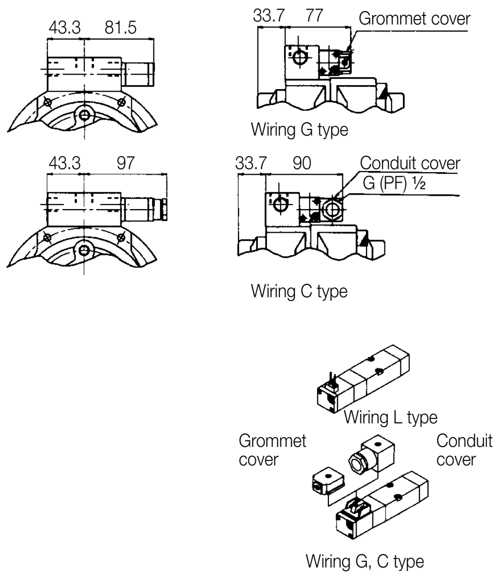


Model No.	EE	FF	GG	HH	JJ	KK
PRH50	23	60	66	20.3	60.1	47
PRH150	31	69	75	23.7	66.9	53.8
PRH300	36	69	75	27.7	76.9	63.8

(Note) For wiring L type, refer to the top figure.

Solenoid valve dimensions

PRH800-G, C



Model No.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	P'	Q
PRH50	79	145	19.5	86	39.5	12	25	27.3	2.5	10	13	57.5	44	Rc⅛	M5	45
PRH150	110	180	23.5	103	53.5	17	30	32	3	13	16	75.8	60	Rc¼	Rc⅛	70
PRH300	141.5	220	30	125	65	25	45	38.2	3.5	19	22	89	72	Rc⅜	Rc¼	80
PRH800	196	285	44.5	171	69.5	40	70	49.5	4.5	32	35	127.8	86	Rc½	Rc⅜	120

Model No.	R	S	T	V	W	Y	Z	Keyway width×depth×length	AA	BB	CC	DD
PRH50	M6 depth 7	5	35.5	47.5	50.5	23	44.5	$4^{\ 0}_{-0.03} \times 2.5^{+0.1}_{\ 0} \times 20$	53.5	1.5	20.3	48.5
PRH150	M8 depth 12	5	30.5	63.4	59.5	31	64	$5^{\ 0}_{-0.03} \times 3^{+0.1}_{\ 0} \times 36$	70.9	1	23.7	55.3
PRH300	M10 depth 10	5	52.5	77	59.5	36	77	$7^{\ 0}_{-0.036} \times 4^{+0.2}_{\ 0} \times 40$	84.5	0	27.7	65.3
PRH800	M12 depth 18	10	49.5	114	—	43.3	114	$12^{\ 0}_{-0.043} \times 5^{+0.2}_{\ 0} \times 40$	121.5	0	33.7	71

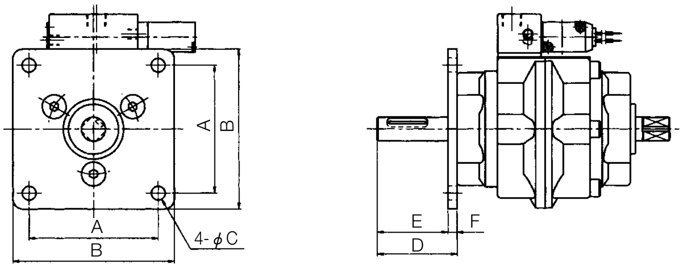
HI-PAL HI-ROTOR/PRH series

DIMENSIONS

(Unit : mm)

With flange plate

PRH50, 150○-○-○-P

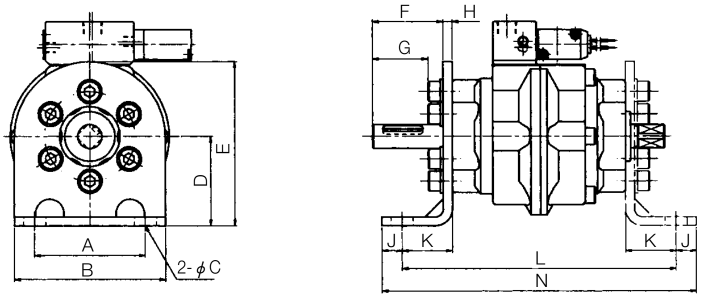


Model No.	A	B	C	D	E	F
PRN50	64	80	7	39.5	35	4.5
PRN150	88	110	9	53.5	47.5	6

(Note) A flange plate can be fitted with it turned in steps of 60° from the original posture.

With foot plate

PRH50, 150, 300, 800○-○-○-L1(L2)

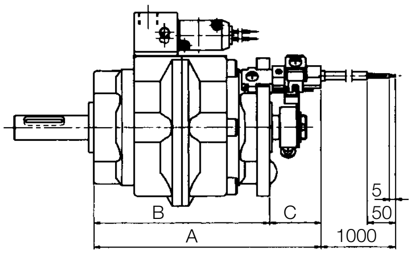


Model No.	A	B	C	D	E	F	G	H	J	K	L	N
PRH50	55	75	11	45	82.5	35	27.5	4.5	10	25	136	156
PRH150	80	110	13	65	115	43.5	33.5	10	12	28	159	183
PRH300	100	140	15	80	135	53	40.5	12	13	32	189	215
PRH800	140	200	15	110	185	54.5	39.5	15	15	35	241	271

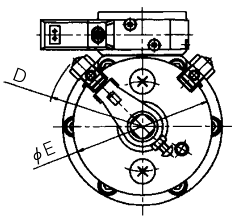
(Note) •A foot plate can be fitted with it turned in steps of 60° from the original posture.
•Short shaft side : Example with L2 (2 pcs.)

With switch unit

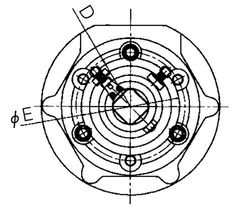
PRH50, 150, 300, 800○-○-○-○-FM-○



PRH50, 150, 300



PRH800



Model No.	A	B	C	D	E
PRH50	115	87.2	27.5	R47	69
PRH150	131.7	104.2	27.5	R61	97
PRH300	161.2	126.2	35	R69	113
PRH800	215.5	174.2	41.3	R60	108

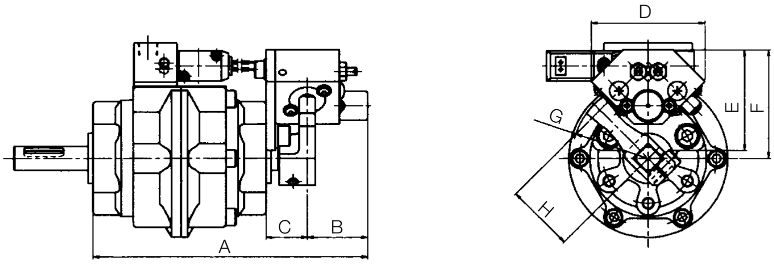
HI-ROTOR/PRH series

DIMENSIONS

(Unit : mm)

With Hydro-cushion

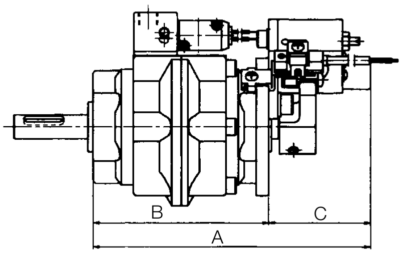
PRH50, 150, 300, 800○-○-○-○-CR



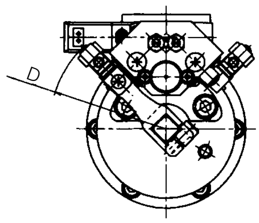
Model No.	A	B	C	D	E	F	G	H
PRH50	136.5	30	20.5	56	50	54	R38	34
PRH150	159.5	34	22.5	80	62	71.5	R51	46
PRH300	187.5	37	25.5	95	87	96	R68	62
PRH800	244	42	31	130	118	135	R98	90

With Hydro-cushion+switch unit

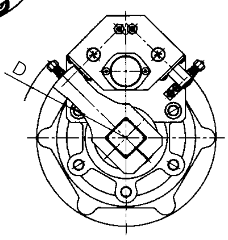
PRH50, 150, 300, 800○-○-○-○-FC-○



PRH50, 150, 300



PRH800



Model No.	A	B	C	D
PRH50	137.7	87.2	50.5	R58.2
PRH150	160.7	104.2	56.5	R72.2
PRH300	188.7	126.2	62.5	R88.2
PRH800	244	174.2	69.8	R118.5

(Note) • Refer on page 49 for the dimensions on HI-ROTOR.
• For switch unit-mounting hardware or hydro-cushions, refer to the required dimensions in each Fig.

For Miniature HI-ROTORs

Switch unit

(Fixed switch position type)

Compact switch unit with detecting position (angle) fixed. Use of a proximity switch extends the service life.

ORDERING INSTRUCTIONS

SR 20 – 180 – 90

① ② ③ ④

①Type of switch

SR	Axial direction of lead wire
SU	Right-angled direction of lead wire

②Applicable HI-ROTOR

3	PRNA3S/D
10	PRNA10S/D, PRHA10S/D
20	PRNA20S/D, PRHA20S/D
30	PRN30S/D, PRH30S/D

③Oscillating angle

90	90°
180	180°
270	270°

④Oscillating reference point

90	90°
45	45°

Applicable HI-ROTOR	Oscillating angle			Oscillating reference point	
	90°	180°	270°	90°	45°
PRNA3S	○	○	○	—	○
	○	○	—	○	—
PRNA10S	○	○	○	—	○
	○	○	—	○	—
PRNA20S	○	○	○	—	○
	○	○	—	○	—
PRN30S	○	○	○	—	○
PRNA3D	○	—	—	—	○
PRNA10D	○	—	—	—	○
PRNA20D	○	—	—	—	○
PRN30D	○	—	—	—	○

SWITCH SPECIFICATIONS

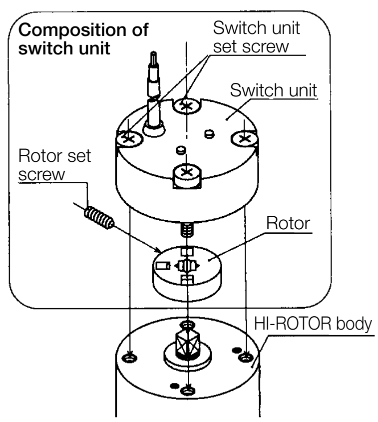
Model No.		Unit	SR, SU
Type of switch			Proximity
Applications			Relay, PLC, IC circuit
Load voltage		V	DC5～30
Load current		mA	5～200
Max. power consumption of switch control		mA	max.20 (at 24V) max.10 (at 12V) max. 4 (at 5V)
Max. leak current		μA	max.10
Internal voltage drop		V	1.5 or less
Mean response time		ms	1
Shock resistance		m/s²	490
Ambient temperature		℃	5～60
Protection grade			IP67
Lead wire	Color		Oil resistance black 4-core cord
	Length	m	1

HYSTERESIS AND RESPONSE RANGE OF SWITCHES

Type of HI-ROTOR	Response range	Hysteresis
PRNA3S/D, 10S/D, 20S/D	15°±7°	Approx. 2°
PRN30S/D		
PRHA10S/D, 20S/D		
PRH30S/D		

(Note) That the response range in a direction will be reduced (that in the other direction will be extended) depeding on the mounting method of the switch unit rotor.

COMPONENTS



For Miniature HI-ROTORs
Switch unit
(Variable switch position type)

Using this switch unit together with HI-ROTORs of PRO series wil allow of flexible angle setting.

ORDERING INSTRUCTIONS

Switch units

FR – 20PRN
①   ②

Switches

CT-3 R U
① ② ③

①Type of switch

FR	CT-3
FU	CT-3U
FP	CTP-3

②Applicable HI-ROTOR

1PRNA	PRNA1S/D
3PRNA	PRNA3S/D
10PRN	PRNA10S/D, PRHA10S/D
20PRN	PRNA20S/D, PRHA20S/D
30PRN	PRN30S/D, PRH30S/D
3PRO	PROA3S/D
10PRO	PROA10S/D
20PRO	PROA20S/D
30PRO	PRO30S/D

①Type of switch

CT-3	NPN
CTP-3	PNP

②Switch setting position

R	For right side
L	For left side

③Wiring specifications

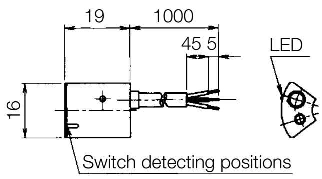
No mark	Axial direction
U	Right-angled direction

(Note) FP and CTP-3 is made-to-order

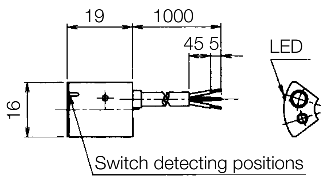
SWITCH DIMENSIONS

(Unit : mm)

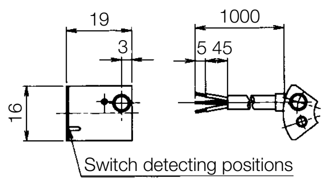
CT-3R
CTP-3R



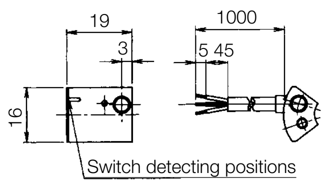
CT-3L
CTP-3L



CT-3RU



CT-3LU



SWITCH SPECIFICATIONS

Model No.		Unit	CT-3	CTP-3
Applications			Relay, PLC, IC circuit	
Type of switch			Proximity	
Output method			NPN	PNP
Load voltage		V	DC5～30	DC10～30
Load current		mA	5～200	
Max. power consumption of switch control		mA	max.20 (at 24V) max.10 (at 12V) max. 4 (at 5V)	max.14 (at 24V) max. 7 (at 12V)
Max. leak current		μA	max.10	
Internal voltage drop		V	1.5	
Mean response time		ms	1	
Shock resistance		m/s^2	490	
Ambient temperature		℃	5～60	
Protection grade			IP67	
Lead wire	Color		Oil resistance black 3-core cord	
	Length	m	1	

(Note) CTP-3 is made-to-order

HYSTERESIS AND RESPONSE RANGE OF SWITCHES

Model No.	Response range	Hysteresis
CT-3, CTP-3	23°±7°	Approx. 2°

Switch unit / Variable switch position type

INDIVIDUAL INSTRUCTIONS

Be sure to read them before use.
Also refer to Par. “For Safety Use” and common instructions.

OSCILLATING ANGLE AND SWITCH MOUNTING ORIENTATION

CAUTION

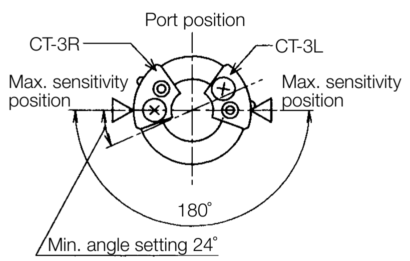
- When ordering PRN or PRH series HI-ROTOR with switches, the following setting are done when shipping.

Oscillating angle	Orientation of switches
90°、180°	A
270°	B

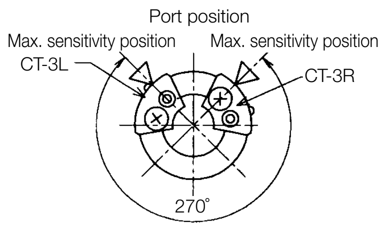
- When ordering adjustable oscillating type PRO series HI-ROTOR with switch unit, the unit will be shipped do not mounting. Mount the switches in accordance with the setting shown below and right after setting the angle stoppers at the desired angle and making final adjustment.

Oscillating angle	Orientation of switches
30°～186°	A
187°～270°	B

Orientation A



Orientation B



SETTING THE OSCILLATING ANGLE

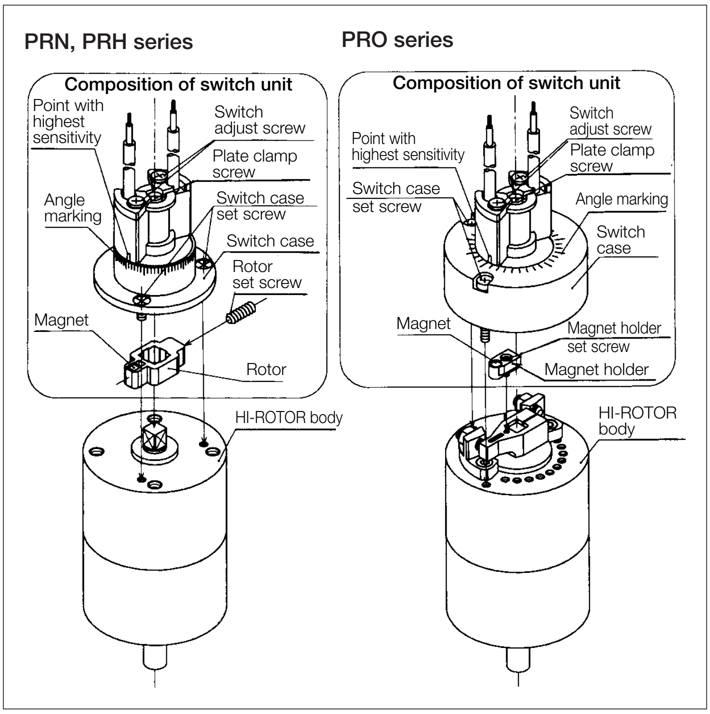
CAUTION

- **Mounting the switch unit**
  Mount the switch unit on the HI-ROTOR body using the set screws on the switch case. For clamping torque, see the table below.

Type of HI-ROTOR	Clamping torque (N・cm)
PRNA1S/D	20～30
PRNA3S/D	
PRNA10S/D, PRHA10S/D	
PRNA20S/D, PRHA20S/D	
PRN30S/D, PRH30S/D	
PROA3S/D	6～10
PROA10S/D	10～20
PROA20S/D	20～30
PRO30S/D	

- **Adjusting the switch position**
  Loosen the switch adjust screw, make the point at which the highest sensitivity of the switch is attained agree with the angle marking equivalent to the HI-ROTOR angle setting and retighten the switch adjust screw at a clamping torque of 40 to 50 N・cm. Since the angle markings are provided just for reference, make a final adjustment by cheking to see if the LED is on.

- **Replacing the switch**
  To remove the switch, remove the switch adjust screws and plate clamp screw. To mount a switch, reverse the procedure for removal. Adjust the switch position without fail after completion of mounting



For HI-ROTORs

Switch unit

(Variable switch position type)

Compact switch unit with M type switches. These switch units are available in both reed type and proximity types, thereby covering wide field of applications.

ORDERING INSTRUCTIONS

Switch unit
for basic type HI-ROTOR

FM50 – MA 2
① ② ③

Switch unit
for HI-ROTOR with hydro-cushion

FC50 – 90 – 45 – MA 2
① ④ ⑤ ② ③

①Applicable HI-ROTOR

FM50	PRN50, PRH50
FM150	PRN150, PRH150
FM300	PRN300, PRH300
FM800	PRN800, PRH800

②Type of switch

MA	Reed type	MA-1	Common to 100V AC and 24V DC (Low current type)
MB	Reed type	MD-1	DC24V
MC	Reed type	MD-3	DC5/DC6V
MD	Reed type	MR	AC/DC5～100V (Without indicator light)
MG	Proximity type	MT-3	DC5 ～30V
MH	Proximity type	MT-3U	DC5 ～30V
MJ	Proximity type	MT-2	DC24V
MK	Proximity type	MT-2U	DC24V
MP	Proximity type	MTP-3	DC5 ～30V

(Note) MP is made-to-order

③Number of switches

1	With one switch
2	With two switches

④Oscillating angle

90	90°
180	180°
270	270°

⑤Oscillating reference point

45	45°

(Note)・The switch unit for a HI-ROTOR with hydro-cushion is fitted on the cushion.
・Adjust the oscillating angle and oscillating reference point according to the HI-ROTOR used.

SWITCH UNIT COMPONENTS ORDERING INSTRUCTIONS

Switch unit for basic type HI-ROTOR

For FM50, 150 and 300

Base bracket

FM 50 –B
①

Magnet arm

FM 50 –A
①

Switch mounting hardware

FM 50 –K
④

①Applicable switch unit

50	FM50
150	FM150
300	FM300

④Applicable switch unit

50	FM50, FM150
300	FM300

For FM800

Base bracket

FM800-B

Magnet arm

FM800-A

(Note) For M type switch, refer to "Type of switch" shown in the ordering instructions for switch units.

Switch unit for HI-ROTOR with hydro-cushion

For FC50, 150 and 300

Base bracket

FM 50 –B [For common use with the basic type HI-ROTOR]
①

Magnet arm

FC 50 – 90 – 45 –T
① ② ③

Switch mounting hardware

FC 50 –K
④

①Applicable switch unit

50	FM50
150	FM150
300	FM300

②Oscillating angle

③Oscillating reference point

For FC800

Hydro-cushion for switch mounting

CRN800-FC

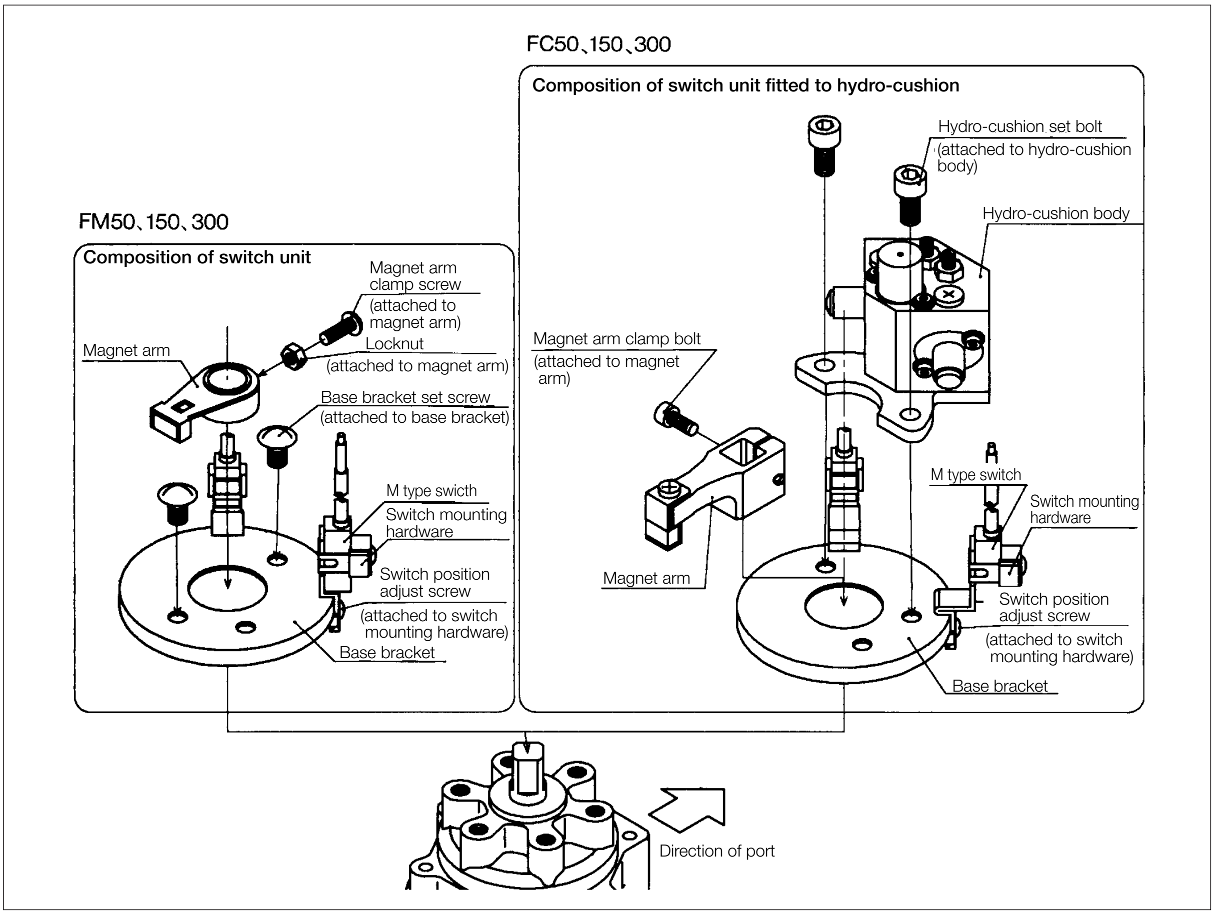
Magnet arm

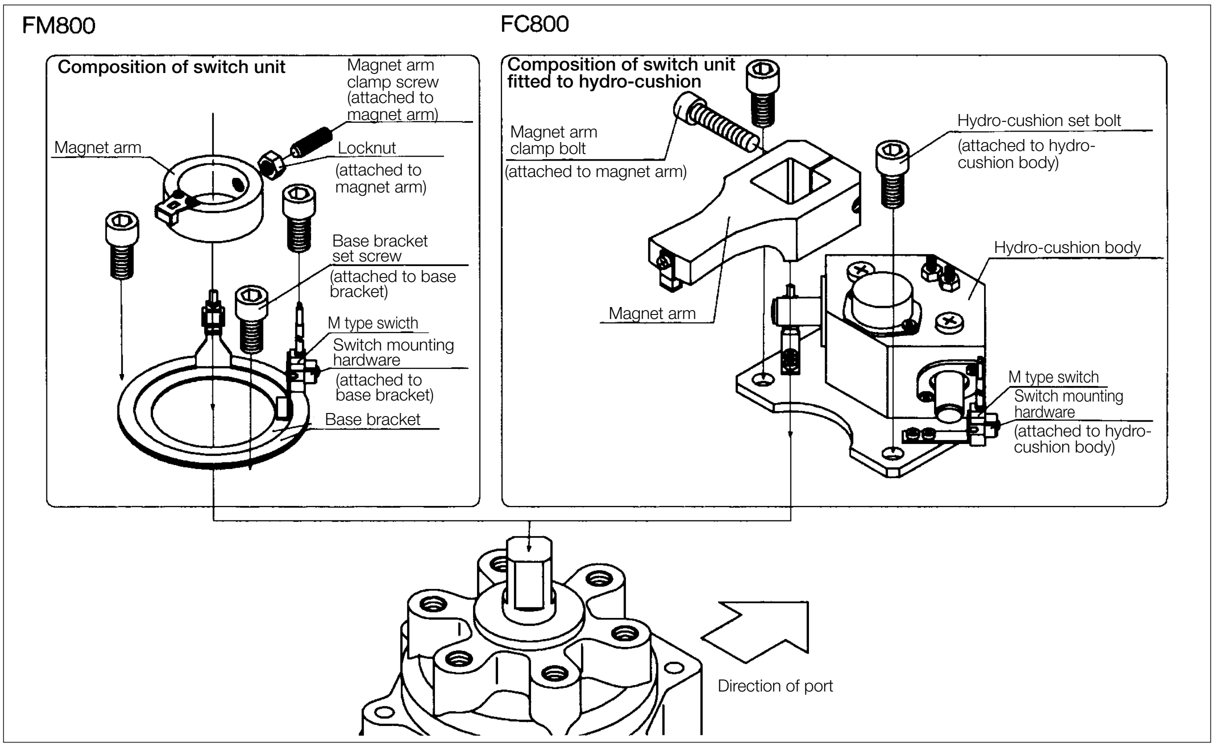
FC800 – 90 – 45 –T
② ③

(Note)
Adjust the oscillating angle and oscillating reference point according to the HI-ROTOR used.

Switch unit / Variable switch position type

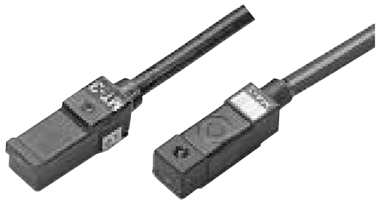
COMPOSITION AND ASSEMBLING METHOD





Switch unit / Variable switch position type

M type reed switch
M type proximity switch



REED SWITCH SPECIFICATIONS

Model No.		Unit	MA-1		MD-1	MD-3	MR
Applications			Relay, PLC		Relay	IC circuit	Relay
Load voltage		V	AC100	DC24	DC24	DC5～6	AC/DC5～100
Max. contact capcity	Inductive load		4.5VA	1W	1.5W	0.3W	1.5VA 1.5W
	Resistance load					1.8W	10VA 10W
Load current	Inductive load	mA	5～45		25～65	50 or less	50 or less
	Resistance load					300 or less	300 or less
Internal voltage drop		V	2 or less			0	
Surge suppressor			Not provided				
Mean response time		ms	1.0				
Shock resistance		m/s^2	294				
Ambient temperature		˚C	5～60				
Indicator light			Red LED (Lights up at on)				Not provided
Lead wire	Color		Black 2-core cord (Blue line)		Black 2-core cord	Black 3-core cord	Black 2-core cord
	Length	m	1				

(Note)・The MA-1 cannot be used at 200V AC.
・When using the MR, the specified maximum contact capacity and load current should be both satisfied.

PROXIMITY SWITCH SPECIFICATIONS

Model No.		Unit	MT-3	MT-3U	MTP-3	MT-2	MT-2U
Applications			Relay, PLC, IC circuit			Relay, PLC	
Output method			NPN		PNP	NPN	
Load voltage		V	DC5～30		DC10～30	DC24 (DC10～30)	
Load current		mA	5～200			5～100	
Max. power consumption of switch control		mA	max.20 (at 24V) max.10 (at 12V) max. 4 (at 5V)		max.20 (at 24V) max.10 (at 12V)	—	
Max. leak current		μA	10			1	
Internal voltage drop		V	1.5 or less			3 or less	
Mean response time		ms	1			1	
Shock resistance		m/s^2	490			490	
Ambient temperature		˚C	5～60			5～60	
Protection grade			IP67			IP67	
Indicator light			Red LED (Lights up at on)		Yellow LED (Lights up at on)	Red LED (Lights up at on)	
Lead wire	Color		Oil resistance black 3-core cord			Oil resistance black 2-core cord	
	Length	m	1			1	

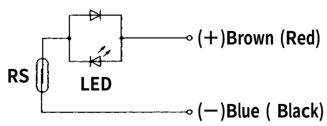
(Note) MTP-3 is made-to-order

Switch unit / Variable switch position type

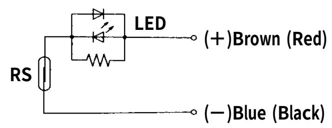
INTERNAL CIRCUIT DIAGRAM OF SWITCH

Reed switch

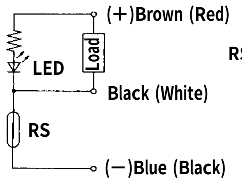
MA-1



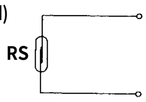
MD-1



MD-3

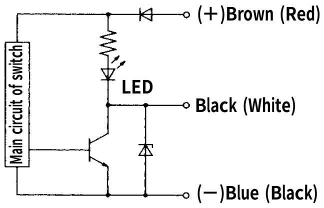


MR

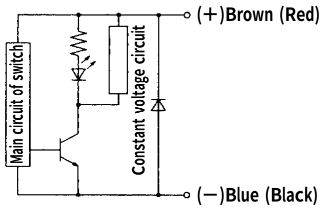


Proximity switch

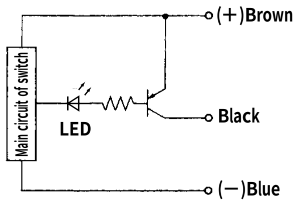
MT-3,MT-3U



MT-2,MT-2U



MTP-3



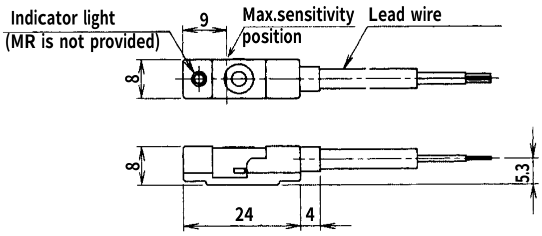
Bracketed ( ) color is former color.

DIMENSION OF SWITCH

(Unit : mm)

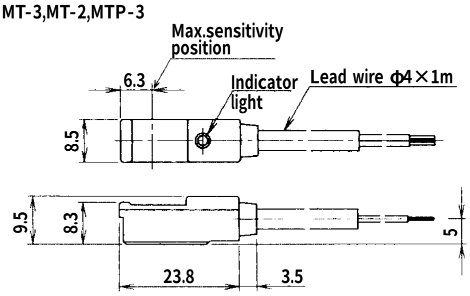
Reed switch

MA-1,MD-1,MD-3,MR

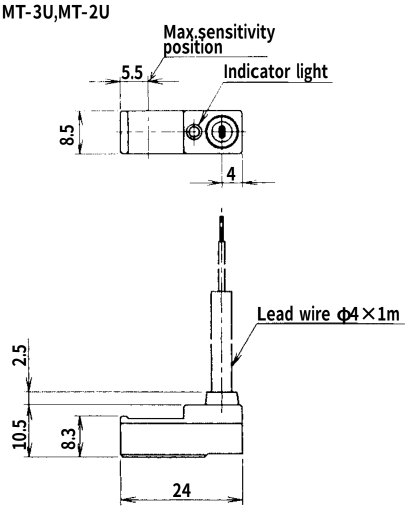


Proximity switch

MT-3,MT-2,MTP-3



MT-3U,MT-2U



SWITCH LEAD WIRE LENGTH

The standard lead wire length of M type switches is 1 m. However, lead wire length of 2 m, 3 m, 4 m and 5 m are optionaly available.

Ordering instructions MT-2 − L30

Lead wire length

No mark	: 1m (Standard)
L20	: 2m
L30	: 3m
L40	: 4m
L50	: 5m

Type of switch

Switch unit / Variable switch position type

HYSTERESIS AND RESPONSE RANGE OF SWITCHES

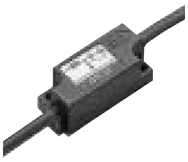
Reed switch

Type of switch	Response range	Hysteresis
FM50	Approx. 35°	Approx. 2° 30'
FC50 (With hydro-cushion)	Approx. 29°	Approx. 1° 30'
FM150	Approx. 25°	Approx. 1° 30'
FC150 (With hydro-cushion)	Approx. 19°	Approx. 1°
FM300	Approx. 26°	Approx. 1° 30'
FC300 (With hydro-cushion)	Approx. 17°	Approx. 1°
FM800	Approx. 32°	Approx. 2°
FC800 (With hydro-cushion)	Approx. 13°	Approx. 1°

Proximity switch

Type of switch	Response range	Hysteresis
FM50	Approx. 61°	Approx. 4.5°
FC50 (With hydro-cushion)	Approx. 35°	Approx. 3°
FM150	Approx. 42.5°	Approx. 3°
FC150 (With hydro-cushion)	Approx. 30°	Approx. 2°
FM300	Approx. 36.5°	Approx. 3°
FC300 (With hydro-cushion)	Approx. 19°	Approx. 2°
FM800	Approx. 46°	Approx. 4.5°
FC800 (With hydro-cushion)	Approx. 13°	Approx. 1.5°

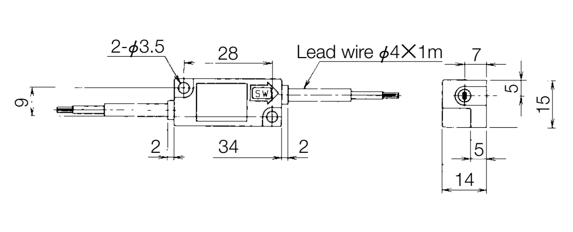
Surge suppressor



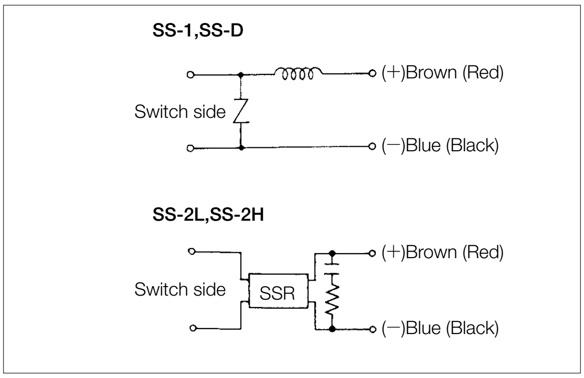
SURGE SUPPRESSOR SPECIFICATIONS

Model No.	Load voltage (v)	Load current (mA)
SS-1	AC100	—
SS-D	DC24	—
SS-2L	AC100/110	5~150
SS-2H	AC200/220	5~150

SURGE SUPPRESSOR DIMENSIONS (Unit : mm)



INTERNAL CIRCUIT DIAGRAM OF SURGE SUPPRESSOR



Bracketed ( ) color is first color.

INDIVIDUAL INSTRUCTIONS

Be sure to read them before use.
Also refer to Par. "For Safety Use" and common instructions.

DETECTION OF INTERMEDIATE ANGLE

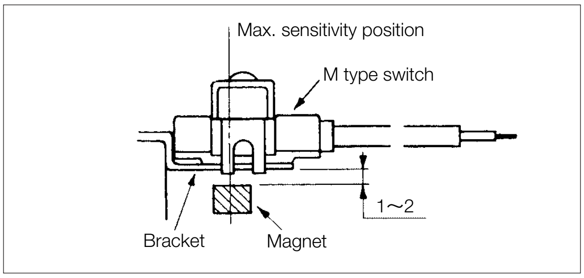
⚠ CAUTION

When the FM50 is used with a relay with an response time of 20 ms, the response range is 35°. Consequently, the available oscillating speed is 35/0.02=1750°/s or less. In this case, however, as the minimum oscillating time of the HI-ROTOR is 0.16s, use the switch unit at 180/0.16=1125°/s or less.

GAP BETWEEN SWITCH AND MAGNET

⚠ CAUTION

When mounting the switch unit, the gap between the switch and magnet is as shown below. Bending switch bracket can allow to adjust the gap.

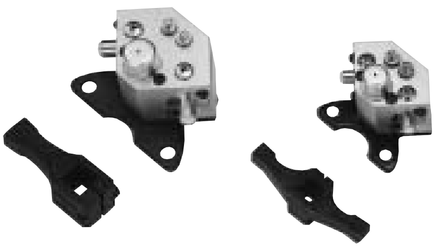


Hydro-cushion

CRNseries

50, 150, 300, 800

Special hydraulic cushion for HI-ROTORs. Use these cushions when the inertia energy exceeds the allowable energy of the HI-ROTOR.



ORDERING INSTRUCTIONS

Hydro-cushion with claw

CRN50 – 90 – 45
① ② ③

Hydro-cushion only

CRN50
①

①Applicable HI-ROTOR

CRN50	PRN50, PRH50
CRN150	PRN150, PRH150
CRN300	PRN300, PRH300
CRN800	PRN800, PRH800

Switch unit for HI-ROTOR with hydro-cushion

CRN50 – 90 – 45 – T
① ② ③

②Oscillating angle

90	90°
100	100°
180	180°
270	270°
280	280°

③Oscillating reference point

40	40°
45	45°

Specific angles (made-to-order)
Specify the required oscillating angle, and the hydro-cushion will be delivered with a claw for the specific angle. In this case, the oscillating start point is selectable only between 40° and 45°.

Relationship between oscillating angle and oscillating reference point

Oscillating reference point	Oscillating angle 90°	100°	180°	270°	280°
40°	–	○	–	–	○
45°	○	–	○	○	–

(Note)
Select an appropriate hydro-cushion according to the oscillating reference point and oscillating angle of the HI-ROTOR to be used.

SPECIFICATIONS

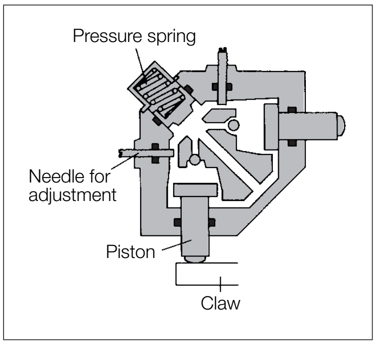
Model No.	Unit	CRN50	CRN150	CRN300	CRN800
Load range	kg·cm²	981	2942	5884	19613
Max. absorption energy	mJ	2942	9807	19613	58840
Max. collision angular velocity	degree/s	850	750	650	550
Max. energy capacity per minute	mJ/min	19613	70608	137293	353039
Ambient temperature	°C	5～50			
Absorbing angle (one end)	degree	11	12	14	15
Mass	g	240	420	780	1620
Applicable HI-ROTOR		PRN50, PRH50	PRN150, PRH150	PRN300, PRH300	PRN800, PRH800

(Note)·Energy capacity per minute =Absorbing energy ×2 N: Frequency of operation (cycle/min)
·When a HI-ROTOR with a hydro-cushion is used, keep a working pressure of 0.3 MPa or more.

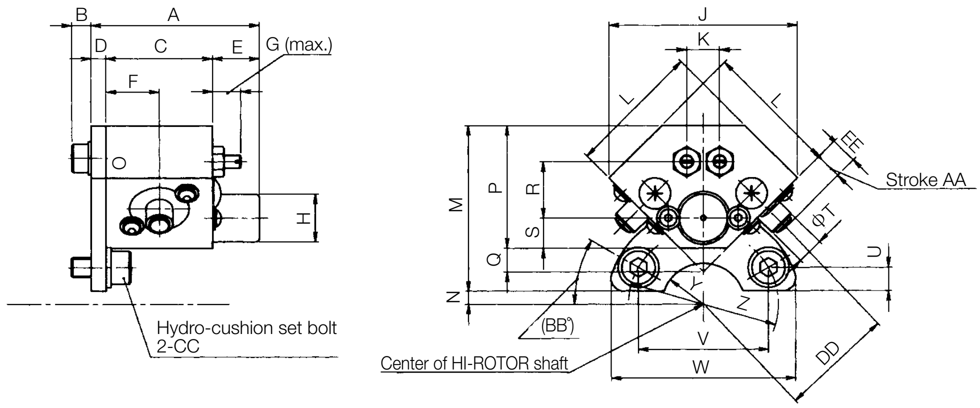
Hydro-cushion/CRN series

PRINCIPLE OF OPERATION

When the claw fitted to the HI-ROTOR shaft runs against the piston, the impact is converted into pressure (hydraulic pressure) applied to the back of the piston. This pressure energy changes into thermal energy when it passes through the clearance between the piston and the inside of the cylinder and through orifice of the needle for adjustment and is consumed before the piston stops at the stroke end. On the other hand, the piston on the opposit side is spring loaded and always returns to the origin.



DIMENSIONS



(Unit : mm)

Model No.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	W	Y	Z	AA	BB	CC	DD	EE
CRN50	50.5	6	32	4.5	14	16	8.5	14.4	56.6	9.9	40	50	4	37	7.1	17	9.2	8	7.2	39	56	R12.5	R45	6.5	30	M6×12ℓ	34	8
CRN150	56.5	7.2	36	4.5	16	18	8.5	18.4	70.7	11.3	50	62	9.5	49	8.4	25.5	11.4	10	8	60.6	80	R15	R70	10	30	M8×16ℓ	46	12
CRN300	62.5	7.2	42	4.5	16	21	12	22.5	91.9	12.7	65	87	8	61	14.2	33.2	14.1	12	12	69.2	95	R22.5	R80	15	30	M10×20ℓ	62	18
CRN800	73	7.2	50	6	17	25	12	32.5	127.0	14.2	90	118	17	82	24.7	46.7	20.6	16	13	103.9	130	R35	R120	24	30	M12×20ℓ	90	27.5

INDIVIDUAL INSTRUCTIONS

Be sure to read them before use.
Also refer to Par. "For Safety Use" and common instructions.

HANDLING

WARNING

- **Do not loosen nor disassemble parts other than the needle for adjustment.**
  Otherwise, oil will leak.
- **The hexagon nut located on the base of the needle for adjustment is not a locknut. Never rotate it.**
  Otherwise, oil will leak.
- **Do not use the hydro-cushion in places where it may be subject to dust, chips and liquid like water or oil.**
  Such elements will cause the hydro-cushion to malfunction and will reduce the service life.

HOW TO MOUNT THE HYDRO-CUSHION

CAUTION

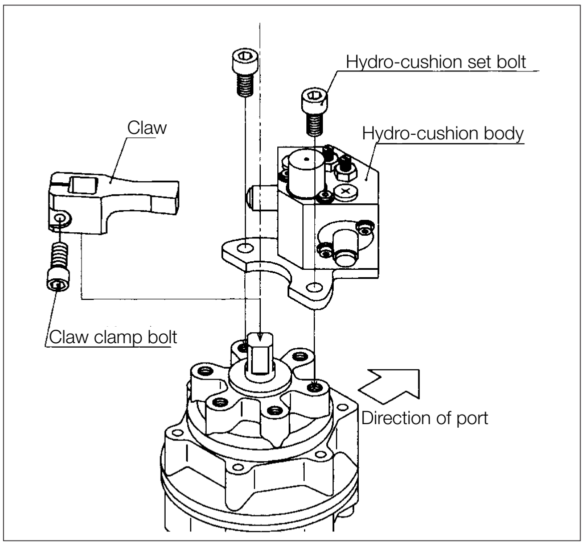
①Mount the hydro-cushion on the end with a square shaft of the HI-ROTOR using the clamp holes on the cushion body.

②Place the cushion body just above the port of the HI-ROTOR when mounting. Make sure that the cushion body is securely mounted on the HI-ROTOR.

③Before fitting the cushion claw, check if the HI-ROTOR shaft is located at the oscillating reference point, (Refer to the description on the oscillating reference point.)

④At the oscillating reference point, the cushion claw depresses the piston of the cushion body into body. So, turn the square shaft counterclockwise until the claw is fitted into the square shaft.

⑤Note that the hydro-cushion cannot be used as a stopper.



KINETIC ENERGY

CAUTION

①Find the moment of inertia from the size of the load and check if it is within the allowable range.

②Check if the collision angular velocity is within the allowable range.

$\omega_0 \fallingdotseq 1.2\omega$ — ω_0: Collision angular velocity (Degree/s)
ω : Mean angular velocity (Degree/s)

③Find the collision energy from the load and collision angular velocity.

$E_1 = ½ \times I \times \omega_0^2 \times 10^{-1}$ (mJ) — I : Moment of inertia (kg·cm^2)
ω_0: Collision angular velocity (Degree/s)

④Find the energy generated from the torque of the HI-ROTOR.

$E_2 = ½ \times T \times \theta \times 10$ (mJ) — T : Torque of HI-ROTOR (N·cm)
θ : Absorption angle (One side) (rad)

⑤Check if the value obtained by adding E_1 to E_2 is equal to or less than the maximum absorption energy.

⑥Find the energy per minute from the frequency of operation.

$Em = 2 \times N \times (E_1 + E_2)$
N : Frequency of operation (cycle/min)

Make sure that "Em" is equal to or less than the maximum energy capacity per minute.

⑦Use radian instead of degree.

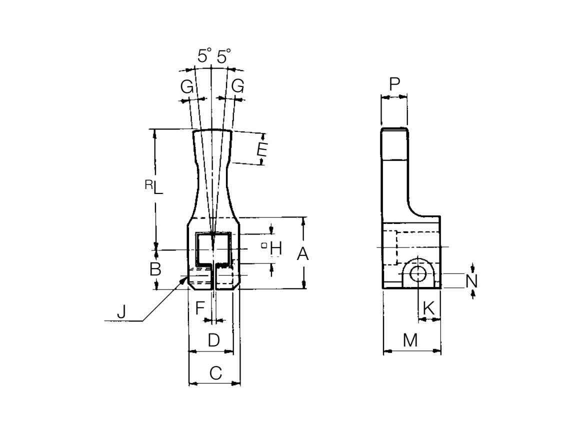
$1^\circ = 0.0174$rad

Hydro-cushion/CRN series

DIMENSIONS OF HYDRO-CUSHION CLAWS

Oscillating angle 270°(Reference point 45°)

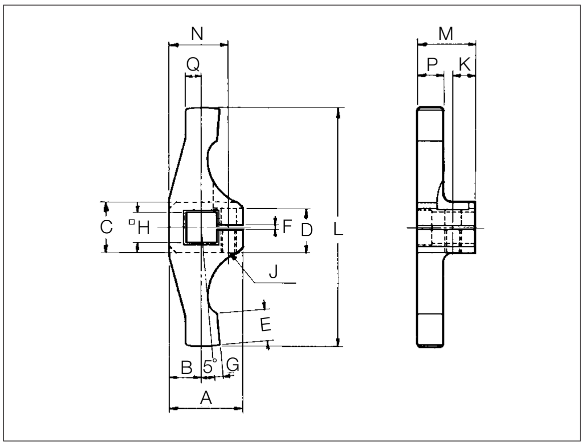
(Unit : mm)



Model No.	A	B	C	D	E	F	G	H	J	K	L	M	N	P
CRN50	23	13	16	13.7	10	1.2	2.6	10	M5	7	38	18	4.5	8
CRN150	28	16	24	19.5	12	1.2	4.1	13	M6	9	51	20	5	10
CRN300	40	22	35	30.5	14	1.2	5.5	19	M8	11	68	23.5	6.5	12
CRN800	63	34	58	49	18	1.2	8	32	M10	14.5	98	29.5	8	16

Oscillating angle 90°(Reference point 45°)

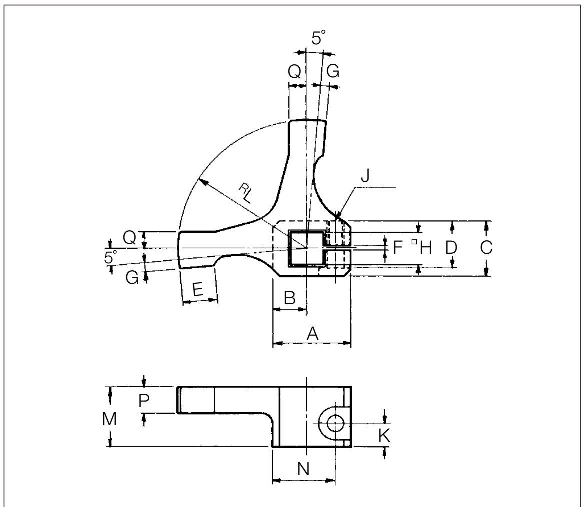
(Unit : mm)



Model No.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q
CRN50	23	10	16	13.7	10	1.2	2.5	10	M5	7	76	18	18.5	8	5
CRN150	28	12	24	19.5	12	1.2	4	13	M6	7.5	102	20	23	10	5
CRN300	40	18	35	30.5	14	1.2	5.4	19	M8	9	136	23.5	33.5	12	9
CRN800	63	29	58	49	18	1.2	8	32	M10	14.5	196	29.5	55	16	14

Oscillating angle 180°(Reference point 45°)

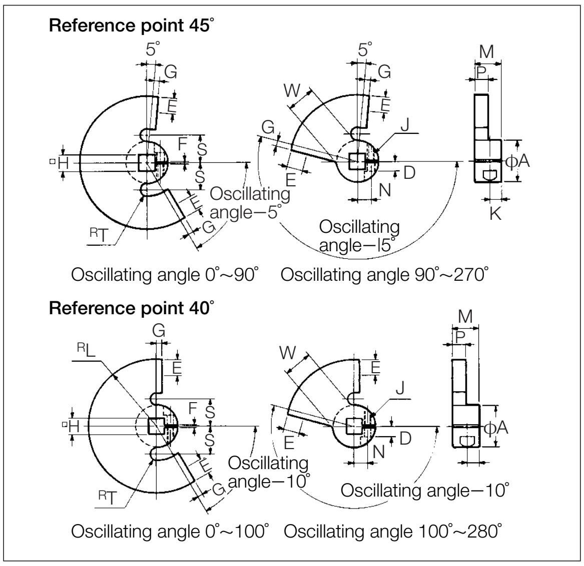
(Unit : mm)



Model No.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q
CRN50	23	10	16	13.7	10	1.2	2.5	10	M5	7	38	18	18.5	8	5
CRN150	28	12	24	19.5	12	1.2	4	13	M6	9	51	20	23	10	5
CRN300	40	18	35	30.5	14	1.2	5.4	19	M8	11	68	23.5	33.5	12	9
CRN800	63	29	58	49	18	1.2	8	32	M10	14.5	98	29.5	55	16	14

Special angle (Reference point 40°, 45°)

(Unit : mm)



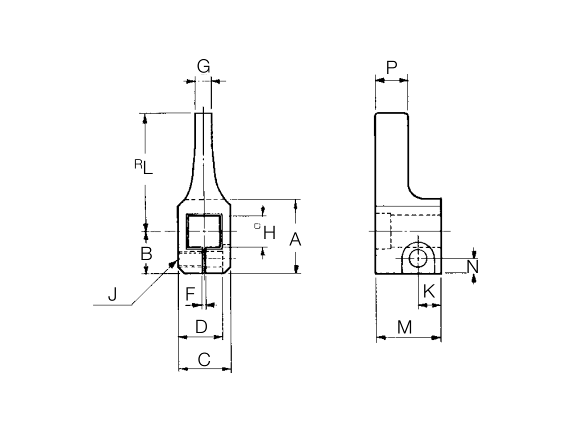
Model No.	A	D	E	F	G ±0.1	H +0.05 0	J	K	L	M	N	P	S	T	W
CRN50	26	5.5	8	1.5	2.5	10	M5 depth 13	7	37	17.5	8.5	7	18	5	13
CRN150	32	7.5	12	1.5	4	13	M6 depth 16	9	51	20	10.5	10	21	5	16
CRN300	48	13	14	1.5	5.5	19	M8 depth 22	11	68	23.5	15	12	30	6	24
CRN800	78	20	18	1.5	8	32	M10 depth 30	14	98	28.5	26	15.5	45	6	39

(Note) • Material : S45∼55C
• We recommend to harden the claw at H_{RC}≒40 for oscillating angle of 260° or more.

Hydro-cushion/CRN series

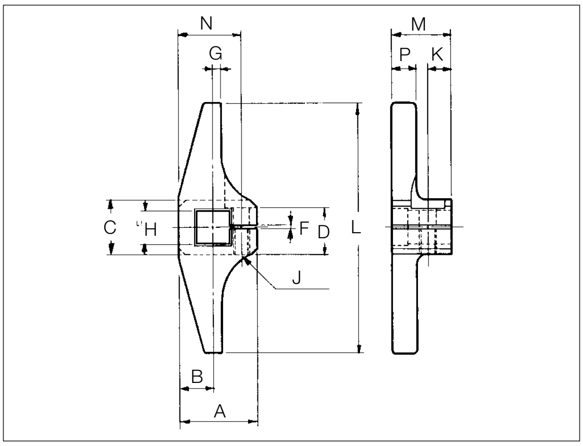
DIMENSIONS OF HYDRO-CUSHION CLAWS

Oscillating angle 280°(Reference point 45°) (Unit : mm)



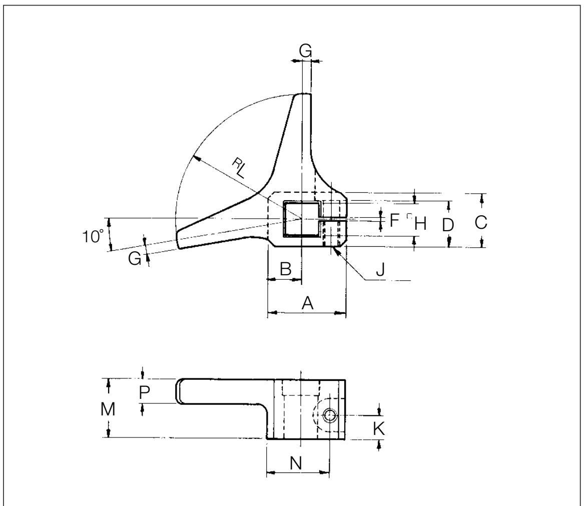
Model No.	A	B	C	D	F	G	H	J	K	L	M	N	P
CRN50	23	13	16	13.5	1.2	5	10	M5	7	37	20	4.5	10
CRN150	28	16	24	19.5	1.2	8	13	M6	9	51	20	5	10
CRN300	40	22	35	30.5	1.2	11	19	M8	11	68	24	6.5	12.5
CRN800	63	34	58	49	1.2	16	32	M10	14	98	28.5	8	15.5

Oscillating angle 100°(Reference point 40°) (Unit : mm)



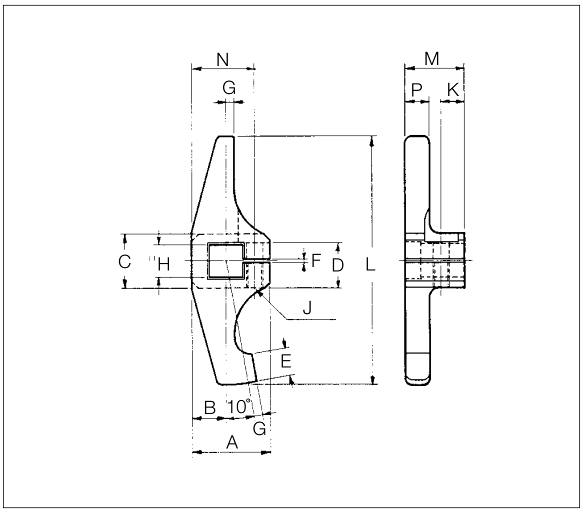
Model No.	A	B	C	D	F	G	H	J	K	L	M	N	P
CRN50	23	10	16	13.5	1.2	2.5	10	M5	7	74	17.5	18.5	7
CRN150	28	12	24	19.5	1.2	4	13	M6	9	102	20	23	10
CRN300	40	18	35	30.5	1.2	5.5	19	M8	11	136	23.5	33.5	12
CRN800	63	29	58	49	1.2	8	32	M10	14	196	28.5	55	15.5

Oscillating angle 180°(Reference point 40°) (Unit : mm)



Model No.	A	B	C	D	F	G	H	J	K	L	M	N	P
CRN50	23	10	16	13.5	1.2	2.5	10	M5	7	37	17.5	18.5	7
CRN150	28	12	24	19.5	1.2	4	13	M6	9	51	20	23	10
CRN300	40	18	35	30.5	1.2	5.5	19	M8	11	68	23.5	33.5	12
CRN800	63	29	58	49	1.2	8	32	M10	14.5	98	29.5	55	16

Oscillating angle 90°(Reference point 40°) (Unit : mm)



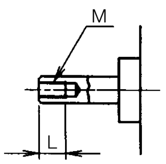
Model No.	A	B	C	D	E	F	G	H	J	K	L	M	N	P
CRN50	23	10	16	13.5	8	1.2	2.5	10	M5	7	74	17.5	18.5	7
CRN150	28	12	24	19.5	12	1.2	4	13	M6	9	102	20	23	10
CRN300	40	18	35	30.5	14	1.2	5.5	19	M8	11	136	23.5	33.5	12
CRN800	63	29	58	49	32	1.2	8	32	M10	14	196	28.5	55	15.5

HI-ROTOR with special shape of shaft (Made-to-order)

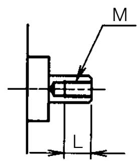
Miniature HI-ROTOR/ PRNA1, PRNA3, PRNA10, PRNA20, PRN30

For detailed specifications, size and time of delivery, contact KURODA.
For other models than listed below, consult with KURODA.

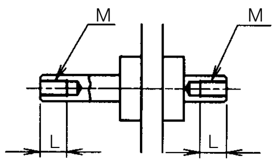
Symbo : X1
Long shaft side : Female screw



Symbol : X2
Short shaft side : Female screw



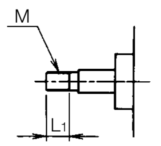
Symbol : X3
Both sides : Female screw



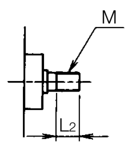
Model No.	M(Female screw)	L
PRNA3	M3	6
PRNA10	M3	6
PRNA20	M3	6
PRN30	M4	8

(Note) •Thread pitch : Metric coarse thread
•PRNA20 and PRN30 are provided with keyway according to circumstances.

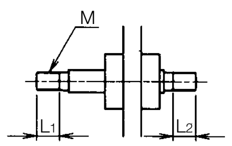
Symbol : X4
Long shaft side : Male screw



Symbol : X5
Short shaft side : Male screw



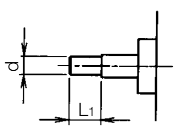
Symbol : X6
Both sides : Male screw



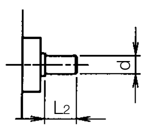
Model No.	M(Male screw)	L_1	L_2
PRNA3	M4	8	6
PRNA10	M4	8	6
PRNA20	M5	10	6
PRN30	M8	20	8

(Note) Thread pitch : Metric coarse thread

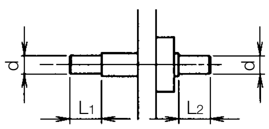
Symbol : X7
Long shaft side : Round bar



Symbol : X8
Short shaft side : Round bar

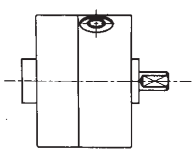


Symbol : X9
Both sides : Round bar

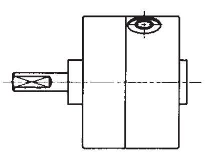


Model No.	ϕ d	L_1	L_2
PRNA1	3	10	7
PRNA3	4	10	7
PRNA10	5	14	7
PRNA20	4	20	7
PRN30	5	22	10

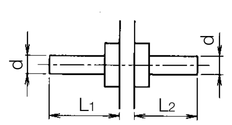
Symbol : X10
Long shaft side : Cut



Symbol : X11
Short shaft side : Cut

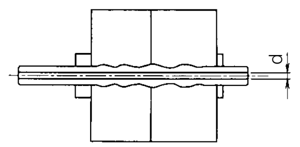


Symbol : X14
Both sides : Round bar

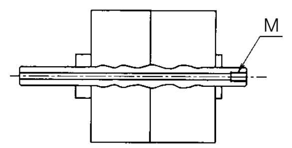


Model No.	ϕ d	L_1	L_2
PRNA1	4	16	14
PRNA3	5	19	17
PRNA10	6	23	20
PRNA20	8	28.5	27
PRN30S	10	31.5	28.5
PRN30D	10	31.5	22

Symbol : Y1
Hollow shaft (Through-hole alone)



Symbol : Y2
Hollow shaft (Through-hole, Short shaft side : Female screw)



Model No.	ϕ D	ϕ d	M(Female screw)
PRNA1	4	1.5	—
PRNA3	5	2	M3
PRNA10	6	2	M3
PRNA20	8	2.5	M3
PRN30	10	3	M5

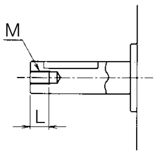
(Note) •Thread pitch : Metric coarse thread
•PRNA20 and PRN30 are provided with keyway according to circumstances.

HI-ROTOR with special shape of shaft (Made-to-order)

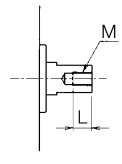
HI-ROTOR/ PRN50, PRN150, PRN300, PRN800

For detailed specifications, size and time of delivery, contact KURODA.
For other models than listed below, consult with KURODA.

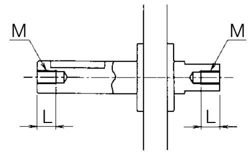
Symbol : X1
Long shaft side : Female screw



Symbol : X2
Short shaft side : Female screw



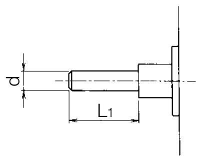
Symbol : X3
Both sides : Female screw



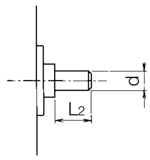
Model No.	M(Female screw)	L
PRN50	M4	8
PRN150	M5	10
PRN300	M6	12
PRN800	M8	16

(Note) •Thread pitch : Metric coarse thread
•Long shaft side is provided with keyway according to circumstances.

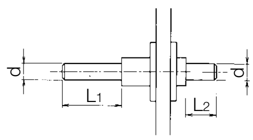
Symbol : X7
Long shaft side : Round bar



Symbol : X8
Short shaft side : Round bar

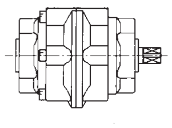


Symbol : X9
Both sides : Round bar

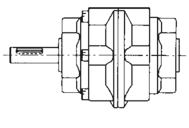


Model No.	ϕ d	L_1	L_2
PRN50	7	25	13
PRN150	11	41	16
PRN300	17	45	22
PRN800	30	50	35

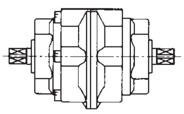
Symbol : X10
Long shaft side : Cut



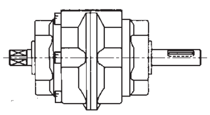
Symbol : X11
Short shaft side : Cut



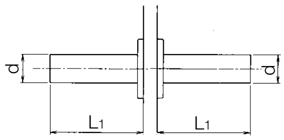
Symbol : X12
Both sides : Short shaft



Symbol : X13
Long shaft and short shaft contrary position

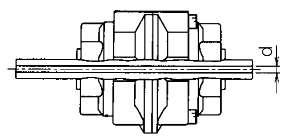


Symbol : X14
Both sides : Round bar

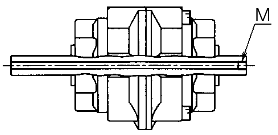


Model No.	ϕ d	L_1
PRN50	12	39.5
PRN150	17	53.5
PRN300	25	65
PRN800	40	69.5

Symbol : Y1
Hollow shaft (Through-hole alone)



Symbol : Y2
Hollow shaft (Through-hole, Short shaft side : Female screw)



Model No.	ϕ D	ϕ d	M(Female screw)
PRN50	12	4	M5
PRN150	17	7	Rc⅛
PRN300	25	8	Rc⅛
PRN800	40	8	Rc⅛

(Note) •Thread pitch : Metric coarse thread
•Long shaft side is provided with keyway according to circumstances.

Reference data for selecting HI-ROTOR

⚠ SELECTING A PNEUMATIC HI-ROTOR

Step 1 Selecting a size

When simple static force such as clamping force is required:

①Determine required force, arm length from HI-ROTOR and operating pressure.

Required force F (N)
Arm length from HI-ROTOR ℓ (cm)
Operating pressure P (MPa)

②Calculating required torque T_S

$T_S = F \times \ell$

F : Required force (N)
ℓ : Arm length from HI-ROTOR (cm)

③Compare the output torque T_H of the HI-ROTOR under operating pressure with the required torque T_S to select a HI-ROTOR that can satisfy the following equation.
Refer to Pages 14, 23, 34, 42 and 47 for output torque table.

$T_S = T_H$

T_S : Required torque (N・cm)
T_H : Output torque of HI-ROTOR (N・cm)

When moving a load:

The required torque for moving a load is the total of resistance torque and acceleration torque.
The resistance torque is the sum of friction, gravity and external force/torques.
The acceleration torque is provided to accelerate the load to certain speed agaist inertia.

①Calculating resistance torque

ⓐDetermine required force, arm length from HI-ROTOR and operating pressure.

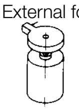
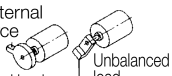
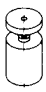
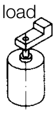
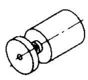
Required force F (N)
Arm length from HI-ROTOR ℓ (cm)
Operating pressure P (MPa)

ⓑCalculating resistance torque T_R

$T_R = K \times F \times \ell$ (N・cm)

K : Margin factor Where there is noload variation K=2
Where there is load variation K=5
(Ehere resistance torque by gravity acts on:)

(Note) Assuming that K<5, where there is load variation, the angular velocity increases, and thus smooth operation cannot be obtained.

Calculating resistance torque	Horizontal load	Vertical load
Required	Load resistance exists. External force  Balanced load Unbalanced load	Load resistance exists. External force  Balanced load Unbalanced load Unbalanced load gravity
Not required	No load resistance exists. Balanced load  Unbalanced load 	No load resistance exists.  Balanced load

②Calculating acceleration torque

ⓐDetermine oscillating angle θ and oscillating time t.
Oscillating time is the time required for the vane from starting movement to reaching the oscillation end.

Oscillating angle θ (rad)

$90° = 1.5708$ rad
$180° = 3.1416$ rad
$270° = 4.7124$ rad

Oscillating time t (s)

ⓑCalculating moment of inertia
Calculate moment of inertia from the shape and mass of load.
For calculating formula, refer to the table of "Calculating moment of inertia".

I (Kg・cm²)

ⓒCalculating angular velocity

$$\alpha = \frac{\theta}{t^2}$$

θ : Oscillation angle (rad)
t : Oscillation time (s)

ⓓCalculating acceleration torque T_A

$T_A = 5 \times I \times \alpha \times 10^{-2}$ (N・cm)

I : Moment of inertia of load (rad)
α : Angular velocity (s)

③Calculating required torque T

$T = T_R + T_A$ (N・cm)

T_R : Resistance torque (N・cm)
T_A : Acceleration velocity (N・cm)

④Compare the output torque T_H of the HI-ROTOR under operating pressure with the required torque T_S to select a HI-ROTOR that can satisfy the following equation. Refer to Pages 14, 23, 34, 42 and 47 for output torque table.

$T_S \leqq T_H$

T_S : Required torque (N・cm)
T_H : Output torque of HI-ROTOR (N・cm)

Reference data for selecting HI-ROTOR

Step 2 Checking the oscillating time

Since the upper and lower limits of the oscillating time are fixed for each model, set it within such the range.
Check the oscillating time is within the specification indicated in the pages 15, 25, 35, 42 and 47.

Step 3 Checking allowable energy

For the inertia, use the HI-ROTOR so that energy of inertia should be within the allowable energy of the HI-ROTOR.
For this purpose, check the allowable energy for the HI-ROTOR in accordance with the following procedure :

①Calculating angular velocity ω

$\omega=\theta/t$ (rad/s)

θ : Oscillating angle (rad)

t : Oscillating time (s)

②Calculating energy of inertia of load E

$E=\frac{1}{2}\times I\times\omega^2\times10^{-1}$ (mJ)

I : Moment of inertia of load (kg·cm²)

ω: Angular velocity (rad/s)

③Check the energy of inertia E is within the allowable energy indicated in the specifications shown in the pages 14, 23 and 34.
(Note) If energy of inertia exceeds the allowable energy, HI-ROTOR may be damaged. Therefore, it is necessary to take the following measures :
- Select a larger size HI-ROTOR by which energy of inertia is lower than the allowable energy.
- Slow down the oscillating time.
- Fit a cushion or other shock absorber directly on the load side.

⚠ SELECTING A HYDORO-CUSHION

Step 1 Checking the allowable energy

Calculate the load inertia. When the calculated value exceeds the allowable energy for the HI-ROTOR, mount a cushion (Hydoro-cushion) suitable for the HI-ROTOR. For the load inertia, refer to “Selecting a Pneumatic HI-ROTOR”.

Step 2 Checking the capability of the cushion

Calculate the moment of inertia by the shape and mass of the load and make sure that it is within the allowable range.

⬇

Make sure that the collision angular velocity is equal or less than the prescribed maximum value.
$\omega_0\fallingdotseq1.2\times\omega$ (Degree/s) ω : Mean angular velocity (Degree/s)

⬇

Calculate the collision energy from the load and collision angular velocity.
$E_1=\frac{1}{2}\times I\times\omega_0^2\times10^{-1}$ (mJ) I : Moment of inertia (kg·cm²) ω_0 : Collision angular velocity (rad/s) $1^\circ=0.0174$rad

⬇

Find the energy generated from the torque of the HI-ROTOR.
$E_2=\frac{1}{2}\times T\times\theta\times10$ (mJ) T : Torque of HI-ROTOR (N·cm) θ : Absorption angle of cushion (one side) (rad)

⬇

Check if the value obtained by adding E_1 to E_2 is equal or less than the maximum absorption energy.

⬇

Find the energy per minute from the frequency of operation.
$E_m=2\times N\times(E_1+E_2)$ (mJ/min) N : Frequency of operation (cycle/min)

⬇

Make sure that “E_m” is equal or less than the maximum energy capacity per minute.

It is OK if all the above-mentioned items are satisfied. If any one item is not satisfied, hydro-cushion cannot be used.
In this case, another shock absorber having a larger absorbing capacity is required.

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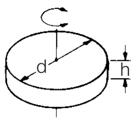
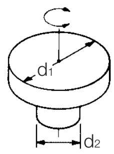
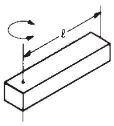
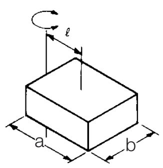
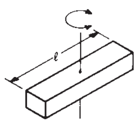
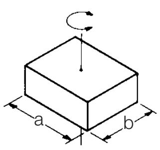
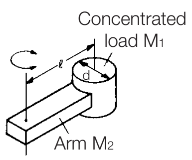
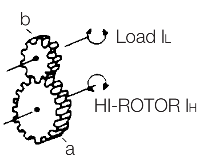
Reference data for selecting HI-ROTOR

Calculating the moment of inertia

Shape	Sketch	Requirement	Inertia moment I (kg·cm²)	Radius of gyration	Remarks
Disc		Diameter d (cm) Mass M (kg)	$I = M \cdot \frac{d^2}{8}$	$\frac{d^2}{8}$	
Stepped disc		Diameter d_1 (cm) d_2 (cm) Mass portion d_1 M_1 (kg) portion d_2 M_2 (kg)	$I = M_1 \cdot \frac{d_1^2}{8} + M_2 \cdot \frac{d_2^2}{8}$	——	When portion d_2 is much smaller than portion d_1, value of d_2, is negligible.
Bar (with rotating center at the end)		Bar length ℓ (cm) Mass M (kg)	$I = M \cdot \frac{\ell^2}{3}$	$\frac{\ell^2}{3}$	If the ratio of the bar width : length is over 0.3, use formula for rectangle.
Rectangular parallelepiped		Side length a (cm) b (cm) Distance between the center of gravity and rotation ℓ (cm) Mass M (kg)	$I=M(\ell^2+\frac{a^2+b^2}{12})$	$\ell^2+\frac{a^2+b^2}{12}$	
Bar (with rotating center at the center)		Bar length ℓ (cm) Mass M (kg)	$I=M \cdot \frac{\ell^2}{12}$	$\frac{\ell^2}{12}$	If the ratio of the bar width : length is over 0.3, use formula for rectangle.
Rectangular parallelepiped		Side length a (cm) b (cm) Mass M (kg)	$I = M \cdot \frac{a^2+b^2}{12}$	$\frac{a^2+b^2}{12}$	
Concentrated load		Shape of concentrated load Disk Diameter of disk d (cm) Arm length ℓ (cm) Mass of concentrated load M_1 (kg) Mass of arm M_2 (kg)	$I = M_1 \cdot \ell^2 + M_1 \cdot K_1^2 + M_2 \cdot \frac{\ell^2}{12}$ Case of disc $K_1^2 = \frac{d^2}{8}$	K_1^2 : Select from above this column	When M_2 is much smaller than M_1, assume M_2 to be 0 for calculation.

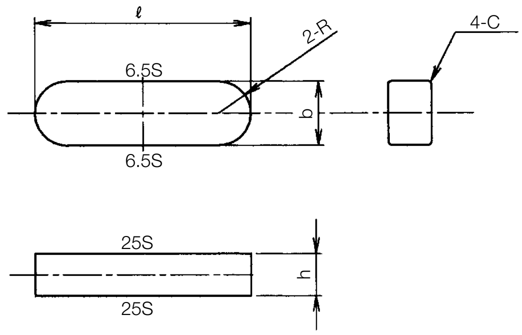
How to convert the inertia of load applied through gears "I_L" for HI-ROTOR's shaft

Gear		Gear HI-ROTOR side a Load side b Inertia moment of load I_L (kg·cm²)	Inertia moment of load for HI-ROTOR's shaft $I_H = (\frac{a}{b})^2 I_L$	——	When a large gear is required, it is necessary to take inertia moment of gear into consideration.

Key for HI-ROTOR

HI-ROTORs with keyway are accompanied by the following keys, respectively.

JIS B 1301 Parallel key b×h×ℓ, both end rounded S50C



(Unit : mm)

Model No.	Key size	b	h	ℓ	*C	R
PRNA20 PROA20 PRHA20	3×3×16	$3^{\ 0}_{-0.025}$	$3^{\ 0}_{-0.025}$	$16^{\ 0}_{-0.18}$	0.16∼0.25 (R0.16∼0.25)	1.5
PRN30 PRO30 PRH30	4×4×18	$4^{\ 0}_{-0.03}$	$4^{\ 0}_{-0.03}$	$18^{\ 0}_{-0.18}$	0.16∼0.25 (R0.16∼0.25)	2
PRN50 PRH50	4×4×20	$4^{\ 0}_{-0.03}$	$4^{\ 0}_{-0.03}$	$20^{\ 0}_{-0.21}$	0.16∼0.25 (R0.16∼0.25)	2
PRN150 PRH150	5×5×36	$5^{\ 0}_{-0.03}$	$5^{\ 0}_{-0.03}$	$36^{\ 0}_{-0.25}$	0.25∼0.40 (R0.25∼0.40)	2.5
PRN300 PRH300	7×7×40	$7^{\ 0}_{-0.036}$	$7^{\ 0}_{-0.036}$	$40^{\ 0}_{-0.25}$	0.25∼0.40 (R0.25∼0.40)	3.5
PRN800 PRH800	12×8×40	$12^{\ 0}_{-0.043}$	$8^{\ 0}_{-0.09}$	$40^{\ 0}_{-0.25}$	0.40∼0.60 (R0.40∼0.60)	6

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