





Before selecting and using the product, please read all the Safety Precautions carefully to ensure proper product use.

The Safety Precautions shown below are to help you use the product safely and correctly, and to prevent injury or damage to you, other people, and assets beforehand.

Follow the Safety Precautions for: ISO4414 (Pneumatic fluid power—Recommendations for the application of equipment to transmission and control systems), JIS B 8370 (Pneumatic system regulations)

The directions are ranked according to degree of potential danger or damage:

“DANGER!”, “WARNING!”, “CAUTION!”, and “ATTENTION!”

 DANGER	Expresses situations that can be clearly predicted as dangerous. If the noted danger is not avoided, it could result in death or serious injury. It could also result in damage or destruction of assets.
 WARNING	Expresses situations that, while not immediately dangerous, could become dangerous. If the noted danger is not avoided, it could result in death or serious injury. It could also result in damage or destruction of assets.
 CAUTION	Expresses situations that, while not immediately dangerous, could become dangerous. If the noted danger is not avoided, it could result in light or semi-serious injury. It could also result in damage or destruction of assets.
 ATTENTION	While there is little chance of injury, this content refers to points that should be observed for appropriate use of the product.

■ This product was designed and manufactured as parts for use in General Industrial Machinery.

- In the selection and handling of the equipment, the system designer or other person with fully adequate knowledge and experience should always read the Safety Precautions, Catalog, Owner's Manual and other literature before commencing operation. Making mistakes in handling is dangerous.
- After reading the Owner's Manual, Catalog, etc., always place them where they can be easily available for reference to users of this product.
- If transferring or lending the product to another person, always attach the Owner's Manual, Catalog, etc., to the product where they are easily visible, to ensure that the new user can use the product safely and properly.
- The danger, warning, and caution items listed under these “Safety Precautions” do not cover all possible cases. Read the Catalog and Owner's Manual carefully, and always keep safety first.

DANGER

- Do not use the product for the purposes listed below:
 1. Medical equipment related to maintenance or management of human lives or bodies.
 2. Mechanical devices or equipment designed for the purpose of moving or transporting people.
 3. Critical safety components in mechanical devices.

This product has not been planned or designed for purposes that require advanced stages of safety. It could cause injury to human life.
- Do not use the product in locations with or near dangerous substances such as flammable or ignitable substances. This product is not explosion-proof. It could ignite or burst into flames.
- When mounting the product and workpiece, always firmly support and secure them in place. Dropping or falling the product or improper operation could result in injury.
- When mounting the Flat Rodless cylinder, always mount it with an end plate tightened with mounting bolts at 4 counterbore locations (left and right).
Failure to firmly secure the end plate could result in separation of the connection between the cylinder barrel and the end plate, leading to possible injury.
- Persons who use a pacemaker, etc., should keep a distance of at least 1 meter [3.28ft.] away from the product. There is a possibility that the pacemaker will malfunction due to the strong magnet built into the product.
- Never attempt to remodel the product. It could result in abnormal operation leading to injury, electric shock, fire, etc.
- Never attempt inappropriate disassembly, or assembly of the product relating to its basic inner construction, or to its performance or functions. It could result in injury, electric shock, fire, etc.
- Do not splash water on the product. Spraying it with water, washing it, or using it underwater could result in malfunction of the product leading to injury, electric shock, fire, etc.
- While the product is in operation, avoid touching it with your hands or otherwise approaching too close. In addition, do not make any adjustments to the interior or to the attached mechanisms (shock absorbers, stroke adjusting mechanism, sensor switch mounting location, disconnection of piping tubes or plugs, etc.). The actuator can move suddenly, possibly resulting in injury.
- When operating the product, always install speed controllers, and gradually loosen the needle valve from a choked state to adjust the speed increasing. Failure to make this adjustment could result in sudden movements, putting lives at risk.

- Do not apply loads exceeding the allowable buckling and bending strength to piston rod. It could reduce operating life or cause abnormal wearing or other damage to the rod and tube.
- Connect axial center of the piston rod and movement direction of load to surely bring them in line. If not, applying excessive force to the piston rod and tube could cause abnormal wearing or other damage to them.

WARNING

- Do not use the product in excess of its specification range. Such use could result in product breakdowns, function stop, damage, or drastically reduce the operating life.
- Before supplying air or electricity to the device and before starting operation, always conduct a safety check of the area of machine operation. Unintentional supply of air or electricity could possibly result in electric shock, or in injury caused by contact with moving parts.
- Do not touch the terminals and the miscellaneous switches, etc., while the device is powered on. There is a possibility of electric shock and abnormal operation.
- Do not throw the product into fire.
The product could explode and/or release toxic gases.
- Do not sit on the product, place your foot on it, or place other objects on it.
Accidents such as falling could result in injury. Dropping or toppling the product may result in injury, or it might also damage or break it, resulting in abnormal or erratic operation, runaway, etc.
- When conducting any kind of operation for the product, such as maintenance, inspection, repair, or replacement, always turn off the air supply completely and confirm that residual pressure inside the product or in piping connected to the product is zero before proceeding. In particular, be aware that residual air will still be in the air compressor or air storage tank. The actuator could abruptly move if residual air pressure remains inside the piping, causing injury.
- Do not use the actuator for equipment whose purpose is absorbing the shocks and vibrations of mechanical devices. It could break and possibly result in injury or in damage to mechanical devices.
- Avoid scratching the cords for the sensor switch lead wires, etc.
Letting the cords be subject to scratching, excessive bending, pulling, rolling up, or being placed under heavy objects or squeezed between 2 objects, may result in current leaks or defective continuity that lead to fire, electric shock, or abnormal operation.
- For the cylinder rod bushing, when the bore size is 16mm [0.630in.] or less, avoid applying a lateral load with a cylinder thrust force of 1/40 or

more generated by the nominal pressure, or when the bore size is 20mm [0.787in.] or more, avoid applying a lateral load with a cylinder thrust force of 1/20 or more. Such loads could reduce operating life or cause galling or other damage to the rod and tube.

- Do not subject the sensor switch to an external magnetic field during actuator operation. Unintended movements could result in damage to the equipment or in personal injury.
- Use within the recommended load and specified speed. Use exceeding the recommended load and specified speed could cause unintended movement of the rod and plate, and increase the possibility of damage to equipment or of personal injury.
- Use safety circuits or system designs to prevent damage to machinery or injury to personnel when the machine is shut down due to emergency stop or electrical power failure.
- Use under the conditions described below is subject to regulation under the Japanese High Pressure Gas Safety Law. Violation of this law can result in penalties to individuals or the corporation. Before use, perform procedures mandated by the supervising authorities.
 1. Pressurized gases at gauge pressures of 1MPa [145psi.] or more are used at room temperature. (Acetylene gas and liquefied gas are subject to even stricter standards.)
 2. Compressed air at gauge pressures of 5MPa [725psi.] or more are used. For details, see the Japanese High Pressure Gas Safety Law.
- Install relief valves, etc., to ensure that the actuator does not exceed its specified pressure when such pressure is rising due to external forces on the actuator. Excessive pressure could lead to breakdown and damage.
- In initial operations after the equipment has been idle for 48 hours or more, or has been in storage, there is a possibility that contacting parts may stick, resulting in equipment operation delays or sudden movements. For these initial operations, always run a test operation before use to check that operating performance is normal.



CAUTION

- Always wash your hands thoroughly after coming into contact with the grease used in the Low Speed Cylinders. If you light a cigarette with greasy hands, grease adhering to the cigarette could release toxic gases along with the cigarette smoke.
- Do not apply lubrication to the Low Speed Cylinders. Supplying oil could result in erratic operation.
- Do not use the product in locations that are subject to direct sunlight (ultraviolet rays), dust, salt, iron powder, high humidity, or in the ambient atmospheres that include organic solvents, phosphate ester type hydraulic oil, sulphur dioxide, chlorine gas, acids, etc. It could lead to an early shutdown of some functions or a sudden degradation of performance, and result in a reduced operating life. For the materials used, see Major Parts and Materials.
- When installing the product, leave room for adequate working space around it. Failure to ensure adequate working space will make it more difficult to conduct daily inspections or maintenance, which could eventually lead to system shutdown or damage to the product.
- For mounting or transport of heavy products, use a lift, supporting tool, or several people, to provide firm support, and proceed with due caution to ensure personal safety.
- Do not bring floppy disks or magnetic media, etc., within 1 meter [3.28ft.] of the product. There is the possibility that the data on the floppy disks will be destroyed due to the magnetism of the magnet.
- Do not use the sensor switch in locations subject to large electrical currents or strong magnetic fields. It could result in erratic operation. In addition, do not use magnetized materials in the mounting bracket. The magnetism could leak, possibly resulting in erratic operation.
- Do not place too closely to magnets. Placing near magnets or in locations subject to large magnetic fields can magnetize the main body or table, resulting in erratic operation of sensor switches or in other operating problems caused by metal powders sticking to parts.
- Never use other companies' sensor switches with these products. It could possibly cause erratic operation or out of control.
- Do not scratch, dent, or deform the actuator by climbing on the product, using it as a scaffold, or placing objects on top of it. It could result in damaged or broken a product that results in operation shutdown or degraded performance.
- Always post an "operations in progress" sign for installations, adjustments, or other operations, to avoid unintentional supplying of air, electrical power, etc. Such accidental supplies may cause electric shock or sudden activation of the product that could result in physical injury.

- Do not pull on the cords of the lead wires, etc., of the sensor switches mounted on the actuators, grab them when lifting or carrying, or place heavy objects or excessive loads on them. Such action could result in current leaks or defective continuity that lead to fire, electric shock, or abnormal operation.



ATTENTION

- When considering the possibility of using this product in situations or environments not specifically noted in the Catalog or Owner's Manual, or in applications where safety is an important requirement such as in an airplane facility, combustion equipment, leisure equipment, safety equipment, and other places where human life or assets may be greatly affected, take adequate safety precautions such as an application with enough margins for ratings and performance or fail-safe measure.
Be sure to consult us about such applications.
- Always check the catalog and other reference materials for product wiring and plumbing setup.
- Use a protective cover, etc., to ensure that human bodies do not come into direct contact with the operating portion of mechanical devices, etc.
- Do not control in a way that would cause workpieces to fall during power failure. Take control measures so that they prevent the table or workpieces, etc., from falling during power failure or emergency stop of the mechanical devices.
- When handling the product, wear protective gloves, safety glasses, safety shoes, etc., to keep safety.
- When the product can no longer be used, or is no longer necessary, dispose of it appropriately as industrial waste.
- Pneumatic equipment can exhibit degraded performance and function over its operating life. Always conduct daily inspections of the pneumatic equipment, and confirm that all requisite system functions are satisfied, to prevent accidents from happening.
- For inquiries about the product, contact your nearest Koganei sales office or Koganei overseas department. The address and telephone number is shown on the back cover of this catalog.



OTHERS

- Always observe the following items.
 1. When using this product in pneumatic systems, always use genuine KOGANEI parts or compatible parts (recommended parts).
When conducting maintenance and repairs, always use genuine KOGANEI parts or compatible parts (recommended parts). Always observe the required methods.
 2. Do not attempt inappropriate disassembly or assembly of the product relating to basic configurations, or its performance or functions.

Koganei cannot be responsible if these items are not properly observed.



Design and selection

Warning

1. Check the specifications.

As use of this component over the specified ranges of voltage, current, temperature, shock, etc., could result in breakdown or abnormal operation, always read the specifications carefully to ensure correct use.

2. Avoid mounting actuators in close proximity.

Mounting 2 or more actuators with sensor switches in close proximity could result in erratic operation of the sensor switches, due to magnetic field interference with the system.

Follow the instructions of each cylinder series when written in the catalog.

3. Caution about sensor switch ON time for position-detection at intermediate stroke position.

Take caution that if the sensor switch is mounted at an intermediate position of the actuator stroke for detection of the piston travel, the sensor switch actuation time may be too short when the actuator speed is very rapid, so that the load (programmable controller, etc.) may fail to activate.

Maximum cylinder speed for positioning detection

$$V \text{ (mm/s) [in./sec.]} = \frac{\text{Sensor switch actuation range (mm) [in.]}}{\text{Time required for activating load (ms)}} \times 1000$$

4. Keep wiring as short as possible.

The solid state sensor switch lead wire length should be within 30m [98ft.] as stipulated in the EN standards. For the reed sensor switch, if the lead wire is long (10m [33ft.] or more), capacitive surges will shorten the operating life of the sensor switch. If long wiring is needed, install the protection circuit mentioned in the catalog. If the load is inductive or capacitive, also install the protection circuit mentioned in the catalog.

5. Avoid repeated or excessive bending or pulling of lead wires.

Applying repeated bending stress or tension force on the lead wire could result in wire breakage.

6. Check for leakage current.

Two-lead wire solid state sensor switches produce leakage current to activate their internal circuits, and the current flows even when in the turned off condition. Check to ensure they satisfy the following inequality.

Input off current of programmable controller > Leakage current
If the above inequality cannot be satisfied, select a 3-lead wire solid state sensor switch, instead. Also note that parallel connection of a total of n sensor switches will multiply the amount of leakage current by n times.

Caution

1. Check for sensor switch internal voltage drop.

Series connection of reed sensor switches with indicator lamps or 2-lead wire solid state sensor switches causes increasing internal voltage drop, and the load may fail to activate. A total of n sensor switches will lead to n times the internal voltage drop. Ensure that the system satisfies the following inequality.

$$\text{Supply voltage} - \text{Internal voltage drop} \times n > \text{Minimum operating voltage for load}$$

In relays with rated voltage of less than 24VDC, check to see whether the above inequality is satisfied, even in the case of $n = 1$. If the above inequality cannot be satisfied, select a reed sensor switch without indicator lamp.

2. Do not use our sensor switches with other companies' actuators.

The sensor switches are designed for use with Koganei actuators. Use with other companies' actuators could lead to abnormal operation.



Installation and adjustment

Warning

1. Do not subject the sensor switch to an external magnetic field during actuator operation.

Unintended movements could result in damage to the equipment or in personal injury.

Caution

1. Ensure a safe installation environment for the actuators with sensor switches.

Do not use sensor switches in places where large current or magnetic fields are present. This could lead to unintentional operation. Do not use magnetic material for the mounting brackets. It could result in erratic operation.

2. Install sensor switches in the center of their operating range.

Adjust the mounting position of a sensor switch so that the piston stops in the center of its operating range (the range while the sensor turns ON). Operations can be unstable if mounted at the end of the operating range (at the boundary near ON and OFF). Also be aware that the operating range can vary with changes in temperature.

3. Follow the tightening torque of sensor switches when mounting.

Over-tightening beyond the allowed tightening torque may damage the mounting screws, mounting brackets, sensor switches, etc. In addition, insufficient tightening torque could cause the sensor switch position to be changed, resulting in operation instability.

For the tightening torque, follow the instructions of each cylinder series.

4. Do not carry the actuator grabbing its sensor switch lead wires.

After mounting a sensor switch to an actuator, do not grab and lift the lead wires to carry the actuator. Never do this, as it could result in lead wire disconnections, and could also apply stress to the interior of the sensor switch, resulting in breakage of internal elements.

5. Do not drop switches, or bump them against others.

During handling of switches, do not apply excessive shocks (294.2m/s² [30G] or more) such as hitting, dropping, or bumping. In reed sensor switches, the contact reed can be activated unintentionally, causing it to send or break sudden signals. It can also cause changes in the contact interval that lead to changes in sensor switch sensitivity and result in erratic operation. Even if the sensor switch case is undamaged, the inner parts of the sensor switch may suffer breakdown or cause erratic operation.



Wiring

Danger

1. Avoid letting moving objects near sensor switches come into contact with them.

When actuators with sensor switches are moving, or when moving objects are nearby, do not let the moving objects come into contact. In particular, lead wires could become worn out or damaged, causing operational instability in the sensor switch. In the worst case, it could result in current leaks or electrical shock.

2. Always turn off the power supply for wiring work.

Conducting wiring work while the power is on could result in electric shock. Also, incorrect wiring could damage sensor switches in an instant. Turn on the power only after wiring work is completed.

Warning

1. Check the Catalog, etc., to ensure that the sensor switch wiring is correctly connected.

Miswiring could result in abnormal operation.

2. Do not share the same wiring with power or high voltage lines.

Avoid wiring in parallel to or shared with power or high voltage lines. The sensor switch or control circuit may suffer electric noise that results in erratic operation.

3. Avoid repeated or excessive bending or pulling on lead wires.

Applying repeated bending stress or tension force on the lead wire could result in wire breakage.

4. Check polarity in the wiring.

In sensor switches that specify polarity (+, –, output), be sure that wiring connections are correct. The wrong polarity could result in damage to the sensor switch.

Caution

1. Avoid short circuiting the loads.

Turning a sensor switch on while the load is short-circuited causes overcurrent, which will damage the sensor switch in an instant.





Example of short-circuited load: Sensor switch's output lead wire is directly connected to the power supply.

Before selecting and using products, please read all the Safety Precautions carefully to ensure proper product use.

The Safety Precautions shown below are to help you use the product safely and correctly, and to prevent injury or damage to assets beforehand.

Follow the Safety Precautions for: ISO4414 (Pneumatic fluid power—Recommendations for the application of equipment to transmission and control systems), JIS B 8370 (Pneumatic system regulations)

The directions are ranked according to degree of potential danger or damage: “DANGER!” “WARNING!” “CAUTION!” and “ATTENTION!”

 DANGER	Expresses situations that can be clearly predicted as dangerous. If the noted danger is not avoided, it could result in death or serious injury. It could also result in damage or destruction of assets.
 WARNING	Expresses situations that, while not immediately dangerous, could become dangerous. If the noted danger is not avoided, it could result in death or serious injury. It could also result in damage or destruction of assets.
 CAUTION	Expresses situations that, while not immediately dangerous, could become dangerous. If the noted danger is not avoided, it could result in light or semi-serious injury. It could also result in damage or destruction of assets.
 ATTENTION	While there is little chance of injury, this content refers to points that should be observed for appropriate use of the product.

■ This product was designed and manufactured as parts for use in General Industrial Machinery.

■ In the selection and handling of equipment, the system designer or other person with fully adequate knowledge and experience should always read the Safety Precautions, Catalog, User’s Manual and other literature before commencing operation. Making mistakes in handling is dangerous.

■ After reading the Instruction Manual, Catalog, etc., always place it where it can be easily available for reference to users of this product.

■ If transferring or lending the product to another person, always attach the Instruction Manual, Catalog, etc., to the product where it is easily visible, to ensure that the new user can use the product safely and properly.

■ The danger, warning, and caution items listed under these “Safety Precautions” do not cover all possible cases. Read the catalog and user’s manual carefully, and always keep safety first.

DANGER

- Do not use for the purposes listed below:
 1. Medical equipment related to maintenance or management of human lives or bodies.
 2. Mechanical devices or equipment designed for the purpose of moving or transporting people.
 3. Critical safety components in mechanical devices.
 This product has not been planned or designed for purposes that require advanced stages of safety. It could cause injury to human life.
- Do not use in locations with or near dangerous substances such as flammable or ignitable substances. This product is not explosion-proof. It could ignite or burst into flames.
- When attaching the product and workpiece, always ensure that it is securely mounted in place. Dropping or falling the product or improper operation could result in injury.
- Persons who use a pacemaker, etc., should keep a distance of at least one meter [3.28ft.] away from the product. There is a possibility that the pacemaker will malfunction due to the strong magnet built into the product.
- Never attempt to remodel the product. It could result in abnormal operation leading to injury, electric shock, fire, etc.
- Never attempt inappropriate disassembly, assembly or repair of the product’s basic construction, or of its performance or functions. It could result in injury, electric shock, fire, etc.
- Do not splash water on the product. Spraying it with water, washing it, or using it underwater could result in malfunction of the product leading to injury, electric shock, fire, etc.
- While the product is in operation, avoid touching it with your hands or otherwise approaching too close. In addition, do not make any adjustments to the interior or to the attached mechanisms (manual override, connecting and disconnecting of wiring connectors, adjustment of pressure switches, or release or connection of piping tubes or plugs) while in operation. The actuator can move suddenly, possibly resulting in injury.

WARNING

- Do not use the product in excess of its specification range. Such use could result in product breakdowns, function stop or damage or drastically reduce the operating life.
- Before supplying air or electricity to the device and before starting operation, always conduct a safety check of the area of machine operation. Unintentional supply of air or electricity could possibly result in electric shocks, or in injury caused by contact with moving portion.
- Do not touch the terminal and the miscellaneous switches, etc., while the device is power on. There is a possibility of electric shock and abnormal operation.
- Do not allow the product to be thrown into fire. The product could explode and/or release toxic gases.
- Do not sit on the product, place your foot on it, or place other objects on it. Accidents such as falling and tripping over could result in injury. Dropping the product may result in injury, or also damage or break the product resulting in abnormal or erratic operation, or runaway etc.
- When conducting any kind of operation for the product, such as maintenance, inspection, repair, or connect/disconnect or replacement of piping, always turn off the air supply completely and confirm that residual pressure inside the product or in piping connected to the product is zero before proceeding. In particular, be aware that residual air will still be in the air compressor or air storage tank. The actuator could abruptly move if residual air pressure remains inside the piping, causing injury.
- Before commencing normal operation, always release the lock on the locking type manual override, and confirm that the manual override is in the normal position and that the main valve is in the proper switching position, and only then commence the operation. Failure to do so could lead to erroneous operation.
- Always shut off power when performing wiring operations. Leaving the power on could result in electric shocks.
- Apply the specified voltage for the solenoid. Using the wrong voltage level will prevent the solenoid from performing its function, and could lead to breakage or burn damage of the product itself.
- Avoid scratching the cords for the sensor switch lead wires, etc. Letting the cords be subject to scratching, excessive

bending, pulling, rolling up, or being placed under heavy objects or squeezed between two objects, may result in current leaks or defective transmission that lead to fires, electric shocks, or abnormal operation.

- Do not pull out the connectors while the power is ON. Also, do not put unnecessary stress on the connector. It could result in erroneous equipment operation that could lead to personal injury, equipment breakdown, or electrical shocks, etc.
- Always check the Catalog to ensure that the product wiring and piping is done correctly. Errors in wiring and piping could lead to abnormal operation of the actuators, etc.
- In the first operation after the equipment has been idle for 48 hours or more, or has been in storage, there is a possibility that contacting parts have been stuck, resulting in equipment operation delays or sudden movements. For these first operations, always run a test operation before use to check that operating performance is normal.
- In low frequency use (more than 30 days between uses), there is a possibility that contact parts will stick, resulting in equipment operation delays or sudden movements that could lead to personal injury. Run a test operation at least once every 30 days to confirm that movement is normal.
- For double solenoid type (excluding the Tandem 3-port valve), do not apply current through both solenoids simultaneously. It is impossible in such a situation to maintain the correct valve position, and the equipment may operate in an unintended direction, leading to the possibility of equipment breakdown or personal injury.
- Do not use the solenoid valves or the wiring that controls them, near power lines where large electrical currents are flowing, or in locations subject to powerful magnetic fields or power surges. Such application could lead to unintended operation.
- The solenoid valve can generate surge voltage and electromagnetic waves when the switch is turned off, affecting the operations of surrounding equipment. Use solenoids with surge suppression, or take countermeasures in the electrical circuits for surges or electromagnetic waves.
- Do not use where ozone may be generated, such as near ocean beaches or other places subject to direct sunlight or mercury lamps. Ozone can cause rubber parts to deteriorate, which can lead to degraded performance and functions, or to equipment stoppages and functional shutdown. (Excludes items where measures against ozone have been taken.)
- Do not use any media other than shown on the specifications. Use of non-specified media could lead to functional shutdown after a short period, to sudden performance drops, or to shorter operating life.
- If mounting the solenoid valve inside a control panel, or if energizing it for long periods, provide heat radiation measures to ensure that temperatures surrounding the solenoid valve always remain within the specified temperature range. If energizing the unit for long periods, consult us.
- After finishing wiring operations, always check to ensure that no wiring connection errors exist before turning on the power.
- Do not collect the exhaust lines for air cylinders, etc. with pilot exhaust lines for solenoid valves into the same piping, etc. Interference in the exhaust could result in erratic operation.



CAUTION

- When mounting the product, leave room for adequate working space around it. Failure to ensure adequate working space will make it more difficult to conduct daily inspections or maintenance, which could eventually lead to system shutdown or damage to the product.
- For mounting or transport of heavy products, use a lift, supporting tool, or several people, to provide firm support, and proceed with due caution to ensure personal safety.
- Do not bring floppy disks or magnetic media, etc., within one meter [3.28ft.] of the product. There is the possibility that the data on the floppy disks will be destroyed due to the magnetism of the magnet.
- If leakage current is occurring in the control circuit, there is a possibility of the product performing an unintended operation. Take measures against current leaking in the control circuit, to ensure that the leakage current value does not exceed the allowed range in the product specifications.

- Do not block the product's breathing holes. Pressure changes occur due to changes in volume during operation. Blocking the breathing holes destroys the pressure balance, and could cause failure of the intended operation, equipment damage, or personal injury.
- Do not use the solenoid valve in locations subject to large electrical currents or magnetic fields. It could result in erratic operation.
- Oily materials from the compressor (excluding the oil-free compressor) can cause drastic deterioration in product performance, and even a functional shutdown. Always install a mist filter before pneumatic equipment to remove the oily component.
- The properties of the lubrication oil can change when used in dry air where dew point temperatures is lower than -20 degrees Celsius [-4°F]. It could result in degraded performance or in functional shutdown.
- Do not use the product in locations of direct sunlight (ultraviolet), in locations subject to dust, salt, or iron powder, in locations with humidity and high temperature, or in the media and/or the ambient atmospheres that include organic solvents, phosphoric ester type hydraulic oil, sulfur dioxide, chlorine gas, or acids, etc. These conditions could lead to functional shutdowns, sudden degraded performance, or shortened operating life in a brief period of time. For materials used, see Major Parts and Materials.



ATTENTION

- When considering the possibility of using this product in situations or environments not specifically noted in the Catalog or User's Manual, or in applications where safety is an important requirement, such as in an airplane facility, combustion equipment, leisure equipment, safety equipment and other places where human life or assets may be greatly affected, take adequate safety precautions such as application with enough margins for ratings and performance or fail-safe measures. Be sure to consult us with such applications.
- Always check the catalog and other reference materials for product wiring and piping.
- Install a muffler, etc. on the exhaust port. It is effective in reducing exhaust noise.
- When handling the product, wear protective gloves, safety glasses, safety boots, etc. to keep safety.
- When the product can no longer be used, or is no longer necessary, dispose of it appropriately as industrial waste.
- Pneumatic equipment can exhibit degraded performance and function over its operating life. Always conduct daily inspections of the pneumatic equipment, and confirm that all requisite system functions are satisfied, to prevent accidents from happening.
- Air leaks from the valve are not zero. For application of requiring holding pressure (including vacuum) inside the pressure vessel, consider adequate margin of capacity and holding time in design of the system.
- For inquiries about the product, consult your nearest Koganei sales office or Koganei overseas department. The address and telephone number is shown on the back cover of this catalog.



OTHERS

- Always observe the following items.
 1. When using this product in pneumatic systems, always use genuine KOGANEI parts or compatible parts (recommended parts).
When conducting maintenance and repairs, always use genuine KOGANEI parts or compatible parts (recommended parts). Always observe the required methods and procedure.
 2. Do not attempt inappropriate disassembly or assembly of the product relating to basic construction, or its performance or functions.

Koganei cannot be responsible if these items are not properly observed.

General Precautions

Mounting

1. While any mounting direction is allowed, be sure to avoid strong shocks or vibrations applied directly to the body. Also, avoid strong shocks in the lateral direction when using a mounting base for installation. For the order code, see the Additional Parts item under each series.
2. Avoid using in the locations and environment listed below, as it could result in malfunction of the valve. If use in such conditions is unavoidable, always provide a cover or other adequate protective measures.
 - Location directly exposed to water drops or oil drops
 - Environment where a valve body is subject to dew condensation
 - Location directly exposed to machining chips, dust, etc
3. Install a muffler, etc. in the exhaust port to prevent dust from entering into the piping.
4. In piping connection with valves, flush the tube completely (by blowing compressed air) before piping. Intrusion of machining chips or sealing tape, rust, etc., generated during plumbing could result in air leaks and other defective operations.
5. When mounting a valve unit inside the control panels or when the operation requires long energizing periods, consider providing heat radiation measure such as ventilation.
6. Never use the valve with the 4(A) and 2(B) ports vent to atmosphere.

Media

1. Use air for the media. For the use of any other media, consult us.
2. Air used for the cylinder should be clean air that contains no deteriorated compressor oil, etc. Install an air filter (filtration of 40 μm or less) near the valve to remove collected liquid or dust. In addition, drain the air filter periodically.
3. When supply pressure is low, use piping for the 1(P) port with sufficient tube size.

Lubrication

Can be used without lubrication. When the actuator requires lubrication, use Turbine Oil Class 1 (ISO VG32) or the equivalent. Avoid using spindle oil or machine oil.

Atmosphere

The product cannot be used when the media or ambient atmosphere contains any of the substances listed below. Organic solvents, phosphate ester type hydraulic oil, sulphur dioxide, chlorine gas, or acids, etc.

How to find the flow rate

Subsonic speed flow when
 $P_1 + 0.1013 < 1.89 (P_2 + 0.1013)$

$$Q = 226S \sqrt{\Delta P (P_2 + 0.1013)}$$

Sonic speed flow when
 $P_1 + 0.1013 \geq 1.89 (P_2 + 0.1013)$

$$Q = 113S (P_1 + 0.1013)$$

Q: Air flow rate [ℓ/min (ANR)]

S: Effective area [mm^2]

ΔP : Pressure drop $P_1 - P_2$ [MPa]

P_1 : Upstream pressure [MPa]

P_2 : Downstream pressure [MPa]

※ Corrections for variances in air temperature
 Multiply the flow rate calculated in the formula above by the coefficients in the table below.

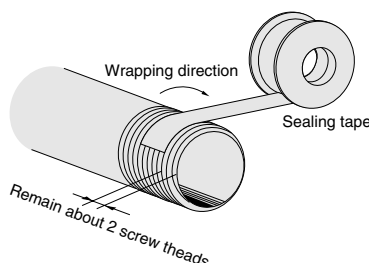
Air temperature °C [°F]	-20 [-4]	-10 [14]	0 [32]	10 [50]	30 [86]	40 [104]	50 [122]	60 [140]
Correction coefficient	1.08	1.06	1.04	1.02	0.98	0.97	0.95	0.94

Piping

Since the 1(P) and exhaust ports are on both ends of the manifold, piping direction can be selected depending on the application (excluding some models). At shipping, plugs are temporarily screwed in ports at one end, but are not firmly tightened. Regardless of which end piping is connected, always remove the plugs, use sealing tape or apply other sealing agent, and securely tighten the plugs into the unused ports.

1. Sealing tape wrapping method

- ① Before piping, use air blowing (flushing) or cleaning to eliminate any machining chips, cutting oil, or dust, etc., remaining inside the pipes.
- ② When screwing in piping or fittings, caution should be taken to avoid letting machining chips or sealing materials from entering into the valves. When using sealing tape, wrap it so that 1.5~2 screw threads remain.



2. Tightening torque for piping

Connection thread	Suitable tightening torque N·cm (kgf·cm) [in·lbf]
M3	59 (6) [5.2]
M5×0.8	157 (16) [13.9]
Rc (PT) 1/8	686~883 (70~90) [60.8~78.1]
Rc (PT) 1/4	1177~1373 (120~140) [104~122]
Rc (PT) 3/8	2157~2354 (220~240) [191~208]
Rc (PT) 1/2	2746~2942 (280~300) [243~260]
Rc (PT) 3/4	2746~2942 (280~300) [243~260]
Rc (PT) 1	3530~3727 (360~380) [313~330]
Rc (PT) 1 1/4	3923~4119 (400~420) [347~365]
Rc (PT) 1 1/2	4707~4903 (480~500) [417~434]

Block-off plate

To close the unused stations, use a block-off plate.

For the order code, see the Additional Parts item under each series.

- Cautions:**
1. For the 1(P) port piping, use a size that matches the manifold's piping connection port.
 2. When installing piping or mufflers to the exhaust port, ensure there will be minimum exhaust resistance.
 3. On rare occasions, exhaust can interfere with other valves and actuators. In this case, let exhaust from the R ports on both ends.
 4. When a multiple number of valves are operating simultaneously on a multi-unit manifold, or during high frequency applications, supply air from the 1(P) ports on both ends, and let exhaust from the R ports on both ends.
 5. Since the twin solenoid valve uses 2 stations, it cannot be mounted on the final station.
 6. In the 025 series, the seal between the valve and manifold is used reversed top-to-bottom, in accordance with the valve function (NC or NO). Install the seal as the mark (NC or NO) is located on the valve side and matches the valve function.

Tube installation and removal

Insert the tube to connect as far as the tube stopper contacts the tubes. Pull the tube to confirm the connection.

For tube removal, push the release ring forward parallel to the ring, and pull the tube out.

Tubes

Either nylon or urethane tubes can be used. Use tubes that are not scratched on their outer surface.

The tube's outer diameter tolerance should be within $\pm 0.1\text{mm}$ [$\pm 0.004\text{in.}$] of the nominal dimension, and within 0.2mm [0.008in.] for the ellipticity (difference between long and short diameter).

Caution: Do not excessively bend the tube near fittings.





Before selecting and using the product, please read all the Safety Precautions carefully to ensure proper product use.

The Safety Precautions shown below are to help you use the product safely and correctly, and to prevent injury or damage to you, other people, and assets beforehand.

Follow the Safety Precautions for: ISO4414 (Pneumatic fluid power—Recommendations for the application of equipment to transmission and control systems), JIS B 8370 (Pneumatic system regulations)

The directions are ranked according to degree of potential danger or damage:

“DANGER!”, “WARNING!”, “CAUTION!”, and “ATTENTION!”

 DANGER	Expresses situations that can be clearly predicted as dangerous. If the noted danger is not avoided, it could result in death or serious injury. It could also result in damage or destruction of assets.
 WARNING	Expresses situations that, while not immediately dangerous, could become dangerous. If the noted danger is not avoided, it could result in death or serious injury. It could also result in damage or destruction of assets.
 CAUTION	Expresses situations that, while not immediately dangerous, could become dangerous. If the noted danger is not avoided, it could result in light or semi-serious injury. It could also result in damage or destruction of assets.
 ATTENTION	While there is little chance of injury, this content refers to points that should be observed for appropriate use of the product.

■ This product was designed and manufactured as parts for use in General Industrial Machinery.

- In the selection and handling of the equipment, the system designer or other person with fully adequate knowledge and experience should always read the Safety Precautions, Catalog, Owner's Manual and other literature before commencing operation. Making mistakes in handling is dangerous.
- After reading the Owner's Manual, Catalog, etc., always place them where they can be easily available for reference to users of this product.
- If transferring or lending the product to another person, always attach the Owner's Manual, Catalog, etc., to the product where they are easily visible, to ensure that the new user can use the product safely and properly.
- The danger, warning, and caution items listed under these “Safety Precautions” do not cover all possible cases. Read the Catalog and Owner's Manual carefully, and always keep safety first.



DANGER

- Do not use the product for the purposes listed below:
 1. Medical equipment related to maintenance or management of human lives or bodies.
 2. Mechanical devices or equipment designed for the purpose of moving or transporting people.
 3. Critical safety components in mechanical devices.

This product has not been planned or designed for purposes that require advanced stages of safety. It could cause injury to human life.
- Do not use the product in locations with or near dangerous substances such as flammable or ignitable substances. This product is not explosion-proof. It could ignite or burst into flames.
- When mounting the product and workpiece, always firmly support and secure them in place. Dropping or falling the product or improper operation could result in injury.
- Persons who use a pacemaker, etc., should keep a distance of at least 1 meter [3.28ft.] away from the product. There is a possibility that the pacemaker will malfunction due to the strong magnet built into the product.
- Never attempt to remodel the product. It could result in abnormal operation leading to injury, electric shock, fire, etc.
- Never attempt inappropriate disassembly, or assembly of the product relating to its basic inner construction, or to its performance or functions. It could result in injury, electric shock, fire, etc.
- Do not splash water on the product. Spraying it with water, washing it, or using it underwater could result in malfunction of the product leading to injury, electric shock, fire, etc.
- While the product is in operation, avoid touching it with your hands or otherwise approaching too close. In addition, do not make any adjustments to the interior or to the attached mechanisms (manual override, disconnection or connection of wiring connectors, adjustment of pressure switches, or disconnection of piping tubes or plugs, positioning of mounting products). Improper handling of the product could cause it to fall or operate abnormally, which could result in injury.



WARNING

- Do not use the product in excess of its specification range. Such use could result in product breakdowns, function stop, damage, or drastically reduce the operating life.
- Before supplying air to the device and before starting operation, always conduct a safety check of the area of machine operation. Unintentional supply of air or electricity could possibly result in electric shock, or in injury caused by contact with moving parts.
- Do not touch the terminals and the miscellaneous switches, etc., while the device is powered on. There is a possibility of electric shock and abnormal operation.
- Do not throw the product into fire.
- The product could explode and/or release toxic gases.
- Do not sit on the product, place your foot on it, or place other objects on it.
- Accidents such as falling could result in injury. Dropping or toppling the product may result in injury, or it might also damage or break it, resulting in abnormal or erratic operation, runaway, etc.
- When conducting any kind of operation for the product, such as maintenance, inspection, repair, or replacement, always turn off the air supply completely and confirm that residual pressure inside the product or in piping connected to the product is zero before proceeding. In particular, be aware that residual air will still be in the air compressor or vacuum pump or air storage tank. The actuator could abruptly move if residual air pressure remains inside the piping, causing injury.
- In preparation for equipment shutdowns due to emergency stops, power blackouts, or other system problems, prepare safety circuit and equipment designs that prevent the occurrence of equipment damage or personal injury.
- Always release the lock on the locking type manual override before commencing normal operations. An unreleased lock could result in incorrect operation.
- Always shut OFF the power before wiring operations. Wiring with the power ON could result in electrical shocks.
- Always apply the stipulated amount of voltage to the solenoids. Applying the wrong voltage could result in failure to perform the intended function, and could damage or burn the product itself.
- Avoid scratching the cords for the sensor switch lead wires, etc.
- Letting the cords be subject to scratching, excessive bending, pulling, rolling up, or being placed under heavy objects or squeezed between two objects, may result in current leaks or defective continuity that lead

CAUTION

For Fluoresin Products, always read the Safety Precautions on p.819 and 866 carefully before use.

to fire, electric shock, or abnormal operation.

- Do not pull out or plug in the connectors while the power is ON. Also, do not put unnecessary stress on the connector. It could result in erratic equipment operation that could lead to personal injury, equipment breakdown, or electrical shock, etc.
- Always check the Catalog to ensure that the product wiring and piping is done correctly. Errors in wiring and piping could lead to abnormal operation of the actuators, etc.
- When mounting a solenoid valve or electro-pneumatic transducing regulator inside a control panel, or when supplying electrical power to such units over long periods of time, take heat radiation measures to ensure that temperatures surrounding the solenoid valve or electro-pneumatic transducing regulator remain within the specified ambient temperature range. If planning long periods of continuous energizing, consult us.
- In low frequency use (more than 30 days between uses), there is a possibility that contacting parts may have stuck together, resulting in equipment operation delays or sudden movements that could lead to personal injury. Run a test operation at a minimum operations frequency of 30 days between tests to confirm that movement is normal.
- Do not locate solenoid valves, electro-pneumatic transducing regulators, or the wiring for controlling such units near power lines carrying large electrical currents, or in areas subject to the generation of powerful magnetic fields or electrical surges. Such location could result in unintentional operations.
- Surge voltages and electromagnetic pulses could occur when solenoid valves and electro-pneumatic transducing regulators are being switched OFF, which could have an effect on the operations of surrounding equipment. Either use solenoids with surge suppression, or take protective measures against surges and electromagnetic pulses on electrical circuits.
- Do not use the product where ozone may be generated, such as near ocean beaches or other places subject to direct sunlight or mercury lamps. Ozone can cause rubber parts to deteriorate, which can lead to degraded performance and functions, or to equipment stoppages. (Excludes items where measures against ozone have been taken.)
- Do not use any media other than shown on the specifications. Use of non-specified media could lead to functional shutdown after a short period, to sudden performance drops, or to shorter operating life.
- In initial operations after the equipment has been idle for 48 hours or more, or has been in storage, there is a possibility that contacting parts may have stuck together, resulting in equipment operation delays or sudden movements. For these initial operations, always run a test operation before use to check that operating performance is normal.
- After wiring operations, always check to ensure that no wiring connection errors exist before turning ON the power.

CAUTION

- Do not use the product in locations that are subject to direct sunlight (ultraviolet rays), dust, salt, iron powder, high temperature, high humidity, or in the ambient atmospheres that include organic solvents, phosphate ester type hydraulic oil, sulphur dioxide, chlorine gas, acids, etc. It could lead to an early shutdown of some functions or a sudden degradation of performance, and result in a reduced operating life. For the materials used, see Major Parts and Materials.
- When installing the product, leave room for adequate working space around it. Failure to ensure adequate working space will make it more difficult to conduct daily inspections or maintenance, which could eventually lead to system shutdown or damage to the product.
- For mounting or transport of heavy products, use a lift, supporting tool, or several people, to provide firm support, and proceed with due caution to ensure personal safety.
- Always post an "operations in progress" sign for installations, adjustments, or other operations, to avoid unintentional supplying of air, electrical power, etc. Such accidental supplies may cause electric shock or sudden activation of the product that could result in physical injury.
- Do not bring floppy disks or magnetic media, etc., within 1 meter [3.28ft.] of the energized valves or electro-pneumatic transducing regulators. There is the possibility that the data on the floppy disks will be destroyed due to the magnetism of the magnet.
- Depending on the product, generation of leakage current on a control circuit could result in unintentional equipment motion. Take measures to ensure that the amount of current leaking into the control circuit does not exceed the leakage current limits allowed in the product specifications.

- For lubrication of sliding areas, use the specified lubricants. Use of the wrong lubricant could result in alteration or deterioration of the operating material's physical properties, or in degradation of its performance.
- Do not block the product's breathing holes. This will result in pressure changes due to changes in volume during operation. Blocking the breathing holes destroys the pressure balance, and could cause failure of the intended operation, equipment damage, or personal injury.
- The pressure used in vacuum equipment is vacuum (negative) pressure. Be careful to prevent positive pressure from intruding, which could cause damage to vacuum gauges and vacuum pumps. Moreover, supply of pressure greater than 0.2MPa [29psi.] for **VR100**, or 0.5MPa [73psi.] for **VR200** and **NVRA200**, could result in damage to the product.
- The properties of the lubrication oil can change if using in dry air where dew point temperatures is lower than -20°C [-4°F]. It could result in degraded performance or in functional shutdown.

ATTENTION

- When considering the possibility of using this product in situations or environments not specifically noted in the Catalog or Owner's Manual, or in applications where safety is an important requirement such as in an airplane facility, combustion equipment, leisure equipment, safety equipment, and other places where human life or assets may be greatly affected, take adequate safety precautions such as an application with enough margins for ratings and performance or fail-safe measure.
Be sure to consult us about such applications.
- Always check the catalog and other reference materials for product wiring and plumbing setup.
- Use a protective cover, etc., to ensure that human bodies do not come into direct contact with the operating portion of mechanical devices, etc.
- Do not control in a way that would cause workpieces to fall during power failure. Take control measures so that they prevent the table or workpieces, etc., from falling during power failure or emergency stop of the mechanical devices.
- Install a muffler, etc., on the exhaust port. It is effective in reducing exhaust noise.
- After adjusting the pressure, lock the pressure regulating knob.
- When handling the product, wear protective gloves, safety glasses, safety shoes, etc., to keep safety.
- When the product can no longer be used, or is no longer necessary, dispose of it appropriately as industrial waste.
- Pneumatic equipment can exhibit degraded performance and function over its operating life. Always conduct daily inspections of the pneumatic equipment, and confirm that all requisite system functions are satisfied, to prevent accidents from happening.
- For inquiries about the product, contact your nearest Koganei sales office or Koganei overseas department. The address and telephone number is shown on the back cover of this catalog.

OTHERS

- Always observe the following items.
 1. When using this product in pneumatic systems, always use genuine KOGANEI parts or compatible parts (recommended parts).
When conducting maintenance and repairs, always use genuine KOGANEI parts or compatible parts (recommended parts). Always observe the required methods.
 2. Do not attempt inappropriate disassembly or assembly of the product relating to basic configurations, or its performance or functions.

Koganei cannot be responsible if these items are not properly observed.