Safety Instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by labels of **"Caution", "Warning"** or **"Danger"**. To ensure safety, be sure to observe ISO 4414 Note 1), JIS B 8370 Note 2) and other safety practices.

⚠ **Caution :** Operator error could result in injury or equipment damage.

⚠ **Warning :** Operator error could result in serious injury or loss of life.

⚠ **Danger :** In extreme conditions, there is a possible result of serious injury or loss of life.

Note 1) ISO 4414: Pneumatic fluid power--General rules relating to systems.
Note 2) JIS B 8370: General Rules for Pneumatic Equipment

⚠ Warning

1. The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.

Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements. The expected performance and safety assurance will be the responsibility of the person who has determined the compatibility of the system. This person should continuously review the suitability of all items specified, referring to the latest catalog information with a view to giving due consideration to any possibility of equipment failure when configuring a system.

2. Only trained personnel should operate pneumatically operated machinery and equipment.

Compressed air can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.

3. Do not service machinery/equipment or attempt to remove components until safety is confirmed.

1. Inspection and maintenance of machinery/equipment should only be performed once measures to prevent falling or runaway of the driver objects have been confirmed.
2. When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for this equipment and exhaust all residual compressed air in the system.
3. Before machinery/equipment is restarted, take measures to prevent shooting-out of cylinder piston rod, etc.

4. Contact SMC if the product is to be used in any of the following conditions:

1. Conditions and environments beyond the given specifications, or if product is used outdoors.
2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, clutch and brake circuits in press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

Common Precautions

Be sure to read before handling.
For detailed precautions on every series, refer to main text.

Selection

⚠ Warning

1. Confirm the specifications.

Products represented in this catalog are designed for use in compressed air appllications only (including vacuum), unless otherwise indicated.
Do not use the product outside their design parameters.
Please contact SMC when using the products in applications other than compressed air (including vacuum).

Mounting

⚠ Warning

1. Instruction manual

Install the products and operate them only after reading the instruction manual carefully and understanding its contents. Also keep the manual where it can be referred to as necessary.

2. Securing the space for maintenance

When installing the products, please allow access for maintenance.

3. Tightening torque

When installing the products, please follow the listed torque specifications.

Piping

⚠ Caution

1. Before piping

Make sure that all debris, cutting oil, dust, etc, are removed from the piping.

2. Wrapping of pipe tape

When screwing piping or fittings into ports, ensure that chips from the pipe threads or sealing material do not get inside the piping. Also, when the pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.

Air Supply

⚠ Warning

1. Operating fluid

Please consult with SMC when using the product in applications other than compressed air (including vacuum).
Regarding products for general fluid, please ask SMC about applicable fluids.

2. Install an air dryer, aftercooler, etc.

Excessive condensate in a compressed air system may cause valves and other pneumatic equipment to malfunction.
Installation of an air dryer, after cooler etc. is recommended.

3. Drain flushing

If condensate in the drain bowl is not emptied on a regular basis, the bowl will over flow and allow the condensate to enter the compressed air lines.
If the drain bowl is difficult to check and remove, it is recommended that a drain bowl with the auto-drain option be installed.
For compressed air quality, refer to “Air Preparation Equipment” catalog.

4. Use clean air

If the compressed air supply is contaminated with chemicals, cynthetic materials, corrosive gas, etc., it may lead to break down or malfunction.

Operating Environment

⚠ Warning

1. Do not use in environments where the product is directly exposed to corrosive gases, chemicals, salt water, water or steam.

2. Do not expose the product to direct sunlight for an extended period of time.

3. Do not use in a place subject to heavy vibrations and/or shocks.

4. Do not mount the product in locations where it is exposed to radiant heat.

Maintenance

⚠ Warning

1. Maintenance procedures are outlined in the operation manual.

Not following proper procedures could cause the product to malfunction and could lead to damage to the equipment or machine.

2. Maintenance work

If handled improperly, compressed air can be dangerous.
Assembly, handling and repair of pneumatic systems should be performed by qualified personnel only.

3. Drain flushing

Remove drainage from air filters regularly. (Refer to the specifications.)

4. Shut-down before maintenance

Before attempting any kind of maintenance make sure the supply pressure is shut of and all residual air pressure is released from the system to be worked on.

5. Start-up after maintenance and inspection

Apply operating pressure and power to the equipment and check for proper operation and possible air leaks. If operation is abnormal, please verify product set-up parameters.

6. Do not make any modifications to be product.

Do not take the product apart.

Digital Pressure Switches
Precautions 1

Be sure to read before handling. Refer to pages 16-14-3 to 16-14-4 for Safety Instructions and Common Precautions on the products mentioned in this catalog, and refer to main text for more detailed precautions on every series.

Selection

⚠ Warning

1. Monitor the internal voltage drop of a switch.

When operating below the specified voltage, it is possible that a load may be ineffective, even though the pressure switch functions normally. Therefore, the formula below should be satisfied after confirming the voltage of operating load.

Supply voltage − Internal voltage drop of switch > Voltage of operation load

2. Leakage current

A 2-wire switch design requires a minimal amount of current (1 mA or less) to flow through the switch in the OFF condition.

Load operating current (Input OFF current on controller) > Switch leakage current

If the above condition is not met, the switch fails to return (remains ON). If it does not meet the specifications, use a 3-wire switch. If n pieces of switches are connected in parallel, n times the current flows through the loads.

⚠ Caution

1. Adsorption confirmation switch for presence of a workpiece.

Use the Air Catch Sensor (back pressure sensor) Series ISA (dustproof/dripproof type) for correct workpiece placement.

2. The calibration data is stored in an EDPROM.

Input data (set pressure, etc.) is be stored in EEPROM, so that the data will not be lost after the pressure switch is turned off. (Data is stored for up to 100,000 hours after the power is turned off.)

Mounting

⚠ Warning

1. Do not drop or apply the excessive force (1000 m/s^2) to a switch when handling.

Do not drop, or bump, or apply the excessive force (more than 1000 m/s^2) when handling a switch. The internal parts of a switch are damaged, and may result in a malfunction, even though a switch case itself is not damaged.

2. When handling a switch, hold it by the switch body.

The tensile strength of the power source cord is 49 N. If pulling with more strength, switch may be damaged. When handling a switch, hold it by the switch body.

3. Operation by the button

Refer to the instruction manual for operating by the button for the digital pressure switch.

4. Do not touch the LCD readout.

Do not touch the LCD indicator face of the pressure switch during operation. Static electricity can change the readout.

5. Use a straight bladed watchmakers' screwdriver for the set trimmer to turn it softly.

Use a straight bladed watchmakers' screwdriver to adjust the set trimmer for I(Z)SE1/I(Z)SE2/PS1□00. Turn it softly, but do not turn more when reached to the stopper at both ends. If a trimmer were broken, it would be impossible to adjust it.

6. Pressure port

Do not introduce any wire or similar object to a pressure port as this may damage the pressure sensor and cause a malfunction.

Wiring

⚠ Warning

1. Do not wire in conjunction with power lines or high voltage lines.

Wire separately from power lines and high voltage lines, avoiding wiring in the same conduit with these lines. Control circuits including switches may malfunction due to noise from these other lines.

2. Do not connect directly the power source and the output wire.

(2-wire type)

If a switch changes to the ON condition without any load connected, damage will occur due to overcurrent flow.

3. Do not short-circuit a load.

(3-wire type)

The digital pressure switches display an error code if the load is short-circuited, but it is impossible to protect the switch from wiring errors.

As for other pressure switches, the switches will be instantly damaged if loads are short-circuited. Use caution to avoid reverse wiring between the power supply line (brown) and the output line (black) for 3-wire type particularly.

Digital Pressure Switches
Precautions 2

Be sure to read before handling. Refer to pages 16-14-3 to 16-14-4 for Safety Instructions and Common Precautions on the products mentioned in this catalog, and refer to main text for more detailed precautions on every series.

Piping

⚠ Caution

1. Piping materials such as air hose, etc.

If a switch is used in a panel-mount application, the excessive stress may be applied on the switch body by the piping materials such as air hose, etc. Make sure not to apply such an excessive force by piping materials.

Pressure Source

⚠ Warning

1. Use a switch within the specified fluid and ambient temperature range.

Ambient and fluid temperature operation is as follows: Digital pressure switches: 0 to 50°C, other pressure switches: 0 to 60°C. Take measures to prevent moisture from freezing in circuits when below 5°C, since this may cause damage to the O-ring and lead to a malfunction. The installation of an air dryer is recommended for eliminating condensate and moisture. Never use the switch in an environment where there are drastic temperature changes even when these temperatures are operated within the specified temperature range.

2. Vacuum switch

An instant pressure pulse up to 500 kPa (0.5 MPa) (at the time of vacuum release) does not affect the performance of the switch. However, a constant pressure of 200 kPa (0.2 MPa) or more should be avoided.

Operating Environment

⚠ Warning

1. Do not use in an area, where surges are generated.

Installation of a switch in an area around the equipment (electromagnetic lifters, high frequency induction furnaces, motors etc.), which generates the large surge voltage could cause to deteriorate an internal circuitry element of a switch or result in damage. Implement countermeasures against the surge from the generating source, and avoid touching the lines with each other.

2. Operating environment

In general, the digital pressure switches featured here are open type. Avoid using in an environment where the likelihood of splashing or spraying of liquids (water, oil, etc.) exists. If used insuch an environment, use a dusttight or dripproof type.

Maintenance

⚠ Caution

1. Replacement of filter element

If the operation of the switch deteriorates due to clogging of the filter, replace the filter element (ZX1-FE). This only applies to the vacuum switches ZSE2, ZSP1 and ZSE3 when used with the ZX series vacuum ejector.

2. Cleaning of switch body

Wipe off dirt with a soft cloth. If dirt does not come off easily, use a neutral detergent diluted with water to dampen a soft cloth. Wipe the switch only after squeezing the excess water out of the dampened cloth. Then finish off by wiping with a dry cloth afterwards.

Flow Switches
Precautions 1
Be sure to read before handling.

Design and Selection

⚠ Warning

1. Make sure to use a switch by the specified voltage.
Use of a switch outside the range of the specified voltage can cause not only malfunction and damage of the switch, but also electrocution and fire.

2. Never use such a load, which exceeds the maximum allowable load.
It may result in a damage to a switch.

3. Since the type of fluid varies depending on the product, make sure to verify the specifications.
Never use flammable gases or fluids, since the switch is not explosion proof construction. It may result in a fire.

[For air]

4. Make sure to use a switch within the specified flow rate for measurement and the maximum operating pressure.
Operating beyond the specified flow rate and operating pressure can damage the switch.

If using a switch by exceeding the maximum operating pressure, switch is damaged.

[For water]

5. Make sure to use a switch within the specified flow rate for measurement and the maximum operating pressure.
Operating beyond the specified flow rate and operating pressure can damage the switch.

Damage to the switch may occur if the switch is subject to higher pressure than its designed limit.

Avoid especially the application of pressure above specifications through a water hammer.

<Countermeasure examples>

a) Use a device such as a water hammer relief valve to slow the valve's closing speed.

b) Absorb an impact pressure by using a rubber material piping such as a rubber hose and an accumulator.

c) Keep the piping length as short as possible.

Mounting

⚠ Warning

1. Mount a switch by observing the proper tightening torque.
When a switch is tightened beyond the specified tightening torque, a switch may be damaged. On the other hand, tightening below the specified tightening torque may cause the installation screws to come loose during operation.

Thread	Proper tightening torque (N·m)
1/8	7 to 9
1/4	12 to 14
3/8	22 to 24
1/2	28 to 30
3/4	28 to 30
1	36 to 38

2. Apply a wrench only to the metal part of the piping when installing the flow switch in the system piping.
Do not apply a wrench to the plastic part of the main housing of the switch.

3. Monitor the flow direction of the fluid.
Install a switch in the direction as indicated on the body.

4. Remove solid foreign objects, etc. inside piping by air blow before connecting a switch with piping.

5. Do not drop or bump.
Do not drop, bump, or apply excessive impacts (490 m/s^2) while handling. Although the external body of the switch (switch case) may not be damaged, the inside of the switch could be damaged and cause a malfunction.

6. Hold the body of a switch when handling.
The tensile strength of the cord is 49 N. Applying a greater pulling force on it can cause a malfunction. When handling, hold the body of the switch—do not dangle it from the cord.

7. Do not use until you can verify that equipment can operate properly.
Verify whether it is mounted correctly by running fluids or applying the electricity in order to conduct suitable function and leakage tests when mounting for the first time or after system repair or modification was made.

[For air]

8. Ever mount a switch in a place that will be used as a scaffold during piping.
If an excessive weight is applied on a switch, switch may be damaged.

9. Be sure to allow straight pipe length that is minimum 8 times the port size upstream and downstream of the switch piping.
Do not suddenly narrow the pipe size because doing so will disturb the flow speed distribution in the pipe, making it impossible to obtain the correct measurements.

[For water]

10. Never install a switch in such a place, where switch is used as a foothold in the piping.
Damage may occur if an excessive load is applied to the switch. Especially when the switch supports the piping, do not apply a load of 15 N·m or more to the metal parts of the switch.

Flow Switches
Precautions 2
Be sure to read before handling.

Wiring

⚠ Warning

1. Verify the color and terminal number when wiring.
Incorrect wiring can cause a switch to be damaged and may result in a malfunction. Verify the color of wiring and the terminal number in the instruction manual when wiring.

2. Avoid repeatedly bending or stretching the lead wire.
Repeatedly applying bending stress or stretching force to the lead wire will cause it to break.

3. Confirm proper insulation of wiring.
Make sure that there is no wiring insulation (contact with other circuits, ground fault, improper insulation between terminals, etc.). Overcurrent is flown and may result in a damage.

Operating Environment

⚠ Warning

1. Never use in an environment, where explosive gases are used.
The switches do not have an explosion-proof rating. Never use in an environment, where explosive gases are used, as this may cause a serious explosion.

2. Mount a switch in such locations, where no vibration or shock (less than 98 m/s^2) is affected.

[For air]

3. Use the switch within the specified fluid and ambient temperature range.
Fluid and ambient temperatures are 0° to 50°C. Take measures to prevent freezing fluid when below 5°C, since this may cause damage to a switch and lead to a malfunction. The installation of an air dryer is recommended for eliminating condensate and moisture.
Never use a switch in an environment, where temperature changes drastically even within the allowable ambient temperature range.

Maintenance

⚠ Warning

1. Perform periodical inspections to ensure proper operation of the switch.
Unexpected malfunctions and wrong operations may not secure the safety.

2. Use caution when using a switch for an interlock circuit.
When a pressure switch is used for an interlock circuit, devise a multiple interlock system to prevent trouble or malfunctioning. Verify the operation of the switch and interlock function on a regular basis.

3. Do not disassemble or modify the main body.

Fluid

⚠ Warning

1. Check regulators and the flow adjustment valves before introducing the fluid.
If pressure or flow rate beyond the specified range are applied to the switch, the sensor unit may be damaged.

[For air]

2. Fluids for measurement for this digital flow switch are nitrogen and air.
Please note that accuracy cannot be guaranteed when other fluids are used.

3. Never use flammable fluids.

4. Install a filter or mist separator on the upstream side when there is a possibility of condensate and foreign matter being mixed in with the fluid.
The rectifying device built into the switch will be clogged up and accurate measurement will no longer be possible.

[For water]

5. Never use flammable fluids.

6. Install a filter in the inlet side when it is likely for solid foreign objects to get mixed with fluids.