



# Operation Manual

Product Name

***Time Delay Valve***

Model

**VR2110**

**SMC Corporation**

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# Time Delay Valve Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions are categorized into three groups, "Caution", "Warning" and "Danger" depending on the level of hazard and damage, and the degree of emergency. They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC), Japan Industrial Standards (JIS)<sup>1)</sup> and other safety regulations<sup>2)</sup>.

\*1) ISO 4414: Pneumatic fluid power – General rules relating to systems

ISO 4413: Hydraulic fluid power -- General rules relating to systems

IEC 60204-1: Safety of machinery -- Electrical equipment of machines (Part 1: General requirements)

ISO 10218-1992: Manipulating industrial robots -- Safety

JIS B 8370: General rules for pneumatic equipment.

JIS B 8361: General rules for hydraulic equipment.

JIS B 9960-1: Safety of machinery – Electrical equipment for machines. (Part 1: General requirements)

JIS B 8433-1993: Manipulating industrial robots - Safety, etc.

\*2) Labor Safety and Sanitation Law, etc.



## Caution

Caution indicates a hazard with a low level of risk, which if not avoided, could result in minor or moderate injury.



## Warning

Warning indicates a hazard with a medium level of risk, which if not avoided, could result in death or serious injury.



## Danger

Danger indicates a hazard with a high level of risk, which if not avoided, will result in death or serious injury.

## Warning

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

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results.

The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product.

This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

### 2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly.

An operator who is appropriately trained and experienced must perform the assembly, operation and maintenance of machines or equipment.

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

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent dropping of driven objects or run-away of machinery/equipment have been confirmed.

2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.

3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

### 4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or used outdoors or in a location exposed to direct sunlight.

2. Installation of equipment in conjunction with atomic energy, railways, air navigation, space appliances, shipping, vehicles, military, medical equipment, combustion devices, recreation equipment, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or any other applications unsuitable for the standard specifications described in the product catalog.

3. An application that could have adverse effects on people, property, or animals, especially those applications requiring special safety-requirements.

4. If used in an interlock circuit, please provide a double interlock for possible failure by using a mechanical protective function, etcetera, with periodical checks to confirm proper operation. Furthermore, Check the product regularly in order to confirm normal operation.



# Time Delay Valve Safety Instructions

## Caution

**The product is provided for use in manufacturing industries.**

The product herein described is basically provided for use in manufacturing industries.

If the product is being considered for use in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.

If anything is unclear, contact your nearest sales branch.

## Limited Warranty and Disclaimer/ Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”.

Read and accept them before using the product.

### [Limited Warranty and Disclaimer]

1. The warranty period of the product is 1 year in service or within 1.5 years after the product is delivered.  
**Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.**
2. For any failure or damage reported within the warranty period, which is clearly our responsibility, a replacement product or necessary parts will be provided.  
**This limited warranty applies only to the SMC product independently, and not to any other damage incurred due to the failure of the product.**
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

### [Compliance Requirements]

When the product is exported, strictly follow the laws required by the Ministry of Economy, Trade and Industry (Foreign Exchange and Foreign Trade Control Law).

## Design precautions



### Warning

#### 1. Actuator drive

When an actuator, such as a cylinder, is driven, take appropriate measures (cover installation or approach prohibition) to prevent potential danger caused by actuator operation.

#### 2. Maintenance space

When installing the products, allow access for maintenance.

#### 3. Ventilation

When using the valve in a closed control panel, etc., install ventilating openings to prevent the following:

an increase of pressure inside the control panel, and generation of excessive heat by other equipment.

## Selection



### Warning

#### 1. Confirm the specifications.

The product is designed for use only in compressed air systems. Do not use fluids other than compressed air. Do not operate at pressures or temperatures, etc., beyond the range of specifications, as this can cause damage or malfunction.

#### 2. Use in low temperature environments

When using the valve in a low temperature condition, take appropriate measures to avoid drainage freezing, moisture, etc.

## Mounting



### Warning

#### 1. If air leakage increases or the equipment does not operate properly, stop operation.

Unexpected motion can cause injury.

#### 2. Check the mounting conditions

Make sure that screws and fittings are properly tightened and the piping is not bent or flattened. Connect the compressed air supply to the product and perform appropriate functional and leakage inspections to verify it is mounted properly.

#### 3. Do not paint the product.

Models or specifications printed or marked on the product should not be erased, removed or covered. Do not paint resin parts, as this may have an adverse effect due to the solvent in the paint.

## Mounting



### Caution

**1. Tube, other than coil tube, should be used for static piping.**

For example, if a flexible moving tube is used, it may become worn, elongated, disconnected from the fitting, or torn due to tensile forces. Before using, ensure the tube is in a static condition at all times. After installation and maintenance, apply air supply to the equipment and perform appropriate functional and leakage inspections to verify the equipment is mounted properly.

**2. Transportation, installation, piping, wiring, operation, handling, and maintenance should be performed by personnel with sufficient knowledge and experience.**

There is a risk of injury.

**3. Do not disassemble or modify the product.**

This may cause human injury and/or an accident. Please contact SMC for repair and maintenance of the product.

**4. Do not wipe the product using chemicals.**

## Piping



### Caution

**1. Prior to piping**

Before piping, perform air blow (flushing) or cleaning to remove any cutting chips, cutting oil, dust, etc. from the piping.

**2. Piping to product**

When piping to the product, refer to the symbols and labels on the product to avoid mistakes in the position of the supply port, etc.

**3. Secure sufficient tubing length for connection.**

Allow a sufficient margin of tube length when piping to prevent twisting, tensile, or moment loads being applied to the tubes and fittings. This can cause damage to the tube fittings and crushing, bursting or disconnection of tubing.

**4. Bending of tube**

Ensure that the tube connected to the product is sufficient, such that it satisfies the required minimum bending radius. A bending radius less than the minimum required may cause folding of the tubing, which will restrict proper air flow through the tubing.

## One-touch Fitting Precautions



### Caution

#### 1. Connection and disconnection of tubing to/from One-touch fitting

##### 1. Connection of tubing

- 1) Cut the tube perpendicularly, being careful not to damage the external surface. Use SMC's tube cutter TK-1, 2 or 3 for cutting. Do not cut the tube with pliers, nippers, scissors, etc. These tools result in a poor quality cut (e.g. flattening, rough edges, poor angle) and can result in a bad connection between the tube and the fitting, causing disconnection of the tube and air leakage. Also, allow for a sufficient margin of tube length.
- 2) The outside diameter of polyurethane tubing swells when internal pressure is applied; therefore, it may not be possible to re-insert used tubing into One-touch fittings. Confirm the outside diameter of the tubing. If the accuracy of the outside diameter is +0.15mm or more, insert into the One-touch fitting again without cutting it. When tubing is re-inserted into a One-touch fitting, confirm that the tubing is able to move pass the release button smoothly.
- 3) Hold the tube and push it in slowly, inserting it completely into the fitting.
- 4) After inserting the tubing, pull on it gently to confirm it is secure.  
If it is not securely installed into the fitting, problems, such as leakage or disconnection of the tube can occur.

##### 2. Removal of tubing

- 1) Press the release button firmly. Push the collar evenly around its circumference.
- 2) Pull out the tube, while pressing the release button.  
If the release button is not held down fully, it will be more difficult to remove the tube, which can result in damage to the fitting and tubing.
- 3) If the removed tubing is to be used again, cut off the section that has been secured in the fitting. Re-using this portion of the tube can cause problems such as air leakage or difficulty in removing the tube.

## If using tubing made by a manufacturer

### other than SMC



### Caution

#### 1. If using tubing made by a manufacturer other than SMC, confirm that the tolerance of the tubing outside diameter will satisfy the following specifications.

1. Nylon tube    Within +/-0.1mm
2. Soft nylon tube    Within +/-0.1mm
3. Soft polyurethane tube    Within +0.15mm or -0.2mm

Do not use tubing which does not meet these tolerances, as it may prevent proper connection to the product.

## Lubrication



### **Caution**

#### **1. Lubrication**

1. The product has been lubricated for life by the manufacturer and does not require additional lubrication while in service.
2. Use turbine oil Class 1, ISO VG32 (with no additives), if lubricating.  
Once additional lubricant is used in the system, lubrication must be continued because the original lubricant applied during manufacturing will be washed away.
3. Refer to the following brand name table of lubricants compliant to class 1 turbine oil (no additive), ISO VG32.

## Air Supply



### **Warning**

#### **1. Use clean air.**

Do not use compressed air that contains chemicals, organic solvent based synthetic oils, salts, corrosive gases, or etc., as this can cause damage or malfunction.



### **Caution**

#### **1. Install an air filter.**

Install air filters close to valves on the upstream side. A filtration degree of 5 micron millimeter or less should be selected.

#### **2. Install an aftercooler, air dryer or drain catch before the filter.**

Compressed air that contains excessive drainage may cause malfunction of valves and other pneumatic equipment. Therefore, take appropriate measures to ensure air quality, by providing an after cooler or water separator, if needed.

#### **3. Install a mist separator,**

Install a mist separator on the upstream side of the valve, when excessive carbon powder is generated by the compressor. Carbon powder which adheres to the inside of the valves may cause malfunction.

**For detailed information regarding the quality of the compressed air described above, refer to SMC's Cleaning Systems".**



## Operating Environment



### **Warning**

1. Do not use in an environment where corrosive gases, chemicals, sea water, water or steam are present.
2. Do not operate in a location subject to vibration or impact.
3. Use a protective cover, etc. to shield the product from direct sunlight.
4. Shield the product from radiated heat generated by nearby heat sources.
5. Employ suitable protective measures in a location where there is contact with oil or welding spatter, etc.



### **Caution**

1. Avoid using in a location where it could be splashed by liquids such as oils, coolants and water. Also avoid locations where exposed to dust.

## Maintenance



### **Warning**

#### **1. Removal of equipment, and supply/exhaust of compressed air**

When equipment is serviced, first confirm that measures are in place to prevent dropping of driven objects and/or equipment running out of control, etc. Then cut the supply pressure and power, and exhaust all compressed air from the system using its residual pressure release function.

When the equipment is to be started again after remounting, first confirm that measures are in place to prevent lurching of actuators, etc., and then confirm that the equipment can operate normally.

#### **2. Before performing maintenance, confirm that measures are taken to prevent sudden action and protect operators.**

#### **3. Draining**

Exhaust the drainage from an air filter periodically.

## 1-2. Time Delay Valve Specific Product Precautions

### Air Source



#### Caution

1. Use regulated air using a regulator for input signal air.

When the input signal air fluctuates, there will be larger differences in the delayed time, making it impossible to obtain the intended functions. Make sure to regulate the air using a regulator to avoid any influence of pressure fluctuation due to air consumption of other equipment.

### Operation



#### Warning

1. The Time Delay Adjusting Handle should be operated by hand **ONLY**. Do not over tighten the handle.

If operating the handle with pliers or a jig or when the handle is over tightened, the needle at the adjusting part may be damaged causing an operation failure.

The handle should be operated by hand **ONLY**. Do not tighten the handle further than the fully closed position of the needle (the position at which the needle stops rotating when it is tightened gently by hand).



#### Caution

1. Differences in the delayed time may be larger due to adhesion of the seal when the product is operated for the first time following an extended period of non-operation.

When the product is operated after an extended period of non-operation,, the tolerance for the accuracy of repeatability for the time delay may be outside of the +/- 10 % range. To eliminate this issue, run the Time Delay Valve a number of cycles prior to operation.

### Maintenance



#### Warning

1. Perform inspection on a regular basis as necessary, such as at the beginning of operation, to verify that the Time Delay Valve operates properly.

## 2. Application

For design of a sequence control using pneumatic pressure, delayed operation is necessary as one of the basic functions. The VR2110 Time Delay Valve is used to delay the operation in a general industrial pneumatic circuit.

### 3. Specifications

Fluid	Compressed air
Supply pressure	0 to 1.0 MPa
Input signal pressure	0.25 to 0.8 MPa
Delayed time	0.5 to 60 s
Repeated accuracy*	+/- 10% F.S.
Ambient and operating air temperature	-5 to 60 °C (No freezing)
Effective area	2.5 mm <sup>2</sup>
Port size	Rc, NPT, G1/8
ON timing	ON upon the set delay
Output method	Normal close
Reset	Resets by exhausting the input signal pressure
Weight	500g

\*) The dispersion is shown excluding the first actuation when actuated 4 times continuously.

### 4. How to Order

**VR2110 -01**

• Port size

<b>01</b>	Rc1/8
<b>N01</b>	NPT1/8
<b>F01</b>	G1/8

### 5. Operation Patterns

- ON timing: ON upon the set delay
- Output method: Normal close
- Settable time delay: 0.5 to 60 seconds

Operation time chart is shown in Fig. 1.

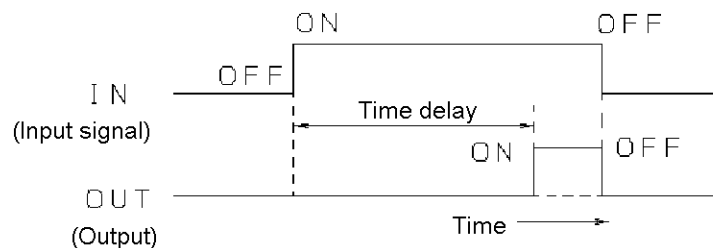


Fig. 1: Operation timing chart

When an Input Signal Pressure is provided, Output turns ON after the preset time. The Output will transition to OFF after the Input Signal Pressure is removed.

## 6. Characteristics

### 1. How to set the time delay

The time delay can be set by turning the setting handle. Relation between the delay time and the number of rotations of the handle is shown in Fig. 2. Turning the handle in the clockwise direction will increase the time delay, while turning it in the counter-clockwise direction will decrease the time delay. However, as there are variations in the time delay, it should be confirmed with a stopwatch prior to use.

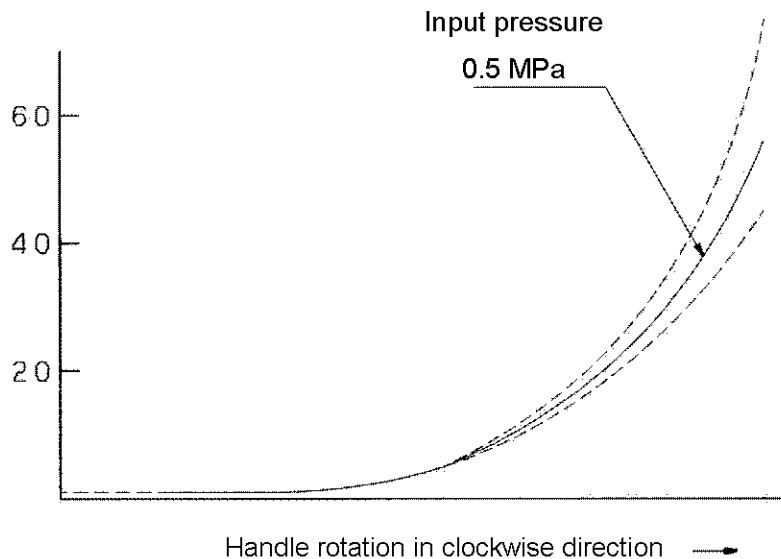
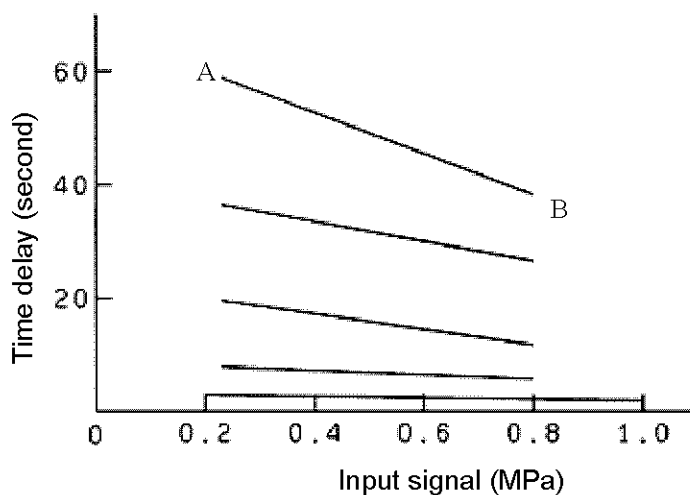


Fig. 2: Relationship between the time delay and number of rotations of the setting handle

### 2. Input signal pressure and the set delay time

Input pressure and supply pressure are fed from separate lines for the VR2110 Time Delay Valve. It is possible to operate the valve at pressure levels independent of each other.

Supply pressure fluctuation is not related to the time delayed switch ON operation. However, fluctuation of the input pressure does influence the time delay. The time delay will decrease by increasing the input pressure with the setting handle fixed in place. Fig. 3 shows this relationship.



e.g. "A" in the graph shows the position when the time delay is set to 60 seconds for an Input Signal Pressure of 0.25 MPa. The time delay will be changed to position "B" (approximately 40 seconds) when the Input Signal Pressure is increased to 0.8 MPa.

Fig. 3: Relationship between the input signal pressure and time delay

### 3. Reset time

The time delay from when Input is turned OFF until Output is turned OFF is the Reset time. The reset time of the Time Delay Valve varies depending on the signal generating valve type, pressure and piping length <sup>Note 1)</sup> as shown in Fig. 4.

Note 1) Piping length is the distance for piping from the OUT port of the signal generating valve to the signal port of the Time Delay Valve.

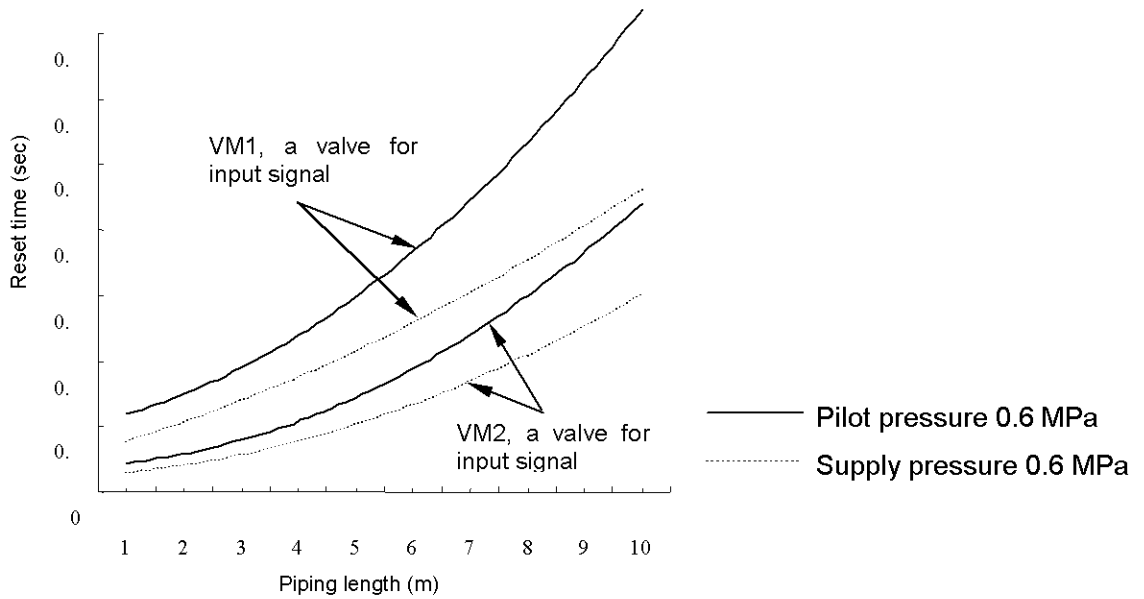
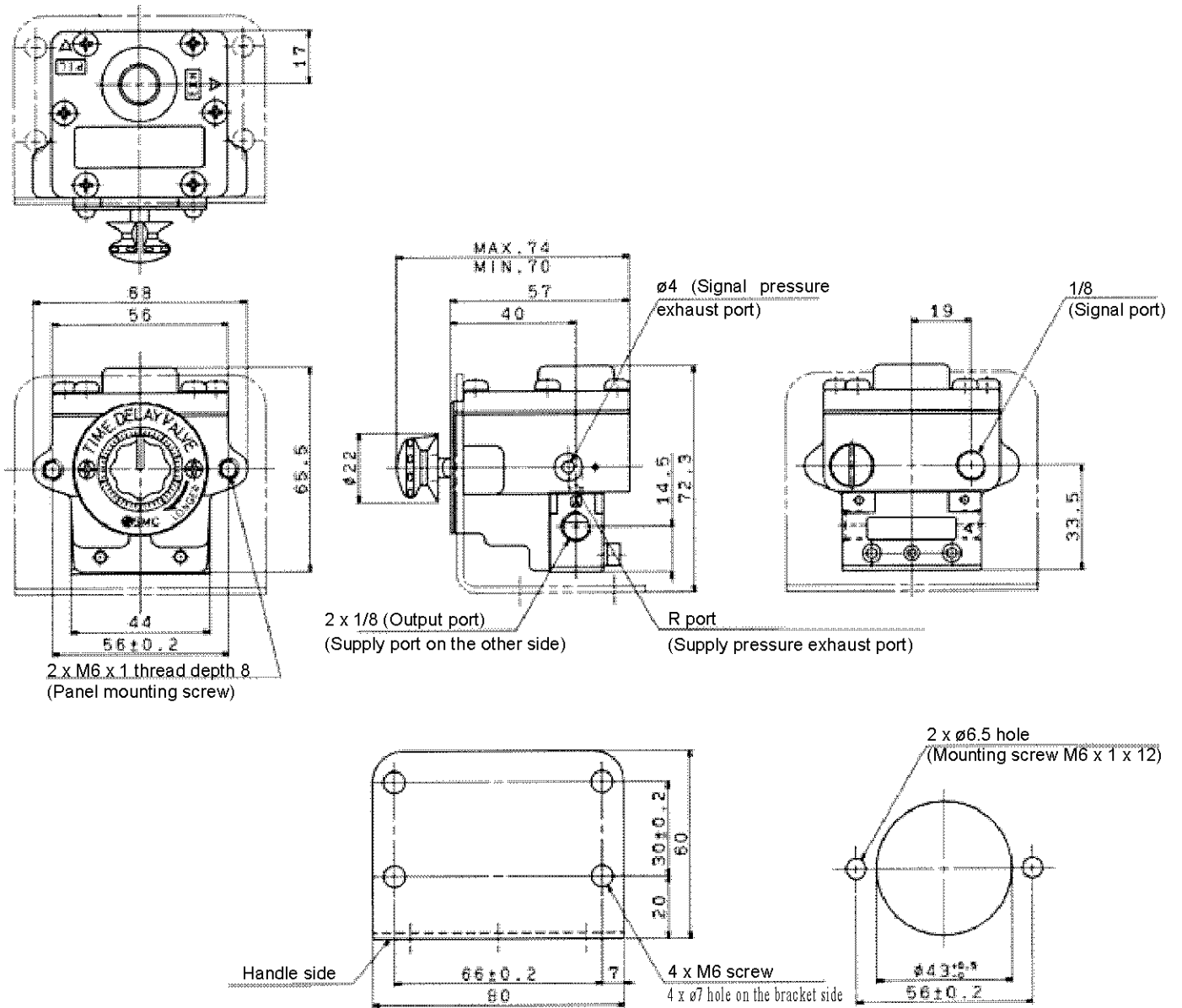


Fig. 4: Relationship among the signal generating valve type, pressure, piping length and reset time

## 7. Dimensions



Bracket plate thickness  $t = 2$

Panel plate thickness  $t = 3$  or less

Revision history
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Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.  
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