

# Example of fail-safe circuit for air servo cylinder IN-777

## 1. Features

This is an example of fail-safe circuit only for the air servo cylinder (IN-777). The example of fail-safe circuit temporarily operates the air servo cylinder which cannot be operated correctly when the supplied air pressure decreases or when power failure occurs. Piston rod position setting and manual operation can be performed in the fail-safe mode.

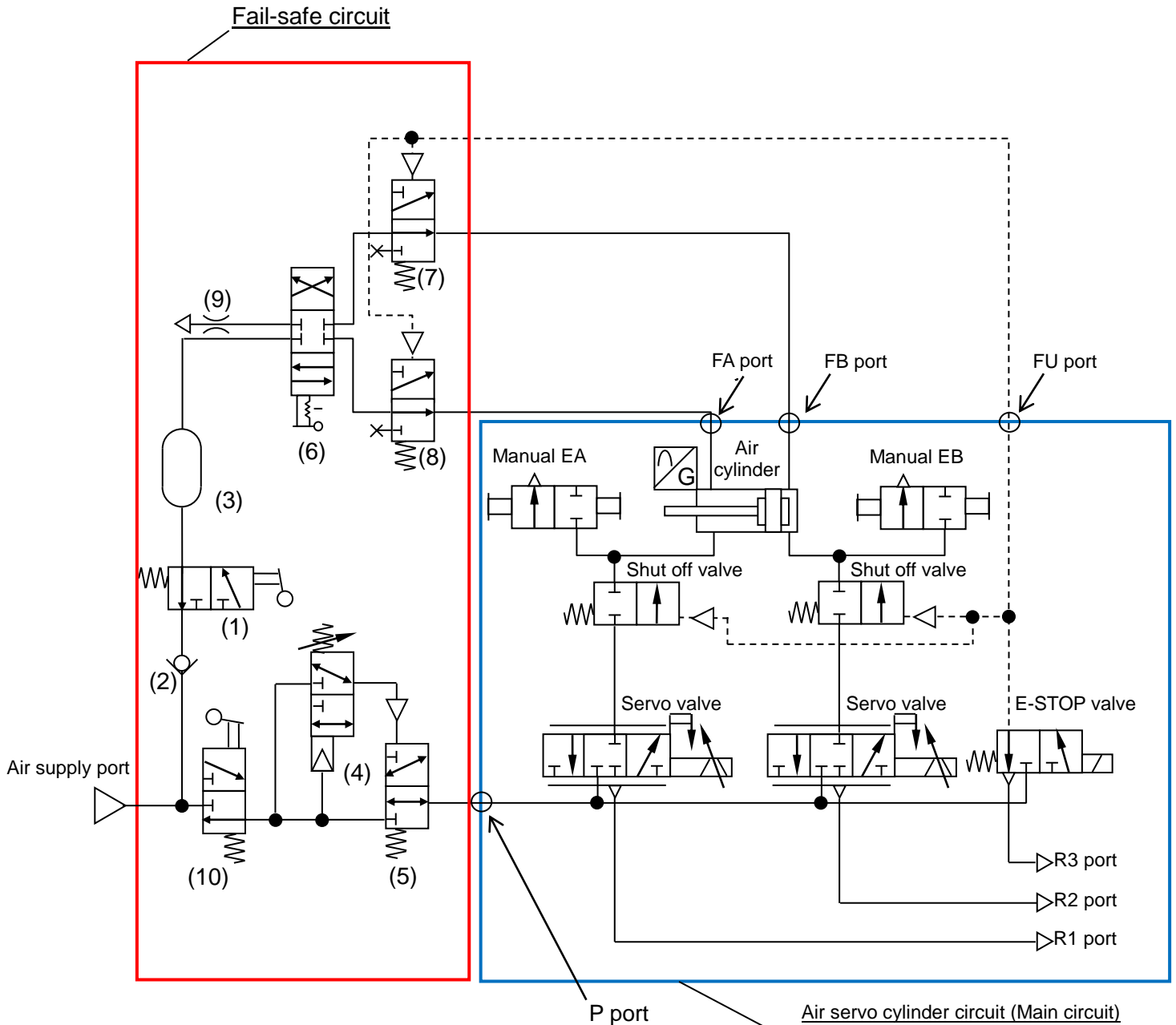
The piston rod position setting can be selected from the following three positions.

- (1) Piston rod position retained
- (2) Piston rod moves to the extended end
- (3) Piston rod moves to the retracted end

## 2. Operating conditions

Item	Operating conditions
Fluid	Air
Filtration of compressed air	0.3 $\mu\text{m}$ or less
Proof pressure	1.2 MPa
Operating pressure range	0.55 to 0.8 MPa
Pressure to change to fail-safe mode	0.3 MPa
Ambient/fluid temperature	-20 to 60°C (No freezing)
Operating humidity	35 to 85 % (No condensation)

### 3. Example of fail-safe circuit



#### Components

No.	Part name
(1)	Switching hand valve between Air servo cylinder circuit and fail-safe circuit
(2)	Check valve
(3)	Emergency air receiver
(4)	Lock-up valve
(5)	Air servo cylinder circuit supply valve
(6)	Fail-safe hand valve (Ex. VH Series 3 position closed center model)
(7)	Cylinder rod side supply valve
(8)	Cylinder head side supply valve
(9)	Fixed orifice for cylinder speed reduction
(10)	3-port valve

## 4. Installation/Setting

### 4-1. Installation

When installing the fail-safe circuit, perform piping referring to "3. Example of fail-safe circuit". Make sure to install an emergency air tank for piston rod operation in the fail-safe mode and a check valve for pressure drop prevention due to backflow.

### 4-2. Piston rod position setting after changing to the fail-safe mode

The piston rod position setting after changing to the fail-safe mode can be performed by changing the handle position of the fail-safe hand valve. Refer to the figure shown below and Table 1 for the handle positions and the piston rod position settings.

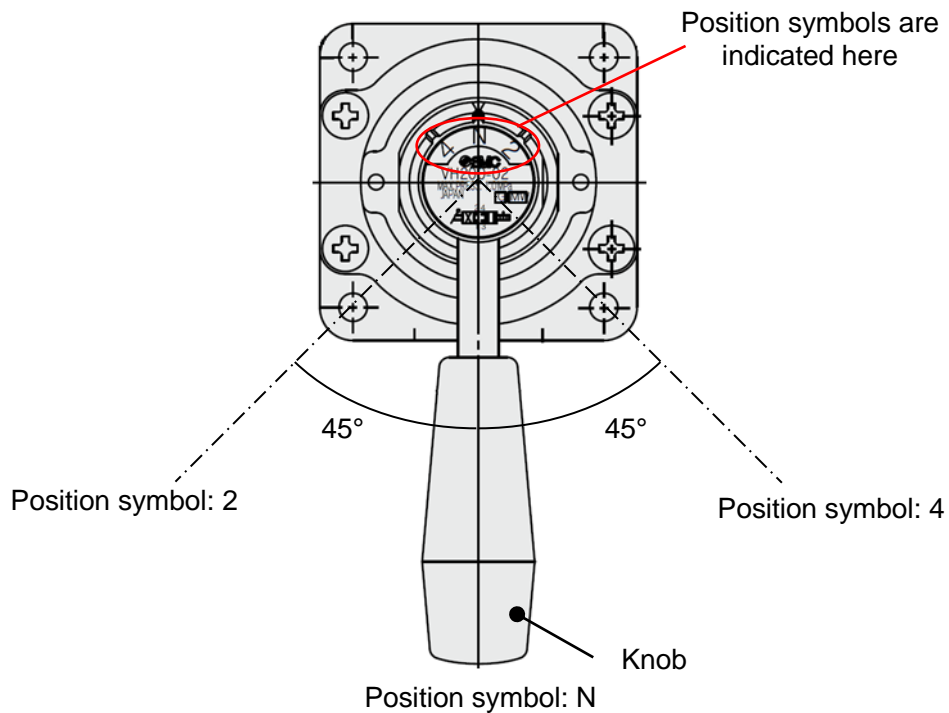


Table 1

Handle position symbols	Piston rod position settings
2	Moves to the extended end
N	Current position retained
4	Moves to the retracted end

## 5. How to Operate

By installing this fail-safe circuit to the air servo cylinder, the fail-safe mode is available when the supply pressure decreases (down to 0.3 MPa or lower) or when power failure occurs.

Piston rod position setting and manual operation can be performed in the fail-safe mode.

### 5.1 How to change to the fail-safe mode

#### (1) When supply pressure decreases

When the supply pressure becomes 0.3 MPa or lower, the lock-up valve closes the pilot pressure to the main circuit supply valve automatically, and air supply to the main circuit stops.

When the air supply to the main circuit stops, the supply valves on the cylinder rod and head sides in the fail-safe circuit open automatically. According to the setting of the fail-safe hand valve, air is supplied to the cylinder and the piston rod moves to the retracted or extended end or retains the current position automatically.

#### (2) When power failure occurs

When power failure occurs, the E-STOP valve and two shut off valves in the main circuit close automatically, and pressure supply to the air cylinder stops.

When the E-STOP valve closes, pilot air is exhausted, and the supply valves on the cylinder rod and head sides in the fail-safe circuit open automatically. According to the setting of the fail-safe hand valve, air is supplied to the air cylinder and the piston rod moves to the retracted or extended end or retains the current position automatically.

### 5-2. Manual operation

After the piston rod operation is completed, the piston rod can be operated manually by operating the handle of the fail-safe hand valve. Refer to the figure shown below and Table 2 for the handle positions and the piston rod operations.

The movement distance for the manual operation varies depending on the capacity and pressure in the emergency tank.

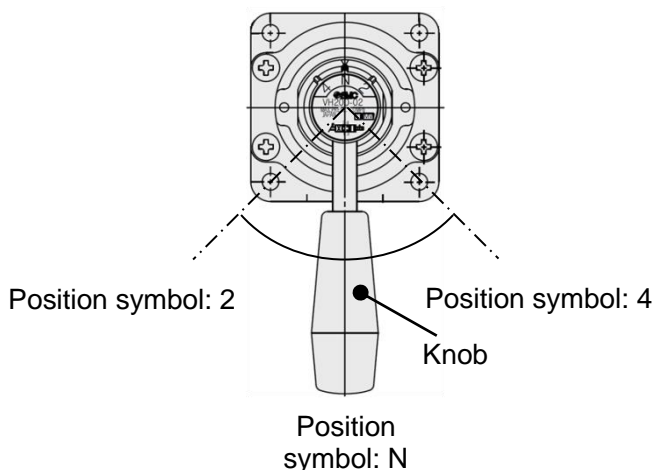


Table 2

Handle position symbols	Piston rod operations
2	Moves to the extended end
N	Stops at the intermediate position and retains the position
4	Moves to the retracted end

## 6. Handling Precautions

### **Warning**

When the supply pressure or power supply is recovered, the operation mode is changed from the fail-safe mode to a normal operation (Target position operation, No signal operation, JOG operation) automatically. At that time, the piston rod may be extended or retracted suddenly. Please install a 3-port valve to the air servo cylinder and take countermeasures. (e.g. Stop supplying air until safety is guaranteed.)

When the pressure value varies around 0.3 MPa after decrease in the supply pressure or when the pressure value of the main circuit could not decrease sufficiently and the pressure remains due to customer's piping condition, the operation mode may not be changed to the fail-safe mode smoothly, leading to chattering. If so, please review the piping condition and take countermeasures as necessary (e.g. Installation of a residual pressure exhaust valve to the upstream side of the lock-up valve in the main circuit).

### **Caution**

Operate the fail-safe mode at the initial installation and periodically (once a month) to check the operation. If the installation environment is incorrect or the product is not operated for a long period of time, the sliding part may be stuck, resulting in malfunction.