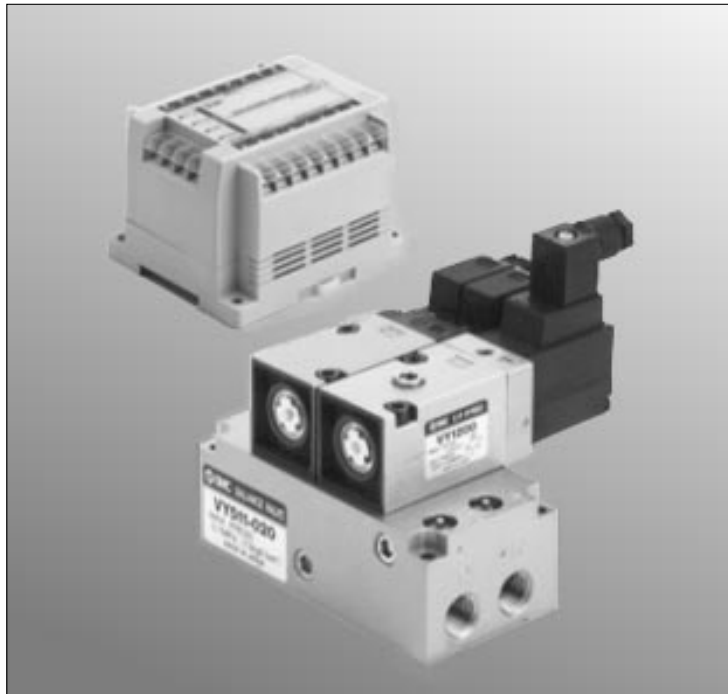


Balance Controller *VY511, VYU5*

Automatic Balancing with Cylinder Load Changes



Three Operating Functions to Achieve Energy Saving Automation

Manual Operation
Auto balance only

○ Human support

Internally Set Operation
Auto balance
+
Drive

○ Lifter
○ Parts assembly

External Input Operation
Auto balance
+
Drive

○ Holding force control
○ Tension control
○ Robotic support

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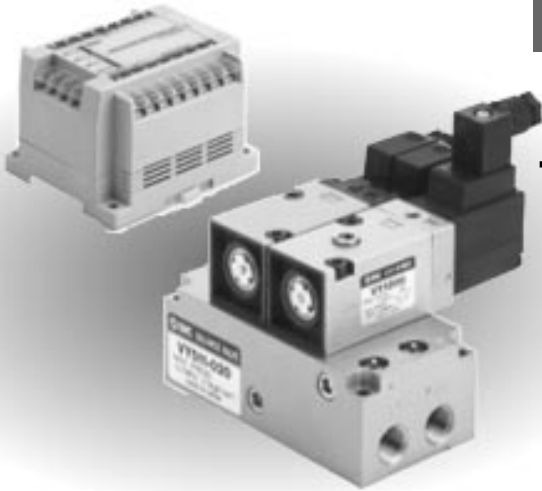
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Automatic Balancing with

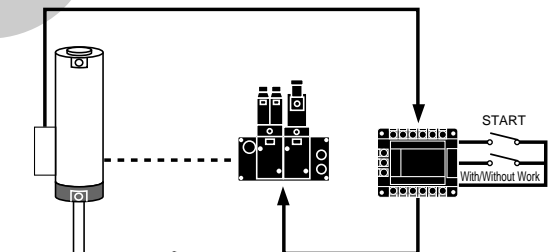


Three operations to accommodate a wide range of applications

1. Manual operation (Auto balance only)

After the balance pressure has been set, the cylinder is moved by an external force. (Set the rotary switch to 0 or 1. Refer to the instruction manual for details on the rotary switch settings.)

For assisting human operators (Manual operation)

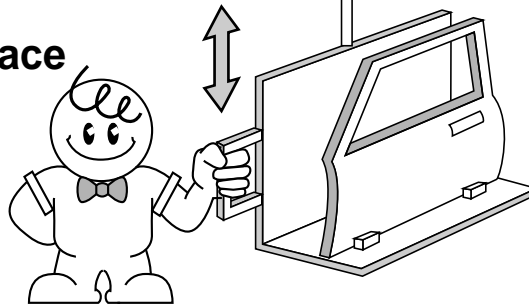


By inputting the start signal, an air pressure that offsets the weight of the workpiece is automatically set. (Auto balance)

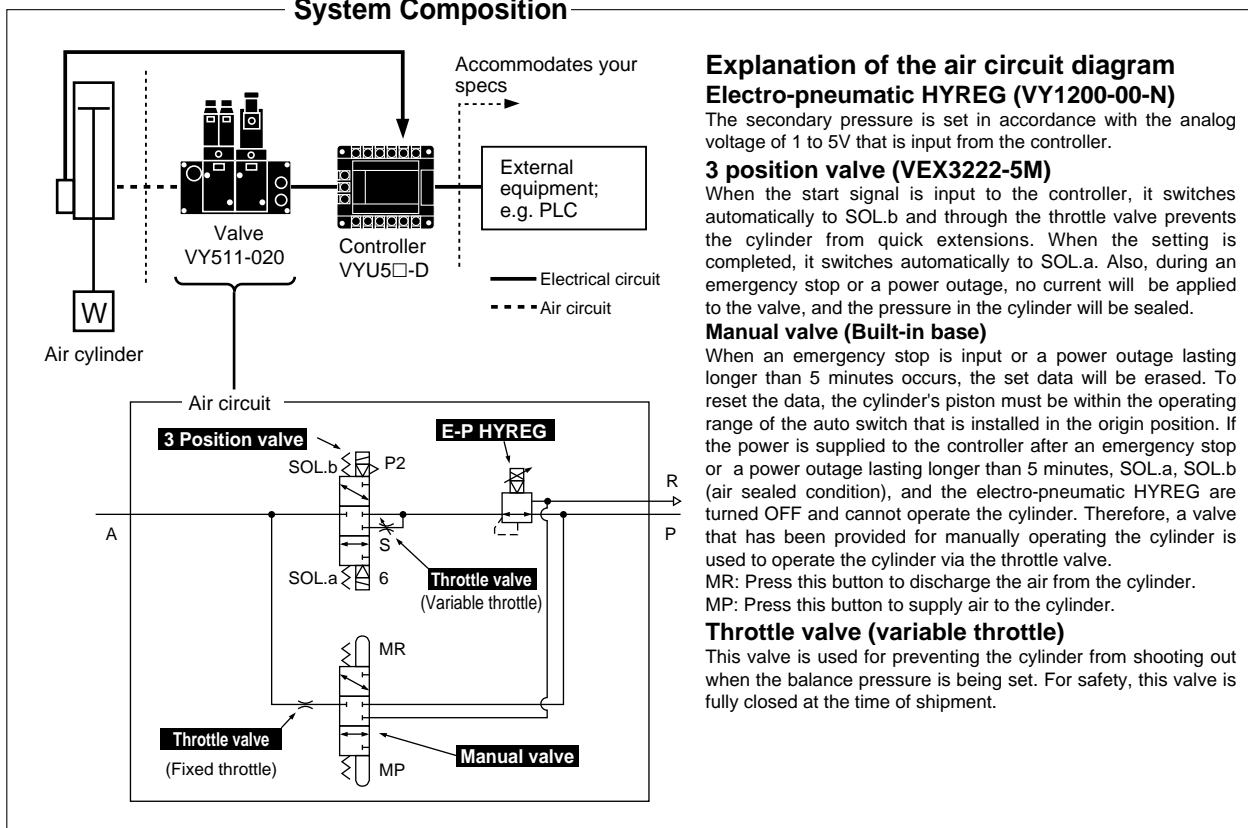
■ The balance pressure is automatically set

■ Easily installed without space constraints

The balance function can be easily provided to a production line or in equipment by providing only air pressure piping.



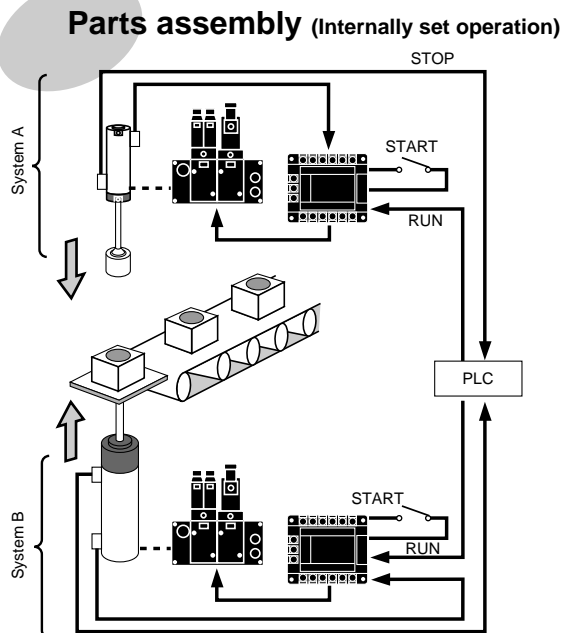
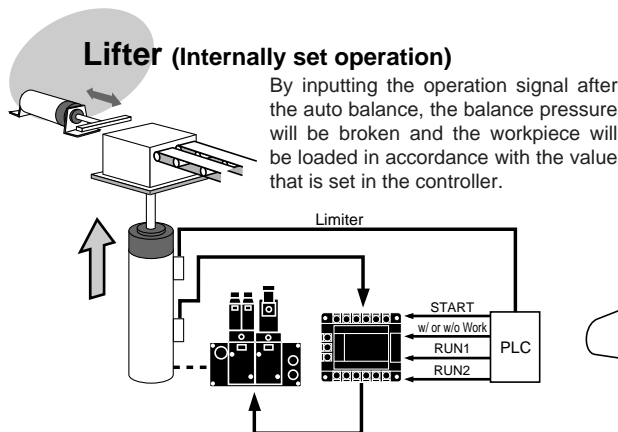
System Composition



Cylinder Load Changes

2. Internally set operation (Auto balance + Drive)

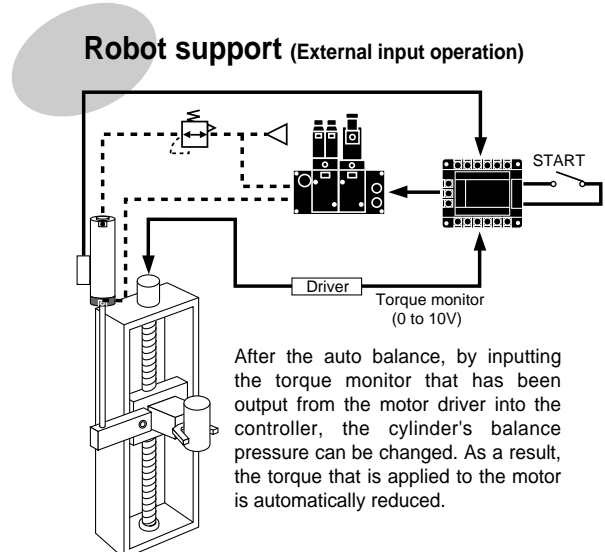
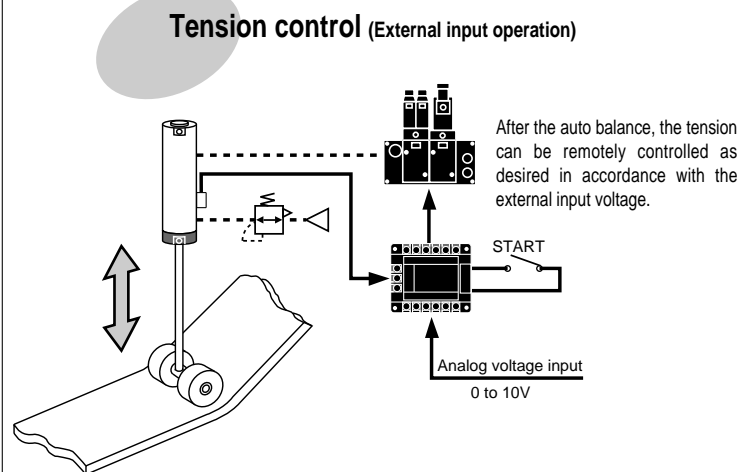
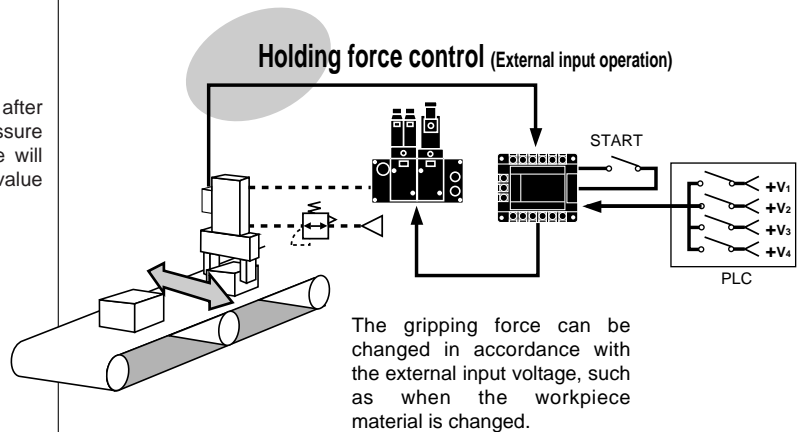
After the balance pressure has been set, ON/OFF signals are sent to the terminal block to change the cylinder's balance pressure, thus driving the cylinder. A trimmer inside the controller is used to adjust the settings for changing the balance pressure. (Set the rotary switch to 2 or 3.)



After both systems A and B have been auto balanced, an operation command is input to the controller to operate the cylinder. At the point at which the auto switch for stopping has been tripped, systems A and B are stopped to assemble parts.

3. External input operation (Auto balance + Drive)

After the balance pressure has been set, the balance pressure is changed in accordance with the voltage (0 to 10V) that is input to the terminal block in order to drive the cylinder. (Set the rotary switch to 4 or 5.)



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How to Order

Valve

VY511 — 020

Exclusive controller

VYU5  **—D**

Output

—	NPN open collector output
P*	PNP open collector output

*Consult SMC for PNP output style.

Specifications

Valve

Model	VY511-020
Valve construction	VY1200-00-N, VEX3222-5M, Manual operating valve (Base installed)
Port size P, A, R port	Rc(PT)1/4
Effective area	16mm ² , Cv. Factor: 0.9
Response time	40 ms or less
Balance pressure setting precision	0.75%FS (After running-in)
Repeatability	1%FS (After running-in)
Fluid	Air, Inert gas
Ambient and fluid temperature	0 to 50°C (No condensation)
Operating pressure range	0.2 to 0.7MPa
Set pressure range	0.2 to 0.7MPa
Electrical entry	VEX3222-5M: M type plug connector VY1200-00-N: DIN connector
Mounting	Universal
Lubrication	Not required
Weight	850g

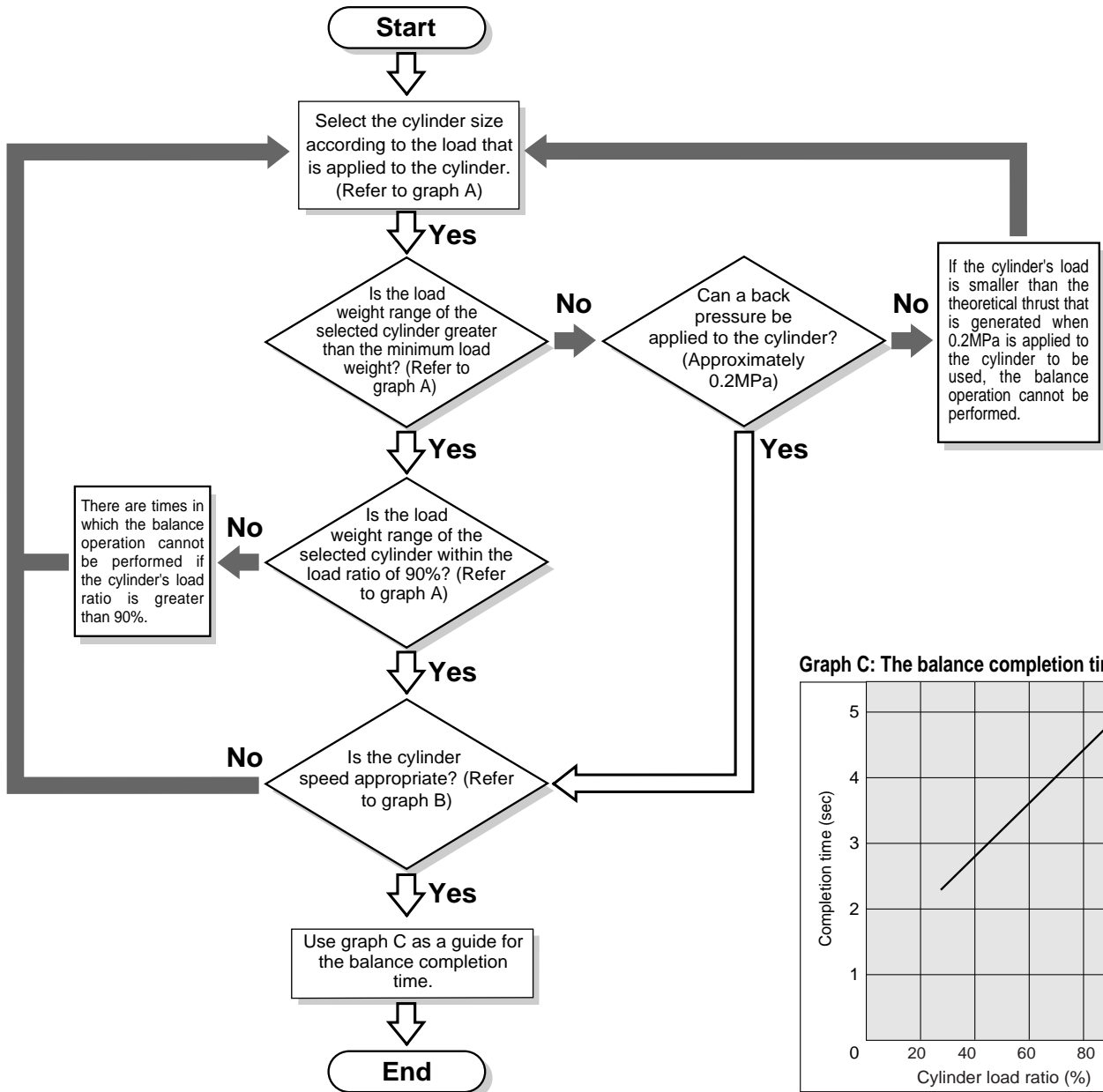


Note) Valve should be used with exclusive controller.

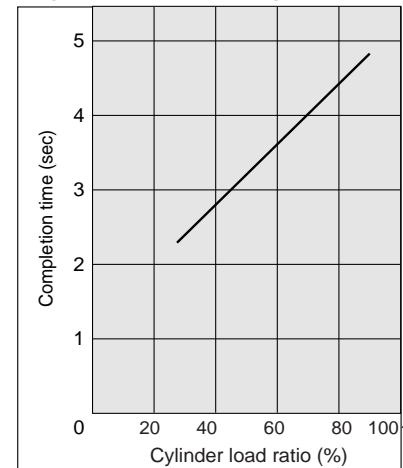
Exclusive controller

Model	VYU5-D
Driving power	24V DC±5%, 0.4A
Mounting	Mounting onto the surface (DIN rail or screw mounting)
Memory of electric current shut off	5 minutes of back-up by super capacitor (at 50°C)
Input	Non voltage input (0V/Between respective input: Short or open) and Analog voltage input (RUN1 input during external input operation)
Input signal	○ Start (START) ○ Reset (RESET) ○ Detecting switch of cylinder motion (SW) ○ Emergency stop (STOP) ○ Operation 1 (RUN 1) ○ Operation 2 (RUN 2) ○ Prepared (READY)
Output	NPN open collector (24V DC 50mA)
Output signal	○ Setting completed 1 (SET UP1) ○ Setting completed 2 (SET UP2) ○ Error (ERR.) ○ Preparation completed (READY)
Valve output	Valve output: 24V DC, 1.8W, 2 pieces E-P HYREG valve output: 24 V DC, 1.3W, 1 piece 0V DC to 5V DC, 1mW, 1 piece
Temp range	0 to 50°C No condensation
Humidity range	35 to 85% No condensation
Insulation press resistance	1000V AC in one minute, 20mA or less (Between 0V terminal of 24V DC and mounting part for resin bowl fixation)
Insulation resistance	500V DC, 50M Ω or more (Between 0V terminal of 24V DC and mounting part for resin bowl fixation)
Noise resistance	Square wave noise (Pulse width: 1μs) produced by a noise simulator. Between power terminals: 1000V, 3 minutes Between input terminals: 500V, 3 minutes
Vibration resistance	2G or less
Shock resistance	10G or less
Current consumption	0.4A or less
Weight	200g

Selection of Cylinder Size



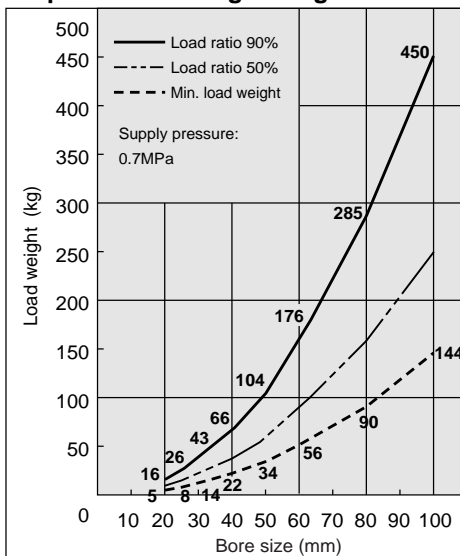
Graph C: The balance completion time



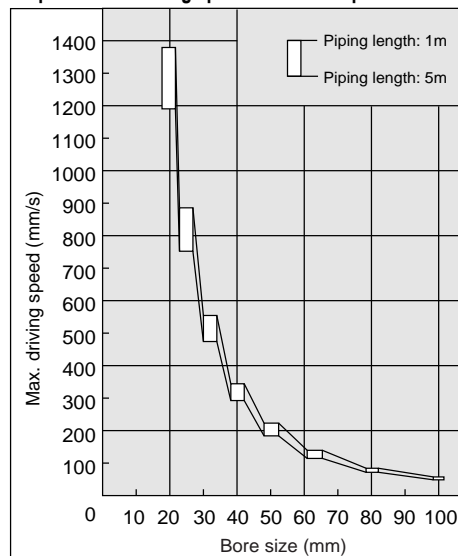
- Conditions
Supply air pressure: 0.7MPa
Mounting position: Vertically facing downward
Supply port: Front port
Work mounting position: Fixed to the piston rod (Without the guide)
Cylinder: CDG1G (20 to 100) -200-K59S
After preparatory operation

- System
Silencer: AN200
Tube size (Nylon tube): T1075 (ø10)
Fittings (4 pcs.): DL10-02
- Conditions
Supply air pressure: 0.5MPa
Load ratio: 50%
90° elbow: 4 pcs.
- When load ratio is 0% (no load), maximum driving speed is 1.2 times and when 75%, it is 0.7 times of these figures.

Graph A: Load weight range



Graph B: Max. driving speed at manual operation



⚠ Precautions

Be sure to read before handling. Refer to p.0-26 and 0-27 for Safety Instruction and common precautions on the products mentioned in this catalog.

Operation and Adjustment

Before Handling

⚠ Caution

Operating air quality

- ① Air of poor quality could cause an equipment malfunction. Use compressor oil with a minimal generation of oxidants and make sure to install a mist separator (SMC's AM series). Refer to the No.4 system of the Compressed Air Cleaning Systems.

② Air source

When the balance pressure and the source pressure become equal, fluctuations in the source pressure cause the cylinder's balance pressure to fluctuate, which may cause the cylinder to operate. Therefore, install an air tank on the source pressure side or increase the size of the cylinder that is used.

③ Piping

To improve and stabilize the setting precision of the balance pressure, keep the piping distance between the cylinder and the solenoid valve short, and use large bore sizes (6 to 8mm bore).

④ Built-in throttle valve

The throttle valve that is built into the solenoid valve is fully closed at the time of shipment to ensure safety. The cylinder will not operate if the solenoid valve is used in the state in which it was shipped. Therefore, use the throttle valve by opening it gradually to adjust the cylinder speed.

Operation

⚠ Warning

① Back-up of the balance pressure data

The balance pressure data is backed up by the controller for approximately 5 minutes during a power outage or when the power supply has been turned OFF. If the power to the controller is interrupted longer than 5 minutes, the balance pressure data could be erased. Therefore, if the power to the controller has been interrupted longer than 5 minutes, operate the controller while observing the setting completion signal that is output by the controller (terminal block names: SET UP1, SET UP2).

② Yes/No switching for workpieces (terminal block name: SEL)

Because "SEL" can be switched as desired regardless of whether the home position switch is ON or OFF, be aware of jumping up or dropping of the cylinder during switching.

⚠ Caution

① Setting of the balance pressure after a long stopped period

The friction resistance of the cylinder's sliding surface increases when the cylinder remains stopped for a long period of time. When the balance pressure is set up under this condition, a proper balance pressure might not be obtained. Therefore, perform a warm up operation of the cylinder.

Cylinder Selection

⚠ Caution

① Minimum load weight for transporting

Use a cylinder with a minimum load weight that is greater than the theoretical thrust that is generated when 0.2MPa is applied to the cylinder to be used. If a cylinder with a load weight that is smaller than the theoretical thrust is used, the balance pressure cannot be set.

② Cylinder installation

As a rule, trunnion or clevis brackets cannot be used to rock the cylinder while setting the balance pressure because the load that is applied to the cylinder cannot be maintained at a constant level.

③ Minimum sensing weight after balancing

Minimum sensing weight =

Cylinder friction + Valve error + Exterior guide friction

Cylinder friction =

Cylinder minimum operating pressure
x piston area

Valve error =

VY 1200 sensitivity (≒ 0.01MPa)
x piston area

Refer to the data of the respective guide for the friction of the exterior guide.

For example, when a cylinder of the CA1□Q series is used, installed vertically, and without a guide.

(Unit: N)

Bore size (mm)	Min. sensing weight
ø40	26
ø50	40
ø63	62
ø80	100
ø100	160

Setting

⚠ Caution

① Cylinder speed while setting the balance pressure

The cylinder could shoot out when setting the balance pressure. Therefore, before setting the balance pressure, lower the cylinder speed by adjusting the variable throttle that is built into the solenoid valve.

Also, make sure that SOL.a and SOL.b are wired correctly, because if the wires are reversed, the variable throttle cannot be adjusted during the balance pressure setting.

② Cylinder cushion

When using a cylinder that is equipped with a cushion, it might not be possible to set the balance pressure if the cushion is excessively restricted. Therefore, use the cylinder with its cushion open.

③ Load fluctuations while setting the balance pressure

The load that is applied to the cylinder may fluctuate during the setting of the balance pressure, due to the processes of centering the equipment, synchronizing it with other actuators, or pulling the piping during setting. In such a case, it might not be possible to accomplish an optimal balance pressure setting. Therefore, while setting the balance pressure, make sure to operate the cylinder in such a way that the load does not fluctuate.

④ Inputting of the emergency stop signal (terminal block name: STOP)

The emergency stop signal can be received in the 0V and open state. To operate the balance controller, always operate in the 0V and short state.

⑤ Setting of the auto switch

The cylinder's pressure increase and pressure decrease are detected by the ON/OFF operation of the auto switch. Therefore, install the auto switch at the home position of the cylinder as much as possible. If the auto switch is not at the home position, a setting error will result, making it difficult to accomplish an optimal balance. (Use an auto switch rated 24V DC, with a minimum amperage capacity of 10mA.)

Valves

3 position valve (VEX3222-5M)

⚠ Caution

① Energizing time

When the valve is energized continuously for a long period of time, make sure to not exceed 1,400 hours (equivalent to approximately 2 months) per year with the condition that the valve is switched at least once every 30 days.

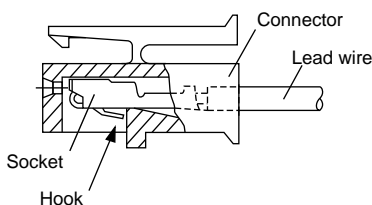
② Installation and removal of the socket with lead wires

●To install the socket with lead wires:

Insert the socket into the square holes (marked + and -) of the connector. Then, grasp the lead wires and push them all the way in and engage the hook of the socket with the seat of the connector to lock it in place. (When the lead wire is pushed in, the hook opens and locks automatically.) Then, lightly pull on the lead wires to make sure that they are locked.

●To pull out the socket with lead wires from the connector:

Pull out the lead wire while using a thin rod ($\approx 1\text{mm}$) to push the hook of the socket. To reuse the socket, open the hook outwards.



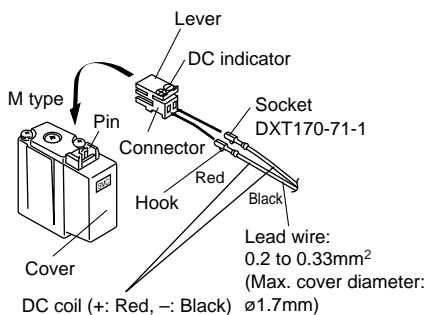
③ Installation and removal of the connector

●To install the connector:

Place the connector directly over the pin while pinching the lever and the connector body with your fingers. Then, push the tab of the lever into the groove of the cover to lock it in place.

●To pull out the connector

Push the lever down with your thumb, and pull the connector straight out while removing the tab from the groove.



Electro-pneumatic HYREG (VY1200-00-N)

⚠ Caution

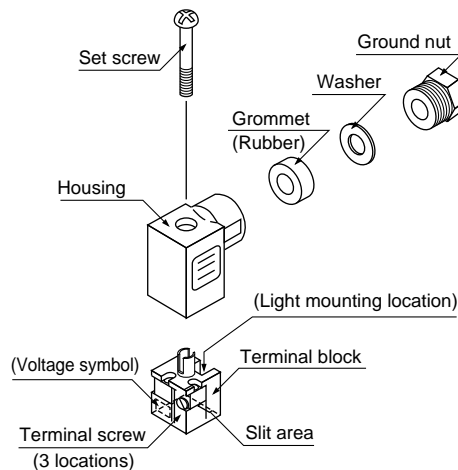
① Pressure gauge

If equipped with a pressure gauge, be aware of the possibility of the gauge being affected due to sudden pressure fluctuations.

② How to use DIN connector

●DIN connector wiring procedure

1. Loosen the retaining screw and pull the connector from the solenoid valve terminal block.
2. Remove the retaining screw, insert the tip of a flat head screw driver into the groove below the terminal block and pry it up to separate the terminal block from the housing.
3. Loosen the terminal screws (slot head screws) on the terminal block. Then, in accordance with the wiring procedure, insert the cores of the lead wires into the terminals and tighten the terminal screws to secure the wires in place.
4. Tighten the ground nut to secure the cord.



●DIN connector outlet changing procedure

After the terminal block has been separated from its housing, reassemble the housing in the desired direction (in four 90° increments) to change the cord outlet. Make sure to push or pull the connector straight, without tilting it diagonally.

●Applicable wire and connector part number

Cord external diameter: $\phi 4$ to $\phi 6.5$

c.f. 3-core, 0.5mm^2 (equivalent to JISC3306)

Connector part number: VK300-82-1

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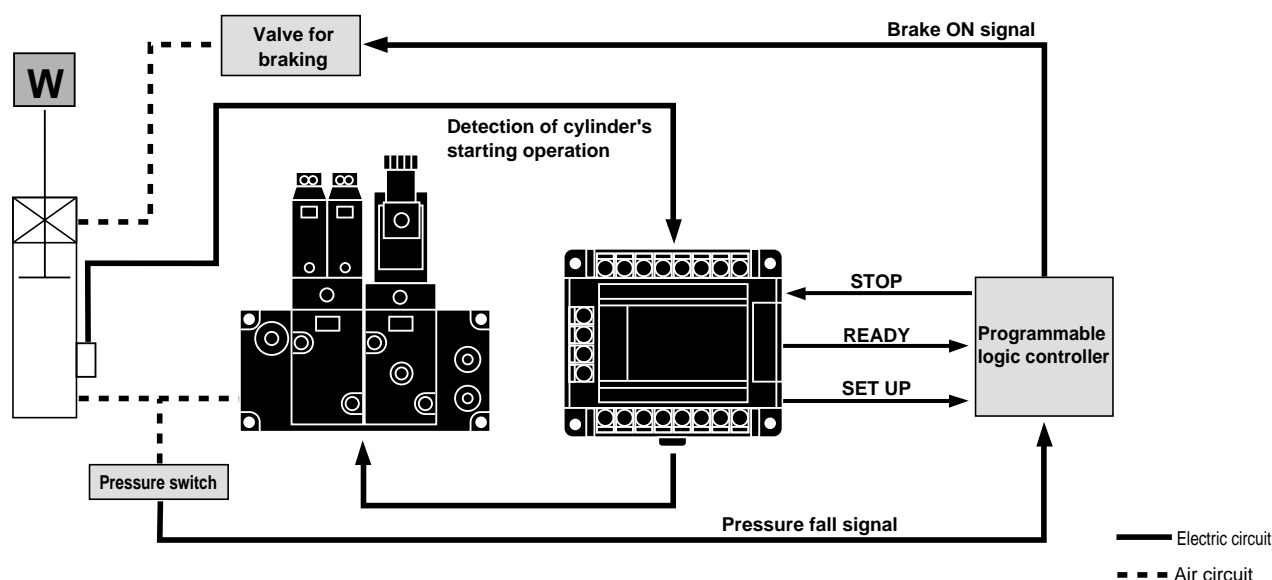
AL

Drop prevention countermeasure

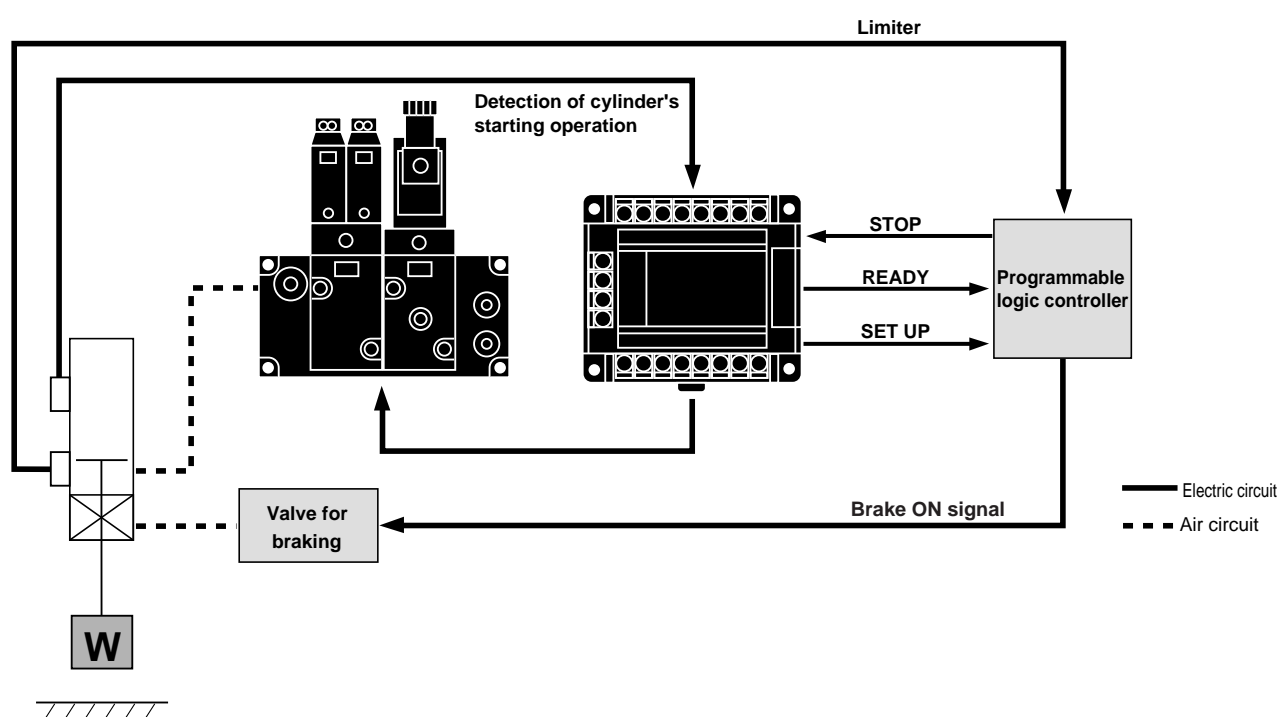
⚠ Caution

As a countermeasure against dropping in case the source pressure is down or the valve cannot be switched because it is clogged with debris, it is recommended to install a pressure switch or a limit switch as a safety measure. Furthermore, the safety performance can be improved by using a cylinder with a built-in brake mechanism. Although an example is shown in the diagram below, there are times in which a countermeasure against dropping cannot be accomplished due to the length of the piping or the response speed of the sequence controller. Therefore, be aware that it might be necessary to conduct a test on the actual equipment.

(System Example) A system that effects an emergency stop of the controller and applies the brake on the cylinder if the valve's secondary pressure surveillance pressure switch has been turned ON after the setting has been completed.



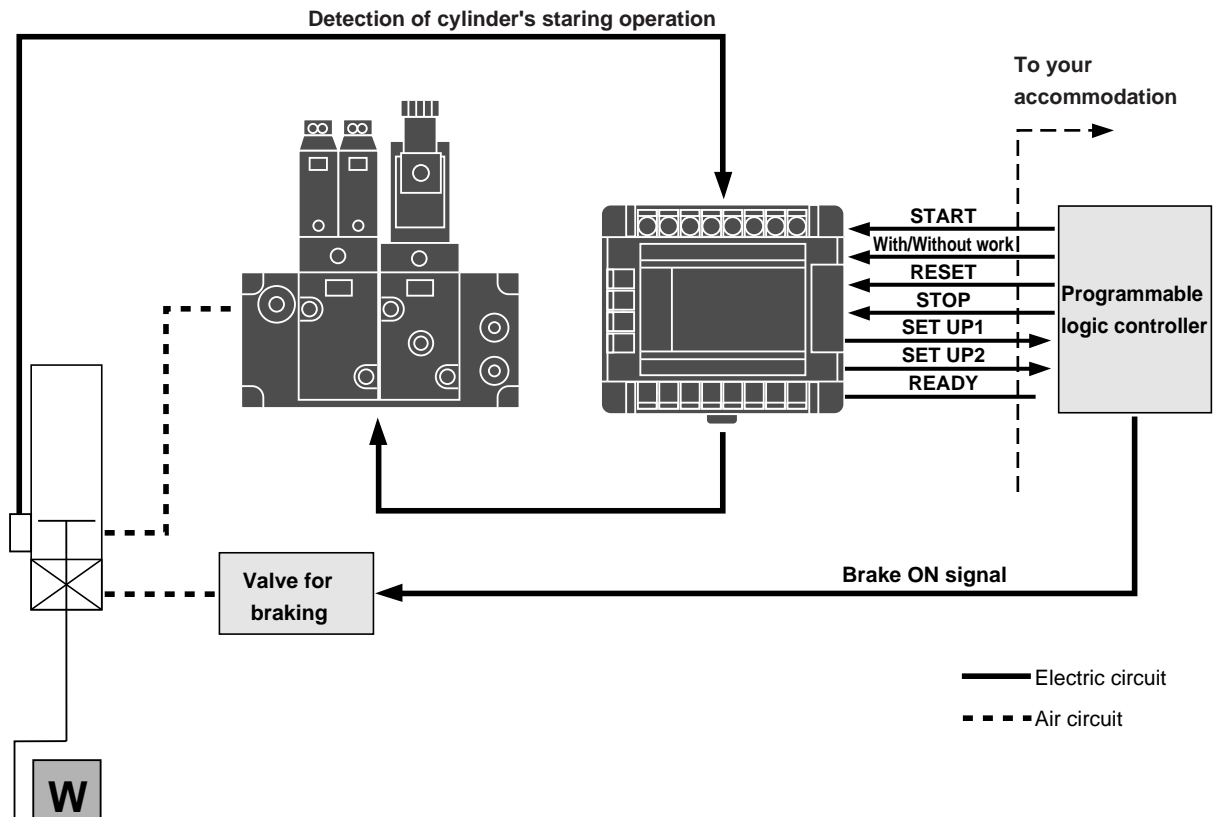
(System Example) A system that effects an emergency stop of the controller and applies the brake on the cylinder if the auto switch for the limiter is turned ON after the setting has been completed.



Countermeasure for preventing the cylinder from running after the load has been removed

⚠ Caution

After completing the balance and performing an operation that involves the loading of a workpiece and releasing the workpiece from the cylinder, the balance of the cylinder is upset as the workpiece is being released from the cylinder. As a result, the cylinder actuates. For this reason, when a workpiece must be lowered, use a cylinder with a built-in brake mechanism so that the cylinder will not actuate.



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Series VY511/VYU5

Wiring to External Equipment

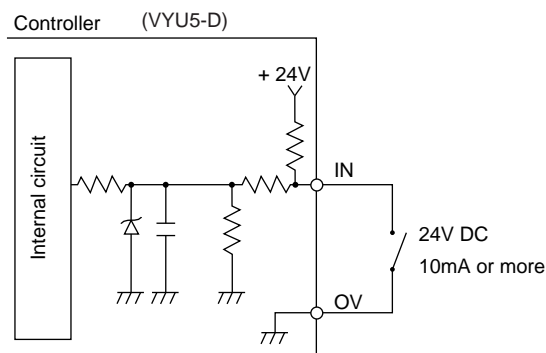
⚠ Caution

1 Power supply for controller

Supply 24V DC $\pm 5\%$ and 0.4A or more for the controller.

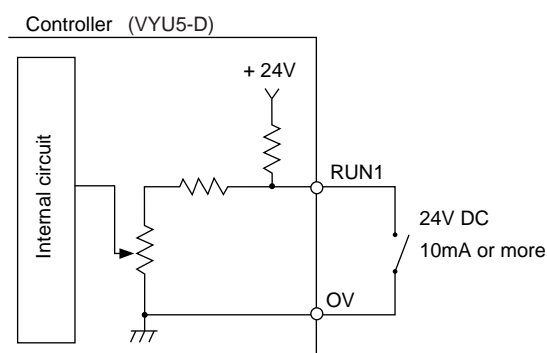
2 Input circuit

RUN2, RESET, SW, SEL, START, STOP



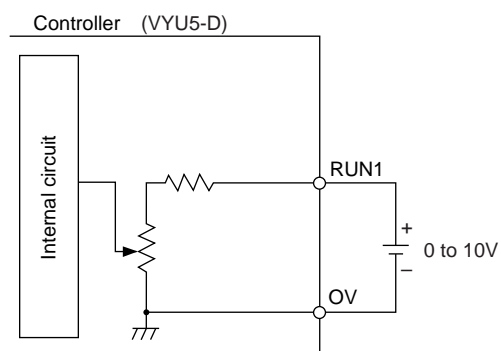
Connect the switch or the sequence controller with 24V DC voltage and 10mA or more capacity.

3 RUN1 input circuit at internally set operation

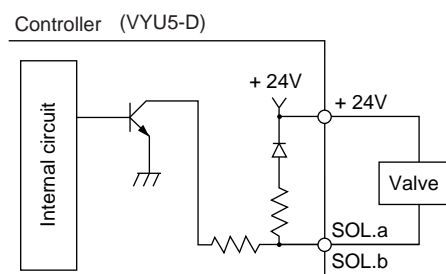


Connect the switch or the sequence controller with 24V DC voltage and 10mA or more capacity.

4 RUN1 input circuit at external input operation

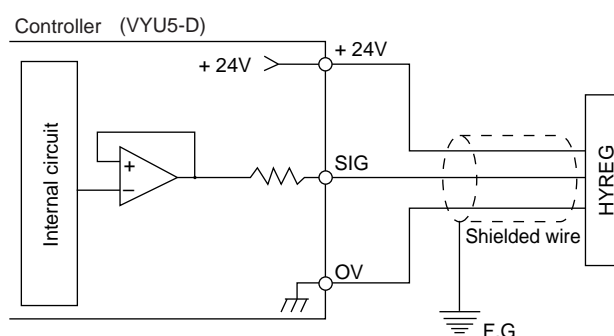


5 Solenoid valve output (SOL.a, SOL.b)



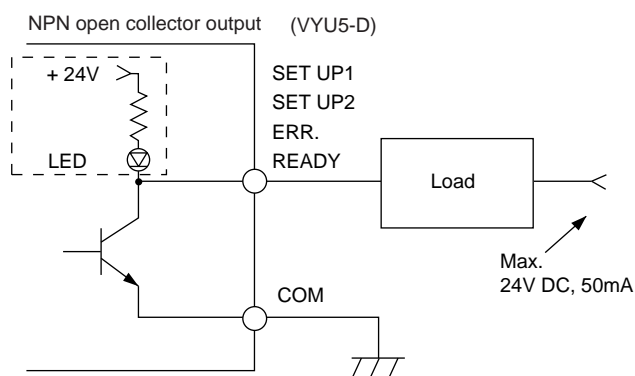
Rated voltage: 24V DC1 Power consumption: 1.8W

6 Electro-Pneumatic HYREG output (+24V, 0V, SIG)



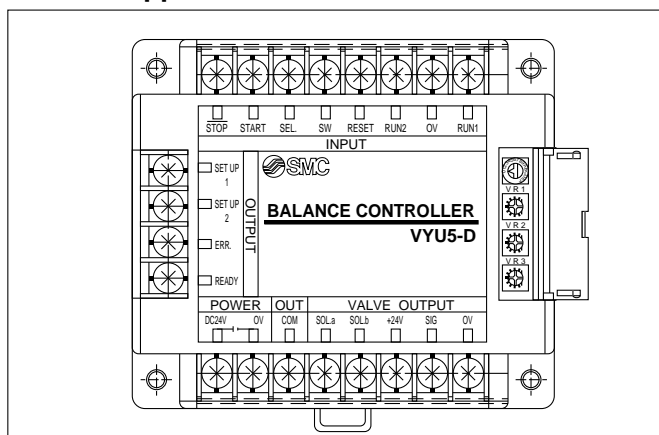
7 Output circuit

SET UP1, SET UP2, ERR., READY



Note) []: This circuit is not necessary for READY signal.

External appearance of exclusive controller

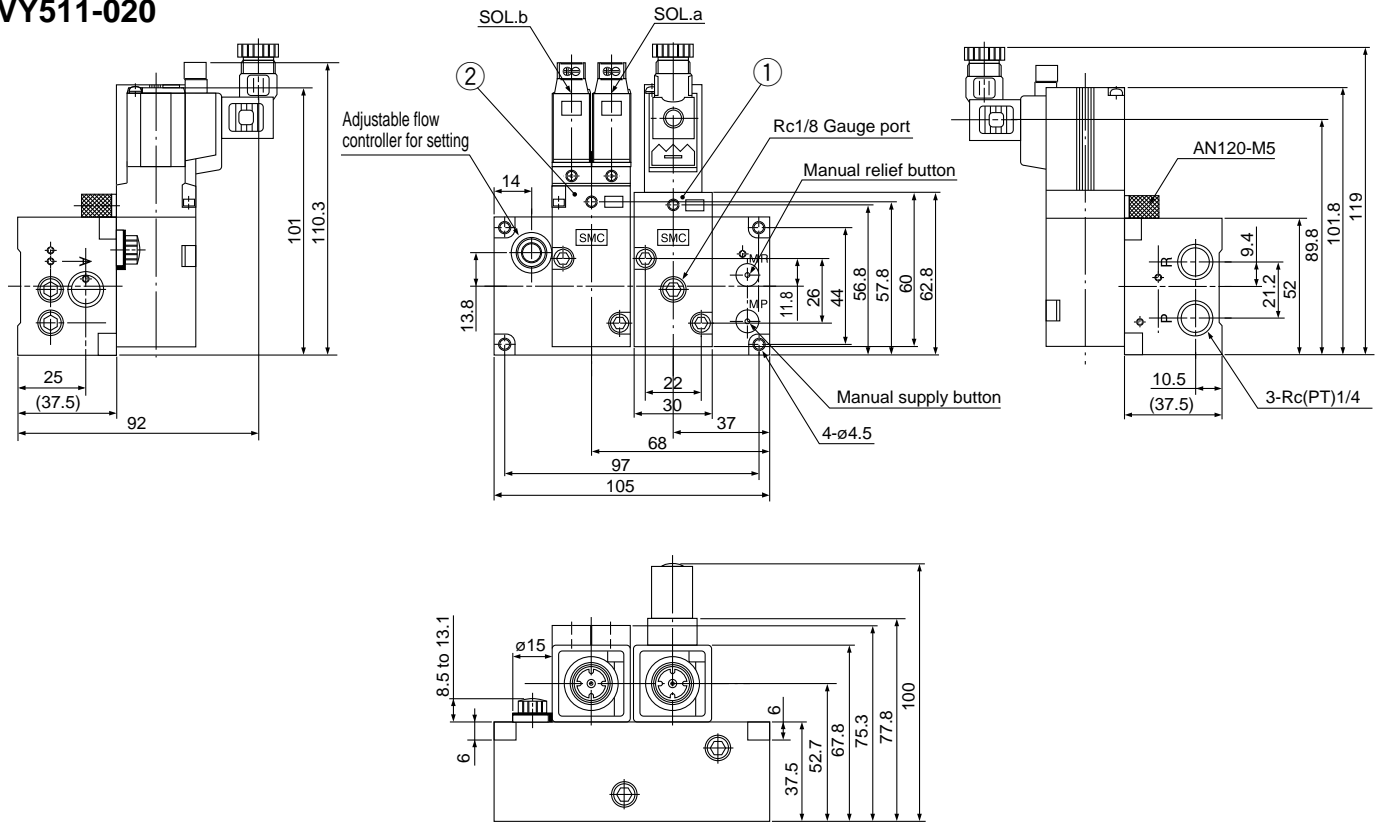


Balance Controller *Series VY511/VYU5*

Dimensions

Valve

VY511-020



Replacement parts

No.	Description	Part No.
①	E-P HYREG valve	VY1200-00-N
②	3 position valve	VEX3222-5M

Exclusive controller

VYU5-D

