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# Pneumatic Systems User Manual

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## Items included

The pneumatic systems referred to:

- Suction gripper kit
- Soft gripper kit
- Pneumatic gripper kit

Depending on your kit you will get a package of items ready to set up and operate with the robot.



### Note

Throughout this document; we use a 6 mm [\(OD\) air tube](#) and 6 mm push-to-connect tube fittings for passing the air and connecting the pneumatic devices. All of our suggestions in this document are based on these dimensions. Notice that you can always use different tube sizes and fittings based on your application.

## Suction gripper kit

The items in this kit are:

- Suction cup
- Toolhead adapter and mounting screws
- Vacuum ejector
- Push-to-connect tube fittings
- Relay switch
- Solenoid valve
- DC power supply
- I/O cable
- Air tube

## Soft gripper kit

The items in this kit are:

- Soft gripper
- Toolhead adapter and mounting screws
- Vacuum ejector
- Push-to-connect tube fittings

- Relay switch
- Solenoid valve
- DC power supply
- I/O cable
- Air tube

## Pneumatic gripper kit

The items in this kit are:

- Pneumatic gripper
- Toolhead adapter and mounting screws
- Vacuum ejector
- Push-to-connect tube fittings
- Relay switch
- Solenoid valve
- DC power supply
- I/O cable
- Air tube

## Air compressor

To run and operate a pneumatic kit, you need to have access to compressed air. Most generic air compressors in the market can work with our pneumatic kits.

Something you want to keep in mind when searching for an air compressor is

- The noise level
- Air tank volume
- Portability
- Operating voltage

For example, [this air compressor](#) can be a good general candidate.



### Note

Your kit does not include an air compressor.

## Pressure level

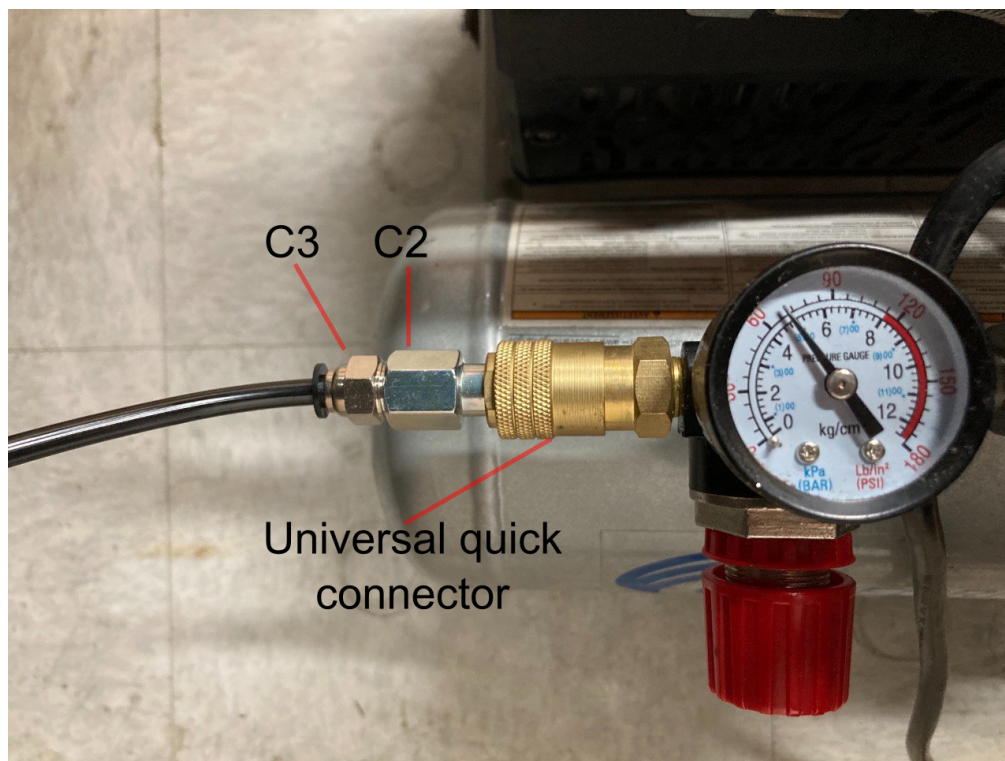
The suction force of a suction cup, or the jaw force in a pneumatic gripper, is proportional to the air pressure generated by the air compressor. We usually set the air compressor to **500 kPa (72.5 psi)**.



### Note

Depending on your application; you can always increase or decrease the air pressure. Read your tool head and air compressor datasheet to find the right and safe values.

## Air compressor adaptors



**Fig 1.** Air compressor air routing.

You usually need the right coupler(s) to connect the 6 mm air tube to the air compressor. Most air compressors have a universal quick connector to connect to your device. In that case, you need:

- (C2) Industrial quick-disconnect hose coupling to attach a push fitting to the air compressor ([example](#)).
- (C3) Push-to-connect tube fitting to connect the air tube to the air compressor ([example](#)).



### Note

Items C2 and C3 are not included in your kits, and you need to get them according to your air compressor.

## Wiring

In this section, we explain how to wire the pneumatic kit and control it with the robot. The items in this section and their pin assignment are as follows:

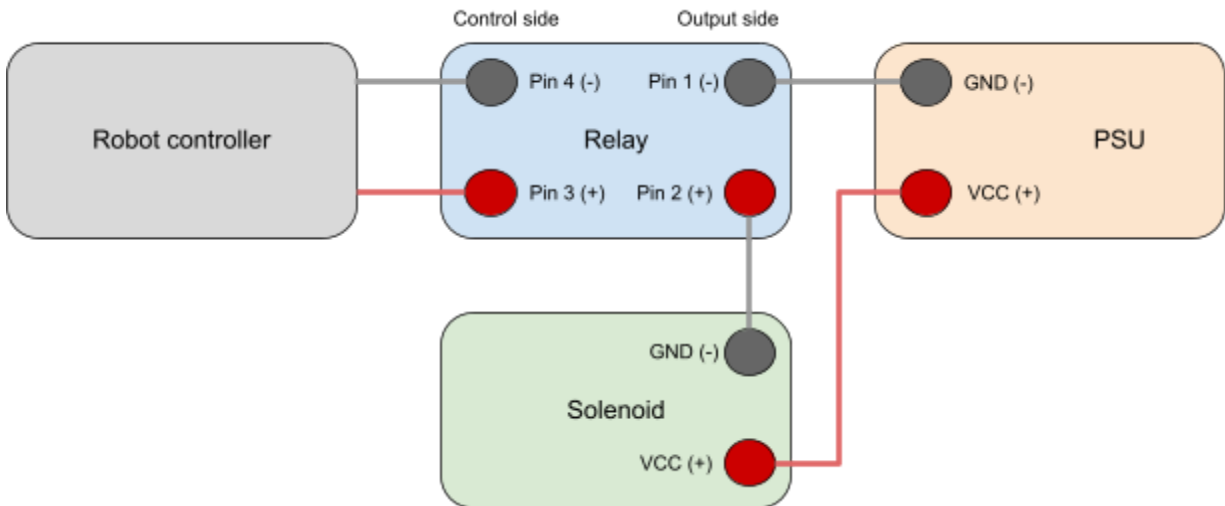
- Power supply: Usually a 24 VDC power supply with VCC (positive) and GND (negative) pins.
- Solenoid: The solenoid has two main electrical pins VCC (positive) and GND (negative). If not stated on the solenoid, you can pick any of the two pins as the VCC and the other as the GND.
- Relay: The relay ([example](#)) is an electrical switch, and its job is to enable the control of the solenoid valve (turn it on or off) via the robot controller output pins. The solenoid has four pins. The output side pins 1 (negative) and 2 (positive), and the control side (input side) pins 3 (positive) and 4 (negative).



### Warning

Make sure to connect all the IO wires when the controller is turned off. Connecting the IO wire to the controller when the controller is on can damage the robot controller.

## Connections



**Fig 2.** Pneumatic kit wire diagram

- The **VCC** pin (positive) on the solenoid is connected to the **VCC** pin on the DC power supply.
- The **GND** pin (negative) on the solenoid is connected to pin 2 of the relay (positive pin on the output side of the relay).
- Pin 1 of the relay (the negative pin on the output side of the relay) is connected to the **GND** pin on the DC power supply.

Based on the robot model, choose one of the assignments below in order to complete the wiring.

### Dorna 2 Blue

- Pin 4 (negative) on the relay is connected to the robot controller **GND** pin.
- Pin 3 (positive) on the relay is connected to one of the robot controller output pins.

### Dorna 2 Black

- Pin 3 (positive) on the relay is connected to the robot controller **VCC** pin.
- Pin 4 (negative) on the relay is connected to one of the robot controller output pins.

### Dorna 2S

- Pin 3 (positive) on the relay is connected to the robot controller **VCC** pin.



- Pin 4 (negative) on the relay is connected to one of the robot controller output pins.

## Air connection

We use a 5/2 solenoid ([example](#)) with one intake port P (1/8 NPT thread), two air outlet ports A and B (1/8 NPT threads), and two exhaust ports. The solenoid valve acts as an air valve with two states:

- When it is not energized (turned off), port P and port A are connected, and port B is connected to the exhaust.
- When energized (turned on), port P and port B are connected, and port A is connected to the exhaust.

Based on your kit, you need to follow one of the items below in order to connect the air tubes to the gripper.

## Suction gripper kit

This kit operates by negative pressure (suction). To create a suction force (vacuum), we use a device called (Venturi) vacuum ejector. The vacuum ejector has two main ports and one exhaust port. The two main ports are called:

- Port 1 (also known as port P or pressure port): Apply the air pressure to this port.
- Port 2 (also known as port V or vacuum port): Once pressure is applied to port 1 of the ejector, we get a vacuum on port 2 of the ejector.



### Note

The Venturi vacuum ejector is not bidirectional, and it is important to apply the air pressure on port 1, to create a vacuum on port 2.

In this setup, you must:

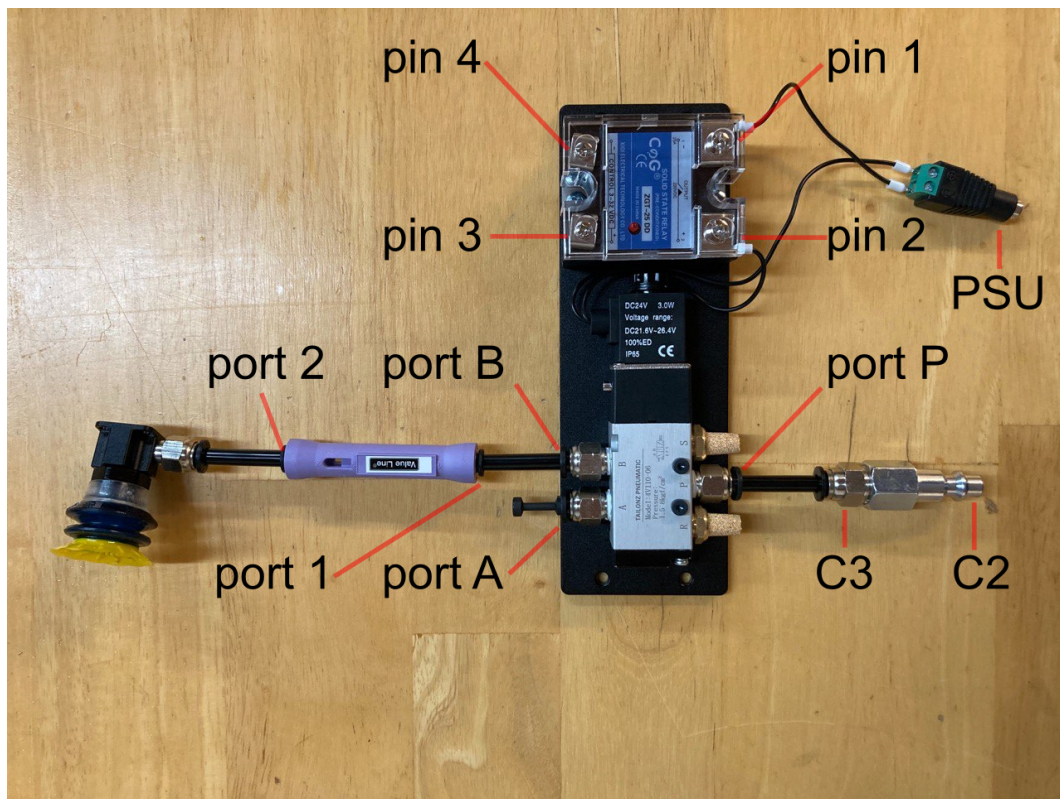
- Block port A on the solenoid.
- Connect port B on the solenoid to port 1 of the vacuum ejector, and connect port 2 of the vacuum ejector to your suction cup.



### Note

To reverse the state of the gripper, you can change the role of ports **A** and **B** on the solenoid, which means:

- Block port **B** on the solenoid.
- Connect port **A** on the solenoid to port **1** of the vacuum ejector, and connect port **2** of the vacuum ejector to your suction cup.



**Fig 3.** Suction gripper kit air routing.

## Soft gripper kit

This kit operates by negative pressure (suction). To create a suction force (vacuum), we use a device called (Venturi) vacuum ejector. The vacuum ejector has two main ports and one exhaust port. The two main ports are called:

- Port 1 (also known as port P or pressure port): Apply the air pressure to this port.
- Port 2 (also known as port V or vacuum port): Once pressure is applied to port 1 of the ejector, we get a vacuum on port 2 of the ejector.



### Note

The Venturi vacuum ejector is not bidirectional, and it is important to apply the air pressure on port 1, to create a vacuum on port 2. It is also recommended not to keep the vacuum ejector far from the pneumatic tool (suction cup or gripper).

In this setup, you must:

- Block port A on the solenoid.
- Connect port B on the solenoid to port 1 of the vacuum ejector, and connect port 2 of the vacuum ejector to your suction cup.



### Note

To reverse the state of the gripper, you can change the role of ports A and B on the solenoid, which means:

- Block port B on the solenoid.
- Connect port A on the solenoid to port 1 of the vacuum ejector, and connect port 2 of the vacuum ejector to your suction cup.

## Pneumatic gripper kit

These types of pneumatic tools work with air pressure and not vacuum. They usually have two air ports for open and closed states. When applying air pressure on one port, the gripper goes to the all-open state; when applying air pressure to the other port, it goes to the all-close state.

In this setup, we need to:

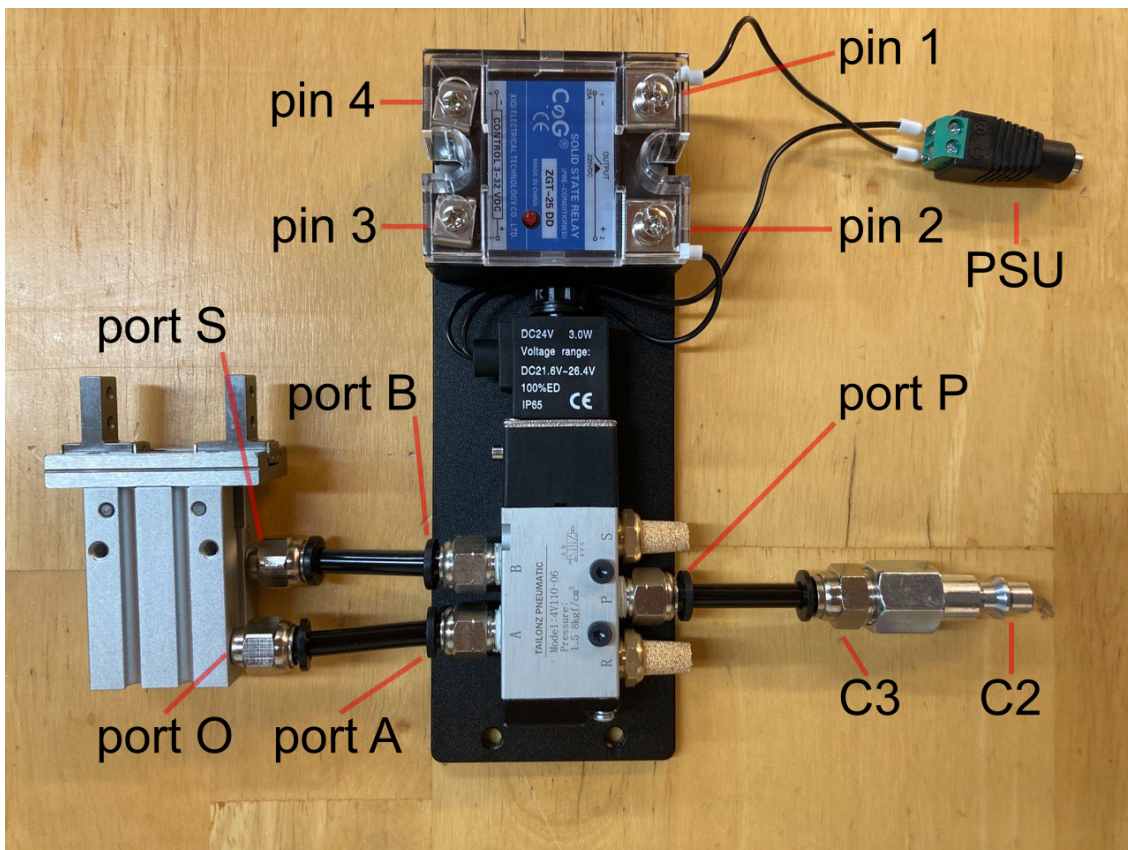
- Connect port A on the solenoid to port S on the gripper.
- Connect port B on the solenoid to port O on the gripper.



Note

To reverse the state of the gripper, you can change the role of ports **A** and **B** on the solenoid, which means:

- Connect port **B** on the solenoid to port **O** on the gripper.
- Connect port **A** on the solenoid to port **S** on the gripper.



**Fig 4.** Pneumatic gripper kit air routing.