Spherical universal mechanical claw and controller instructions

First, product introduction

The spherical universal mechanical claw is designed and made of unique grasping principle, with the advantages of simple structure, strong grasping safety and no damage to the object, strong grasping versatility and strong interest.

1.1 principle introduction:

The grasping principle is summarized as follows: the elastic sac (the blue part in Figure 1) is filled with small particles of low friction, and the objects are grasped and released by controlling the internal air pressure so that the filled particles can be transformed in the loose flow state and the rigid state. Specifically: as shown in Figure 2, under positive pressure, the blue elastic sac bulges slightly, the powder is loose flow state, the blue elastic sac part is vertically soft pressed on the object to be grabbed, and the powder flows around the object; Switch to negative pressure, under the action of external atmospheric pressure, the powder is pressed, the blue part hardens, so as to grasp the object. Switching to positive pressure again, the internal powder becomes loose again, and the blue elastic pouch bulges slightly, releasing the grasped object.

Figure 1. Spherical universal mechanical claw

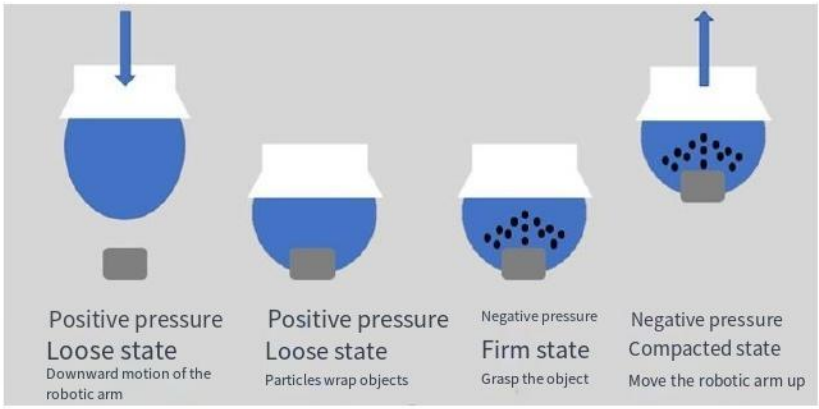


FIG. 2. Grasping process diagram of spherical universal mechanical claw

1.2 Introduction of grasping mechanism:

There are three sources of the grasping force of the spherical universal mechanical claw, namely, the pressure difference similar to the effect of the suction cup, the friction generated under the action of pressure, and the shape locking. This makes it possible to grasp a wide variety of objects.

FIG. 3. Grasping mechanism diagram of spherical universal mechanical claw

It should be noted that the force provided by the pressure difference is very small, so it can not be equated with the suction cup, the spherical mechanical claw is difficult to pick up flat objects, mainly rely on shape locking and friction to grasp the object.

二、产品参数介绍

Spherical universal mechanical claw BU60 dimension mark:

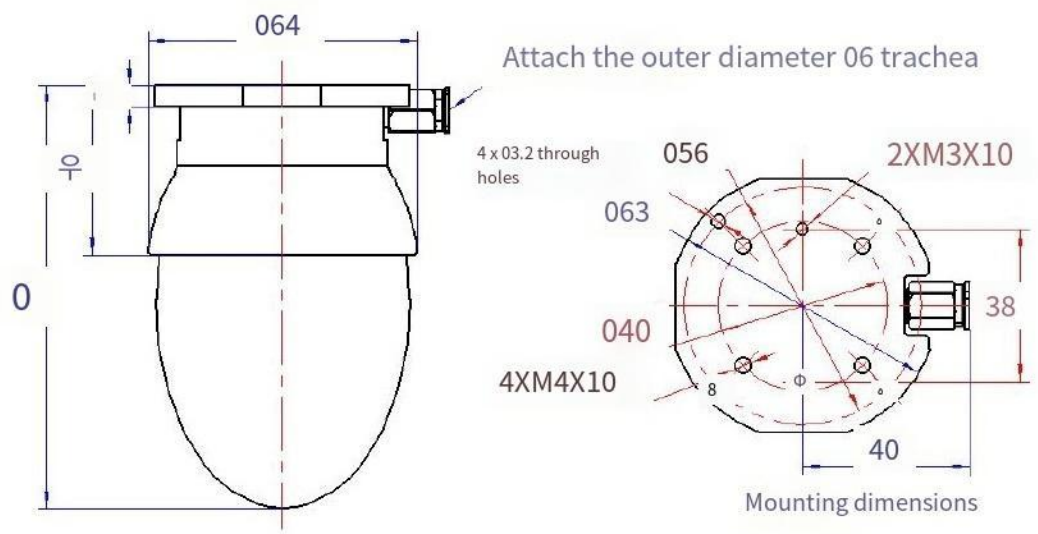


Figure 4. Size of BU60 spherical general mechanical claw

As shown in Figure 4, the blue mark is the outline size of the spherical universal mechanical claw, and the red mark is the installation size mark of the mechanical claw. There are two types of mounting holes reserved on the mounting plate above the top plate, namely, two M3 threaded holes with a spacing of 36mm, four M4 threaded holes with a diameter of 40mm and four through holes with a diameter of 3.2mm that are evenly distributed on a diameter of 56mm. Among them, the four 3.2mm diameter holes in the 56mm diameter can be used for the connection of the mounting adapter plate (to be purchased separately) in the stock of Yippon, and installed on the cooperative robot arm (such as UR, Maxtel, etc.).

Common parameters of spherical universal mechanical claw

category	Parameters	Remarks
Self-respect	110 g	
load	<300 g	Different shapes, sizes, materials of the object, grasp the situation is different, the maximum load does not exceed 300g.
Grasp range	Within 40mm diameter Or narrow sides within 40mm	Cylindrical, spheroid, strip, and irregular shape
Ambient temperature	Less than 50C	

Three, the use of pneumatic controller introduction

The spherical universal mechanical claw needs to be controlled with positive and negative pressure. According to different needs, easy claw has developed three kinds of controllers to control. The following are respectively introduced.

Comparison item	Express edition	Standard EDITION	High-speed version
Control mode	10 control is required after the user connects the cable	Manual switch 10 control (3.3-24V)	Manual control IO control (24V)
Power demand	DC24V (user supplied)	DC24V (delivered)	DC24V (delivered)
Air demand	Built-in included	Built-in included	Own industrial air supply
Air source flow	4升/分钟	8 l / Min	> 40 l / Min
Grab speed	<20 times /Min	< 35 /分钟	<60 times /Min
Grab load	It is recommended to grab objects weighing less than 300g		
Grab size	At least one side <40mm, can not grab soft objects such as bread		
ready-to-use	Wiring and control required	is	Air demand

Only require to achieve the function, the speed requirements are not high, there is a certain technical ability, the budget is not much education scene, and the mobile use scene, optional simple version;

Have certain requirements for speed, appearance and noise requirements for display, education and other purposes, as well as mobile use scenes, you can choose the standard version.

The speed requirements are high, there is a certain technical ability, there is an industrial air source (air pump), and the fixed location is used, the high-speed version is optional.

3.1 simple version instructions:

Figure 5. Simple version pneumatic controller

Wiring instructions:

Simple version of the pneumatic controller mainly includes the upper and lower two air pumps, and a solenoid valve, when the upper air pump is energized, the output negative pressure, the lower air pump and the solenoid valve are in parallel, when the power is connected, the output positive pressure. In order to prevent the positive pressure into the spherical mechanical claw too much, resulting in the elastic sac rupture powder leakage, positive pressure output accompanied by a slight leak, is normal.

In IO control, positive pressure control time requirements, negative pressure control can be stopped after 2-3S, can also be

To provide negative pressure at all times。

Figure 6. Rear view of simple pneumatic controller

When connecting the solenoid valve, first unscrew the bolt on the transparent plastic shell and remove the transparent plastic shell. As shown in the figure, the upper left terminal of the solenoid valve is connected to 24V+ of IO, and the upper right terminal is connected to GND.

The wiring of the air pump is similar to that of a DC motor, where the one near the "+" is 24V+

The solenoid valve or air pump is rated for less than 0.5A.

3.2 Standard version instructions:

Figure 7. Standard pneumatic controller

Shipping list: BUC8 pneumatic controller, is a portable positive and negative pressure controller with built-in air pump. With a spherical mechanical claw, its shipping list is shown below. Includes: spherical mechanical claw, gas pipe, pneumatic controller, power supply.

Figure 8. Shipping list of standard pneumatic controller + spherical mechanical claw

The main interface of the controller includes: power switch, power socket, external IO control interface, air outlet, positive and negative pressure switch button, positive and negative pressure adjustment dip switch.

Figure 9. Control panel of standard pneumatic controller

Specific operation:

System connection: one end of the gas pipe is inserted into the air outlet, and the other end is inserted into the pneumatic joint on the spherical mechanical claw. Power is plugged into the 220V socket to take power, and the other end is plugged into the power socket of the controller to supply power to the controller.

Press the power switch and the indicator on the power switch will light up. Use the positive and negative pressure switch keys for control. The negative pressure side is pressed, and the built-in air pump stops after the set time, and the spherical claw becomes hard to grasp the object. At this time, you can press the key to the middle position, or you can directly press to the positive pressure position, the output is switched to positive pressure, and the captured object is released.

Note: After the power is powered on, only the negative pressure can work first, if the positive pressure is given first, the air pump does not act and has no reaction. Negative pressure or positive pressure can only be switched after running the set time, otherwise there is no reaction.

Positive and negative pressure adjustment: positive and negative pressure adjustment dip switches can be set respectively for positive pressure and negative pressure running time. (In the initial period of time, the longer the running time, the greater the air pressure; The positive pressure required by the spherical mechanical claw is very low, about 5KPA, so the positive pressure time is short; The longer the positive pressure time, the larger the spherical drum, the better the grasp effect of slightly larger objects, the longer the negative pressure time, the greater the negative pressure value, the greater the grasp of the object.)

The corresponding relationship between dip and the corresponding positive and negative time of air pump:

	below	Up and down	Under the Up.	Up-and-down
Red positive pressure	0.5S	0.7S	0.75S	0.8S
Blue negative pressure	0.75S	1S	1.25S	1.5S

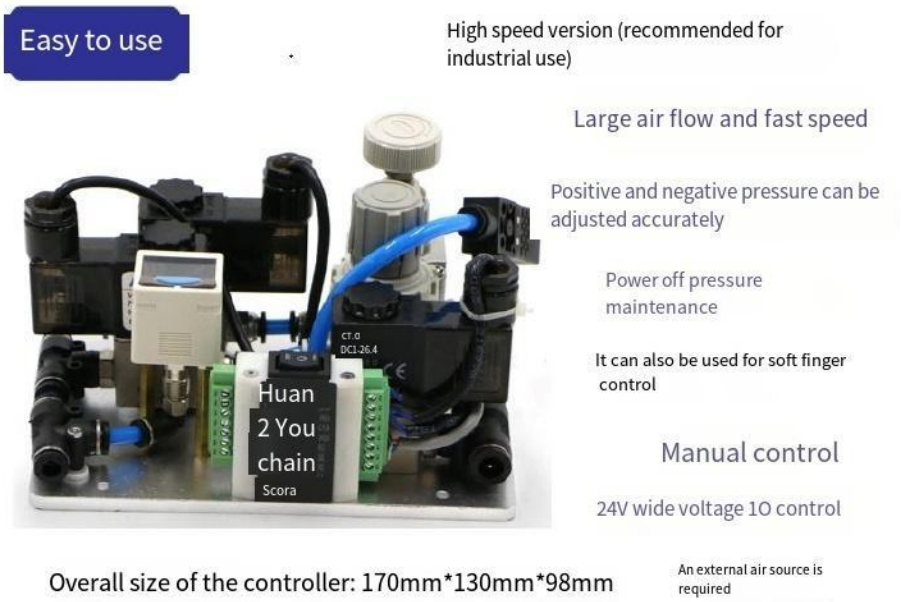
External IO control: This method can be used when program control needs to be combined with other controllers.

IN1, IN2 are high level (5-24V) effective. GND can be controlled only when it is in common with the GND of other controllers. IN1 is valid, it is negative pressure, IN2 is valid, it is positive pressure.

Like manual control, negative pressure control must be carried out first, and the corresponding time can be switched.

3.3 high-speed version instructions:

Figure 10, high-speed version pneumatic controller



The SAC40A pneumatic controller is mainly used for regulating and stabilizing the output of positive pressure and negative pressure, switching the output of positive pressure and negative pressure, and maintaining the air pressure after the gas/electricity is cut off. It is mainly suitable for mechanical claws that need to be controlled by positive pressure and negative pressure, including soft adaptive mechanical claw, spherical universal mechanical claw, etc. The following describes its use method.

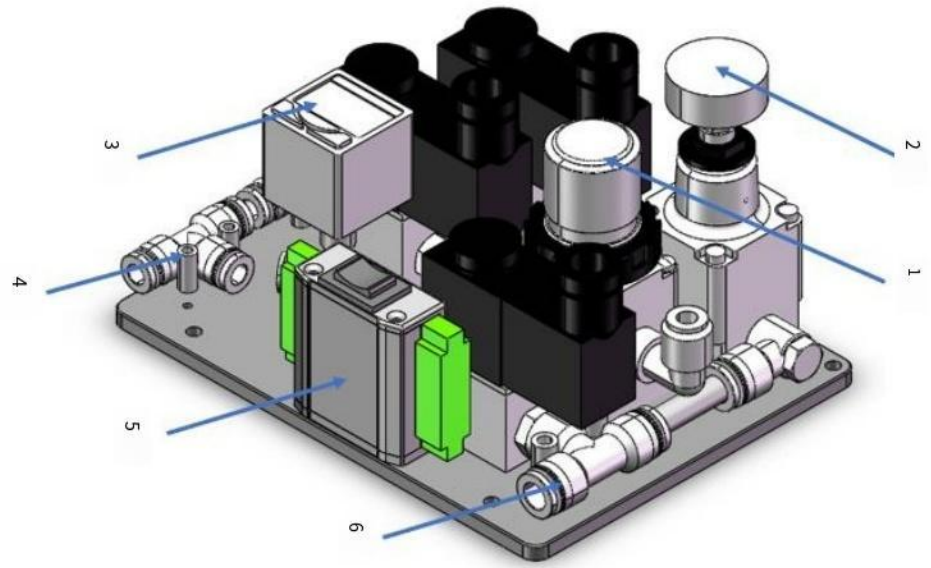


Figure 11. Overall picture of SAC40A pneumatic controller

1 Negative pressure regulator 2 Positive pressure regulator 3 Barometer 4 Air outlet 5 electric control part 6 Air inlet

1. **Circuit connection:**

The main instructions of the electric control part are shown in the figure. Among them, the 8P connector on the right has been connected to the components of the pneumatic controller. The left 7P is the part that the customer needs to connect.

From top to bottom: 24V+, 24V- is the power connection (required

Connect). The required voltage is 24V, and the power supply is greater than 1.5A;

IN1 IN2 GND is the interface for IO control (it can be connected when IO control). GND is common to the controller, IN1 IN2 is valid at 24V high level. IN1 is high, IN2 is low, and the output pressure is positive; IN1 is low, IN2 is high, and the output pressure is negative. Note that the upper three-gear boat switch should be in the middle position when using IO control.

OUT1 OUT2 means that the actual air pressure reaches the positive set by the barometer

The 24v level output feedback is given when the pressure and negative pressure values are reached. (can not be connected).

The sign of positive and negative pressure refers to the upper third gear boat type switch, and the output air pressure will be changed to the set positive or negative pressure after pressing in the direction shown. It belongs to the manual control mode.

2. Air pressure adjustment: First adjust the positive pressure and then access the mechanical claw (the output can be temporarily blocked by the fingertips of the interface). For the soft mechanical claw, the positive pressure is strictly less than 100KPA, otherwise it may damage the finger; For spherical mechanical claws, set the positive pressure strictly less than 12kpa, and pay strict attention to the ventilation time.) .

Port 6 is the air intake port, which connects to the air source; 4 is the air outlet, access the required control of the soft mechanical claw, the air source pressure is greater than 0.4MPA, the flow rate is greater than 40L/MIN. After connecting the power supply to 5, the ship switch is pressed in the corresponding direction of positive pressure, according to the instructions on the positive pressure regulator knob, turn the handwheel, look at the display pressure of the barometer, adjust to the required positive pressure, cut to the negative pressure for negative pressure adjustment. Negative pressure regulator first pull the regulator cap upward, and then rotate, to set the negative pressure and then press it to lock.

3, positive and negative pressure switching control:

Two ways: boat type switch manual control and IO control, has been explained in the circuit connection. Note that the boat type switch should be in the middle position for IO control.

About air pressure hold. The positive or negative pressure can be turned off after the control is connected about 0.5S, and the mechanical claw will maintain the previously designed air pressure. This is more energy saving, especially the negative pressure will always consume a large amount of gas. At the same time, it will not cause unexpected power failure or gas interruption to drop the things that are grabbing and moving (the negative pressure of the spherical mechanical claw can provide a little more time, or make up a negative pressure in the middle).

For the spherical mechanical claw: the positive pressure control of the spherical mechanical claw is essentially to control the gas volume, if the set positive pressure value is 11-12kpa, the positive pressure intake speed will be relatively fast, and the time to close the positive pressure should also be very short. Manual control, basically press the positive pressure, the switch immediately press back to the middle or negative pressure position. For program control, it is about 0.3s. If the positive pressure value is set at 8-9kpa, it can be appropriate to increase the gas supply time. It can also be tested to stop the positive pressure output after the barometer figure is displayed in

5-6kpa is appropriate ().

4. Precautions for use

Do not contact high temperature, corrosive, sharp objects, so as not to cause damage to the blue elastic airbag. Do not disassemble without permission, otherwise it may affect the air tightness.