

# Gas Mixing System for Tube furnace

## Operation Manual



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## Introduction

1. This mixer is specified for mixing 3 gases or continuously supplies one gas under small gas flowing rate and low pressure. The air can not get in whenever you switch the different gases into use.
2. Gas flowing rate and pressure can be exactly displayed in one screen for an efficient control.
3. Easy installation and repair of the valve and meter because of dual-union-adapter between them.

## Specification

Float flowing meter: 10~100ml/min, 16~160ml/min. 25~250ml/min. (optional)

Gas mixing tank:  $\Phi 80 \times 120$ mm

Stop valve: 160P stainless steel needle valve,  $\Phi 1/4$ "

Connection pipe: PTFE (Teflon) or stainless steel,  $\Phi 1/4$ "

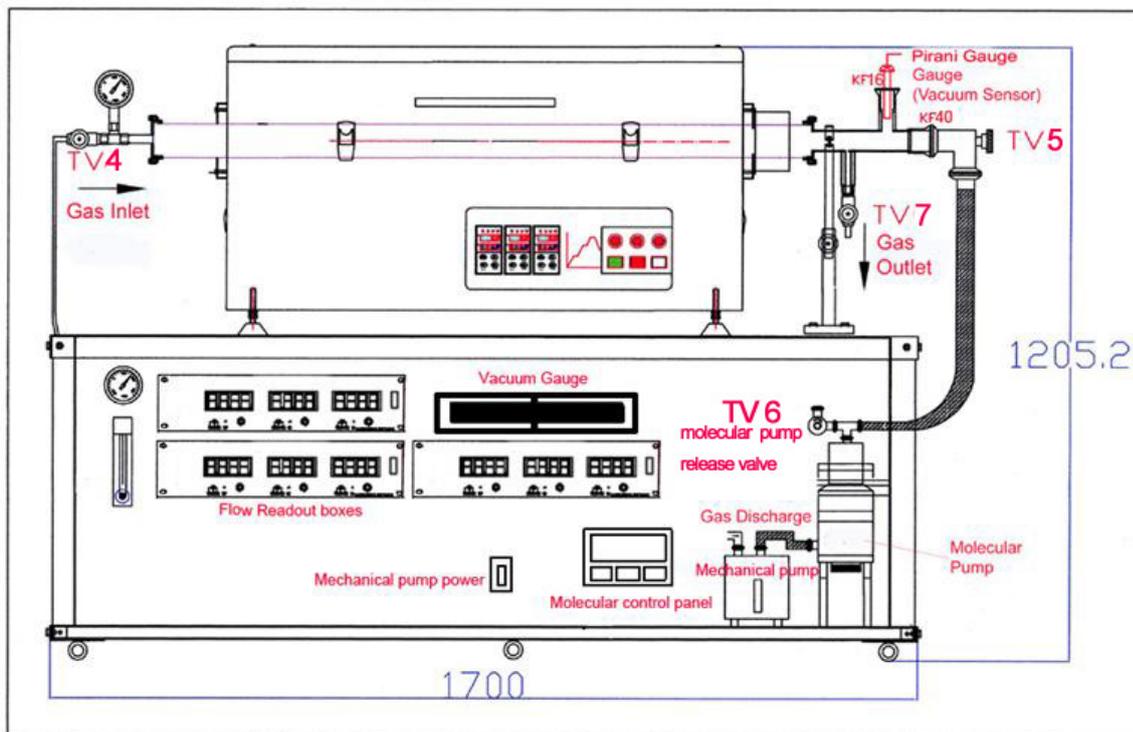
Vacuum gauge: ( $\Phi 60$ ) -0.1~0.15Mpa, accuracy 0.01Mpa.

Working Voltage: 220V $\pm$ 10% 50~60Hz

Power: 1KW

System Final Vacuum:  $4.3 \times 10^{-3}$ Pa

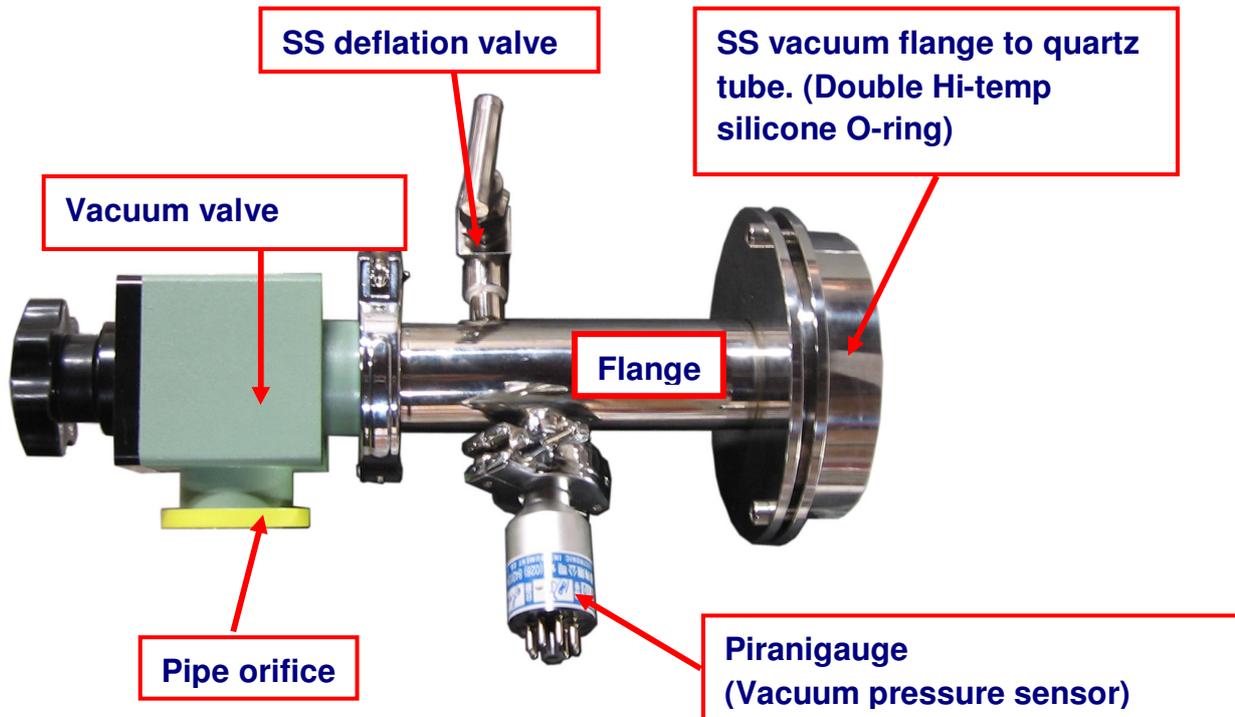
## Illustration



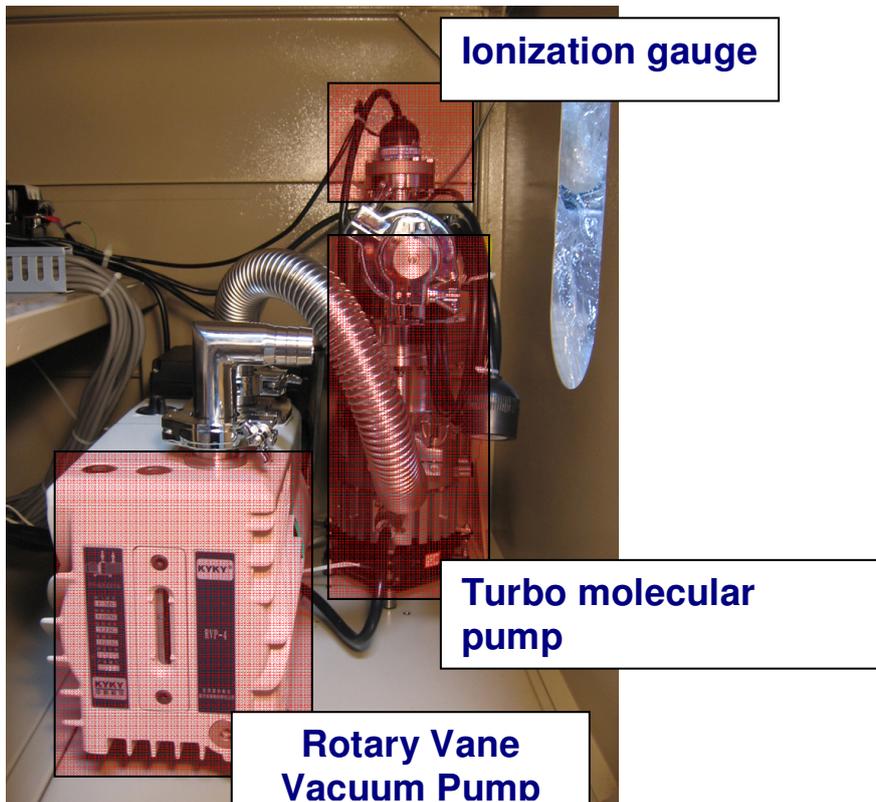
Reference Drawing

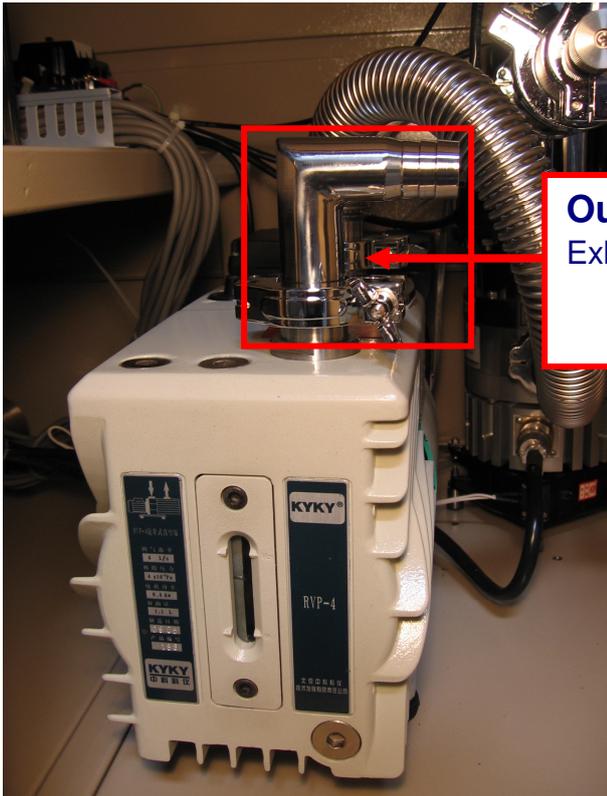
## Installation

1. Assemble vacuum fittings and connect them with the quartz tube in furnace. (Detail process please read the **OTF-1200X-III Split Three-Zone Tube Furnace** operational manual)

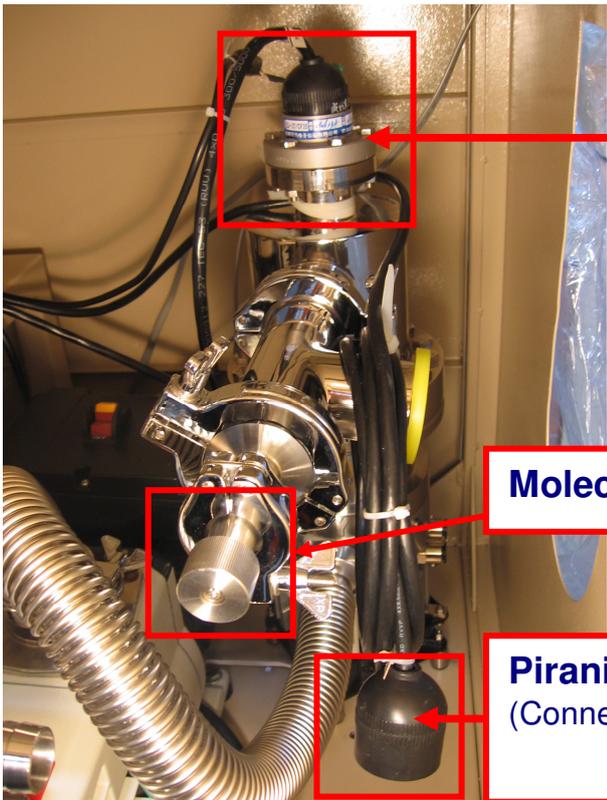


2. When first open the door on Mixer. Such scene appears as the following picture shows.





**Outlet port**  
Exhaust gases during vacuuming



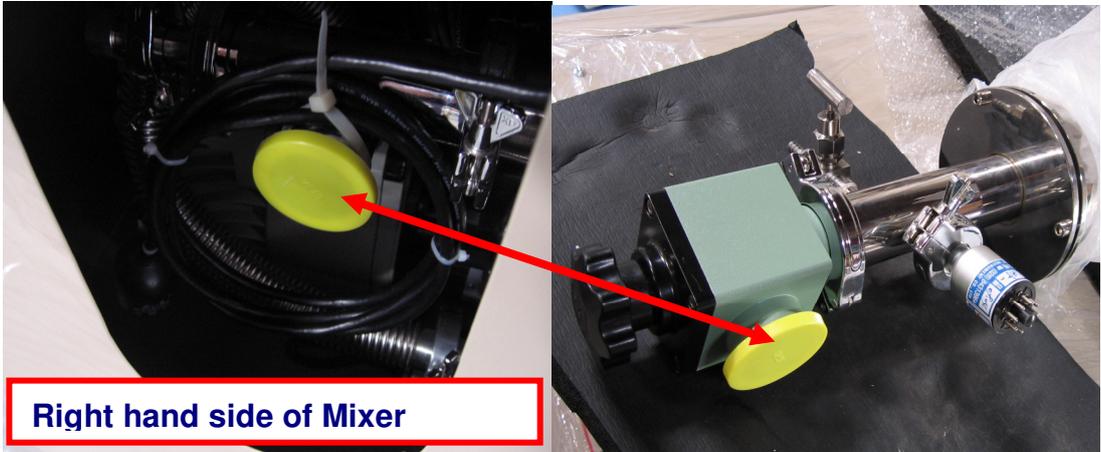
**Ionization gauge**  
(Already installed)

**Molecular pump release valve**

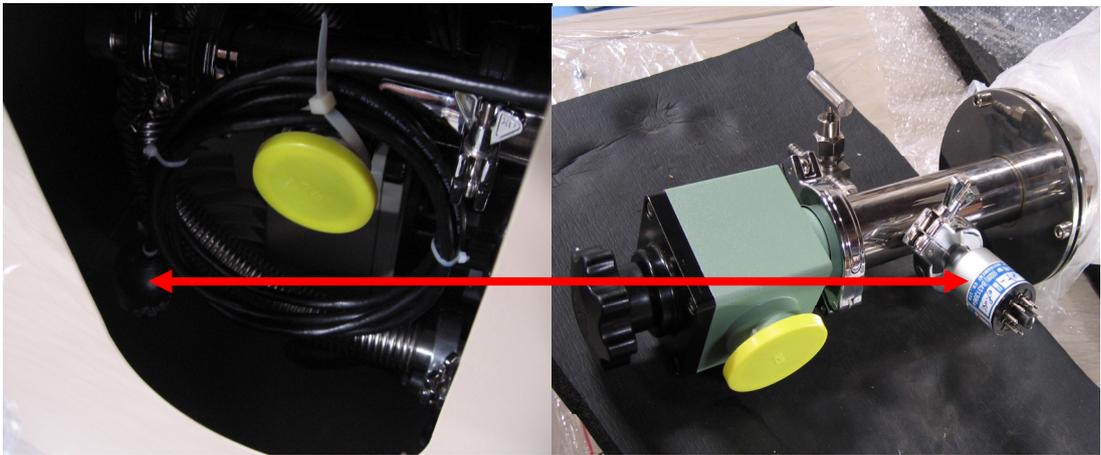
**Piranigauge socket**  
(Connect with Piranigauge manually)

2. Connect Mixer with furnace by vacuum pipe (KF D-40) and clamp tightly by quick clamp. (KF D-40).

You will see a pair of yellow lids. One is on the vacuum valve which connected with flange, and the other is in Mixer as the following figure illustrates.



3. Connect pirani gauge.



4. Finish installation.

# Operation

1. Power on the machine (AC220V/50HZ, 1KW);
2. Turn on the valve **TV5** clockwise and then open the power of mechanical pump (fore pump) to vacuum.
3. When the pressure of the system reaches to 10 Pa, the powers of molecular pumps will startup automatically with the “High Speed”, “Rotation Speed” indicating light on. Press down the working button, “working” indicating light will be on which means the molecular pump starts to work. As the speedup of the pump’s rotation, number displayed on LED possessing 4 digits increases until at  $704\pm 10\text{Hz}$ , when the pump enters stable rotation state. During this process, the customer can freely adjust the value of rotation speed, current and voltage by operating the button on panel.
4. Turn off the valve **TV5** after vacuuming to the ideal state (normally,  $10\times 10^{-3}\text{Pa}$  after 2 hours);  
Press down the working button again, the working indicating light will be off, and then, cut off the power of molecular pump to cease it. In order to extend the durability of this molecular pump, please turn on the valve **TV6** used for inching adjustment of exhaust before the pump speed decreases to the half of rated rotation speed to make the molecular pump get through the resonance point. Meanwhile, this operation can farthest prevent the forepump oil from reverse diffusion. When exhausting, please be advised to let the pressure in the molecular pump gradually increase to 40000 Pa, then to atmospheric pressure, also, shut down the mechanical pump.
5. Turn on valve **TV4** to put the protect gas in, and out from **TV7**.
6. High polluting, corrosive and explosive gas is forbidden to use for this system.

**Note:** When operating the pump, please open the front panel so that the system can get good heat dissipation.

## Rotary Vane Vacuum Pump

This rotary vane vacuum pump features:

1. High ultimate vacuum degree
2. Low noise
3. No oil leaking or spurting
4. Convenient pressure control

### Maintenance

1. Oil Check: Oil level should be in the domain of level mark when pump working.
2. Keep oil clean and proper amount: Normal oil should be fair and clear, please change the oil regularly or whenever it is dark.
3. Shut down the pump and change the oil in a warm environment: Firstly, open the oil outlet to release the polluted oil into a tank. Secondly, open the gas inlet, fill some clean oil in, and then run

the pump less than 10 seconds to expel the remnant. Finally, open the oil inlet to fill the clean oil in and then tighten the cap (Specific pump oil like MR-200 or PV-200 is advised)

## Turbo Molecular Pump

### 1. Cooling:

The bearing and motor of molecular pump should be cooled when it is working because of frictional heat by bearing, dissipation of heater and lower natural cooling rate in vacuum. Air cooling is for a general use when the ambient temperature is lower than 32°C and, water cooling is preferable if the temperature is high and long time operating the machine (4 hours or more), remember that the flowing rate of water (no more than 25 °C) should be higher than 1L/minute and the inner diameter of the hose matching with the nozzle on the pump, is 10mm.

### 2. Lubricant

Change the lube every 3000 working hours of the pump (lube is enough for the first time use since we had it full before shipping), which means the customer can change it every one year and a half if for general use. However, please increase the change frequency if use the machine too often.

Follow the instruction below to change the lube:

- a. Accordingly, loosen off two screws on the oil inlet (upper) and oil outlet (lower) which on the upper bearing and then, the two on the lower.
- b. Remove the pump from the whole system and horizontally place it on a flat to ensure the inlet face up, and then, inject the lube into the two inlets and dispose the oil from another side, tighten the four M5 screws when done.

Note: 1. When tightens the screws please well seal the black o-ring to avoid air leakage.

2. Do not use any substitute of the specific lubricant, otherwise, it may damage your pump.

### 3. Startup

When the system pressure reaches to 10 Pa, you can start this pump.

### 4. Speed up

Generally, the molecular pump should go to 700 Hz within 2 minutes, if it can not approach 400 Hz within 3 minutes, the power will cut off the power.

### 5. Baking

To bake the pump and vacuum system to get an ultimate pressure, please plug the power cable to the socket supplying single phase 220v.

Note: 1. Baking temperature for pump should be lower than 100 °C, for flange connecting to pump lower 120 °C, for vacuum system lower than 300 °C.

2. To obtain vacuum with  $10^{-3}$  Pa, no need to bake, if  $10^{-4}$  Pa bake the system, and higher to bake both system and pump.

### 6. Shut down:

Power off the pump and the pump gradually decelerate until stop, please release the pump no later than the decelerating speed to the half of rate speed (make the pump quickly pass the resonate point to prolong the pump's life). When release the pump, please strictly follow the releasing rule, otherwise, **it may cause danger!** Do not let the pump in a long time vacuum state; the oil pump

steam may diffuse into this pump from fore-pump. Please stop water cooling after shutting down the pump.

#### 7. Cleaning

Contact MTI for a cleaning service.

#### 8. Troubleshooting

Problem Description	Possible Reason	Solution
Pump can not start	1. Cable broken or not contact well 2. Other reason	1. Change one or contact well 2. Inform us
Pump can not reach to the rate speed after a long time running	1. Vacuum system leakage 2. Oil pollution or Lube lack 3. Bearing broken	1. Eliminate the leakage and the fore pressure should be lower than 5 Pa. 2. Change lube 3. Change bearing
Big noise or abnormal vibration when operating	1. Lube lack 2. Pump works in resonate range 3. Bearing broken	1. Fill lube 2. Change connection position and size, and fix the moving part and add damping O-ring 3. Change bearing
Low vacuum degree	1. Fore vacuum leakage 2. High vacuum leakage 3. Fore pump works abnormally	1. Seal the fore vacuum 2. Repair and seal the system 3. Check and repair the pump
System can not reach the desired vacuum degree after a baking	1. Fore pressure is high 2. Pump pollution	1. Fore pressure should be lower than 5 Pa 2. Contact us to clean

9. To derive the ultimate vacuum, please bake the pump and testing hood for more than 48 hours, and pump the hood to get the lowest pressure in the testing hood, which is the total air pressure remain in the hood.

## Molecular Pump Controlling Power

### 1. Pump startup:

When fore pump get a pressure lower than 10 Pa, the system will automatically power on with “High Speed” and “Rotation” on the front panel brightens up, press “Working” button to start the pump. The pump will accelerate the rotating speed with the number on 4-digit LED increasing until pump stays at  $704\text{HZ} \pm 10$ . Customer can use keypad to change the rotation speed, current, voltage, low speed and high speed.

### 2. Pump Stop:

Press “Working” button again, the working indication light will get off with the rotation speed decelerating to “0000” on the panel. When the system pressure is higher than 60 Pa, pump will be shut down automatically.

### 3. Troubleshooting

Problem	Possible Reason	Solution
Overtime indicating light is on, Buzzer is on.	Air pressure is too high, $P \geq 1\text{mbar}$ , the system can not reach to 400 Hz when the acceleration time is over 3 minutes, or, the four-terminal output is damaged.	Check the fore pump, system leakage and the four tubes IRFP460 in the power box, change them if needed.
Overheating indicating light is on, and the buzzer is on	Motor is overheated, no air or water cooling for the pump	Check the cooling system
Overheating indicating light is on, and the buzzer is on	System decreases to 400 Hz but with normal power, four-terminal output tube or core power circuit is damaged.	Check four tubes IRFP460 or send back to the manufactory for mending
Both overtime and overcurrent indicating light are on, buzzer is on.	System leakage	Check the leakage
No indication after power on the machine	No power	Check the 3A fuse in the power box.
Both rotating speed and switch voltage maintain the value "0000" when press working button	Output stage is open circuit or core power is damaged.	Check the 7A fuse on the power board which is in the power box or send back for mending.
Rotating speed is small but no Increase but with the switch voltage	Sensor (Hall element) is damaged.	Send the molecular pump back for mending

## Compound vacuum gauge with digital display

### 1. Introduction

ZDF-III-LED compound vacuum gauge consists of ZJ-52T pirani gauge and ZJ-27 ionization gauge which could accordingly measure the low vacuum ( $10^5 \sim 10^{-1}$  pa) and high vacuum ( $100 \sim 10^{-5}$  pa). This device will automatically measure the vacuum degree when the system is powered on.

### 2. Pirani gauge (on the left):

2-1. Pirani gauge is used for measuring low vacuum (higher than  $10^{-1}$  pa).

2-2. Calibrate this gauge when **first time use**: Set the device as "Manual", press "Open ionization" to monitor the system vacuum degree, calibrate potentiometer to "ZERO" to display 1.0E-1 when the system vacuum is about  $1.0 \times 10^{-1}$ , and adjust it to "F.S" when at atmosphere to display 1.0E5.

2-3. When the gauge is broken, the unit will display "-----" and enter the state of "manual".

### 3. Ionization gauge

#### 3-1. Continuous measurement

3-1-1. Make sure the both pirani gauge and ionization gauge are to measure the same system.

3-1-1. The pirani gauge will automatically measure the vacuum degree after system starts, and when the vacuum is higher than 200 pa, ionization gauge will be on.

### 3-2. Separate measurement

3-2-1. Press “auto” button to disable auto function (the “auto” LED will be off).

3-2-2. Press “Ionization” button until the “Ionization” LED is on to enable the ionization gauge.

3-2-3. Again press down “Ionization” button to check the emit current and release the button to display vacuum degree. If the current is “-----”, please check if the vacuum is too low or change a new gauge to measure.

3-2-4. Air release for 3~5 minutes to decrease the measurement error, when the vacuum is higher than  $10^{-2}$  Pa, press “release” to release the air and the unit will display the time for releasing, press “ionization” to stop

3-2-5. When the vacuum is lower than 10 Pa, the system will go to self-protection and displays “----”, the ionization measurement will recover after the vacuum is higher than 10 Pa.

### 4. Controlling and setting:

This function is used for setting the upper and lower limit for the system.

4-1. Hold “set 1” and the upper limit LED is on, release the button until to your target.

4-2. Again hold “set 1” and the lower limit LED is on, release the button until to your target.

### 5. Notice

5-1. Auto-self-lock function will forbid system releasing the air when the vacuum is lower than  $10^{-2}$ .

5-2. Data protection can save the setting for next time use.

5-3. A measurement drift may happen at  $10^5$  but does nothing to the accuracy when lower than  $10^3$ .

If any questions please contact us 1-510-525-3070 or email [info@mtixtl.com](mailto:info@mtixtl.com), we will help you out within 24 hours.