

Operation Manual for JFB Series Molecular Pumps



TYPE:

- | | | | | |
|--|--|--|--|--|
| ☒ JFB-63/81M | ☒ JFB-63/81 | ☒ JFB-100/251 | ☒ JFB-100/301 | ☒ JFB-160/401 |
| ☒ JFB-160/450D | ☒ JFB-160/700 | ☒ JFB-160/701 | ☒ JFB-200/1400 | ☒ JFB-200/1401 |
| ☒ JFB-250/2200 | ☒ JFB-250/2201 | ☒ JFB-400/4201 | | |

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Safety Warning Instructions



Instructions for use:

- Before installing and debugging the pump, please carefully read these operating instructions and follow this information to ensure the stable operation of the pump!
- For correct, safe, and efficient operation, users must carefully read and strictly follow the safety precautions described in the operating instructions!
- The molecular pump must be operated under the conditions described in the operating instructions!
- Must be operated and maintained by trained personnel!

Dangerous



1. Molecular pumps are not suitable for pumping active, corrosive, and toxic media!
2. When lifting or manually handling pumps, avoid the danger caused by slipping and falling!
3. Electrical connection operations must be performed by trained personnel!
4. Before starting any maintenance and repair work, disconnect the power supply first!

Caution



1. If the pump is heated during use, please be careful not to touch it to avoid burns!
2. Transport pumps and connecting cables must use their original packaging.

Attention



Avoid scratching the front stage of the molecular pump, the outer edges or edges of the controller during work



This series of products is only used to obtain high (ultra-high) vacuum; Suitable for pumping dry inert gas media; Must be used in conjunction with a pre pump that meets the standards; Regular maintenance and upkeep must be carried out during use.



This series of products cannot extract liquids; Cannot extract condensed steam; Explosive substances cannot be extracted; Cannot be used in a heat-insulating and sealed environment; Do not experience severe vibrations or impacts during transportation, installation, and operation.

CBVAC has the final interpretation right of the content of this manual, and any changes related to product improvements in the future will not be notified separately!

1. Product Introduction

1.1 Product Overview

Molecular pump is a high-speed rotating momentum transfer vacuum pump, which has the characteristics of fast start-up speed, wide working range, low operating power consumption, high cleanliness, and simple maintenance operation. It is an important vacuum acquisition equipment for achieving high and ultra-high vacuum.

This manual includes magnetic levitation molecular pumps, series of grease lubrication molecular pumps, and oil lubrication molecular pumps, mainly including JFB-63/81M, JFB-63/81, JFB-100/251, JFB-100/301, JFB-160/401 and JFB-160/450D, JFB-160/700 (including split), JFB-160/701 (including split), JFB-200/1400 (including split), JFB-200/1401 (including split), JFB-250/2200 (including split), JFB-250/201 (including split), JFB-400/4201 (including oil lubrication, including split) and other models. The intake diameter includes DN63, DN100, DN160, DN200, DN 250 and DN400.

1.2 Product Advantages

✓ **Advanced technological performance**

- Strong sedimentation resistance and dust resistance
- High ultimate pressure ratio, high rotational speed, and fast pumping speed
- Good cooling effect and high reliability
- High bearing capacity

✓ **Convenient design concept!**

- Installation at any angle
- Easy to blow and connect
- Integrated controller, saving space
- Split controller, remote operation (split type)
- One click start stop, adjustable speed

1.3 Application

Decorative coating, tool coating, glass coating, optical coating, conductive glass, solar manufacturing, lighting industry, LCD flat panel, environmental simulation, vacuum metallurgy, vacuum degassing, vacuum leak detection, etc.



JFB-63/81M(J)

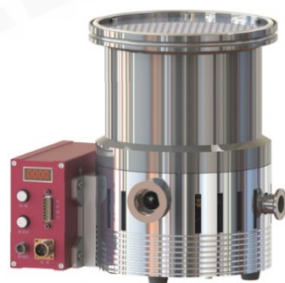
Picture 1: Schematic diagram of JFB Series Magnetic Levitation Molecular Pump



JFB-63/81

JFB-100/251

JFB-100/301



JFB-160/401 (JFB-160/450D)



JFB-160/700 (701)



JFB-200/1400 (1401)



JFB-250/2200 (2201)

Picture 2: Schematic diagram of JFB Series Lubrication Molecular Pump



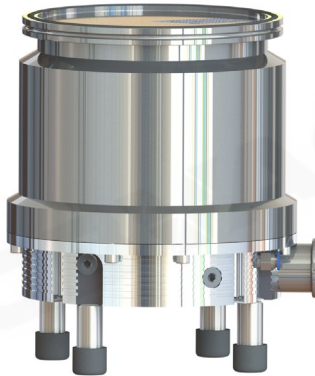
JFB-100/301



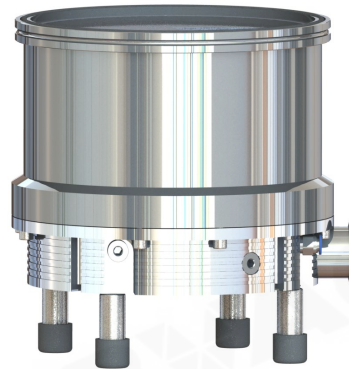
JFB-160/401 (450D)



JFB-160/700 (701)

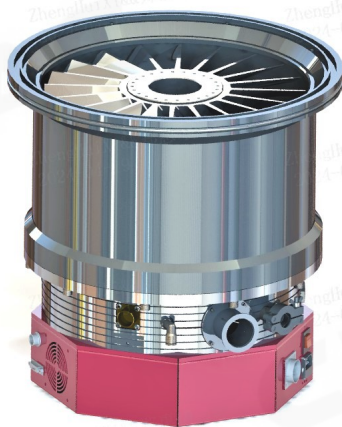


JFB-200/1400 (1401)



JFB-250/2200 (2201)

Picture 3: Schematic diagram of JFB Series Lubrication Molecular Pump – Split types



JFB-400/4201



Picture 4: Schematic diagram of JFB Series Oil Lubricated Molecular Pump
(Integrated & split type)

1.4 Product Code Explanation

J F B - □ / □ - □

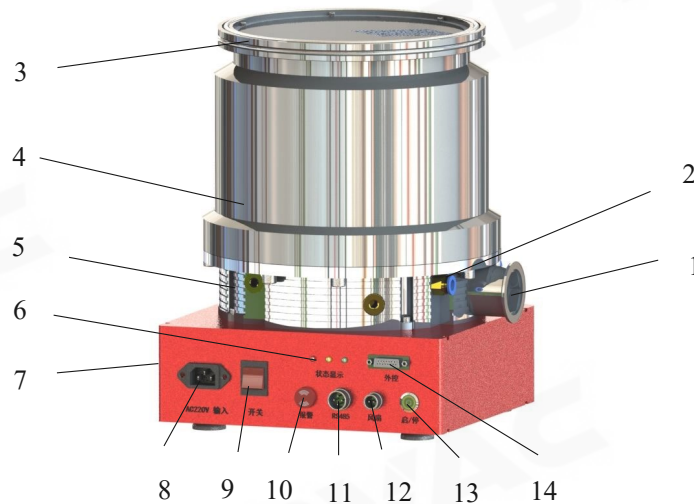
Feature code, represented by letters.
For example, D represents the anti vibration type; M represents the single ended magnetic levitation type

Nominal pumping speed: L/s
(last 0 represents turbo type, last 1 and other numbers represent composite type)

Inlet Diameter

1.5 Structural Unit

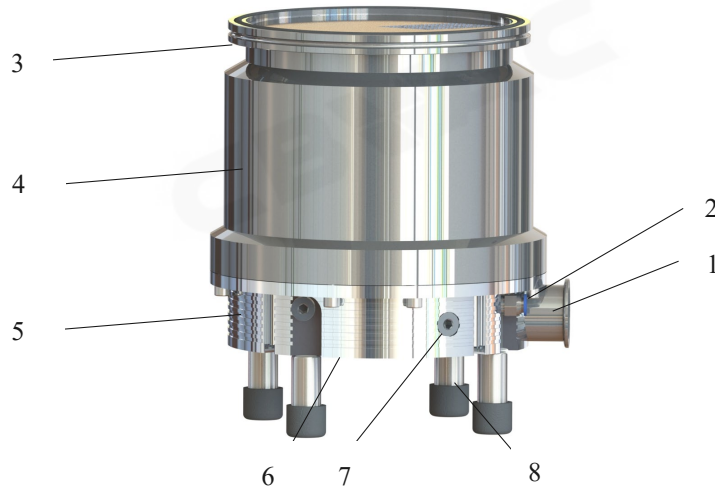
Taking JFB-200/1401 grease lubricated integrated molecular pump as an example, as shown in the following picture:



Picture 5: Schematic diagram of structural composition

- 1- Front interface 2- Water nozzle 3- LF flange 4- Pump casing 5- Pump body
- 6- Status indicator light 7- Controller 8- Power interface 9- Switch 10- Alarm
- 11- Fan interface 12- RS485 13- Start/Stop button 14- DB15 external control interface

Taking JFB-200/1401 grease lubricated molecular pump (split type) as an example, as shown in the following picture:



Picture 6: Schematic diagram of structural composition

- 1- Front interface 2- Water nozzle 3- LF flange 4- Pump casing
5- Pump body 6- Controller socket position 7- Blow plug 8- Support legs

1.6 Technical Parameter

1.6.1 Parameter List

Type	JFB-63/81M		JFB-63/81MJ	
☑ Vacuum parameters				
Ultimate pressure (Pa)	< 8×10 ⁻⁶ (LF); < 8×10 ⁻⁷ (CF)		< 1×10 ⁻⁵ (A); < 1×10 ⁻⁴ (B); < 1×10 ⁻³ (C)	
Pumping speed (L/s)	N ₂	He	N ₂	He
	85	55	A:40	A:45
			B:8	B:10
			C:4	C:5
Compression ratio	3×10 ⁹	3×10 ⁶	A:2×10 ⁹	A:2×10 ⁶
			B:5×10 ⁷	B:7×10 ⁴
			C:3×10 ⁴	C:2×10 ²
Maximum continuous inlet pressure (Pa)	3	5	A:5	A:10
			B:40	B:50
			C:160	C:180
Maximum continuous outlet pressure (Pa)			1200	
Critical outlet pressure (Pa)			1800	

☒ Physical parameters		
Inlet flange	DN63 ISO-K (LF) or CF	Multiple flow ports (A、B、C)
Export flange	DN16 ISO-KF	
Blowing port	DN16 ISO-KF	
Suggest front-end pump (L/s)	0.5 ~ 2	
Weight (kg)	LF	2.9
	CF	3.9
	Multiple flow ports	3.1
Vibrate (μm)	≤0.05	
Noise (dB)	≤50 (Standard air cooling)	
Bearing	Magnetic levitation + precision ceramic bearings	
Installation Angle	Any Angle	
Work environment magnetic field (mT)	≤3 (Radial) ; ≤5 (Axial)	
Environment Temperature	Air cooling	0 ~ 35°C (Natural convection cooling can be achieved at 0-30 °C without air load conditions)
	Water cooling	0 ~ 40°C (Flanges require water cooling due to baking, external air load, and other working conditions)
Cooling water parameters		Water temperature: 15 ~ 25°C ; Pressure: 0.15Mpa ; PH 6 ~ 8, clear; Volume of flow ≥ 1L/min; Outer diameter of water-cooled tube 6mm
☒ Electrical parameters		
Controller model	JFB-I	
Communication method	RS485	
Supply voltage	24VDC±5%	
Maximum power (W)	100	
Rated power (W)	~ 7	
Start/stop control mode	Controller button controls start and stop/RS485 controls start and stop/DB15 controls start and stop	
Protection function	Controller overcurrent, overvoltage, under voltage, and overheating protection, molecular pump overcurrent, overload, and overheating protection	
Rated speed (r/min)	84000 (1400Hz)	
Idle speed (r/min)	58800 (980Hz)	

Normal operating current (A)	< 0.5
Maximum starting current (A)	< 3.5
Acceleration time (min)	~ 2.5
Downtime (min)	~ 3.5
CBVAC can also provide industry-specific splitter molecular pumps such as mass spectrometry.	
For more information, please consult our technical engineers.	

Table 1: List of parameters for JFB-63/81M and JFB-63/81MJ

Type	JFB-63/81		JFB-100/251		JFB-100/301		JFB-160/401		JFB-160/450D	
☒ Vacuum parameters										
Ultimate pressure (Pa)	< 8×10 ⁻⁶ (LF) ; < 8×10 ⁻⁷ (CF)		< 5×10 ⁻⁶ (LF) ; < 5×10 ⁻⁷ (CF)		< 5×10 ⁻⁶ (LF) ; < 5×10 ⁻⁷ (CF)				< 8×10 ⁻⁶ (LF) ; < 8×10 ⁻⁷ (CF)	
Pumping speed (L/s)	N ₂	He	N ₂	He	N ₂	He	N ₂	He	N ₂	He
	85	55	250	200	300	230	460	380	380	310
Compression ratio	1×10 ⁸	1×10 ⁶	1×10 ¹⁰	1×10 ⁶	1×10 ¹⁰	5×10 ³	1×10 ¹⁰	5×10 ³	1×10 ⁸	1×10 ³
Maximum continuous inlet pressure (Pa)	2	4	2	5	10	2	10	2	20	5
Maximum continuous outlet pressure (Pa)	650	300	1200	800	300	200	300	200	20	10
Critical outlet pressure (Pa)	950	500	2200	1500	1000	500	1000	500	50	20
☒ Physical parameters										
Inlet flange	DN63 ISO-K (LF) or CF		DN100 ISO-K (LF) or CF				DN160 ISO-K (LF) or CF			
Export flange	DN16 ISO-KF				DN25 ISO-KF, KF40 Optional					
Blowing port	DN16 ISO-KF									
Suggest front-end pump (L/s)	0.5 ~ 2		1 ~ 4		2 ~ 6		3 ~ 8			
Weight (kg)	LF	2.7	6		9.6		10			
	CF	3.9	7.9		10		11			
Vibrate (μm)	≤0.05									
Noise (dB)	≤50 (Standard air cooling)									
Bearing	Precision ceramic bearings									
Installation	Any Angle									

angle					
Work environment magnetic field (mT)		≤3 (Radial); ≤5 (Axial)			
Environ ment Tempera ture	Air cooling	0 ~ 35℃			
	Water cooling	0 ~ 40℃ (Flanges require water cooling due to baking, external air load, and other working conditions)			
Cooling water parameters		Water temperature : 15 ~ 25℃ ; Pressure: 0.15Mpa ; PH 6 ~ 8, clear; Volume of flow≥1L/min;			
Outer diameter of water-cooled tube		6mm		10mm	
☒ Electrical parameters					
Controller model		JFB-I	JFB-II-G3	JFB- II /JFD- II (Split type)	
Communication method		RS485			
Supply voltage		24VDC±5%		48VDC±5%/220VAC±10% (Split type)	
Maximum power (W)		100	300	400	
Rated power (W)		~ 10	~ 18	~ 30	~ 25
Start/stop control mode		Controller button controls start and stop/RS485 controls start and stop/ DB15 controls start and stop			
Protection function		Controller overcurrent, overvoltage, under voltage, and overheating protection, molecular pump overcurrent, overload, and overheating protection			
Rated speed (r/min)		75000 (1250Hz)	54000 (900Hz)	48000 (800Hz)	36000 (600Hz)
Idle speed (r/min)		52500 (875Hz)	37800 (630Hz)	33600 (560Hz)	25200 (420Hz)
Normal operating current (A)		< 1			
Maximum starting current (A)		< 5	~ 10	< 5	

Acceleration time (min)	~ 2	~ 3	~ 5
Downtime (min)	~ 4	~ 10	~ 10
Our company can also provide industry-specific splitter molecular pumps such as mass spectrometry. For more information, please consult our technical engineers.			

Table 2: List of parameters for JFB-63/81, JFB-100/251, JFB-100/301, JFB-160/401, JFB-160/450D

Type	JFB-160/700	JFB-160/701	JFB-200/1400	JFB-200/1401	JFB-250/2200	JFB-250/2201
☑ Vacuum parameters						
Ultimate pressure (Pa)	< 5×10 ⁻⁶ (LF); < 5×10 ⁻⁷ (CF)					
Pumping speed (L/s)	N ₂	He	N ₂	He	N ₂	He
	650	550	650	550	1350	1200
Compression ratio	1×10 ⁹	1×10 ⁴	1×10 ¹¹	1×10 ⁴	1×10 ⁹	1×10 ⁴
Maximum continuous inlet pressure (Pa)	2	1	2	1	2	1
Maximum continuous outlet pressure (Pa)	30	10	300	200	20	10
Critical outlet pressure (Pa)	100	50	1000	500	100	50
☑ Physical parameters						
Inlet flange		DN160 ISO-K (LF) or CF		DN200 ISO-K (LF) or CF		DN250 ISO-K (LF) or CF
Export flange		DN25 ISO-KF, KF40 Optional		DN40 ISO-KF, KF50 Optional		
Blowing port		DN16 ISO-KF				
Suggest front-end		4 ~ 10		8 ~ 16		16 ~ 24
Weight (kg)	LF	20 (16)		30 (26)		40 (36)
	CF	23 (19)		34 (30)		45 (41)
Vibrate (μm)		≤0.05				
Noise (dB)		≤60				
Bearing		Precision ceramic bearings				
Installation angle		Any Angle				
Work environment magnetic field (mT)		≤3 (Radial) ; ≤5 (Axial)				

Environment Temperature	Air-coolin	5 ~ 35℃		
	Water -	5 ~ 40℃（Flanges must be water-cooled under conditions such as baking and external air load）		
Cooling water parameters		Water temperature: 15 ~ 30℃ ； Pressure: 0.15Mpa ； PH 6 ~ 8, Clear, Free of oil and suspended solid particles; Volume of flow: ≥1.5L/min; Outer diameter of water-cooled tube 10mm		
☒ Electrical parameters				
Controller model		JFB- III （-A） Integrated、 JFB- III -B Split type		
Communication method		RS-485		
Supply voltage		220VAC±10%		
Power frequency		50/60（±5%）		
Maximum power（W）		1000		
Rated power（W）		~ 65	~ 70	~ 75
Start/stop control mode		Controller button control start and stop/RS485 control start and stop/ DB15 external control start and stop		
Protection function		Controller overcurrent, overvoltage, under voltage, and overheating protection, molecular pump overcurrent, overload, and overheating protection		
Rated speed（r/min）		36000（600Hz）	30000（500Hz）	24000（400Hz）
Idle speed（r/min）		25200（420Hz）	21000（350Hz）	16800（280Hz）
Normal operating current		≤0.6	≤1	≤1
Maximum starting current		≤5.5	≤6.5	≤6.5
Acceleration time		~ 5	~ 6	~ 7
Downtime（min）		~ 5	~ 10	~ 12

Table 3: List of parameters for JFB-160/700, JFB-160/701, JFB-200/1400, JFB-200/1401, JFB-250/2200, JFB-250/2201

Type	JFB-400/4201	
☒ Vacuum parameters		
Ultimate pressure (Pa)	<2×10 ⁻⁶ (LF)	
Pumping speed (L/s)	N ₂	He
	4200	3000
Compression ratio	10 ⁸	10 ³

Maximum continuous inlet pressure (Pa)	10	1.5
Maximum continuous outlet pressure (Pa)	300	200
Critical outlet pressure (Pa)	560	280
☒ Physical parameters		
Inlet flange	DN400 ISO-K (LF)	
Export flange	KF40	
Blowing port	KF16	
Suggest front-end pump (L/s)	30 ~ 70	
Weight (kg)	~ 95 (Integrated)	
	~ 90 (Split type)	
Vibrate (μm)	≤0.25	
Noise (dB)	≤60	
Bearing	Precision ceramic bearings	
Installation angle	Vertical ±5°	
Work environment magnetic field (mT)	≤3mT	
Environment Temperature (°C)	5~40°C (Water cooling)	
Cooling water parameters	Water temperature≤20°C, Volume of flow: ≥3L/min, Pressure 0.15Mpa; Outer diameter of water-cooled tube 10mm	
☒ Electrical parameters		
Controller form	Split type	Integrated
Controller model	JFB-VI (4U Split type)	JFB-VI-A
Outline dimension	440mm×350mm×177mm (L×W×H)	Regular octagon, Side length 350mm, Height 90mm
Communication model	RS-485	RS-485
Supply voltage	220VAC±10%	220VAC±10%
Power frequency (Hz)	50/60 (±5%)	50/60 (±5%)
Maximum power (W)	1500	2200
Start/stop control mode	Controller button control start and stop/RS485 control start and stop/DB15 external control start and stop	
Protection function	Controller overcurrent, overvoltage, under voltage, overheating protection, molecular pump overcurrent, overload, overheating protection, external interference protection	
Rated speed (r/min)	18000 (300Hz)	

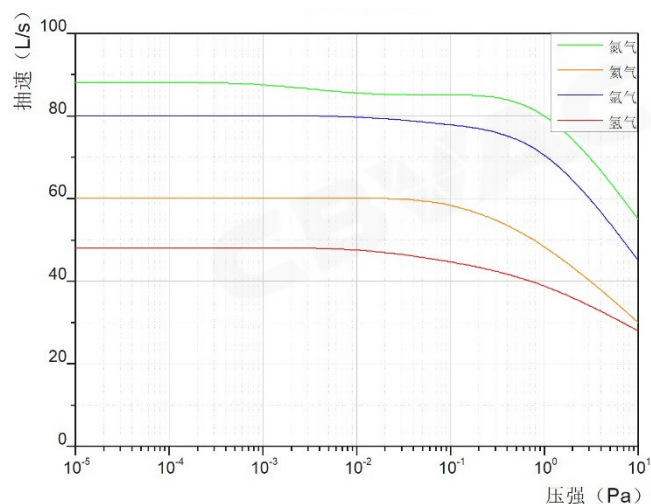
Normal operating current (A)	5.4	4.5
Maximum starting current (A)	≤10	≤12
Acceleration time (min)	~ 20	~ 20
Downtime (min)	~ 30	~ 25
Environmental condition	No corrosive gases and obvious dust particles; Environment temperature: -10°C ~ 50°C; Environment humidity: ≤90%, Vibration intensity: ≤0.5g	

Table 4: List of parameters for JFB-400/4201

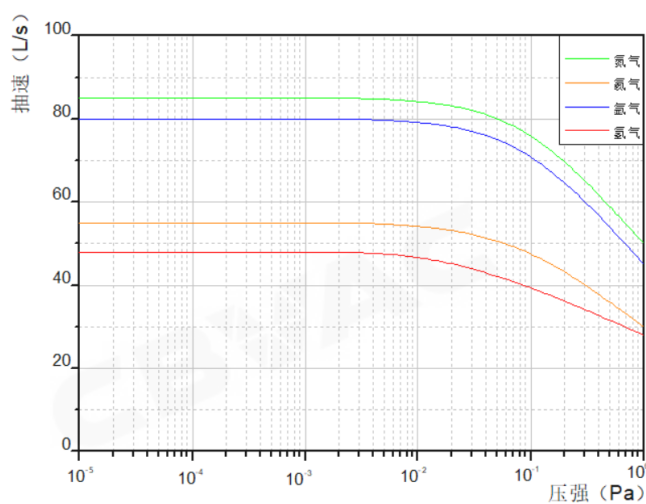
1.6.2 Pumping Speed Curve

Note1: Vertical axis: pumping speed; Horizontal axis: pressure

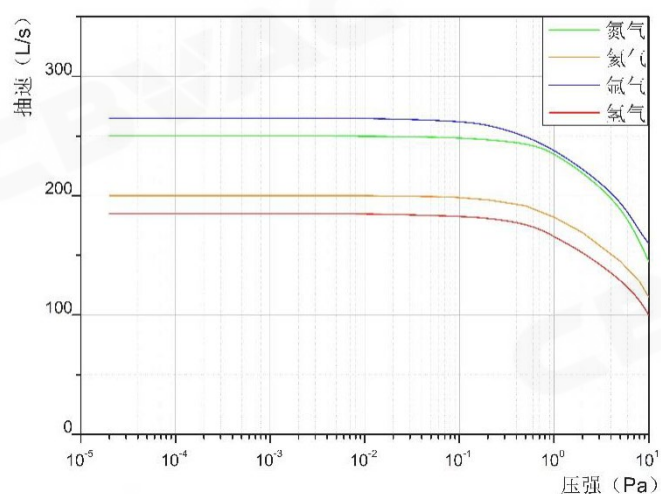
Note2: Green-Nitrogen, Orange-Helium, Blue-Argon, Red-Hydrogen



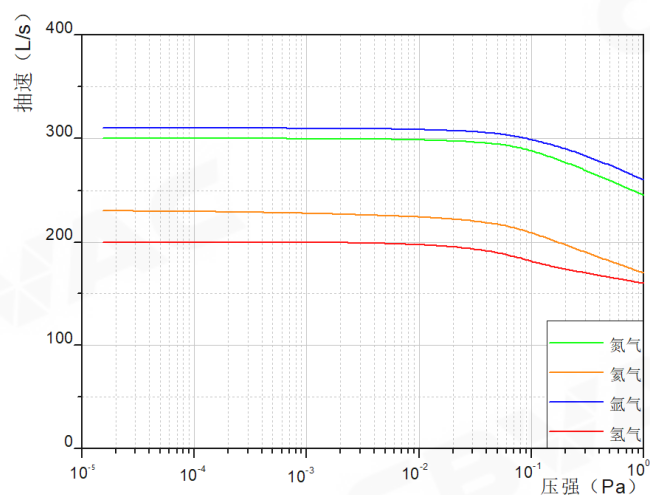
JFB-63/81M



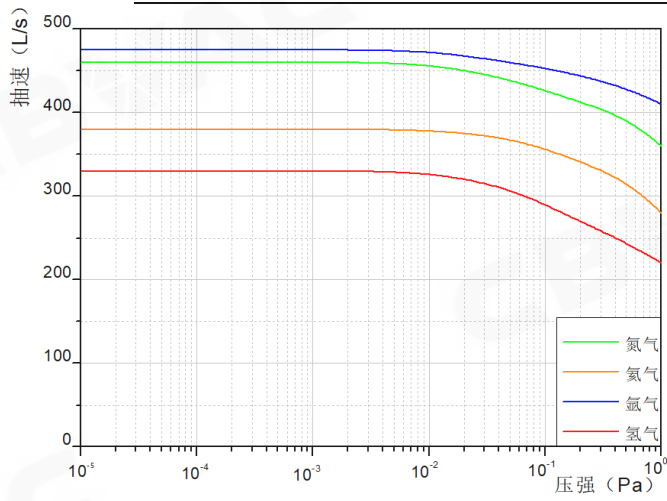
JFB-63/81



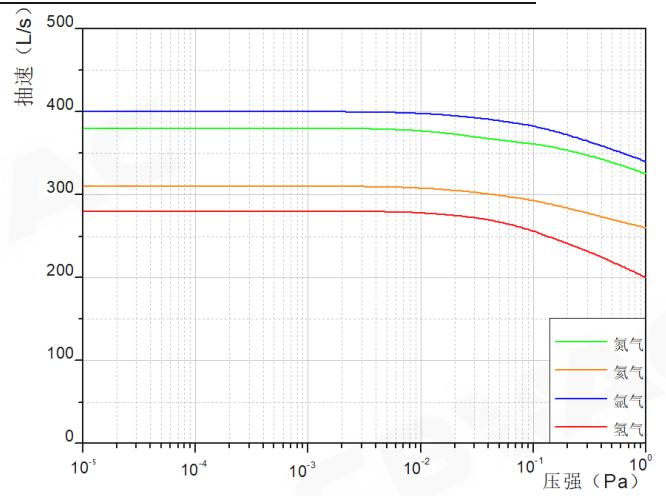
JFB-100/251



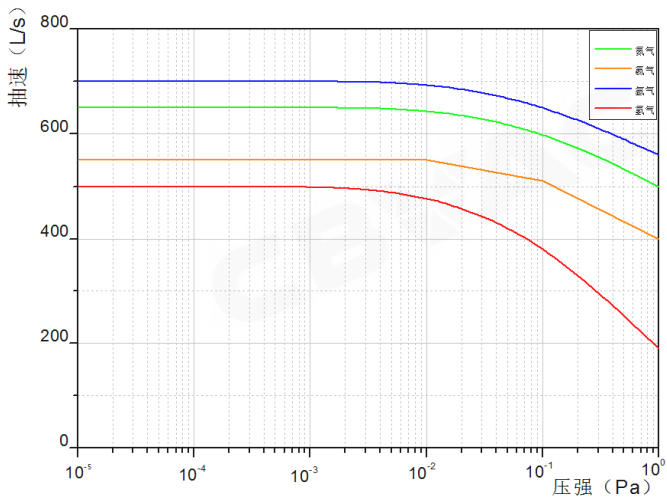
JFB-100/301



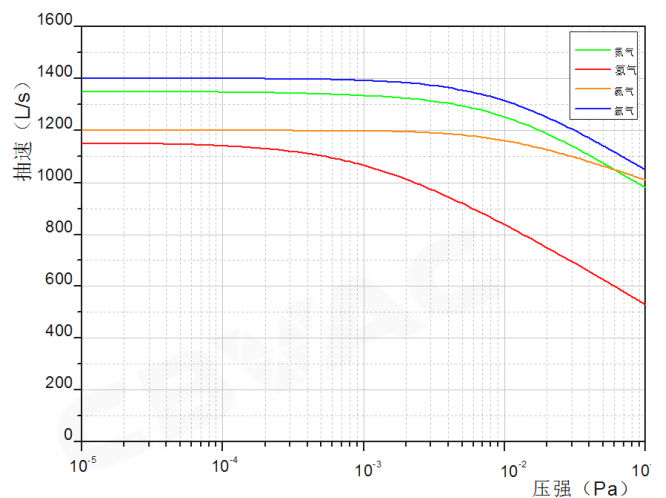
JFB-160/401



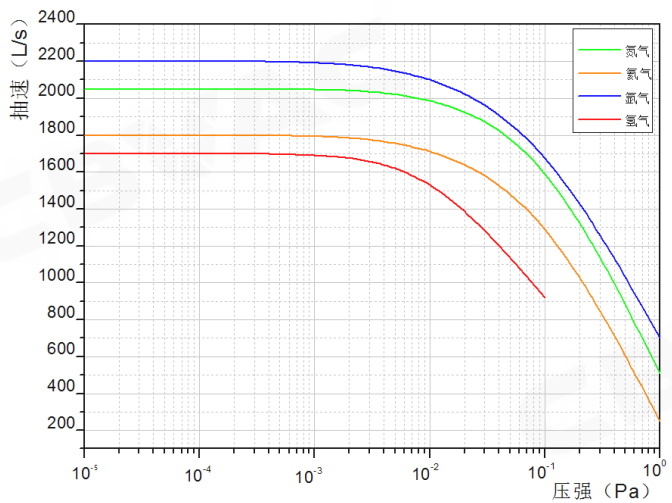
JFB-160/450D



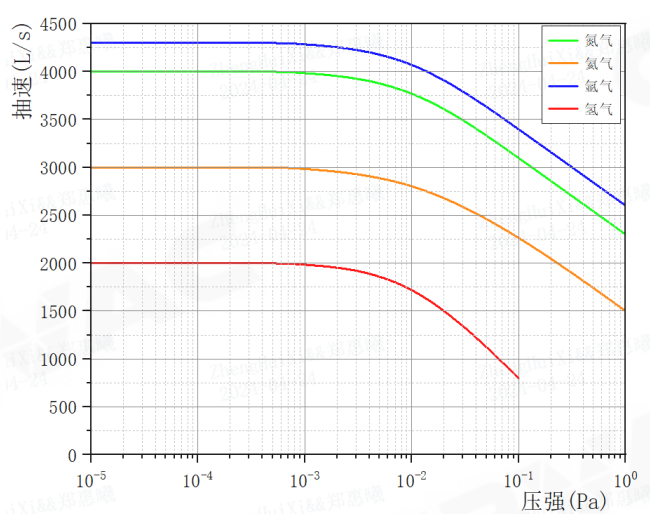
JFB-160/700 (701)



JFB-200/1400 (1401)



JFB-250/2200 (2201)



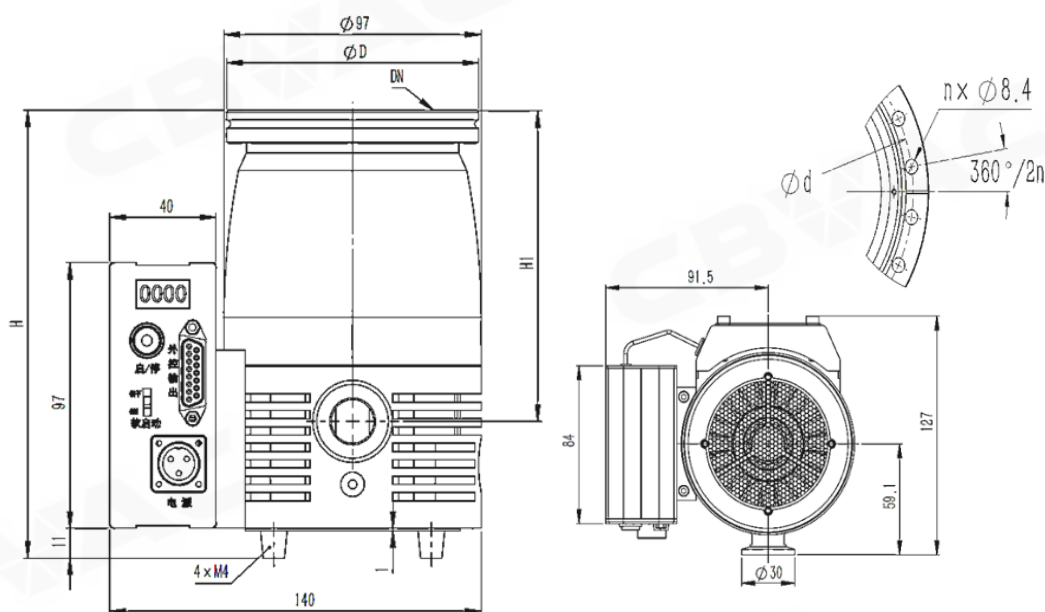
JFB-400/4201

Picture 7: Pumping Speed Curve of each pump

1.6.3 Environmental Requirements for Installation

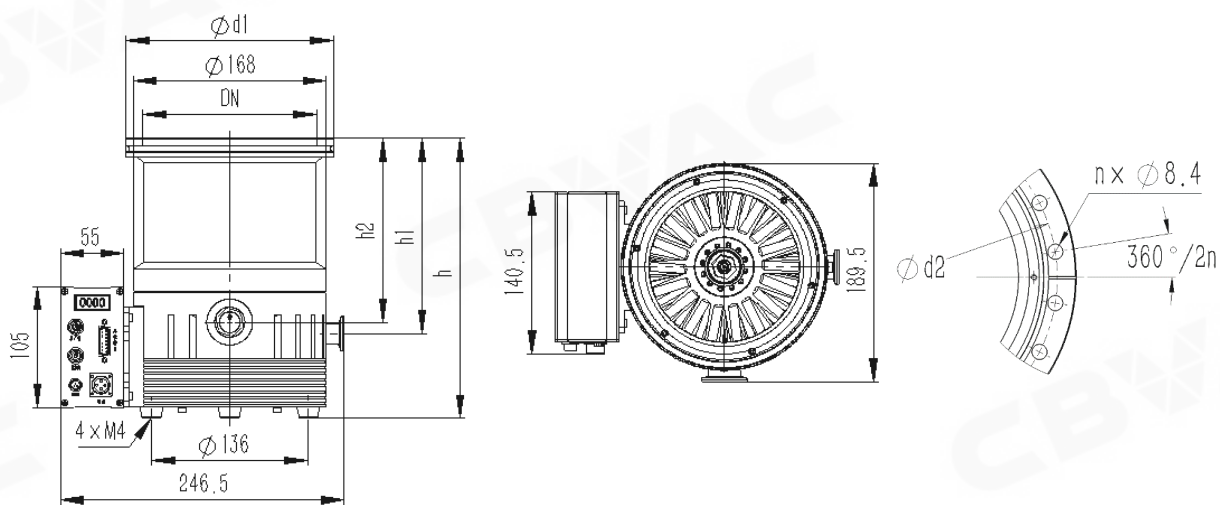
Description	Value
Installation position	Indoor
Environmental temperature (°C)	+ 5 ~ + 40
Relative humidity	≤ 85%
Environmental pressure (×10 ⁵ Pa)	0.75 ~ 1.06
Installation altitude (m)	≤ 2000
Magnetic field environment (mT)	≤ 3 (Radial) ; ≤ 5 (Axial)
Pollution degree	2 (Complies with the pollution level requirements of IEC 61010)
Radiation environment (rad)	≤ 10 ⁵

1.6.4 External Dimensions



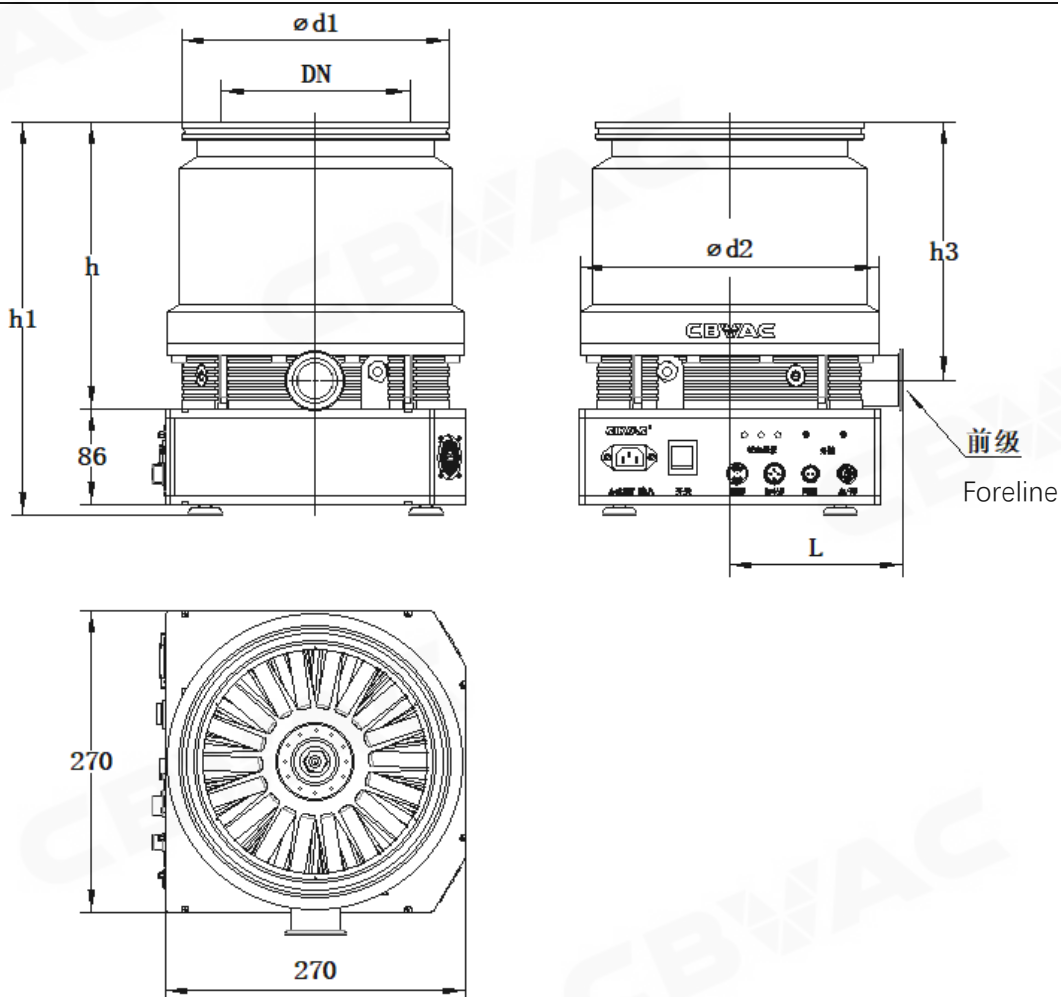
JFB-63/81M

Type	DN	H	H1	D	d	n
JFB-63/81M	LF63	163.6	113.6	95		
	CF63	179.4	129.4	114	92.2	8

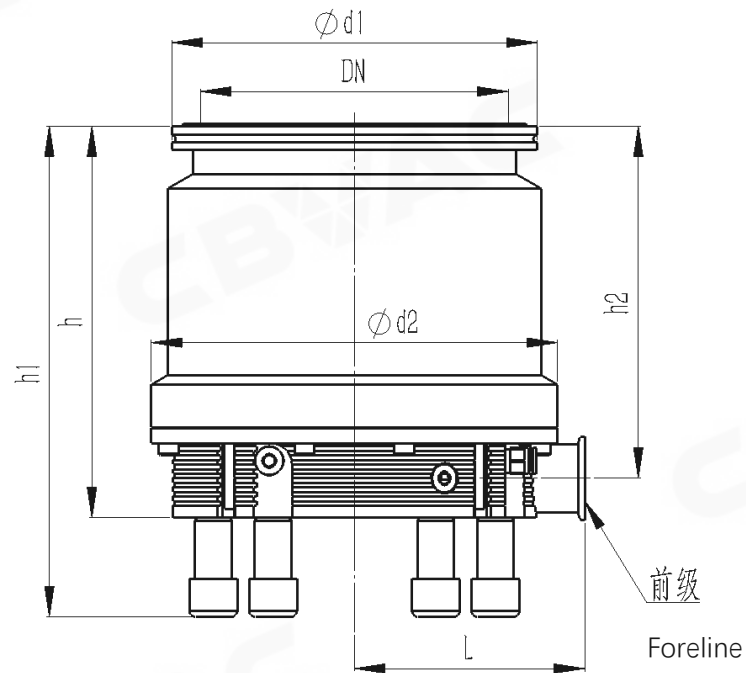


JFB-100/301 (JFB-160/401、JFB-160/450D)

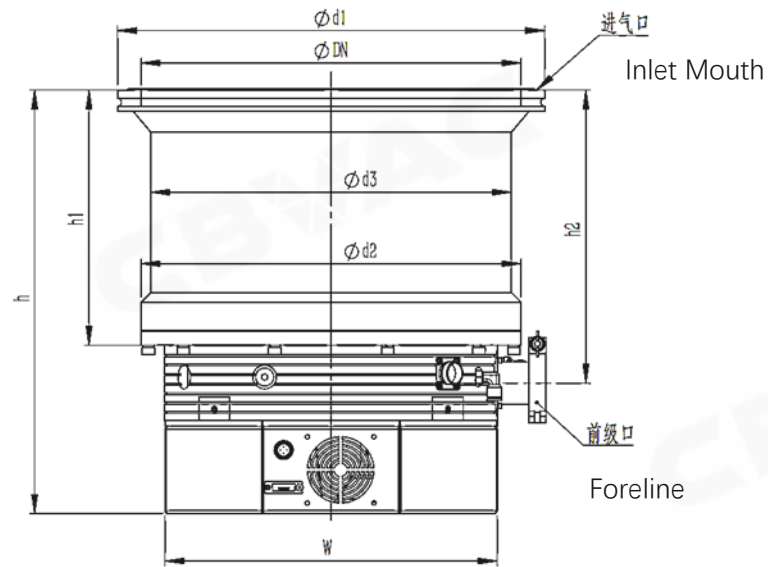
Type	DN	$\Phi d1$	$\Phi d2$	h	h1	h2	n
JFB-63/81	63 LF	95		161.9	82.5		
	63 CF	114	92.2	179.4	100		8
JFB-100/251	100 LF	130		201.6	191.6	161.6	
	100 CF	152	130.3	208	198	168	16
JFB-100/301	100 LF	130		260	192.5	178.5	
	100 CF	152	130.3	279	211.5	197.5	16
JFB-160/401	160 LF	180		240	173	159	
	160 CF	202	181	239	172	158	20
JFB-160/450D	160 LF	180		240	173	159	
	160 CF	202	181	239	172	158	20



Type	DN	Φd1	Φd2	h	h1	h3	L
JFB-160/700	160 LF	180	218.5	241.8	336.8	201.8	124.8
JFB-160/701	160 CF	202	218.5	268.8	359.8	224.8	124.8
JFB-200/1400	200 LF	240	267	257.5	352.5	231.5	155.1
JFB-200/1401	200 CF	253	267	274.5	369.5	248.5	155.1
JFB-250/2200	250 LF	290	296	229.8	324.8	203.8	165.3
JFB-250/2201	250 CF	305	296	259.8	354.8	233.8	165.3

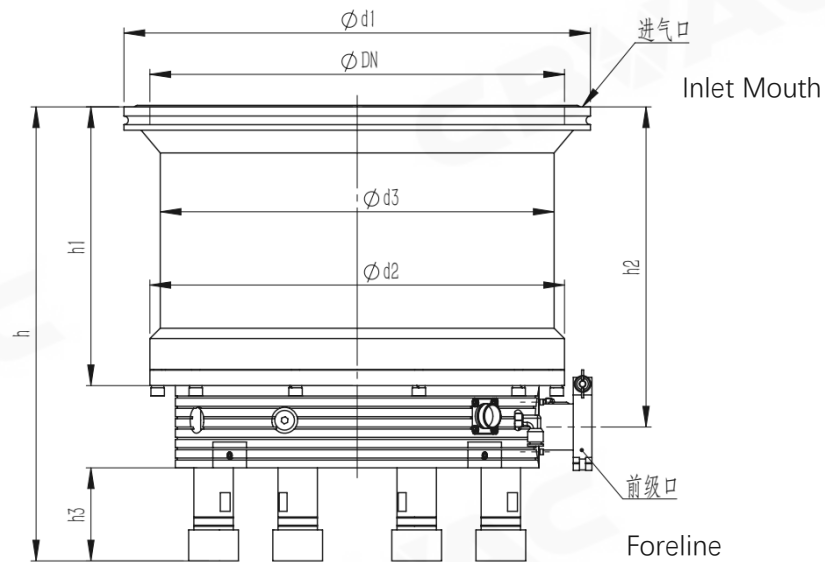


Type	DN	$\Phi d1$	$\Phi d2$	h	h1	h2	L
JFB-160/700	160LF	180	218.5	241.8	331.8	201.8	124.8
JFB-160/701	160CF	202	218.5	268.8	354.8	224.8	124.8
JFB-200/1400	200LF	240	267	257.5	347.5	231.5	155.1
JFB-200/1401	200CF	253	267	274.5	364.5	248.5	155.1
JFB-250/2200	250LF	290	296	229.8	219.8	203.8	165.3
JFB-250/2201	250CF	305	296	259.8	349.8	233.8	165.3



JFB-400/4201 Integrated

Type	DN	$\Phi d1$	$\Phi d2$	$\Phi d3$	h	h1	h2	W
JFB-400/4201	400LF	450	400	380	447	269.5	309.5	350



JFB-400/4201 Split Type

Type	DN	$\Phi d1$	$\Phi d2$	$\Phi d3$	h	h1	h2	h3
JFB-400/4201	400LF	450	400	380	439	269.5	309.5	90

2. Transportation and Storage

2.1 Transport

- a) Remove the equipment from the transport box and ensure that the product is not damaged during transportation.
- b) Be careful not to damage the sockets and connectors during transportation.

2.2 Storage

- a) During storage, please place the molecular pump in a self sealing bag with a desiccant.
- b) Before opening the box, it should be stored indoors in a dry, ventilated, and non corrosive gas environment.
- c) Protect from rain, severe cold, and direct sunlight.
- d) Storage environment temperature: -20 °C to +55 °C.
- e) Store in a dry environment.

2.3 Moving

- a) When transporting molecular pumps, do not use the front stage, water nozzle, and controller interface as leverage points;
- b) Determine the method and number of personnel for transporting the molecular pump based on the weight of the pump in Table 1-4 (Chapter 1.6.1);
- c) Molecular pumps are precision equipment and should be placed gently in the installation position. Do not drop, smash, or fall quickly.

3. Installation

3.1 Tips and Disclaimer

- **Tips:** It is strictly prohibited to use molecular pumps to remove gases containing liquid or solid particles!
- **Disclaimer:** The power supply requirements of the molecular pump must be implemented in accordance with the provisions of this manual. Our company is not responsible for any losses caused by violating the instructions!

3.2 Count The Spare Parts that Come with The Box

- a) First check the spare parts inside the box according to the packing list to see if they are complete.
- b) Remove the molecular pump from the packaging box and check for any damage during transportation.
- c) Remove the plastic cover plate and protective net from the high vacuum interface of the molecular pump, wear clean gloves, gently rotate the turbine rotor, and observe whether it rotates flexibly, whether there are any abnormal phenomena such as jamming or locking.
- d) Finally, reinstall the protective net and plastic cover plate in order.



Caution!



- After opening the packaging box of the molecular pump, if you find any damaged or missing parts, please contact us in a timely manner. Do not repair or find non matching alternatives by yourself.
- To prevent debris and dust from entering the interior of the pump body, do not keep the high vacuum interface and front stage interface open for a long time.
- It is recommended to install the pump in a clean environment.

3.3 Preparation Work Before Installation

3.3.1 Inspection Process

- a) Confirm that the installation environment meets the requirements.
- b) The tools used in the assembly process are fully prepared.
- c) Recheck that the vacuum chamber has been exposed to the atmosphere.
- d) Confirm the installation position and angle of the pump.
- e) According to the packing list, double check the pump and its accessories.

3.3.2 Anti Vibration Measures

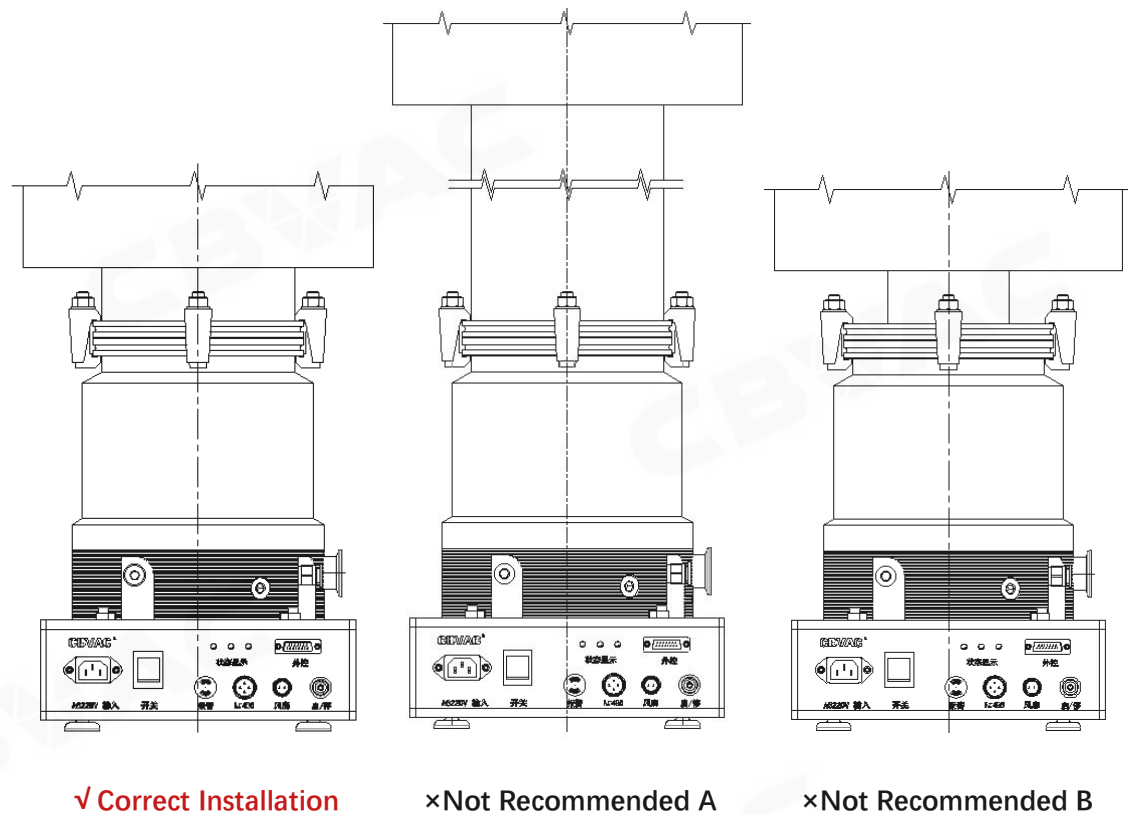
The CBVAC JFB Series Grease Lubrication Molecular Pump is a precision equipment, and

significant impact and vibration should be avoided during use. It is recommended that the installation position of the molecular pump be as far away from the vibration source as possible. **If an anti-vibration version is needed, the JFB-160/450D model can be selected.**

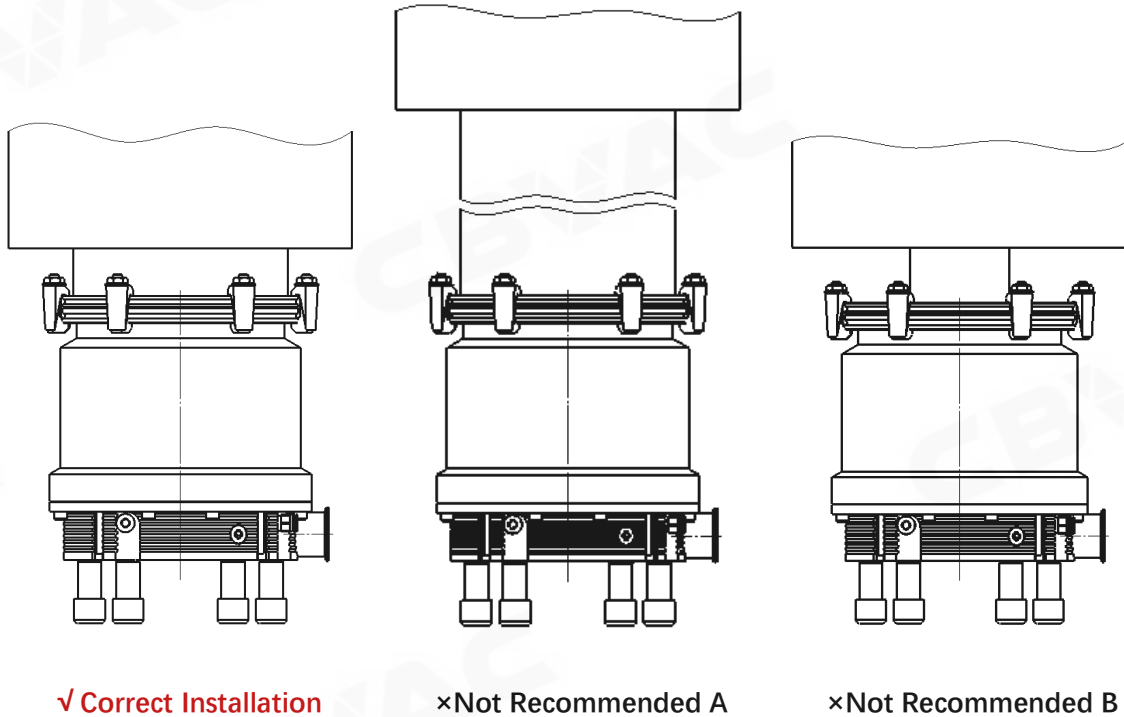
3.4 Installation

3.4.1 Connection with the Vacuum Chamber

Under normal circumstances, the pump is installed below the corresponding interface of the vacuum chamber, and the connection diagram between the pump and the vacuum chamber is shown in Figures 8 and 9. It is generally recommended to connect short pipes of the same diameter directly. If the pipe is too long or the pipe diameter becomes smaller, it will have a negative impact on the pumping time of the cavity and the achievable ultimate vacuum.



Picture 8: Schematic diagram of integrated pump and vacuum chamber connection

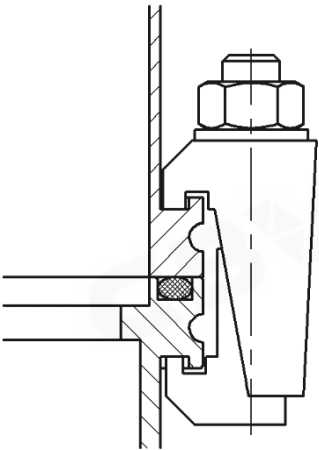
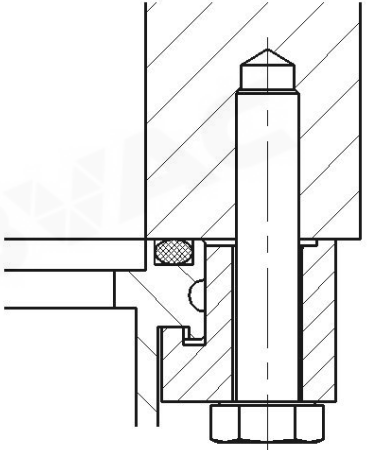
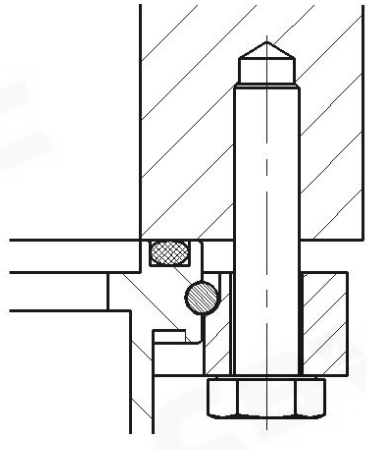


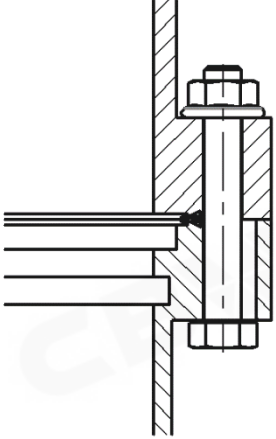
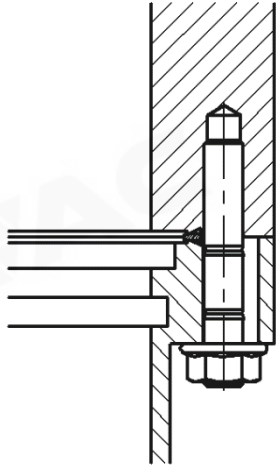
Picture 9: Schematic diagram of split pump and vacuum chamber connection



- The connection between the molecular pump and the vacuum chamber interface must be installed using connectors that meet the required strength level!
- Molecular pumps need to be used in conjunction with suitable front-end pumps, and it is strictly prohibited to start the molecular pump alone!
- When hoisting and installing the molecular pump, pay attention to the stability of the hoisting to prevent local uneven stress from causing tensile cracking!

Connection methods for different flanges:

High Vacuum Flange Type of Pump	Interface Connected to the Chamber	Tool	Illustration Explanation
LF Flange	LF Flange	Caliper screw	
	Blind hole in chamber	Caliper pad	
	Blind hole in chamber	Loose flange	

High Vacuum Flange Type of Pump	Interface Connected to the Chamber	Tool	Illustration Explanation
CF Flange	CF Flange through-hole	Oxygen free copper washer, Hexagonal bolt, Nut	
	CF Blind flange hole	Hexagonal bolts or double headed bolts, Nuts	



Caution!



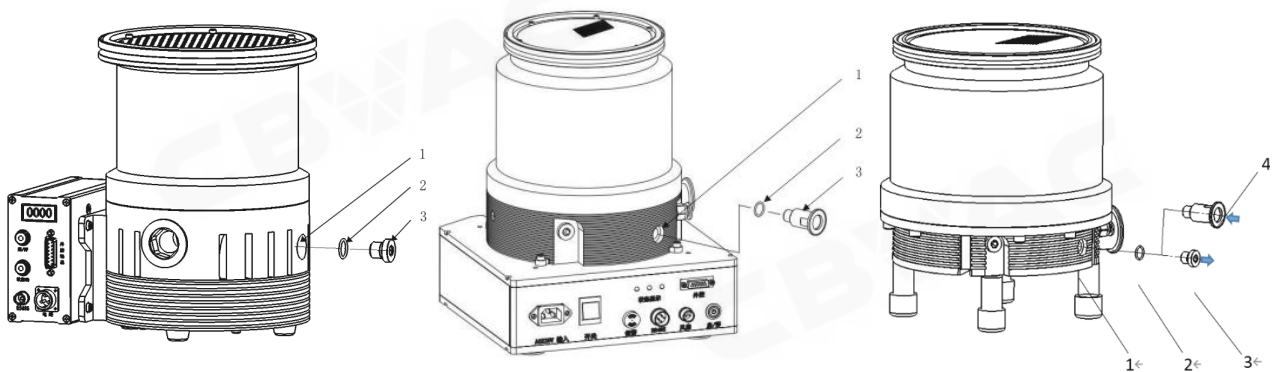
- The connection The effective thread depth of the bolt/stud screwed into the blind hole should be ≥ 1.5 times the thread diameter, while minimizing the length of the bolt/stud as much as possible.
- If the flange and nearby structures are heated and cooled, the bolts must be reinforced and tightened again.
- The diagram only shows two common connection methods for flanges, and more connection forms will be determined based on actual situations.

3.4.2 Connection with the front stage pump

- Try to use metal/hydraulic bellows that can block vibration to a certain extent between the molecular pump and the front-end pump.
- Try to choose a front-end pump with shutdown isolation and air release function, or install an isolation and air release valve at the inlet of the front-end pump that opens and closes at the same time, in order to prevent pump oil from diffusing back into the vacuum chamber when the front-end pump stops.
- It is recommended to install an adsorption trap at the inlet of the front stage pump (for oil sealed mechanical pumps) to prevent the oil from flowing back to the front stage pump to the greatest extent possible.

3.4.3 Connection of protective gas

The protective gas is generally industrial pure nitrogen or argon, and its structural form is shown in Figure 10. Use an internal wrench to unscrew the inflation plug, replace it with a KF16 flange joint, and then connect the blowing component.



Picture 10: Schematic diagram of protective gas connection

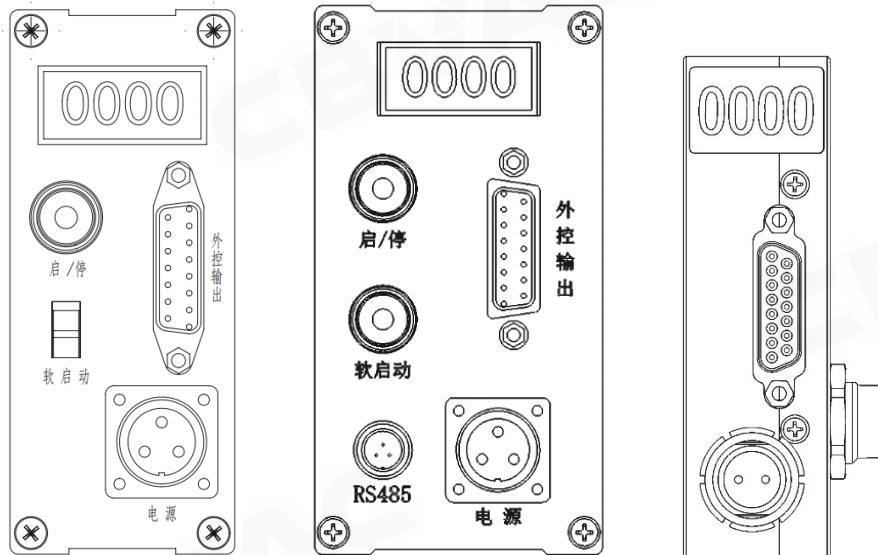
- | | |
|---------------------------------------|-----------------------------------|
| 1- Pump body inflation port | 3- Inflation plug (Right picture) |
| 2- Sealing ring | 4- Purging component |
| 3- Purging component (Middle picture) | |



- The temperature of protective gas is between +5 °C and +30 °C;
- The pressure of protective gas is 1-1.5 atm.

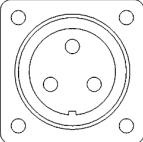
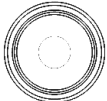
4. Control System Connection Instructions

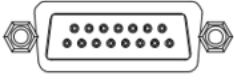
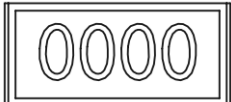
4.1 JFB-I/JFB- II /JFB- II -G3 Controller



Picture 11: JFB-I/JFB- II /JFB- II -G3 Controller operation panel

4.1.1 JFB-I/JFB- II /JFB- II -G3 Controller function description

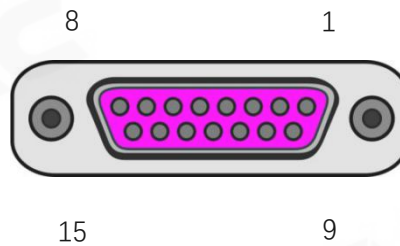
Buttons/Sockets	Button/Socket Name	Description
	Power socket (1+, 3-)	Input power socket (JFB-I/JFB- II -G3 Controller 24VDC Input, JFB-II Controller 48VDC Input)
	Soft start	Long term placement or first-time startup of the molecular pump requires using the soft start button to switch to soft start mode, and then pressing the start/stop button to start.
	Start/Stop	Long term placement or first-time startup of the molecular pump requires using the soft start button to switch to soft start mode, and then pressing the start/stop button to start.
	RS485	This controller can be controlled by an upper computer, which can control the start and stop of

		multiple devices, and monitor and record data such as voltage, current, speed, motor temperature, operating status, and fault status.
	External control output	Specific pin definitions for PLC external device control (see 4.1.3 External Control Output Pin Definitions)
	Digital tube	Used to display real-time speed or fault status

4.1.2 Controller performance indicators (See list 1.6.1)

4.1.3 Definition of I/O External Control Interface

DB15 connector:



Functions of external control output pins:

Needle Size	Function	Description
1	Public end, can be connected to 24V or COM	Internally, a bidirectional optocoupler is used, which can be connected to 24V or COM. It is compatible with two common wiring methods, with 24V low-level control being effective
2	Digital input 1, remote control priority	V+, Input represents remote controller priority, PC does not control
3	Digital input 2, control the blowing air function	V+, Indicates PIN11 is turned on, low voltage indicates PIN11 is turned off

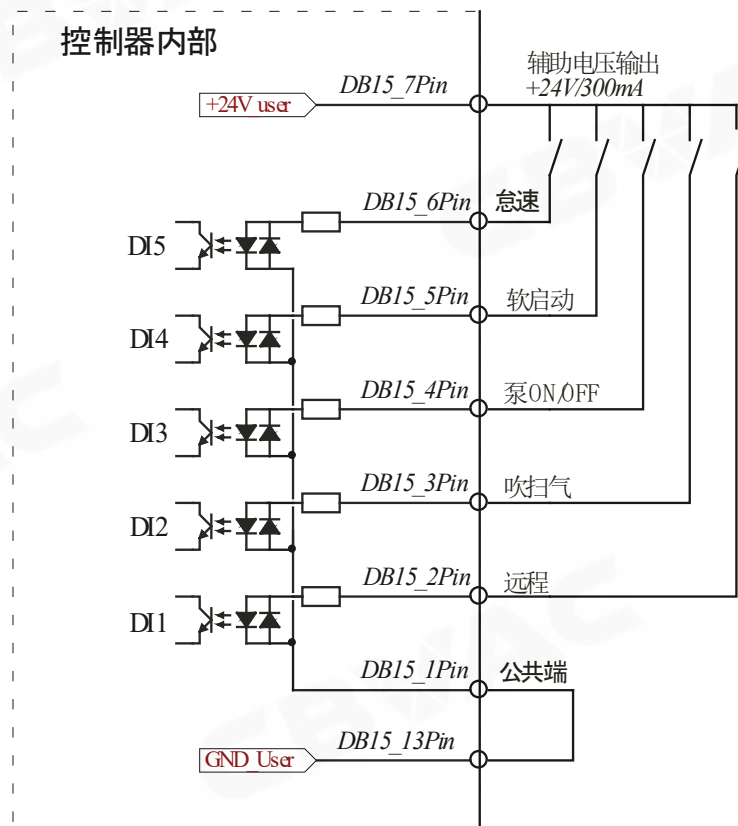
4	Digital input 3, pump control on/off	V+, Start the molecular pump to the set speed. If PIN5 is high voltage, accelerate according to the soft start program. If PIN5 is low voltage, accelerate directly to the set speed; V-, Molecular pump shutdown or reset (i.e. short circuit 4 and 7 to start the molecular pump, disconnect 4 and 7 to stop the molecular pump)
5	Digital input 4, soft start	V+, Enable soft start; V-, Turn off soft start
6	Digital input 5, idle speed	V+, Operate at idle speed, with a default maximum speed of 70%
7	+24 V Voltage Output (V+)	+24 V Output, as the reference voltage for all digital inputs
8	Digital output 1, output pump normal operation signal	GND: No; V+, yes, (I max = 50 mA / 24 V), If the set speed reaches 80% and the output is high, it is considered that the pump has started normally
9	Digital output 2, output power connection information	Once the power is connected, maintaining a high level output of 24V indicates that there are no errors; If there are any errors, output a low level. (Equivalent to the function output of power on self-test)
10	Digital output 3, output fault signal	If there is any malfunction in the molecular pump, it can maintain a high level output of 24V and control the buzzer, light, or gate circuit; The molecular pump is normal and outputs a low level
11	Attachment output A1, which can provide power to the purge valve	High level output, capable of a maximum load of 24V/200mA, can drive the purge valve and supply power to it
12	Analog output, outputting voltage according to the ratio of actual speed/rated speed	Actual speed, 0 - 10VDC, Equal to 0-100% rated speed, $R \geq 10K\Omega$
13	Landing	Landing wire, reference landing for all digital and analog quantities

14	RS485A+/ Relay dry node	JFB-I Controller RS485 Serial communication pin /JFB-II/III Controller dry contact pin: Normally closed, when the molecular pump is started, the contacts open, and when the molecular pump speed is 0, the contacts close, outputting a molecular pump stop signal
15	RS485B-/ Relay dry node	

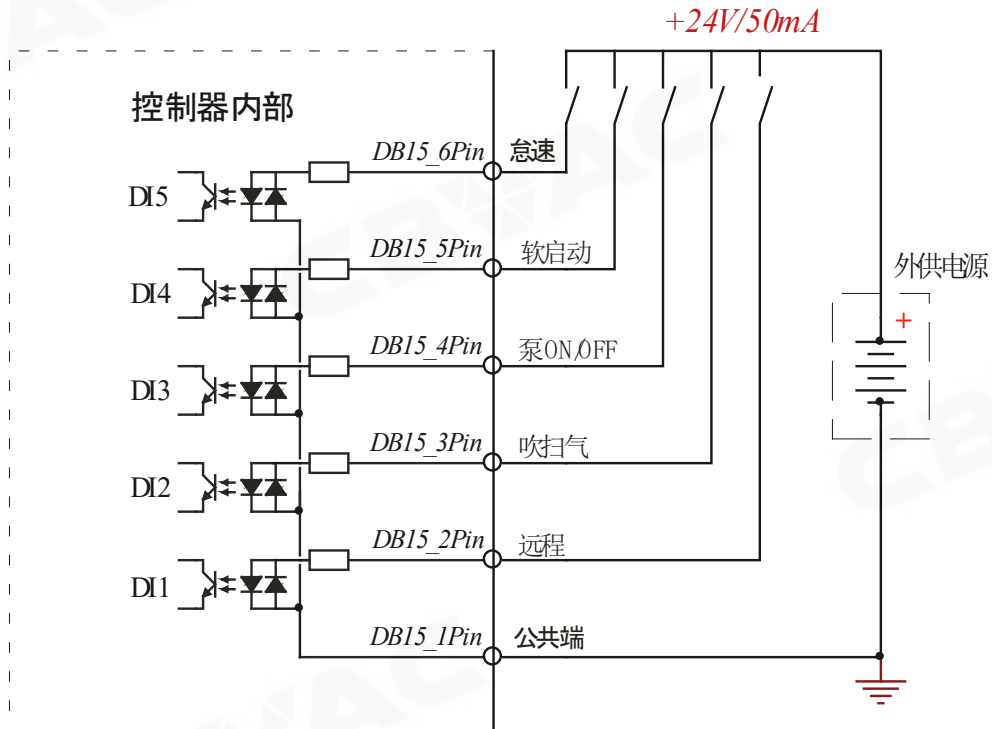
4.1.4 Wiring instructions for external control interface

1) Definition and wiring method of five channel DI

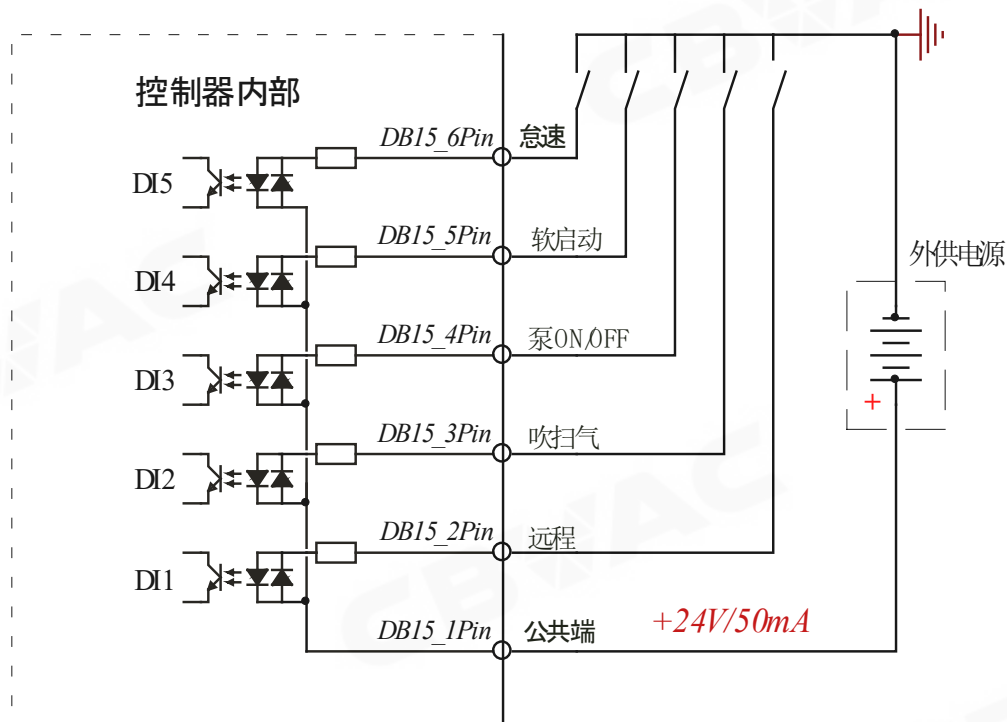
This controller has five DI input signals, and the functions of each DI can be found in the external control output interface definition in 4.1.3; Users can use the auxiliary output 24V power supply as DI power supply, and the wiring method is recommended to be configured according to Figure 12; External 24V power supply can also be used, and the input signal can be configured as high effective or low effective, as shown in Picture 13 and Picture 14.



Picture 12: Adopting auxiliary output power wiring method and high-efficiency configuration method



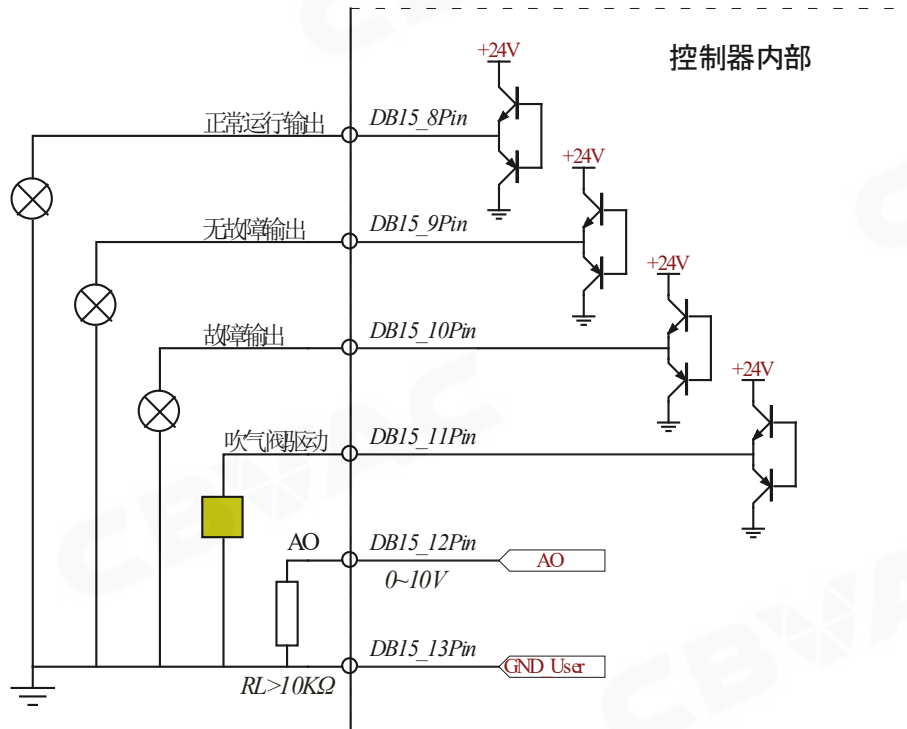
Picture 13: Adopting an external 24V power supply and a highly efficient configuration method



Picture 14: Adopting an external 24V power supply, low effective configuration method, pay attention to power polarity

2) Four push-pull outputs and analog outputs

This controller has four push-pull output signals, all of which are highly effective, with a high level of 24V. The DO functions of each signal can be found in the external control output interface definition in 4.1.3. The typical connection diagram is shown in Picture 15.

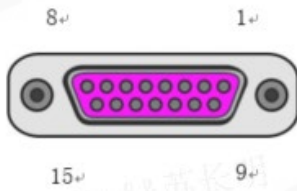


Picture 15: Typical wiring diagram for four-way push-pull output and analog output

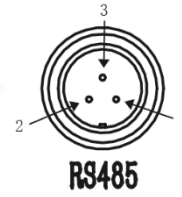
3) Precautions for wiring external control interfaces:

- Please use shielded wire or twisted pair for wiring the control circuit terminals, with a wire length not exceeding 3 meters;
- In order to prevent mis-operation caused by interference, the control circuit connection line should be kept as far away from the high-voltage connection line as possible. When the control circuit connection line must pass through the high-voltage connection line, it should intersect at a right angle;
- The analog output signal adopts a set of twisted pair cables, which are respectively connected to the AO output signal and GND to avoid interference from other circuits on the analog signal;

4.1.5 RS485 communication interface definition



JFB-I/II-G3 Controller Serial Interface



JFB-II Controller Serial Interface

The specific pin definitions are as follows: (It is recommended that customers use a single ended grounding method when connecting the molecular pump 485 communication line. The 485 aviation plug on the molecular pump controller end should not be grounded, and the customer's upper computer end should be grounded.)

JFB-I	JFB-II-G3	JFB-II	Definition
14	13	1	RS485 Serial port A+
15	14	2	RS485 Serial port B-
/	/	3	/

4.1.6 RS485 communication protocol (Modbus Rtu Protocol)

4.1.6.1 Modbus Overview

- Modbus is a serial and asynchronous communication protocol that is a universal language used in PLCs or other controllers. This protocol defines a message structure that a controller can recognize and use, regardless of the network over which they are transmitted.
- The Modbus protocol does not require a dedicated interface, the typical physical interface is RS485.

4.1.6.2 Modbus communication protocol for drive controller

A. Overall description

1) Transmission mode

In RTU mode, the characters sent are represented as hexadecimal numbers. For example, if sending 31H, simply send 31H into the data packet. This series of controllers does not support ASCII transmission mode.

-
- 2) Baud rate - Setting range: 9600
3) Frame structure - In RTU mode:

Bit	Function
1	Start position (low level)
8	Data bits
0	No parity
1	Stop bit

- 4) Error detection

In RTU mode, CRC-16 (cyclic redundancy error check) is adopted. The CRC-16 error check procedure is as follows: The message (only involving data bits here, not referring to the start bit, stop bit, and optional parity bit) is treated as a continuous binary, and its most significant bit (MSB) is preferred for transmission. The message is first multiplied by X^{16} (shifted 16 bits to the left), and then divided by $X^{16}+X^{15}+X^2+1$. $X^{16}+X^{15}+X^2+1$ can be represented as binary number 110000000000 000101.

The integer quotient is ignored and not remembered, and the 16 bit remainder is added to the message (sent by MSB first) to become 2 CRC check bytes. Initialize all 1s in the remainder to prevent all zeros from being received as a single message. The message containing CRC bytes after the above processing, if there are no errors, will be divided by the same polynomial ($X^{16}+X^{15}+X^2+1$) at the receiving device to obtain a zero remainder (the receiving device verifies this CRC byte and compares it with the transmitted CRC). All operations are modulo 2 (without carry).

Devices accustomed to sending data in strings will prefer to send the rightmost bit of the character (LSB least significant bit). In the case of generating CRC, the first bit sent should be the most significant bit MSB of the dividend. Due to the absence of carry in the operation, for ease of operation, the MSB is set to the rightmost position when calculating CRC. The order of generating polynomials must also be reversed to maintain consistency. The MSB of a polynomial is omitted as it only affects the quotient and not the remainder.

The steps to generate CRC-16 checksum bytes are as follows:

- ① Load a 16 bit register with all digits being 1.
- ② The high-order byte of the 16 bit register is XORed with the first 8-bit byte. Put the calculation result into this 16 bit register.
- ③ Move this 16 bit register to the right by one bit.
- ④ If the digit shifted to the right (marker) is 1, generate polynomial 1010000000000001 and perform an XOR operation with this register; If the digit shifted to the right is 0, return ③.
- ⑤ Repeat steps ③ and ④ until 8 digits are removed.

- ⑥ The other 8 bits are XORed with the 16 bit register.
- ⑦ Repeat steps ③ to ⑥ until all bytes of the message are XORed with the 16 bit register and shifted 8 times.
- ⑧ The content of this 16 bit register, which is a 2-byte CRC error check, is added to the most significant bit of the message.

B. Command type and format

- 1) The two command types for commonly used functional domain code are as follows:

Command Type	Name	Description
03	Read and hold the contents of the register	Retrieve the current value from one or more registers, up to a maximum of 10
06	Pre-set single register	Load specific values into the hold register

- 2) Data packet format, in RTU mode:

Start Mark	Address Field	Functiona I Domain	Data Domain	CRC Check		Ending Mark
T1-T2-T3-T4	Controller address	Function code	N Data	CRC Low byte	CRC High byte	T1-T2-T3-T4

- 3) Communication address and command meaning

This section is the content of communication, which can be monitored and controlled through real-time monitoring commands to monitor and control the operation of the motor, as well as set the baud rate and controller address through parameter setting commands.

In communication, the controller is always a slave and does not actively send data. It only sends response data after receiving valid commands from the upper computer, and responds to each command without processing or responding to invalid commands. After sending a command to the controller, the upper computer should wait for the controller's response before sending the next command. The timeout should be set to 1 second, otherwise data may be lost.

Among them, CLO and CHI are the low byte and high byte of CRC check, respectively.

The addresses represented in this section are all in hexadecimal, for example, 1000 represents 4096200 in decimal and 8192 in decimal.

Read (03 function code, read-only function code)		
Register Address	Function	Description
0x1000	Output Frequency	Resolution: 0.1Hz, 0~1500.0Hz
0x1001	Read the address of the molecular pump ID	Address of molecular pump: 1~247
0x1002	Pump type	80:300 Type 81:700 Type 82:1400 Type 83:2200 Type 90: 450
0x1003	Controller model	Software version number (or date): 0: v3.20 1: v3.21 2: v3.22 ...
0x1004	Current alarm status	0: System normal 1: System failure
0x1005	Current operating status	Current status representation: 0- Shutdown 1- Run 2- Idle speed 3- Soft Start 4- Fault 5- Acceleration 6- Deceleration
0x1006	Output voltage	Resolution: 1V, Range: 0 – 65535V
0x1007	Output current	Resolution: 0.01A, 100x data transmission
0x1008	Output power	Resolution: 1W, Range: 0 – 65535W
0x1009	Motor temperature	Resolution: 1 °C, Range: 0 – 255°C
0x100A	Controller temperature	Resolution: 1 °C, Range: 0 – 255°C
0x100B	Bus voltage	Resolution: 1V
0x100C	Actual speed	Resolution 0.1Hz, Range 0~1500.0Hz
0x100D	Current running time	Resolution 1min
0x100E	Total running time/min	Resolution 1min

0x100F	Total running time/hour	Resolution: 1 hour
0x1010	Total number of runs	0-65535
0x1011	Total number of failures	0-65535
0x1012	Maintenance frequency	0-65535
0x1013	Maintain countdown timer	26280h
0x1014	Power B control status (Vent valve)	Undefined
0x1015	Current fault code	Fault code (Taking JFB-II model as an example): E1: Err (Model recognition error) E2: OC (Overcurrent protection) E3: OV (Overvoltage protection) E4: LV (Undervoltage protection) E5: OF (Motor overload) E6: MOT (Motor overheating) E7: DOT (Frequency converter overheating) E8: PM (Maintenance prompt, displaying Pn) E9: STE (Failed to start) EA: SPE (Locked rotor) EB: Motor not connected... etc
0x1016	Latest fault code	
0x1017	Second to last fault code	
0x1018	Third to last fault code	
0x1019	Reserve	
0x101A	Local remote control status	1: Local terminal control: mechanical button 2: External control status: DB15 external control 3: RS485 communication control
0x101B	Target rotational speed	Read only
0x101C	Maximum speed	Read only
0x101D	Minimum speed	Read only
0x101E	Operating motor protection temperature	Read only
0x101F	Idle speed	Read only
0x1020	Acceleration time	Read only
0x1021	Deceleration Time	Read only

Set (06 function code, only write function code)		
Register Address	Function	Description
0x2000	Rated frequency	Resolution: 0.1Hz, soft start/start reaches rated speed
0x2001	Maximum speed	Resolution: 0.1Hz, $\geq$ rated frequency
0x2002	Minimum speed	Resolution: 0.1Hz
0x2003	Operating motor protection temperature	Resolution: 1°C, Range 25-125°C
0x2004	Allow controller to protect temperature	No modifications allowed
0x2005	Acceleration time	Resolution: 1ms, Range: (actual acceleration) JFB-I: 80-300ms/Hz, Default value of 100ms/Hz JFB-II: 300-600ms/Hz, default value 300ms/Hz JFB-III: No modifications allowed
0x2006	Deceleration Time	Resolution: 1ms, Range: (actual deceleration) JFB-I: 100-300ms/Hz, Default value 150ms/Hz JFB-II: 300-600ms/Hz, default value 500ms/Hz JFB-III: No modifications allowed
0x2007	Idle speed	As a percentage of the rated speed, the range is 50% -100%, representing 50% -100% of the rated speed, with a factory value of 70%
0x2008	Power switch A (purge valve)	1 indicates power on, 0 indicates power off
0x2009	Power B switch (vent valve)	1 indicates power on, 0 indicates power off

0x200A	Molecular pump control command	0- Shutdown 1- Run 2- Idle speed 3- Soft start (every 100Hz, stay for 5 minutes) 4- Fault reset
0x200B	Set molecular pump ID	Range 1 ~ 247
0x200C	Restore factory settings	0- Invalid 1- Restore factory settings 2- Reset maintenance time and increase maintenance frequency
0x200D	Target speed (frequency)	Resolution: 0.1Hz, range from lowest speed to highest speed
0x200E	Clear running time	0: Invalid 1: Effective
0x200F	Reserve	
0x2010	485 Communication application for control rights	0: Invalid 1: Effective

Example 1: Read data from 0x0001 to 0x101

Host machine sends

Add	Function code	First register high bit	First register low bit	Register quantity high	Register quantity low	CRC high	CRC low
0x01	0x03	0x10	0x01	0x00	0x19	CLO	CHI

Subordinate machine response

Add	Function code	Byte count	Register 1 value high bit	Register 1 value low bit	Register 2 value high bit	Register 2 value low bit	...	CRC high	CRC low
0x01	0x03	0x32	Molecular pump ID number high byte	Molecular pump ID number low byte	Pump address high position	Pump address low position	...	CLO	CHI

Example 2: Historical fault reading

Host machine sends

Add	Function code	First register high bit	First register low bit	Register quantity high	Register quantity low	CRC high	CRC low
0x01	0x03	0x10	0x16	0x00	0x03	CLO	CHI

Subordinate machine response

Add	Function code	Byte count	Register 1 value high bit	Register 1 value low bit	Register 2 value high bit	Register 2 value low bit	...	CRC high	CRC low
0x01	0x03	0x06	The most recent high byte malfunction	The most recent low byte malfunction	Second to last fault high position	Second to last fault low position	...	CLO	CHI

Example 3: Write data of 0x2000

Host machine sends

Add	Function code	Register Address High Bit	Register Address low Bit	Mandatory high value	Mandatory low value	CRC high	CRC low
0x01	0x06	0x20	0x00	High rated frequency	Low rated frequency	CLO	CHI

Subordinate machine response

Add	Function code	Register Address High Bit	Register Address low Bit	Mandatory high value	Mandatory low value	CRC high	CRC low
0x01	0x06	0x20	0x00	High rated frequency	Low rated frequency	CLO	CHI

Example 4: Configure Address

Host machine sends

Add	Function code	Register Address High Bit	Register Address low Bit	Mandatory high value	Mandatory low value	CRC high	CRC low
0x01	0x06	0x20	0x0B	0x00	0x01	CLO	CHI

Subordinate machine response

Add	Function code	Register Address High Bit	Register Address low Bit	Mandatory high value	Mandatory low value	CRC high	CRC low
0x01	0x06	0x20	0x0B	0x00	0x01	CLO	CHI

Attention:

After successfully setting the parameters of JFB-I/II controller, the new parameter settings will take effect after the controller is powered on again!

4.1.7 Controller Fault Code Table

4.1.7.1 JFB-I/JFB-II Controller Fault Code Table

Fault code	Fault Type
e1	Model recognition error
e2	Hardware overcurrent protection
e3	Overvoltage protection
e4	Under voltage protection
e5	Motor overload
e6	Motor overheating

e7	Controller overheating
e8	Maintenance reminder, displayed Pn
e9	Start failure
eA	Locked rotor
eb	Motor not connected or missing phase
ec	Braking fault
ed	Decryption malfunction
ee	Circuit board identification resistor error
eF	Software overcurrent protection (Can be reset, eliminated, and restarted)

4.1.7.2 JFB-II-G3 Controller Fault Code Table

Fault code	Fault Type
e1	Model recognition error
e2	Hardware overcurrent protection
e3	Overvoltage protection
e4	Under voltage protection
e5	Motor overload
e6	Motor overheating
e7	Controller overheating
e8	Maintenance reminder, displayed Pn
e9	Start failure
eA	Motor not connected or missing phase

4.2 JFB-III Controller

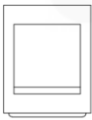
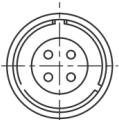
The operation panel is shown in the following picture:

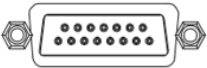


Picture 16: Controller operation panel

1-Status Display 2-External Control 3-Alarm 4-Fan 5-Start/Stop

4.2.1 JFB-III controller operation and function description:

Screenshot of buttons/sockets	Button/socket name	Description
	Switch	Used for opening and closing the controller
	Power interface	Input power socket (220V input)
	Fan (1-, 4+)	Used for fan power supply in air-cooled components, default provides 24V DC power output, 1-pin 24V -, 4-pin 24V+
	Alarm	When there is an unexpected situation with the drive controller, this buzzer will sound an alarm to inform the user
	RS485 (1A+, 2B-)	This drive control adopts upper computer control, which can control the start and stop of multiple devices, and monitor and record data such as voltage, current, speed, motor temperature, operating status, and fault status. It has 1 pin A+ and 2 pins B-

	Start/Stop	Control the start and stop of the molecular pump through an external start/stop button
	External control output	Specific pin definitions for PLC external device control (see 4.1.3 External Control Output Pin Definitions)
	Status indicator light	Used to display real-time operating status or fault status

4.2.2 Schematic diagram of status indicator lights

Running/Shutdown/Fault

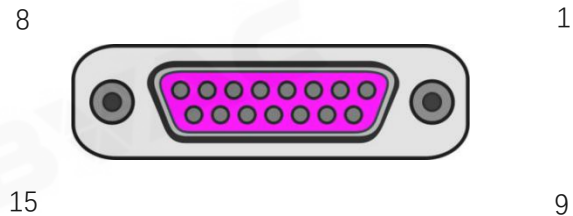


Status indicator lights		Meaning
Green light	Off state	The power supply is not connected
	Continuous and stable illumination	The power has been connected
Yellow light	Off state	Molecular pump stops running
	Fast flashing	Molecular pump acceleration (flashing once every 0.5s)
	Slow flashing	Molecular pump soft start (flashing once every 2 seconds)
	Normal flashing	Molecular pump deceleration (flashing once every 1 second)
	Continuous and stable illumination	Molecular pump operates at target speed
Red light	Off state	The molecular pump and controller are operating normally
	Continuous and stable illumination	Fault occurrence

4.2.3 Controller performance indicators (see 1.6.1 parameter list)

4.2.4 Definition of External Control Output Interface (Same as 4.1.3)

DB15 connector:

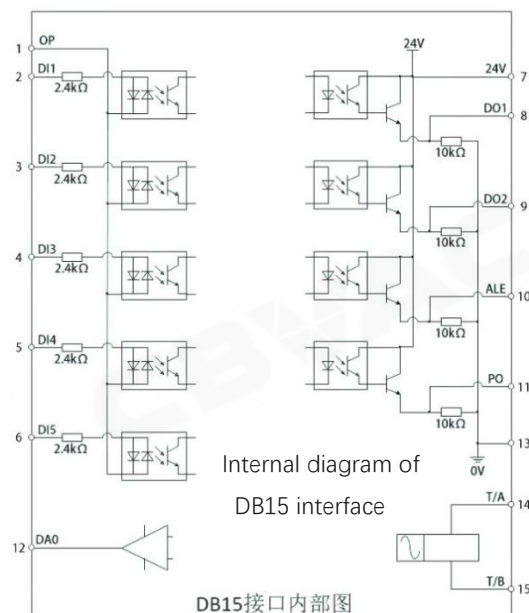


Functions of external control output pins:

Needle sizes	Function	Description
1	Public end, can be connected to 24V or COM	Internally using bidirectional optocouplers, capable of connecting to 24V or COM, compatible with two common wiring methods, default to COM connection
2	Digital input 1, remote control priority	V+, input represents remote controller priority, not controlled by PC end
3	Digital input 2, control the blowing air function	V+, Indicates Pin 11 is turned on, low voltage indicates PIN11 is turned off
4	Digital input 3, pump control on/off	V+, Start the molecular pump to the set speed. If PIN5 is high voltage, accelerate according to the soft start program. If PIN5 is low voltage, accelerate directly to the set speed; V-, Molecular pump shutdown or reset (i.e. short circuit 4 and 7 to start the molecular pump, disconnect 4 and 7 to stop the molecular pump)
5	Digital input 4, soft start	V+, Enable soft start; V-, Turn off soft start
6	Digital input 5, idle speed	V+, Operate at idle speed, with a default maximum speed of 70%
7	+24 V Voltage Output (V+)	+24 V, Output, as the reference voltage for all digital inputs
8	Digital output 1, output pump normal operation signal	GND: No; V+, yes, (I max = 50 mA / 24 V), If the set speed reaches 80% and the output is high, it is considered that the pump has started normally

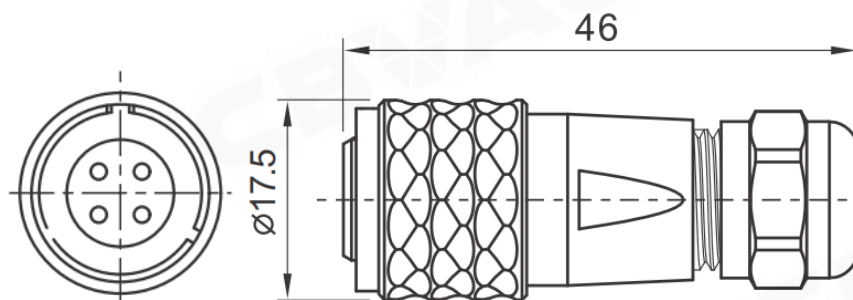
9	Digital output 2, output power connection information	Once the power is connected, maintaining a high level output of 24V indicates that there are no errors; If there are any errors, output a low level. (Equivalent to the function output of power on self-test)
10	Digital output 3, output fault signal	If there is any malfunction in the molecular pump, it can maintain a high level output of 24V and control the buzzer, light, or gate circuit; The molecular pump is normal and outputs a low level
11	Attachment output A1, which can provide power to the purge valve	High level output, capable of a maximum load of 24V/200mA, can drive the purge valve and supply power to it
12	Analog output, outputting voltage according to the ratio of actual speed/rated speed	Actual speed, 0-10VDC, equivalent to 0-100% rated speed, $R \geq 10K\Omega$
13	Grounding	Grounding wire, the reference grounding for all digital and analog quantities
14	Relay dry node	Normally closed, when the molecular pump is started, the contacts open, and when the molecular pump speed is 0, the contacts close, outputting a molecular pump stop signal
15	Relay dry node	

Internal DB15 circuit diagram of JFB-III controller:



4.2.5 RS485 Communication Interface Definition

The communication interface of RS485 is the RS485 four pin interface located on the front panel of the controller:



RS485 Aviation plug

The specific pin definitions are as follows: (It is recommended that customers use a single ended grounding method when connecting the molecular pump 485 communication line. The 485 aviation plug on the molecular pump controller end should not be grounded, and the customer's upper computer end should be grounded.)

Pin number	Definition
1	RS485 Serial port A+
2	RS485 Serial port B-
3、4	/

4.2.6 RS485 Communication Protocol (Modbus Rtu Protocol) (Same as 4.1.6)

Attention:

The JFB-III controller's 0 × 2010 address must be set to 1 before the parameter settings can take effect

4.2.7 JFB-III Controller Fault Code Table

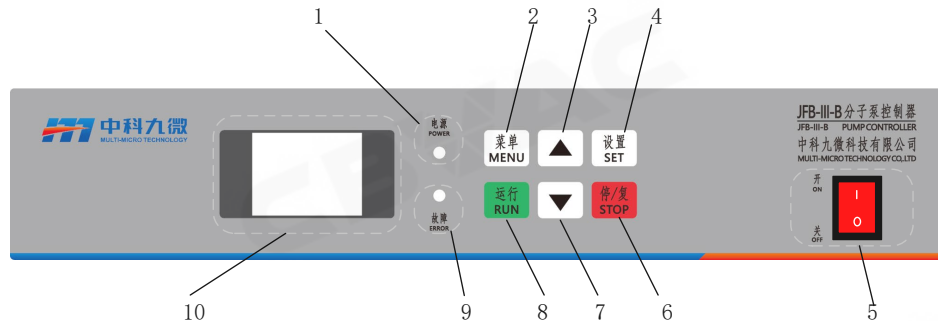
Fault code	Fault/protection type
E01	Molecular pump overheating
E02	Molecular pump overcurrent
E03	Molecular pump overload
E04	Molecular pump startup timeout
E05	Maintenance Tips

E06	Controller overheat protection
E07	Controller short circuit protection
E08	Controller overvoltage protection
E09	Controller undervoltage protection
E10	Other
E10.10	Acceleration overvoltage
E10.11	Overvoltage during deceleration
E10.12	Constant speed overvoltage
E10.13	Bus undervoltage
E10.20	AC power input phase loss
E10.21	AC/DC Power overload
E10.22	AC/DC Power overvoltage
E10.23	AC/DC Power supply overheating
E10.24	DC input power overload
E10.25	Contactors malfunction
E10.26	Power shutdown failed
E10.27	AC input power input overvoltage
E10.28	AC input power supply input undervoltage
E10.30	Short circuit in power circuit output
E10.31	Driver output overload
E10.32	Overload of braking resistor (I _{2t})
E10.33	Hardware malfunction of braking resistor
E10.34	Driver temperature sensor malfunction
E10.36	The ambient temperature is too high
E10.37	The ambient temperature is too low
E10.38	The temperature of the power device is too high
E10.39	Short circuit of power device
E10.40	Fan failure
E10.41	CPU overheat
E10.42	Hardware malfunction of low-speed braking resistor
E10.43	Brake resistor overheating fault
E10.50	Motor open circuit

E10.51	Motor phase loss
E10.52	Motor short circuit
E10.53	Motor overload
E10.55	Motor encoder malfunction
E10.56	Motor temperature sensor malfunction
E10.60	RS485 communication failure
E10.61	CAN Bus communication failure
E10.62	Simulate input disconnection fault
E10.70	Excessive speed deviation
E10.71	Motor tuning fault
E10.72	Actual speed exceeds the upper limit value
E10.73	Deviation frequency exceeds the boundary
E10.74	Motor commutation error
E10.80	Wrong selection of spindle parameters
E10.81	Flash Read out abnormality
E10.82	Password incorrect 3 times
E10.83	Driver parameters not activated
E10.84	FPGA Watchdog triggered
E10.85	Driver parameters not loaded
E10.86	PWM Output fault
E10.87	Flash Abnormal chip model
E10.88	Flash Write exception
E10.89	PS Watchdog triggered
E10.90	Parameter engineering write Modbus register timeout error

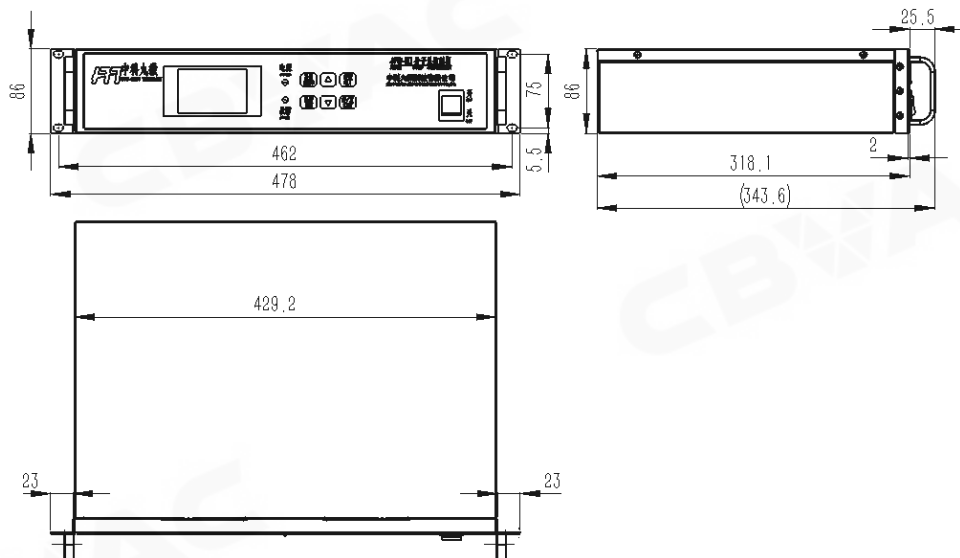
4.3 JFB-III-B Controller

The operation panel and its dimensions are shown in Pictures 17 and 18:



Picture 17: Schematic diagram of operation panel

- | | |
|--------------------------|-------------------------|
| 1. Power indicator light | 6. [Stop/Resume] button |
| 2 [Menu] button | 7 [▼] button |
| 3 [▲] button | 8 [Run] button |
| 4 [Settings] button | 9 Fault indicator light |
| 5 power switches, | 10 display screens |



Picture 18: Schematic diagram of operation panel dimensions

4.3.1 JFB-III-B Controller Operation Panel Description

The overall panel is divided into several parts, including LCD display screen, power indicator, fault indicator, button operation, and power switch.

- 1) **POWER SWITCH:** The controller is powered on/off. When the switch is turned to the "ON" position, the controller is powered on. When the switch is turned to the "OFF" position, the controller is powered off.
- 2) The LCD display screen can switch the display interface through button operation. The main interface displays the current operating status of the vacuum pump, and the menu

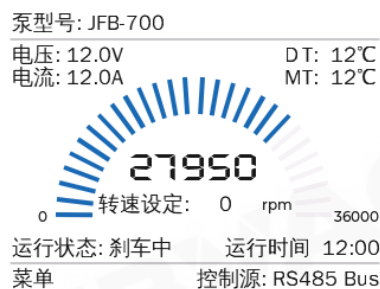
interface displays the set parameters, etc. In the key operation area, the [Menu], [Settings], [▲], and [▼] keys work together to complete parameter settings. The 'Run' button can start the vacuum pump in local mode. The 'Stop/Resume' button can stop the vacuum pump in local mode, and long pressing the 'Stop/Resume' button can reset the controller. The operation area, also known as the key area, includes six function keys. The content and usage functions of the function keys are shown in the table below.

Key	Key Name	Description
Menu	Method key	For use by molecular pump manufacturers
Set	Settings key	For use by molecular pump manufacturers
▲	Up	For use by molecular pump manufacturers
▼	Down	For use by molecular pump manufacturers
Run	Work	Start the molecular pump in local mode.
Stop/Resume	Stop/Resume	This key is for shutdown and reset (valid in local mode): 1) Molecular pump shutdown; 2) Reset in fault state.

Keyboard key instructions

- 3) Front panel operation instructions: The front panel LCD display can be divided into main interface display and menu interface operation.

a) Main interface display



The LCD main interface displays basic information about the operation of the molecular pump, including the pump model, output line voltage, output phase current, motor temperature DT, driver temperature MT, current operating status, current operating time, control source, actual speed, set speed, and other related information.

b) Menu interface

Click the [Menu] button to enter the menu interface from the main interface, and you can switch menu pages through the [Menu] button. Click the [Menu] button on the "Settings" tab page to enter "Parameter Display", and click the [Menu] button on "Parameter Display" to return to the main interface.



c) Set up page

i--Dropdown menu selection:

Select the corresponding setting item through [▲][▼], and then click the [Settings] button to enter the change. For example, selecting "Control Source Settings" and clicking the "Settings" button will bring up the corresponding drop-down box, where you can make the appropriate selection.



ii--Save the set parameters



When there are modifications in the parameter drop-down box on the "Settings" page, clicking the [Menu] button will display a dialog box asking whether to save the parameters. Use the [▲] and [▼] buttons to select whether to save the parameters you just set, and then confirm the selection using the [Settings] button. If saved successfully, the download will be displayed as successful; otherwise, the download will fail. If successful, enter the "Parameter Display" page; if failed, stay on the "Settings" page.

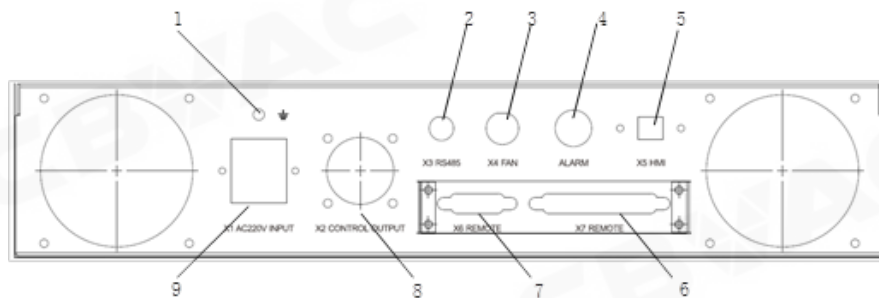
When there is no modification in the parameter drop-down box on the "Settings" page, clicking the [Menu] button will directly enter the "Parameter Display" page.

d) Parameter display page



Users can view the displayed values of the parameters through [▲] [▼], and click the [Menu] button again to return to the main interface.

4.3.2 JFB-III-B Controller Rear Panel Interface Description



Picture 19: Rear panel schematic diagram

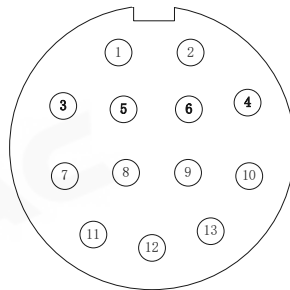
- | | |
|------------|---------------------|
| 1 GROUND | 6 X7 REMOTE |
| 2 X3 RS485 | 7 X6 REMOTE |
| 3 X4 FAN | 8 X2 CONTROL OUTPUT |
| 4 ALARM | 9 X1 AC220V INPUT |
| 5 X5 HMI | |

Introduction to the functions of each component:

- Ground terminal: This terminal must be reliably grounded with a grounding impedance not exceeding 4 Ω .
- RS485 communication interface: used for communication connection and data exchange between molecular pump controller and external devices.
- Fan power output (X4 FAN): Provides power to an external fan.
- Buzzer (alarm indicator light).
- USB interface: used for downloading and upgrading programs internally by the manufacturer.
- External control output interface (DB37): compatible with the external control interface definition of a certain Edwards molecular pump.

- g) External control output interface (DB15): The IO control interface of the molecular pump controller to the outside world.
- h) X2 Control OUTPUT: The main interface for connecting the controller to the molecular pump motor, used to drive the molecular pump.
- i) Input power socket (X1 AC220V INPUT): The JFB-III-B series controller has voltage levels of 110VAC and 220VAC. Please specify when ordering. The default input for the power supply is 220VAC, with built-in 10A/250VAC fuses. When inputting 110VAC, there is built-in 15A fuse.

(1) Drive output (X2 Control OUTPUT): This connector has 13 bits and contains motor drive signal lines and motor overheat protection signal lines. The specific pin distribution is shown in Picture 20:



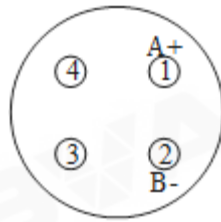
Picture 20: Distribution diagram of aviation plug pins

Pin No.	Pin Definition	Pin No.	Pin Definition
1	PE, Controller ground wire	8	NC
2	U-phase, motor phase line	9	Motor temperature sampling
3	V-phase, motor phase line	10	NC
4	W-phase, motor phase line	11	Vacuum pump identification resistor
5	NC	12	Vacuum pump identification resistor
6	NC	13	NC
7	Motor temperature sampling		

Functions of each pin

(2) RS485 communication connector (X3 485): 485 communication control terminals A+, B -, equipped with international universal Modbus communication protocol, detailed pins are shown in Figure 21: (The 485 chip inside the controller has been isolated, it is recommended

not to be grounded, and the shielding layer can be connected to the aviation plug shell.)



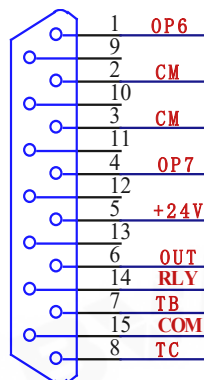
Picture 21: RS485 Communication interface

This controller can be controlled by a microcomputer to start, stop, observe voltage, current, frequency, and monitor faults. Suitable for devices that require microcomputer operation and control along with other peripherals. More suitable for group starting and stopping on production lines, and can also be started and stopped separately.

Note: When using a microcomputer to control operation through a serial communication port, if the microcomputer has an RS232 interface, an RS485/RS232 interface protocol converter is required. If the microcomputer has an RS485 interface, it can be directly connected.

(3) ALARM: When an unexpected situation occurs in the controller, this buzzer will sound an alarm to inform the user. Please refer to the LCD screen for specific faults.

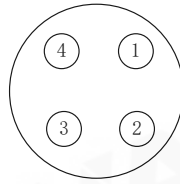
(4) External Control Output (X6 REMOTE): This is a computer socket that contains start signal lines, stop signal lines, operation indicator signal lines, and fault alarm signal lines. The specific pin definitions and distribution are shown in the table below. The external control output interface adopts a 15 pin DB15 connector (the pin numbers are subject to the actual product), which is used to control the operation status of the vacuum pump by the external control equipment, as shown in Picture 22.



Picture 22: DB15 Interface definition

(5) Fan power output (X4 FAN):

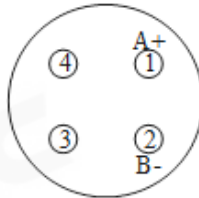
The controller can supply power to external fans, and the fan aviation plug interface is shown in Picture 23, where PIN4 is 24V, PIN1 is 0V, and the maximum output current is 0.2A.



Picture 23: Fan connector definition

4.3.3 RS485 Communication Instructions

RS485 connector (X3 485): 485 communication control terminals 1A+, 2B -, equipped with international universal Modbus communication protocol, detailed pins are shown in Picture 24: (The 485 chip inside the controller has been isolated, it is recommended not to be grounded, and the shielding layer can be connected to the aviation plug shell)



Picture 24: RS485 communication interface

This controller can be controlled by a microcomputer to start, stop, observe voltage, current, frequency, and monitor faults. Suitable for devices that require microcomputer operation and control along with other peripherals. More suitable for group starting and stopping on production lines, and can also be started and stopped separately.

Note: When using a microcomputer to control operation through a serial communication port, if the microcomputer has an RS232 interface, an RS485/RS232 interface protocol converter is required. If the microcomputer has an RS485 interface, it can be directly connected.

RS485 communication protocol: see Picture 25, RS485 mode selection:



Picture 25: RS485 mode selection

- (1) IDW: Customer Custom Agreement;
- (2) BKY: Address 1 (default value), baud rate 19200 (default value), 8, N, 1

Using different types of parameters as addresses.

(The addresses and parameter descriptions represented in this section are all in hexadecimal, for example, 1000 represents 4096 in decimal)

1. Operating status parameters

Parameter Address	Parameter description (read-only)
1000	Output Frequency
1001	Output voltage
1002	Output current
1003	Molecular pump controller status: 00: Standby mode 01: Running 02: Operation error (err) 03: Short circuit protection (OC) 04: DC Overvoltage (OE) 05: Reserved 06: RLU 07: Overcurrent (OL2) 08: Molecular pump overload (SL) 09: Molecular pump overheating (ESP) 0A: Undervoltage (LU) 0B: Molecular pump controller overheating (OH)

2. Control command

Parameter Address	Parameter description (read-only)
2000	Command content meaning: 0003: Deceleration and shutdown 0004: Free shutdown 0008: Running (without direction) 0009: Fault reset
2001	Lock parameters 0001: Release system lock (remote control lock) 0002: Lock remote control (any remote control command is invalid until unlocked)

3. Abnormal response of read and write parameters

Command Description	Function code area	Data area
Subordinate machine parameter response	The highest bit in the function code area becomes 1.	Meaning of Command Content 0001: Illegal Function Code 0002: Illegal data address 0003: Illegal data 0004: Slave equipment malfunction

Attachment description: During the communication process, it is stated that:

- The parameter value of frequency is equal to the actual value multiplied by 10
- The parameter value of time is equal to the actual value multiplied by 10
- The parameter value of current is equal to the actual value multiplied by 10
- Voltage parameter value=actual value × 1
- Power parameter value=actual value × 100
- Version number parameter value=actual value × 100

Explanation: The parameter value is the actual value sent by the data packet. The actual value is the actual value of the parameter in the molecular pump controller. After receiving the parameter values, the upper computer divides them by the corresponding proportional coefficients to obtain the actual values of the corresponding parameters of the molecular pump controller.

Attention:

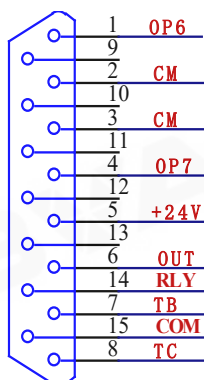
When sending commands to the molecular pump controller, decimal points are not considered in the data packet. All data values cannot exceed 65535, otherwise data overflow occurs.

- (3) MMT: Same as 4.1.6, JFB-I controller RS485 communication protocol

4.3.4 Definition of I/O External Control Interface

(1) External Control Output (X6 REMOTE):

This is a computer socket that contains start signal lines, stop signal lines, operation indicator signal lines, and fault alarm signal lines. The specific pin definitions and distribution are shown in the table below. The external control output interface adopts a 15 pin DB15 connector (the pin numbers are subject to the actual product), which is used to control the operation status of the vacuum pump by the external control equipment, as shown in Picture 26.



Picture 26: DB15 Interface definition

Functions of external control output pins:

The recommended definitions for the functions of each pin are as follows (which can be adjusted according to the actual situation while ensuring scientific rationality):

Pin No.	Function	Description
1	Start control OP6	Normally in an open circuit state with an external relay (or switch). To start the molecular pump, connect an instantaneous passive short-circuit signal for about 0.5S to 1S. After short circuiting 1 pin and 2 pins, the vacuum pump can be started; After disconnecting the 1-pin and 2-pin, the vacuum pump can be stopped.
2	Start control CM	
3	Stop control CM	Normally in a short-circuit state with an external relay (or switch). To stop the molecular pump, connect an instantaneous passive open circuit signal for about 0.5S to 1S. After disconnecting the 3-pin and 4-pin, the vacuum pump can be stopped.
4	Stop control OP7	
5	Normal output signal	During the acceleration process of the vacuum pump, there is no voltage output. After the vacuum pump operates normally, it outputs a DC24V electrical signal, where pin 5 is positive and pin 6 is negative, with a maximum current of 0.1A.
6	Normal output signal	
7	Fault output TB	No voltage contact output signal, can control buzzer, etc. or gate circuit. The maximum allowable voltage of the external power supply is 24VDC, and the maximum allowable current is 0.1A. When there is no fault, TB and TC are connected, and when there is a fault, TB and TC are disconnected.
8	Fault output TC	
9	NC	NC
10	NC	NC

11	NC	NC
12	NC	NC
13	NC	NC
14	Normal output RLY	No voltage contact output signal, can control buzzer, etc. or gate circuit. The maximum allowable voltage of the external power supply is 24VDC, and the maximum allowable current is 0.1A. When the vacuum pump accelerates, RLY and COM are disconnected. After the vacuum pump runs normally, RLY and COM are connected.
15	Normal output COM	

Note: Do not use input voltage of 220VAC or 110VAC as the start or stop input signal for the controller. If that happens, it will cause damage to the controller.

(2) External control output (X7 REMOTE):

The JFB-III-B controller is compatible with several commonly used Edwards molecular pump controllers, including the DB37 interface. The interface definition is as follows:

Pin No.	Pin Name	Pin No.	Pin Name
1	COM	20	NC
2	NC	21	STOP_IN
3	START_IN	22	RESET_IN
4	REM_IN_OPT1	23	REM_IN_OPT2
5	INHIBIT_IN	24	WARNING_OUT(N.O.)
6	WARNING_OUT(COM)	25	WARNING_OUT(N.C)
7	L.VALVE_OUT(N.O.)	26	L.VALVE_OUT(N.O.)
8	REMOTE_OUT(N.O.)	27	REMOTE_OUT(N.O.)
9	POWER_OUT(N.O.)	28	POWER_OUT(N.O.)
10	ACCELERATION_OUT	29	ACCELERATION_OUT
11	NORMAL_OUT(N.O.)	30	NORMAL_OUT(COM)
12	NORMAL_OUT(N.C.)	31	NC
13	BREAK_OUT(N.O.)	32	BREAK_OUT(N.O.)
14	ALARM_OUT(N.O.)	33	ALARM_OUT(COM)

15	ALARM_OUT(N.C.)	34	NC
16	AT_TEMP.OUT(N.O.)	35	AT_TEMP.OUT(N.C.)
17	AT_TEMP.OUT(COM)	36	OPT.1_OUT(N.O.)
18	OPT.1_OUT(COM)	37	OPT.1_OUT(N.C)
19	NC		

4.3.5 Usage of JFB-III-B Controller

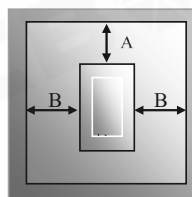
- Connect the 8-pin socket on the molecular pump to the 13 pin drive output socket on the back panel of the controller using a cable.
- If the controller does not use the external control function, be sure to connect the external control plug in the spare parts bag to the external control socket on the back panel of the controller before powering on (short-circuit the 3/4 pin in the DB15 external control); If using the external control function, please follow the instructions for wiring and connect the external control plug to the external control socket.
- After connecting the power cord, turn on the power switch on the back panel of the controller. At this time, the LCD screen of the controller displays the status of the molecular pump. For instructions on how to use the controller, please refer to 4.3.1 JFB-III-B Controller Operation Panel Instructions.

4.3.6 Installation Instructions (JFB-III-B/JFB-VI)

Installation environment:

- No rain, water droplets, steam, dust, or oily dust; No corrosive, flammable gases or liquids; No metal particles or metal powders, etc.
- The ambient temperature is within the range of -10 °C to +50 °C.
- The relative humidity of the environment must be below 90% and there must be no condensation of water droplets.
- No strong electromagnetic interference.
- The vibration intensity is below 0.5g (acceleration).
- If the controller is installed inside the control cabinet, it should ensure smooth ventilation between the control cabinet and the outside.

As shown in Picture 27. Effective ventilation space should be ensured around it.



Picture 27: Controller Installation Diagram

The following table provides the gap dimensions for controller installation:

(Recommended value)

Controller type	Gap Size	
JFB-III-B	$A \geq 150\text{mm}$	$B \geq 50\text{mm}$
JFB-VI	$A \geq 200\text{mm}$	$B \geq 100\text{mm}$

4.3.7 JFB-III-B fault codes

(1) Fault Code Table

(When a fault alarm occurs, the molecular pump will sound an alarm and shut down. After the shutdown, the fault can be reset and eliminated)

Fault code	Fault Type
E01	Molecular pump overheating
E02	Molecular pump overcurrent
E03	Molecular pump overload
E04	Molecular pump startup timeout
E05	Maintenance Tips
E06	Controller overheat protection
E07	Controller short circuit protection
E08	Controller overvoltage protection
E09	Controller undervoltage protection
E10	Other
E10.10	Acceleration overvoltage
E10.11	Deceleration overvoltage
E10.12	Constant speed overvoltage
E10.13	Bus undervoltage

E10.14	Bus overcurrent
E10.20	AC power input phase loss
E10.21	AC/DC Power overload
E10.22	AC/DC Power overvoltage
E10.23	AC/DC Power supply overheating
E10.24	DC input power overload
E10.25	Contactor malfunction
E10.26	Power shutdown failed
E10.27	AC input power input overvoltage
E10.28	AC input power supply input undervoltage
E10.30	Short circuit in power circuit output
E10.31	Driver output overload
E10.32	Overload of braking resistor (I2t)
E10.33	Self correction fault of current sensor
E10.34	Driver temperature sensor malfunction
E10.35	Drive temperature too high
E10.36	The ambient temperature is too high
E10.37	The ambient temperature is too low
E10.38	The temperature of the power device is too high
E10.39	Short circuit of power device
E10.40	Fan failure
E10.41	CPU overheat

E10.42	Hardware malfunction of low-speed braking resistor
E10.43	Brake resistor overheating fault
E10.44	Braking resistor shutdown timeout
E10.50	Motor open circuit
E10.51	Motor phase loss
E10.52	Motor short circuit
E10.53	Motor overload
E10.54	Motor temperature is too high
E10.55	Motor encoder malfunction
E10.56	Pump model identification resistor fault
E10.60	RS485 communication failure
E10.61	CAN Bus communication failure
E10.62	Simulate input disconnection fault
E10.70	Excessive speed deviation
E10.71	Motor tuning fault
E10.72	Actual speed exceeds the upper limit value
E10.73	Deviation frequency exceeds the boundary
E10.74	Motor commutation error
E10.75	Motor startup timeout error
E10.80	Wrong selection of spindle parameters
E10.81	Flash Parameter engineering reading exception
E10.82	Password incorrect 3 times

E10.83	Driver parameters not activated
E10.84	FPGA Watchdog triggered
E10.85	Driver parameters not loaded
E10.86	PWM Output fault
E10.87	Flash Abnormal chip model
E10.88	Flash Parameter engineering write exception
E10.89	PS Watchdog triggered
E10.90	Parameter engineering write Modbus register timeout error
E10.91	Flash Chip B0S0 read error
E10.92	Flash Chip B0S0 writing error
E10.93	Flash Circular storage read error
E10.94	Flash Circular storage write error
E10.99	Maintenance time up

(2) Warning prompt code table

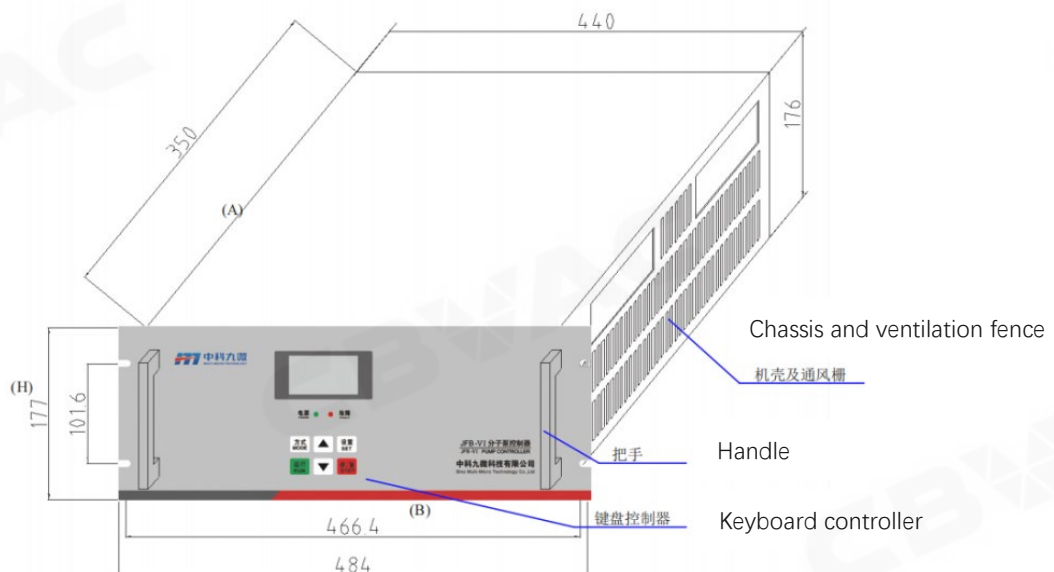
(When a warning prompt occurs, it will not affect the normal operation of the molecular pump, and the warning code can be reset and eliminated after the molecular pump is stopped.)

Alarm main classification	Alarm code	Alarm name
Driver output overcurrent and overload (W0x)	W1	Inverter output overload
Bus alarm (W1x)	W11	Bus overvoltage alarm
	W12	Bus undervoltage alarm
Driver hardware alarm (W3x-W4x)	W31	Inverter overheating alarm
	W38	Fault alarm of power temperature sensor
	W39	Inverter temperature sensor fault alarm

	W40	Fan malfunction alarm
	W41	Driver IO board identification error
Motor alarm (W5x)	W50	Motor overcurrent alarm
	W51	Motor overheating alarm
	W52	Motor speed start
	W53	Motor temperature sensor fault alarm
Communication alarm (W6x)	W60	RS485 communication error
	W61	CAN Bus communication error
	W62	Simulated input disconnection error
	W63	EtherCAT Communication alarm
	W64	ProfiBus Communication alarm
Software Alarm (W8x)	W81	Flash Circular storage read error
	W82	Flash Circular storage write error

4.4 JFB-VI Controller

4.4.1 Controller Appearance

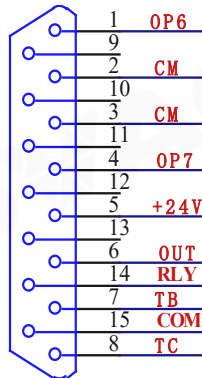


Picture 28: JFB-VI (4U) Split controller

4.4.2 JFB-VI Performance Indicators

Type	JFB-VI
Input voltage	220VAC±10%
Input power frequency	50/60Hz (±5%)
Maximum output power	1500W
Output frequency	0-1000 Hz
Output voltage	≤66VAC
Normal operating current	≤8A
Maximum starting current	≤17A
Start acceleration time	~20min
Shutdown deceleration time	~30min
Weight	27.5kg
Start/Stop Control	Keyboard, external control terminal, and upper computer control
Display function	The LCD screen displays the current output frequency, output current, current output voltage, fault type, as well as function code parameters, operating parameters, and molecular pump model; Two LED indicator lights indicate the power on status and fault status of the controller.
Protection function	Controller input undervoltage, overvoltage, overcurrent, overheating, molecular pump overload, limited current output, overcurrent and overheating protection, user password error, external interference protection.
Environmental condition	Equipment location: No strong corrosive gases or dust; Environmental temperature: -10 °C to +50 °C; Environmental humidity: below 90% (no condensation of water droplets); Vibration intensity: below 0.5g (acceleration)

4.4.3 Definition of External Control Interface (DB15)



Functions of external control output pins:

- Startup mode: The 1st and 2nd pins (OP6, CM) are usually in an open circuit state with an external relay (or switch). To start the molecular pump, connect an instantaneous passive short-circuit signal for about 0.5S to 1S. That is to say, short circuit pins 1 and 2 to start the molecular pump.
- Stop mode: pins 3 and 4 (CM, OP7) are usually in a short-circuit state with an external relay (or switch). To stop the molecular pump, connect an instantaneous passive open circuit signal for about 0.5S to 1S. That is to say, disconnect pins 3 and 4 to stop the molecular pump.

Note: The normally closed and normally open points of the relay or switch must be passive, otherwise it will damage the controller circuit.

- Normal output (active signal): During the acceleration process of the molecular pump, there is no voltage output from pins 5 and 6 (+24V, OUT). After the molecular pump operates normally, pins 5 and 6 output DC24V electrical signals with a maximum current of 0.1A. Normal output (passive signal): pins 14 and 15 (RLY, COM) can provide a normal output signal without voltage contact. Can control buzzer, light or door circuit. The maximum allowable voltage of the external voltage source is 24VDC, and the maximum allowable current is 0.1A. In other words, during the acceleration process of the molecular pump, pins 14 and 15 are in the disconnected state. After the molecular pump operates normally, pins 14 and 15 are in the connected state.
- Fault output: pins 7 and 8 (TB, TC) can provide a fault output signal (no voltage contact output signal). Can control buzzer, light or door circuit. The maximum allowable voltage of the external voltage source is 24VDC, and the maximum allowable current is 0.1A. In other words, when the molecular pump is not faulty, pins 7 and 8 are in the on state, and when there is a fault, they are in the off state.

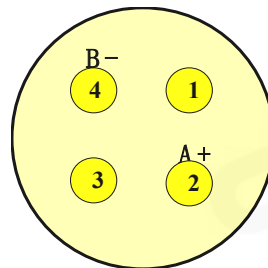
Note: When using the external control start and stop modes mentioned above, an additional external control start and stop function should be added without affecting the front panel start and stop button functions. When not in use, be sure to short-circuit pins 3 and 4 of the external control plug and connect the external control plug to the external control socket, otherwise the controller will not be controlled by the front panel.

- Special startup method: Some users need to control both on and off states with just one key or terminal. The method is as follows: Short circuit pins 1 and 2 of the external control plug, and connect pins 3 and 4 to an external control switch or relay contact (passive required). When normally open, it stops; when normally closed, it starts. At this point, the front panel control fails.

Note: Do not use input voltage of 220VAC or 110VAC as the start or stop input signal for the controller. If that happens, it will cause damage to the controller.

4.4.4 RS485 Communication Protocol

RS485 communication control terminals A+ and B - are equipped with the internationally recognized Modbus communication protocol, the detailed pins are shown in Picture 29:



Picture 29: RS485 communication interface

This controller can be controlled by a microcomputer to start, stop, observe voltage, current, frequency, and monitor faults. Suitable for devices that require microcomputer operation and control along with other peripherals. More suitable for group starting and stopping on production lines, and can also be started and stopped separately.

Note: When using a microcomputer to control operation through a serial communication port, if the microcomputer has an RS232 interface, an RS485/RS232 interface protocol converter is required. If the microcomputer has an RS485 interface, it can be directly connected.

Using different types of parameters as addresses

(The addresses and parameter descriptions represented in this section are all in hexadecimal, for example, 1000 represents 4096 in decimal)

1. Operating status parameters

Parameter Address	Parameter description (Read-only)
1000	Output frequency
1001	Output voltage
1002	Output current
1003	Molecular pump controller status: 00: Standby mode 01: Running 02: Operation error (err) 03: Short circuit protection (OC) 04: DC Overvoltage (OE) 05: Reserved 06: RLU 07: Overcurrent (OL2) 08: Molecular pump overload (SL) 09: Molecular pump overheating (ESP) 0A: Undervoltage (LU) 0B: Molecular pump controller overheating (OH)

2. Control command

Parameter Address	Parameter description (Write only)
2000	Command content meaning: 0003: Deceleration and shutdown 0004: Free shutdown 0008: Running (without direction) 0009: Fault reset
2001	Lock parameters 0001: Release system lock (remote control lock) 0002: Lock remote control (any remote control command is invalid until unlocked)

3. Abnormal response of read and write parameters

Command Description	Function code area	Data area
Subordinate machine Parameter response	The highest bit in the function code area becomes 1	Meaning of Command Content 0001: Illegal Function Code 0002: Illegal data address 0003: Illegal data 0004: Subordinate equipment malfunction

4.4.5 Schematic diagram of rear panel components for controller 220VAC input



Picture 30: Schematic diagram of the rear panel of the controller

4.4.6 Usage Instructions

- 1) Connect the 8-pin socket on the molecular pump to the 13 pin drive output socket on the back panel of the controller using a cable.
- 2) If the controller does not use the external control function, be sure to connect the external control plug in the spare parts bag to the external control socket on the back panel of the controller before powering on; If using the external control function, please follow the instructions for wiring and connect the external control plug to the external control socket.
- 3) After connecting the power cord, turn on the power switch on the back panel of the controller. At this time, the LCD screen of the controller displays standby mode, and the maximum operating frequency of the controller is "400.0" Hz, accompanied by flashing.
- 4) Press the "Run" button to start the molecular pump, and the LCD screen displays "Speed Tracking..." The content of the speed tracking interface is as follows:

Speed tracking in progress...

- 5) After a period of time, the LCD screen switches to the main operation interface, displaying the current molecular pump speed, frequency, voltage value, and current value in real time until acceleration is completed. The content of the operating interface is as follows:

Current speed:	24000
Current frequency:	400.0
Current Voltage:	54
Present current:	5.1

- 6) When it is necessary to shut down, press the "stop/resume" button. At this time, the LCD screen will display the real-time speed, frequency, voltage value, and current value during the process of speed decrease until it returns to standby mode, indicating that the shutdown is complete. At this time, the power switch can be turned off. The deceleration time of each type of controller is shown in Technical Performance Table 1.6.1.
- 7) When the controller detects a fault during use, it has sound and light alarms and character displays. The fault code can be found in the fault code table. To clear the alarm, press the "stop/resume" button on the control keyboard to reset or turn off the main power switch.
- 8) When the controller encounters a sudden input power interruption fault, press the "Run" button after the power is restored, and the LCD screen will display "Speed Tracking in Progress". After a period of time, the LCD screen will display the current status of the tracked molecular pump until it reaches the highest operating frequency.

4.4.7 Fault codes

Fault code	Fault Type
ERR	Button operation error
OC	Controller short circuit protection
OL2	Molecular pump overcurrent protection
SL	Molecular pump overload protection
OE	Controller overvoltage protection
LU	Controller undervoltage protection
ESP	Molecular pump overheat protection
OH	Controller overheat protection

4.4.8 Common fault handling

Fault Phenomenon	Reason for Occurrence	Processing Method
Connect the power and turn on the main power switch on the rear panel, but the fan does not turn	The fuse inside the power input socket is broken	Replace the fuse with a new one
	Unreliable contact of power input line	Replace the power input cable
Turn on the main power switch, the fan rotates, but the LCD screen does not display	The cable connecting the controller motherboard to the LCD screen has poor contact or has come loose	Please contact the manufacturer
	LCD screen itself malfunction	Please contact the manufacturer
The LCD screen displays normally, but the motor does not rotate	The contact of the output connector of the rear panel drive is unreliable	Re plug and unplug the connector
	The cable between the drive output connector and the molecular pump is damaged	Replace the cable
	Motor stalling	Reduce load
	U、V、W Abnormal output	Turn off the power and then turn it back on, contact the manufacturer
Power trip	Input side short circuit	Check the input connection
	The capacity of the air switch is too small	Increase the capacity of the air switch
	Overload	Reduce load
Unstable motor speed	The circulating water of the molecular pump is not connected, or the water	Check the circulating water

	pressure and flow are abnormal	
	System leakage	Leak hunting
Controller overcurrent protection (OC)	Output side short circuit	Check if the motor cable is damaged
	Restart the rotating motor	Wait for the motor to come to a complete stop before starting it again
Controller overvoltage protection (OE)	The input power voltage is too high	Check if the input power voltage is normal
Controller undervoltage protection (LU)	Low input power supply voltage	Check if the power supply is functioning properly
	Instantaneous power failure of input power supply	Normal indication
Molecular pump overcurrent protection (OL2)	System leakage, extremely low vacuum level	Check system equipment
Molecular pump overheat protection (ESP)	Long term air leakage and low vacuum degree in the system	Check system equipment
	Circulating water not turned on or insufficient water volume and pressure	Open or check the circulating water
Controller stall regulation protection (SL)	Molecular pump accelerates for medium to long term with gas leakage and excessive current	Check system equipment
Communication Error	The cable connecting the controller motherboard to the LCD screen has	Please contact the manufacturer

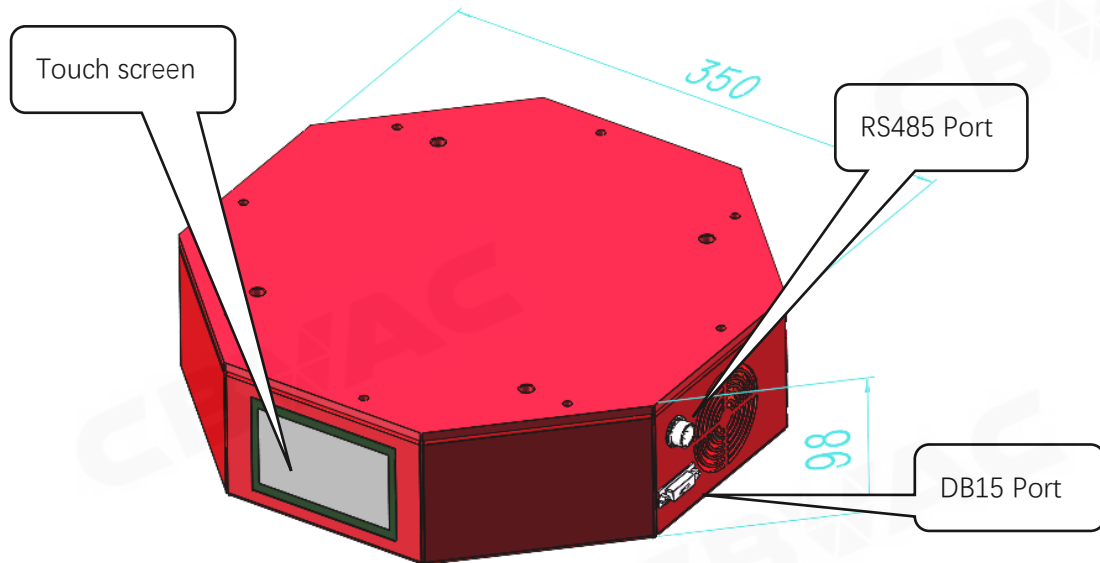
	poor contact or has come loose	
Controller protection (OH) overheat	The ambient temperature is too high	Reduce ambient temperature
	Fan damaged	Please contact the manufacturer
	The controller is too dirty inside	Clean the air inlet and outlet as well as the heat sink
	Installation location is unfavorable for ventilation	Install according to the requirements in the manual to improve ventilation
	Abnormal power module	Request manufacturer service

4.5 JFB-VI-B Controller

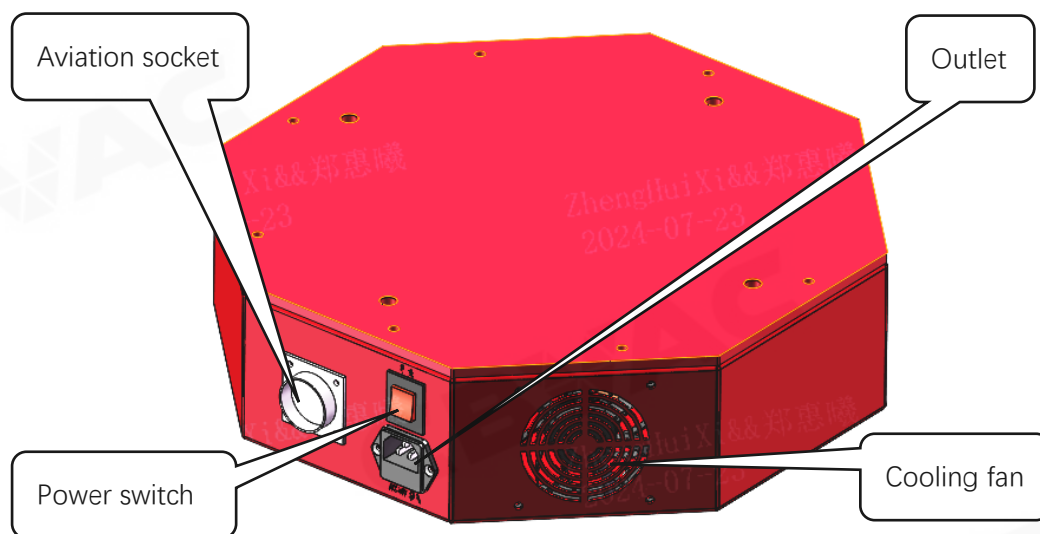
4.5.1 Controller appearance and dimensions

The appearance structure of the integrated controller is a sheet metal shell, made of Q235A material, and the surface is painted. The upper cover is made of aluminum alloy material, and the surface is also painted.

The appearance and dimensions of the JFB-VI-B controller are shown in Pictures 31 and 32.



Picture 31: JFB-VI-B Controller appearance dimension diagram

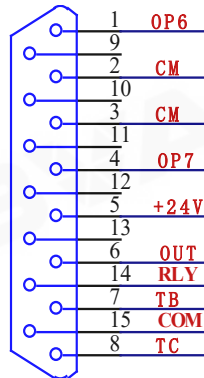


Picture 32: JFB-VI-B Controller appearance diagram

4.5.2 Performance indicators

Type	JFB-VI-B
Input voltage	220VAC±10%
Input power frequency	50/60Hz (±5%)
Maximum output power	2200W
Output Frequency	0-600Hz
Output voltage	≤70VAC
Normal operating current	≤6A
Maximum starting current	≤13A
Start acceleration time	~20min
Shutdown deceleration time	~25min
Weight	11kg
Start/Stop Control	Touch screen, external control IO control, and serial port 485 control
Display function	The touch screen displays the current output frequency, output current, current output voltage, fault type, as well as function code parameters, operating parameters, and molecular pump model
Protection function	Controller input undervoltage, overvoltage, overcurrent, overheating, molecular pump overload, limited current output, overcurrent and overheating protection, etc.
Environmental condition	Equipment location: No strong corrosive gases or dust; Environmental temperature: 5 °C~40 °C; Environmental humidity: below 90% (no condensation of water droplets); Vibration intensity: below 0.5g (acceleration)

4.5.3 Definition of I/O External Control Interface (DB15)



Functions of external control output pins:

- Startup mode: The 1st and 2nd pins (OP6, CM) are usually in an open circuit state with an external relay (or switch). To start the molecular pump, connect an instantaneous passive short-circuit signal for about 0.5S to 1S. That is to say, short circuit pins 1 and 2 to start the molecular pump.
- Stop mode: pins 3 and 4 (CM, OP7) are usually in a short-circuit state with an external relay (or switch). To stop the molecular pump, connect an instantaneous passive open circuit signal for about 0.5S to 1S. That is to say, disconnect pins 3 and 4 to stop the molecular pump.

Note: The normally closed and normally open points of the relay or switch must be passive, otherwise it will damage the controller circuit.

- Normal output (active signal): During the acceleration process of the molecular pump, there is no voltage output from pins 5 and 6 (+24V, OUT). After the molecular pump operates normally, pins 5 and 6 output DC24V electrical signals with a maximum current of 0.1A. Normal output (passive signal): pins 14 and 15 (RLY, COM) can provide a normal output signal without voltage contact. Can control buzzer, light or door circuit. The maximum allowable voltage of the external voltage source is 24VDC, and the maximum allowable current is 0.1A. In other words, during the acceleration process of the molecular pump, pins 14 and 15 are in the disconnected state. After the molecular pump operates normally, pins 14 and 15 are in the connected state.
- Fault output: pins 7 and 8 (TB, TC) can provide a fault output signal (no voltage contact output signal). Can control buzzer, light or door circuit. The maximum allowable voltage of the external voltage source is 24VDC, and the maximum allowable current is 0.1A. In other words, when the molecular pump is not faulty, pins 7 and 8 are in the on state, and when there is a fault, they are in the off state.

Note: When using the external control start and stop modes mentioned above, an additional external control start and stop function should be added without affecting the

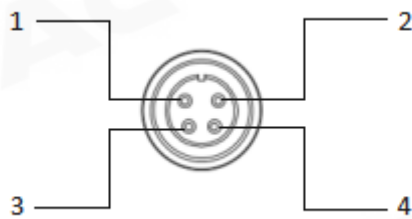
front panel start and stop button functions. When not in use, be sure to short-circuit pins 3 and 4 of the external control plug and connect the external control plug to the external control socket, otherwise the controller will not be controlled by the front panel.

- **Special startup method:** Some users need to control both on and off states with just one key or terminal. The method is as follows: Short circuit pins 1 and 2 of the external control plug, and connect pins 3 and 4 to an external control switch or relay contact (passive required). When normally open, it stops; when normally closed, it starts. At this point, the front panel control fails.

Note: Do not use input voltage of 220VAC or 110VAC as the start or stop input signal for the controller. If that happens, it will cause damage to the controller.

4.5.4 RS485 serial communication (Modbus Rtu protocol)

RS485 communication control terminals 1A+, 2B -, equipped with internationally recognized Modbus communication protocol, detailed pins are shown in Picture 33:



Picture 33: RS485 Communication interface

The interface definition is as follows:

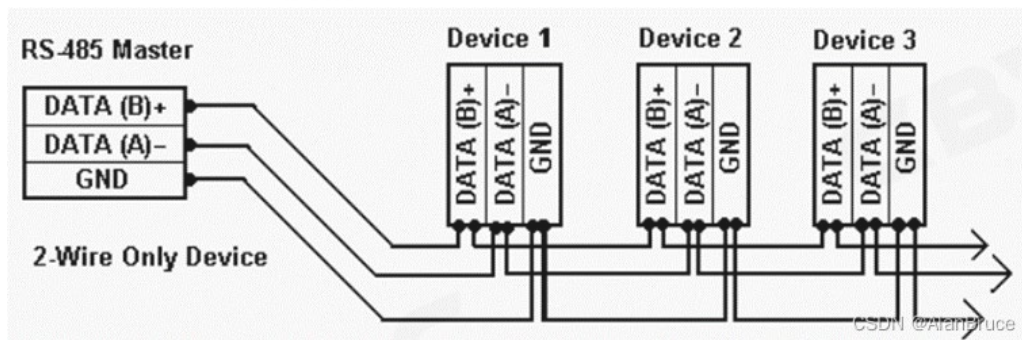
Pin number	Definition
1	RS485 A+
2	RS485 B-
3、4	/

This controller can be controlled by a microcomputer to start, stop, observe voltage, current, frequency, and monitor faults. Suitable for devices that require microcomputer operation and control along with other peripherals. More suitable for group starting and stopping on production lines, and can also be started and stopped separately.

RS485 uses Modbus Rtu protocol to drive and control this product. Modbus is a serial and asynchronous communication protocol that is a universal language used in PLCs or other controllers. This protocol defines a message structure that a controller can recognize and use,

regardless of the network over which they are transmitted.

Note: When using a microcomputer to control operation through a serial communication port, if the microcomputer has an RS232 interface, an RS485 to 232 interface converter is required. If the microcomputer is an RS485 interface, it can be directly connected. To reduce the impact of interference on communication, it is recommended to use the connection method shown in Picture 34.



Picture 34: Connection method between upper computer and controller

Using different types of parameters as addresses

The addresses and parameter descriptions represented in this section are in hexadecimal, for example, 1000 represents 4096 in decimal.

1. Operating status parameters (03 function code)

Parameter Address	Parameter Description (Read-only)
1000	Output Frequency
1001	Output voltage
1002	Output current
1003	Molecular pump controller status: 00: Stop 01: Deceleration 02: Standby mode 03: Running

2. Control command (06 function code)

Parameter Address	Parameter Description (Write only)
2000	Command content meaning: 0003: Deceleration and shutdown 0004: Free shutdown 0008: Running (without direction) 0009: Fault reset
2001	Lock parameters 0001: Release system lock (remote control lock) 0002: Lock remote control (any remote control command is invalid until unlocked)

3. Abnormal response of read and write parameters

Command Description	Function Code Area	Data Area
Subordinate machine parameter response	The highest bit in the function code area becomes 1	Meaning of Command Content 0001: Illegal Function Code 0002: Illegal data address 0003: Illegal data 0004: Subordinate machine malfunction

Attachment description: During the communication process, it is stated that:

- The parameter value of frequency is equal to the actual value multiplied by 10
- The parameter value of time is equal to the actual value multiplied by 10
- The parameter value of current is equal to the actual value multiplied by 10
- Voltage parameter value=actual value × 1
- Power parameter value=actual value × 100
- Version number parameter value=actual value × 100

Explanation: The parameter value is the actual value sent by the data packet. The actual value is the actual value of the parameter in the molecular pump controller. After receiving the parameter values, the upper computer divides them by the corresponding proportional

coefficients to obtain the actual values of the corresponding parameters of the molecular pump controller.

Note: When sending commands to the molecular pump controller, decimal points are not considered in the data packet. All data values cannot exceed 65535, otherwise data overflow occurs.

4.5.5 Schematic diagram of controller display screen



Picture 35: Schematic diagram of controller display screen

4.5.6 Usage Instructions

1. Connect the 8-pin socket on the molecular pump to the 13 pin drive output socket on the back panel of the controller using a cable.
2. If the controller uses the external control function, be sure to connect the external control plug in the spare parts bag to the external control socket on the back panel of the controller before powering on.
3. After connecting the power cord, turn on the power switch on the back panel of the controller. At this time, the touch screen of the controller displays the initial interface shown in Picture 36. Press the "Enter" button area on the screen to enter the standby interface shown in Picture 37.

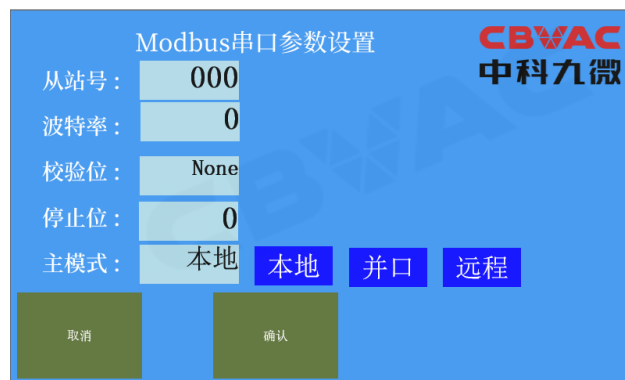


Picture 36: Initial



Picture 37: Standby

4. There are three control modes for this machine: local control mode, parallel port control (external control), and remote control (RS485). By pressing the button area in the lower left corner of the standby interface, the communication parameters of the control mode and remote mode can be changed. The setting interface is shown in Picture 38. Touch the relevant area in sequence to pop up the relevant options. Select the setting value and press the confirm button to return to the standby interface.



Picture 38: Modbus serial port parameter settings

5. If the local control mode is selected, touch the button area for setting the speed to enter the speed setting interface shown in Picture 39. Enter the operating speed value (unit: rpm) on the keypad, press Enter, and the new set speed will be displayed in the set speed position on the standby interface.



Picture 39: Speed set

6. Press the "Start" button on the standby interface to start the molecular pump, and the touch screen will display "Search speed...".



Picture 40: Start search speed

7. After a period of time, the touch screen switches to the main operation interface, displaying the current speed, frequency, voltage value, and current value of the molecular pump in real time until acceleration is completed.

The content of the operating interface is as follows:



Picture 41: Accelerate

8. When it is necessary to shut down, press the "shutdown" button. At this time, the touch screen will display the real-time speed, frequency, voltage value, and current value during the process of speed decrease until it returns to standby mode, indicating that the shutdown is complete. At this time, the power switch can be turned off.



Picture 42: Decelerate

9. When the controller detects a fault during use, the screen will display an alarm and error characters. The fault code can be found in the fault code table. To clear the alarm, press the "Cancel" button on the screen to reset or turn off the main power switch.

10. When the controller encounters a sudden input power interruption fault and the power is restored, it can start according to the same startup process as described above. The screen still displays "Search speed..." first, and after a period of time, the screen displays the current speed of the molecular pump tracked, and then "Accelerate" until it reaches the maximum working speed.

11. The setting button in the bottom right corner of the touch screen is used to set the action of the molecular pump overheat relay alarm. The relay alarm temperature is 55 degrees Celsius. After entering the password "12345678", there are three options:

- 1) Error shutdown "means that when the molecular pump reaches the alarm temperature of 55 degrees Celsius, the screen displays overheating and automatically brakes to shut down.
- 2) Error sliding "means that when the molecular pump reaches the alarm temperature of 55 degrees Celsius, the screen displays overheating and automatically slides and stops.
- 3) 'No alarm' means that when the molecular pump reaches the alarm temperature of 55 degrees Celsius, it will not alarm and there will be no protective action.

After selecting the action settings option, press the "Settings Return" button to save the settings and return to the main interface



Picture 43: Enter password to modify settings



Picture 44: Controller parameter settings

4.5.7 Fault and warning codes

Fault code:

Fault code	Fault name
0	No abnormal records
1	Acceleration overcurrent (ocA)

2	Overcurrent during deceleration (ocd)
3	Overcurrent during constant speed operation (ocn)
4	Grounding protection circuit action (GFF)
5	IGBT Short circuit between the upper and lower bridges (occ)
6	Stop the overcurrent in the middle (ocS)
7	Acceleration overvoltage (ovA)
8	Overvoltage during deceleration (ovd)
9	Overvoltage during constant speed operation (ovn)
10	Stop overvoltage (ovS)
11	Low voltage occurs during acceleration (LvA)
12	Low voltage occurs during deceleration (Lvd)
13	Low voltage occurs during constant speed (Lvn)
14	Low voltage occurs during stoppage (LvS)
15	Input under phase protection (OrP)
16	IGBT High Temperature (oH1)
17	Internal key component temperature is too high (oH2)
18	IGBT Abnormal temperature detection (tH1o)
19	Abnormal temperature detection of capacitor (tH2o)
21	Inverter overload (oL)
22	Electronic Thermal Power Station 1 Protection (EoL1)
23	Electronic Thermal Power Station 2 Protection (EoL2)
24	Motor overheating PTC / PT100 (oH3)
26	Overtorque 1 (ot1)
27	Overtorque 2 (ot2)
28	Low Current (uC)
29	Limit errors (LiT)

31	Memory read exception (cF2)
33	U-phase current detection error (cd1)
34	V-phase current detection error (cd2)
35	W-phase current detection error (cd3)
36	cc Hardware circuit abnormality (Hd0)
37	oc Hardware circuit abnormality (Hd1)
40	Motor automatic measurement error (AUE)
41	PID disconnection ACI (AFE)
42	PG Feedback setting error (PGF1)
43	PG Feedback disconnection (PGF2)
44	PG Feedback stall (PGF3)
45	PG Abnormal slip (PGF4)
48	ACI disconnection (ACE)
49	External terminal abnormality (EF)
50	External terminal emergency stop (EF1)
51	External interrupt (bb)
52	Password entered incorrectly three times (Pcod)
54	Illegal communication command (CE1)
55	Illegal mailing address (CE2)
56	Communication data value error (CE3)
57	Write communication to read-only address (CE4)
58	Modbus Transmission timeout (CE10)
61	Motor Y-D switching error (ydc)
62	Slow down energy regeneration action (dEb)
63	Over slip (oSL)
65	PG card hardware error (PGF5)

72	S1 Internal circuit diagnosis abnormalities (STL1)
76	STO (STO)
77	S2 Internal circuit diagnosis abnormalities (STL2)
78	Internal circuit diagnosis abnormalities (STL3)
79	Detecting U-phase short circuit before operation(Aoc)
80	Detected V-phase short circuit before operation (boc)
81	W-phase short circuit detected before operation (coc)
82	Output under phase U phase (oPL1)
83	Output under phase V phase (oPL2)
84	Output under phase W phase (oPL3)
87	Low frequency overload protection (oL3)
89	Rotor position detection error (roPd)
101	CANopen disconnection (CGdE)
128	Overtorque 3 (ot3)
102	CANopen disconnection (CHbE)
104	CANopen Hardware disconnection (CbFE)
105	CANopen Index error (CIIdE)
106	CANopen Station number error (CAAdE)
107	CANopen memory error (CFrE)
121	Internal communication specific error code (CP20)
123	Internal communication specific error code (CP22)
124	Internal communication specific error code (CP30)
126	Internal communication specific error code (CP32)
127	Firmware version exception error (CP33)
129	Overtorque 4 (ot4)
134	Internal communication specific error code (EoL3)

135	Internal communication specific error code (EoL4)
140	oc Hardware circuit abnormality (Hd6)
141	Short circuit to ground detected before operation (b4GFF)
142	Motor automatic measurement error (AuE1)
143	Motor automatic measurement error (AuE2)
144	Motor automatic measurement error (AuE3)
149	Motor automatic measurement error (AuE5)

Warning code:

Warning code	Warning Name
0	No abnormal records
1	Communication Error (CE1)
2	Communication data location error (CE2)
3	Communication content value error (CE3)
4	The frequency converter cannot handle it (CE4)
5	Communication transmission timeout (CE10)
7	Parameter copying error (SE1)
8	Parameter copying error (SE2)
9	IGBT Overheating warning (oH1)
11	PID Feedback signal error (PID)
12	ACI Mode simulation signal loss (AnL)
13	Low current warning (uC)
17	Overspeed warning (oSPd)
18	Excessive speed deviation (dAvE)
19	Input under phase (PHL)
20	Overtorque (ot1)
21	Overtorque (ot2)

22	Motor overheating (oH3) PTC/KTY-84 / PT100
24	Over slip (oSL)
25	Automatic parameter measurement (tUn)
28	Output under phase warning (OPHL)
30	Copy error due to different models (SE3)
31	Overtorque (ot3)
32	Overtorque (ot4)
36	CANopen Software disconnection (CGdn)
37	CANopen Software disconnection (CHbn)
39	CANopen Hardware disconnection (CbFn)
40	CANopen Index error (CIdn)
41	CANopen Station number error (CAdn)
42	CANopen memory error (CFrn)
43	CANopen SDO Transmission timeout (CSdn)
44	CANopen SDO Receive overflow (CSbn)
45	CANopen Startup message error warning (Cbtn)
46	CANopen format error (CPtn)
50	PLC Download error (PLod)
51	PLC Download and storage error (PLSv)
52	Data error during operation (PLdA)
53	Download function code error (PLFn)
54	PLC Buffer overflow (PLor)
55	Function code error during operation (PLFF)
56	Checksum error (PLSn)
57	No end instruction (PLEd)
58	PLC MCR Command error (PLCr)

59	PLC Download error (PLdF)
60	PLC Scan time timeout (PLSF)
70	Communication card node error (ECid)
71	Communication card voltage too low (ECLv)
72	Communication card testing mode (ECtt)
73	Communication card hardware disconnection (ECbF)
74	Communication card without power supply (ECnP)
75	Factory customization error (ECFF)
76	Serious internal error (ECiF)
78	Parameterized data error (ECPP)
79	Configuration data error (ECPi)
80	Ethernet Online error (ECEf)
81	Communication timeout with frequency converter (ECto)
82	Checksum error (ECCS)
83	Return to factory settings (ECrF)
84	Exceeding the maximum number of communications (Eco0)
85	Exceeding the maximum number of communications (ECo1)
86	IP error (ECiP)
87	Mail error (EC3F)
88	Communication card busy (ECbY)
89	Communication card disconnected (ECCb)
90	PLC Copy: Password error (CPLP)
91	PLC Copy: Read mode (CPL0)
92	PLC Copy: Write Mode (CPL1)
93	PLC Copy: Version error (CPLv)
94	PLC Copy: Capacity error (CPLS)

95	PLC Copy: PLC needs to be turned off (CPLF)
96	PLC Copy: timeout error (CPLt)

4.5.8 Common fault handling

Fault phenomenon	Reason for occurrence	Processing method
Connect the power and turn on the main power switch on the rear panel, but the fan does not turn	The fuse inside the power input socket is broken	Replace the fuse with a new one
	Unreliable contact of power input line	Replace the power input cable
Turn on the main power switch, the fan rotates, but the LCD screen does not display	The cable connecting the controller motherboard to the LCD screen has poor contact or has come loose	Contact the manufacturer
	LCD screen itself malfunction	Contact the manufacturer
The LCD screen displays normally, but the motor does not rotate	The contact of the output connector of the rear panel drive is unreliable	Re plug and unplug the connector
	The cable between the drive output connector and the molecular pump is damaged	Replace the cable
	Motor stalling	Reduce load
	U、V、W Abnormal output	Turn off the power and then turn it back on, contact the manufacturer
Power trip	Input side short circuit	Check the input connection

	The capacity of the air switch is too small	Increase the capacity of the air switch
	Overload	Reduce load
Unstable motor speed	The circulating water of the molecular pump is not connected, or the water pressure and flow are abnormal	Check the circulating water
	System leakage	Leakage detecting
Controller overcurrent protection (OC)	Output side short circuit	Is the motor cable damaged
	Restart the rotating motor	Wait for the motor to come to a complete stop before starting it again
Controller overvoltage protection (OE)	The input power voltage is too high	Check if the input power voltage is normal
Controller undervoltage protection (LU)	Low input power supply voltage	Check if the power supply is functioning properly
	Instantaneous power failure of input power supply	Normal indication
Molecular pump overcurrent protection (OL2)	System leakage, extremely low vacuum level	Check system equipment
Molecular pump overheat protection (ESP)	Long term air leakage and low vacuum degree in the system	Check system equipment
	Circulating water not turned on or	Open or check the

	insufficient water volume and pressure	circulating water
Controller stall regulation protection (SL)	Molecular pump accelerates for medium to long term with gas leakage and excessive current	Check system equipment
Communication Error	The cable connecting the controller motherboard to the LCD screen has poor contact or has come loose	Contact the manufacturer
Controller overheat protection (OH)	The ambient temperature is too high	Reduce ambient temperature
	Fan damaged	Contact the manufacturer
	The controller is too dirty inside	Clean the air inlet and outlet as well as the heat sink
	Installation location is unfavorable for ventilation	Install according to the requirements in the manual to improve ventilation
	Abnormal power module	Contact the manufacturer

5. Interpretation of Usage

Precautions before use:



- **Danger: Do not remove flammable mixtures!**



- **Warning: This series of pumps cannot be used to remove gases containing liquids or solid particles!**

5.1 Starting Conditions for Molecular Pumps

The starting conditions of a molecular pump depend on the pumping speed K of the preceding stage pump and the volume V of the pumped chamber. The molecular pump can only be started when the pumping speed meets certain conditions.

$K/V \text{ (h}^{-1}\text{)}$	Molecular pump startup mode
> 40	Molecular pump and front-end pump can be started simultaneously
≤ 40	First, start the front-end pump

5.2 Start the Cooling System

- 1) Connect cooling water through the water nozzle on the pump body;
- 2) The cooling water must meet the requirements of the cooling method parameters in the technical specifications of pump 1.6.1.

5.3 Introduce Protective Gas

Condition	Gas flow (sccm)
Mild corrosion condition	20 ~ 50
Severe corrosion situation	In addition to blowing protective gas, other treatments are also required

After adding the purge gas, the pumping speed of the pre stage pump of the molecular pump should be appropriately increased. If you need assistance with specific situations, please contact our technical engineer!

5.4 Start**Caution**

- 1) Confirm that the front-end pump is working properly!
- 2) When using the JFB series molecular pump for the first time or after long-term storage (≥ 6 months), it is necessary to perform a soft start operation on the molecular pump to evenly distribute the bearing grease!

5.5 Accelerate**Caution**

- 1) The actual acceleration time of the pump is less than or approximately equal to the start time in the parameter list of the 1.6.1 molecular pump.
- 2) If abnormal acceleration is found, please stop the pump in a timely manner. After having experienced workers investigate the possible cause of the abnormality, contact our after-sales support engineer!

5.6 Working**Warnings**

- 1) The turbine rotor of the JFB series pump is machined as a single unit and belongs to high-speed rotating components with extremely high machining accuracy. The clearance between the turbine rotor and the pump casing is very small, so it is necessary to avoid impact and vibration from the outside of the pump body during operation!
- 2) Avoid the risk of hard objects falling into the pump inside the vacuum chamber!

5.7 Shutdown**Warnings**

- 1) During the deceleration process of the molecular pump, try not to cut off the power supply as much as possible! Sudden power outages can have adverse effects on the lifespan of molecular pumps!
- 2) After the molecular pump stops running, the cooling water should be immediately turned off to prevent condensation from forming inside the pump body. At the same time, the

residual water in the cooling water channel should be blown clean with high-pressure gas!

- 3) Press the "start/stop" button on the controller or click the "stop" button on the human-computer interaction software interface on the computer to gradually stop the rotation of the molecular pump. After the molecular pump is completely stopped, turn off the front stage pump; Turn off the cooling water (water-cooled pump).

5.8 Inflate after Shutdown

The molecular pump can be completely stopped before inflation, and the pressure inside the pump should gradually reach atmospheric pressure.

When the vacuum system stops working, the molecular pump should generally be inflated to atmospheric state to prevent contamination of the molecular pump and vacuum chamber by the preceding stage.

Selection of other inflation methods:

- ✧ After the rotational speed of the molecular pump is below 50Hz, it can also be directly filled with air, and the mechanical pump should be stopped before filling;
- ✧ If the rotational speed of the molecular pump is below 50% of the maximum speed, controlled inflation can be carried out, and the pressure rise rate inside the molecular pump or vacuum chamber should be strictly controlled;
- ✧ After shutdown, the protective gas interface can be delayed to gradually raise the molecular pump to atmospheric state.
- ✧ If there is an inflation valve between the molecular pump and the chamber, slowly open it and slow down the inflation speed to prevent solid particles in the vacuum chamber from entering the molecular pump.



Warnings



- 1) When inflating, try to inflate slowly to avoid the entry of oil vapor and solid particles from the front stage into the interior of the molecular pump!
- 2) The internal pressure of the molecular pump cannot exceed one atmosphere!

6. Usage in Special Environments

6.1 Strong Magnetic Field Environment

When a molecular pump operates in a strong magnetic field, the rotating rotor generates eddy currents and heats up, weakening the strength of the material. Therefore, molecular pumps have certain requirements for radial and axial magnetic field strength.

Magnetic field intensity (mT)	Corresponding measures
Axial ≤ 5	Can be used normally
Radial ≤ 3	Can be used normally
Other cases	Use magnetic shielding materials or consult our technical engineers.

6.2 Strong Radioactive Environment

Most materials will change their properties in highly radioactive environments, especially organic materials (such as lubricants, seals) and semiconductor components. To prevent accidental damage to the pump, the radioactive intensity in the operating environment of the molecular pump should be less than 10^5 rad.

6.3 Special working conditions with large amounts of dust and particulate matter deposition

In order to protect the normal and stable operation of the pump, when there is a large amount of dust and particulate matter in actual working conditions:

- 1) A purge valve needs to be connected and a protective gas (recommended nitrogen, argon or similar inert gas, pressure 1-1.5 atm) should be introduced;
- 2) Add other filtering protection structures;
- 3) Replace the molecular pump protective net with a detailed protective net (contact our sales engineer for specific structure);
- 4) Heating the pump body or casing to reduce the formation of sediment;
- 5) Invert the molecular pump at the upper end of the working chamber.

In addition to the above protective measures, the maintenance cycle of the molecular pump should be shortened, and it is generally recommended to conduct a return to factory maintenance every 6-12 months depending on the working conditions.

During on-site application, for individual dust conditions, customers can regularly use clean

gas to clean the molecular pump and remove viscous particles remaining on the blade teeth and layer discs. **Be careful:**

- A. Do not deform the blade teeth due to excessive gas pressure;
- B. Suggest using the air inlet as the clean gas inlet;
- C. During gas cleaning, it is recommended to continuously introduce protective gas into the purge valve to prevent impurities and particles from being carried into the bearing.

6.4 Usage in Vibrating Environment

Molecular pumps are high-speed rotating precision equipment and should be avoided from use in vibration environments. If customers use them in environments with vibration, it is recommended to choose the JFB-160/450D anti vibration molecular pump. If other models of molecular pumps cannot avoid vibration environments, please consult our technical engineers.

6.5 Working Conditions that Require Water Cooling

When the molecular pump operates under the following conditions, water cooling must be used for heat dissipation:

- 1) The ambient temperature is above 35 °C;
- 2) Frequent start stop situations;
- 3) When the air load is large, including the front stage air load and the intake air load;
- 4) When purging the air path, water cooling should generally be selected;
- 5) When the molecular pump is baked and heated;
- 6) Other situations (please consult our sales engineer).

7. Maintenance

7.1 Small Maintenance

Type	Small Maintenance	
	Content	Period
JFB-63/81M(J)	Start operation	Not used for 3 months
	Vibration and noise testing	1 Year or 4000h
	Check the oil wool	1 Year or 4000h
	Clean the static film	Depending on working conditions

Type	Small Maintenance	
	Content	Period
JFB-63/81、JFB-100/251、JFB-100/301、 JFB-160/401、JFB-160/450D、JFB- 160/700、JFB-160/701、JFB-200/1400、JFB- 200/1401、JFB-250/2200、JFB-250/2201	Soft start operation	Not used for 6 months
	Vibration and noise testing	1 Year or 4000h
	Clean the static film	Depending on working conditions

7.2 Large Scale Maintenance

Type	Large Scale Maintenance	
	Content	Period
JFB-63/81M(J)	Clean all	Depending on the cleanliness condition
	Replace the oil wool	3 Years or 20000h
	Replace the turbine rotor	After 80000 hours of operation

Type	Large Scale Maintenance	
	Content	Period
JFB-63/81、JFB-100/251、JFB-100/301、JFB-160/401、JFB-160/450D、JFB-160/700、JFB-160/701、JFB-200/1400、JFB-200/1401、JFB-250/2200、JFB-250/2201	Clean all	Depending on the cleanliness condition
	Replace bearings	3 Years or 20000h
	Clean the waterway	Depending on the corrosion situation
	Replace the turbine rotor	After 80000 hours of operation

**Caution**

- 1) When there is no change in the leakage and desorption rate of the system, and even long-term baking cannot restore its vacuum performance, or when the front-end pump returns oil severely, the JFB-400/4201 oil lubricated molecular pump should be cleaned.
- 2) If JFB series pumps need maintenance and cleaning, they must be disassembled and assembled by professional technicians. If disassembled and assembled without training, the consequences will be borne by oneself!

7.3 Maintenance Principle

7.3.1 Free Warranty Policy

The molecular pump products sold by our company have a free warranty period of 12 months (calculated from the date of shipment). During the free warranty period, our company provides customers with free repair services.

The free maintenance policy only applies to repair services caused by quality issues of molecular pumps and their controllers under normal use conditions. **Malfunctions caused by customers dismantling the product without authorization, not following the product manual, or other accidents are not covered by the free maintenance policy.**

If there are any other situations beyond the scope of this manual, our company representative needs to engage in friendly negotiations with the client to find a solution.

7.3.2 Maintenance Services

Our company solemnly promises that after customers make effective maintenance requests, our customer service personnel will provide clear and effective maintenance solutions within 24 hours, and provide notarized and transparent maintenance services.



Caution



- 1) Customers have the obligation to cooperate with our customer service personnel, provide detailed descriptions of the fault phenomenon, and cooperate with customer service personnel to find the cause and solve the problem.
- 2) Outside the free repair period, if our customer service personnel need to go to the customer site, the repair cost will include normal travel expenses.
- 3) Please keep the purchase contract, product qualification certificate and other materials properly when customers purchase our company's products, so as to provide you with efficient services in the future.

8. Fault Analysis

No.	Fault Description	Possible Causes	Method
1	Molecular pump does not start	1. The pump has not received a signal 2. Controller malfunction 3. Pump damage 4. Other reasons	1. Check if the power cord is loose or replace the power cord; 2. Return to factory for repair; 3. Return to factory for repair;
2	Start timeout or slow down or stop after starting	1. There is a leak in the vacuum system 2. Abnormal pre stage pressure 3. Bearing damage 4. Poor lubrication 5. Controller malfunction	1. Leak detection and handling; 2. Check if the front-end pump is working properly and if there is any air leakage in the pipeline; 3. Check if the turbine rotation is normal, and if the bearing is damaged, return it to the factory as a whole; 4. Return to the factory to replace the bearings.
3	Excessive vibration or noise during molecular pump operation	1. Equipment resonance 2. Pump dynamic balance failure 3. Bearing damage	1. Change the assembly position or connection method of the pump, fix moving parts or add vibration reduction devices; 2. Conduct a separate test run on the pump, but there is still significant vibration and noise. It should be returned to the factory for maintenance; 3. Complete machine return to factory for maintenance
4	Low vacuum	1. High pre stage pressure 2. System micro leakage 3. The pump is contaminated 4. Abnormal pump speed 5. Measurement gauge	1. Check if the front-end pump is working properly and if there is any air leakage in the pipeline; 2. Instrument leak detection and processing; 3. Return to the factory for repair, cleaning, and maintenance; 4. The pump has not reached its rated speed.

		malfunction 6. System pollution 7. Unreasonable system design	Check the pump and control system; 5. If the vacuum gauge has a large gas output or other malfunctions, perform baking degassing or maintenance; 6. Shutdown, clean or heat bake the system; 7. Calculate vacuum configuration or pipeline design
5	Pre stage backstreaming	1. No partition valve installed 2. Other operational malfunctions	1. Install a partition vent valve between the molecular pump and the front-end pump. 2. After the molecular pump is shut down, the operation of the mechanical pump should be immediately stopped and cut off or deflated.
6	Controller overcurrent protection	1. Output side short circuit 2. Implemented restart for the rotating motor	1. Check if the motor cable is damaged; 2. Wait for the motor to come to a complete stop before starting it again
7	Controller overvoltage protection	The input power voltage is too high	Check if the input power voltage is normal
8	Controller undervoltage protection	1. Low input power supply voltage 2. Instantaneous power failure of input power supply	1. Check if the input power voltage is normal; 2. Normal indication;
9	Controller overheat protection	1. The ambient temperature is too high 2. Fan damaged 3. The controller is too dirty inside 4. The installation location is not conducive to ventilation	1. Reduce the ambient temperature; 2. Please contact the manufacturer; 3. Clean the air inlet and outlet as well as the heat sink; 4. Improve ventilation conditions

10	Molecular pump overcurrent protection	System leakage, extremely low vacuum level	Check system equipment
11	Molecular pump overheat protection	1. Long term air leakage and low vacuum degree in the system 2. Circulating water not turned on or insufficient water volume and pressure	1. Check the system equipment; 2. Open or check the circulating water
12	Molecular pump overload protection	Molecular pump accelerates for medium to long term with gas leakage and excessive current	Check system equipment
13	Other faults		Please contact our after-sales technical engineer for assistance

9. Ordering Information for Pump Accessories

9.1 Accessories List A

Suitable for: JFB-63/81, JFB-100/251, JFB-100/301, JFB-160/401, JFB-160/450D types.

No.	Category	Name	Function/Description	Order No.
1	Wire	24VDC power line 1.5m	Molecular pump standard power cord, suitable for: JFB-63/81、JFB-63/81M (J)、JFB-100/251	
2	Cable connector	48VDC power line 2.5m	Suitable for: JFB-100/301、JFB-160/401、JFB-160/450D	—
		DB15 public head		
		Four core RS485 communication plug		
3	Water cooling components	Water cooling components	Optional accessories The customer needs to provide a cooling water source	—
4	Blowing accessories	Regularly open high traffic	Optional accessories For applications involving corrosive gases	A3351
		Regularly open small traffic		A3362
		Electromagnetic valve with high flow rate		A3373
		Electromagnetic valve with low flow rate		A3384
5	Baking components	Heated band $\Phi 150 \times 80$ mm	Optional accessories For low-temperature environments or high vacuum degassing scenarios	—
		Heated band $\Phi 90 \times 45$ mm		
6	Standard accessories	M8 Caliper screw	ISO-K flange (LF) standard	
		M10 Caliper screw	Combination form of caliper screws	4.1.7738-2
		M8 Clamp pad	Optional caliper pad combination form	4.1.7817
		DN100 Flexible flange (with snap ring)	Optional LF100 Flexible flange	4.1.7719
		DN160 Flexible flange (with snap ring)	Optional LF160 Flexible flange	4.1.7720
		DN63 Oxygen free copper gasket	CF63 Standard flange configuration Combination form of oxygen free copper gasket	
		DN100 Oxygen free copper gasket	CF100 Standard flange configuration	

			Combination form of oxygen free copper gasket	
		DN150 Oxygen free copper gasket	CF160 flange standard	4.1.7362
		M8×55 Bolt (including nut, flat washer, spring washer)	Combination form of oxygen free copper gasket	—
7	更多选择	KF16 Clamp		
		KF16 Equipped with a mesh center bracket		
		O-ring (for KF 16 center bracket)		
		KF25 Clamp	—	4.1.7055
		KF25 Equipped with a mesh center bracket	—	4.1.7040
		O-ring (for KF 25 center bracket)	—	7045.0.0010
		Transition chamber LF100-CF35-KF40-KF25	—	4.5.3234
		Transition chamber CF100-CF35-KF40-KF25	—	4.5.3235
		Transition chamber LF160-CF35-KF40-KF25	—	4.5.3236
		Transition chamber CF160-CF35-KF40-KF25	—	4.5.3237
		Transition chamber LF200-CF35-KF40-KF25	—	4.5.3238
		Transition chamber CF200-CF35-KF40-KF25	—	4.5.3239

Remarks:

1. In the column of standard accessories in the table, our sales engineers need to negotiate and determine with the customer based on the actual flange form of the cavity;
2. In the "More Options" accessory column, only some of our company's products are involved.
3. The "Order No." may be iteratively updated. For the final accurate order number, please contact our sales engineer before purchasing.

9.2 Accessories List B

Suitable for: JFB-160/700、JFB-160/701、JFB-200/1400、JFB-200/1401、JFB-250/2200、JFB-250/2201 types.

No.	Category	Name	Function/Description	Order No.
1	Cable connector	220VAC power line 2.5m	Molecular pump standard power supply line	—
		D15 public head		—
		Four core RS485 communication plug	RS485 Communication connector	
		JFB-I-B Cable 2.5m (default length)	For split molecular pumps	A3264-1
		JFB-I-B Cable 5.0m		A3264-2
		JFB-I-B Cable 10m		A3264-3
		JFB-I-B Cable 15m		A3264-4
2	Air cooled components	JFB-III Air cooled components	Optional accessories The air volume is sufficient and there is no need to configure a separate power supply. It can be directly connected to the controller fan socket for use	A3331
3	Blowing accessories	Electromagnetic valve with high flow rate	Optional accessories For applications with corrosive gases or dust	A3351
		Electromagnetic valve with low flow rate		A3362
		Regularly open high traffic		A3373
		Regularly open small traffic		A3384
4	Baking components	Heated band $\Phi 197 \times 80\text{mm}$	JFB-700 Pump casing heating function	A3831
		Heated band $\Phi 245 \times 80\text{mm}$	JFB-1400 Pump casing heating function	A3832
		Heated band $\Phi 273 \times 80\text{mm}$	JFB-2200 Pump casing heating function	A3833
5	Standard accessories	M10 Caliper screw	ISO-K flange (LF) standard Combination form of caliper screws	4.1.7738-2
		M8 Clamp pad	Optional caliper pad combination	4.1.7817

			form	
		DN160 Flexible flange (with snap ring)	Optional LF160 Flexible flange	4.1.7720
		DN200 Flexible flange (with snap ring)	Optional LF200 Flexible flange	4.1.7721
		DN250 Flexible flange (with snap ring)	Optional LF250 Flexible flange	4.1.7722
		DN150 Oxygen free copper gasket	CF160 Standard flange	4.1.7362
		M8×55 Bolt (including nut, flat washer, spring washer)	configuration Combination form of oxygen free copper gasket	4.1.7900
		DN200 Oxygen free copper gasket	CF200 Standard flange	4.1.7363
		M8×60 Bolt (including nut, flat washer, spring washer)	configuration Combination form of oxygen free copper gasket	4.1.7901
		DN250 Oxygen free copper gasket	CF250 Standard flange	4.1.7364
		M8×65 Hexagonal head bolt, including nut, flat washer, and spring washer	configuration Combination form of oxygen free copper gasket	4.1.7900
6	More options	KF25 Clamp	—	7055 (AL)
		KF40 Clamp	—	7056 (AL)
		KF25 Equipped with a mesh center bracket	—	7040
		KF40 Equipped with a mesh center bracket	—	7041
		O-ring (for KF 25 center bracket)	—	7045.0.0010
		O-ring (for KF 40 center bracket)	—	7046.0.0013
		CF35 to KF25 connector	—	7459
		CF35 to KF40 connector	—	7460
		CF Copper washer 35	—	7357
		CF Copper washer 40	—	7358
		Transition chamber LF160-2KF40-CF35	—	4.5.3866

	Transition chamber CF160-2KF40-CF35	——	4.5.3867
	Transition chamber LF200-2KF40-CF35	——	4.5.3868
	Transition chamber CF200-2KF40-CF35	——	4.5.3869
	Transition chamber LF250-2KF40-CF35	——	4.5.3870
	Transition chamber CF250-2KF40-CF35	——	4.5.3871

Remarks:

1. In the column of standard accessories in the table, our sales engineers need to negotiate and determine with the customer based on the actual flange form of the cavity;
2. In the "More Options" accessory column, only some of our company's products are involved.
3. The "Order No." may be iteratively updated. For the final accurate order number, please contact our sales engineer before purchasing.

10. CE and SEMI Certifications

CERTIFICATE										
of Conformity EC Council Directive 2006/42/EC Machinery										
Registration No.:	AM 50517174 0001									
Report No.:	CN21OWAN 001									
Holder:	Multi-micro Technology Co., Ltd. No. 299, Section 4, North Yinghua road, Shunqing District, Nanchong City, 637000 Sichuan P.R. China									
Product:	<u>Vacuum pump</u> (MOLECULAR PUMP)									
Identification:	<table border="0"><tr><td>Type Designation</td><td>Serial No.</td></tr><tr><td>JFB-160/701 JFB-200/1401</td><td>A3139210604002 A3135210604002</td></tr><tr><td>JFB-250/2201 JFB-100/301</td><td>A3141210604002 A3123210604002</td></tr><tr><td>JFB-160/401</td><td>A3127210604002</td></tr></table> Remark: For details refer to test report CN21OWAN 001. The pumps are incomplete machines, can't be used independently. They shall be used with back vacuum pump, valve, pipework, EMO, SCCR, etc. as the whole system machine for normal use.		Type Designation	Serial No.	JFB-160/701 JFB-200/1401	A3139210604002 A3135210604002	JFB-250/2201 JFB-100/301	A3141210604002 A3123210604002	JFB-160/401	A3127210604002
Type Designation	Serial No.									
JFB-160/701 JFB-200/1401	A3139210604002 A3135210604002									
JFB-250/2201 JFB-100/301	A3141210604002 A3123210604002									
JFB-160/401	A3127210604002									
This certificate of conformity is based on an evaluation of a sample of the above mentioned product. This is to certify that the tested sample is in conformity with all provision of Annex I of Council Directive 2006/42/EC, referred to as the Machinery Directive. This certificate does not imply assessment of the production of the product and does not permit the use of a TÜV Rheinland mark of conformity. The holder of the certificate is authorized to use this certificate in connection with the EC declaration of conformity according to Annex II of the Directive.										
Date <u>16.09.2021</u>	 Certification Body <i>Ming Shan</i> Ming Shan									
TÜV Rheinland LGA Products GmbH - Tillystraße 2 - 90431 Nürnberg										
CE The CE marking may be used if all relevant and effective EC Directives are complied with. CE										

100220 © 04.08 TÜV, TÜV and TÜV are registered trademarks. Utilization and application requires prior approval.

Certificate



Certificate no.

WA 50517202 01

License Holder:

Multi-micro Technology Co., Ltd.
No. 299, Section 4, North
Yinghua road, Shunqing District,
Nanchong City,
637000 Sichuan
P.R. China

Manufacturing Plant:

Multi-micro Technology Co., Ltd.
No. 299, Section 4, North
Yinghua road, Shunqing District,
Nanchong City,
637000 Sichuan
P.R. China

Test report no.: KCL CN21HGWS 001

Client Reference: S.C.M

Tested to: SEMI S2-0818
SEMI S8-0218
EN 60204-33:2011

Certified Product: (MOLECULAR PUMP)

License Fee - Units

Type Designation: JFB-160/701 JFB-200/1401 JFB-250/2201
Serial No.: A3139210604002 A3135210604002 A3141210604002
Electrical supply: AC220V, Single phase, 3 wires, 50/60 Hz

Type Designation: JFB-100/301 JFB-160/401
Serial No.: A3123210604002 A3127210604002
Electrical supply: 48Vdc

Remark: For further specifications refer to test report
CN21HGWS 001. Not subject to factory inspections.

Licensed Test mark:**Signature**

Ming Shan
Ming Shan

Date of Issue

(day/month/year)
16/09/2021



TÜV Rheinland (China) Ltd

No. 01/03B-08, Floor 7 and No. 01/04B-08, Floor 11, AVIC Building, No.10B, Central Road, East 3rd Ring Road,
Chaoyang District, Beijing, P.R. China

Tel: +86 10 6566 6660 Fax: +86 10 6566 6667 E-mail: info@bj.chn.tuv.com <http://www.tuv.com>

Product Warranty Form

Product Name: _____

Product Number: _____

Date of Production: _____

Customer Name: _____

Date	Repair Content	Repair Personnel

Warranty Statement

Any purchase of JFB Series Pump products produced by our company will strictly follow the maintenance terms.

Warranty or warranty fees will not be provided due to any of the following circumstances:

1. Users dismantle or modify the process structure of the product without authorization.
2. Improper storage or use by users.
3. Damage caused by other reasons attributable to the user.

.....**Cutting and Stamping Area**.....

Please provide detailed information and send it back to our company for future reference:

Product Name: _____

Contacts: _____

Product Number: _____

Contact Number: _____

Purchase Date: _____

Post Code: _____

Customer Name: _____

Customer Address: _____