VSU Series
Dry Vacuum Pumping Station

Operating Manual

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1. Use Information

Dear customer, thank you for your trust and support. We welcome your use of our VSU series vacuum pump product (hereinafter referred to as the pump). We are dedicated to providing you with quality service. Please carefully check whether the received product matches your order, whether the accessories, attachments, and user manual are complete, and whether there is any damage from transportation. If any of the above situations are found, please promptly contact our Sales Department or the local distributor. To ensure the long-term stable operation of this product, before you install, operate, inspect, or maintain it, please read this manual carefully to fully understand relevant safety issues, the pump's technical parameters, operating methods, and related precautions.

Warning

Failure to observe the terms could result in serious personal injury.

Notice

Failure to observe the terms could result in damage to the pump.

This warning label indicates that there may be a risk of electric shock. Cut off the power supply first in the process of electrical connection, repair and maintenance. Make sure the cover of the junction box is installed before running.

This warning label indicates high temperature while running the pump, do not touch the pump.

Notice

Please read the Instructions carefully prior to use and handle it according to the operation regulations. The Product (including the Instructions) is subject to changes without a prior notice. Make sure to fill vacuum pump oil before using the Product for the very first time.

2. Precautions

For personal safety, please read the following hints carefully before installation, operation, repair and maintenance.

Warning

The power supply must match the product specifications exactly. Power connections must be properly installed by certified electricians according to electrical equipment technical standards and wiring regulations.

Warning

When inspecting or repairing the pump, the power supply must be disconnected before operation. This avoids electric shock or sudden pump startup causing personal injury or death.

Warning

The rated current of the selected cable and protective switch must match the rated current specified in the product parameters.

Warning

Do not pump active, corrosive, toxic, flammable, or explosive gases. Please contact us if you have any needs.

Warning

Do not place obstacles that obstruct ventilation around the pump, to avoid abnormal temperature rise which could cause burns, fire, etc.

Warning

Before pump operation, the exhaust port must remain unobstructed; do not block or restrict exhaust airflow in any way. The exhaust pipe size must ensure that the relative pressure does not exceed 1500 mbar.

Warning

The operating ambient temperature for the pump is 5~40°C. Using the pump outside this required temperature range may cause it to fail to operate.

Warning

The oil quantity for the pump must be filled strictly according to the markings. Too much or too little oil will cause pump failure.

Warning

During pump operation and for up to one hour after the pump stops, the surface temperature of the pump may be very high. Do not touch the oil tank or pump surfaces to avoid burns.

Warning

Install the pump horizontally within 10° on a stable, solid surface.

Warning

When disposing of used oil and other parts, please comply with the relevant environmental protection regulations.

Warning

When pumping gases containing small amounts of dust, install appropriate accessories. Otherwise, pump failure or severe performance degradation may occur.

Warning

For special application requirements, such as pumping flammable, explosive gases, corrosive media, or special materials, please contact us.

Warning

Non-professionals should not disassemble the pump, as this may cause pump damage or operational failure. Please contact us if needed.

3. Product Overview

3.1 Overview

The VSU Series Air-Cooled Compact Oil-Free Screw Roots Pumping Station covers a pumping speed range of 100-300 m³/h. The model correspondence chart is as follows:

VSU **60** / **100** **L** — **1P** — **CE**

① ② ③ ④

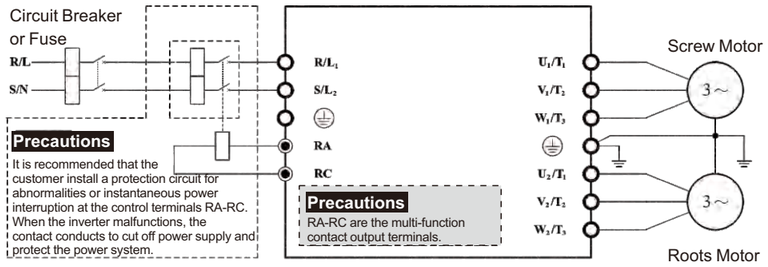
	Mark	Content	① VSP/VBP 20/100	① VSP/VBP 40/100	① VSP/VBP 60/100	① VSP/VBP 60/300
② Duty Grade	C	Clean Duty(1)	■	■	■	■
	L	Light Duty(2)	■	■	■	■
	M	Medium Duty(3)	■	■	■	■
	H	Severe Duty(4)	—	—	—	—
③ Voltage	1P	Single-phase 220V	■	■	■	■
	3P	Three-phase 380V	■	■	■	■
④ Certification	None	No Certification Required	■	■	■	■
	CE	CE Certification Required	■	■	■	■
	UL	UL Certification Required	—	—	—	—
	CSA	CSA Certification Required	—	—	—	—

Remarks

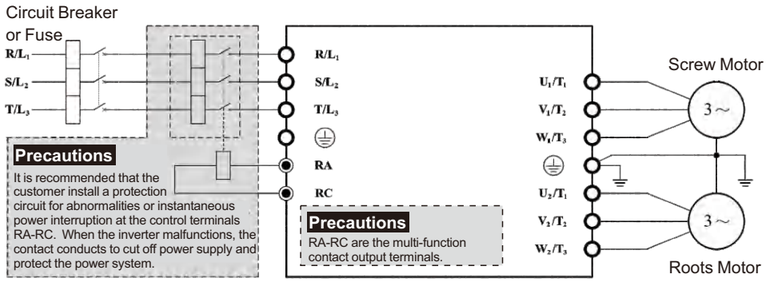
Clean Duty	Inert gases, Air Exhaust	Sputtering/Evaporation/Molding/Loadlock Chamber /TMP Boosting
Light Duty	Exhaust of condensable gases, etc.	Vacuum Drying/Freeze-drying/Ashing/General Industrial Applications
Medium Duty	CVD, Chemical Solvents	
Severe Duty	Etching, ALD, and Biochemical Analysis	

3.2 Electrical Interface

3.2.1 Single-Phase Station Main Power Circuit Schematic



3.2.2 Three-Phase Station Main Power Circuit Schematic:

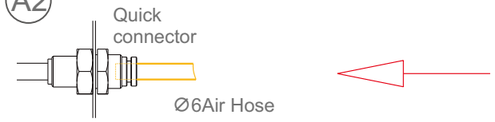


3.3 Pre-startup Preparation Before Purge

A1

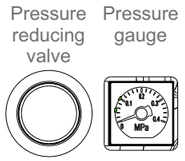
Remove the dust plug installed on the quick connector

A2



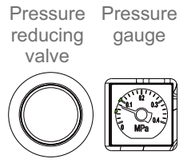
Take an air hose with an outer diameter of ø 6, connect one end to the gas source, the other end to the quick connector.
Note: Gas source must be dry nitrogen or dry compressed air.

B1



With no gas source connected, pressure gauge reads 0 Mpa.

B1



1. With gas source connected, pressure gauge reading should be between 0.05 and 0.1MPa.
2. Pressure can also be manually adjusted by the user. Rotate the knob on the pressure reducing valve below to adjust pressure. To inquire about the relationship between pressure and flow rate, please refer to the appendix: Relationship Between Purge Flow Rate and Purge Pressure for VSP20/40.

C

Thermal mass flow meter can be installed here.

4.Technical Parameters

4.1 Parameters

Item		Unit	VSU102		VSU104		VSU106		VSU206	
		Power Supply	Single-phase 220V / Three-phase 380V							
Pumping Speed		m^3/h	70		90		120		200	
Peak Pumping Speed		m^3/h	150		165		180		300	
Ultimate Pressure		Pa	1							
Noise (at ultimate pressure)		dB	≤65							
Cooling Method			Air-Cooled							
Maximum Continuous Inlet Pressure		MPa	0.02							
Time to Reach Ultimate Vacuum		min	≤3							
Maximum Exhaust Pressure		MPa	0.103							
Water Vapor Handling Capacity		g/h	370				450			
Motor	Rated Power	kW	2.2				2.5			
	Ultimate Operating Total Power	Kw	1				1.2			
	Ultimate Operating Total Current	A	8	3	8	3	8	3	8	3
	Peak Total Current	A	18	7	22	9	32	11	35	14
	Speed (Screw / Roots)	rpm	4500/3600				4200/4200		4200/3600	
	Cable	AWG	14				10	14	10	14
Environmental Requirements	Operating Temp.	°C	5~40							
	Operating Humidity		20~80% (non-condensing)							
	Storage Temp.	°C	-10~50							
Inlet		KF	KF40						DN80	
Outlet		KF	KF25							
Lubricating Oil	Gearbox Oil Capacity	L	0.08L (Screw Pump Oil) 0.5L (Roots Pump Oil)							
IP Class		IP	IP20							
N_2	Air Supply Pressure Pressure Gauge Reading	MPa	0.015~0.1							
	Purge Flow Rate	SLM	22~100							
	Connection		Φ6Quick-Connect Air Hose Interface							
Weight		kg	90.5				103		113	
Dimensions (L*W*H)		mm	850*288*545							
Pollution Degree			Pollution Degree 2							
Maximum Operating Altitude		m	2000							

表 1 技术参数

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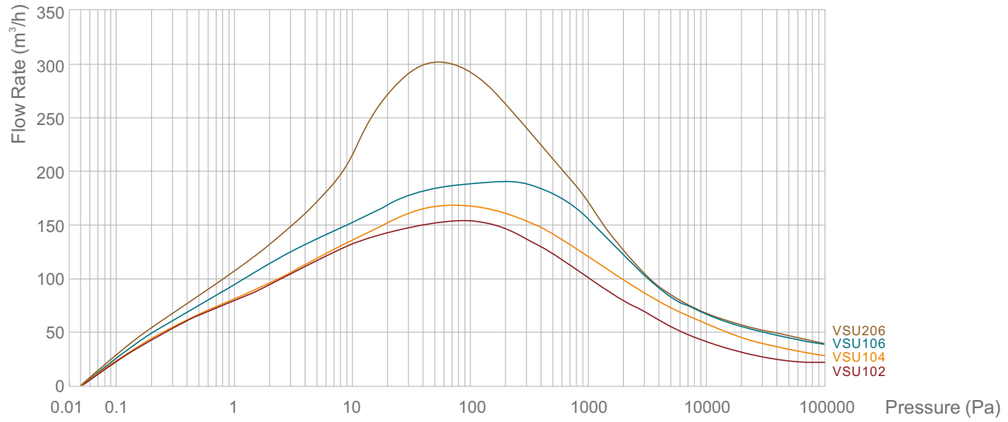
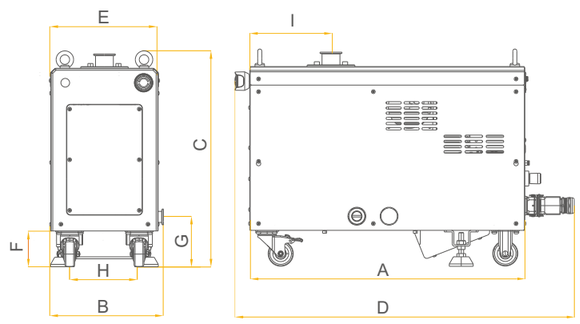
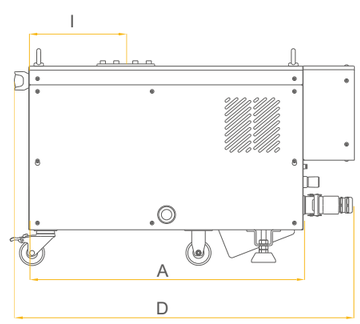
4.2 Flow Rate



4.3 Dimensions



VSU102/104/106 Product Dimensions

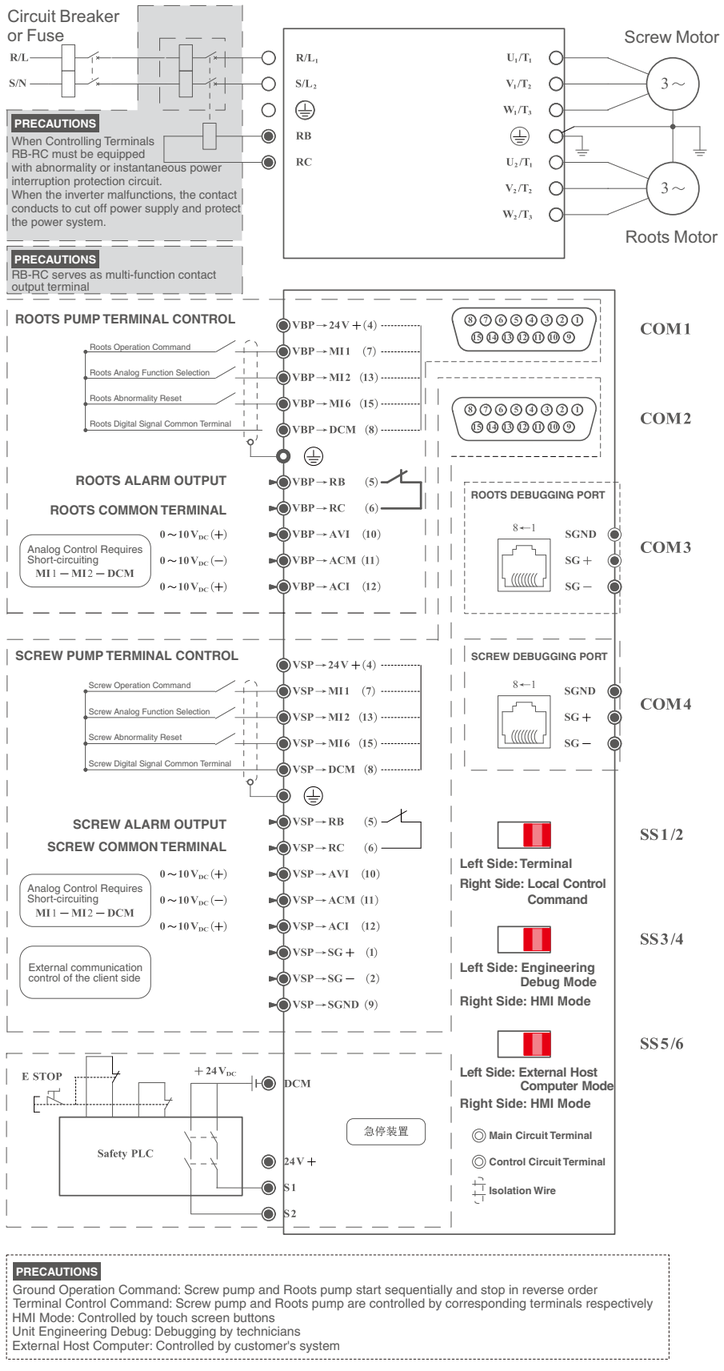


VSU206 Product Dimensions

Dimensions (Unit: mm)

Model	A	B	C	D	E	F	G	H	I	DN
VSU102 VSU104 VSU106	680	288	545	850	262	90	128	165	204	KF40
VSU206	680	288	545	850	262	90	128	165	245	DN80

4.4 Communication Protocol and Control Method (Example with Single-Phase Station)



PRECAUTIONS

Ground Operation Command: Screw pump and Roots pump start sequentially and stop in reverse order
Terminal Control Command: Screw pump and Roots pump are controlled by corresponding terminals respectively
HMI Mode: Controlled by touch screen buttons
Unit Engineering Debug: Debugging by technicians
External Host Computer: Controlled by customer's system

4.5 Installation

The VSU series is equipped with heavy-duty connectors. The wiring is shown in the following diagram.

Specification	Power Supply		Current (A)		Power Cable Specification
	Voltage (V)	Phase	Running Current	Heavy-Duty Peak Current	
VSU 102 X-1P	200-240(1P)	Single	8	18	14AWG
VSU 104 X-1P	200-240(1P)	Single	8	**22**	14AWG
VSU 106 X-1P	200-240(1P)	Single	8	**32**	10AWG
VSU 206 X-1P	200-240(1P)	Single	8	**35**	8AWG
VSU 102 X-3P	380-480(3P)	Three	3	7	14AWG
VSU 104 X-3P	380-480(3P)	Three	3	9	14AWG
VSU 106 X-3P	380-480(3P)	Three	3	11	10AWG
VSU 206 X-3P	380-480(3P)	Three	3	14	10AWG

1. Place the VSU horizontally, reserving 30cm of space front and back for heat dissipation.
2. Connect the vacuum system to the vacuum pump.
3. Connect the exhaust system.
4. For the VSU, connect a dry nitrogen source or dry compressed air source to the corresponding interface, and check if the pressure meets the requirements.
5. If starting via communication is desired, connect the control signal. Refer to section 4.4 Control Panel.

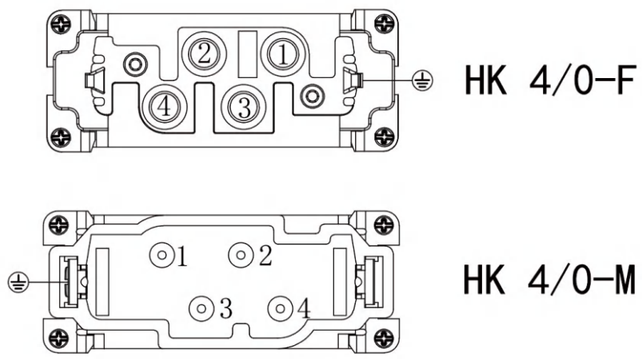
Start up

6. Turn on the dry nitrogen source or dry compressed air source. Adjust to an appropriate flow rate within the green range indicated by the pressure gauge.
7. Turn on the power switch.
8. In local mode, the vacuum pump will start directly after the switch is turned on.
   In communication control mode, requires run command from host computer.
9. Check if the operating current is normal.

This series of stations is standardly equipped with heavy-duty connectors, using the universal H16B double-latch protective sleeve and HK4/0 combination-type high-current plug body.
Corresponding Pin Assignments:

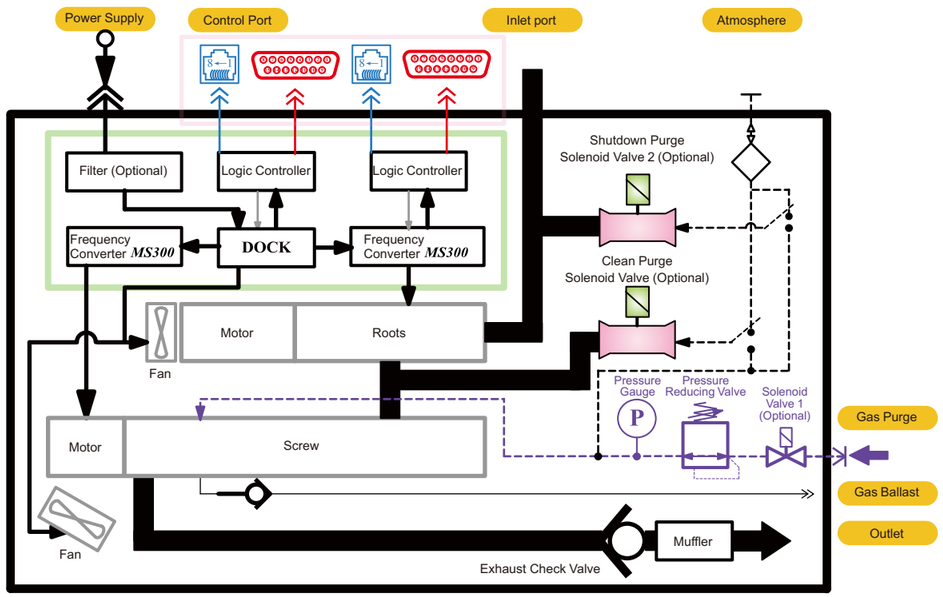
Model	Pin				
	1	2	3	4	Side PE
Single-Phase Models	L_1			N	PE
Three-Phase Models	L_2	L_2	L_3		PE
Remarks	All stations in this series have built-in frequency converters. The three-phase wiring sequence does not affect motor rotation direction.				

Refer to the following image for specifics:



Heavy-Duty Connector Pin Actual Position Diagram

4.6 Station Application Examples



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4.6.1 Main Process Gas Vacuum Circuit

When the vacuum pump is in operation, the primary gas enters through the Roots pump inlet, passes through the Roots pump body, and exits from the Roots pump outlet. It then passes through the connecting seat. Entering the screw pump inlet, passing through the screw pump body, and discharging from the screw pump exhaust end. Finally, it passes through the built-in exhaust check valve and exhaust muffler, and is discharged from the exhaust port.

4.6.2 Main Power and Control Circuit

External power enters via the aviation plug or heavy-duty connector into the EMC filter module (optional).
It then passes through a distribution block, splitting into four paths.

① The first path goes to the input of the Roots frequency converter, then from the Roots frequency converter output to the Roots motor.

② The second path from the distribution block goes to the Roots fan.

③ The third path goes to the input of the screw pump frequency converter, then from the screw pump frequency converter output to the screw pump motor.

④ The fourth path from the distribution block goes to the screw pump fan.

Logic functions are handled by the logic controller. The Roots pump logic controller controls the Roots pump, and the screw pump logic controller controls the screw pump.

4.6.3 Purge Circuit

External dry gas passes through Solenoid Valve 1 (optional), through a pressure reducing valve, pressure gauge, and finally enters the pump exhaust end.

4.6.4 Gas Ballast Circuit

A gas ballast is taken from the exhaust end.

4.6.5 Cleaning Circuit

When the pump enters maintenance mode or shutdown state, air, dry compressed air, or cleaning fluid is introduced via the clean purge solenoid valve located between the screw pump and Roots pump.

4.6.6 Shutdown Purge Circuit

After the process ends, with a set shutdown delay, air, dry compressed air, or nitrogen is introduced at the inlet side of the shutdown purge solenoid valve.

5. Pump Operation, Storage and Usage

5.1 Handling and Storage

Warning

The pump may only be moved when stopped and power disconnected.

Warning

Any minor negligence during handling may cause pump damage; handle with care. When moving a pump that has been filled with oil, keep it vertical and level to avoid oil spillage.

Warning

Dispose of packaging materials according to environmental regulations.

Warning

If the pump is to be stored for an extended period, please power it on and run it once every 6 months to ensure it remains in good working condition.

5.2 Notes Before Use

Warning

Before operating the pump, observe through the oil sight glass to ensure there is lubricating oil inside and that the oil level is between the marked lines;
If there is no lubricating oil inside the pump, please fill it with lubricating oil according to steps a-d-e-f in section 6.3;

Warning

The pump will start once powered on. Before powering on, ensure the inlet and exhaust ports are correctly connected, and that the air inlet and outlet vents for heat dissipation are not obstructed or blocked. Refer to section 6.1.3 for the heat dissipation air inlet and outlet vents;

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6. Inspection and Maintenance

During prolonged use, some internal components of the pump may wear or age. To ensure stable pump operation, please perform regular inspections and maintenance.

6.1 Routine Inspection

Warning

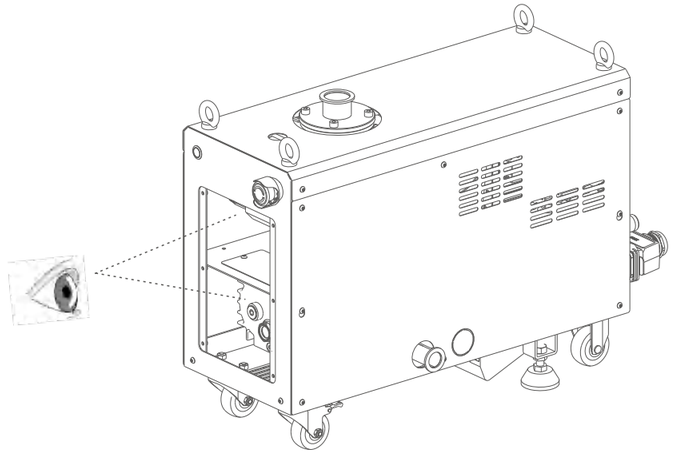
Before starting the pump and during its daily operation, it is necessary to check the pump's operating status.

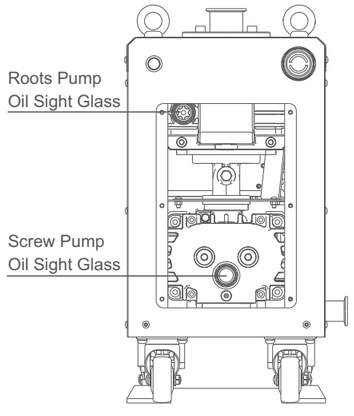
All inspections must be performed in accordance with all safety regulations, and all work must be completed by professionally trained personnel. When hazardous conditions exist, first determine the nature of the hazard and eliminate it according to the corresponding procedures. Before beginning any inspection work, hazardous situations must be properly handled.

The following items need to be checked daily:

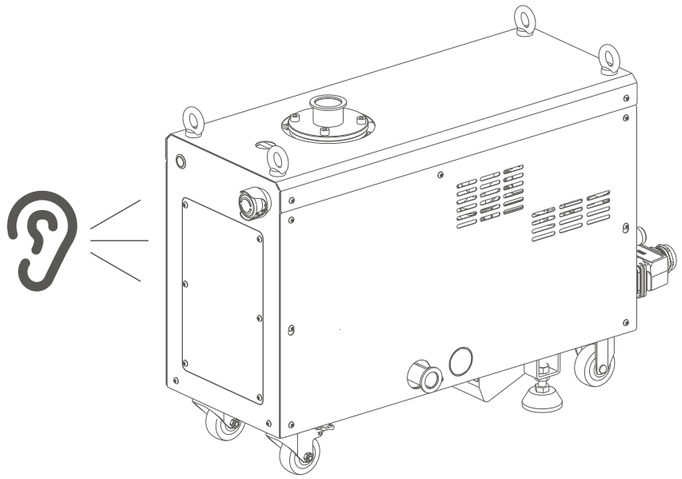
Inspection Item	Inspection Frequency	Inspection Method
Pump Oil	Daily	1. When the pump is operating, the oil level should remain within the marked lines;
		2. Normal pump oil is clean and transparent; change the oil if it becomes dark or cloudy;
Pump Operating Sound	Daily	The sound during pump operation should be continuous, stable, and free of other abnormal noises;
Pump Heat Dissipation Vents	Daily	The air inlet and outlet vents for heat dissipation should be free of blockage or obstruction;
Pump Inlet Port	Daily	The connection at the inlet port should be secure and leak-free over the long term;
Pump Exhaust Port	Daily	The exhaust port should be clear and unobstructed, with no blockage or obstruction;

6.1.2 Observe the Oil Level and Oil Condition Through the Oil Sight Glass; They Must Meet Requirements





6.1.3 During Pump Operation, Listen for Any Abnormal Sounds



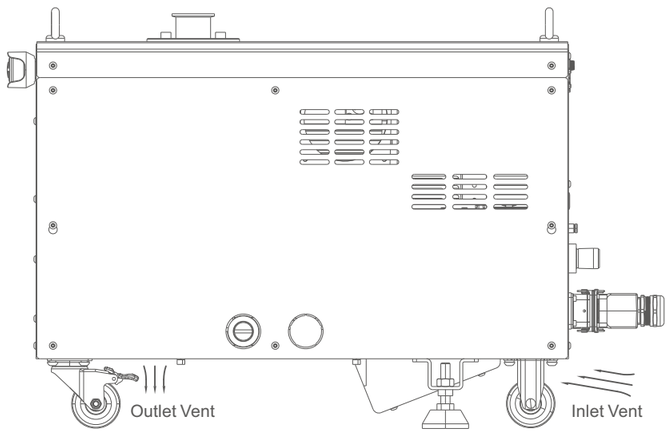
Warning

Do not place your ear directly against the pump during operation to avoid burns.

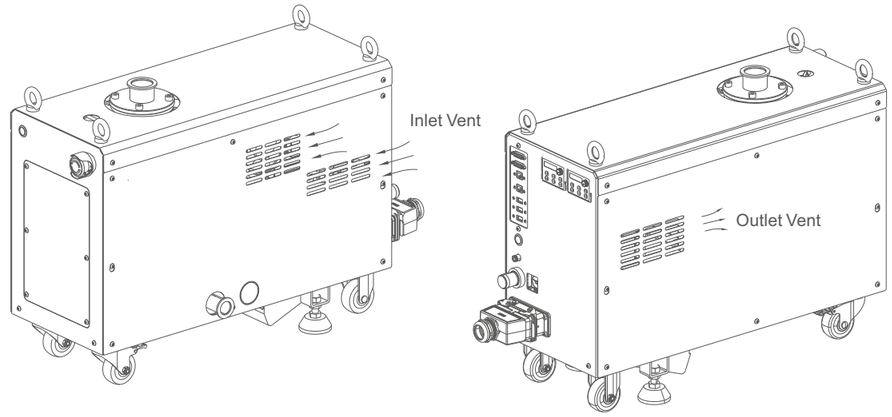
6.1.4 The Pump's Heat Dissipation Air Inlet and Outlet Vents Must Be Clear

The air inlet and outlet vents for the pump's air cooling must be free from blockage or obstruction.

a. Pump Bottom Air Inlet/Outlet Vent Locations



b. Pump Side Air Inlet/Outlet Vent Locations



6.2 Periodic Maintenance

Warning

After the pump operates for a certain period, maintenance is required to keep it running under stable conditions.

Warning

All maintenance must be performed in accordance with all safety regulations, and all work must be completed by professionally trained personnel. When hazardous conditions exist, first determine the nature of the hazard and eliminate it according to the corresponding procedures. Before beginning any inspection work, hazardous situations must be properly handled. Components, pump oil, and other items removed during replacement must be disposed of in accordance with environmental protection regulations.

The following items require periodic maintenance:

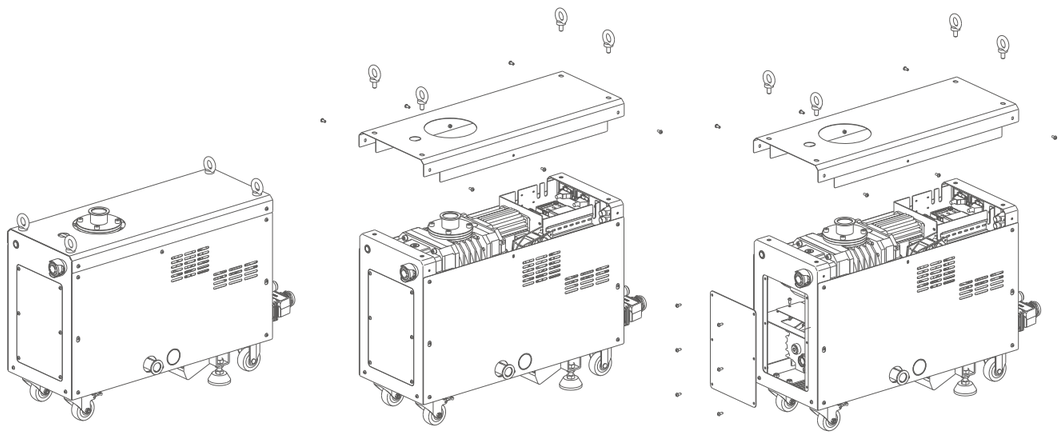
Content	Maintenance Cycle	Method	Replacement Items
Clean Fan Cover	1 year	Periodically clean dust from the fan air inlet and outlet vents. In harsh environments, the maintenance cycle needs to be shortened.	None
Replace Gas Ballast Filter Element	1 year	Remove the left side panel and clean the gas ballast filter element according to section 6.4.	Gas Ballast Filter Element (as needed)
Replace Lubricating Oil	2 year	Replace the lubricating oil periodically to ensure stable pump operation. Refer to section 6.3 for oil change procedure.	Lubricating Oil, Oil Plug
Check Wiring	1 year	Periodically check for loose connections on the terminal blocks.	None

Note: The VSU series uses two types of lubricating oil. Please purchase in advance:

1. The Roots pump requires VALUE Roots Pump Special Oil 500ml;
2. The screw pump requires VALUE Screw Pump Special Oil 80ml;
3. Improper disassembly/assembly may damage the oil plug or gas ballast filter element. Please purchase in advance if needed.

6.3 Oil Change Procedure

a. Remove the covers to expose the oil filler ports.

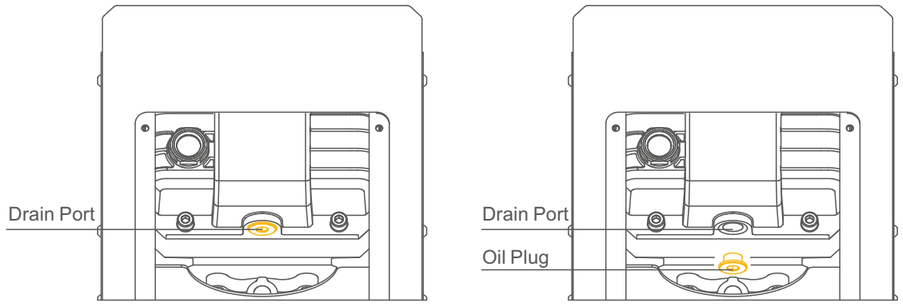


1. Initial state

2. Using a wrench, remove the 6 screws on the left and right sides of the top cover plate, and unscrew the 4 lifting rings.

3. Using a wrench, remove the 6 screws on the front panel cover, unscrew the 2 screws on the internal partition cover plate, and remove the cover plate.

b. Drain the Roots pump lubricating oil.



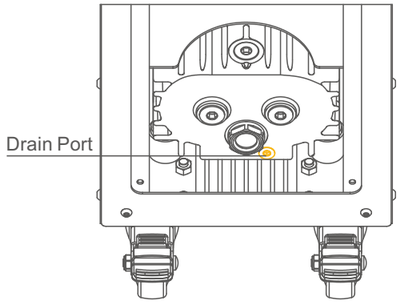
1. Place an oil container or a drain tube under the drain port, and dispose of the used oil properly. Do not leave it inside the machine.

2. Use the provided tool to remove the oil plug and completely drain the lubricating oil inside.

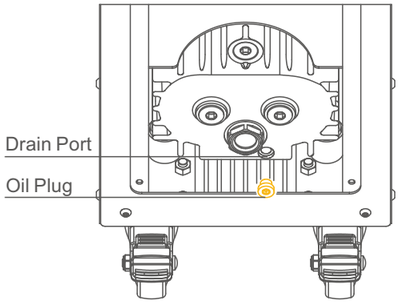
Warning

After draining the oil, reinstall the oil plug, ensuring it is tightened securely.

c. Drain the screw pump lubricating oil.



1. Place an oil container or a drain tube under the drain port, and dispose of the used oil properly. Do not leave it inside the machine.

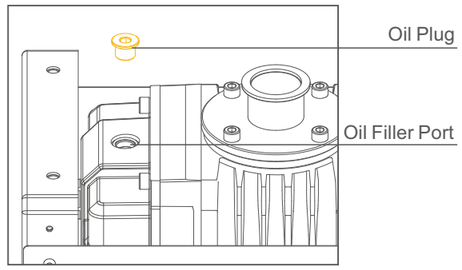


2. Remove the oil plug and completely drain the lubricating oil inside.

Warning

After draining the oil, reinstall the oil plug, ensuring it is tightened securely.

d. Fill the Roots pump with lubricating oil.



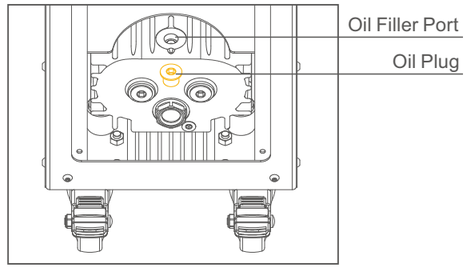
1. Use a wrench to remove the oil plug.

2. Unscrew the bottle cap and pour the provided 500ml lubricating oil into this filler port.

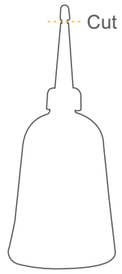
Warning

Tighten the oil plug with a wrench, ensuring it is tightened securely.

e. Fill the screw pump with lubricating oil.



1. Use a wrench to remove the oil plug.

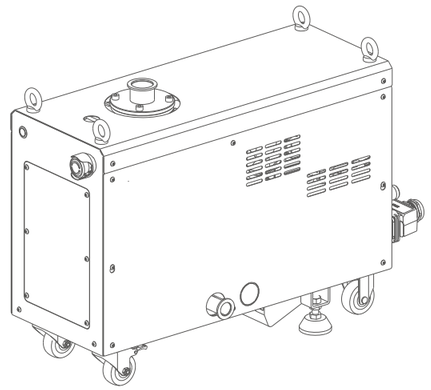


2. Use scissors to cut off the tip of the oil bottle spout, then pour the provided 80ml lubricating oil into the filler port.

Warning

Tighten the oil plug with a wrench, ensuring it is tightened securely.

f. Reinstall the pump covers.



After oil filling is complete, reinstall the pump's top cover and front panel cover, restoring it to the initial state.

Warning

Note: Please add the corresponding lubricating oil to the correct filler port as required. The lubricating oils for the screw pump and Roots pump cannot be mixed. The Roots pump requires VALUE High Vacuum Pump Oil 500ml; the screw pump requires VALUE Screw Pump Special Oil 80ml.

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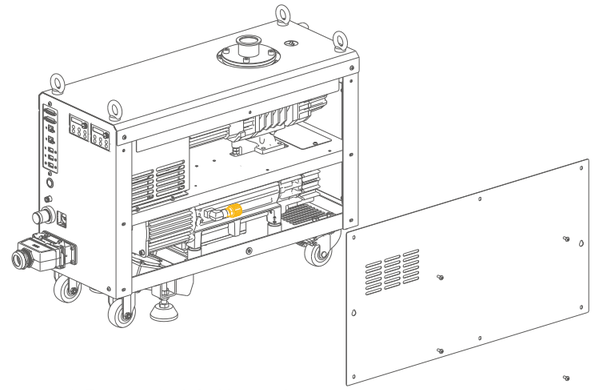
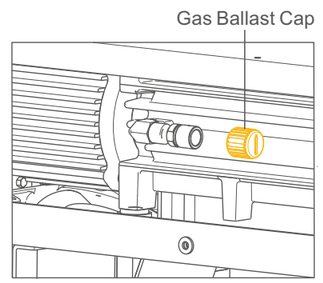
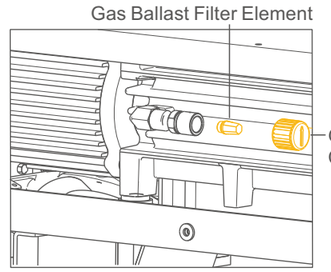
6.4 Maintaining the Gas Ballast Filter Element



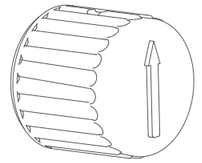
1. Remove the left side panel.



2. Pull out the gas ballast cap.



3. Use a hex socket to remove the gas ballast filter element.



4. After cleaning, reinstall the gas ballast filter element (or replace it). Then reinstall the gas ballast cap, paying attention to its orientation. Finally, reinstall the left side panel.

Warning

After reinstalling, the arrow on the gas ballast cap must face upward.

7. Handling and Storage

Warning

The pump may only be moved when stopped and power disconnected.

Notice

Any minor negligence during handling may cause pump damage; handle with care. When moving a pump that has been filled with oil, keep it vertical and level to avoid oil spillage.

Notice

Dispose of packaging materials according to environmental regulations.

8. Inspection and Maintenance

Notice

All inspection and maintenance must comply with relevant safety regulations. All work must be performed by professionally trained personnel.

Notice

When hazardous substances are present, first identify the nature of the hazard and follow appropriate safety procedures. If potential dangers persist, the pump must be decontaminated before any maintenance work begins.

8.1 Routine Maintenance Chart

Content	Maintenance Cycle	Remarks
Oil Change Cycle	After 6000 hours of operation or when oil color darkens	8.2.1
Check Pump Sound	During operation	8.2.2
Initial Oil Change	After 3000 hours of operation	8.2.3
Clean Silencer	After 6000 hours of operation or when pump sound is abnormal	8.2.4
Clean Fan Cover	Before operation	8.2.5
Wiring Inspection	Before operation	

8.2 Routine Maintenance Methods

8.2.1 Check Oil Level

① During pump operation, the oil level should always remain between the minimum and maximum oil level lines. If the level is below the minimum line, add oil promptly; if above the maximum line, loosen the drain plug to remove excess oil, otherwise oil may enter the pump chamber.
② Observe oil color: normal pump oil is clean and transparent; replace oil if color darkens or becomes cloudy.

8.2.2 Check Pump Sound

① During operation, the pump sound should be continuous and stable, without abnormal noises. If abnormal sounds occur, refer to Table 2 Troubleshooting for handling methods.

8.2.3 Oil Change

① After stopping the pump, wait for it to cool before changing oil to avoid burns.
② During oil change, open the drain plug and discharge used oil into an appropriate container. When oil flow stops, retighten the drain plug. Ensure both drain and fill plugs are tightly secured to maintain gearbox airtightness, preventing external air ingress and vacuum level degradation.
③ After oil change, place processed pump oil in designated containers and dispose according to relevant environmental regulations.

8.2.4 Clean the Muffler

① If abnormal sound is noticed during pump operation, or after the pump stops running, inspect the exhaust muffler.
② When inspecting the exhaust filter, stop the pump and wait for it to cool down before proceeding.
③ Open the exhaust port housing at the pump bottom, remove the exhaust muffler cover plate, and clean any debris inside the cavity.

8.2.5 Clean the Fan Cover

① Before operation, check if a large amount of dust has accumulated on the fan cover at the fan air inlet. Keep the fan cover surface clear for smooth airflow to avoid poor heat dissipation which could affect pump performance.

9. Troubleshooting

9.1 Rotor Rotation Inspection Method

Process for Judging Rotor Jamming

1. As shown in Figure 1, remove the six M5×12 stainless steel screws on the gear front cover plate.
2. Remove the gear front cover plate.
3. As shown in Figure 2, use an 8mm L-shaped wrench to unscrew the oil plugs on the gear front cover end face, aligned with the main and driven rotor shaft ends.
4. As shown in Figure 3, use a 5mm L-shaped wrench to turn the main rotor counterclockwise and feel the resistance during rotation.

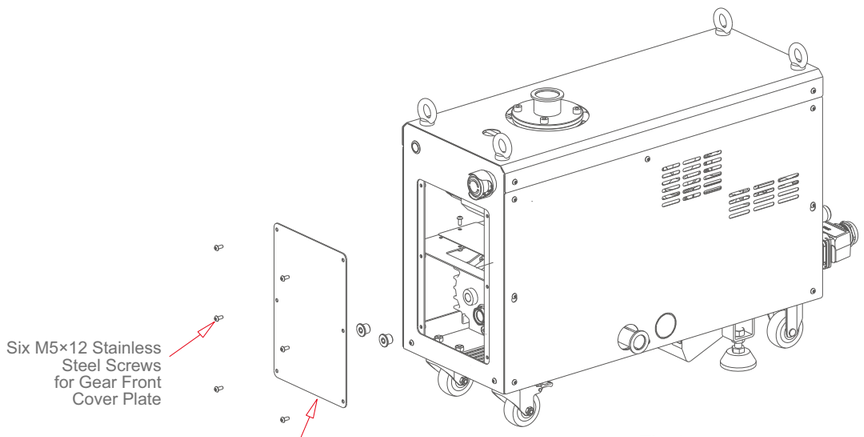


Fig.1

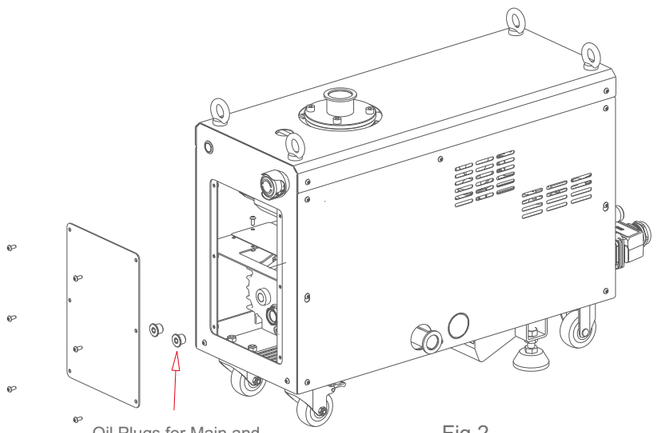


Fig.2

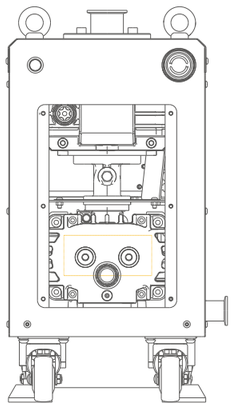


Fig.3

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9.2 Controller Error Code Inquiry

Process for Judging Rotor Jamming:
As shown in Figure 4, the controller display is located at the indicated position.

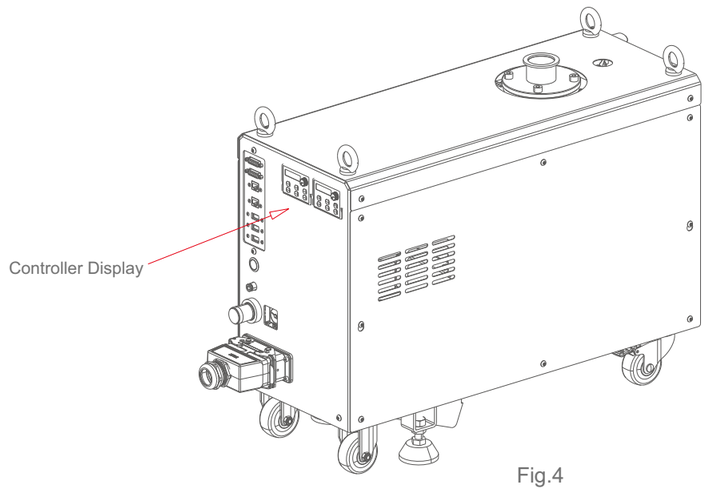

Fig.4

9.3 Troubleshooting Examples

Example: Pump fails to start normally, user self-check process.

Possible Cause 1:
In the operating environment, a sudden load change exceeds the controller's capacity, causing a protective warning output (including but not limited to ocX, ovX, olX).
Solution for Cause 1:
Completely disconnect the pump from power for three minutes (unplug the power cord and turn off the switch), then reconnect the power cord, turn on the switch, and input the run command.
It should now operate normally.

Possible Cause 2:
In high-dust, high-corrosivity, or high-water-vapor environments, if unscheduled stops recur, it may be due to solid-liquid mixtures adhering inside the pump clearances, increasing the load. As per the requirements in Figure 4. Record the controller error code. Solution for Cause 2:
1. Enable purge for the entire cycle (shutdown purge and operation purge);
2. In high-water-vapor environments, a gas ballast can be configured.

Possible Cause 3:
Complete seizure.
Solution for Cause 3:
Follow the steps in Figures 1, 2, and 3 to check for rotor jamming.

Example: Abnormal noise during pump operation, user self-check process.
1. As per Figure 4 requirements, check if the controller current is normal;
2. Listen carefully for any abnormal noise from the motor.

Fault	Cause of Fault	Troubleshooting Method
Pump fails to start	1. Power supply disconnected	1.1 Check power line connections.
		2.2 No run command input.
	2. Abnormal input power voltage	2. Ensure voltage within ±10% of rated voltage
	3. Motor malfunction	3. Replace motor
	4. Overload protector activated	4. Check ambient temperature or pumped gas temperature
	5. Ambient temperature too low	5. Raise ambient temperature to 5°C or higher
	6. Foreign object in pump causing seizure	6. Repair pump
	7. Pump stopped for too long	7. Repair pump
	8. Exhaust blocked	8. Clean exhaust silencer or clear exhaust pipe
	9. Internal components damaged	9. Repair pump
Pump cannot reach ultimate vacuum or pumping speed too slow	1. Vacuum system configuration is unreasonable	1. Select appropriate pump
	2. Vacuum system leakage	2. Check system
	3. Measurement method or gauge inappropriate	3. Use correct measurement method and gauge to directly measure vacuum at pump inlet
	4. Inlet pipe blocked	4. Clean inlet pipe
	5. Inlet pipe too small or too long	5. Use shortest and widest possible inlet pipe
	6. Exhaust pipe obstructed	6. Keep exhaust pipe clear
	7. Exhaust silencer clogged	7. Clean exhaust silencer
	8. Motor speed too low	8. Check power supply voltage
	9. Exhaust blocked	9. Clean exhaust silencer or clear exhaust pipe
	10. Internal components damaged	10. Repair pump

Fault	Cause of Fault	Troubleshooting Method
System vacuum drops too rapidly after pump stop	1. Vacuum system leakage	1. Check system
	2. No anti-backflow valve installed	2. Add vacuum valve or install anti-backflow valve
Abnormal noise during operation.	1. Abnormal input power voltage	1.1 Check power supply, switch, and line connections.
		1.2 Ensure voltage is within ±10% of the rated voltage.
	2. Foreign object entered pump	2. Repair pump
	3. Oil level in pump too low	3. Add specified oil quantity
	4. Internal components damaged	4. Disassemble for repair, replace parts
Pump temperature rise too high	1. Poor ventilation during installation.	1. Improve ventilation environment.
	2. Damaged fan.	2. Replace fan.
	3. Pumped gas temperature too high	3. Add cold trap etc. at inlet
	4. Exhaust pipeline blockage.	4. Clean exhaust pipeline.
	5. Poor lubrication.	
	5.1 Unsuitable or deteriorated pump oil.	5.1. Add qualified oil.
	5.2. Insufficient gearbox oil.	5.2. Add oil to the specified level.
	6. Ambient temperature too high.	6. Reduce ambient temperature.
Pump oil in inlet pipe	1. Oil from vacuum system	1. Check vacuum system
	2. Gearbox oil level too high	2. Drain excess pump oil

Table 2 Troubleshooting

10. Warranty

The warranty period for VSU series vacuum pumps is one full year from the date of purchase. During the warranty period, if malfunctions occur under normal usage conditions as specified in the operation manual, our company will provide free repair services. Faults caused by the following circumstances require paid repair by our company:

(1) Malfunctions caused by natural disasters or human factors.
(2) Faults resulting from special operating environments.
(3) Malfunctions identified by our technical personnel as caused by abnormal operation or improper use.
(4) When returning pumps to our company for repair, you must declare whether the pump is contaminated or contains substances harmful to human health. If the pump is contaminated, please specify exactly what contaminants are present. Without a contamination declaration, we will return the pump to the shipper's address.

11. Accessories

To ensure pump reliability, please select accessories provided by our company. When ordering, please provide the pump model number and consumable part codes. The diagram shows optional accessories. If you have other accessory requirements, please contact us.

Accessories we provide include:

1. Other types of inlet/outlet interfaces
2. Dust filters

Proper Disposal Methods for This Product

This marking indicates that this product should not be disposed of with other household waste. To prevent potential environmental or human health hazards from uncontrolled waste disposal, use return and collection systems or contact retailer where product was purchased. They can arrange environmentally safe recycling of this product.

VSU Series Dry Vacuum Pumping Station

Communication Manual

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www.valuevacuum.com

Contents

1. VSU Series Port Corresponding Functions

1. COM1 (Roots Pump Port Control Functions)

Port	Wire Number	I/O	Remarks	Other
1	VBP-SG+	RS485(A)	Communication signal (+)	Default Communication Format 9600-8-N-2
2	VBP-SG-	RS485(B)	Communication signal (-)	
3				
4	VBP-24V	Output (shared with input)	DC regulated power supply	
5	VBP-RA	Digital output	Run Status	Relay output
6	VBP-RC	Digital output	Run Status Common Terminal	Relay output
7	VBP-MI1	Digital input	Run command	
8	VBP-DCM	Digital input common terminal		
9	VBP-SGND	RS485-SGND	Communication Signal Ground	
10	VBP-AVI	Analog input	Analog speed control (+)	0-10V_{DC}
11	VBP-ACM	Analog input common terminal		
12	VBP-ACI	Analog input	Other control	
13	VBP-MI2	Digital input	Analog start command	MI1-MI2-DCM
14				
15	VBP-MI2	Digital input	Alarm Reset	

Table 1 COM1 (Roots Pump Port Control Functions)

2. COM2 (Screw Pump Port Control Functions)

Port	Wire Number	I/O	Remarks	Other
1	VSP-SG+	RS485(B)	Communication signal (+)	Default Communication Format 9600-8-N-2
2	VSP-SG-		Communication signal (-)	
3		Output (shared with input)		
4	VSP-24V	Digital output	DC regulated power supply	
5	VSP-RA	Digital output	Run Status	Relay output
6	VSP-RC	Digital input	Run Status Common Terminal	Relay output
7	VSP-MI1	Digital input common terminal	Run command	
8	VSP-DCM	RS485-SGND		
9	VSP-SGND	Analog input	Communication Signal Ground	
10	VSP-AVI	Analog input common terminal	Analog speed control (+)	0-10V_{DC}
11	VSP-ACM	Analog input		
12	VSP-ACI	Digital input	Other control	
13	VSP-MI2		Analog start command	MI1-MI2-DCM
14		Digital input		
15	VSP-MI6		Alarm Reset	

Table 2 COM2 (Screw Pump Port Control Functions)

3. COM3 (Roots Pump Engineering Debug Port)

Port	Wire Number	I/O	Remarks	Other
1	Reserved			
2	Reserved			
3	VBP-SGND	RS485-SGND	Communication Signal Ground	
4	VBP-SG-	RS485(B)	Communication signal (-)	
5	VBP-SG+	RS485(A)	Communication signal (+)	
6	Reserved			
7	VBP-SGND	RS485-SGND	Communication Signal Ground	
8	Reserved			

Table 3 COM3 (Roots Pump Engineering Debug Port)

4. COM4 (Screw Pump Engineering Debug Port)

Port	Wire Number	I/O	Remarks	Other
1	RS485-SGND	Reserved		
2	Reserved			
3	VBP-SGND	RS485-SGND	Communication Signal Ground	
4	VBP-SG-	RS485(B)	Communication signal (-)	
5	VBP-SG+	RS485(A)	Communication signal (+)	
6	Reserved			
7	VBP-SGND	RS485-SGND	Communication Signal Ground	
8	Reserved			

Table 4 COM4 (Screw Pump Engineering Debug Port)

5. SS1/2 (Terminal / Local Run Command)

Left	Terminal
Right	Local Run Command Mode

Table 5 SS1/2 (Terminal / Local Run Command)

6. SS3/4 (Engineering Debug Mode / HMI Mode)

Left	Engineering Debug Mode
Right	HMI Mode

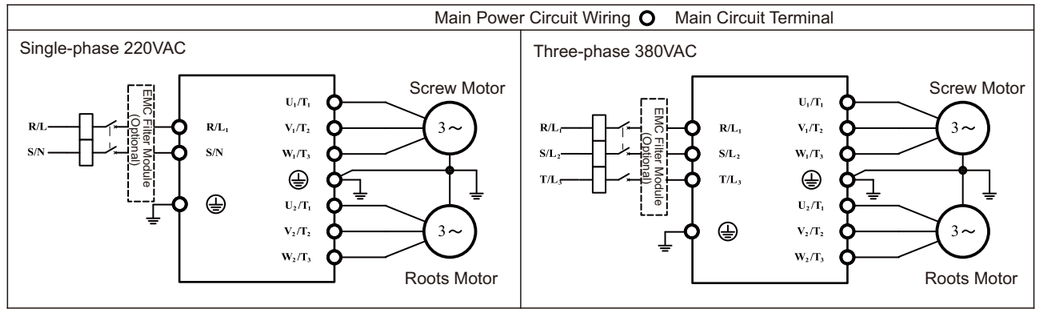
Table 6 SS3/4 (Engineering Debug Mode / HMI Mode)

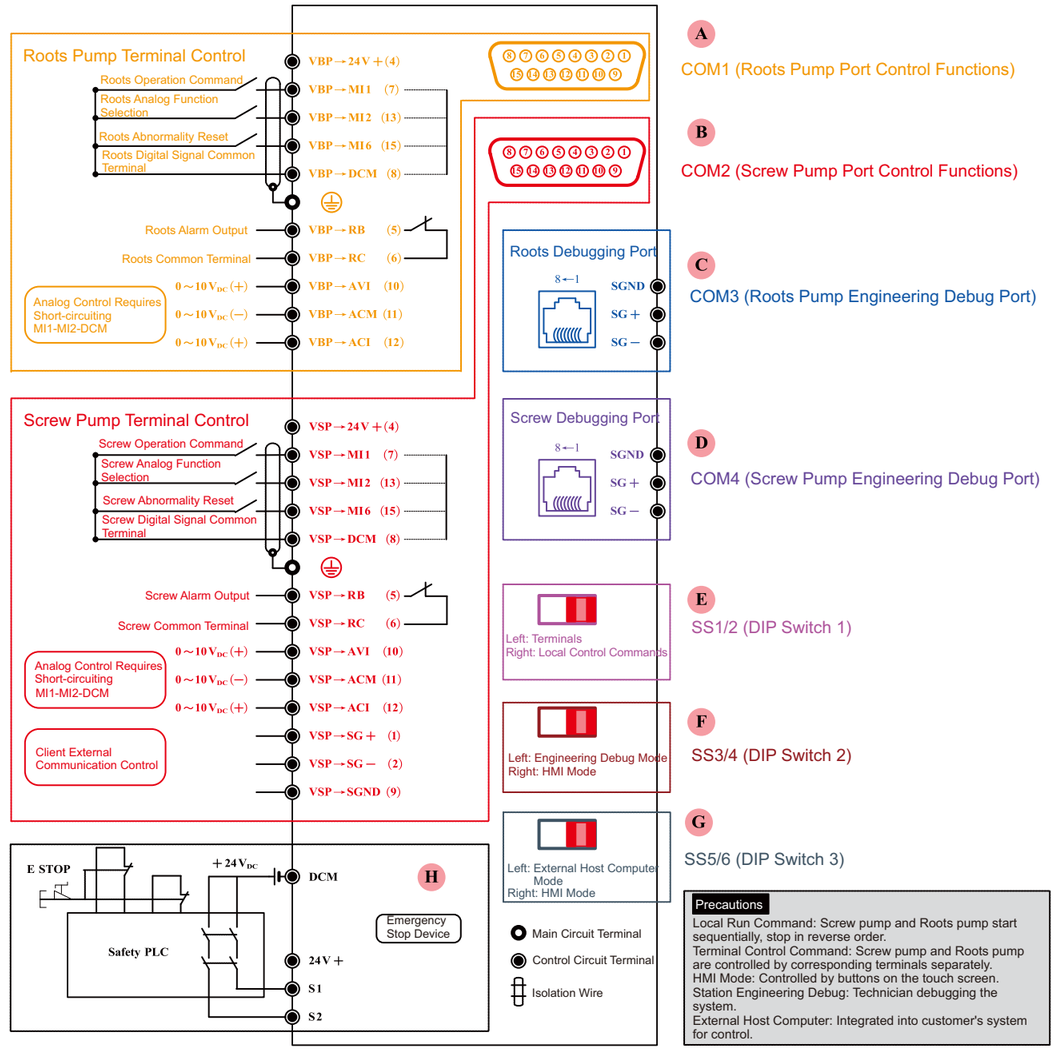
7. SS5/6 (External Host Computer Mode / HMI Mode)

Left	External Host Computer Mode
Right	HMI Mode

Table 7 SS5/6 (External Host Computer Mode / HMI Mode)

Circuit Breaker or Fuse





A COM1 (Roots Pump Port Control Functions)

B COM2 (Screw Pump Port Control Functions)

C COM3 (Roots Pump Engineering Debug Port)

D COM4 (Screw Pump Engineering Debug Port)

E SS1/2 (DIP Switch 1)

F SS3/4 (DIP Switch 2)

G SS5/6 (DIP Switch 3)

Precautions

Local Run Command: Screw pump and Roots pump start sequentially, stop in reverse order.
Terminal Control Command: Screw pump and Roots pump are controlled by corresponding terminals separately.
HMI Mode: Controlled by buttons on the touch screen.
Station Engineering Debug: Technician debugging the system.
External Host Computer: Integrated into customer's system for control.

2. VSU Series Operation Function Descriptions

NO.	SS1/2	SS3/4	SS5/6	Function Description
1	Right	Right	Right	1. Local Run Command Mode; 2. HMI Mode (can control frequency commands, run commands, and all other parameters) (Optional).
2	Left	Right	Right	1. Terminal Run Command Mode; 2. HMI Mode (can control frequency commands, run commands, and all other parameters) (Optional).
3	Right	Left	Right	1. Local Run Command Mode; 2. Roots Debug Mode; 3. Screw Debug Mode.
4	Right	Left	Left	1. Local Run Command Mode; 2. Roots Debug Mode; 3. Screw Debug Mode.
5	Left	Left	Right	1. Terminal Run Command Mode; 2. Roots Debug Mode; 3. Screw Debug Mode.
6	Left	Left	Left	1. Terminal Run Command Mode; 2. Roots Debug Mode; 3. Screw Debug Mode.
7	Right	Right	Left	1. Local Run Command Mode; 2. External Host Computer Mode
8	Left	Right	Left	1. Terminal Run Command Mode; 2. External Host Computer Mode.

Table 8 Function Groups

2.1 Local Switch Control Mode

SS1/2 (Right) + SS3/4 (Right) + SS5/6 (Right) = Local Run Command Mode + HMI Mode (can control frequency commands, run commands, and all other parameters) (Optional).
1. Function Description: In this mode, the pumping system is controlled by the start switch on the rear panel of the system.
2. Startup Sequence: Sequential control startup. After pressing the start switch, the screw pump starts immediately, and the Roots pump starts with a 30-second delay. If the start command is interrupted before the Roots pump starts, the Roots pump will not start, and the screw pump will stop running after a 30-second delay.
3. Operation Sequence: Both the screw and Roots pumps have current-limiting protection; if the current exceeds the limit, the operating frequency will be reduced to a specified value. Specific parameters vary by station model.
4. Shutdown Sequence: Sequential control shutdown. After resetting the start switch, the Roots pump begins shutdown immediately, and the screw pump shuts down with a 30-second delay. If the shutdown command is canceled before the screw pump stops, the Roots pump will still restart 30 seconds after the command is canceled.
5. Fault Handling Sequence: Interlock shutdown. If an error occurs during operation of either the screw pump or the Roots pump, an interlock mechanism actively forces the other pump to shut down.

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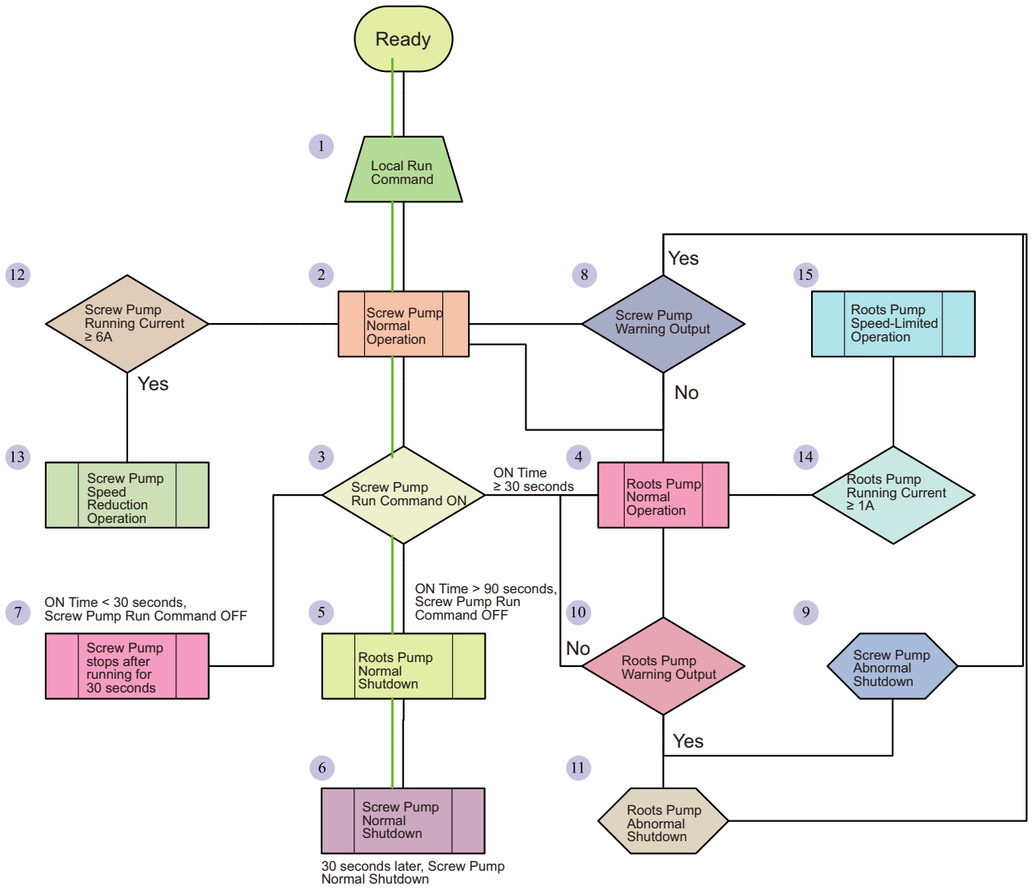
6. Overall Flowchart, see Chart 1 below.



Process	Meaning
Normal Operation	1 → 2 → 3 → 4 → 5 → 6
Run Command ON briefly, then Run Command OFF	7
Roots/Screw Interlock Alarm	8 9 10 11
Screw Pump Current-Limited Speed Reduction	12 → 13
Roots Pump Current-Limited Speed Reduction	14 → 15

Symbol	Meaning
	Ready
	Manual Operation
	Predefined Process
	Decision
	End

2.2 Terminal Run Mode

Mode Entry: SS1/2 (Left) + SS3/4 (Right) + SS5/6 (Right) = Terminal Run Command Mode + HMI Mode (can control frequency commands, run commands, and all other parameters) (Optional).
1. Function Description: Provides control commands, frequency commands, and all other parameters for the screw pump and Roots pump. The customer manually or via a host computer controls all system parameters and logic functions (except for fault handling procedures).
2. Startup Sequence: Defined by the customer.
3. Operation Sequence: Defined by the customer.
4. Included Functions: Functions marked A and B in the client terminal wiring schematic.

- 4.1 Roots Run Command (A);
- 4.2 Roots Analog Function Selection (A);
- 4.3 Roots Fault Reset (A);
- 4.4 Roots Alarm Output (A);
- 4.5 Roots Analog Input (A);
- 4.6 Screw Run Command (B);
- 4.7 Screw Analog Function Selection (B);
- 4.8 Screw Fault Reset (B);
- 4.9 Screw Alarm Output (B);
- 4.10 Screw Analog Input (B);
- 4.11 Station Communication Port (B);

5. Shutdown Sequence: Defined by the customer.
6. Fault Handling Sequence: Interlock shutdown. If an error occurs during operation of either the screw pump or the Roots pump, an interlock mechanism actively forces the other pump to shut down.

2.4 External Host Computer Mode

1. Mode Entry: SS1/2 (Right) + SS3/4 (Right) + SS5/6 (Left) = Local Run Command Mode + External Host Computer Mode.

1. Function Description: In this mode, the pumping system is controlled by the start switch on the rear panel of the system.
2. Startup Sequence: Sequential control startup. After pressing the start switch, the screw pump starts immediately, and the Roots pump starts with a 30-second delay. If the start command is interrupted before the Roots pump starts, the Roots pump will not start, and the screw pump will stop running after a 30-second delay.
3. Operation Sequence: Both the screw and Roots pumps have current-limiting protection; if the current exceeds the limit, the operating frequency will be reduced to a specified value. Specific parameters vary by station model.
4. Shutdown Sequence: Sequential control shutdown. After resetting the start switch, the Roots pump begins shutdown immediately, and the screw pump shuts down with a 30-second delay.
If the shutdown command is canceled before the screw pump stops, the Roots pump will still restart 30 seconds after the command is canceled.
5. Fault Handling Sequence: Interlock shutdown. If an error occurs during operation of either the screw pump or the Roots pump, an interlock mechanism actively forces the other pump to shut down.
6. Overall Flowchart, see Chart 1.

2. SS1/2 (Right) + SS3/4 (Right) + SS5/6 (Left) = Terminal Run Command Mode + External Host Computer Mode.
1. Function Description: Provides control commands, frequency commands, and all other parameters for the screw pump and Roots pump. The customer manually or via a host computer controls all system parameters and logic functions (except for fault handling procedures).
2. Startup Sequence: Defined by the customer.
3. Operation Sequence: Defined by the customer.
4. Included Functions: Functions marked A and B in the client terminal wiring schematic.

- 4.1 Roots Run Command (A);
- 4.2 Roots Analog Function Selection (A);
- 4.3 Roots Fault Reset (A);
- 4.4 Roots Alarm Output (A);
- 4.5 Roots Analog Input (A);
- 4.6 Screw Run Command (B);
- 4.7 Screw Analog Function Selection (B);
- 4.8 Screw Fault Reset (B);
- 4.9 Screw Alarm Output (B);
- 4.10 Screw Analog Input (B);
- 4.11 Station Communication Port (B);

5. Shutdown Sequence: Defined by the customer.
6. Fault Handling Sequence: Interlock shutdown. If an error occurs during operation of either the screw pump or the Roots pump, an interlock mechanism actively forces the other pump to shut down.

3.VSU Series Operation Function Overview

3.1 Run Command

1. In Local Control Mode (set DIP switch SS1/2 to the right side, as shown in Figure 2 "SS1/2 Position under Local Control Command"), then press the start button.
2. In Terminal Control Mode (set DIP switch SS1/2 to the left side, as shown in Figure 3 "SS1/2 Position under Terminal Control"):

    2.1 Short VSP-MI1 and VSP-DCM to run the screw pump (as shown in Figure 4 "Screw Pump Run Command Wiring Method"). Note: The screw pump is set with a 30-second delayed shutdown (parameters can be modified via host computer or HMI).
    2.2 Short VBP-MI1 and VBP-DCM to run the Roots pump (as shown in Figure 5 "Roots Pump Run Command Wiring Method"

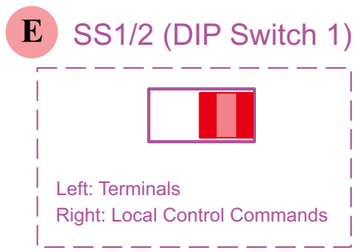


Figure 2 SS1/2 Position under Local Control Command

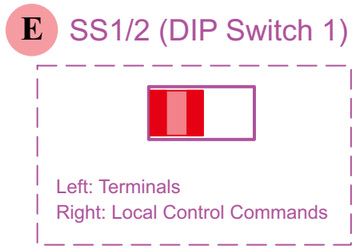


Figure 3 SS1/2 Position under Terminal Control

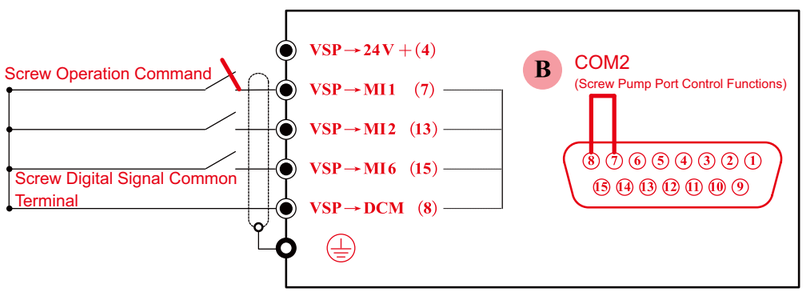


Figure 4 Screw Pump Run Command Wiring Method

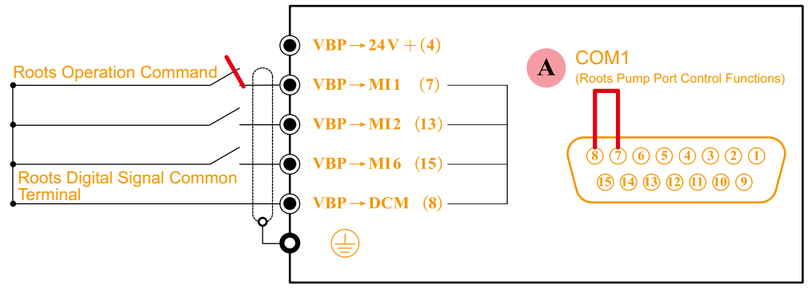


Figure 5 Roots Pump Run Command Wiring Method

3. In HMI Mode (set DIP switches SS3/4 and SS5/6 to the right side, as shown in Figure 6): Can be controlled by touch buttons on the HMI.

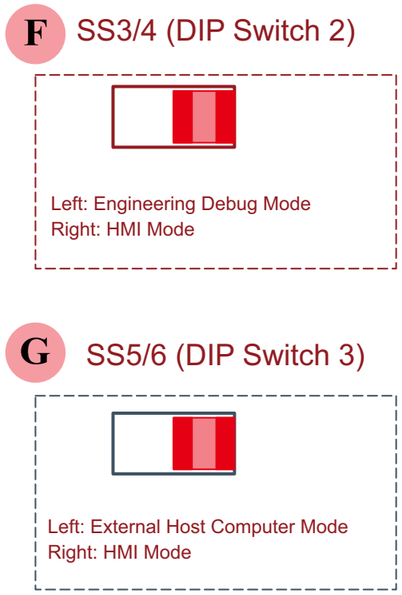


Figure 6 SS3/4 and SS5/6 Positions in HMI Mode

4. In External Host Computer Mode (set DIP switch SS3/4 to the right side, SS5/6 to the left side, as shown in Figure 7 "SS3/4 and SS5/6 Positions in External Host Computer Mode"): Run commands, etc., can be controlled via host computer communication.

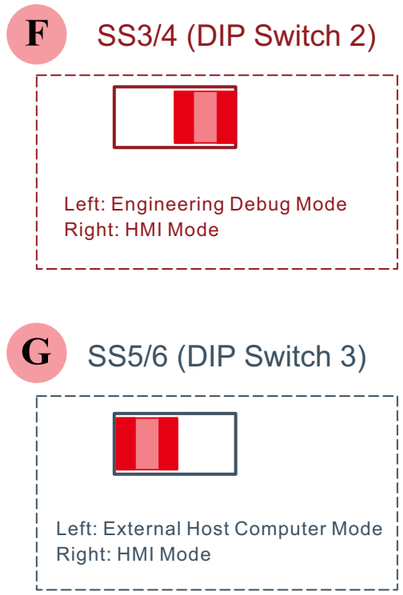


Figure 7 SS3/4 and SS5/6 Positions in External Host Computer Mode

1. When DIP switch SS1/2 is set to the right side:

1.1 The communication protocol is 9600-8-N-2. Station numbers are: Screw Pump Frequency Converter station 1, Screw Pump Built-in PLC station 2, Roots Pump Frequency Converter station 2, Roots Pump Built-in PLC station 4.

1.2 Write data 16#1 to MODBUS address 0801H of station 2 to start the pumping system. The station will start following the normal timing sequence.

Function Name	Modbus Address	Attribute (Function Code)	Size	Function Description	
Station Run Command	0801H	R(01H)/W(05H)	U16	bit1 ~ 0	00B：Stop
				bit1 ~ 0	01B：Run

2. When DIP switch SS1/2 is set to the left side:

2.1 Write data 16#1 to MODBUS address 0801H of station 2 to start the screw pump. Write data 16#1 to MODBUS address 0801H of station 4 to start the Roots pump.

Function Name	Modbus Address	Attribute (Function Code)	Size	Function Description	
Single Pump Run Command	0801H	R(03H)/W(06H、10H)	U16	bit1 ~ 0	00B：Stop
				bit1 ~ 0	01B：Run

Figure 7 SS3/4 and SS5/6 Positions in External Host Computer Mode

3.2 Frequency Command

1. The preset frequency cannot be adjusted in Local Run Mode; it can only be adjusted via the frequency converter panel.
2. In Terminal Control Mode, analog signals can be used to adjust the frequency.

2.1 Adjustment in Terminal Control Mode (set DIP switch SS1/2 to the left side, as shown below):

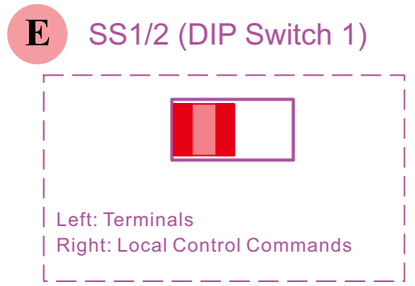


Figure 8 SS1/2 Position in Terminal Control Mode

2.2 For the screw pump, short VSP-MI1, VSP-MI2, and VSP-DCM to enable the analog control command, and connect the analog signal to VSP-ACI and VSP-ACM, as shown in Figure 9. For the Roots pump, short VBP-MI1, VBP-MI2, and VBP-DCM to enable the analog control command, and connect the analog signal to VBP-ACI and VBP-ACM, as shown in Figure 10 (Note: Figure number corrected per context).

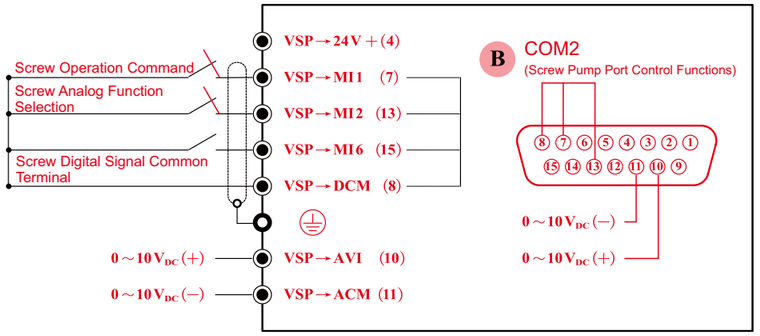


Figure 9 Screw Pump Analog Control Wiring Diagram

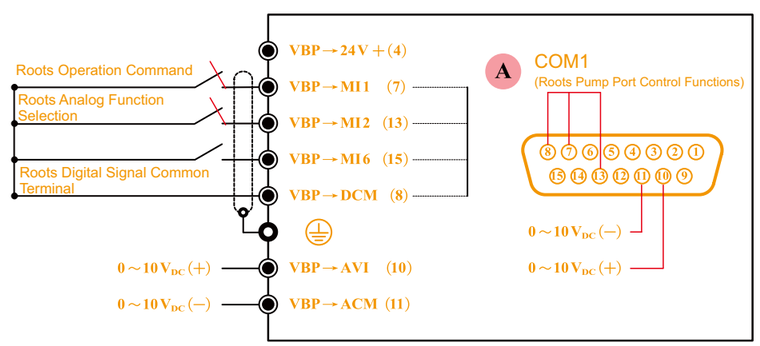


Figure 10 Roots Pump Analog Control Wiring Diagram

3. Analog 0-10VDC Correspondence:

Pump Type		Frequency	Speed	Corresponding Analog Voltage
Screw Pump	VSP8/20/40	0-320Hz	0-4800rpm	0-10VDC
	VSP60	0-280Hz	0-4200rpm	0-10VDC
Roots Pump	VBP100/300L	0-70Hz	0-4200rpm	0-10VDC

Table 10 Analog Voltage vs. Frequency Correspondence

4. In HMI Mode, directly modify frequency parameters via the touch screen parameter input window, as shown in Figure 11 below:

DCIOT Simulator

Delayed Shutdown Function Timeout	0	s	Screw Normal Operating Frequency	000.00	Hz
Screw Pump Delayed Shutdown Time	0	s	Screw First Acceleration Time	000.00	s
Time 3	0	s	Screw First Deceleration Time	000.00	s
Roots Pump Start Delay Time	0	s	PID Feedback Terminal Selection	0	
Power Disconnect Time	0	s	P	0	
Time 6	0	s	I	0	
			D	0	
Shutdown Purge Duration Record	0	s	Screw Current Limit	0.0	A
Operation Purge Duration Record	0	s	Roots Start Time	000.0	s
Screw Pump Shutdown Delay Time	000	s	Roots Normal Operating Frequency	00.00	Hz
Shutdown Purge Delay Time	000	s	Roots First Acceleration Time	000.00	s
Operation Purge Time Setting	0	s	Roots First Deceleration Time	000.00	s
			Roots Current Limit	0.0	A
			Roots Frequency after Current Limit	00.00	Hz
			Unlock	0	0

Figure 11 Modifying Operating Frequency via Touch Screen

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5. In External Host Computer Control Mode:

5.1 In External Host Computer Mode (set DIP switch SS3/4 to the right side, SS5/6 to the left side, as shown in Figure 12 "SS3/4 and SS5/6 Positions in External Host Computer Mode"): Run commands, etc., can be controlled via host computer communication.

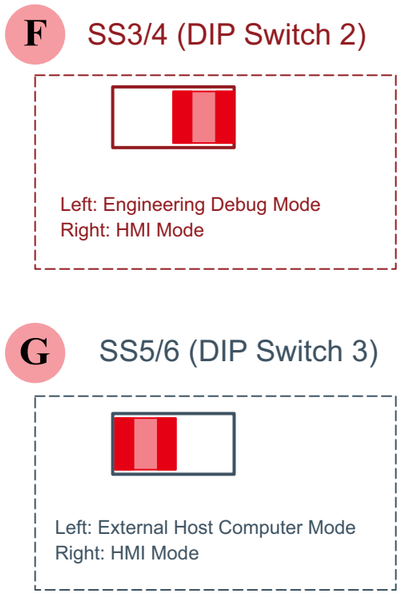

Figure 12 SS3/4 and SS5/6 Positions in External Host Computer Mode

5.2 The communication protocol is 9600-8-N-2. Station numbers are: Screw Pump Frequency Converter station 1, Screw Pump Built-in PLC station 2, Roots Pump Frequency Converter station 2, Roots Pump Built-in PLC station 4.

5.3 Writing data 16#28000 (280Hz) to MODBUS address 0432H of station 1 sets the screw pump frequency to 280Hz. Writing data 16#7000 (70Hz) to MODBUS address 0432H of station 3 sets the Roots pump frequency to 70Hz.

Function Name	Modbus Address	Attribute (Function Code)	Size	功能说明
Frequency Command	0432H	R(03H)/ W(06H,10H)	U16	Frequency Command (XXX.XXHz) Standard machines use 2 decimal places; High-speed machines use 1 decimal place (320Hz = 32000). 1000 = 10 seconds
First Acceleration Time	0433H			1000=10 seconds
First Deceleration Time	0434H			1000=10 seconds

Table 11 Run Command and Frequency Command Communication Address Table

6. In Engineering Debug Mode.

6.1 Use DIA series software to debug the station.

DIAStudio	DIASelector Fast and intelligent product selection tool	Times New Roman	Debugging Features
 **An All-in-one integrated platform** Simplifies engineering development process, reduces system configuration time High-efficiency machine system development Product Selection Programming Device Configuration Debugging Tools Visualization	DIADesigner Integrated development and programming software	Programming Configuration Debugging	Parameter Setting Gain Tuning Motion Control Setup Oscilloscope Device Wizard Status Monitoring
	DIADesigner-AX Motion control development and programming software	Programming Configuration Debugging	
	DIAScreen Intuitive visualization software	HMI operation interface design Parameter sharing with DIADesigner	
3	4		

Download link:
https://downloadcenter.delta-china.com.cn/zh-CN/DownloadCenter?v=1&CID=06&itemID=060706&dat aType=1,8 &sort_expr=cdate&sort_dir=DESC

4. Communication Operations

1. In Local Run Mode and Terminal Control Mode, read status parameters via MODBUS-RTU. It is not recommended to write parameters via communication in these two modes. Note: The run and frequency commands should be controlled by only one method at a time to avoid control logic confusion.
2. In HMI Mode, all parameters are controlled via the screen.

Screw Operating Frequency		000	Hz	Roots Operating Frequency		Hz	▷	0
Line Current		00	A	Line Current		A	Screw	
Screw IGBT Temperature		00	℃	Roots IGBT Temperature		℃		
Screw Output Power		0	kW	Roots Output Power		kW	Roots	
Screw ACI Analog Value		00	VDC	Roots ACI Analog Value		VDC		
Screw AVI Analog Value		00	VDC	Roots AVI Analog Value		VDC	▷	0
Digital Output Status		0		Digital Output Status			Operation Purge	
Digital Input Status		0		Digital Input Status				
Screw Pump Error	0	0:	No Error Recorded	Roots Pump Error	0	No Error Recorded		
Run Status	0		Stop	Run Status0	0	Stop		
Running Direction	0		Forward	Running Direction	0	Forward	▷	0
Screw Pump Warning	0	0:	No Error Recorded	Roots Pump Warning	0	No Error Recorded	Shutdown Purge	
Screw Run Time	0	Day	0 Minute	Roots Run Time	0	0 Minute		

Delayed Shutdown Function Timeout	0	s	Sscrew Normal Operating Frequency	000.00	Hz
Screw Pump Delayed Shutdown Time	0	s	Screw First Acceleration Time	000.00	s
Time 3	0	s	Screw First Deceleration Time	000.00	s
Roots Pump Start Delay Time	0	s	PID Feedback Terminal Selection	0	
Power Disconnect Time	0	s	P	0	
Time 6	0	s	I	0	
			D	0	
Shutdown Purge Duration Record	0	s	Screw Current Limit	0.0	A
Operation Purge Duration Record	0	s	Roots Start Time	000.0	s
Screw Pump Shutdown Delay Time	000	s	Roots Normal Operating Frequency	00.00	Hz
Shutdown Purge Delay Time	000	s	Roots First Acceleration Time	000.00	s
Operation Purge Time Setting	0	s	Roots First Deceleration Time	000.00	s
			Roots Current Limit	0.0	A
			Roots Frequency after Current Limit	00.00	Hz
			Unlock 0	0	

3. In External Host Computer Control Mode, control station functions via MODBUS-RTU.

1. The station's default factory setting is the frequency converter's built-in PLC forcibly controlling the run and frequency commands. In this mode, the system must be controlled using the special addresses provided by our company.

Station Number	Function Name	Modbus Address	Attribute (Function Code)	Size	Function Description	
2,4	Single Pump Run Command	0801H	H,R(03H) /W(0610H)	U16	bit1~0	00B: Stop
					bit1~0	01B: Run
1,3	Frequency Command	0432H			Frequency Command (XXX.XXHz) Standard machines use 2 decimal places; High-speed machines use 1 decimal place (320Hz = 32000).	
1,3	First Acceleration Time	0433H			1000 = 10 seconds	
1,3	First Deceleration Time	0434H			1000 = 10 seconds	
1	Screw Pump Current Limit	0439H			60=6A	
1	Roots Pump Delayed Start Time	043AH			300 = 30 seconds	
1	Screw Pump Shutdown Delay Time	043BH			300 = 30 seconds	
3	Roots Current Limit	0435H			10=1A	
3	Roots Current-Limited Operating Frequency	0436H			1000=10Hz	
3	Operation Purge Time Setting	0437H			50 = 5 seconds	
3	Operation Purge Start Command	0439H			0: OFF; 1: START	
3	Shutdown Purge Start Command	043AH			0: OFF; 1: START	

2. If only reading frequency converter or frequency converter built-in PLC parameters, they can be read via the following addresses.

3. Status Information (21XX): Communication station number is the set value of parameter 09-00.

Function Name	Modbus Address	Attribute	Size	Function Description	
Fault Status	2100H	R(03H)	U16	bit7~0: Error Code bit15~8: Warning Code	
Frequency Converter Operation Status	2101H	R(03H)	U16	bit1~0 Run/Stop Status	00B: Frequency Converter Stopped (RUN indicator OFF / STOP indicator ON)
					01B: Frequency Converter Decelerating to Stop (RUN indicator blinking / STOP indicator ON)
					10B: Frequency Converter in Standby (RUN indicator ON / STOP indicator blinking)
					11B: Frequency Converter Running (RUN indicator ON / STOP indicator OFF)
Frequency Command	2102H	R(03H)	U16	Frequency Command (XXX.XX Hz) 1: Speed Mode → Speed Command 2: Torque Mode → Speed Limit	
Output Frequency	2103H	R(03H)	U16	Frequency Converter Output Frequency (XXX.XX Hz)	
Output Current	2104H	R(03H)	U16	Frequency Converter Output Current (XX.XX A). When current exceeds 655.35, it automatically switches to one decimal place representation (XXX.X A). The number of decimal places can be determined by referring to the High byte of 211F.	
DC Bus Voltage	2105H	R(03H)	U16	Frequency Converter DC Bus Voltage (XXX.X V)	
Output Voltage	2106H	R(03H)	U16	Frequency Converter Output Voltage (XXX.X V)	
Multi-Step Speed Status	2107H	R(03H)	U16	Currently executing step speed command of the frequency converter multi-step speed (0 is the main speed).	
Count Value	2109H	R(03H)	U16	Current count value of the MI terminal counting function.	
Output Power Factor Angle	210AH	R(03H)	U16	Frequency Converter Output Power Factor Angle (XXX.X) (0.0 degrees ~ 180.0 degrees)	
Output Torque	210BH	R(03H)	U16	Output Torque (XXX.x%)	
Motor Actual Speed	210FH	R(03H)	U16	Motor Actual Speed (XXXXX rpm)	
Output Power		R(03H)	U16	Frequency Converter Output Power (XXXX.X kW)	
Multi-function Display	2116H	R(03H)	U16	This address is used to display the Low Word value of the user-defined selected item (parameter 00-04). The value is low 16 bits data.	
User-Defined Maximum Value	211BH	R(03H)	U16	Maximum Set Frequency (parameter 01-00) or Maximum Set Physical Quantity (parameter 00-26): • When parameter 00-26 is set to 0: This value equals the setting of parameter 01-00. • When parameter 00-26 is set to non-0, and the control source is the digital operator: This value = parameter 00-24 x parameter 00-26 / parameter 01-00. • When parameter 00-26 is set to non-0, and the control source is 485: This value = parameter 09-10 x parameter 00-26 / parameter 01-00.	
Output Current Decimal Places	211FH	R(03H)	U16	High byte: Current Decimal Places (display).	

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4. Status Information (22XX): Communication station number is the set value of parameter 09-00.

Function Name	Modbus Address	Attribute	Size	Function Description
Output Current	2200H	R(03H)	U16	Displays frequency converter output current. When current exceeds 655.35, it automatically switches to one decimal place representation (XXX.X A). The number of decimal places can be determined by referring to the High byte of 211F.
Count Value	2201H	R(03H)	U16	Count Value
Output Frequency	2202H	R(03H)	U16	Motor actual operating frequency (XXXXX Hz).
DC Bus Voltage	2203H	R(03H)	U16	DC bus voltage value inside the frequency converter (XXX.X V).
Output Voltage Value	2204H	R(03H)	U16	U, V, W output voltage values of the frequency converter (XXX.X V).
Power Factor Angle	2205H	R(03H)	U16	Power factor angle output by the frequency converter (XXX.X deg).
Output Power	2206H	R(03H)	U16	Displays U, V, W output power (XXXX.X kW).
Motor Actual Speed	2207H	R(03H)	U16	Motor speed estimated by the frequency converter or fed back from an encoder,in rpm units (XXXXX rpm).
Output Torque	2208H	R(03H)	U16	Positive/Negative output torque % estimated by the frequency converter (+0.0: positive torque; -0.0: negative torque) (XXX.X%).
PID Feedback Value	220AH	R(03H)	U16	After the PID function is started, displays the PID feedback value in % (XXX.XX%).
AVI Analog Input	220BH	R(03H)	U16	Displays the signal value of the AVI analog input terminal. 0~10v corresponds to 0.00~100% (refer to parameter 00-04, Note 2).
ACI Analog Input	220CH	R(03H)	U16	Displays the signal value of the ACI analog input terminal. 4~20mA / 0~10V corresponds to 0.00~100% (as per Note 2).
IGBT Temperature	220EH	R(03H)	U16	Power module IGBT temperature (XXX.X℃).
Digital Input Status	2210H	R(03H)	U16	Digital input ON/OFF status. Refer to parameter 02-12. (Refer to parameter 00-04, Note 3).
Digital Output Status	2211H	R(03H)	U16	Digital output ON/OFF status. Refer to parameter 02-18. (Refer to parameter 00-04, Note 4).
Multi-Step Speed	2212H	R(03H)	U16	Currently executing step speed command.
CPU Pin Status Corresponding to Digital Inputs	2213H	R(03H)	U16	CPU Pin Status Corresponding to Digital Inputs (Refer to parameter 00-04, Note 3).
CPU Pin Status Corresponding to Digital Outputs	2214H	R(03H)	U16	CPU Pin Status Corresponding to Digital Outputs (Refer to parameter 00-04, Note 4).
Pulse Input Frequency	2216H	R(03H)	U16	Pulse input frequency (XXX.XX Hz).
Overload Count	2219H	R(03H)	U16	Overload count (XXX.XX%).
GFF Ground Fault Current	221AH	R(03H)	U16	GFF value (XXX.XX%).
DC Bus Ripple Voltage	221BH	R(03H)	U16	DC bus ripple voltage (XXX.X V).

PLC Register	221CH	R(03H)	U16	Value of PLC register D1043.
Pole Segment	221DH	R(03H)	U16	Pole segment of synchronous motor.
User-Defined Output Display	221EH	R(03H)	U16	User physical quantity output.
Parameter 00-05 User Gain	221FH	R(03H)	U16	Output value of parameter 00-05 (XXX.XX Hz).
Control Mode	2223H	R(03H)	U16	Frequency Converter Control Status 0: Speed Control Mode 1: Torque Control Mode
Carrier Frequency	2224H	R(03H)	U16	Frequency converter operating carrier frequency (XX kHz).
Frequency Converter Status	2226H	R(03H)	U16	Frequency Converter Status bit1~0: 00b: No direction 01b: Forward 10b: Reverse bit3~2: 01b: Frequency converter ready 10b: Fault bit4: 0b: Frequency converter has no output 1b: Frequency converter has output bit5: 0b: No warning 1b: Warning present
Positive/Negative Torque	2227H	R(03H)	U16	Positive/Negative output torque estimated by the frequency converter (XXXX Nt-m).
Torque Command	2228H	R(03H)	U16	Torque command (XXX.X%).
kWh	2229H	R(03H)	U16	kWh display (XXXX.X).
PID Reference Target	222EH	R(03H)	U16	PID reference target (XXX.XX%).
PID Compensation	222FH	R(03H)	U16	PID offset (XXX.XX%).
PID Output Frequency	2230H	R(03H)	U16	PID output frequency (XXX.XX Hz).
Auxiliary Frequency	2232H	R(03H)	U16	Auxiliary frequency display.
Main Frequency	2233H	R(03H)	U16	Main frequency display.
Frequency after Adding/ Subtracting Main and Auxiliary Frequencies	2234H	R(03H)	U16	Display of frequency after adding/subtracting main and auxiliary frequencies.

5. If the host computer needs to fully take over run commands and frequency commands. This means all default settings, including preset protection logic, need to be disabled. Then, the user needs to implement their own logic protection functions in the host computer system. Then, the user can fully utilize all addresses and commands related to frequency converter communication.
6. Frequency Converter Internal Parameter Settings (Ggxx): Communication station number is the set value of parameter 09-00.

Function Name	Modbus Address	Attribute (Function Code)	Size	Function Description
Parameter Read	GGnnH	R(03H)/ W(06H, 10H)	U16	GG represents the parameter group, nn represents the parameter number. Example: The Modbus address for reading/writing parameter 04-10 is 040AH.(Use Delta VFDsoft software for reading).

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7. Control Commands (20xx): Communication station number is the set value of parameter 09-00.

Function Name	Modbus Address	Attribute (Function Code)	Size	Function Description		
	2000H	R(03H)/ W(06H 10H)	U16	bit1~0	00B: No function 01B: Stop 10B: Start 11B: JOG Start	1： After receiving a command once, it will maintain the operating state specified by that command until a new command is received to change the state. 2: "Operation Command Source" must be set to communication for this field to be effective (parameter 00-21 = 2).
				bit5~4	00B: No function 01B: Forward direction command 10B: Reverse direction ommand 11B: Change current direction command	
				bit7~6	00B: First acceleration/ deceleration 01B: Second acceleration/ eceleration 10B: Third acceleration/ deceleration 11B: Fourth acceleration/ deceleration	1: To enable the function of this field, bit12 of address 2000h must first be set to 1. 2: The currently executed step speed can be known by reading 2107h.
				bit11~8	0000B: Main speed 0001B: First step speed 0010B: Second step speed 0011B: Third step speed 0100B: Fourth step speed 0101B: Fifth step speed 0110B: Sixth step speed 0111B: Seventh step speed 1000B: Eighth step speed 1001B: Ninth step speed 1010B: Tenth step speed 1011B: Eleventh step speed 1100B: Twelfth step speed 1101B: Thirteenth step speed 1110B: Fourteenth step speed 1111B: Fifteenth step speed	
				bit12	1: Enable the function of bits 06~11	
	2001H	R(03H)/ W(06H, 10H)	U16	Frequency Command (XXX.XXHz) Standard machines use 2 decimal places; High-speed machines use 1 decimal place (320Hz = 32000).		
	2002H	R(03H)/ W(06H, 10H)	U16	bit0	1: External Fault (EF) ON	Used to trigger an external fault to the frequency converter to halt operation. The stopping method can be set via frequency converter parameters.
				bit1	1: Reset Command	Used to clear the fault status.
				bit2	1: External Interrupt (B.B) ON	Triggers an external interrupt to the frequency converter unit to pause operation. When this bit = 0 is cleared, the frequency converter unit will immediately resume its previous operating state.
				bit5	1: Fire Mode Trigger	Prevents the frequency converter from shutting down due to its own protection, allowing critical fans to maintain operation regardless of any control signals or alarms.

4. STO Function

1. The MS300 series provides a Safe Torque Off (STO) function. It uses dual-channel S1 and S2 signal inputs to cut off IGBT switching, thereby preventing motor torque generation to achieve a safe stop. The frequency converter's built-in STO function complies with:

1.1 ISO 13849-1:2015 Category 3 PL d

1.2 .IEC 61508 SIL2

1.3 EN 62061 SIL CL 2

1.4 EN 60204-1 Category 0

2. The action logic and panel display after S1/S2 signal input are described in Table 12 "Action Logic and Panel Display Description".

Signal	Status			
S1~DCM	ON	ON	OFF	OFF
S2~DCM	ON	OFF	ON	OFF
Frequency Converter Output	Ready, output enabled	STL2 Mode Torque Output Stop	STL1 Mode Torque Output Stop	STO Mode Torque Output Stop
Panel Fault Display	No Fault Display	STL2	STL1	STO

Table 12 Action Logic and Panel Display Description

2.1 STO indicates channels 1 and 2 are both active, entering Safe Torque Off.

2.2 STL1 indicates channel 1 is active.

2.3 STL2 indicates channel 2 is active.

2.4 STL3 indicates an internal circuit fault is diagnosed in channel 1 or channel 2.

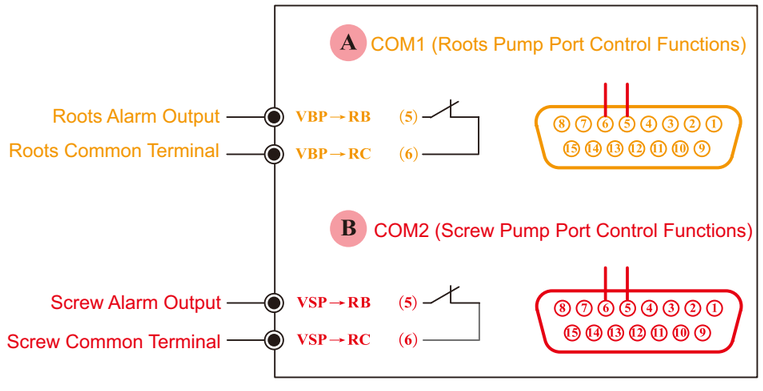
2.5 S1~DCM / S2~DCM ON (conducting): Indicates S1~DCM / S2~DCM has an input voltage greater than 11VDC.

2.6 S1~DCM / S2~DCM OFF (open circuit): Indicates S1~DCM / S2~DCM has an input voltage less than 5VDC.

5. VSU Series Fault Indications and Reset Functions

5.1 Fault Indications

1.1 In Terminal Control Mode, alarm digital signals can be output.



1.2 Error contents can be directly viewed on the frequency converter panel;

1.3 If reading error codes via communication, warnings and errors correspond to the table below.

Warning Code Description			
Setting Value	Warning Name	Setting Value	Warning Name
0	No Error Recorded	52	Runtime Data Error (PLdA)
1	Communication Error (Ce1)	53	Download Function Code Error (PLFn)
2	Communication Data Location Error (CE2)	54	PLC Register Overflow (PLor)
3	Communication Content Value Error (CE3)	55	Runtime Function Code Error (PLFF)
4	Frequency Converter Unable to Process (CE4)	56	Checksum Error (PLSn)
5	Communication Transmission Timeout (CE10)	57	No End Instruction (PLEd)
7	Parameter Copy Error (SE1)	58	PLCMCR Instruction Error (PLCr)
8	Parameter Copy Error (SE2)	59	PLC Download Error (PLdF)
9	IGBT Overheat Warning (OH1)	60	PLC Scan Time Timeout (PLSF)
11	PID Feedback Signal Error (PID)	70	Communication Card Node Error (ECid)
12	ACI Mode Analog Signal Loss (AnL)	71	Communication Card Undervoltage(ECLv)
13	Low Current Warning (uC)	72	Communication Card Test Mode (ECtt)
17	Overspeed Warning (oSPd)	73	Communication Card Hardware Disconnect (ECbF)
18	Speed Deviation Too Large (dAvE)	74	Communication Card No Power Supply (ECnP)
19	Input Phase Loss (PHL)	75	Factory Custom Error (ECFF)
20	Over-torque (ot1)	76	Internal Severe Error (ECiF)
21	Over-torque (ot2)	78	Parameterization Data Error (ECPP)
22	Motor Overheat (oH3) PTC/KTY-84/PT100	79	Configuration Data Error (ECPi)
24	Excessive Slip (oSL)	80	Ethernet Connection Error (ECEF)
25	Parameter Auto-tuning (tUn)	81	Communication Timeout with Frequency Converter (ECto)
28	Output Phase Loss Warning (OPHL)	82	Checksum Error (ECCS)
30	Model Mismatch Copy Error (SE3)	83	Restore to Factory Defaults (ECrF)
31	Over-torque (ot3)	84	Exceeded Maximum Communication Number (Eco0)
32	Over-torque (ot4)	85	Exceeded Maximum Communication Number (ECo1)
36	CANopen Software Disconnect (CGdn)	86	P Error (ECiP)
37	CANopen Software Disconnect (CHbn)	87	Mail Error (EC3F)
39	CANopen Hardware Disconnect (CbFn)	88	Communication Card Busy (ECbY)
40	CANopen Index Error (Cldn)	89	Communication Card Detached (ECCb)
41	CANopen Station Number Error (CAdn)	90	PLC Copy: Password Error (CPLP)
42	CANopen Memory Error (CFrn)	91	PLC Copy: Read Mode (CPLO)
43	CANopen SDO Transmission Timeout (CSdn)	92	PLC Copy: Write Mode (CPL1)
44	CANopen SDO Receive Overflow (CSbn)	93	PLC Copy: Version Error (CPLv)
45	CANopen Boot Message Error Warning (Cbtn)	94	PLC Copy: Capacity Error (CPLS)
46	CANopen Format Error (CPtn)	95	PLC Copy: PLC Must Be Off (CPLF)
50	PLC Download Error (PLod)	96	PLC Copy: Timeout Error (CPLt)
51	PLC Download Save Error (PLSV)		

Table 13 Warning Code Description

Fault Display Code Description			
Setting Value	Fault Name	Setting Value	Fault Name
0	No Error Recorded	44	PG Feedback Stall (PGF3)
1	Overcurrent During Acceleration (oCA)	45	PG Rotation Difference Abnormal (PGF4)
2	Overcurrent During Deceleration (ocd)	48	ACI Disconnect (ACE)
3	Overcurrent During Constant Speed Operation (ocn)	49	External Terminal Fault (EF)
4	Ground Fault Protection Circuit Activated (GFF)	50	External Terminal Emergency Stop (EF1)
6	Overcurrent While Stopped (ocS)	51	External Interrupt (bb)
7	Overvoltage During Acceleration (ovA)	52	Password Input Error Three Times (Pcod)
8	Overvoltage During Deceleration (ovd)	54	Invalid Communication Command (CE1)
9	Overvoltage During Constant Speed \ Operation (ovn)	55	Invalid Communication Address (CE2)
10	Overvoltage While Stopped (ovS)	56	Communication Data Value Error (CE3)
11	Undervoltage During Acceleration (LvA)	57	Communication Write to Read-Only Address (CE4)
12	Undervoltage During Deceleration (Lvd)	58	Modbus Transmission Timeout (CE10)
13	Undervoltage During Constant Speed (Lvn)	61	Motor Y-Delta Switching Error (ydc)
14	Undervoltage While Stopped (LvS)	62	Deceleration Energy Regeneration Action (dEb)
15	Input Phase Loss Protection (OrP)	63	Excessive Slip (oSL)
16	IGBT Overtemperature (OH1)	72	S1 Internal Circuit Fault Detected (STL1)
18	IGBT Temperature Detection Abnormal (tH10)	76	STO (STO)
21	Frequency Converter Overload (oL)	77	S2 Internal Circuit Fault Detected (STL2)
22	Electronic Thermal Relay 1 Protection (EOL1)	78	Internal Circuit Fault Detected (STL3)
23	Electronic Thermal Relay 2 Protection (EoL2)	79	U-phase Short Detected Before Operation (Aoc)
24	Motor Overheat PTC/PT100 (oH3)	80	V-phase Short Detected Before Operation (boc)
26	Over-torque 1 (ot1)	81	W-phase Short Detected Before Operation (coc)
27	Over-torque 2 (ot2)	82	Output Phase Loss U-phase (oPL1)
28	Low Current (uC)	83	Output Phase Loss V-phase (oPL2)
31	Memory Read Error (cF2)	84	Output Phase Loss W-phase (oPL3)
33	U-phase Current Detection Error (cd1)	87	Low-frequency Overload Protection (oL3)
34	V-phase Current Detection Error (cd2)	89	Rotor Position Detection Error (roPd)
35	W-phase Current Detection Error (cd3)	101	CANopen Disconnect (CGdE)
36	Cc Hardware Line Fault (HdO)	102	CANopen Disconnect (CHbE)
37	oc Hardware Line Fault (Hd1)	104	CANopen Hardware Disconnect (CbFE)
40	Motor Auto-tuning Error (AUE)	105	CANopen Index Error (CldE)
41	PID Disconnect ACI (AFE)	106	CANopen Station Number Error (CAdE)
43	PG Feedback Disconnect (PGF2)	107	CANopen Memory Error (CFrE)
121	Internal Communication Dedicated Error Code (CP20)	135	Internal Communication Dedicated Error Code (EoL4)
123	Internal Communication Dedicated Error Code (CP22)	140	oc Hardware Line Fault (Hd6)
124	Internal Communication Dedicated Error Code (CP30)	141	Ground Short Detected Before Operation (b4GFF)
126	Internal Communication Dedicated Error Code (CP32)	142	Motor Auto-tuning Error (AuE1)
127	Firmware Version Anomaly Error (CP33)	143	Motor Auto-tuning Error (AuE2)
128	Over-torque 3 (ot3)	144	Motor Auto-tuning Error (AuE3)
129	Over-torque 4 (ot4)	149	Motor Auto-tuning Error (AuE5)
134	Internal Communication Dedicated Error Code (EOL3)		

5.2 Reset Operation:

For the screw pump, short VSP-MI6 and VSP-DCM to reset, as shown in Figure 14; for the Roots pump, short VBP-MI6 and VBP-DCM to reset, as shown in Figure 15.

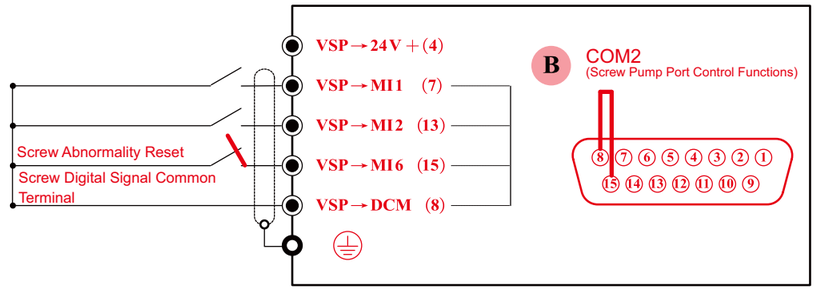


Figure 14 Screw Pump Reset

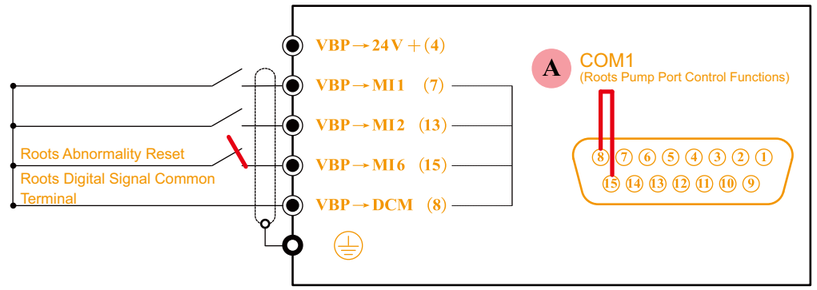


Figure 15 Roots Pump Reset

表 14 故障显示码说明

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