

TURBO MOLECULAR PUMP

Model : TMP-V2304LM

Specification

SHIMADZU CORPORATION
Semiconductor Equipment Division

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SHIMADZU TMP-V2304LM Standard Specification

1. Construction

1.1 Main Unit

One of followings :

Description	Inlet Flange	Outside dimensions	Notes	Part number
TMP-V2304LM	VG250	263-19600	—	263-18250-07
TMP-V2304LM	ISO250B	263-19601	Bolted flange	263-18250-08

1.2 Gas Purge Adaptor (Option)

This turbo molecular pump need to flow the purge gas for protection of the bearings, when it evacuates a lot of corrosive gas.

The proper purge gas flow rate is 30 mL/min.

One of followings :

Joint	Part number	Orifice Size	Description
KF10 (Clamp / Centering with O-ring)	262-77592-19	ϕ 0.5 mm	GP ADAPTOR, 0.5 KF10
KF10 (Dust cap)	262-77592-25	ϕ 0.5 mm	GP ADAPTOR 0.5, KF DUST CAP
UJR 6.35	263-14770	ϕ 0.5 mm	GP ADAPTOR, 0.5 UJR
SWAGELOK ϕ 6.35	263-14771	ϕ 0.5 mm	GP ADAPTOR, 0.5 SWG
4-VCR	263-14772	ϕ 0.5 mm	GP ADAPTOR, 0.5 VCR

Fig.1-1 is an example of gas purge piping diagram. Use a filter of 5 μ m or less in element size. Use flow control valve to control the flow rate.

Gas feed start	After starting backing vacuum pump ; before evacuating of process gas
Gas feed stop	After exhausting process gas sufficiently ; before stopping backing vacuum
Type of gas	Nitrogen gas (Purity > 99.99 %)

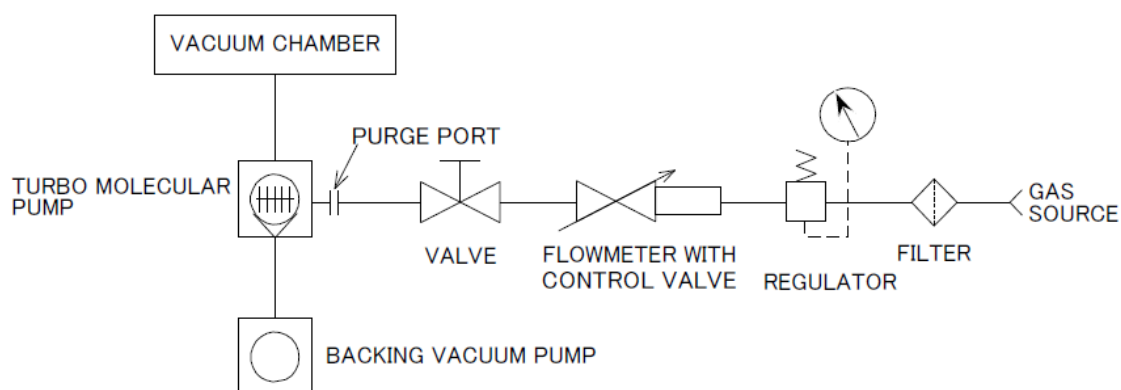


Fig. 1-1 Gas Purge Method (adaptor with ϕ 0.5 mm orifice)

1.3 Power Cable

One of followings :

	Part number	Description	Notes
1	262-76773-05	AC cable, 1003MD05 200	5 MT
2	262-76773-10	AC cable, 1003MD10 200	10 MT
3	262-76773-15	AC cable, 1003MD15 200	15 MT
4	262-76773-20	AC cable, 1003MD20 200	20 MT
5	263-41042	AC connector set	<ul style="list-style-type: none"> ▪ Connector ▪ Clamp ▪ Core ▪ Assembling procedure

1.4 Standard Accessories

	Description	Q'ty	Notes	Part number	Status
1	Gasket (inlet flange) (Note)	1	VG250 : O-ring gasket	036-13529-76	Attached to the pump
			ISO250B : Not included	—	—
2	Bolt set (inlet flange)	—	VG250 : Not included ISO250B : Not included	—	—
3	Dust cap (outlet flange)	1	KF40	267-93896-03	Attached to the pump
4	Connector for Remote Control	1	D-sub 37 pin male	070-02175-03 070-02174-03	Inside the box
5	Instruction manual	1	English or Japanese	263-12475 263-13475	Inside the box
6	Instruction manual (Serial Communication Specification)	1	English or Japanese	263-12476 263-13476	Inside the box

(Note) One of followings.

2. Specifications

2.1 Pump Main Unit

Turbo molecular pump		TMP-V2304LM
Inlet flange		VG250 / ISO250B
Outlet flange		KF40
Cooling Method		Water Cooled
Mass		56 kg
Ultimate pressure (after baking)		10^{-7} Pa order
Maximum flow quantity (Note 1)		Refer to chapter 2.2
Maximum allowable inlet pressure (N ₂ continuous exhaust) (Note 1)		4.5 Pa
Maximum allowable outlet pressure (N ₂ continuous exhaust) (Note 1)		200 Pa
Pumping speed (Note 2) (Note 3)	N ₂	2100 L/s
	Ar	2000 L/s
Compression ratio	N ₂	1×10^8 or more
	He	5×10^3
	H ₂	9×10^2
Rated speed		33,700 rpm
Start-up time		9 minutes or less
Mounting position		In any desired direction (Refer to chapter 4)
Vibration level (by Shimadzu's method)		0.01 μ m or less (0-peak)
Admissible pumping speed of backing vacuum pump in case of gas purge		1500 L/min or more
Display	LED	POWER / STATUS / ROTATION / NET (Refer to chapter 7)
Communication	Contact	REMOTE (D-sub 37 pin female, Screw lock size M2.6) Input : START / STOP / RESET / LOW SPEED Output : ROTATION / ACC. / BRAKE / NORMAL / REMOTE / ALARM / WARNING / CONNECTION
	Serial	RS-232C / RS-485 (D-sub 9 pin male, Screw lock size M2.6)
Speed variation		Speed is variable between 25 % and 100 % of the rated speed (set as 0.1 %).
Alarm history		Stores up to latest 99 alarms.
Momentary power failure (Note 4)		If the electrical power is recovered in 1 second or less, then the power supply operation prior to the electrical power failure is continued. No change output signal. Otherwise, the turbo molecular pump rotor is decelerated.
Water valve for dew interlock		The water valve is closed and coolant water supply is stopped at AC input OFF. (Refer to chapter 3(6)) The water valve is opened and the coolant water supply is continued during AC input ON.
Alarm Detection	Alarm	Pump temperature, Pump startup error, Overload, and Overspin for motor, Magnetic bearing failure, Control system malfunction (Over temperature inside control system or failure of drive circuit), Power interruption, Dew condensation (Refer to chapter 3), etc.
	Warning	Failure of magnetic bearing, Control system malfunction (Over temperature inside control system), Dew condensation (Water valve close. Refer to chapter 3)

Protection	Alarm	STATUS orange lamp illuminates. Power Interruption Alarm : Decelerated while maintaining levitation using regenerative power. After decelerating to specified low speed, levitation is stopped and rotor is supported by touchdown bearing. When power is restored, the pump can be restarted by resetting. Dew Alarm : The pump is decelerated after dew condensation alarm is detected. (Refer to chapter 3(6)) When other alarms occur : Stops operation or decelerates. Magnetic levitation is continued.
	Warning	STATUS orange lamp flashes and pump continues to function. (Dew Warning : Water valve is closed.)
Water	Flow rate Pressure Temperature (Note 5)	3 to 4 L/min 0.2 to 0.4 MPa 19 to 30 °C (above dew point)
	Water quality	Non-corrosive industrial water (not purified water) Solid particle size (Max) : 0.025 mm ² PH (@25°C) : 6.5 – 8.2 Electrical conductivity (@25°C) : 100 – 800 μS/cm (Electrical resistivity : 1250 – 10000 Ω cm)
Admissible ambient magnetic field	Radial direction Axial direction	3 mT 15 mT
Input electric Power	Voltage	Single phase 200 to 240 VAC ± 10 % (50 / 60 Hz ± 2 Hz)
	Maximum power	1.2 kVA
	Insulation withstand voltage	1500 V, 1 minute

- (Note 1) Maximum allowable flow rate, Maximum allowable inlet pressure and Maximum allowable outlet pressure can not be satisfied at same time.
- (Note 2) Without a protective net. Pumping speed for N₂ is 1950 L/s with a protective net.
- (Note 3) Do not use corrosive gas because there is possibility that the pump breaks down by the product material.
- (Note 4) In detection time is able to change to two seconds.
- (Note 5) Water temperature above dew point.

2.2 The maximum allowable flow rate

Gas type (Note 1)	The maximum allowable flow rate (Note 2) (Note 3)
Ar	600 mL/min (Note 4)

(Note 1) Consult your Shimadzu representative before using gasses except shown in above table.

(Note 2) The maximum allowable flow rate depends on the gas type.

(Note 3) Assuming the parts connected to the turbo molecular pump inlet at 35 °C celsius without gas purge. Maximum allowable flow rate for Ar is 850 mL/min when using gas purge.

(Note 4) mL/min : volume flow rate at 0 °C, 1 atm. (Compatible with SCCM.)

2.3 Environmental Conditions

Installation conditions (See EN61010-1 standard)		Use : Indoor, Altitude max : 2000 m Overvoltage category III, Pollution degree 2 IP classification 40
Temperatures	Operation	10 to 40 °C
	Storage	-25 to 70 °C
Relative humidity		40 to 80 %RH

2.4 Standards Fulfilled

Safety	EN61010-1 ; 2001 UL61010A-1 SEMI S2 EN1012-2 ; 1996
EMC	EN61326-1 ; 2006 class A SEMI F47

3. Attention in use

- (1) The TMP-V2304LM is a water cooled model. Always provide a flow of coolant water that meets the indicated specifications.
- (2) Make sure no water is leaking from the coolant lines. Do not spill coolant on the pump.
- (3) Confirm the cable from water valve is surely connected to VALVE connector of External I/F panel. (Refer to chapter 8)
- (4) Make sure that there is no condensation and not high humidity environment. Do not switch the power supply unit ON with condensation at the location indicated in Fig. 3-1.
- (5) If dew condenses inside controller during operation, dew warning turns on and the water valve is turns off so that the coolant water should not enter in the pump. If the dew is not disappeared for a while, dew alarm turns on and decelerate the motor to protect the controller. Please use it at the temperature that the dew condensation is not generated and keep environment humidity low.
Even if the power supply unit is OFF, do not flow coolant through it that is below dew point.
- (6) The water valve is closed and coolant water supply is stopped at AC input OFF. When coolant water of several pumps is connected in serial, coolant water of one pump is stopped while the other pump is AC input OFF or in generating "dew error".

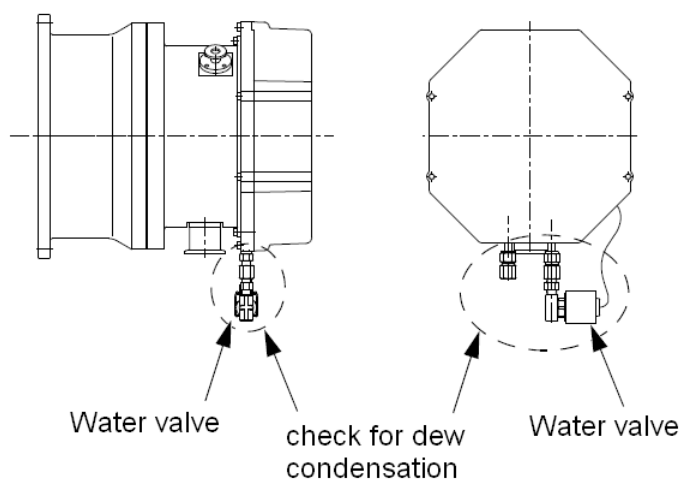
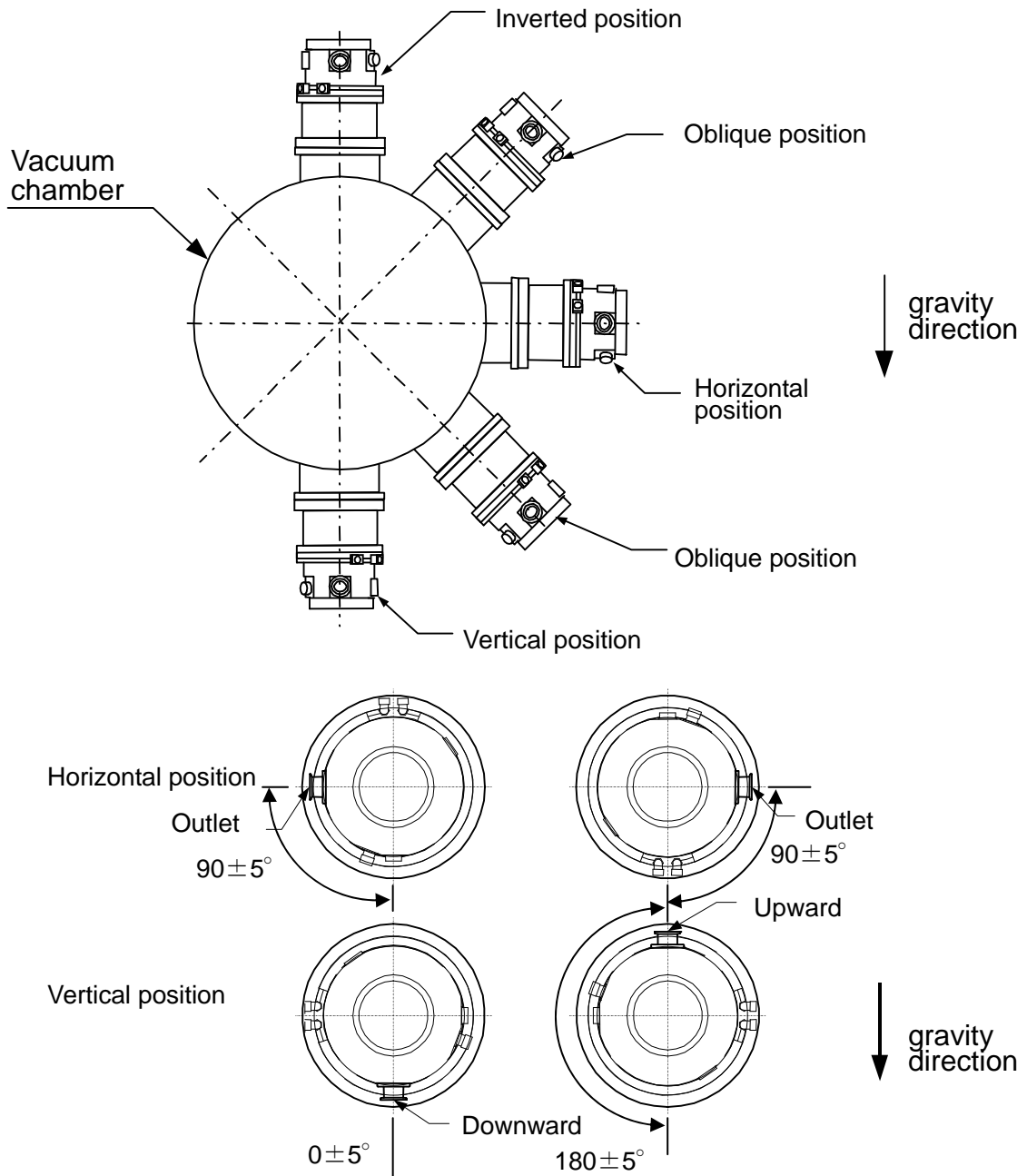


Fig. 3-1 Locations to Check for Dew Condensation

4. Pump Mounting Direction

This turbo-molecular pump can be installed in vertical, the horizontal, inverted, oblique position. The outlet flange of the turbo molecular pump should face horizontally or vertically when installing horizontally and obliquely.

When an installation direction is non-appropriate, reliability of operation may deteriorate.



5. Installation of the Pump

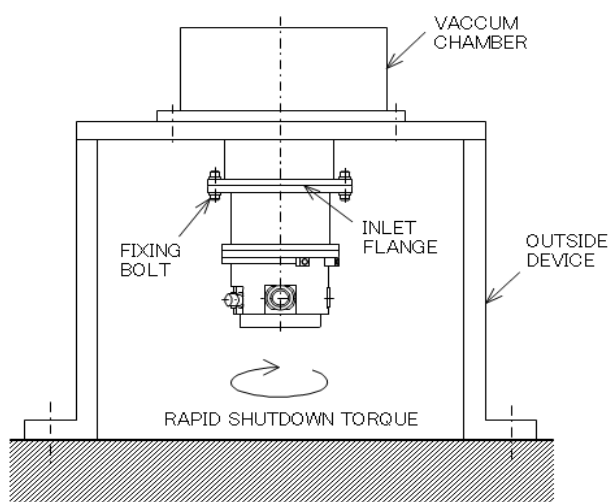
WARNING

- Fix the pump to the device according to the following. The method to fix the pump is different depending on the pump model and the size of inlet flange of the pump.
- The device should be fixed to the floor so as not to move. The device should be designed to have enough margins in strength, in preparation for an emergency accident.
- The rotor assembly of the turbo molecular pump rotates at high speed. Large rapid shutdown torque should be generated when abnormality occurs in the pump by any chance. Incidental accident will cause the pump to drop out and to make a catastrophe if the pump is fixed by insufficient method.

Please fix the inlet flange of the turbo molecular pump to the flange of vacuum chamber (Refer to Fig. 5-1).

When you fix the pump, use the bolts regulated grade, size, number and tightening torque (Refer to Table 5-1 and Table 5-2). And use all the bolt-holes of the inlet flange of the pump. The sets of half-screw bolt and nut should be used to fix the inlet flange of the pump. Make installation with the cylindrical part of the bolt (not screw part) fit in the mating section of flanges.

When you connect piping or valve between the chamber and the pump, please fix the same method as the inlet flange.



Fixed only by the inlet flange of TMP

Description	Rapid Shutdown torque [N·m] (Note)
TMP-V2304LM	50,000

(Note) Rapid shutdown torque is the typical value measured by the Shimadzu's test condition. The torque to transmit to the device might be different according to the rigidity of the device. The device should be designed to have enough margins in strength.

Fig. 5-1 Installation of Turbo Molecular Pump

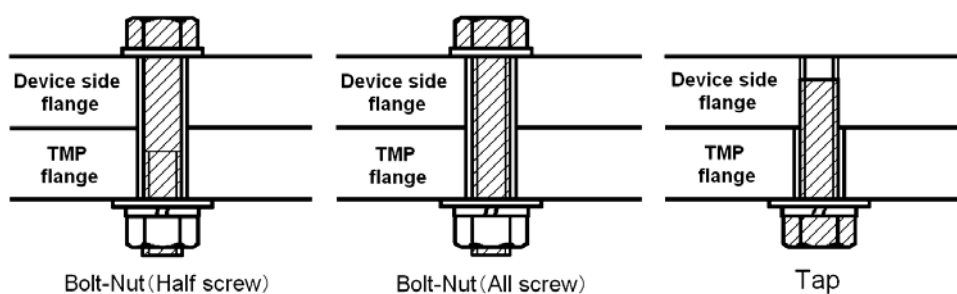


Fig. 5-2 How to use of the bolt

Table. 5-1 The recommended fixing bolt

Bolt - Nut (Half screw)

Fixing method	Only by the inlet flange	
Inlet flange	VG250	ISO250B
Bolt Size, Quantity	M12, 12 PC	M10, 12 PC
Material	Stainless steel	SCM435 (JIS G 4053 / ISO-683) or equivalent
Grade	A2-70 (JIS B 1054 / ISO-3506)	12.9 (JIS B 1051 / ISO-898)
Washer	Special washer (Note) and spring lock washer	

Bolt - Nut (All screw) · Tap

Fixing method	Only by the inlet flange	
Inlet flange	VG250	ISO250B
Bolt Size, Quantity	M12, 12 PC	M10, 12 PC
Material	SCM435 (JIS G 4053 / ISO-683) or equivalent	
Grade	12.9 (JIS B 1051 / ISO-898)	
Washer	Special washer (Note) and spring lock washer	

(Note) The special washers are attached to the inlet flange of TMP when shipping.
Do not remove them at the time of TMP installation.
Refer to the following figure for the details of the bolt attaching part.

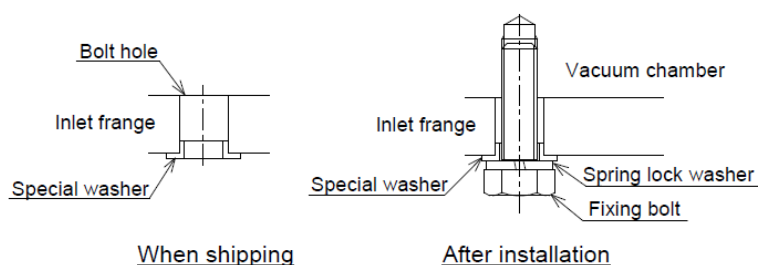


Fig. 5-3 Example of the fixing method using the special washer

Table. 5-2 Tightening torque of the fixing bolt

Flange	Size of bolt	Tightening torque [N·m]
ISO250B	M10	9.4 to 15
VG250	M12	16 to 26

6. Interface

- Control Panel...Refer to chapter 7
- External I/F Panel...Refer to chapter 8

7. Control Panel

7.1 Description and function

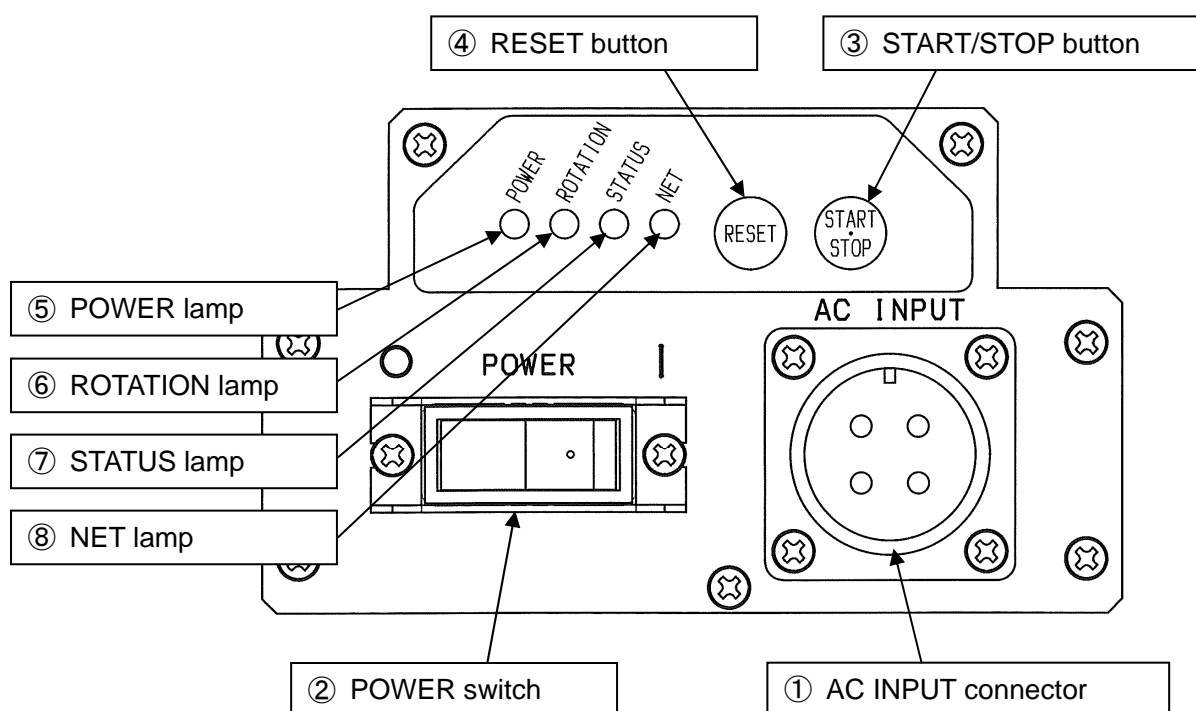


Fig. 7-1 Outline view of control panel

- ① AC INPUT connector Power cable receptacle
- ② POWER Switch..... Power switch
- ③ START/STOP button..... Push to acceleration or deceleration.
During LOCAL MODE, control by maintained push.
- ④ RESET button When occur ALARM or WARNING, After remedying the cause of the ALARM, An abnormal state is released by pushing button.
By maintained push, REMOTE MODE and LOCAL MODE are changed.
- ⑤ POWER lamp..... This lamp lights or blinks while power on. (green)
Lights : REMOTE MODE
Blinks : LOCAL MODE
- ⑥ ROTATION lamp Operation indicator lamp indicating that the pump's rotor is running. (green)
- ⑦ STATUS lamp Operation indicator lamp indicating that the pump's operation status. (green · orange) (Note 1)
green/lights : Rotational speed reaches 80 % rated value.
green/blinks : Accelerating
orange/lights : ALARM occurs
orange/blinks : Warning occurs
- ⑧ NET lamp..... For option. This lamp is always turned off.

(Note 1) The pattern when both green and orange are lit and blink becomes the following.

- When warning occurred during rating speed.
green/light and orange/blink : green – orange – green – orange – ...
- When warning occurred during acceleration.
green/blink and orange/blink : green – orange – turned off – green – orange – turned off – ...

8. External I/F Panel

8.1 Description and function

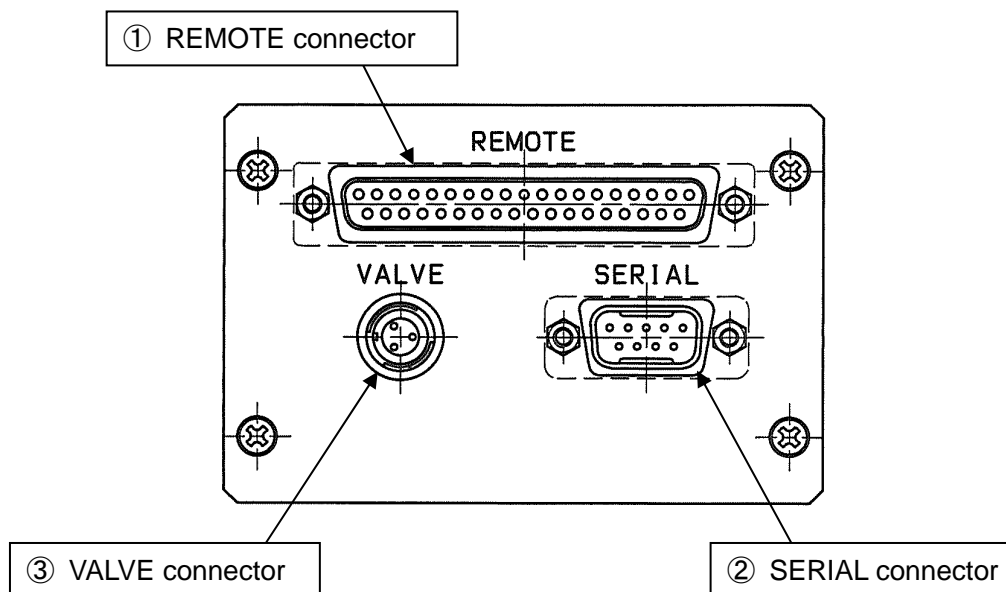


Fig. 8-1 Outline view of control panel

- ① REMOTE connector Connect by Remote-control connector
Refer to chapter 8.2
- ② SERIAL connector Connect by RS-232C and RS-485 communication
Refer to chapter 8.5
- ③ VALVE connector Water valve connector
connection to water valve with cable (provided)
Refer to chapter 3

8.2 Remote-Control

8.2.1 Specification

This TMP is provided with remote-control connector for connection with remote operation, ALARM signals, etc. (Refer to Fig. 8-3, Table 8-1)

For connection with this connector, cable with shield is necessary. The shield of the cable should be connect to case. (Refer to Fig. 8-2)

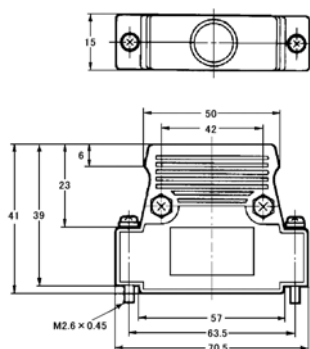


Fig. 8-2 Remote-Control Connector

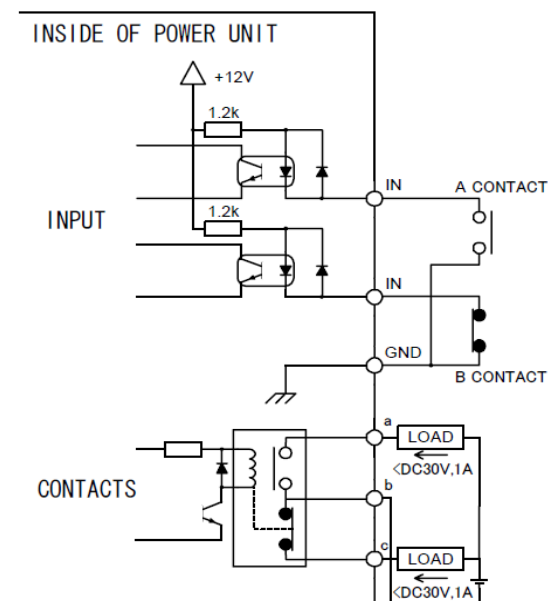


Fig. 8-3 Remote-Control Circuit

Table 8-1 Start/Stop According to Remote-Control Signals

Connection method	By momentary type START/STOP switch	By alternate type switch
Wiring connection	<p>START STOP</p>	<p>or</p>
control	<p>Pump start by short-circuiting (1) and (2). Pump stop by opening (1) and (3).</p>	<p>Pump start, with the contact close or photo transistor ON ((1) to (3) short-circuit). Pump stop, with the contact open or photo transistor OFF ((1) to (3) open).</p>
Electric Capacity	<p>[Contact] It is connected to +12 V circuit and subject to stable open-close of 5 V DC, 1 mA. Voltage...30 VDC or more, Current...10 mA or more</p> <p>[Photo transistor] Select a photo transistor with a collector-emitter voltage limit of 30 VDC and an on-state collector current of 10 mA or more</p>	
Input rating	<p>Direct forward current 50 mA ; DC reverse voltage 5 V</p>	

8.3 Pin Assignment

Table. 8-2 Remote-Control Signals

	Name	Pin No.	Operation	Electric spec
In-put	START	2	Starting operation on GND and short-circuiting (Note 1)	Contact Input
	STOP	3	Stopping operation on GND and circuit opening (Note 1)	
	RESET (Note 4)	4	Resetting operation on GND and short-circuiting	
	LOW SPEED	6	Variable speed operation on GND and short-circuiting	
	GND	1	GND	
Out-put	ROTATION	17 18 19	During rotation (17)-(19) open → close (make contact) (18)-(19) close → open (break contact)	Contact Output Contact capacity (resistance load) 30 VDC 1 A
	NORMAL	11 12 13	During rotational speed is more than 80 % rated value (11)-(13) open → close (make contact) (12)-(13) close → open (break contact)	
	ACCELERATION	8 9 10	During acceleration (8)-(10) open → close (make contact) (9)-(10) close → open (break contact)	
	BRAKE	14 15 16	During deceleration (14)-(16) open → close (make contact) (15)-(16) close → open (break contact)	
	REMOTE	20 21 22	Remote-controlled operation is available (Note 5) (20)-(22) open → close (make contact) (21)-(22) close → open (break contact)	
	ALARM	26 27 28	Against ALARM (Note 5) (26)-(28) open → close (make contact) (27)-(28) close → open (break contact)	
	WARNING	29 30 31	Against WARNING (Note 5) (29)-(31) open → close (make contact) (30)-(31) close → open (break contact)	
	CONNECTION	23 25	Always closed	

(Note 1) "STOP" signal is prior to "START" signal.

(Note 2) Don't connect any pins other than specified above.

(Note 3) It takes six seconds until it comes to show that this signal is correct, after POWER switch is turned on.

(Note 4) One Reset signal is each time the contacts close. Repeatedly short and open the contacts to input multiple Reset signals.

(Note 5) It is possible to change movement by remote-control signal settings of serial communication. (If set to [SEMI E74], remote control signals will conform to SEMI Standard E74 "Specification for Vacuum Pump Interfaces".)

8.4 Connector

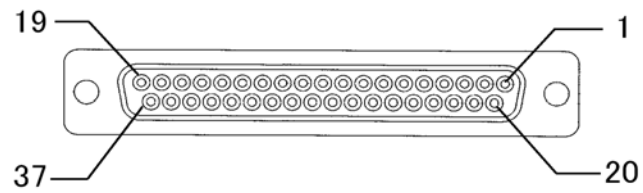


Fig. 8-4 Arrangement of Remote-Control Connector Pins
(Figure where connector of panel was viewed from the front)

Connector	D-sub 37 pin female
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8.5 SERIAL connector

8.5.1 RS-232C hardware specification

(1) Transmission specification

Interface	RS-232C
Synchronous system	Asynchronous
Transmission rate	9600 bps (fixed)
Character configuration	Start bit : 1 Data bits : 8 Parity : None Stop bits : 1
Flow control	None

(2) Communications connector

Interface	SERIAL Connector (shared by RS-485)
Connector type	D-Sub 9 pin male, Screw lock size : M2.6
Pin Assignment	2 : RD (Receive data) 3 : SD (Transmit data) 5 : SG (Signal ground) ※Don't connect other pins except the above-mentioned.

8.5.2 RS-485 hardware specification

(1) Transmission specification

Interface	RS-485 (2-wired, half duplex)
Synchronous system	Asynchronous
Transmission rate	9600 bps (fixed)
Character Configuration	Start bit : 1 Data bits : 8 Parity : None Stop bits : 1
Flow control	None
Number of power supply	max 32

(2) Communications connector

Interface	SERIAL Connector (shared by RS-232C)
Connector type	D-Sub 9 pin male, Screw lock size : M2.6
Pin Assignment	4 : RXA (Received data +) 7 : RXB (Received data -) ※Don't connect other pins except the above-mentioned.

8.5.3 Software specification

By serial communication, Operation, Status monitor, and Setting is possible.

	Description
Operation	START, STOP, ALARM reset, LOW SPEED
Status monitor	Rotation, Normal, Acceleration, Brake, Remote, LOW SPEED, ALARM, WARNING
	Rotational speed, Motor current, Running time, ALARM number, Read ALARM history etc.
Setting	rotational speed at low-speed setting, Power failure detection time etc

8.5.4 Connector

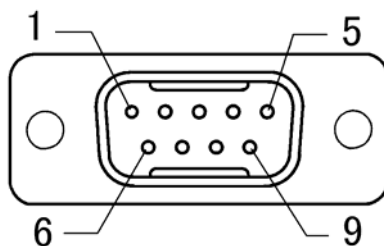


Fig. 8-5 Serial Connector Pin Configuration

(Figure where connector of panel was viewed from the front)

Connector	D-sub 9 pin male
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NOTICE

Serial interface protocol are compliant RS-232C / RS-485.
 We have tested only our environment, guarantee the operation for device is not all.

9. Warranty

- 9.1** Warranty period is 12 months on new TMP's from the date of shipment from Shimadzu, or from any of its worldwide sales offices.
- 9.2** During the warranty period and under normal operation, if the TMP fails to meet its product specification due to defects in material and/or workmanship, Shimadzu will, at its discretion, either repair it or exchange it with a new one for free.
- 9.3** The warranty covers only TMP's, controllers and accessories sold by Shimadzu.
- 9.4** In-warranty repaired or replacement parts are warranted only for the remaining unexpired portion of the original warranty period applicable to the parts that have been repaired or replaced.
- 9.5** During the warranty period, Shimadzu will charge for repair or exchange in the following cases :
- 1) Failure caused by natural disasters or fire.
 - 2) Failure or functional deterioration due to the following :
 - a) Pumping of special gases and materials.
 - b) Ingestion of foreign object (solid and liquid) and attachment of reacted object through the TMP's protective net.
 - c) TMP is operated differently than what is prescribed in the instruction manual.
 - d) When Shimadzu determines through failure analysis that the cause of failure was due to abnormal operation or external circumstances. Our engineers judge that the cause of the trouble is an irregular operation.
 - 3) Warranty is voided if the "Security Seal" on the product has been removed, hampered with, or altered.

10. Limitation of Liability

Except as stated herein, SHIMADZU makes no warranty, expressed or implied (either in fact or by operation of law), statutory or otherwise :

And, except as stated herein, SHIMADZU shall have no liability for special or consequential damages of any kind or from any cause arising.

Out of the sale, installation, or use of any its products.

11. Turbo Molecular Pump Recondition

It is different for deterioration progress speed of each part changes greatly by pump condition. Refer to the following list as overhaul of each process.

These are not terms of warranty.

	process	Recommended maintenance intervals
1	Non-active gas (Sputtering, Evaporation and so on) and Light load process	3 years

- (1) Recommended maintenance intervals for parts
These are not terms of warranty.

1) Non-active gas and Light load process

	Part name	Recommended maintenance intervals
1	Touch down bearing	3 years
2	Shaft	7 years It has a possibility of under 2 years (Dependent on condition)
3	Rotor	
4	Motor	7 years
5	Magnetic bearing parts	

2) Use of corrosive gas

	Part name	Recommended maintenance intervals
1	Transformer	10 years
2	Capacitor	5 years
3	Button Battery	10 years

- 3) Recommended maintenance intervals for other parts.

It has the possibility that the following part is exchanged, when cleaning TMP.

Part name
55-pin Receptacle

- (2) Others

When exchanging parts, it has possibility that other parts are exchanged for improving a reliability. (Example : Old type lower and upper radial sensor had changed dimensions for reliability. When exchanging them, these housing must also be exchanged.)