SK00-2200-AI-130-01 527-12046(14.03)

ULVAC

INSTRUCTION MANUAL

OPERATION MANUAL

MAINTENANCE MANUAL

ULVAC TURBO-MOLECULAR PUMP

UTM-350FW, UTM-350FH
UTM-480FW, UTM-480FH
UTM-800FW, UTM-800FH
UTM-1001FW, UTM-1001FH
UTM-1400FW, UTM-2300FW
UTM-3301FW, UTM-3302FH
UTM-3303FH, UTM-6300FH
UTM-3500D

This manual is applicable to

Pump proper : UTM-350FW/FH, UTM-480FW/FH, UTM-800FW/FH
UTM-1001FW/FH, UTM-1400FW, UTM-2300FW
UTM-3301FW, UTM-3302FH, UTM-3303FH
UTM-6300FH, UTM-3500D

Control unit : FTI-xxxxW-D3R (Digital Control Unit)

NOTICE

- This manual contains the important information for handling the product safely.
- Read and thoroughly understand this manual before unpacking, installing and operating the product.
- Keep this manual in a safe place where it can be consulted at any time.

ULVAC, Inc.

Contents

AT FIRST

This manual is written only in English. Words of switches to start and stop the product are important in this manual. These words are described both in English and German as follows.

Language	Functions	
	To start the Product	To stop the Product
English	Start button	Stop button
German	Start kragenknopf	Stopp kragenknopf

CAUTIONARY NOTICE

The customer must understand that the operation of a turbo-molecular pump has potential danger.

ULVAC,Inc. (hereinafter, “ULVAC”) is not liable for any damage or injury arising from an individual’s failure to follow instructions contained in this manual, or his (or her) failure to exercise due care and caution in the installation, operation, inspection, and service of the turbo-molecular pump.

LIMITED WARRANTY

The turbo-molecular pump and control unit are warranted for one (1) year after delivery.
During the warranty period, ULVAC, Inc. (hereinafter, "ULVAC"), at its option, will repair or replace the turbo-molecular pump or control unit returned intact to the factory, transportation charges prepaid, which ULVAC, upon inspection, shall determine to be defective in material and/or workmanship. The foregoing shall constitute the sole remedy for any breach of ULVAC's warranty.

ULVAC makes no warranties, either express or implied, except as provided herein, including without limitation thereof, warranties as to marketability, merchantability, for a particular purpose or use, or against infringement of any patent. In no event shall ULVAC be liable for any direct, incidental or consequential damages of any nature, or losses or expenses resulting from any defective product or the use of any product.

The warranty does not apply if the turbo-molecular pump or control unit;

(1) is operated in such a way as not described in this manual;

(2) is used under a special condition not described in this manual;

(3) is repaired or modified by any other party than ULVAC;

(4) is subjected to any troubles caused by reaction products.

ULVAC will not be responsible for any bugs in the semiconductor chips.

IF EXPORTED

If this product is to be shipped overseas, necessary procedures must be followed including application to the Japanese government for export license according to the Foreign Exchange and Foreign Trade Control Law.

In such a case ULVAC should be notified in advance.

IMPORTANT INFORMATION

- Today's new materials, processes and high-speed equipment require greater attention to safety.
- To maintain production and to avoid potential injury, accident prevention must be integrated with the function of the pumping operation.
- Accident prevention is an activity which must be planned, systematic, continual and adapted to individual setting need. Everyone should actively participate, recognize one's role and organize oneself and one's work for a safe environment.
- The foremost safety objective is to prevent accidents which could result in injury or death, disrupt production or damage facilities, equipment or property.
- Legislation from the federal, state or local level dictates many of the minimal requirements to reduce personal injury.
- Extreme caution must be exercised while servicing or installing the turbo-molecular pump. The nature of automatic equipment is such that false external inputs may cause the equipment to operate in an abnormal sequence. The only safe policy to follow when servicing the turbo-molecular pump is to shut off the electric power.
- ULVAC cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this manual and on the turbo-molecular pump are therefore not all inclusive.
- It is assumed that this equipment will be operated and serviced by English speaking personnel. If this is not case, the customer should add safety, caution, and operation signs in the native language of the operator.
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- Specification are subject to change without any obligation on the part of the manufacturer.
- Your turbo-molecular pump may differ from the photographs and figures in this manual. Guards and covers may have been removed for illustrative purposes.
- If your have any suggestions or questions, contact the Supplier.

SAFETY

Observe the general precautions on safety in electrical wiring work and transport of a heavy lift，or injures to the body by packing material.

Observe the provisions of the federal, state, or local regulations to reduce personal injury.

The warnings described below are used throughout this manual according to the seriousness of potential accident for the part that requires special attention for safety in handling the turbo-molecular pump. Make sure that you understand and follow the instructions given under these warnings.

In addition, it is noted that this turbo-molecular pump should be used only by those who can comprehend this manual satisfactorily.

Meanings of Notice

WARNING : indicates a potentially hazardous situation which, if not heeded, could result in death or serious injury.

CAUTION : indicates a hazardous situation which, if not heeded, may result in minor or moderate injury and damage to the pump.

NOTES TO USERS

CAUTION Do not drop or give any intensive shocks at unpacking.

CAUTION Secure the pump properly.

CAUTION Do not allow use in extremely high or low temperatures.

	Ambient temperature
Turbo-molecular pump	5℃～35℃
Control unit	0℃～40℃

CAUTION Do not disassemble, or damage the pump body.

CAUTION Do not allow any foreign matter to enter inside.
Make sure to attach the protecting net.

CAUTION Do not use fixation bolt for transportation to fix TMP inlet flange and equipment flange.

CAUTION Do not allow use in a dusty place.

CAUTION Do not allow use in a strong magnetic or electric field.

Direction of magnetic field	Allowance of magnetic field
Horizontal	< 3mT (30G)
direction	< 10mT (100G)

CAUTION Do not allow use the Max. specified gas flow exceeds the allowable range.

CAUTION Do not use power other than AC 200～240V, single phase. Carry out earthing properly.

CAUTION Do not allow use in high humidity, and within the reach of water splashes.

CAUTION The cooling water should be at a flow rate of more than 3L/min.
(at a temperature of 5～25℃, at a pressure of not greater than 0.6 MPa)

NOTES TO USERS

CAUTION Be careful not to bend pins when connecting the output cables.

CAUTION Use the POWER switch to turn power on/off.
Do not turn power on/off by plugging in/out or turning on/off the main contact breaker.

CAUTION Never turn off a power source while in operation.

CAUTION Do not clog the ventilation holes on the control unit.

CAUTION Use START/STOP button to start or stop.
Do not attempt to stop using the POWER switch.

CAUTION Do not touch other than the panel of control unit during operation.

CAUTION Do not bend or pile up the cables excessively.

CAUTION Do not touch the pump while using the bake-out heater.
It is dangerous; the pump becomes very hot.

CAUTION Set the bake-out temperature under 120℃.

CAUTION Practice gas purge when handling corrosive gases. Do not use special gasses (ex. Ga, Hg, flammable gasses)

CAUTION Check the connecting parts to the equipment side such as the inlet flange, outlet flange and N2 purge flange for any leaks by executing the leak test to prevent the leak of poisonous gas etc.

CAUTION Do not allow atmosphere inrush during rotation.
(Keep in mind that the suction in of a large amount of gas is the primary cause of pump trouble.) In case of atmosphere inrush, consult with the Supplier.

CAUTION Install the breaker with protection of electric leakage to the input power source.

NOTES TO USERS

CAUTION When using the pump in the process of corrosive and deliquescent environments, and in case of maintenance, avoid exposing the rotor of pump to wet air, and purge the pump by dry N2 gas.
If not, the pump repair may become impossible.

CAUTION Since the rotor blade consists of a sharp edge, do not directly touch it to avoid injury.

CAUTION Take periodical maintenance, when using the pump at the process of corrosive and deliquescent environments.

CAUTION Do not make insulation resistance and withstand voltage tests of the control unit. The control circuit is composed by electronic parts and may be subject to damage.

1. Features and Name/Function of Each Part

1.1 Features

Anti-corrosion surface treatment

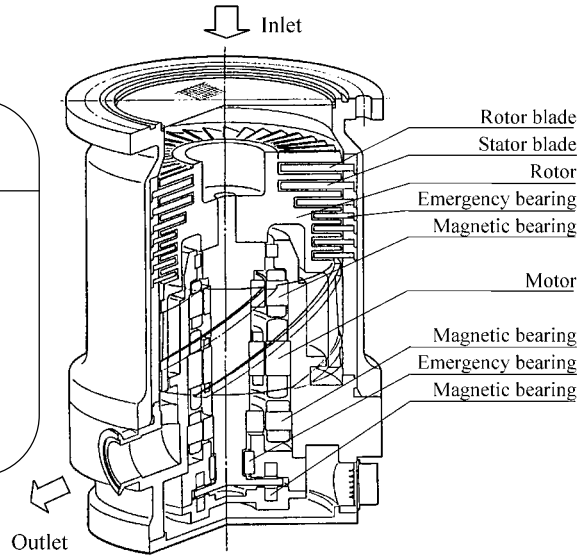
If gas is corrosive, the pump should be an anti-corrosion surface treatment. However, special gases (Ga, In, Hg, etc.) should not be used.

Controlled magnetic bearings

As totally active magnetic bearings are used, the pump can be installed in any orientation.

Battery-free

The control unit has a built-in function which floats the rotor in case of a power failure until safe rotation for touch down without a back up battery.



Tuning-free

The pump and control unit can be used in free combination as long as they are the same model.

Self-diagnosis function

Operating data such as rotor vibration and motor temperature can be output by RS-232C/RS-485.

Coupling-free

A unit of the control unit enables the operation of various models for TMP.

Control Unit

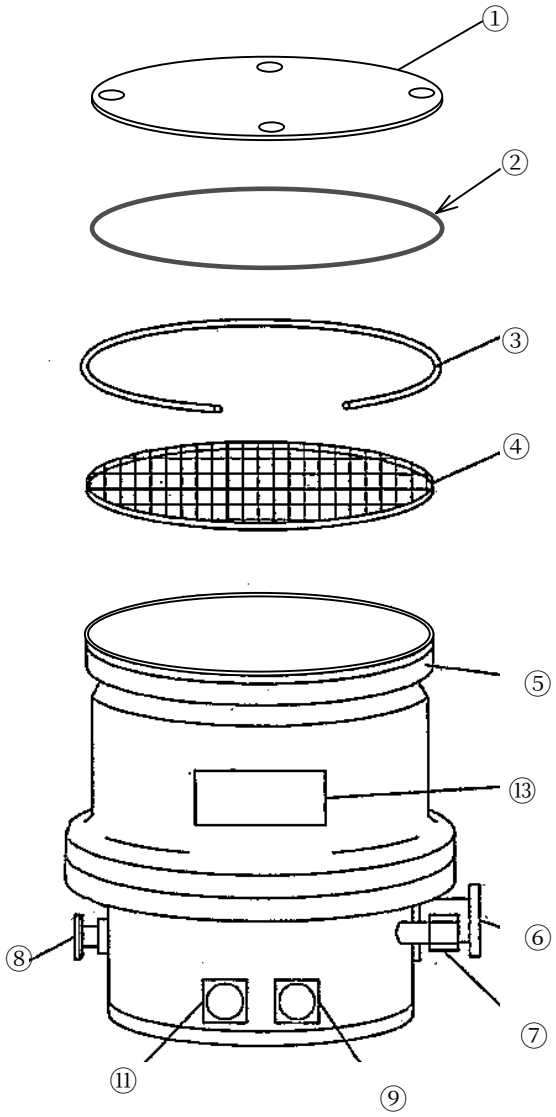
Magnetic bearing is controlled by digital signal processor. This enables furnishing with coupling-free, self-diagnosis and communication functions.

Speed-variable

Control unit is equipped with function of speed variable normally; enables the setting of pump revolution freely.

1.2 Name and function of each part

The turbo-molecular pump (hereinafter “TMP”) consists of a pump proper, a control unit, and cables.



(1) Pump proper

① Protection cover
Prevents damages in transportation. Keep it in a safe place. It is required to transport TMP for maintenance etc

② “O” ring
Maintains air tightness of a pump. (an “O” ring will be installed in the pump when delivery)

③ Ring spring
Fixes the protecting net. Make sure that it is fitted properly. (a ring spring will be installed in the pump when delivery

④ Protecting net
Prevents the suction of foreign matter.(a protecting net will be installed in the pump when delivery)

⑤ Inlet flange
Allows gas into TMP.

⑥ Outlet flange
Exhausts gas out from TMP.
Connects the backing vacuum pump.

⑦ Cooling water port
Feeds the cooling water to cool down bearings.(Rc 3/8)

⑧ Gas purge flange
Takes in N_2 gas for bearing protection when using a corrosive gas.

⑨ Connector for bearing
Connects the output cable for bearing.

⑩ Output cable for bearing
Connects the TMP and the control unit.

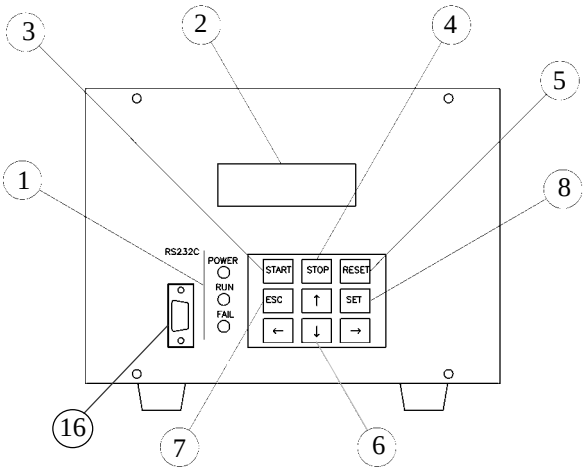
⑪ Connector for motor
Connects the output cable for motor.

⑫ Output cable for motor
Connects the TMP and the control unit.

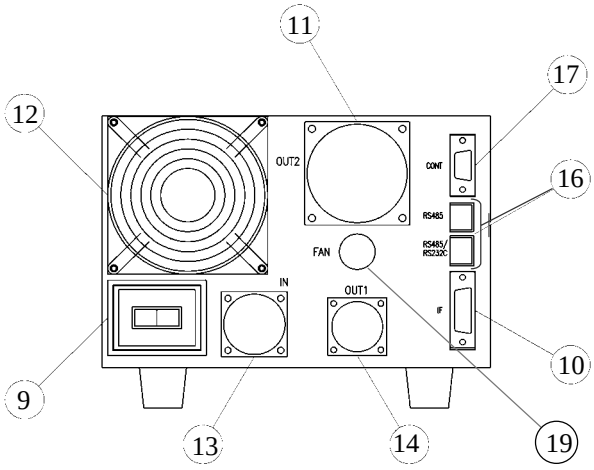
⑬ Name plate
Describes model and production No. of the TMP.

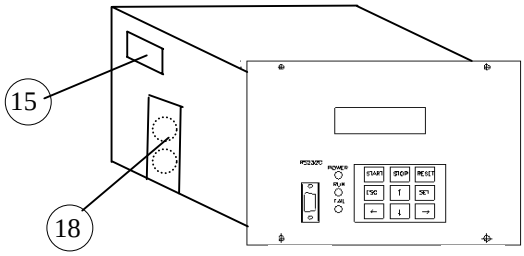
(2) Control unit

[Front view]



[Rear view]





① Status LEDs
Each of the LEDs indicates respectively active status of power, operation（acceleration, normal operation at the rated speed, deceleration) and, failure.

② Status LCD
Indicates the active status of operation (acceleration, normal operation at the rated speed, deceleration), alarm items, rotation (%), and operating time.
In addition display the driving situation to show in supplement B, a driving history.

③ START button
Starts operation.

④ STOP button
Stops operation.

⑤ RESET button
Resets in case of failure.

⑥ An arrow button
Use it for LCD indication conversion and a change of a driving state.

⑦ ESC button
Cancel the input with an arrow button.

⑧ SET button
Push this button at the same time, when you operate the other buttons on the control unit panel.
In addition, it is settled by the input with an arrow button.

⑨ Power switch
Turns on/off power source.

⑩ Remote control connector (I/F)
Used for remote control.

⑪ Output connector for bearing (OUT2)
Used to connect the output cable for bearing.

⑫ Cooling air fan
Cools the internal parts.

⑬ Input connector for power source(IN)
Inputs power of 200～240V, single phase.

⑭ Output connector for motor(OUT1)
Used to connect the output cable for motor.

⑮ Name plate
Describes model and production No. of the control unit.

⑯ RS-232C andRS-485,RS-232C/RS-485
This is for input of TMP operation (such as Start/Stop) as well as for output of self-diagnosis internal data.
The details refer to supplement C

⑰ Remote control connector (CONT)
It can be setting of speed variable, alarm resetting, forced stopping, output of revolution pulse.

⑱ Model change switch
Model change switch for the function of coupling –free.

⑲ Input power source connector for cooling air fan
Cable connector for fans of air-cooled type.

2. Inspection at Unpacking

⚠ CAUTION	Handle the product carefully when unpacking, so that the flange parts are not damaged. Otherwise, leakage may occur.

(1) Check the package for dents, breaks, and watermarks.

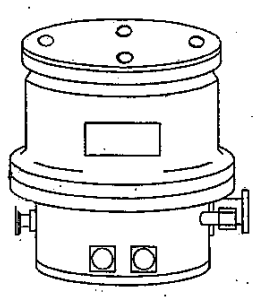
(2) Check the quantities of the delivered parts against the delivery list enclosed in the package.

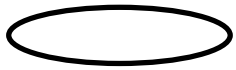
(3) Check the delivered parts for damages or any other defects.
If you should find any part is defective or missing, contact ULVAC.

A protecting net ring spring and "**O**"ring for inlet flange will be installed in the pump when delivery.

(4) Keep the packing box and protection cover in a safe place. They are required when shipping back the product for maintenance etc.

Pump proper





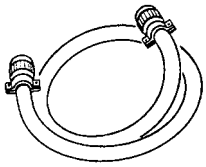
• "O" ring

• Ring spring

• Protecting net

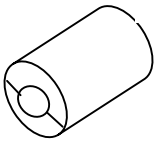
Output cable for motor

Output cable for bearing



Input cable for Power source

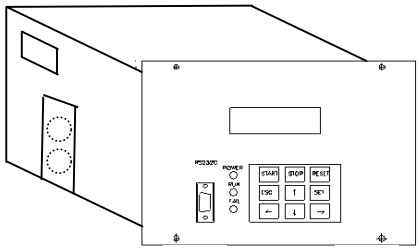
• Manual



• Ferrite-Core for IN Plug Cable
: 1piece

• I/F plug
(15 pins male)

• Cont plug
(9 pins male)



• RS232C plug
(9 pins female)

• Control unit

3. Installation Procedure

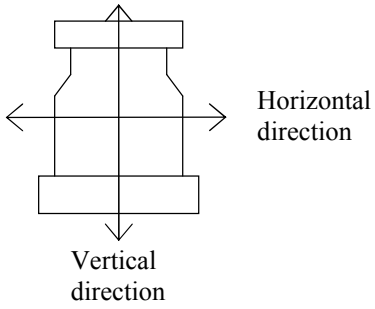
3.1 Selection of TMP installation place

We assume TMP is used in clean rooms or in semiconductor factories ,etc.

⚠ CAUTION	Do not install TMP in any of the following places.

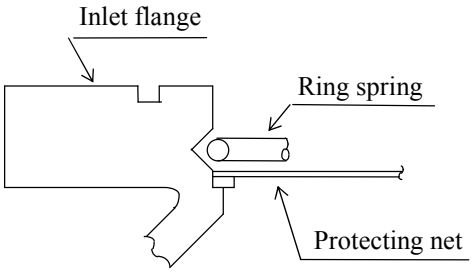
(a) Where the ambient temperature is other than 5～35℃.(Control unit: Other than 0～40℃)
(b) Near heaters
(c) Place exposed to direct sunlight
(d) Where the humidity is above 90% (no dew formation)
(e) Place exposed to corrosive gases
(f) Place exposed to explosive or flammable field
(g) Place exposed to a strong magnetic or electric field
(h) Place with poor ventilation
(i) Place exposed to salt air
(j) Dusty place
(k) Place exposed to water drops
(l) Place subjected to large electrical noise
(m) Place subjected to large vibration
(n) Place exposed to radiation

Direction of magnetic field	Allowance of magnetic field
Horizontal direction	< 3mT (30G)
Vertical direction	< 10mT (100G)



3.2 Installation procedure of TMP

(1) When connecting inlet flange to the equipment flange, make sure to insert the protecting net into the inlet flange and fix it by the ring spring.



⚠ CAUTION	When handling TMP, fit an eyebolt to the lifting thread of the inlet flange and choose a proper hoisting accessory. The TMP is a heavy lift, fall of it can cause serious accidents.

⚠ CAUTION	Make sure to install the protecting net. The protecting net cannot prevent completely small foreign matter from entry into the TMP. Take due care not to allow its entry.

Tightening torque of the fixing bolt

Size of bolt	Tightening torque [N･m]
M 8	4.7～7.6
M 10	9.4～15
M 12	16～26
M 16	41～66
M 20	80～130

⚠ CAUTION	In case of connecting the inlet flange of TMP to the flange of equipment, install a specified gasket and execute the leak test.

⚠ WARNING	The TMP is a high-speed rotary machine. Install it properly to avoid danger and accidents, otherwise the TMP may jump around and become loose.

(2) Installation of the TMP to the equipment

(a) Install the TMP with care not to give it impact.

(b) Fix the inlet flange to the equipment directly (see the right table) by all the bolt holes.

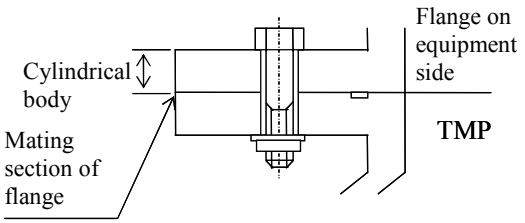
(c) Secure the inlet flange with bolts specified for the flange (see the right table) installed through the entire bolt holes. For safety, it is recommended to also secure the screw holes for mounting frame, located on the bottom of unit.

(d) Use bolts of the material that strength is equivalent or more of that of austenitic stainless steel bolts A2-70 (JIS B 1054 or ISO3506 tensile strength>700N/mm^2)

Bolt size for inlet flange

Casing	Size	Quantity	TMP Flange Thickness
JISVG100	M10	8	12mm
JISVG150	M 10	8	12mm
JISVG200	M 12	8	16mm
JISVG250	M 12	12	16mm
JISVG300	M 12	12	20mm
JISVG350	M 12	12	20mm
JISVG500	M 16	16	22mm
ICF152	M 8	16	21mm
ICF203	M 8	20	22mm
ICF253	M 8	24	25mm
ICF305	M 8	32	28mm

Model	Size	Quantity
UTM-350FW/FH UTM-480FW/FH	M 8	4
UTM-800FW/FH UTM-1001FW/FH	M 8	8
UTM-1400FW	M 12	8
UTM-2300FW	M 16	8
UTM-3301FW UTM-3302FH UTM-3303FH	M 16	8
UTM-6300FH	M 20	16
UTM-3500D	M 16	8



Make installation with the cylindrical body of bolt fit in the mating section of flange.

(e) The rotor with Ip (pole moment of inertia) rotates at the high speed. Therefore, take due care so that the installation support and the equipment have the sufficient strength to avoid accidents.

(f) For the center of gravity of TMP, see Fig. 10.

(g) For the weight of TMP, see Table 1 Basic Specifications.

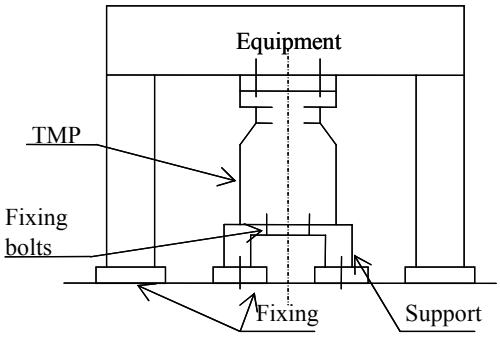
! CAUTION	Verify that the power supply is cut off at the time of TMP installation, and do not energize.

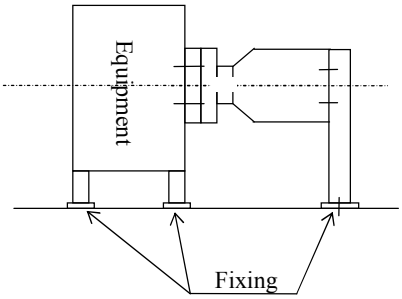
! CAUTION	Do not directly touch any rotor blade to avoid injury.

! WARNING	Make installation with the cylindrical body (not screw) of bolt fit in the mating section of flange.

Pole moment of inertia・Rotational speed

Model	kg・cm^2	rps
UTM-350FW/FH UTM-480FW/FH	27	750
UTM-800FW/FH UTM-1001FW/FH	96	600
UTM-1400FW	150	535
UTM-2300FW	452	410
UTM-3301FW UTM-3302FH	940	360
UTM-3303FH	940	370
UTM-6300FH	3821	280
UTM-3500D	998	360





3.3 Connect with backing vacuum pump

⚠CAUTION	Make sure to provide, between the TMP and the backing vacuum pump, an automatic valve that closes at power failure.

⚠CAUTION	At connecting TMP outlet to the equipment flange, fit a specified gasket and perform leak test.

(1) Connect the backing vacuum pump (see the right table) to the outlet flange.

(2) Install the backing vacuum pump separately from the TMP to prevent vibration of the backing vacuum pump from transmitting to the TMP, or take a vibration-proof measure and connect the backing vacuum pump to TMP with a flexible hose.

(3) The connecting pipe should have a large inside diameter and a small length so that conductance will not become small.

(4) Provide, in the outlet flange, an automatic valve which closes when the backing vacuum pump stops or the power fails, to prevent a back flow of air and oil into TMP.

Backing vacuum pump

Model	L/min
UTM-350FW/FH UTM-480FW/FH	290
UTM-800FW/FH UTM-1001FW/FH	800
UTM-1400FW	800
UTM-2300FW	1500
UTM-3301FW UTM-3302FH UTM-3303FH	1500
UTM-6300FH	1500
UTM-3500D	800

Cooling water condition	
Rate	> 3L/min
Temp in.	5～25℃
Pressure	< 0.6 MPa
pH	7～8
$C\ell^-$	< 10 ppm

$C\ell^-$: Chlorine ion density

3.4 Cooling of TMP

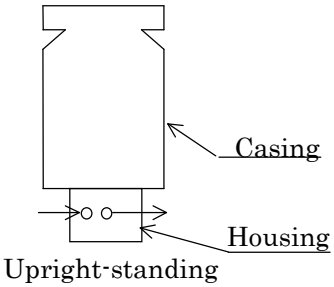
(1) Connect cooling water pipes to the cooling water ports in the housing. Cooling water should enter and go out as shown right figure.

(2) Before connection, check the inside of the pipes for foreign matter. After connection, be sure to confirm that the cooling water flows smoothly.

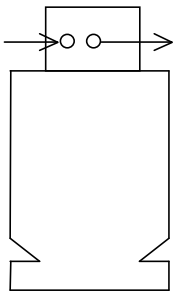
(3) Use cooling water which is pure.

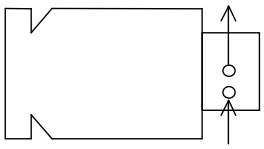
(4) Cooling water should conform to the requirements in the right table.

(5) Provide a flow switch on the cooling water port so that operation can be stopped when supply is cut off. Stop operation when the flow rate lowers under the specified value.



Upright-standing


Handstand


Sideways

⚠ CAUTION	The cooling water should be supplied appropriately so as not to form any dew condensation.

⚠ CAUTION	Connect the cooling water pipe to TMP firmly so as not to allow any water leakage.

⚠ CAUTION	Check the cooling water condition in daily inspection. The operation in the state of cooling water flow of under specified rate, if continued, must cause troubles due to temperature rise of the pump body. In addition, touching the pump body can cause burn.

3.5 Gas purge

⚠ CAUTION	If the purge gas flow rate or the time to start supplying the gas is not proper, a decrease in the exhausting performance must result and this must cause trouble.

⚠ CAUTION	At connecting TMP gas purge flange to the equipment flange, fit a specified gasket and perform leak test.

(1) When you use a corrosive gas, be sure to feed a purge gas from the gas purge flange to protect the bearings. The purge gas flow rate should be as shown in the right table. Be sure to exhaust the purge gas through the backing vacuum pump.

Gas purge condition (Dry N_2)

Model	Quantity of Gas purge Pa L/s (SCCM)
UTM-350FW/FH UTM-480FW/FH	17 (10)
UTM-800FW/FH UTM-1001FW/FH	42 (25)
UTM-1400FW	42 (25)
UTM-2300FW	84 (50)
UTM-3301FW	84 (50)
UTM-3302FH	—
UTM-3303FH	—
UTM-6300FH	—
UTM-3500D	84(50)

⚠ CAUTION	Be sure to introduce purge gas, while corrosive gas remains inside a pump regardless of pump operation/stop. Be sure to make introductory pressure of purge gas below into 0.1MPa (gauge pressure). If it continues passing purge gas where a pump is confined, the pressure in a pump will rise and leak will occur on a pump.

3.6 Installation procedure of control unit

The control unit can be installed either in a rack or on the floor.

⚠ CAUTION	Do not drill holes in the control unit for installation.

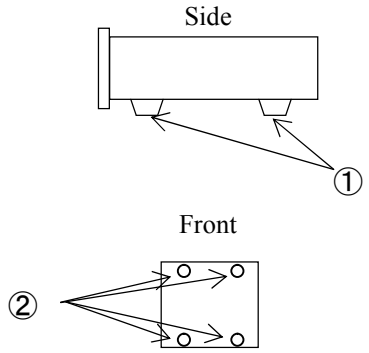
⚠ WARNING	Never open the top cover in the control unit. Unless get an electric shock, or fire may occur.

To install the control unit in a rack, proceed as follows:

(1) Remove rubber leg covers① from the bottom.

(2) Put the control unit into the rack and screw the front panel at 4 points②.

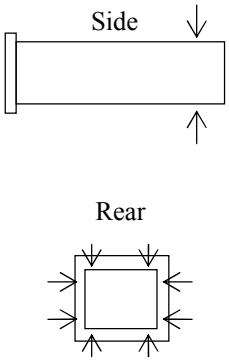
(3) Fix firmly the rear end of the control unit in four directions as shown in the right figure so that the control unit and rack will not be damaged due to its weight or vibration.



Tighten firmly all screws (M4).

⚠ CAUTION	Use the control unit in the ambient temperature range of 0℃～40℃. Otherwise, accidents can occur.

⚠ CAUTION	Be careful for the corners of control unit panel in its handling. They are acute and can cause injury.



Fix rear end in four directions.

⚠ CAUTION	At installation of the control unit, watch for your fingers not to be pinched between the rack and the unit.

⚠ CAUTION	At installation of the control unit, watch for your feet not to be damaged by its accidental fall.

3.7 Electrical wiring procedure of control unit

(1) Connection of input power source

(a) The power source to the control unit can be AC200～240V, single phase, and 50Hz or 60Hz. Connect the input connector for power source (IN) according to the right table.

Input connector for power source	Power source
A	AC200～240V Single phase, 50/60 Hz
B	
D	Earth (Ground)

⚠ WARNING	Perform reliable connect a ground work (based on a standard of each countries value to applicable) to ensure safety.

⚠ CAUTION	The conductor size of power input cable must be equivalent to AWG14 (2.14mm^2). Moreover, applicable cable outer diameter must be 13mm or less. When the cable outer diameter is over 13mm, take out each of triplex cables from insulation coating, and apply insulation tube to make it under applicable outline dimension.

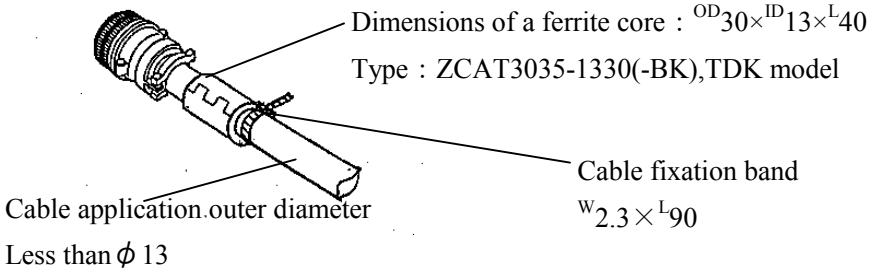
(b) This power supply is installed a circuit protector (15A). Choose the all-pole circuit breaker (IEC947 standard or IEC898 standard) lancing with each power source capacity in the right table to the input power source.

Circuit protector specifications	
Model	NRLY2100-15A-AA B
maker	IZUMI

Power source condition

	Model	spec.
Power source capacity (kVA, above)	UTM-350FW/FH UTM-480FW/FH	0.6
	UTM-800FW/FH UTM-1001FW/FH	0.9
	UTM-1400FW	1.2
	UTM-2300FW	1.3
	UTM-3301FW	2.0
	UTM-3302FH	1.6
	UTM-3303FH	1.6
	UTM-6300FH	1.6
	UTM-3500D	1.7
Voltage Fluctuation	A model is common	< ±10%
Frequency Fluctuation	A model is common	< ±3Hz
Leak electric current value.	A model is common	Less than 3.5mA

(c) For the input power source cable, install an attached ferrite core, and fix a cable in the cable fixation band.



⚠ CAUTION	In case of noise from the power source, take countermeasures such as using an insulating transformer, or other devices to prevent noise.

⚠ WARNING	To prevent from getting an electric shock, install the breaker with protection electric leakage to the input power source.

⚠ CAUTION	When putting the power input plug to the control unit, insert the cable plug horizontally along the guide, and rotate it about 7.5 turns, then tighten it completely.

(2) Connection of control unit with TMP

⚠CAUTION	Never detach the output cables when the TMP is running or the control unit is in failure.

(a) Use the output cable for bearing and motor supplied to connect the connector on the control unit to the connector on TMP.

(b) Make sure that the respective connectors of the output cables to the TMP and control unit are securely locked.

(i) The connector to the control unit will be completely tightened by rotating it approx. 7.5 turns.

(ii) The connector to the TMP can be locked by rotating it 120 degrees.
To install the output cable for bearing, follow these steps described below. To install the output cable for motor, follow the same steps.

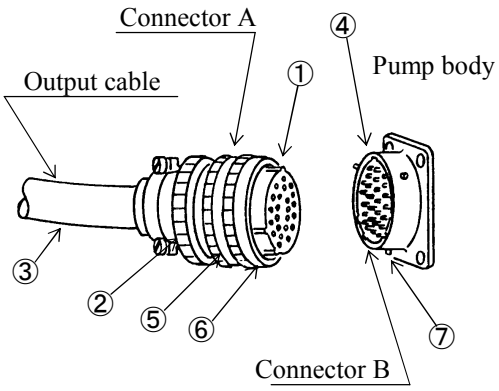
① Place connector A perpendicularly to connector B, with the widest guide (2 mm) ① of connector A upward.

② Grasp shell② of connector A with a hand, and grasp the output cable for bearing③ with the other hand.
Lightly insert connector A to fit guide① into slot④ on connector B.
When inserting connector A, press cable③ while guiding connector A② with a hand.

③ **If it is difficult to insert the cable, slightly shake it horizontally or vertically.**

④ Align guides⑥ (3 slots) on the locking cover ⑤ of connector A with the locking pins⑦ of connector B, insert connector A, and make sure that connector A is installed.

⑤ Further insert connector A until it stops. Then, turn clockwise the locking cover⑤ of connector A to lock connector A.



(c) Do not remove or install the output cable for bearing or motor while the control unit is energized.

(d) Route wires so the connectors of output cable for bearing and motors may not subject to excessive force.

(e) Tension to the connectors, derived from bending and weight of the output cable for bearing and motor, shall not exceed 196 N.

⚠ CAUTION	Tension to the connectors, derived from bending and weight of the output cable for bearing and motor, shall not exceed 196 N. If any of the connectors is subject to excessive force, reduce the force to the connector using appropriate supports.

⚠ CAUTION	Insert the cable connector horizontally along guide. Do not force in the connector. Applying excessive force may bend pins of the connector, causing malfunctions.

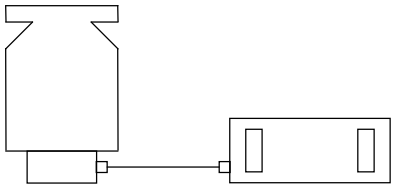
⚠ CAUTION	Please install output cables within a radius of allowable range of bending. (1) Output cables for motor: >100mm (2) Output cables for bearing: >150mm

(3) If the model is same, the TMP and the control unit can be combined freely.

(4) The digital control unit can be furnished with the coupling-free function that enables the operation with different models (but limited to the models corresponding to digital control unit) a model is selectable by switch changeover.

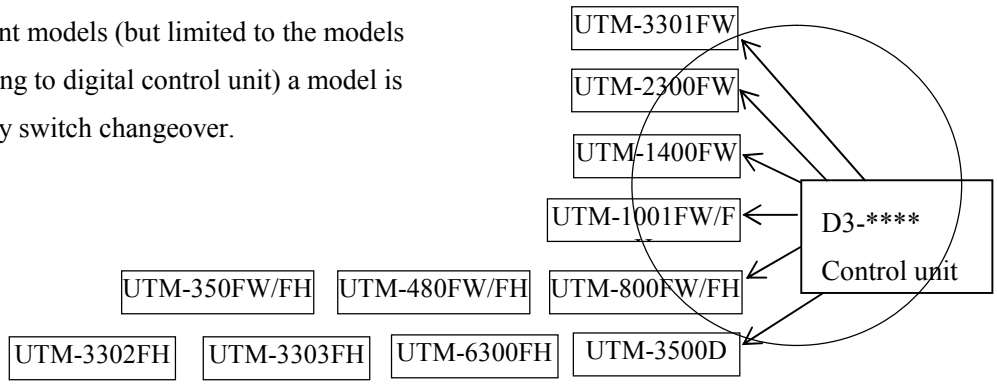
Example of coupling-free

(Combination possible by changeover)



(TMP corresponding to digital control unit)

(control unit)



4. Operation Procedure

4.1 Confirmation before operation

(1) Make sure that the TMP is installed to the equipment and supported properly. The control unit should be installed in the rack firmly and reliably.

(2) Make sure that the equipment and exhaust line are free of leak.

(3) Do not apply pressures above atmospheric pressure in any conditions including the time of a TMP stop.

(4) Make sure that the input cable for power source and output cables are connected correctly and are not loosed.

(5) Make sure that the cooling water is flowing on required condition without any leaks before turning on power.

(6) Operate the backing vacuum pump and make sure that the outlet pressure is under 13 Pa.

(7) Make sure that the purge gas is flowing at the required rate.

(8) When you use a corrosive gas, the pump should be an anti-corrosion surface treatment

⚠ CAUTION	Check connecting parts to equipment side such as the inlet flange, the outlet flange and the N_2 purge flange for any leaks by executing the leak test to prevent the leak of poisonous gas, etc.

⚠ CAUTION	This product is a vacuum pump and, naturally, the internal is in a vacuum state including pipes, therefore, pay due attention for removal of the pipes etc. because the human body can be exposed to the vacuum, which is very dangerous.

⚠ CAUTION	Do not give external excitation. Abnormal vibration may occur and TMP may be damaged.

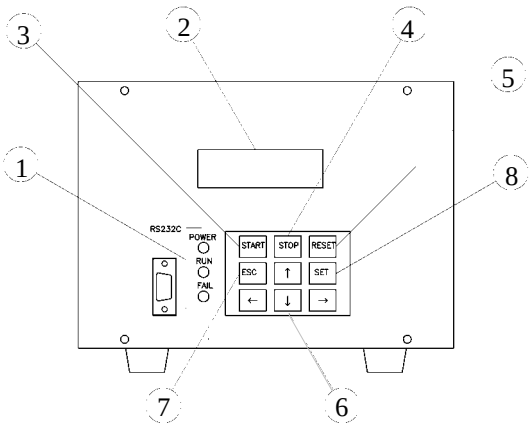
4.2 Switching on control unit

(1) When the POWER switch⑨ is turned on, the rotor floats and the cooling air fan of the control unit begins to run.

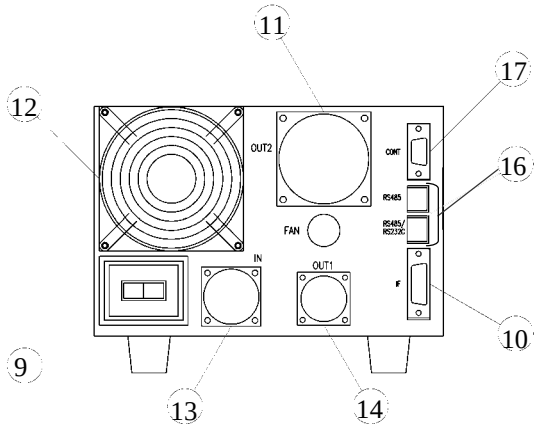
(2) When the POWER switch⑨ is turned off, the rotor touches down to the emergency bearing and the cooling air fan of the control unit stops running.

⚠ **CAUTION**	Make sure that the rotor stops rotation before turning off the POWER switch.

[Front view]



[Rear view]



4.3 Change the set point of Over load

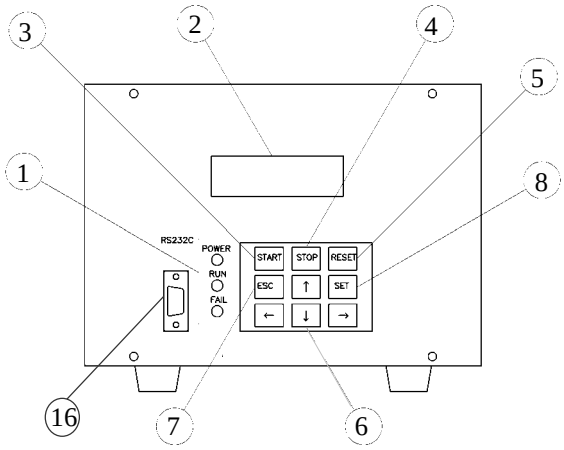
In this control unit is able to change the setting of over load, which is a protective function in case of failures, according to the type of gas (N_2 or Ar) to be pumped and cooling method of the TMP.
Factory setting is “Ar”. If gas that is equivalent to N_2 is used, refer to **Sec. 4.4 Control unit setting change flow chart** choose a user screen with a “←” or “→” key .
Then choose the [USet09] with a “ ↑ ” or “ ↓ ” key. Refer to “**supplement B : Key-controlled Operations and LCD Displayed Items on Operating Conditions ;Sec. 4.2.8**” and change the setting to “N_2”.
Also the cooling method is set to that of the TMP with which the control unit is to be assembled.

⚠ CAUTION	In case of pumping a gas equivalent to Ar, set the gas type setting of over load to “Ar”. If the TMP is operated continuously for long time at a flow-rate above the max. gas flow-rate under Ar with the over load setting unchanged “N_2“, the rotor blade temperature goes up and this can cause troubles. When pump is air-cooled type, set an overload setting to "Air". If the TMP is operated continuously for long time at a flow-rate above the max. gas flow-rate under air-cooled type with the over load setting unchanged “Water “, the rotor blade temperature goes up and this can cause troubles.

4.4 Operations on control unit panel (LOCAL)

Perform operations on the control unit panel in the following procedure. In addition, show each setting screen change flow chart after power source injection on the following page. And perform a change of a screen with a "←" or "→" key.

[Front view]



(1) **$\overline{\text{STOP}}$: setting confirmation procedure (user setting screen [USet16])**

① At the time of factory shipment, a $\overline{\text{STOP}}$ changeover switch becomes in "Enable"

② Choose a **user setting screen** with a "←" or "→" key.

③ Choose a **user setting screen [USet16]** with a "↑" or "↓" key.

④ If a number of $\overline{\text{STOP}}$ (screen display is /STOP) right side of is "0", it is an "Enable". If a number of there right side is "1", it is a "Disable".

(2) The circuit between the pin 9 and 8 of "CONT" connector should be closed to start. (See 4.7(3))

(3) Make sure that the POWER LED①on the control unit panel goes on and model name is displayed on the status LCD②.

(4) **$\overline{\text{STOP}}$: setting change procedure (at the time of "Enable", "Disable" change)**

(a) Change to a **user setting screen** with a "←" or "→" key.

(b) Choose a **user setting screen [USet16]** with a "↑" or "↓" key, and confirm Enable (0) or Disable (1) of $\overline{\text{STOP}}$.

(c) Push a "SET" key and enter an editing mode.

(d) Change a setting into "1" with a "↑" or "↓" key.

(e) Push a "SET" key again and decide a setting change.

(f) Push an "ESC" key out of an editing mode and can do cancellation of a change of setting.

The details refer to "**supplement B : Key-controlled Operations and LCD Displayed Items on Operating Conditions".**

(5) **Operation place selection confirmation (user setting screen [USet01].)**

① At the time of factory shipment, a operation place changeover switch becomes in **LOCAL**.

② Operation place is displayed by a Status LCD in Initial screen ,Ordinary state screen ,Monitoring screen and Extra ordinary state screen.

(6) **Operation place setting change procedure (REMOTE "REM", LOCAL "LOC", COMMUNICATION "COM")**

(a) Choose a **user setting screen** with a "←" or "→" key

(b) Choose a **user setting screen [USet01]** with a " ↑ " or " ↓ " key and confirm REM(0) or LOC(1) or COM(2) of operation place.

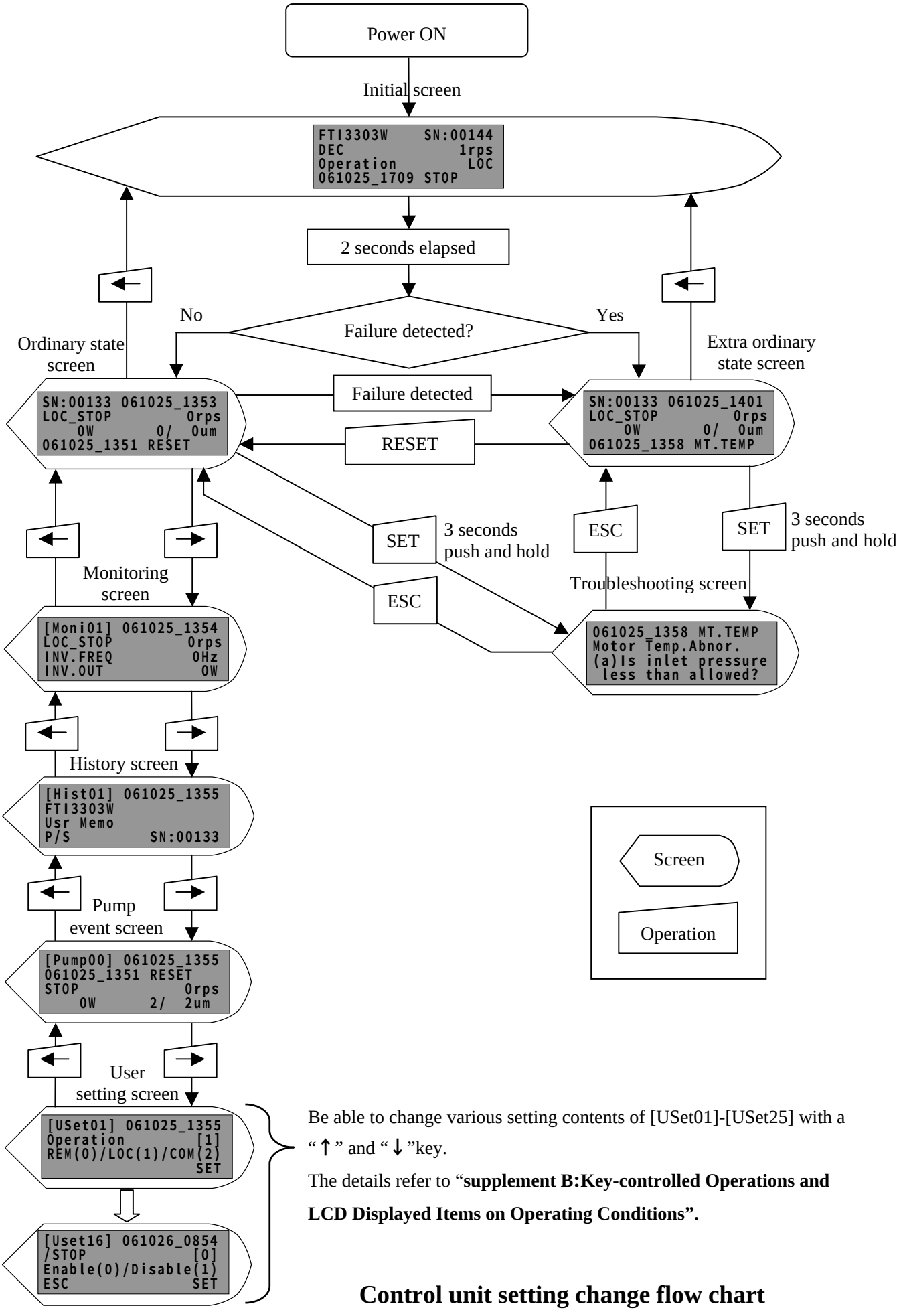
(c) Push a "SET" key and enter an editing mode.

(d) Change a setting into "1" with a " ↑ " or " ↓ " key.

(e) Push a "SET" key again and decide a setting change.

(f) Push an "ESC" key out of an editing mode and can do cancellation of a change of setting.

The details refer to "**supplement B: Key-controlled Operations and LCD Displayed Items on Operating Conditions".**



Be able to change various setting contents of [USet01]-[USet25] with a "↑" and "↓"key.

The details refer to "**supplement B:Key-controlled Operations and LCD Displayed Items on Operating Conditions".**

Control unit setting change flow chart

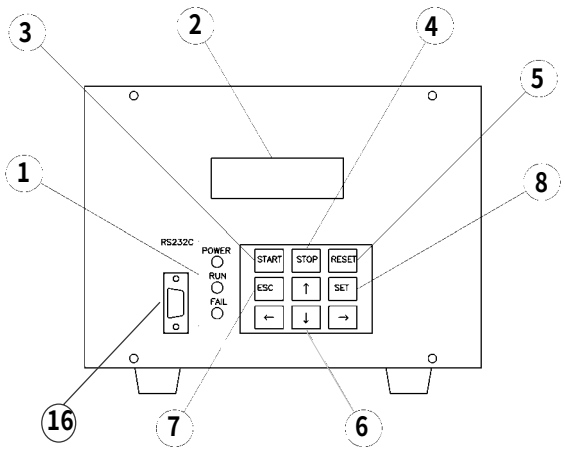
(7) Start operation
Push START button③ and SET button⑧ at the same time.

(8) Stop operation
Push STOP button④ and SET button⑧ at the same time.
Acceleration time and deceleration time is described at chapter 11, table 1.

⚠ CAUTION	Always use STOP button to stop TMP. Never attempt to stop TMP by cutting the power source (by turning off POWER switch or cutting the power source **etc.**)

(9) Alarm resetting
An alarm can be reset when RESET button⑤ and SET button⑧ are pushed at a the same time. Before resetting, be sure to confirm the cause of alarm on the status LCD② on the control unit panel.
(For the causes of alarms, see Sec.5.1.)

[Front view]



4.5 Check of operating conditions

Check operating conditions on the status LEDs on the Control unit and the status LCD on the Operation box panel.

① POWER

Goes on when the power is supplied (goes off when there is no power supply).【Green】

② RUN

Goes on when the TMP is operated. (goes off during free run).【Green】

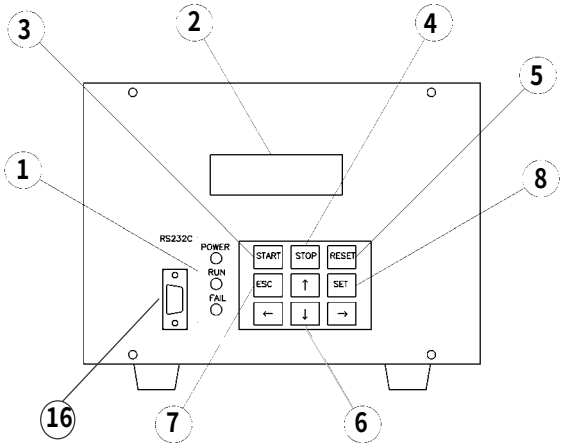
③ FAILURE

Goes on when alarm condition occurs.【Red】

④ Status LCD

Status details, refer to **“supplement B”: Key-controlled Operations and LCD Displayed Items on Operating Conditions”** conformation method.

[Front view]



4.6 Remote control (REMOTE)

Perform remote control in the following procedure.

(1) Make sure that the POWER LED① on the control unit panel.

(2) **Confirm operating place selection (User setting screen [USet01])**
Operation place is displayed by a Status LCD in Initialscreen ,Ordinary state screen ,Monitoring screen and Extra ordinary state screen.

(3) **Operation place setting change procedure (REMOTE “REM”, LOCAL “LOC”, COMMUNICATION “COM”)**

(a) Refer to **sec.4.4. Control unit setting change flow chart** Choose a **user setting screen** with a “←” or “→” key

(b) Choose a **user setting screen [USet01]** with a “↑” or “↓” key and confirm REM(0) or LOC(1) or COM(2) of operation place.

(c) Push a “SET” key and enter an editing mode.

(d) Change a setting into “0” with a “↑” or “↓” key.

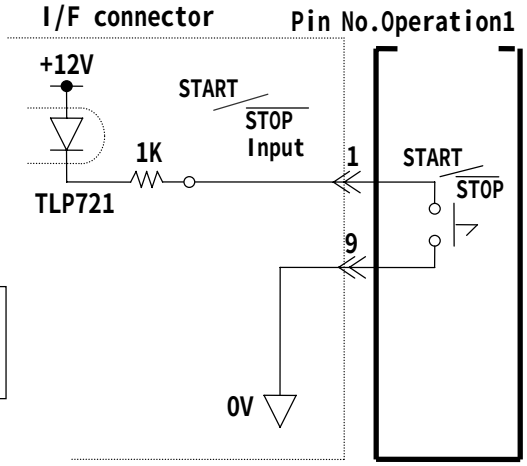
(e) Push a “SET” key again and decide a setting change.

(f) Push an “ESC” key out of an editing mode and can do cancellation of a change of setting.

The details refer to **“supplement B: Key-controlled Operations and LCD Displayed Items on Operating Conditions”.**

(4) START/$\overline{\text{STOP}}$ operation
Example of connection of I/F connectors pin No. is shown below.
The TMP can be started and stopped by closing and opening the circuit between connectors 1 and 9.
In this case, the action of the contact should not be momentary but latched.

⚠ CAUTION	Apply non-voltage dry contacts to input signals.



Remote control connection

4.7 Remote control "CONT" (common to Remote/Local)

Regardless of any operation place selection, the following remote control can be executed.

(a) Remote stop

(b) Error reset

(c) Speed variable

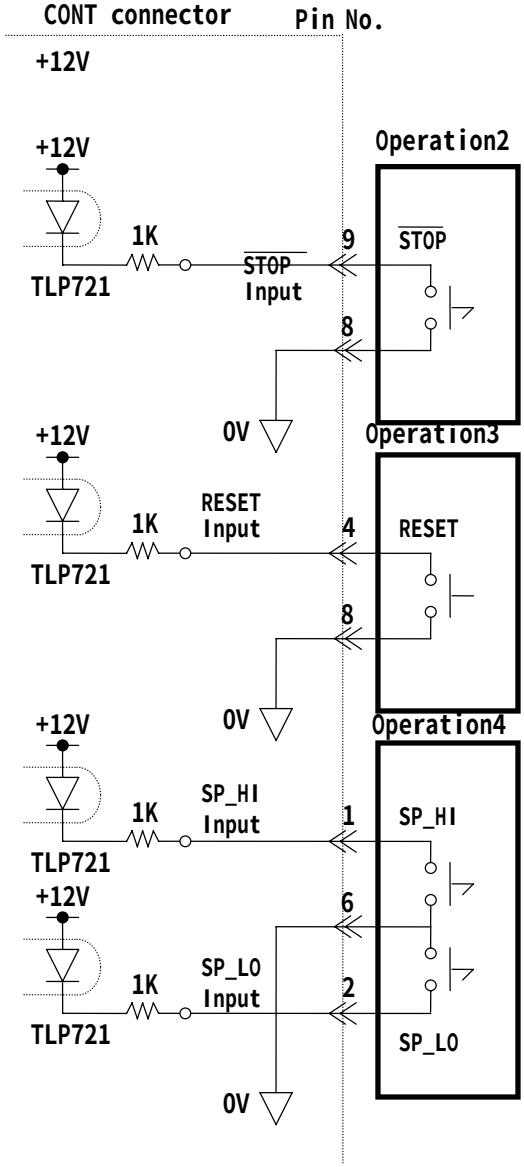
These remote controls are executed by opening/closing the contact of the remote operation connector "CONT".

(1) Make sure that the status LED Power① of the control unit is goes on.

(2) Selection of operating location
Remote operation is effective regardless of operation place selection.

(3) Remote stop ($\overline{\text{STOP}}$)
The connection procedure and the operation example are shown in the right figure (Operation 2).
The TMP can be forcibly stopped by opening the circuit between pin 9 and 8 of "CONT" connector for 10msec or longer using one contact or transistor.
The contact and transistor in this case should not be momentary but latched. In normal running, the circuit between the pin 9 and 8 should be closed to start.

$\overline{\text{STOP}}$ choice key procedure operation (at the time of "Enable", "Disable" change)
The details refer to "sec.4.4.Control unit setting change flow chart"

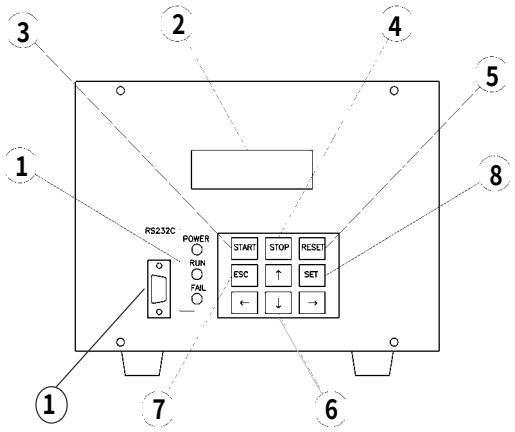


Remote control connection method (1)

(4) Error reset (RESET)

The connection procedure and the operation examples are shown in the right figure (Operation 3). An error can be reset by closing the circuit between pin 4 and 8 of “CONT” connector for approx. 10msec or longer using one contact or transistor. Make sure that the cause of the error before resetting by using the status LCD② on the control unit or RS-232C/RS-485 communication.

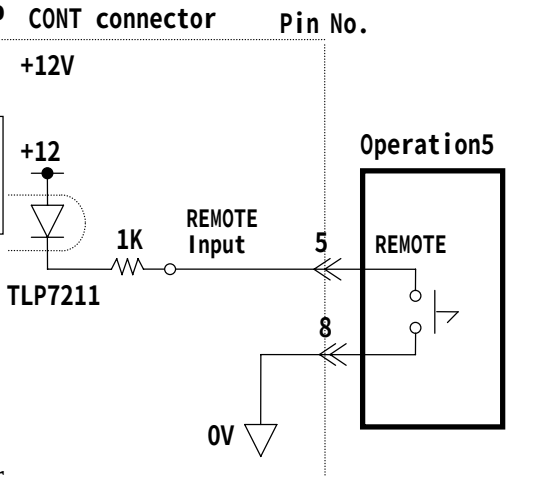
[Front view]



(5) Speed variable

The connection procedure and the operation example are shown in the right figure (Operation 4). The speed variable function setting points can be selected by the combination of opening/closing of the contacts between pin 1 and 6, and 2 and 6 of “CONT” connector. The setting points are ready in quantity of 4. The TMP revolution can be controlled as required by changing the selection of set point by inputting a contact. For details, **refer to supplement E setting change point and a driving state conformation method.**

⚠ **CAUTION**	Apply non-voltage dry contacts to input signals.



Remote control connection method

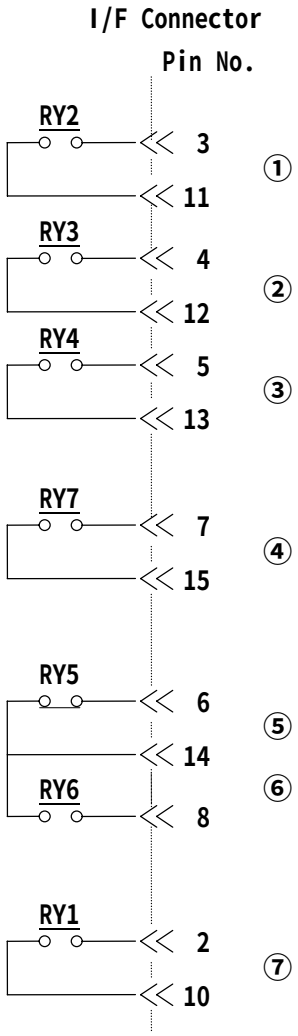
(6) Remote interlock

The connection procedure and the operation are shown in the right figure (Operation 5).
The operation place selection is “REMOTE” by closing the circuit between pin 5 and 8 of “CONT” connector for approx. 10msec or longer using one contact or transistor.
While the point of contact is closing, the operation place selection is forcibly fixed to “REMOTE”, so it is impossible to perform operations on the local panel any longer.

4.8 Operation monitoring signals

Dry contacts and revolution pulse of TMP are taken out to I/F connector and CONT connector as operation monitoring output signals.
The output signals are as follows.

(1) I/F connector



⑴ ACCELERATION
The contact is closed during acceleration.

⑵ NORMAL
The contact is closed during normal operation at the rated speed.

⑶ DECELERATION
The contact is closed during deceleration and opened when the TMP stops.
(The contact is opened during free run.)

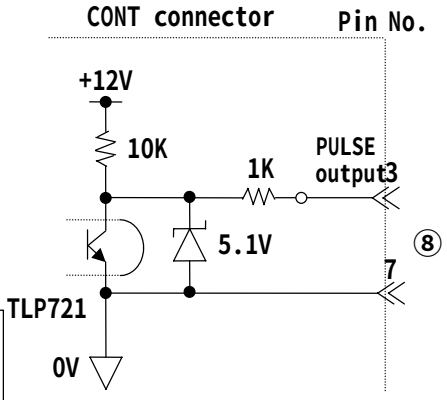
⑷ REMOTE/LOCAL
The contact is closed when the remote control is selected.

⑸ FAILURE-EN
The contact is opened when an alarm occurs.
(The contact is opened until accepting reset. But while POWER OFF or touch down at power failure is occurred, the contact is opened.)

⑹ FAILURE
The contact is closed when an alarm occurs.
(The contact is closed until accepting reset.)

⑺ POWER ON
The contact is closed when the power is supplied.

(2) CONT connector



⑻ PULSE

Output 0-5V pulse (rectangular wave) in synchronized with the revolution.
The specification of the output contacts are as in the right table.

⚠ CAUTION	The circuit voltage and current should be less than the specifications given in the right table. For DC inductive loads, it is necessary to install a damping diode.

SYMBOL	TYPE	MAKER
RY1～5,7	APQ3311	Matsushita Electric
RY6	G6BK-1114P-US-DC12V	OMRON

Resistance load	Inductive load
AC 250V 0.5 A	AC 250V 0.5 A
DC 30V 0.5 A	DC 30V 0.5 A

4.9 Serial communication function

Use a serial communication function for the following item and can perform it.

- Running operation
- Change of the TMP revolution
- Failure resetting
- Acquisition of parameters

When use a serial communication function, Refer to the **Supplement C; Serial Communication Function Features.**

5. Protective Functions

5.1 Protective functions at failures

⚠ CAUTION	In any event, never turn off the power switch of the control unit during operation of the TMP or when the FAILURE LED goes on.

(1) Failure indications when power switch is turned on
When power switch ⑨ is turned on, if the status LED goes on, turn off the power switch and turn on the power switch ⑨ again after alarm (failure ①) resetting.

(2) Failure indications
If the control unit detects a fault, the FAILURE LED ① on the panel goes on and the status LCD ②indicates the alarm item, and TMP automatically decelerates and stops.
The protective functions at failures are shown in the right table.
When failures occur, perform required inspection and treatment according to the procedure described in **10.2 Inspection in case of failure.**

(a) "Free run" means that the motor decelerating function stops and the TMP is decelerating only by mechanical wind losses.
The time required for the TMP to completely stop is about 10 hours.

(b) Even when the treatment of alarms "OPL" and "O.FREQ" is decelerating, the TMP needs about 10 hours before it stops.

(3) Resetting at failure mode
Resetting turns off the FAILURE LED and the indication of the alarm item.
If the failure persists, the protective function continues.

(4) HD Over-Frequency (HD.FREQ) Error resetting

The HD Over-Frequency Error is a hardware trip of over-frequency (trip by the circuit). This resetting is to prevent TMP from over-revolving due to malfunction of the control unit. This error cannot be reset before the power is turned off. Check that the TMP stops operation and execute "4.4(5) Switch Alarm Resetting," then turn off the power switch.

⚠ CAUTION	When "INV TEMP" alarm occurs turn off the POWER switch after the TMP stops, other wise fire may occur.

Protective functions at failures

Alarm (English) Cause of alarm	Treatment
P.SUSPEN Power failure (for more than 2 sec.)	Touch down after deceleration
P.SUPPLY Control power supply abnormal	Deceleration
CNV DC-DC Converter abnormal	Deceleration or free run
CNV.TEMP DC-DC Converter Temp abnormal	Deceleration
HD.FREQ Hard over frequency	Deceleration or free run
O.LOAD Over load	Deceleration
ACC.TIME Acceleration time over	Deceleration
DSP.COMM Internal Communication abnormal	Deceleration
INV Inverter abnormal	Deceleration or free run
OPL Single phase	Deceleration or free run
VIBRATIO Abnormal vibration	Deceleration・ Not Acceleration
PULSE Rotation abnormal	Deceleration
O.REV Over revolution	Deceleration
O.FREQ Over frequency	Deceleration
MT.TEMP. Motor temp. abnormal	Deceleration
SWITCH Start abnormal	Did not start

5.2 Protective functions at power failure

If the power failure duration is less than 2 seconds, the TMP continues operating.
If the power failure lasts longer than 2 seconds, the TMP judges that a power failure has happened and goes into failure mode.

(1) Operation at power failure

(a) When rotation is more than about 20%

The battery-free function is actuated, and the TMP is decelerated to about 20% by regenerative braking.

During power failure and deceleration, POWER LED of the status LED goes off and FAILURE LED goes on and DEC is displayed on the status LCD.

Also, the status LCD indicates “P.SUSPEN”. During this period, resetting cannot be done.

(b) When rotation is less than about 20%

The control unit stops all functions, and the rotor touches down to the emergency bearing and decelerates and stops. It takes from a few minutes to one hour to stop.
During this time, the control unit does not send out signals except the FAILURE signal.

(2) Actions at resumption of power supply

(a) When rotation is more than about 20%

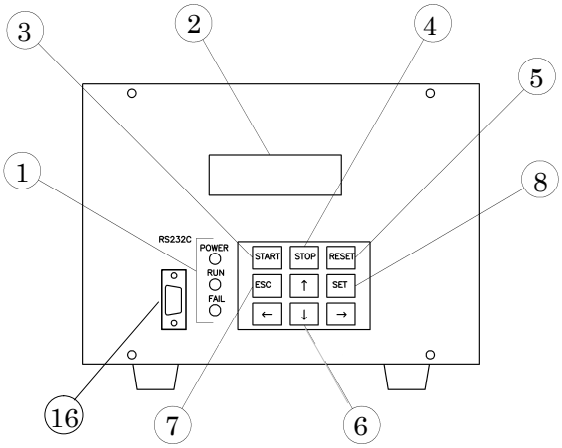
If the power source is resumed during deceleration due to power failure, the POWER LED goes on again. When resetting is done, the FAILURE LED and alarm item on status LCD go off.

If restart operation is not done, the TMP continues decelerating and stops.

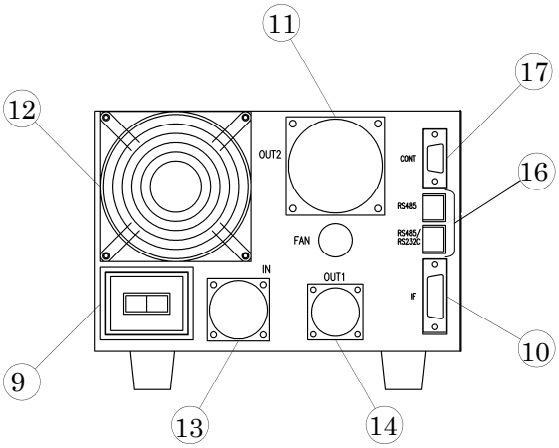
(b) When rotation is less than 20%

If the power source is resumed during touching down and decelerating due to power failure, the rotor floats again, the POWER and FAILURE LED go on and “P.SUSPEN” is indicated on the status LCD. When resetting is done, the FAILURE LED goes off and “P.SUSPEN” is disappeared on the status LCD. If restart operation is not done, the TMP continues decelerating and stops.

[Front view]



[Rear view]



(3) Power failure when failure occurs

(a) If the power fails when a failure which induces deceleration (see Sec5.1.) occurs, the battery-free system is actuated and the TMP decelerates and stops in the manner at power failure. (see Sec5.2.).

(b) If the power fails when a free run occurs (see Sec5.1.), the rotor touches down to the emergency bearing as soon as the power fails.

⚠ CAUTION	If power failure frequently occurs, it may become impossible to operate the TMP. Do not operate the TMP under this condition.

5.3 Occurs free run

(1) When free run occurs, be sure to confirm the cause of alarm and operate to reset.
If resetting cannot be done, maintain the state until the TMP stops.
If resetting can be done, push START button ③ and SET button ⑧ at the same time, and make sure that the status LCD indicates ACC.
Push STOP button ④ and SET button ⑧ at the same time, and the TMP continues decelerating and stops.

(2) During free run, do not turn off the power source of the control unit. The rotor touches down suddenly and a trouble can be caused.

5.4 Failure stop

(1) Operation of TMP at failure

(a) When failure occurs in the TMP, the TMP outputs the alarm signal (Operation monitoring signal FAILURE 8, 14 of I/F connector is closed; FAILURE-EN 6, 14 is opened; FAILURE LED goes on; status LCD indicates the content of failure), and automatically stops. The contents of failure or the operation of the TMP refer to Sec.5.1. With regard to the time to stop, see chapter 11 technical data.

(b) After failure is disappeared or removed, operate to reset.
With regard to the Operation procedure, see sec.4.4 (5), 4.6(5). (Push RESET button ⑤ and SET button ⑧ at the same time, or reset the alarm by 「RS-232C/RS485」data communications, or close the CONT connector pin 4-8) If the TMP is not input the START signal again, the TMP doesn't re-start.

(c) In case of failure about the motor, the time to stop is about 10 hours.

(2) Notes and treatment of the equipment when the failure occurs in the TMP

(a) When the equipment receives the alarm signal, let it carry out the treatment for stopping the equipment or closing the valve between the chamber and the TMP.

(b) Never expose to the air, until the TMP completely stops. The TMP may trouble.

(c) Do not turn off the power switch of the control unit to stop in the emergency. If do it, the TMP is touched down during high speed rotation and may be broken down, because in case of failure about motor the TMP doesn't normally operate battery-free function.

(d) If the situation that TMP cannot be operated should arise, please take the emergency stop measure by turning off the power.
In addition, the function of control unit stops, and a rotor touches down to a protective device, then it slows down and stops. The time to stopping is several minutes - dozens of minutes.

(3) Failure stop of the TMP at failure of the equipment
Operation of the TMP at failure of the equipment

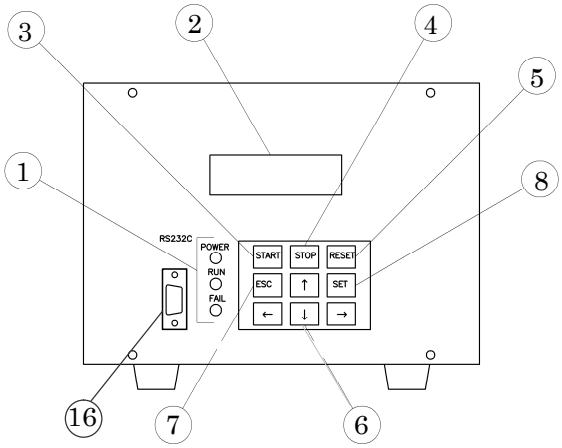
The TMP doesn't have function of the failure stop that failure occurs in the equipment. Stop the TMP when failure occurs. Procedure to stop the TMP is shown as follows.

(a) In case of operation on the control unit (LOCAL)

・Selection of operating location
For details, see Refer to "chapter 4.4" , and please confirm that a place of operation becomes LOCAL.

・Stop operation
Push STOP button④ and SET button⑧ at the same time.

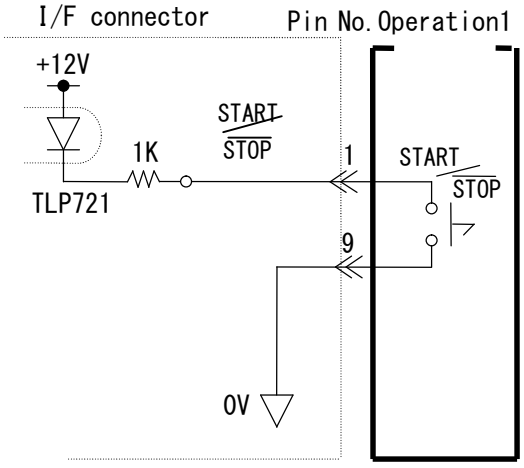
[Front view]



(b) In case of remote control (REMOTE)

・Selection of operating location
For details, see Refer to "chapter 4.6" , and please confirm that a place of operation becomes REMOTE.

・Start/Stop operation
Example of connection of I/F connector's pin No. is shown right figure.
The TMP can be started and stopped by closing and opening the circuit between connectors 1 and 9 by contact or transistor. If the circuit between connectors 1 and 9 is opened, the TMP decelerates from the rated speed. In this case, the action of the contact should not be momentary but latched.
With regard to the STOP operation, see chapter 4.



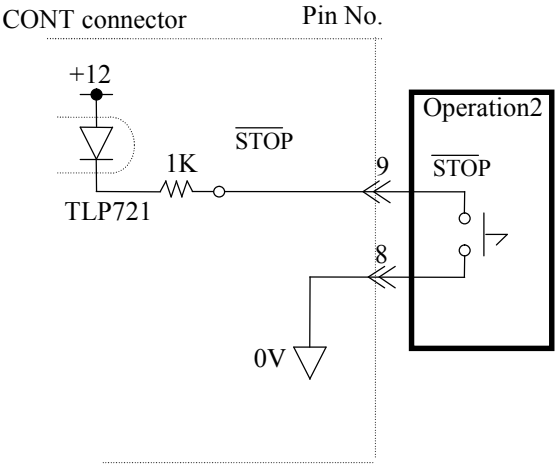
Remote control connection

(c) REMOTE/LOCAL common

・Selection of operating location
Regardless of operating location, following operation can be operating.

・REMOTE stop ($\overline{\text{STOP}}$)

Connection and example of operation is shown right figure (operation 2). The TMP can be stopped obligatory by opening the circuit between CONT connectors 9 and 8 above 10 msec by contact or transistor. In this case, the action of the contact should not be momentary but latched.



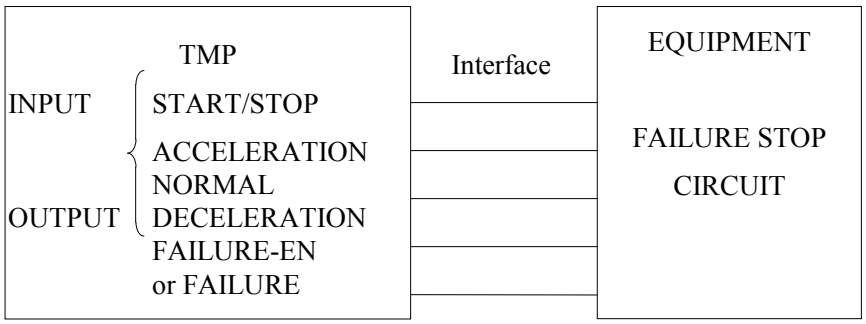
Remote control connection

(4) Notes to stop the TMP in failure stop of the equipment

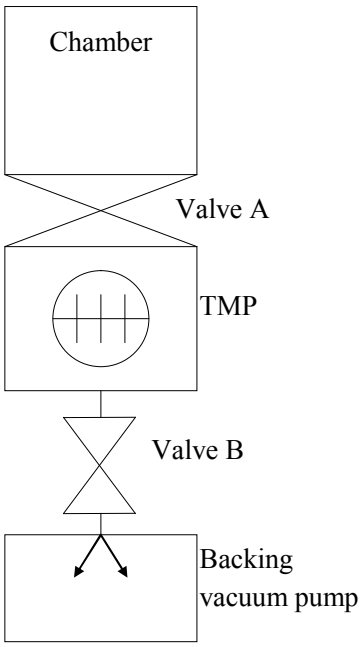
(a) Never expose to the air, until the TMP completely stops. The TMP may trouble. Close the valve between the equipment and the TMP.

(b) Do not turn off the power switch of the control unit to stop in the failure. If do it, the TMP is decelerated to about 20%. When rotation is less than 20%, the control unit stops all functions, and the rotor touches down to the emergency bearing and decelerates and stops. In this case, time to stop is longer than operation to stop at LOCAL or REMOTE, and emergency bearing life decreases. After touch down, the TMP doesn't output the operation monitoring signals.

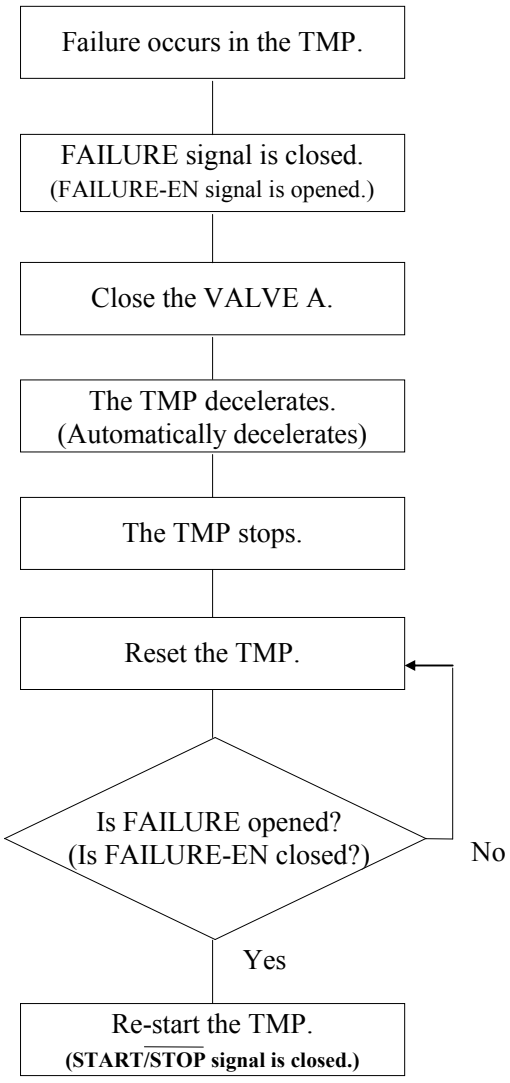
(c) The example to construct the failure stop circuit is shown in next page.



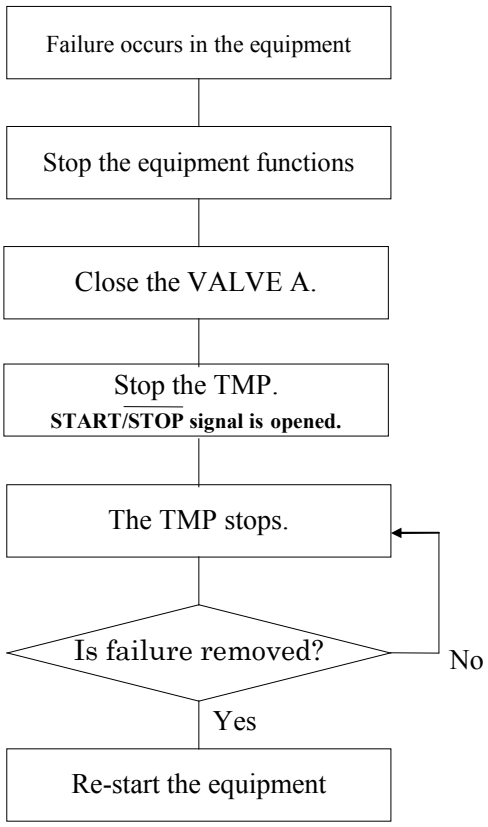
Block diagram of the failure stop circuit



Construction of the equipment



Flow Chart
(Failure occurs in the TMP)



Flow Chart
(Failure occurs in the equipment)

Example to construct failure stop circuit for TMP

6. Bake-out Operation

⚠CAUTION	Do not allow the casing temperature to exceed 120℃. Keep the total time of baking less than 10,000 hours. While baking, do not apply gas load or magnetic fields for TMP.

(1) If ultra-high vacuum in an order of 10^{-6} Pa is required, it is necessary to bake out not only the equipment but also the TMP.

(2) To bake out the TMP, proceed as follows.

(a) In the case of water cooling type, do authority of water of a coolant in the main body. In addition, in the case of air cooling type, confirm that an air-cooling fan revolution normally.

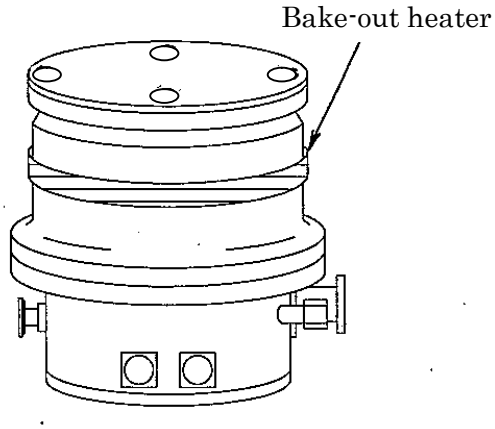
(b) In case of the casing water cooling type (optional), drain water in the casing, and close the inlet of cooling water and open the outlet.

(c) Fit the bake-out heater near the inlet flange.

(d) Operate the TMP.

(e) Energize the bake-out heater.

(f) During the baking, do not flow any gases.



(3) If the water supply fails during bake-out, immediately turn off the bake-out heater.

(4) The bake-out heater is an available on special order. Use heaters purchased from ULVAC.
If you use the bake-out heaters of the other makers, do not allow the casing temperature to exceed 120℃.

⚠CAUTION	The bake-out heater becomes very hot. Do not touch it while it is energized. Allow it to cool down.

(5) Bake out the equipment with care. Do not allow its inlet flange to be heated above 120℃.

7. Gas Conditions

To prevent trouble, observe the following instructions.

(1) The treated (exhaust) gas temperature and pressure should be as in the right table.
In case that the gas temperature exceeds 35℃, and there is a magnetic field, contact ULVAC.

⚠ CAUTION	Do not operate the TMP in the pressure exceeding the allowable.

⚠ CAUTION	In any event, do not use special gases (such as gallium, mercury, and flammable gasses). Use of chlorine or fluorine gas is possible.

⚠ CAUTION	When this pump is used in any process which may cause adhesion of deliquescent reaction products and the pump is exposed to the air for maintenance or other reasons minimize the exposure time and purge the pump with inert gas after the exposure. If not done so, chemical reactions with moisture in the air may cause corrosion leading to unrepeatable damage.

⚠ CAUTION	Operate backing vacuum pump and exhaust the gas during TMP runs.

(2) If a corrosive gas (e.g. Cl_2, HBr, CHF_3) is used, feed a small quantity of purge gas from the purge gas flange.**Refer to Gas purge of clause 3.5**
If you need any clarification on outlet gas conditions, contact ULVAC.

Gas condition *1
(water cooling)

Model	Gas	Inlet (Pa)	Outlet (Pa)
UTM-350/ UTM-480FH	N_2	43	410
	Ar	3	200
UTM-350/ UTM-480FW	N_2	76	440
	Ar	4.5	230
UTM-800/ UTM-1001FH	N_2	18	180
	Ar	1.6	90
UTM-800/ UTM-1001FW	N_2	38	290
	Ar	3	120
UTM-1400FW	N_2	13	240
	Ar	2.6	170
UTM-2300FW	N_2	7	180
	Ar	2	180
UTM-3301FW	N_2	8	180
	Ar	1	150
UTM-3302FH	N_2	7	220
	Ar	0.85	100
UTM-3303FH	N_2	9	210
	Ar	0.9	130
UTM-6300FH	N_2	0.64	160
	Ar	0.51	160
UTM-3500D	Ar	1.7	1330

Do not allow to bake out while gas is treated.

*1 When the suction gas temperature is under 35℃ and there is no magnetic field.

⚠ WARNING	Take the required protection measures for a worker's safety, after getting MSDN （Material Safety Data Sheet） of the used gas from a gas supply maker and checking the characteristic of gas.

⚠ WARNING	At maintenance and inspection of a pump, discharge the remains gas inside a pump completely. If the gas remains in the inside of the pump, in case a pump will be removed, it becomes the cause of serious accidents by the gas.

⚠ WARNING	In case returning, in order to overhaul, to ULVAC the pump which attracted poisonous gas (e.g.AsH_3) , reactant gas (e.g.HBr,Cl_2), inflammable gas (e.g.PH3), etc. , Seal with the inside of the pump filled up with nitrogen gas, and be sure to fill in the Attracted gas kind／notes to the packing.

8. Atmosphere Inrush

⚠CAUTION	Pay attention do not to allow the inflow of a large amount of gas. Suction of a large amount of gas can damage pump functions.

Do not allow inflow as a large amount of gas or air. Depending on its degree, the suction of a large amount of air on gas can damage pump functions. Use special care with valves and other operations on the equipment.

9. Storage Procedure

If the TMP and control unit will be stopped for a long period of time, store them in the following manner.

(1) Evacuate the TMP, purge it with N_2 etc. and close tightly the inlet, outlet, and purge gas flange.

(2) Fully drain the cooling water by feeding compressed air from one side of cooling water port.

(3) Remove the input cable for power source from the control unit.
If other cables are removed, store them with care to protect the cable ends and connectors from damage and dust.

(4) Do not store the TMP and control unit in any of the following places.

(a) Damp place

(b) Place exposed to the direct sunlight

(c) Place exposed to corrosive gasses

(d) Place exposed to water splashes

(e) Dusty place

(f) Where ventilation is poor

(g) Place exposed to a strong magnetic or electric field

(h) Hot place

(i) Place exposed to briny air

(j) Place subjected to large vibration

10. Maintenance and Inspection Procedure in case of Failures

10.1 Maintenance and inspection procedure

Maintenance and inspection of the TMP and control unit depend on the operating and environmental conditions, however, in order to prevent trouble and secure the reliability for a long period of time, practice the inspection given in the table below periodically. Before doing the maintenance and inspection, make sure that the input power source to the TMP and control unit is turned off.

⚠ CAUTION	Do not make insulation resistance and withstand voltage tests of the control unit. The control circuit is composed by electronic parts and may be subject to damage.

⚠ CAUTION	When used in a process where reaction products can deposit, periodical (fix aim from 3 to 6 month) maintenance (removal of reaction products) is required.

Item	Inspection point	Corrective action
Pump proper	(1) Any abnormal sound, vibration, heat? (2) Any looseness in fixing bolts? (3) Any gas solidification, deposit? (4) Any color change in the rotor blade? (5) Any leaks in leak test?	(1), (4): Contact the Supplier. (2): Tighten them with proper torque. (3): Clean off (remove) reaction products. (5): Confirm seal (O rings) parts.
Cooling water inlet	(1) Any leaks, clogs? (2) Cooling water quantity, proper?	(1): Contact the Supplier. (2): Make adjustment.
Connector・Cable (I/O cable, I/F cable)	(1) Any looseness in connectors? (2) Any defects such as discoloration and corrosion in connectors and cables?	(1): Reattach them. (2): Replace them.
Control unit	(1) Any abnormal sound, discoloration, smell? (2) Any dirt, dust? (3) Over 5 years after manufacture date?	(1), (3): Contact the Supplier. (Overhauling required) (2): Remove them using a cleaner.
Cooling air fan (Pump proper)	(1) Any dirt, dust? (2) Any abnormal sound, vibration? (3) Operating hour total, exceeding 30,000 hours?	(1): Remove them using a cleaner. (2), (3): Replace the fan. (See Fig.6 for replacing procedure.)
Cooling air fan (Control unit)	(1) Any dirt, dust? (2) Any abnormal sound, vibration? (3) Operating hour total, exceeding 30,000 hours?	(1): Remove them using a cleaner. (2), (3): Replace the fan. (See Fig.6 for replacing procedure.)

10.2 Inspection in case of failure

If any of the following condition occurs in the TMP during operation, inspect the TMP and take corrective actions in the following manner.
If any condition not included in the table occur or if the TMP does not operate normally after corrective action, contact the Supplier.

	Condition	Inspection and corrective action
POWER ON	(1) POWER LED does not go on	(a) Disconnection of IN connector: Check for plug-in, disconnection and pin deformation. (b) Input power voltage is less than AC 180V: Measure input power voltage.
	(2) Cooling air fan of control unit does not run. (Pump proper and Control unit Cooling air fan.)	(a) Does POWER LED go on? See (1). (b) Inclusion of foreign matter: Visually check for foreign matter and remove it. (c) Locked: Manually inspect.
	(3) Rotor does not float up normally. (No touch sound of emergency bearing when POWER switch is turned on or off. Abnormal noise occurs.)	(a) Disconnection of output cable: Check for plug-in, disconnection and pin deformation. (b) Output cable is broken: Connection test* (c) Does POWER LED go on? See (1).
START ON	(1) No indication of ACCELERATION	(a) Does POWER LED go on? See previous section. (b) Does the rotor float up? See previous section. (c) Output cable is disconnected: Check for plug-out, disconnection and pin deformation. (d) Output cable is broken: Connection test* (e) In case of LOCAL operation: Is a place of operation LOCAL? (f) In case of REMOTE operation: Is a place of operation REMOTE? Is circuit between I/F connectors 1 and 9 (START/$\overline{\text{STOP}}$) closed? (g) In case of REMOTE/LOCAL common Is circuit between CONT connectors 9 and 8 ($\overline{\text{STOP}}$) closed? (h) Confirmation of $\overline{\text{STOP}}$ Refer to chapter **4.4(1).**

	(2) TMP starts but NOR is not indicated in the status LCD. (3) Rotation indicated on the status LCD does not increase.	(a) Pressure at inlet should be less than allowed. (b) In case of REMOTE operation: Is circuit between I/F connectors 1 and 9 (START/$\overline{\text{STOP}}$) closed? (c) Is rotor rotating? Visual check. (d) Disorder of motor: Measure resistance between U, V and W phases.*
STOP ON	(1) No indication of DECELERATION	(a) In case of LOCAL operation: Is a place of operation LOCAL? (b) In case of REMOTE operation: Is a place of operation REMOTE? Is circuit between I/F connectors 1 and 9 (START/$\overline{\text{STOP}}$) opened? (c) Confirmation of LOCAL/REMOTE setting. Refer to chapter **4.4(5).**
	(2) TMP stops but DEC is not indicated in the status LCD.	(a) Is indication of rotation (%) in the status LCD normal?

	Phenomenon		Inspection and corrective action
	FAILURE LED goes on		Trouble of TMP or control unit except the following causes.
	Alarm	Item	
BEFORE OPERA-TION	SWITCH	Start abnormal	(a) Is START operated before turn on power.
	INV	Inverter abnormal	(a) Disorder of motor: Measure resistance between U, V, and W phases.* (b) Was there fluctuation of momentary load (atmosphere inrush)? (c) Is there entry of high voltage surge or electrical noise?
	CNV	DC-DC Converter Abnormal	
	CNV. TEMP	DC-DC Converter temperature abnormal	(a) Is the cooling fan of the control unit normal? (b) Is the control unit ventilated well? (c) Is TMP over loaded?
	OPL	Single phase	(a) Output cable disconnected: Check for plug-in, disconnection and pin deformation.* (b) Disorder of motor: Connection test between U, V, and W phases.*
DURING OPERA-TION	O. LOAD	Over load	(a) Is inlet pressure less than allowed? (b) Disorder of motor: Measure resistance between U, V, and W phases.* (c) Is rotor rotating? (Is it not locked with foreign matter, gas solidification and adhesion?)
	MT. TEMP	Motor temp. abnormal	(a) Is inlet pressure less than allowed? (b) Disorder of motor: Measure resistance between U, V, and W phases.* (c) Are cooling water flow rate and temperature normal? (d) Is the cooling fan of the pump normal? (e) Is ambient temperature less than permission value? (f) Output cable disconnected: Check for plug-in, disconnection and pin deformation.*
	ACC. TIME	Acceleration time over	(a) Is inlet pressure less than allowed? (b) Disorder of motor: Measure resistance between U, V, and W phases.* (c) Is rotor rotating? (Is it not locked with foreign matter, gas solidification and adhesion?) (d) Did rotor touch down to emergency bearing many times during operation?
	VIBRATIO	Abnormal vibration Not float up	(a) Is TMP subjected to external vibration? (b) Are there no gas solidification and adhesion? (c) Does rotor float up? (d) Did rotor touch down to emergency bearing many times during operation?
	P. SUSPEN	Power failure	(a) Was POWER switch not turned off when TMP was rotating? (b) Did power failure of more than 2 sec. occur?
	O. FREQ	Over frequency	(a) Is there any indication of high voltage surge or electrical noise?

*See Fig.5

P. SUPPLY	Control power supply abnormal	(a) Does rotor float up normal? (b) Did abnormal vibration occur?
PULSE	Rotation abnormal	(a) Is indication of rotation (%) in the status LCD normal?
O.REV	Over revolution	(a) Is there any indication of high voltage surge or electrical noise?
HD.FREQ	Hard over frequency	(a) Is there any indication of high voltage surge or electrical noise?
DSP.COMM	Internal Communication abnormal	(a) Is there poor in inside communications cable connection.

*See Fig.5

10.3 Procedure of returning the TMP for maintenance

Handle TMP used with toxic or corrosive gas in the following procedure.

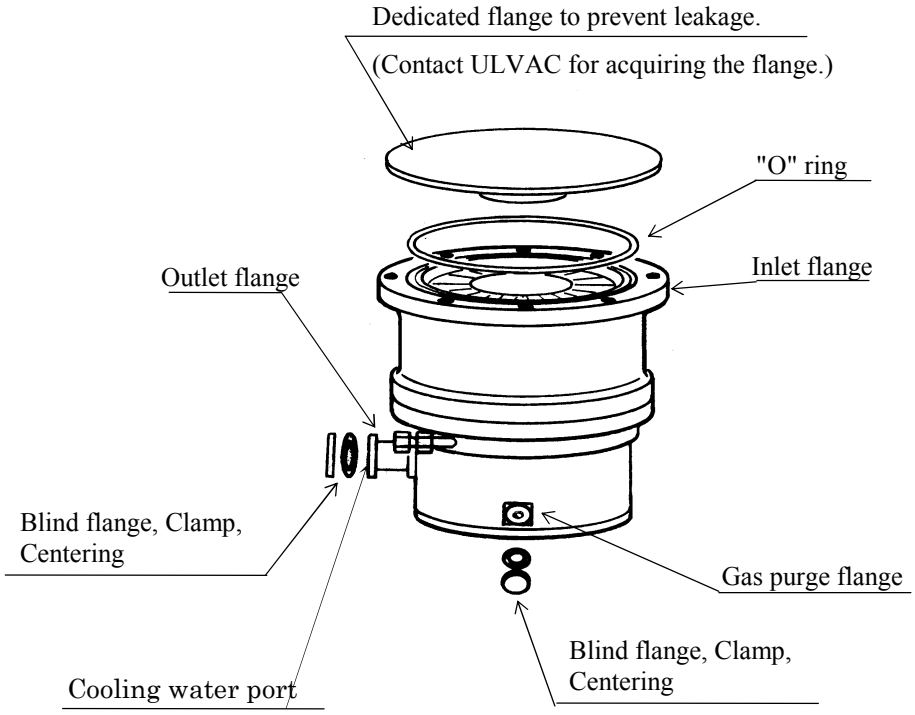
(1) To remove the TMP from equipment for maintenance, perform sufficient N_2 purging before TMP is exposed to the air.

(2) After removing TMP, promptly seal the openings (including inlet flange, outlet flange, and gas purge flange) with a dedicated flange and "O" rings to prevent leakage of toxic gas in the pump.

(3) If deliquescent reaction products such as metal etcher, Polysi etcher, and metal CVD are attached, especially reduce the time when the pump is exposed to the air. (Chemical reactions with moisture in the air may cause corrosion leading to unreparable damage.)

(4) Drain cooling water sufficiently by blowing compressed air into the system from one side of the cooling water ports.

(5) Pack the control unit and cables so carefully that their panels and connectors may not be damaged, and return the package.



10.4 Spare parts list

WARNING	If you remove the pump body in the maintenance from the device, you may be dangerous substance toxic gas, etc. in the pump body is left so please be careful.

It is different for deterioration progress speed of each part changes greatly by pump condition. （Magnetic-bearings, sensors and motor need to change new ones per 3-5 years in addition in using corrosive gas, rotor temperature rises up depending on process, therefore it's possible the rotor life is short.）

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 soon) and Light load process	3 years
2	CVD,Ion implanter and process of having deposition Pump inside	1 - 2 years
3	Etching process	6 months - 1year

(1) Remove of reactive deposition inside of the pump

Process having deposition inner the pump : 3 months – 2 years

(2) 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	
6	Sensor	3 years
7	Heater	5 years
8	Cooling fun units	30,000 hour

2) Use of corrosive gas

	Part name	Recommended maintenance intervals
1	Touch down bearing	3 years
2	Shaft	5 years It has a possibility of under 1 years (Dependent on condition)
3	Rotor	
4	Motor	5 years
5	Magnetic bearing parts	
6	Sensor	3 years
7	Heater	5 years
8	Cooling fun units	30,000 hour

3) Others

Motor and Magnetic bearing unit are manufactured as a 1 unit.

It will be required to exchange base unit in case of exchange the Motor and Magnetic bearing.

(3) Power supply

	Part name	Recommended maintenance intervals
1	Power Printed circuit board	5 years
2	Filter Printed circuit board	10 years
3	Central processing unit Printed circuit board	7 years
4	Digital signal processor Printed circuit board	7 years
5	Button Battery	5 years
6	Cooling fun units	5 years

10.5 Turbo Molecular Pump Decontamination

All expenses incurred with the decontamination of the turbo molecular pump are the responsibility of the customer.

10.6 Touch-Down Bearing Replacement

The touch-down bearing is the only component of ULVAC's turbo molecular pump that is subjected to friction and wear, normally occurring only during electrical power failure. Repeated and/or frequent rotor touch down will cause wear and bigger rotational resistance and require replacement of touch down bearings.

ULVAC recommends replacement of the touch-down bearing by ULVAC or an approved service company.

10.7 Check of the rotor blades

Rotor blades of turbo molecular pump are high-speed rotor made of aluminum alloy. It has the possibility that material strength deteriorates, specially when corrosive gas is evacuated.

Regular check (Customer is liable for the cost.) by ULVAC or a ULVAC approved/authorized service center is suggested. (Every one year is recommended.) ULVAC and/or the service center investigate rotor blades in every overhaul task and check and suggest a rotor replacement to customers if any cracks are found out.

11. Technical Data

Table 1-1 Basic specifications

Pump Model			UTM-350FW		UTM-480FW		Remarks
Pump	Flange size	Inlet	JIS VG100	ICF 152	JIS VG150	ICF 203	
		Outlet	NW25		→		
	Pumping speed (L/s) *1 *2	N_2	350	330	480	480	
		H_2	320	310	340	340	
	Max. compression ratio *1 *3	N_2	$> 10^{10}$		→		
		H_2	3×10^3		→		
	Rotor blade surface treatment		Ni-Plating		→		
	Max. pressure at inlet (at max. flow) *1*4 (Pa)	N_2	76		→		
	Max. pressure at outlet (at max. flow) *1*4 (Pa)	N_2	440		→		
	Max. pressure at outlet (at 100SCCM) *1(Pa)	N_2	650		→		
	Max. flow rate of N_2 *4 SCCM(Pa L/s)		950 (1600)		→		Rotor max. temp. 120℃
	Max. flow rate of Ar*4 SCCM(Pa L/s)		460 (770)		→		
	Ultimate pressure *1*3 (Pa)		10^{-7}		→		
	Rotational speed (rpm)		45000		→		
	Acceleration/deceleration time (min)		Approx. 4/4		→		
	Bearing type		Totally active magnetic bearings		→		
	Baking temperature (℃)		≦ 120		→		
	Cooling		Water		→		
	Cooling water port/ Flow rate of cooling water *6 (L/min)		Rc 3/8／≧ 3		→		
	Pressure drop of cooling water between inlet and outlet (MPa)		≧0.05		→		
	Gas purge port/flow rate SCCM (PaL/s)		NW 10/10 (17)		→		
	Weight (kg)		Approx. 17		→		
	Recommended backing vacuum pump *5(L/min)		290		→		
	Noise level (dBA)		64		→		
	Torque at Rotor destruction (10msec Lock torque) (N・m)		1.3×10^3		→		*7
Control Unit	Motor drive system		VVVF				Digital Type *6
	Output frequency (Hz)		750				
	Power consumption (kVA)		0.6				
	Input voltage (ACV)		200 ～ 240±10%				
	Input frequency (Hz)		50／60				
	Phase		Single				
	Ambient temperature (℃)		0 ～ 40				
	Weight (kg)		Approx. 10				

Notes) *1 These are values measured according to the JVIS 005, or calculated values based on these measured values.
*2 These are values measured under the conditions without using protecting net.
*3 Show the level.
*4 That is used backing vacuum pump (pumping speed 290L/min) and is under conditions that the TMP is cooled by water on the specified rate and temp. and is with the standard surface treatment.
*5 Select the capacity of pump to suit the gas flow rate in your application.
*6 Both UTM-350FW and UTM-480FW use the same control unit.
*7 The safety factor of the device side for torque at rotor destruction more than 2.

Table 1-2 Basic specifications

Pump Model				UTM-350FH		UTM-480FH		Remarks
Pump	Flange size	Inlet		JIS VG100	ICF 152	JIS VG150	ICF 203	
		Outlet		NW25		→		
	Pumping speed (L/s) *1 *2		N_2	350	330	480	480	
			H_2	320	310	340	340	
	Max. compression ratio *1 *3		N_2	$>10^{10}$		→		
			H_2	1×10^{4}		→		
	Rotor blade surface treatment			Ni-Plating		→		
	Max. pressure at inlet (at max. flow) *1*4 (Pa)		N_2	43		→		
	Max. pressure at outlet (at max. flow) *1*4 (Pa)		N_2	410		→		
	Max. pressure at outlet (at 100SCCM) *1(Pa)		N_2	930		→		
	Max. flow rate of N_2 *4 SCCM(Pa L/s)			850 (1430)		→		Rotor max. temp. 120℃
	Max. flow rate of Ar*4 SCCM(Pa L/s)			370(620)		→		
	Ultimate pressure *1*3 (Pa)			10^{-8}		→		
	Rotational speed (rpm)			45000		→		
	Acceleration/deceleration time (min)			Approx. 4/4		→		
	Bearing type			Totally active magnetic bearings		→		
	Baking temperature (℃)			≦ 120		→		
	Cooling			Water		→		
	Cooling water port/ Flow rate of cooling water *6 (L/min)			Rc 3/8／≧ 3		→		
	Pressure drop of cooling water between inlet and outlet (MPa)			≧0.05		→		
	Gas purge port/flow rate SCCM (PaL/s)			NW 10/10 (17)		→		
	Weight (kg)			Approx. 17		→		
	Recommended backing vacuum pump *5(L/min)			290		→		
	Noise level (dBA)			64		→		
	Torque at Rotor destruction (10msec Lock torque) (N・m)			1.3×10^{3}		→		*7
Control Unit	Motor drive system			VVVF				Digital Type *6
	Output frequency (Hz)			750				
	Power consumption (kVA)			0.6				
	Input voltage (ACV)			200 ～ 240±10%				
	Input frequency (Hz)			50／60				
	Phase			Single				
	Ambient temperature (℃)			0 ～ 40				
	Weight (kg)			Approx. 10				

Notes) *1 These are values measured according to the JVIS 005, or calculated values based on these measured values.
*2 These are values measured under the conditions without using protecting net.
*3 Show the level.
*4 That is used backing vacuum pump (pumping speed 290L/min) and is under conditions that the TMP is cooled by water on the specified rate and temp. and is with the standard surface treatment.
*5 Select the capacity of pump to suit the gas flow rate in your application.
*6 Both UTM-350FH and UTM-480FH use the same control unit.
*7 The safety factor of the device side for torque at rotor destruction more than 2.

Table 1-3 Basic specifications

Pump Model				UTM-800FW		UTM-1001FW		Remarks
Pump	Flange size	Inlet		JIS VG150	ICF203	JIS VG200	ICF253	
		Outlet		NW40		NW40		
	Pumping speed (L/s) *1 *2		N_2	810	740	1000	1000	
			H_2	530	520	570	570	
	Max. compression ratio *1 *3		N_2	$>10^9$		→		
			H_2	4×10^3		→		
	Rotor blade surface treatment			Ni-Plating		→		
	Max. pressure at inlet (at max. flow) *1*4 (Pa)		N_2	38		→		
	Max. pressure at outlet (at max. flow) *1*4 (Pa)		N_2	290		→		
	Max. pressure at outlet (at 100SCCM) *1(Pa)		N_2	510		→		
	Max. flow rate of N_2*4 SCCM(Pa L/s)			1800 (3030)		→		Rotor max. temp. 120℃
	Max. flow rate of Ar*4 SCCM(Pa L/s)			700 (1180)		→		
	Ultimate pressure *1*3 (Pa)			10^{-7}		→		
	Rotational speed (rpm)			36000		→		
	Acceleration/deceleration time (min)			Approx. 6/10		→		
	Bearing type			Totally active magnetic bearings		→		
	Baking temperature (℃)			≦ 120		→		
	Cooling			Water		→		
	Cooling water port/ Flow rate of cooling water *6 (L/min)			Rc 3/8／≧ 3		→		
	Pressure drop of cooling water between inlet and outlet (MPa)			≧0.05		→		
	Gas purge port/flow rate SCCM (PaL/s)			NW 10/25 (42)		→		
	Weight (kg)			Approx. 28		→		
	Recommended backing vacuum pump *5(L/min)			800		→		
	Noise level (dBA)			65		→		
	Torque at Rotor destruction (10msec Lock torque) (N・m)			3.6×10^3		→		*7
Control Unit	Motor drive system			VVVF				Digital Type *6
	Output frequency (Hz)			600				
	Power consumption (kVA)			0.9				
	Input voltage (ACV)			200 ～ 240±10%				
	Input frequency (Hz)			50／60				
	Phase			Single				
	Ambient temperature (℃)			0 ～ 40				
	Weight (kg)			Approx. 10				

Notes) *1 These are values measured according to the JVIS 005, or calculated values based on these measured values.
*2 These are values measured under the conditions without using protecting net.
*3 Show the level.
*4 That is used backing vacuum pump (pumping speed 800L/min) and is under conditions that the TMP is cooled by water on the specified rate and temp. and is with the standard surface treatment.
*5 Select the capacity of pump to suit the gas flow rate in your application.
*6 Both UTM-800FW and UTM-1001FW use the same control unit.
*7 The safety factor of the device side for torque at rotor destruction more than 2.

Table 1-4 Basic specifications

Pump Model				UTM-800FH		UTM-1001FH		Remarks
Pump	Flange size	Inlet		JIS VG150	ICF203	JIS VG200	ICF253	
		Outlet		NW40		NW40		
	Pumping speed (L/s) *1 *2		N_2	810	740	1000	1000	
			H_2	530	520	570	570	
	Max. compression ratio *1 *3		N_2	$> 10^9$		→		
			H_2	3×10^4		→		
	Rotor blade surface treatment			Ni-Plating		→		
	Max. pressure at inlet (at max. flow) *1*4 (Pa)		N_2	18		→		
	Max. pressure at outlet (at max. flow) *1*4 (Pa)		N_2	180		→		
	Max. pressure at outlet (at 100SCCM) *1(Pa)		N_2	840		→		
	Max. flow rate of N_2 *4 SCCM(Pa L/s)			1100 (1850)		→		Rotor max. temp. 120℃
	Max. flow rate of Ar*4 SCCM(Pa L/s)			480(810)		→		
	Ultimate pressure *1*3 (Pa)			10^{-8}		→		
	Rotational speed (rpm)			36000		→		
	Acceleration/deceleration time (min)			Approx. 6/10		→		
	Bearing type			Totally active magnetic bearings		→		
	Baking temperature (℃)			≦ 120		→		
	Cooling			Water		→		
	Cooling water port/ Flow rate of cooling water *6 (L/min)			Rc 3/8／≧ 3		→		
	Pressure drop of cooling water between inlet and outlet (MPa)			≧0.05		→		
	Gas purge port/flow rate SCCM (PaL/s)			NW 10/25 (42)		→		
	Weight (kg)			Approx. 28		→		
	Recommended backing vacuum pump *5(L/min)			800		→		
	Noise level (dBA)			65		→		
	Torque at Rotor destruction (10msec Lock torque) (N・m)			3.6×10^3		→		*7
Control Unit	Motor drive system			VVVF				Digital Type *6
	Output frequency (Hz)			600				
	Power consumption (kVA)			0.9				
	Input voltage (ACV)			200 ～ 240±10%				
	Input frequency (Hz)			50／60				
	Phase			Single				
	Ambient temperature (℃)			0 ～ 40				
	Weight (kg)			Approx. 10				

Notes) *1 These are values measured according to the JVIS 005, or calculated values based on these measured values.
*2 These are values measured under the conditions without using protecting net.
*3 Show the level.
*4 That is used backing vacuum pump (pumping speed 800L/min) and is under conditions that the TMP is cooled by water on the specified rate and temp. and is with the standard surface treatment.
*5 Select the capacity of pump to suit the gas flow rate in your application.
*6 Both UTM-800FH and UTM-1001FH use the same control unit.
*7 The safety factor of the device side for torque at rotor destruction more than 2.

Table 1-5 Basic specifications

Pump Model				UTM-1400FW			Remarks
Pump	Flange size	Inlet		JIS VG250	JIS VG200	ICF253	
		Outlet		NW40	NW40	NW40	
	Pumping speed (L/s) *1 *2		N_2	1490	1360	1300	
			H_2	890	860	860	
	Max. compression ratio *1 *3		N_2	$> 10^9$			
			H_2	6×10^3			
	Rotor blade surface treatment			Ni-Plating			
	Max. pressure at inlet (at max. flow) *1*4 (Pa)		N_2	13			
	Max. pressure at outlet (at max. flow) *1*4 (Pa)		N_2	240			
	Max. flow rate of N_2 *4 SCCM(Pa L/s)			1400 (2360)			Rotor max. temp. 120℃
	Max. flow rate of Ar*4 SCCM(Pa L/s)			1000 (1680)			
	Ultimate pressure *1*3 (Pa)			10^{-8}			
	Rotational speed (rpm)			32100			
	Acceleration/deceleration time (min)			Approx. 7/7			
	Bearing type			Totally active magnetic bearings			
	Baking temperature (℃)			≦ 120			
	Cooling			Water			
	Cooling water port/ Flow rate of cooling water (L/min)			Rc 3/8／≧ 3			
	Pressure drop of cooling water between inlet and outlet (MPa)			≧0.05			
	Gas purge port/flow rate SCCM (PaL/s)			NW 10/25 (42)			
	Weight (kg)			Approx. 36			
	Recommended backing vacuum pump *5(L/min)			800			
	Noise level (dBA)			63			
	Torque at Rotor destruction (10msec Lock torque) (N・m)			5.0×10^3			*6
Control Unit	Motor drive system			VVVF			Digital Type
	Output frequency (Hz)			535			
	Power consumption (kVA)			1.2			
	Input voltage (ACV)			200 ～ 240±10%			
	Input frequency (Hz)			50／60			
	Phase			Single			
	Ambient temperature (℃)			0 ～ 40			
	Weight (kg)			Approx. 10			

Notes) *1 These are values measured according to the JVIS 005, or calculated values based on these measured values.
*2 These are values measured under the conditions without using protecting net.
*3 Show the level.
*4 That is used backing vacuum pump (pumping speed 800L/min) and is under conditions that the TMP is cooled by water on the specified rate and temp. and is with the standard surface treatment.
*5 Select the capacity of pump to suit the gas flow rate in your application.
*6 The safety factor of the device side for torque at rotor destruction more than 2.

Table 1-6 Basic specifications

Pump Model				UTM-2300FW			Remarks
Pump	Flange size	Inlet		JIS VG300	JIS VG250	ICF305	
		Outlet		NW40	NW40	NW40	
	Pumping speed (L/s) *1 *2		N_2	2730	2230	2110	
			H_2	1850	1720	1700	
	Max. compression ratio *1 *3		N_2	$> 10^9$			
			H_2	9×10^3			
	Rotor blade surface treatment			Ni-Plating			
	Max. pressure at inlet (at max. flow) *1*4 (Pa)		N_2	7			
	Max. pressure at outlet (at max. flow) *1*4 (Pa)		N_2	180			
	Max. flow rate of N_2*4 SCCM(Pa L/s)			1500 (2530)			
	Max. flow rate of Ar*4 SCCM(Pa L/s)			1350 (2280)			
	Ultimate pressure *1*3 (Pa)			10^{-7}			Rotor max. temp. 120℃
	Rotational speed (rpm)			24600			
	Acceleration/deceleration time (min)			Approx. 9/9			
	Bearing type			Totally active magnetic bearings			
	Baking temperature (℃)			≦ 120			
	Cooling			Water			
	Cooling water port/ Flow rate of cooling water (L/min)			Rc 3/8／≧ 3			
	Pressure drop of cooling water between inlet and outlet (MPa)			≧0.05			
	Gas purge port/flow rate SCCM (PaL/s)			NW 10/50 (84)			
	Weight (kg)			Approx. 60			
	Recommended backing vacuum pump *5(L/min)			1500			
	Noise level (dBA)			62			
	Torque at Rotor destruction (10msec Lock torque) (N・m)			1.2×10^4			*6
Control Unit	Motor drive system			VVVF			
	Output frequency (Hz)			410			
	Power consumption (kVA)			1.3			
	Input voltage (ACV)			200 ～ 240±10%			
	Input frequency (Hz)			50／60			
	Phase			Single			
	Ambient temperature (℃)			0 ～ 40			
	Weight (kg)			Approx. 10			

Notes) *1 These are values measured according to the JVIS 005, or calculated values based on these measured values.
*2 These are values measured under the conditions without using protecting net.
*3 Show the level.
*4 That is used backing vacuum pump (pumping speed 1500L/min) and is under conditions that the TMP is cooled by water on the specified rate and temp. and is with the standard surface treatment.
*5 Select the capacity of pump to suit the gas flow rate in your application.
*6 The safety factor of the device side for torque at rotor destruction more than 2.

Table 1-7 Basic specifications

Pump Model				UTM-3301FW	Remarks
Pump	Flange size	Inlet		JIS VG350	
		Outlet		NW40	
	Pumping speed (L/s) *1 *2		N_2	3300	
			H_2	2400	
	Max. compression ratio *1 *3		N_2	$> 10^8$	
			H_2	8×10^3	
	Rotor blade surface treatment			Ni-Plating	
	Max. pressure at inlet (at max. flow) *1*4 (Pa)		N_2	8	
	Max. pressure at outlet (at max. flow) *1*4 (Pa)		N_2	180	
	Max. flow rate of N_2 *4 SCCM(Pa L/s)			1500 (2530)	Rotor max. temp. 120℃
	Max. flow rate of Ar*4 SCCM(Pa L/s)			1300 (2190)	
	Ultimate pressure *1*3 (Pa)			10^{-7}	
	Rotational speed (rpm)			21600	
	Acceleration/deceleration time (min)			Approx. 12/16	
	Bearing type			Totally active magnetic bearings	
	Baking temperature (℃)			≦ 120	
	Cooling			Water	
	Cooling water port/ Flow rate of cooling water (L/min)			Rc 3/8／≧ 3	
	Pressure drop of cooling water between inlet and outlet (MPa)			≧0.05	
	Gas purge port/flow rate SCCM (PaL/s)			NW 10/50 (84)	
	Weight (kg)			Approx. 90	
	Recommended backing vacuum pump *5(L/min)			1500	
	Noise level (dBA)			58	
	Torque at Rotor destruction (10msec Lock torque) (N・m)			2.2×10^4	*6
Control Unit	Motor drive system			VVVF	Digital Type
	Output frequency (Hz)			360	
	Power consumption (kVA)			2.0	
	Input voltage (ACV)			200 ～ 240±10%	
	Input frequency (Hz)			50／60	
	Phase			Single	
	Ambient temperature (℃)			0 ～ 40	
	Weight (kg)			Approx. 10	

Notes) *1 These are values measured according to the JVIS 005, or calculated values based on these measured values.
*2 These are values measured under the conditions without using protecting net.
*3 Show the level.
*4 That is used backing vacuum pump (pumping speed 1500L/min) and is under conditions that the TMP is cooled by water on the specified rate and temp. and is with the standard surface treatment.
*5 Select the capacity of pump to suit the gas flow rate in your application.
*6 The safety factor of the device side for torque at rotor destruction more than 2.

Table 1-8 Basic specifications (No surface treatment/No gas purge)

Pump Model				UTM-3302FH	Remarks
Pump	Flange size	Inlet		JIS VG350	
		Outlet		NW40	
	Pumping speed (L/s) *1 *2		N_2	3300	
			H_2	2300	
	Max. compression ratio *1 *3		N_2	$> 10^{11}$	
			H_2	6×10^4	
	Rotor blade surface treatment			Non	
	Max. pressure at inlet (at max. flow) *1*4 (Pa)		N_2	7	
	Max. pressure at outlet (at max. flow) *1*4 (Pa)		N_2	220	
	Max. flow rate of N_2 *4 SCCM(Pa L/s)			1800 (3030)	Rotor max. temp. 120℃
	Max. flow rate of Ar*4 SCCM(Pa L/s)			1100 (1850)	
	Ultimate pressure *1*3 (Pa)			10^{-8}	
	Rotational speed (rpm)			21600	
	Acceleration/deceleration time (min)			Approx. 12/16	
	Bearing type			Totally active magnetic bearings	
	Baking temperature (℃)			≦ 120	
	Cooling			Water	
	Cooling water port/ Flow rate of cooling water (L/min)			Rc 3/8／≧ 3	
	Pressure drop of cooling water between inlet and outlet (MPa)			≧0.05	
	Gas purge port/flow rate SCCM (PaL/s)			—	
	Weight (kg)			Approx. 90	
	Recommended backing vacuum pump *5(L/min)			1500	
	Noise level (dBA)			58	
	Torque at Rotor destruction (10msec Lock torque) (N・m)			2.2×10^4	*6
Control Unit	Motor drive system			VVVF	Digital Type
	Output frequency (Hz)			360	
	Power consumption (kVA)			1.6	
	Input voltage (ACV)			200 ～ 240±10%	
	Input frequency (Hz)			50／60	
	Phase			Single	
	Ambient temperature (℃)			0 ～ 40	
	Weight (kg)			Approx. 10	

Notes) *1 These are values measured according to the JVIS 005, or calculated values based on these measured values.
*2 These are values measured under the conditions without using protecting net.
*3 Show the level.
*4 That is used backing vacuum pump (pumping speed 1500L/min) and is under conditions that the TMP is cooled by water on the specified rate and temp. and is with the standard surface treatment.
*5 Select the capacity of pump to suit the gas flow rate in your application.
*6 The safety factor of the device side for torque at rotor destruction more than 2.

Table 1-9 Basic specifications (No surface treatment/No gas purge)

Pump Model				UTM-3303FH	Remarks
Pump	Flange size	Inlet		JIS VG350	
		Outlet		NW40	
	Pumping speed (L/s) *1 *2		N_2	3300	
			H_2	2400	
	Max. compression ratio *1 *3		N_2	$> 10^{11}$	
			H_2	9×10^4	
	Rotor blade surface treatment			Non	
	Max. pressure at inlet (at max. flow) *1*4 (Pa)		N_2	9	
	Max. pressure at outlet (at max. flow) *1*4 (Pa)		N_2	210	
	Max. flow rate of N_2 *4 SCCM(Pa L/s)			1800 (3030)	Rotor max. temp. 120℃
	Max. flow rate of Ar*4 SCCM(Pa L/s)			1100 (1850)	
	Ultimate pressure *1*3 (Pa)			10^{-8}	
	Rotational speed (rpm)			22200	
	Acceleration/deceleration time (min)			Approx. 12/16	
	Bearing type			Totally active magnetic bearings	
	Baking temperature (℃)			≦ 120	
	Cooling			Water	
	Cooling water port/ Flow rate of cooling water (L/min)			Rc 3/8／≧ 3	
	Pressure drop of cooling water between inlet and outlet (MPa)			≧0.05	
	Gas purge port/flow rate SCCM (PaL/s)			—	
	Weight (kg)			Approx. 86	
	Recommended backing vacuum pump *5(L/min)			1500	
	Noise level (dBA)			55	
	Torque at Rotor destruction (10msec Lock torque) (N・m)			2.3×10^4	*6
Control Unit	Motor drive system			VVVF	Digital Type
	Output frequency (Hz)			370	
	Power consumption (kVA)			1.6	
	Input voltage (ACV)			200 ～ 240±10%	
	Input frequency (Hz)			50／60	
	Phase			Single	
	Ambient temperature (℃)			0 ～ 40	
	Weight (kg)			Approx. 10	

Notes) *1 These are values measured according to the JVIS 005, or calculated values based on these measured values.
*2 These are values measured under the conditions without using protecting net.
*3 Show the level.
*4 That is used backing vacuum pump (pumping speed 1500L/min) and is under conditions that the TMP is cooled by water on the specified rate and temp. and is with the standard surface treatment.
*5 Select the capacity of pump to suit the gas flow rate in your application.
*6 The safety factor of the device side for torque at rotor destruction more than 2.

Table 1-10 Basic specifications (No surface treatment/No gas purge)

Pump Model				UTM-6300FH	Remarks
Pump	Flange size	Inlet		JIS VG500	
		Outlet		NW40	
	Pumping speed (L/s) *1 *2		N_2	6300	
			H_2	5000	
	Max. compression ratio *1 *3		N_2	$> 10^{10}$	
			H_2	4×10^4	
	Rotor blade surface treatment			Non	
	Max. pressure at inlet (at max. flow) *1*4 (Pa)		N_2	0.64	
	Max. pressure at outlet (at max. flow) *1*4 (Pa)		N_2	160	
	Max. flow rate of N_2 *4 SCCM(Pa L/s)			1400 (2359)	Rotor max. temp. 120℃
	Max. flow rate of Ar*4 SCCM(Pa L/s)			1400 (2359)	
	Ultimate pressure *1*3 (Pa)			10^{-8}	
	Rotational speed (rpm)			16800	
	Acceleration/deceleration time (min)			Approx. 30/40	
	Bearing type			Totally active magnetic bearings	
	Baking temperature (℃)			≦ 120	
	Cooling			Water	
	Cooling water port/ Flow rate of cooling water (L/min)			Rc 3/8／≧ 3	
	Pressure drop of cooling water between inlet and outlet (MPa)			≧0.05	
	Gas purge port/flow rate SCCM (PaL/s)			—	
	Weight (kg)			Approx. 205	
	Recommended backing vacuum pump *5(L/min)			1500	
	Noise level (dBA)			63	
	Torque at Rotor destruction (10msec Lock torque) (N・m)			6.9×10^4	*6
Control Unit	Motor drive system			VVVF	Digital Type
	Output frequency (Hz)			280	
	Power consumption (kVA)			1.6	
	Input voltage (ACV)			200 ～ 240±10%	
	Input frequency (Hz)			50／60	
	Phase			Single	
	Ambient temperature (℃)			0 ～ 40	
	Weight (kg)			Approx. 10	

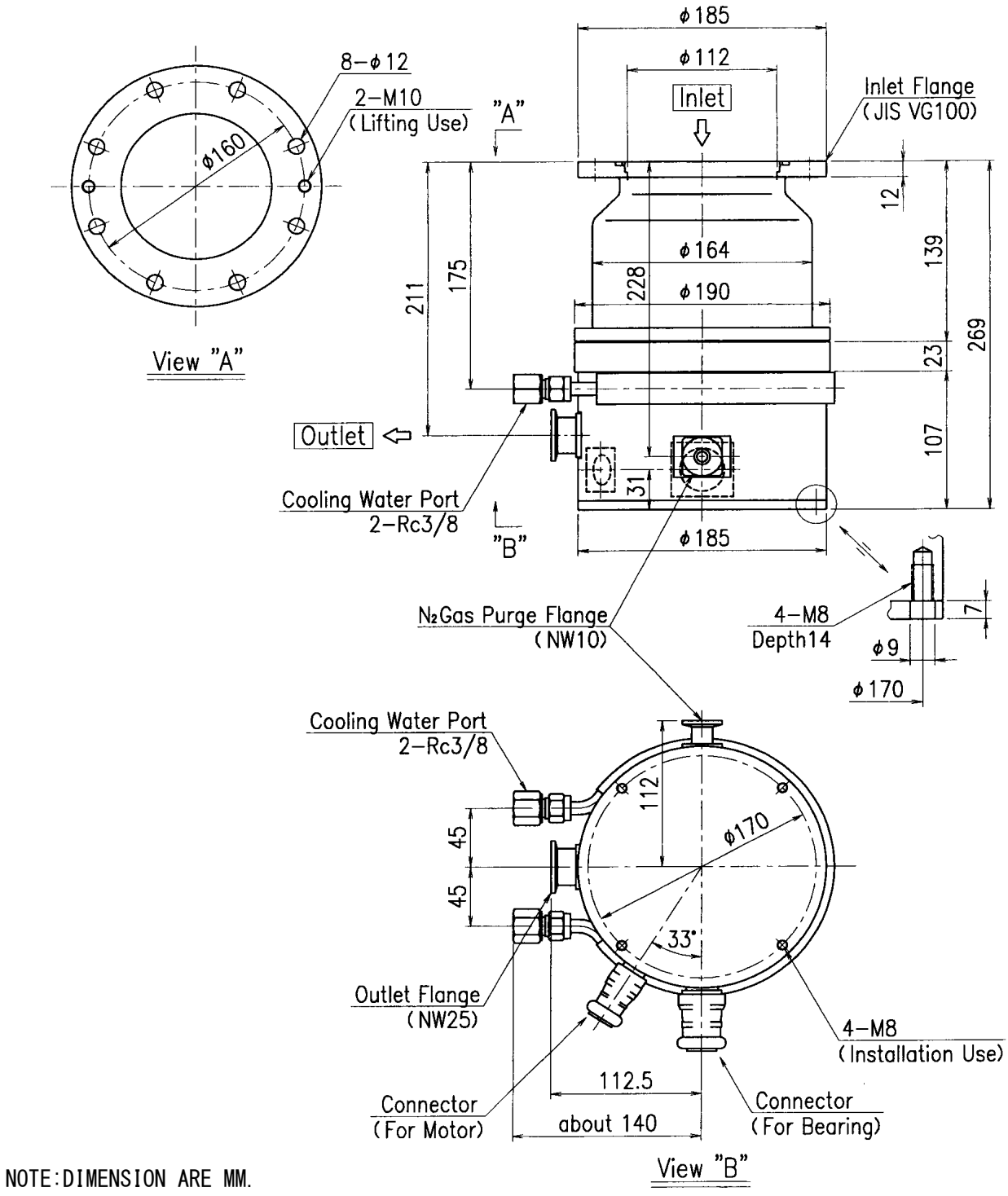
Notes) *1 These are values measured according to the JVIS 005, or calculated values based on these measured values.
*2 These are values measured under the conditions without using protecting net.
*3 Show the level.
*4 With normal surface treatment specification at the time of Max. flow quantity exhaust.
*5 Select the capacity of pump to suit the gas flow rate in your application.
*6 The safety factor of the device side for torque at rotor destruction more than 2.

Table 1-11 Basic specifications (No surface treatment/No gas purge)

Pump Model				UTM-3500D	Remarks
Pump	Flange size		Inlet	JIS VG350	
			Outlet	NW40	
	Pumping speed (L/s) *1 *2		N_2	3270	
	Max. compression ratio *1 *3		N_2	5×10^9	
			H_2	1×10^6	
	Rotor blade surface treatment			Black Ni-Plating	
	Max. pressure at inlet (at max. flow) *1*4 (Pa)		Ar	1.7	
	Max. pressure at outlet (at max. flow) *1*4 (Pa)		Ar	1330	
	Max. flow rate of Ar*4 SCCM(Pa L/s)			2000 (3360)	
	Ultimate pressure *1*3 (Pa)			10^{-7}	Rotor max. temp. 120℃
	Rotational speed (rpm)			21600	
	Acceleration/deceleration time (min)			Approx. 13/17	
	Bearing type			Totally active magnetic bearings	
	Baking temperature (℃)			≦ 120	
	Cooling			Water	
	Cooling water port/ Flow rate of cooling water (L/min)			Rc 3/8／≧ 3	
	Pressure drop of cooling water between inlet and outlet (MPa)			≧0.05	
	Gas purge port/flow rate SCCM (PaL/s)			NW 10/ 50 (84)	*6
	Weight (kg)			Approx. 88	
	Recommended backing vacuum pump *5(L/min)			800	
	Noise level (dBA)			53	
	Torque at Rotor destruction (10msec Lock torque) (N・m)			2.3×10^4	*7
Control Unit	Motor drive system			VVVF	Digital Type
	Output frequency (Hz)			360	
	Power consumption (kVA)			1.7	
	Input voltage (ACV)			200 ～ 240±10%	
	Input frequency (Hz)			50／60	
	Phase			Single	
	Ambient temperature (℃)			0 ～ 40	
	Weight (kg)			Approx. 10	

Notes) *1 These are values measured according to the JVIS 005, or calculated values based on these measured values.
*2 These are values measured under the conditions without using protecting net.
*3 Show the level.
*4 Back pressure 1330Pa and a value with water-cooledspecifications.
*5 Select the capacity of pump to suit the gas flow rate in your applications.
*6 MHI recommended value; if you need to have purge gas flow at a flow rate more than this, consult with MHI.
*7 The safety factor of the device side for torque at rotor destruction more than 2.

Technical Data	Designation	Sheet No.
	UTM-350FW/FH(JISVG100) Outline Drawing	33402150



NOTE:DIMENSION ARE MM.
Outline is the same between
UTM-350FW and UTM-350FH

Fig.1-1 Construction of TMP (JIS VG100)

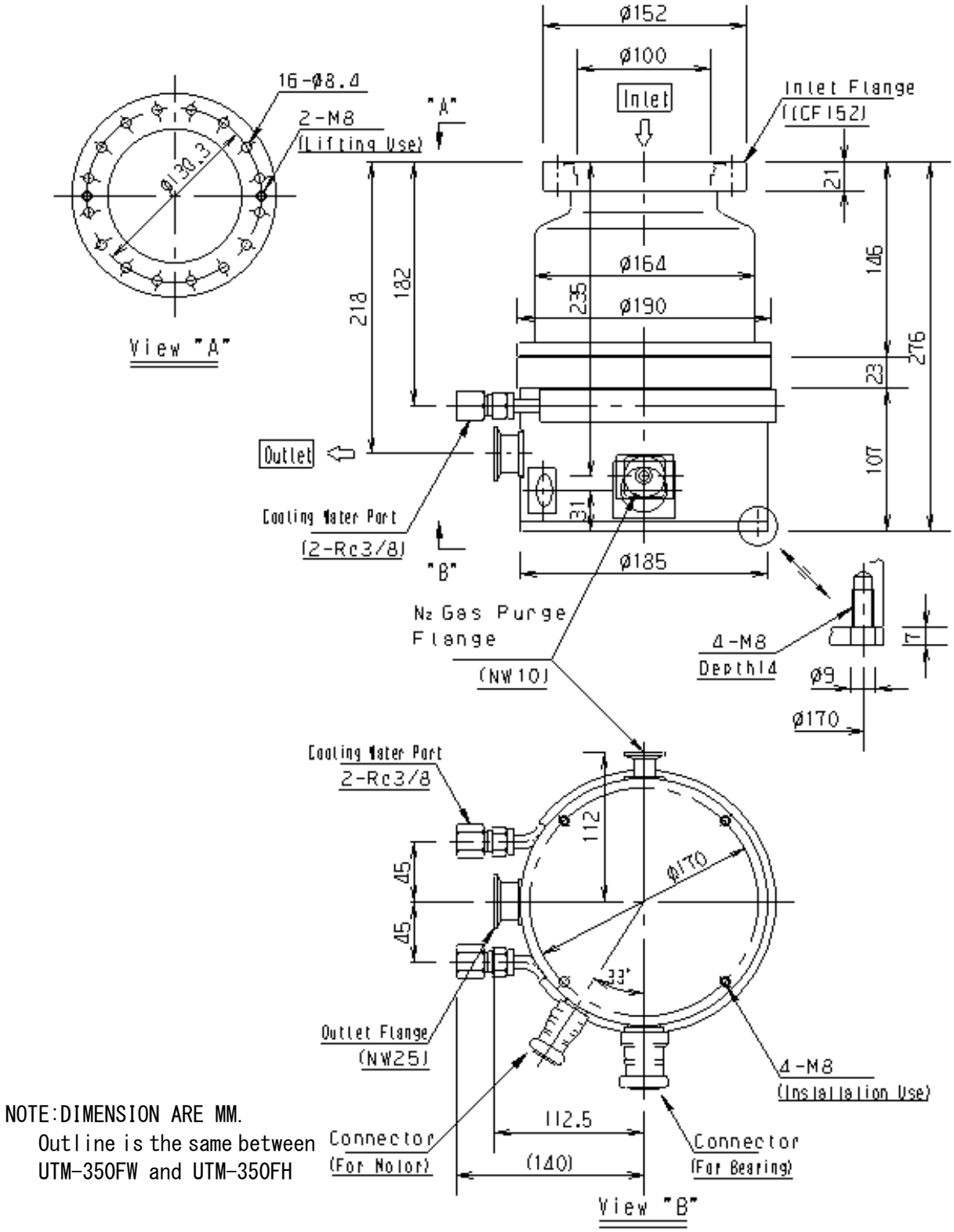
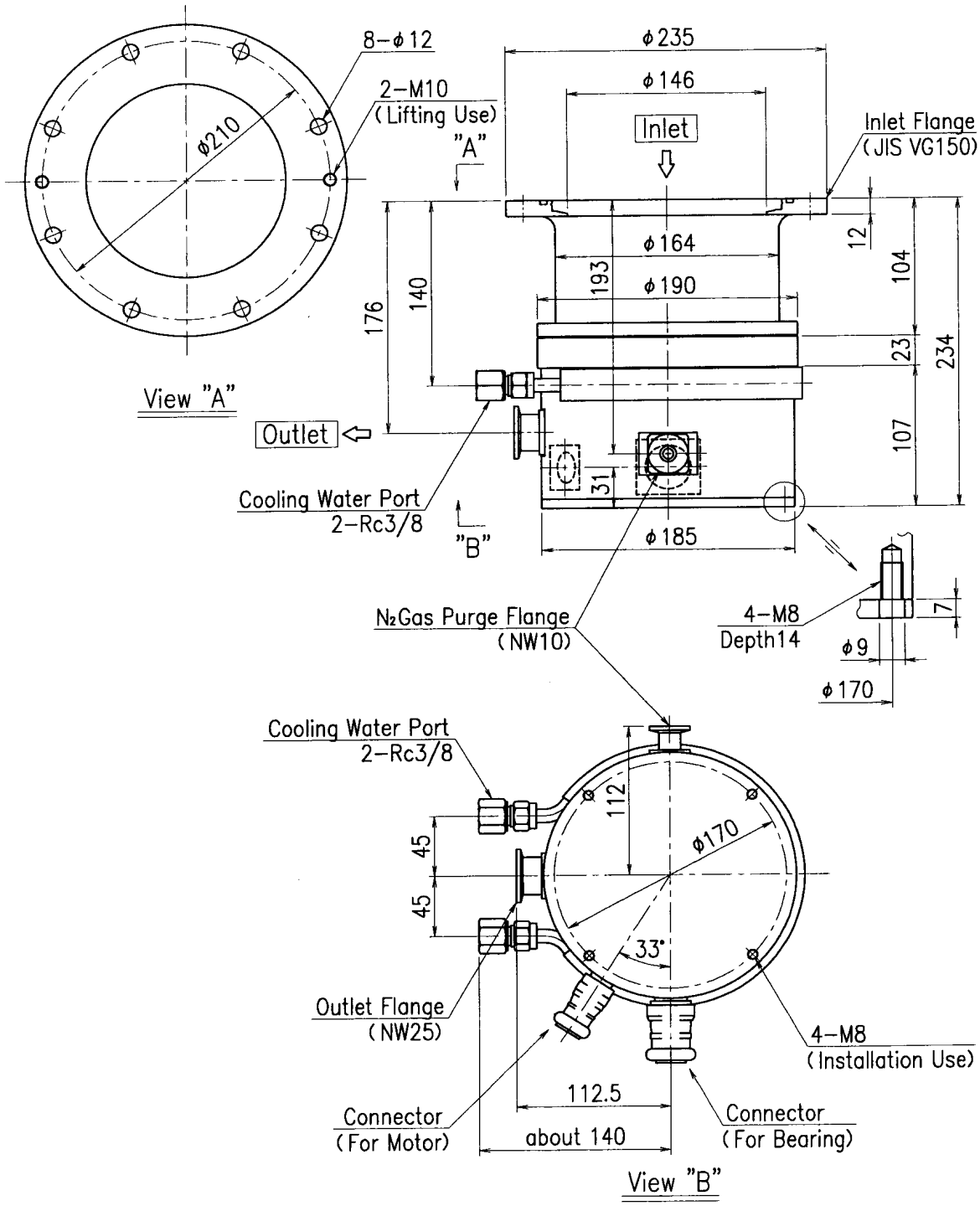


Fig.1-2 Construction of TMP (ICF152)

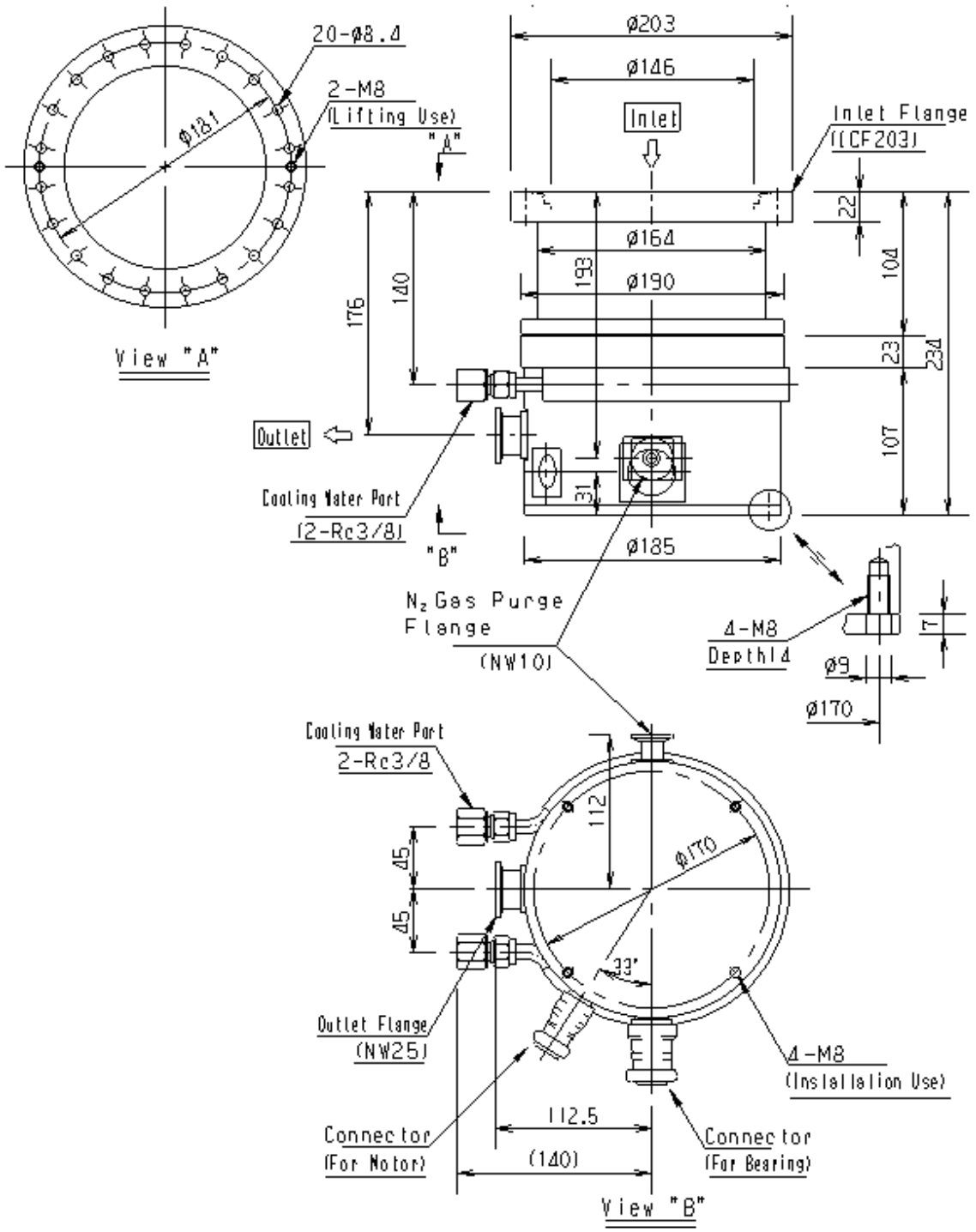
Technical Data	Designation	Sheet No.
	UTM-480FW/FH (JISVG150) Outline Drawing	33402160



NOTE:DIMENSION ARE MM.
Outline is the same between
UTM-480FW and UTM-480FH

Fig.1-3 Construction of TMP (JIS VG150)

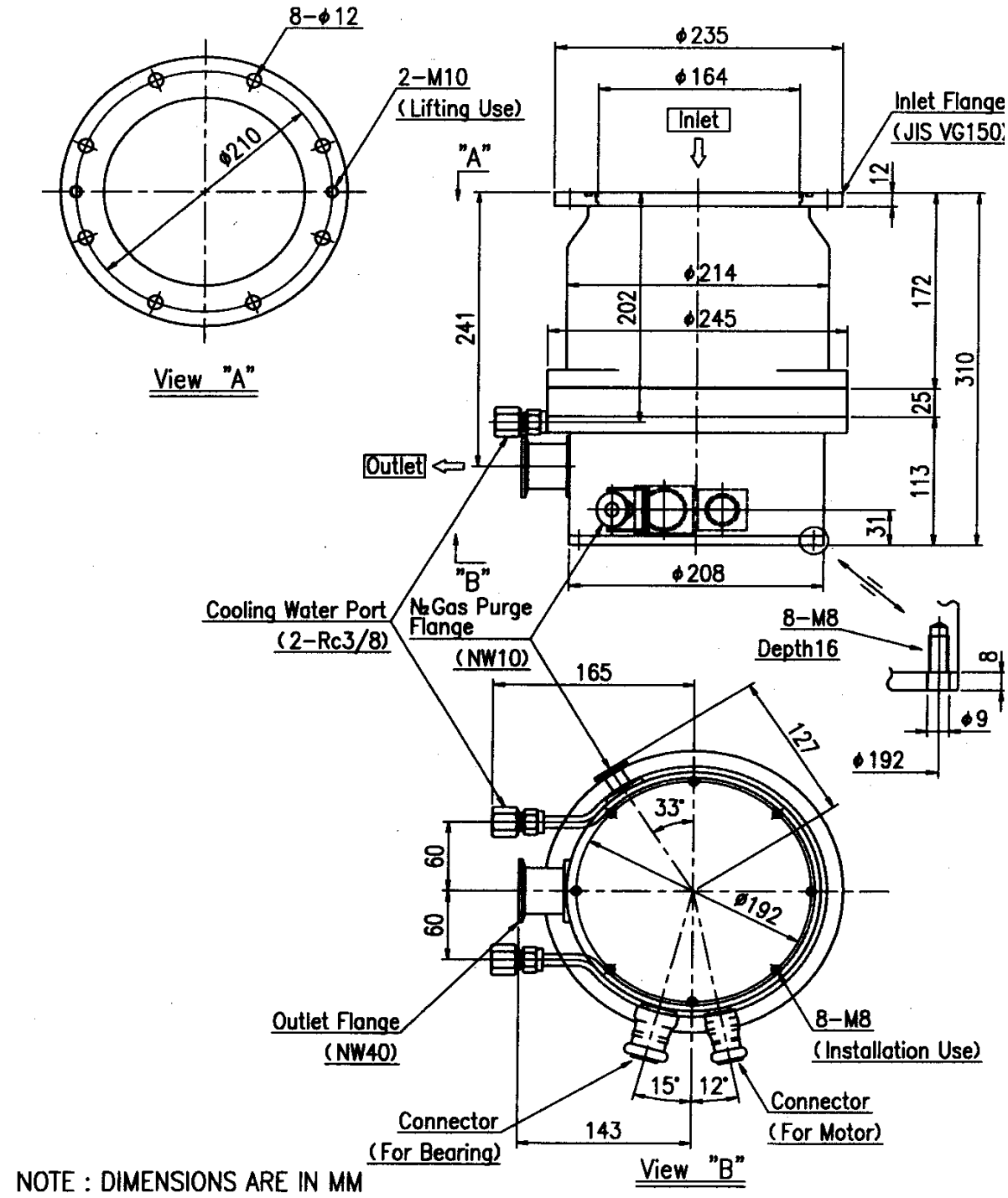
Technical Data	Designation	Sheet No.
	UTM-480FW/FH (ICF203) Outline Drawing	33402080



NOTE:DIMENSION ARE MM.
Outline is the same between
UTM-480FW and UTM-480FH

Fig.1-4 Construction of TMP (ICF203)

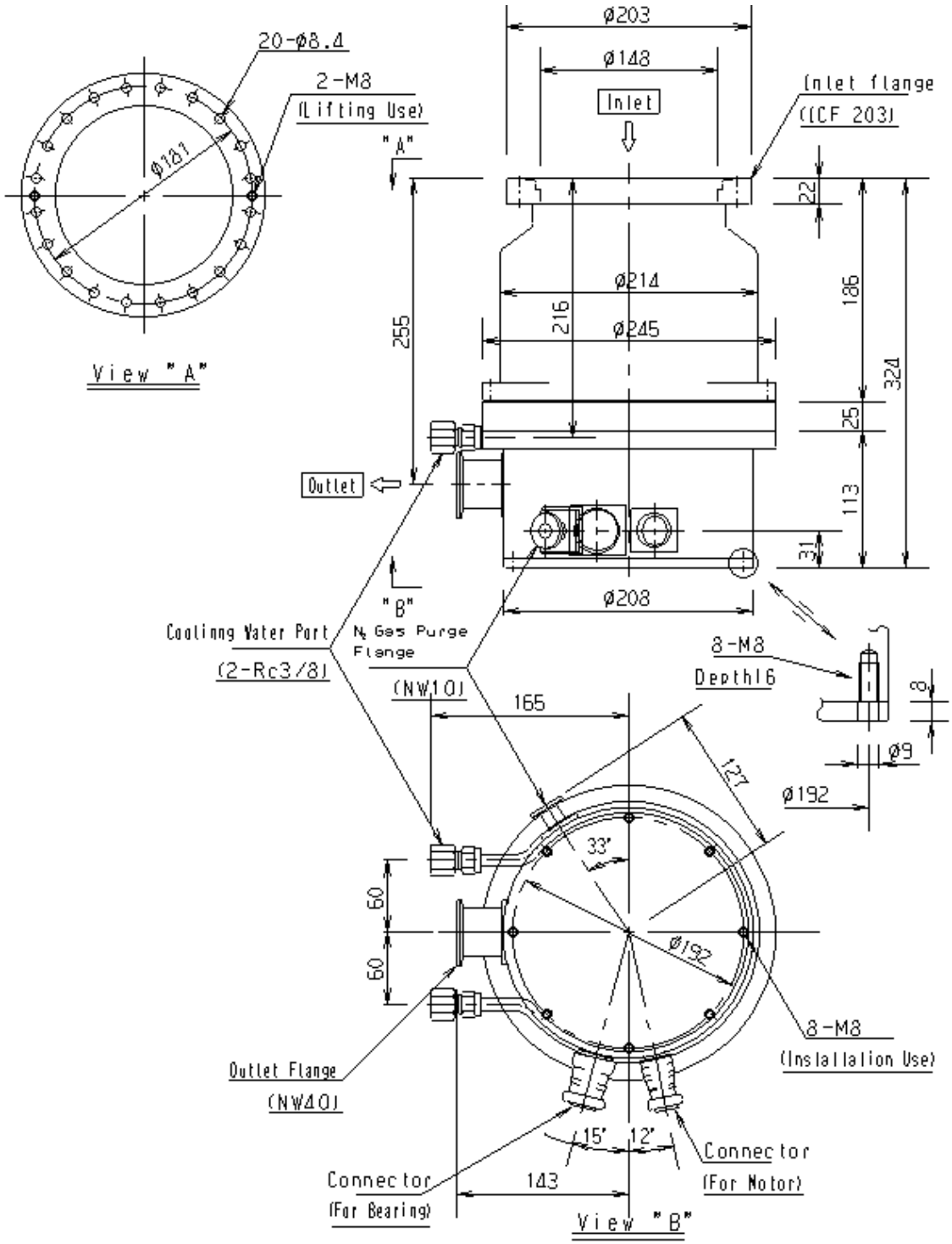
Technical Data	Designation	Sheet No.
	UTM-800FW/FH(JISVG150) Outline Drawing	35502040



NOTE:DIMENSION ARE MM.
Outline is the same between
UTM-800FW and UTM-800FH

Fig.1-5 Construction of TMP (JIS VG150)

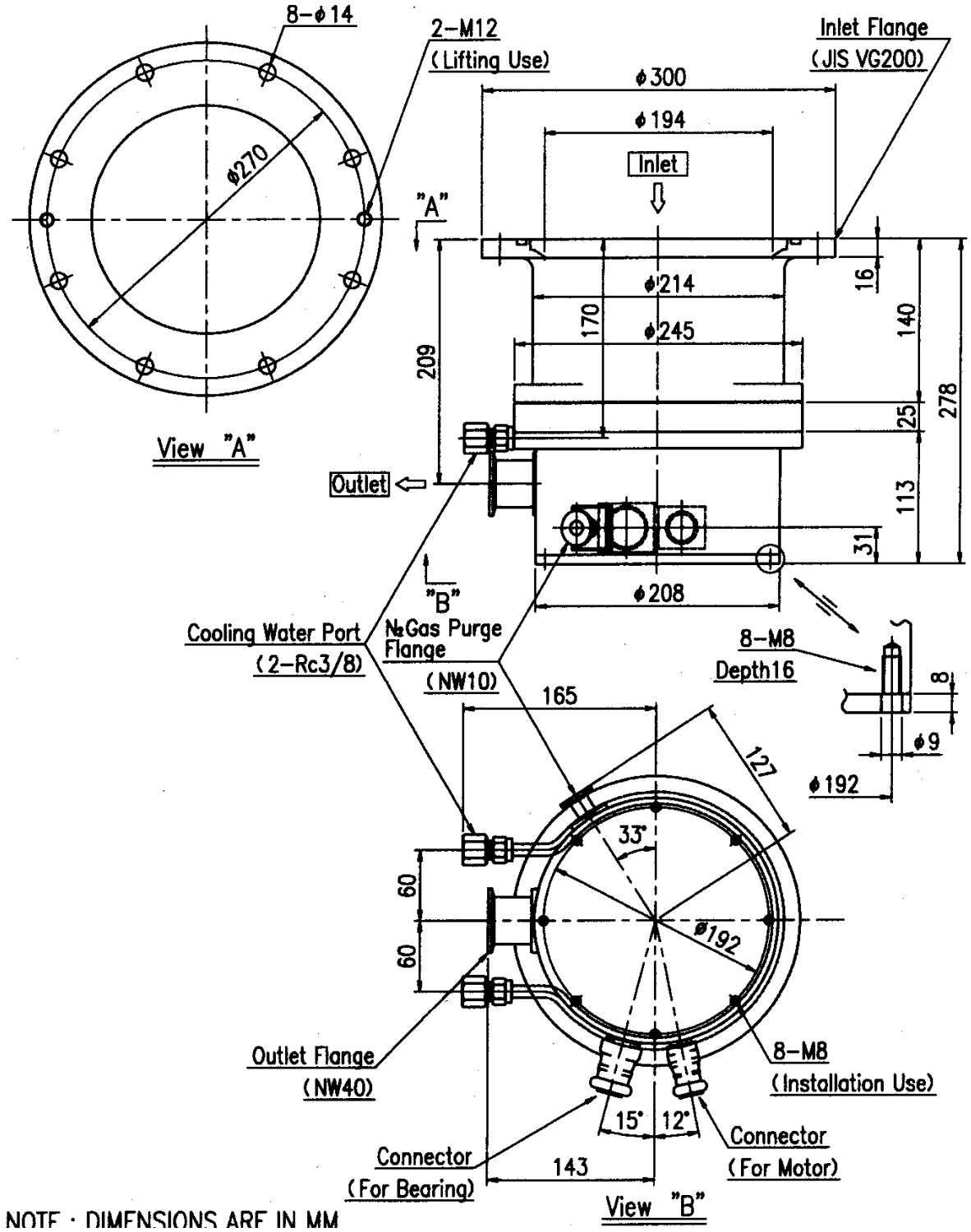
Technical Data	Designation	Sheet No.
	UTM-800FW/FH(ICF203) Outline Drawing	35502030



NOTE:DIMENSION ARE MM.
Outline is the same between
UTM-800FW and UTM-800FH

Fig.1-6 Construction of TMP (ICF203)

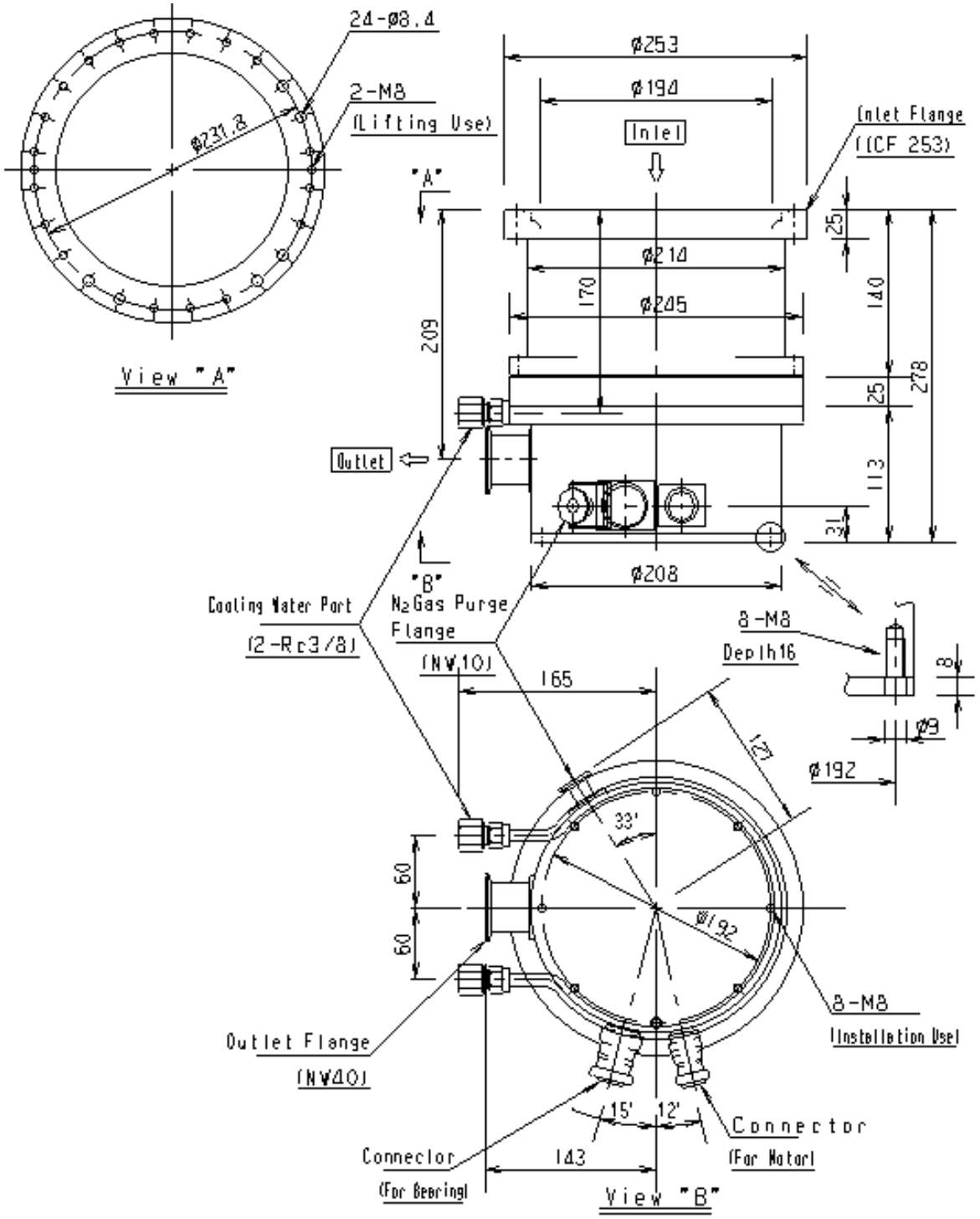
Technical Data	Designation	Sheet No.
	UTM-1001FW/FH (JISVG200) Outline Drawing	35502050



Outline is the same between
UTM-1001FW and UTM-1001FH

Fig.1-7 Construction of TMP (JIS VG200)

Technical Data	Designation	Sheet No.
	UTM-1001FW/FH (ICF253) Outline Drawing	35502070



NOTE:DIMENSION ARE MM.
Outline is the same between
UTM-1001FW and UTM-1001FH

Fig.1-8 Construction of TMP (ICF253)

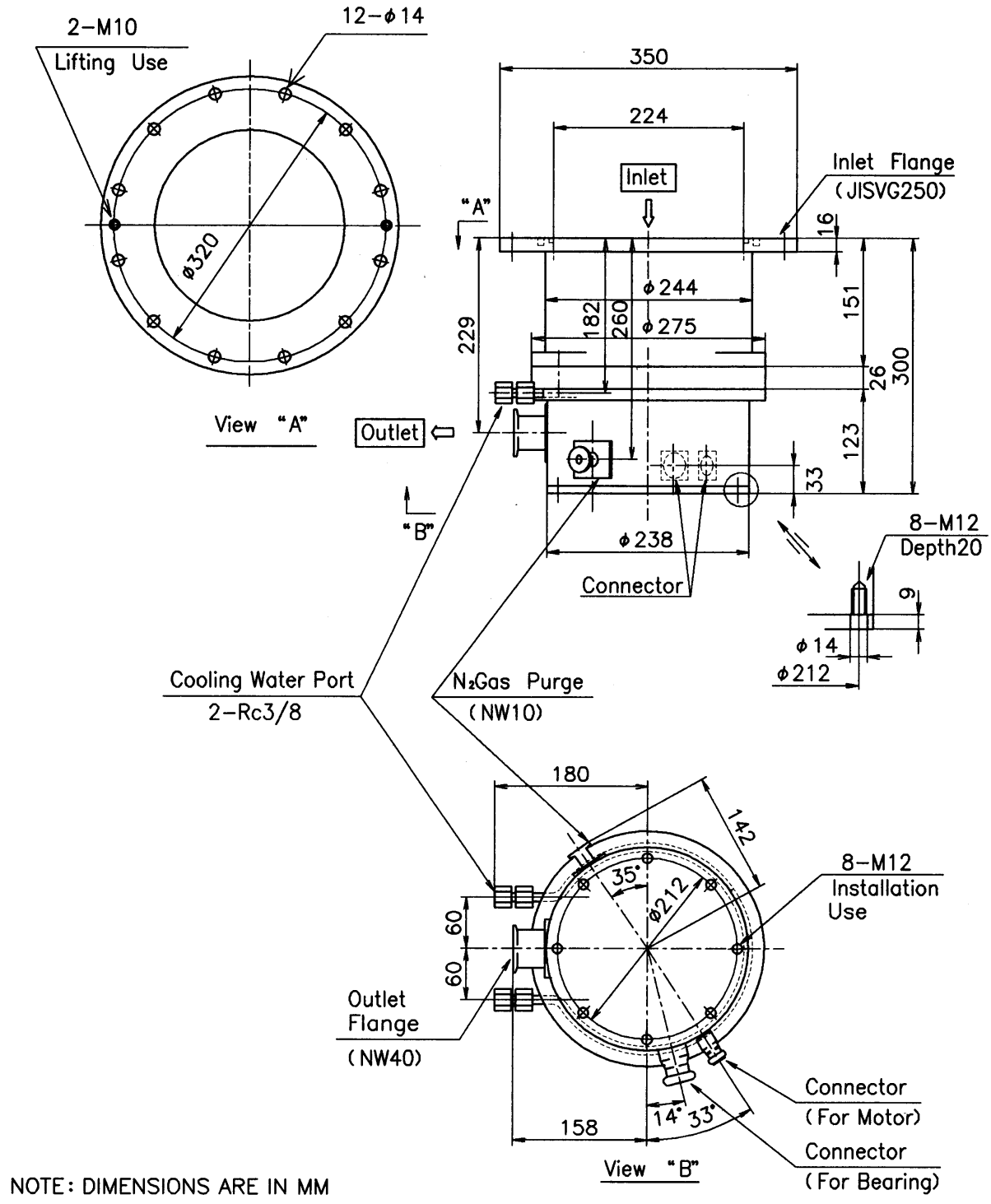
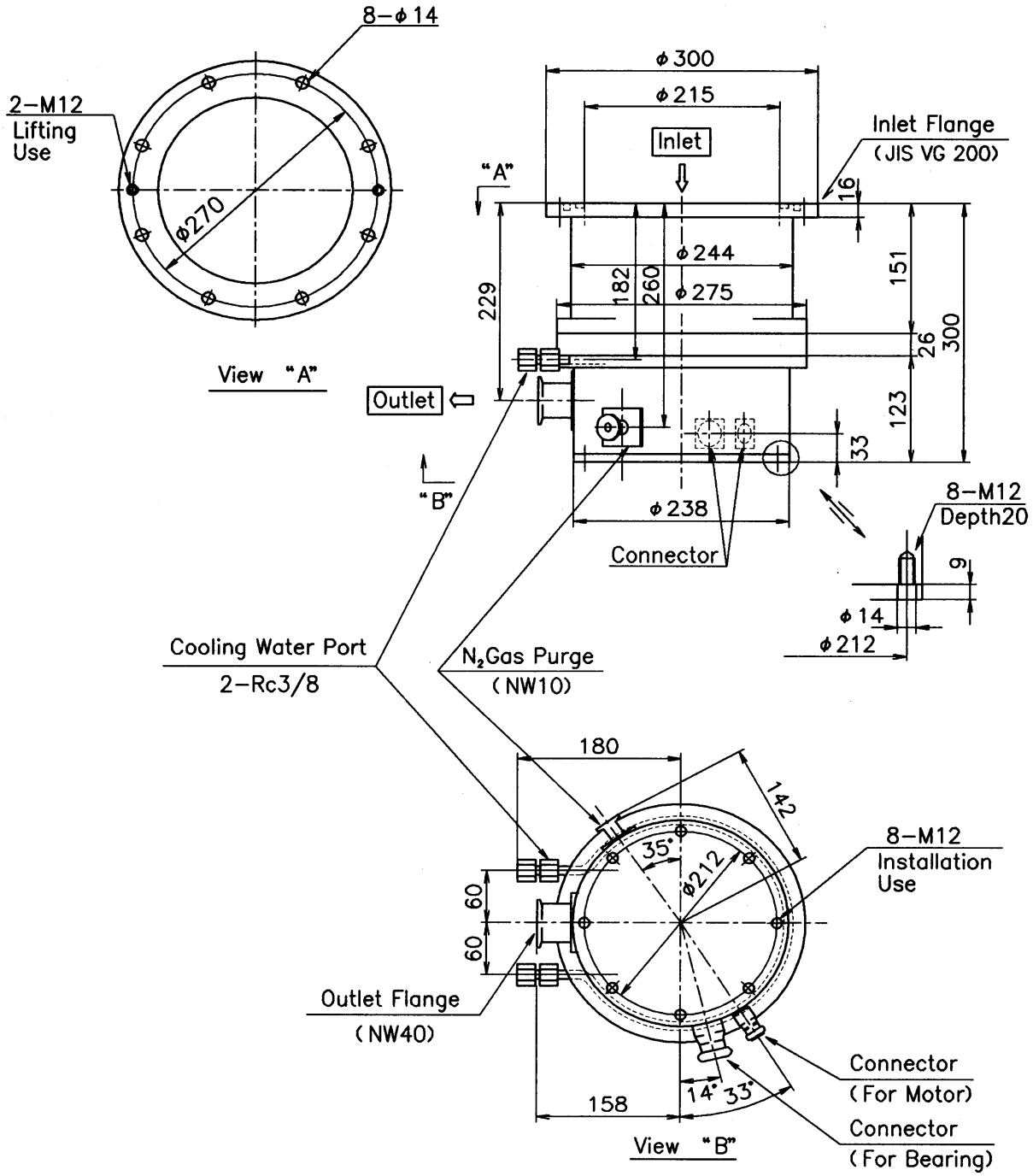
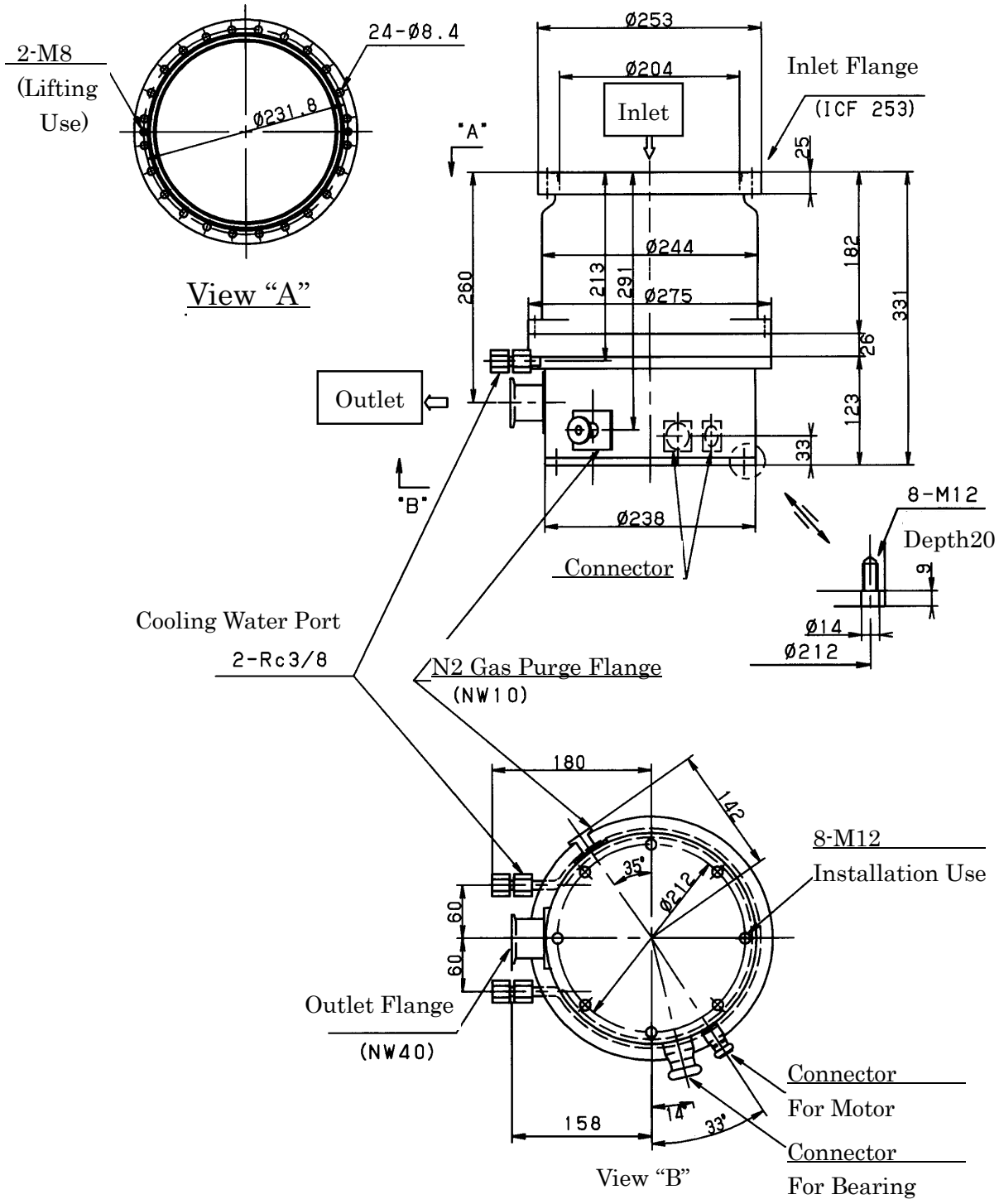


Fig.1-9 Construction of TMP (JIS VG250)



NOTE:DIMENSION ARE MM.

Fig.1-10 Construction of TMP (JIS VG200)



NOTE:DIMENSION ARE MM.

Fig.1-11 Construction of TMP (ICF253)

Technical Data	Designation	Sheet No.
	UTM-2300FW (JISVG300) Outline Drawing	37102070

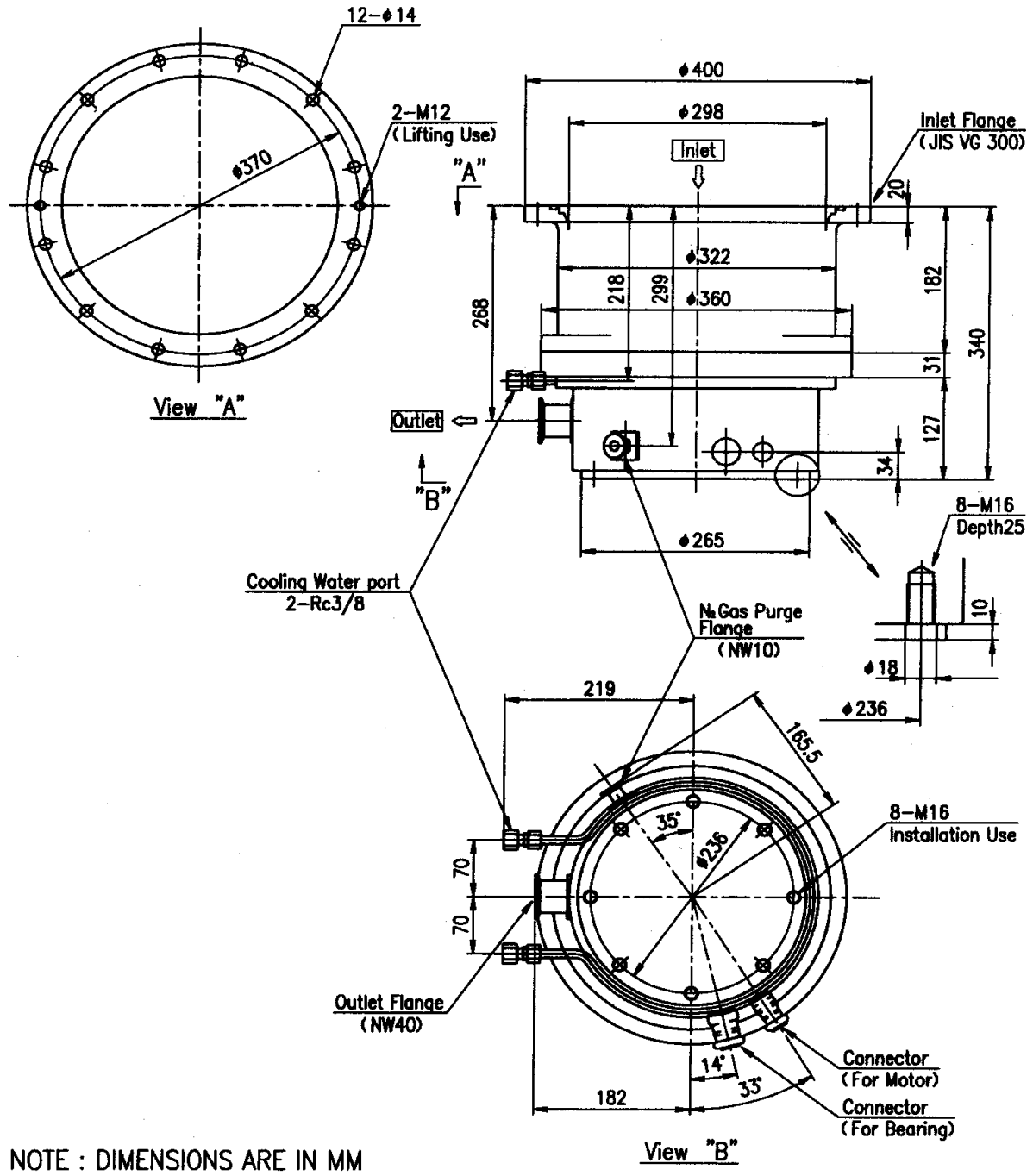


Fig.1-12 Construction of TMP (JIS VG300)

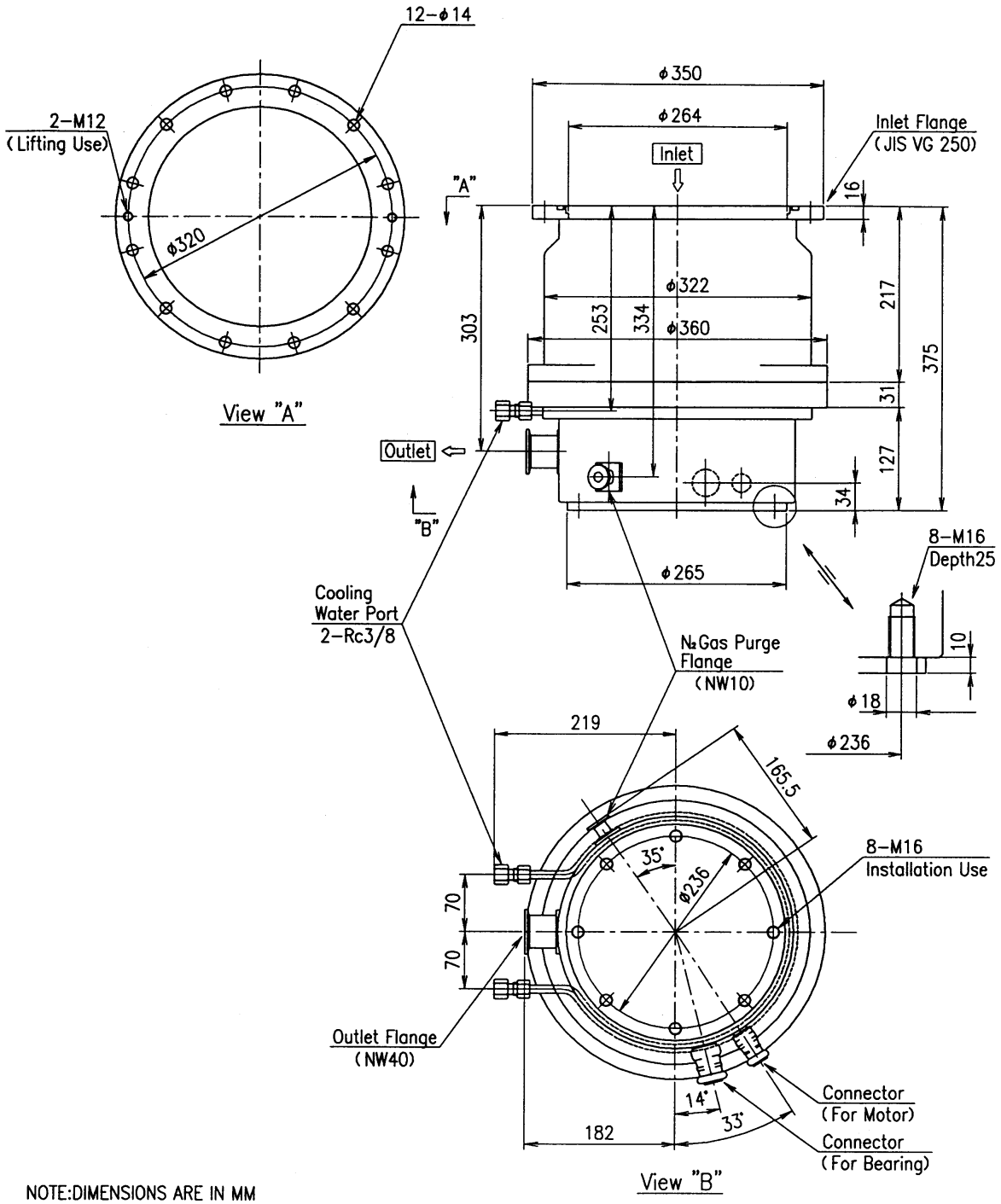
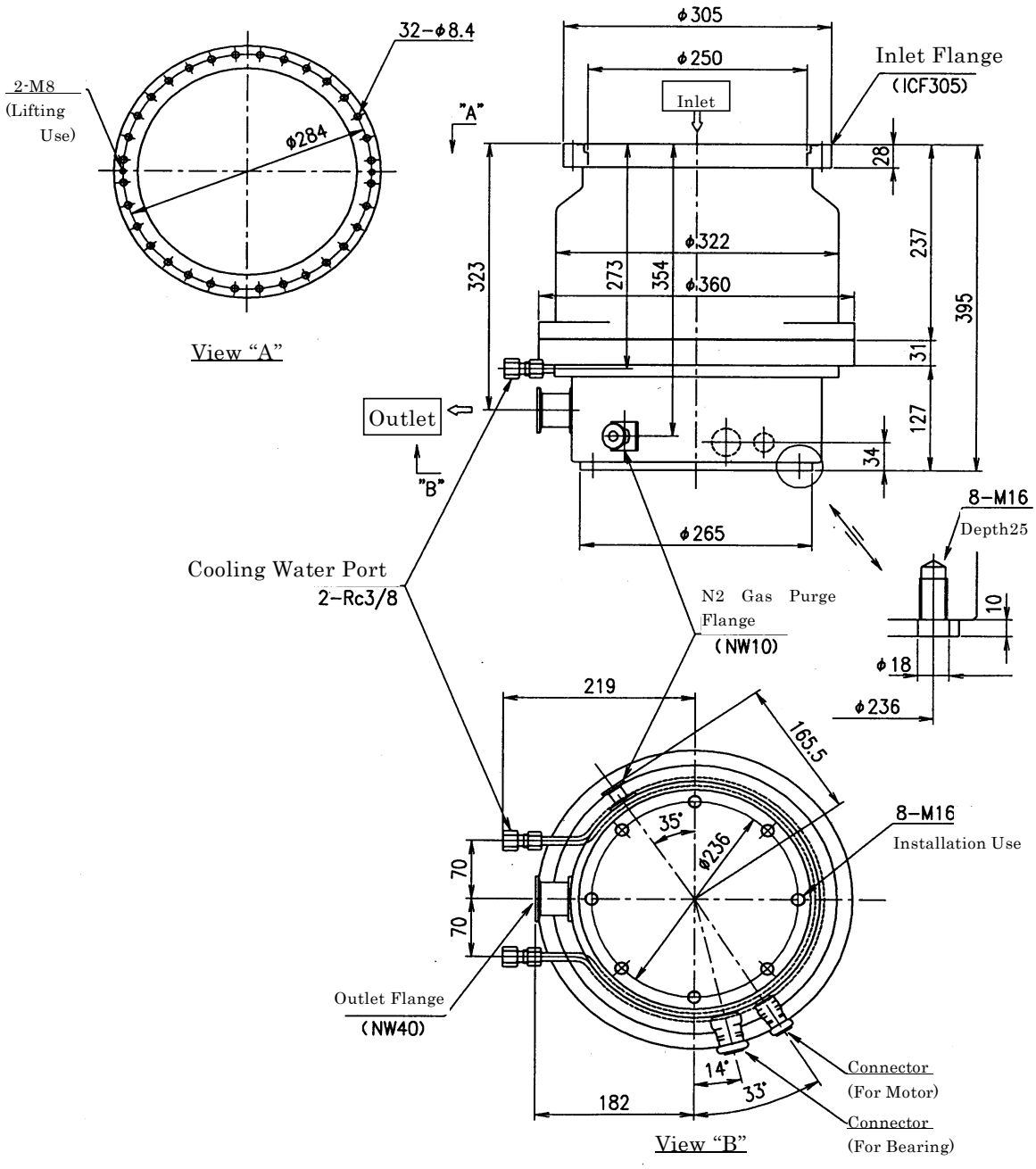
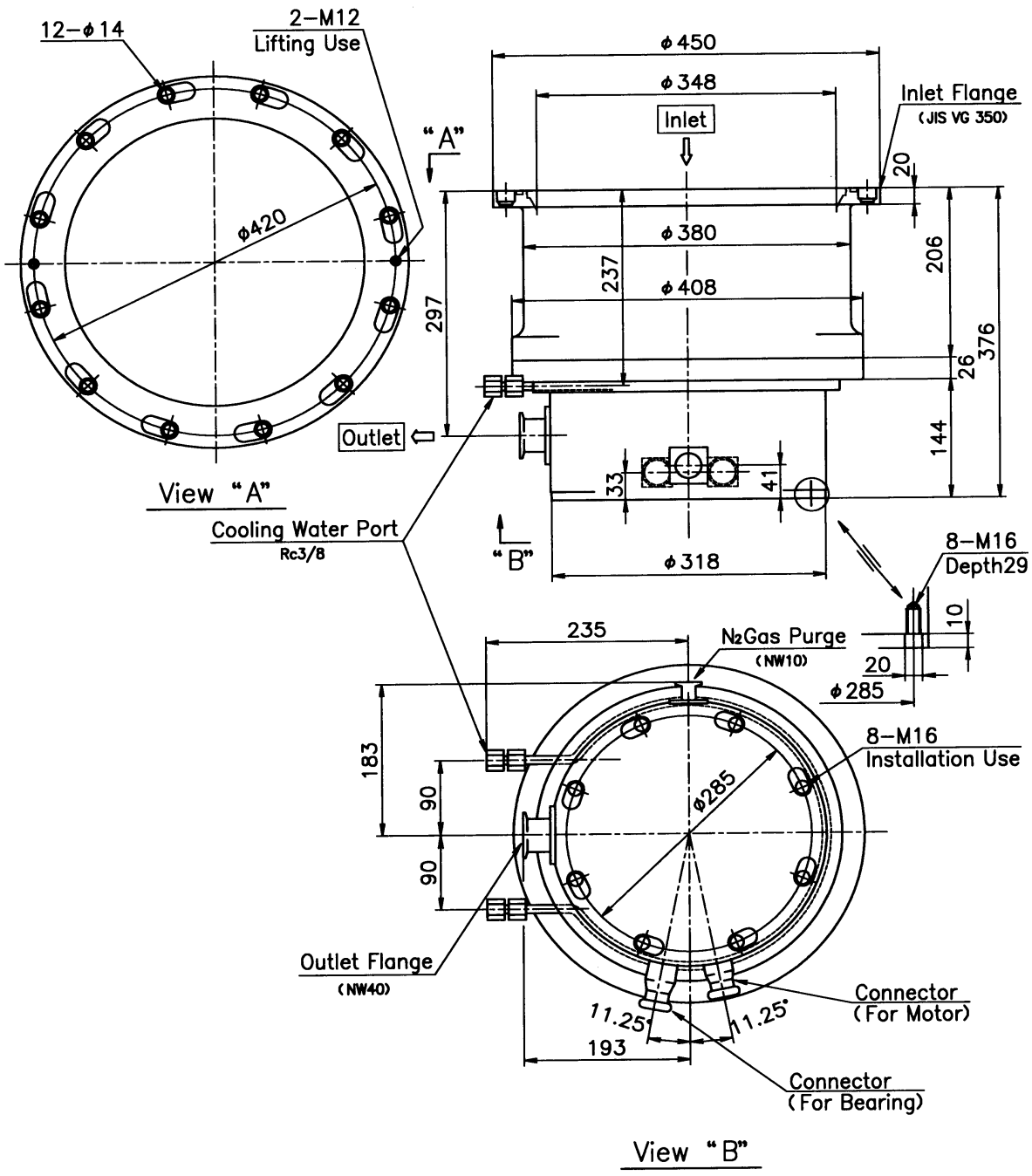


Fig.1-13 Construction of TMP (JIS VG250)



NOTE:DIMENSION ARE MM.

Fig.1-14 Construction of TMP (ICF305)



NOTE : DIMENSIONS ARE IN MM

Fig.1-15 Construction of TMP (JIS VG350)

Technical Data	Designation	Sheet No.
	UTM-3302FH (JIS VG 350) Outline Drawing	38202040

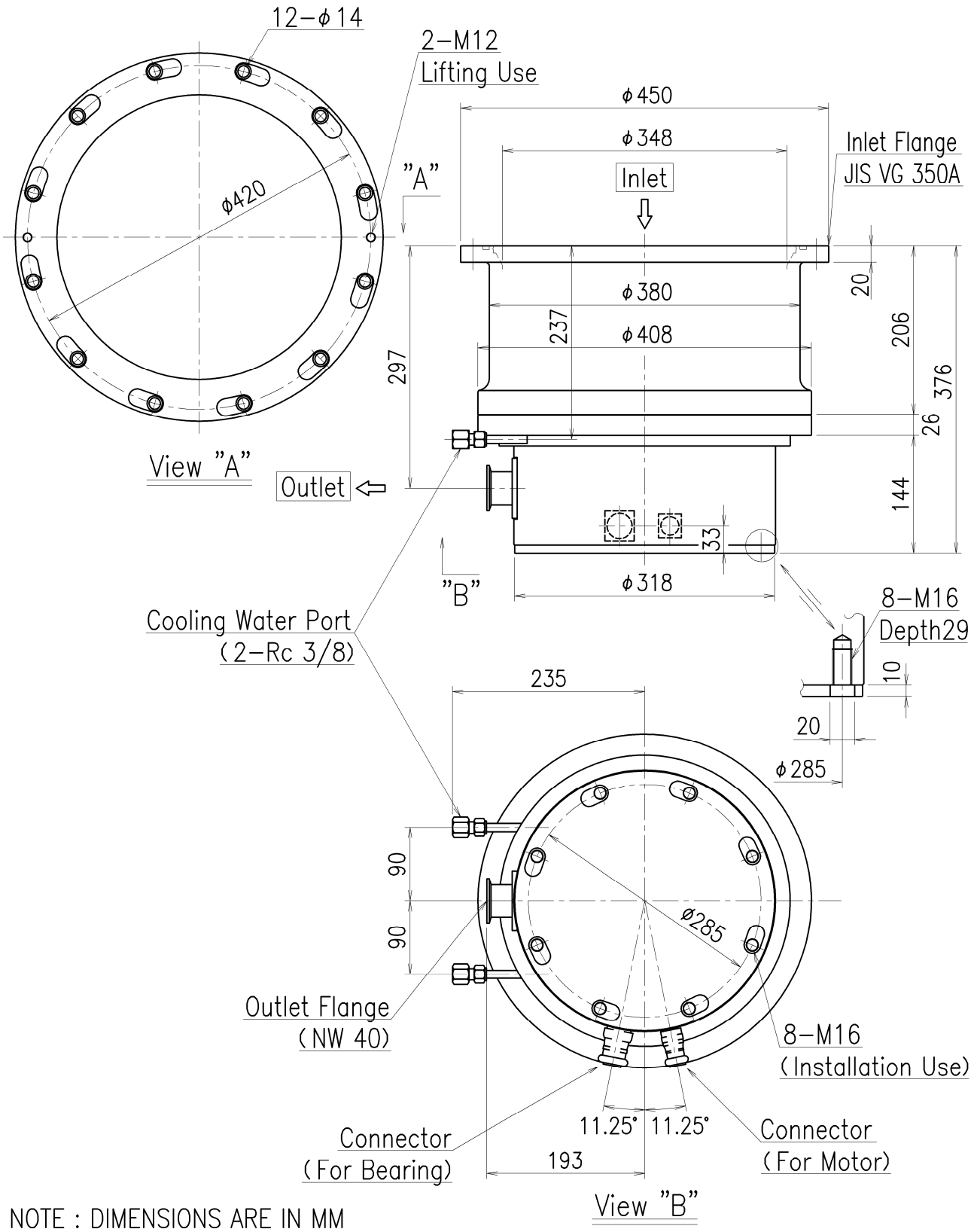


Fig.1-16 Construction of TMP (JIS VG350)

Technical Data	Designation	Sheet No.
	UTM-3303FH (JIS VG 350) Outline Drawing	38302020

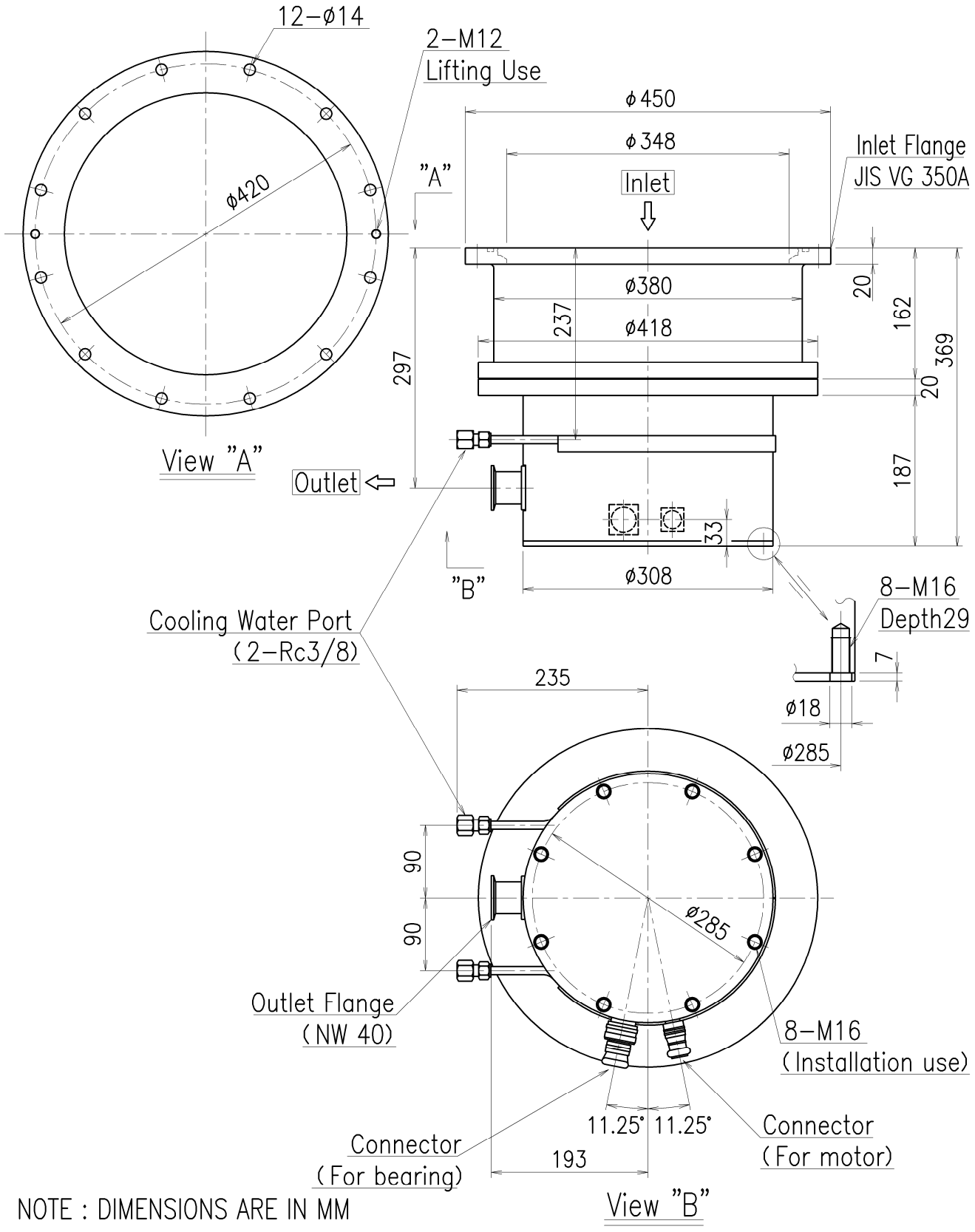


Fig.1-17 Construction of TMP (JIS VG350)

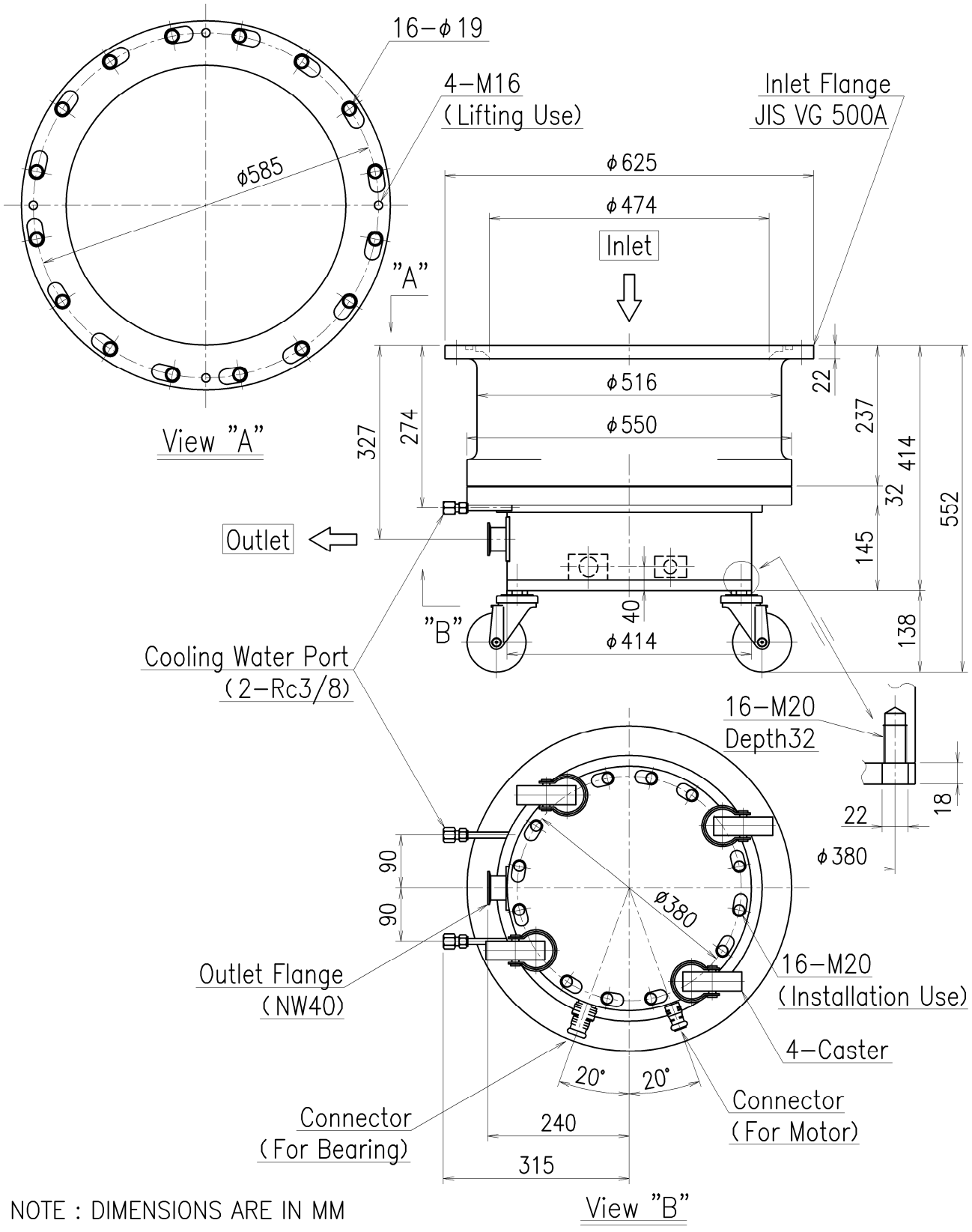


Fig.1-18 Construction of TMP (JIS VG500)

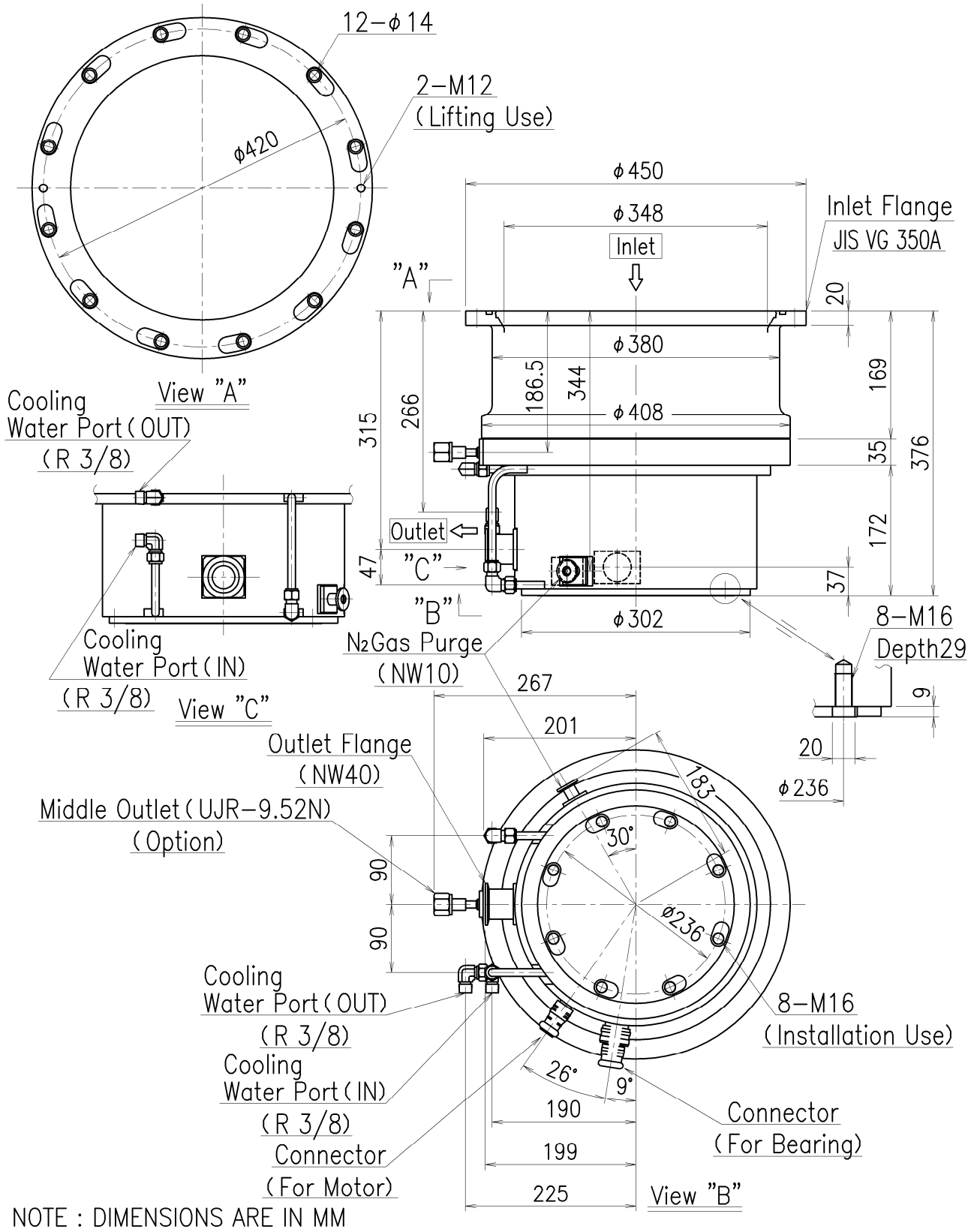
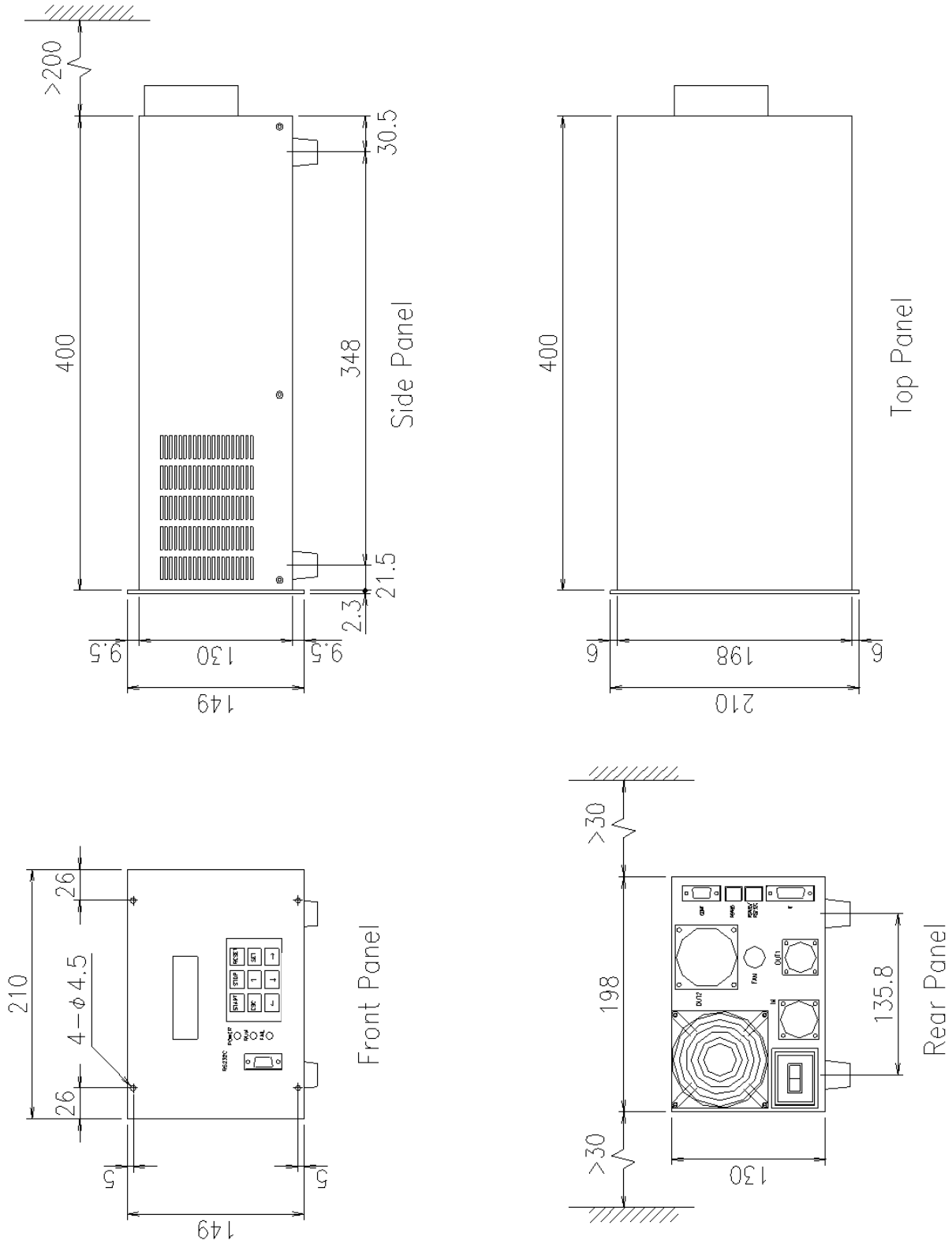


Fig.1-19 Construction of TMP (JIS VG350)

Technical Data	Designation	Sheet No.
	Digital Control Unit (D3R Type) Outline Drawing	33002220



NOTE : DIMENSIONS ARE IN MM

Fig. 2 External view of Control Unit

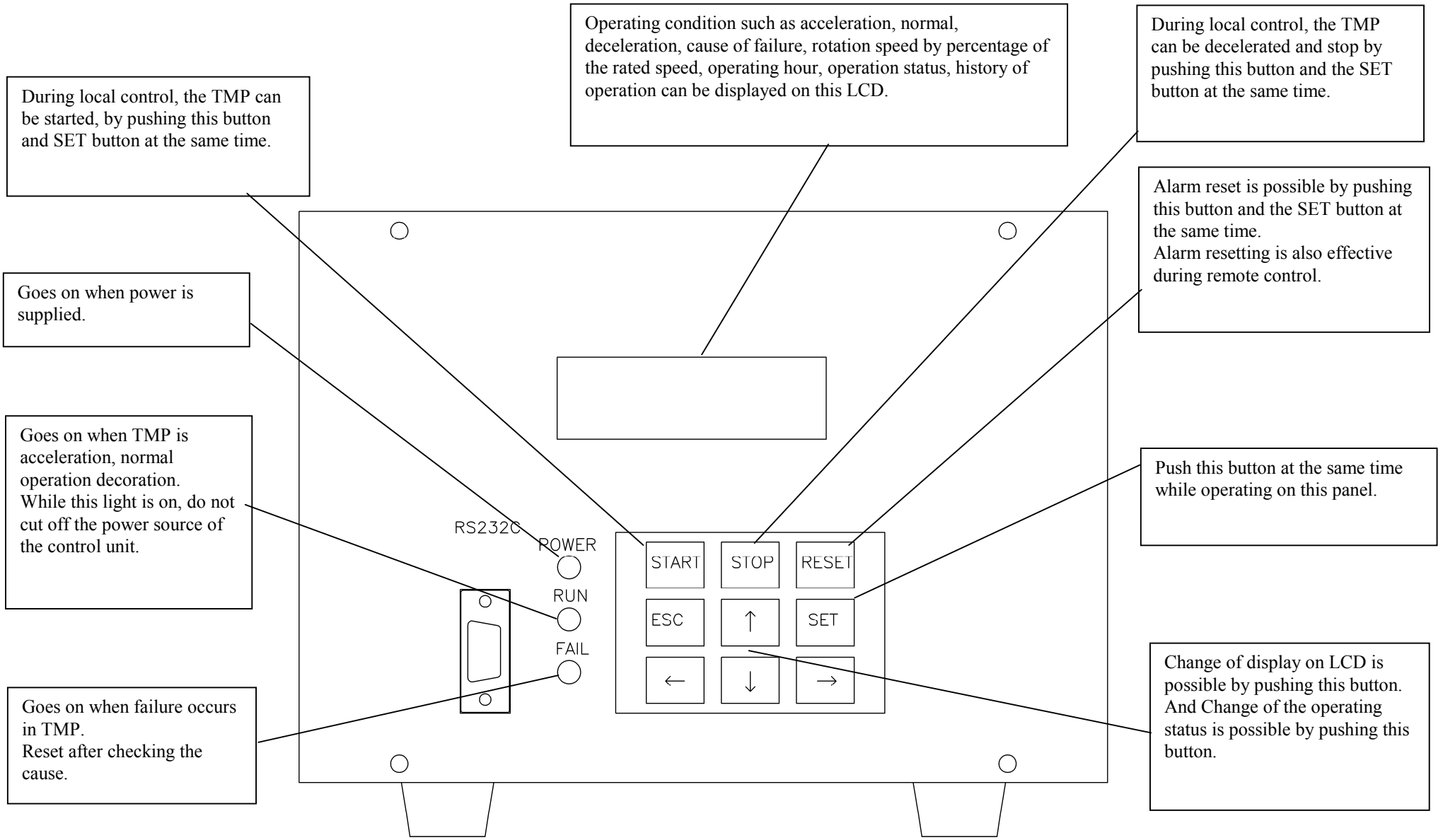


Fig.3 Operations of Control unit panel

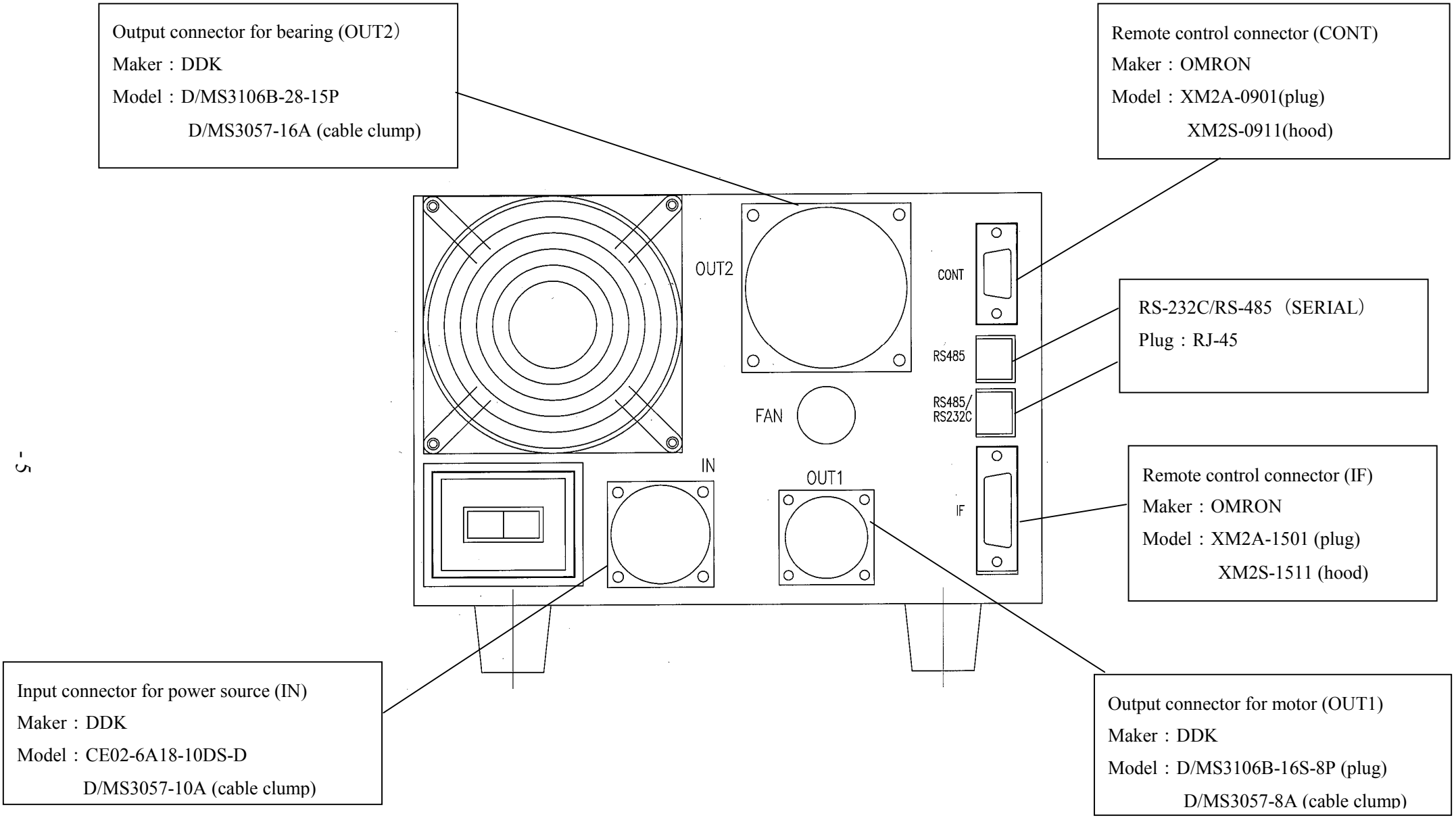


Fig.4　Control unit I/O connector specification

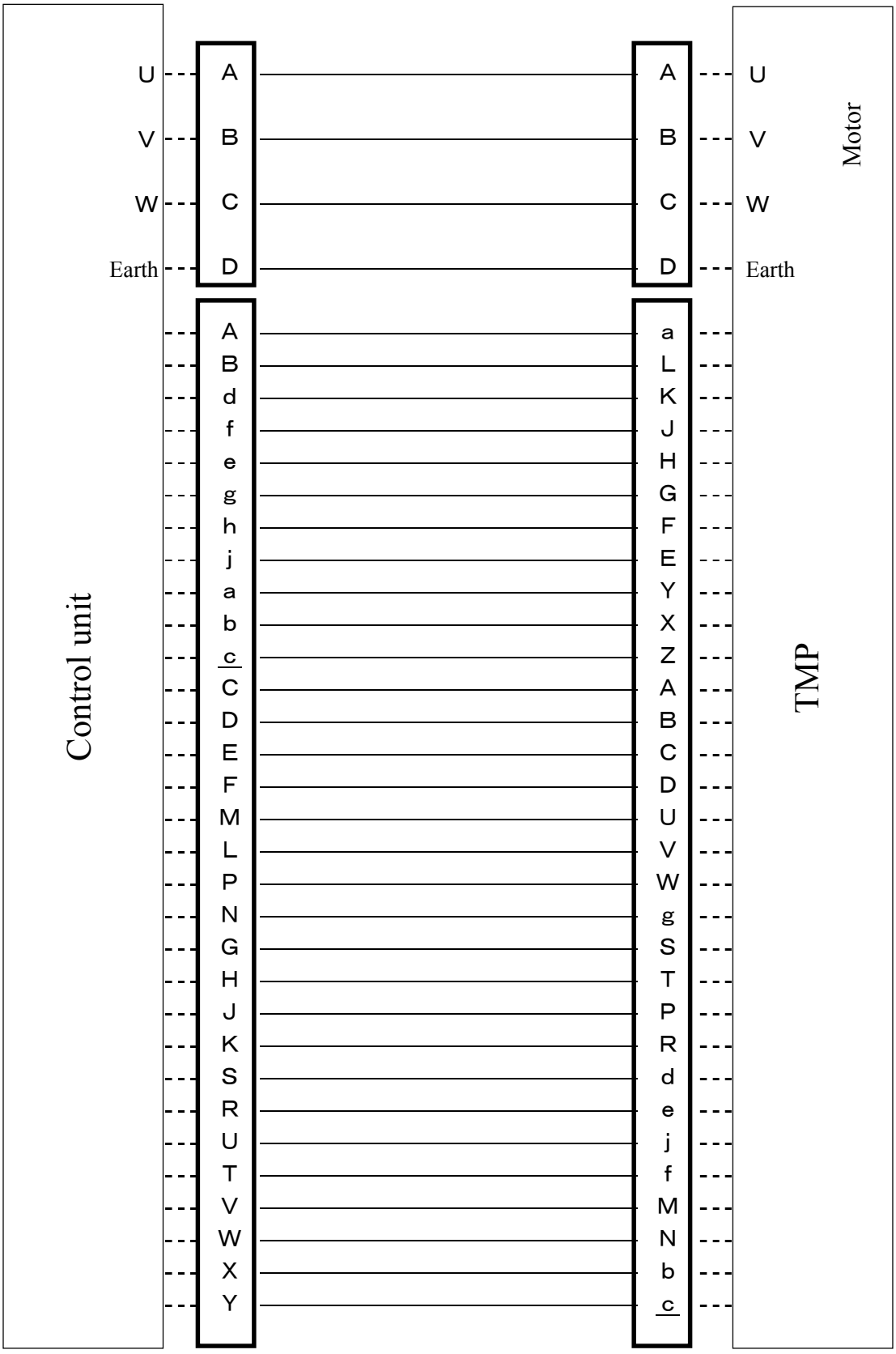
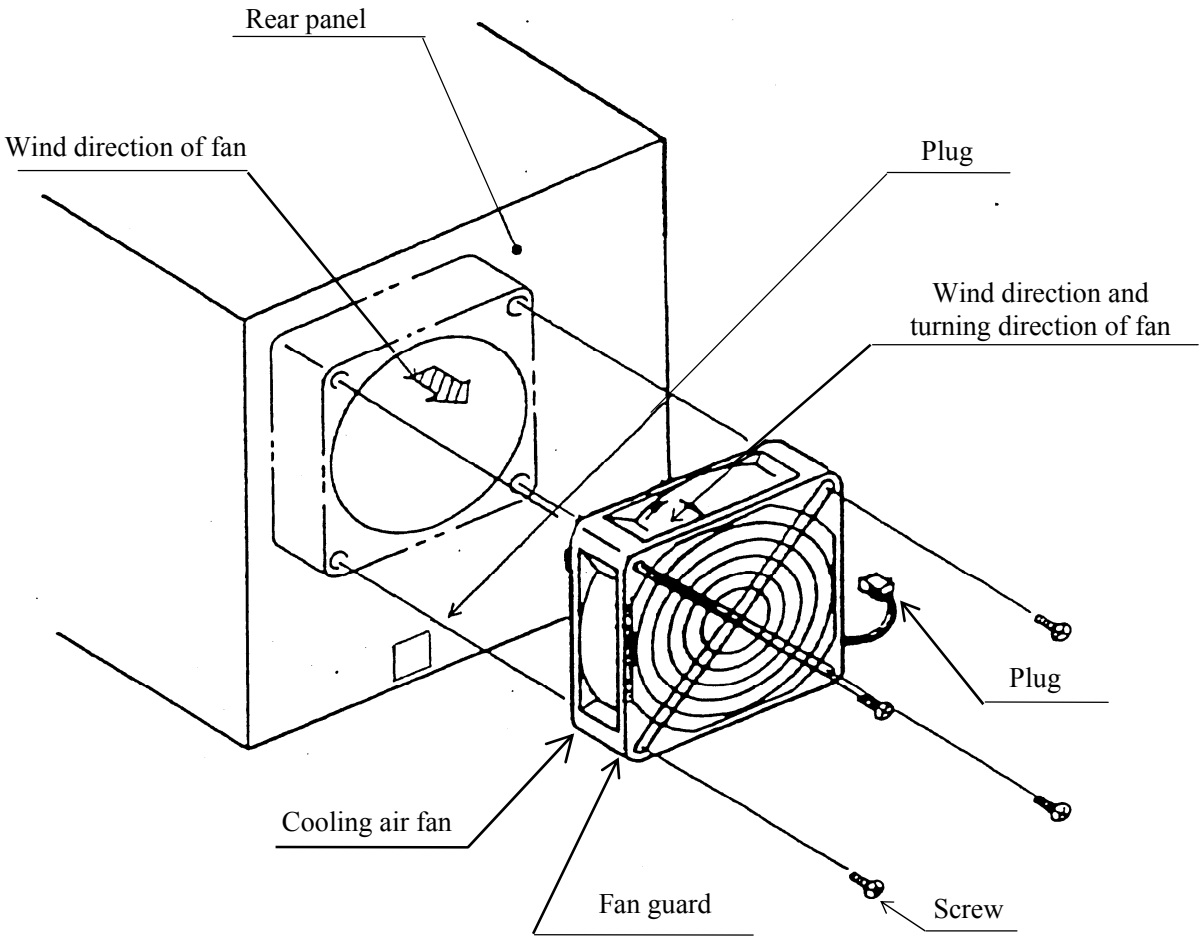


Fig.5 Output cable connection diagram



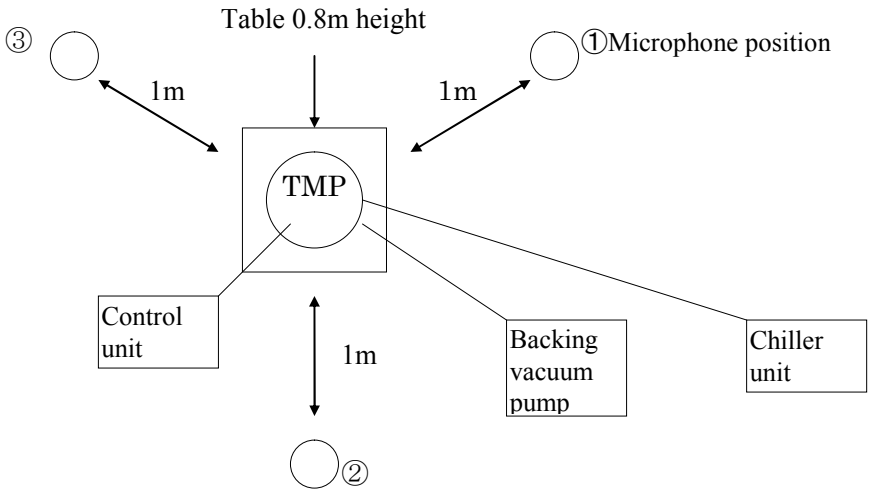
Procedure of replacing the cooling air fan

Make sure that the POWER switch is turned OFF before replacing the cooling air fan.

1. Loosen the screws on fan, and remove the fan from the control unit
   (Retain the removed screws for reuse).
2. Remove the plug.
3. Reverse the preceding steps to install the fan.
4. When installing the fan, observe the installing direction of the fan.

   The installing direction is indicated on a side as the wind direction and turning direction.

Fig.6 Procedure of replacing the cooling air fan



System configuration and Microphone Locations

1. Measurement set up

   The system was set up as above. The TMP was placed on the rigidly fixed table. The measurement device (microphone) was set at 1.6m height from the floor and 1m away from the TMP. The measurement was carried out in accordance with the Annex 1 of the EC Machinery Directive 89/392/EEC.

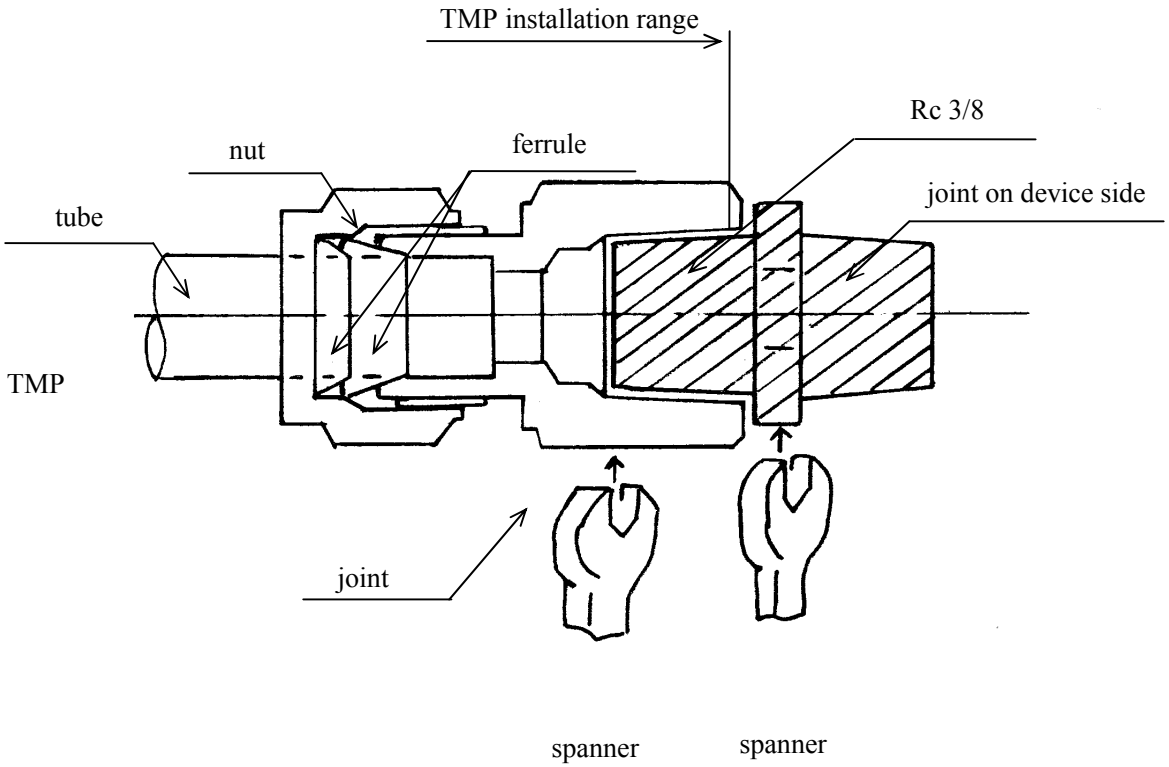
2. Test procedure

   The ambient (background) noise was measured at position 1 while the system was completely de-energized. The formal measurement was then carried out at three positions while TMP and control unit were operated in the normal operation. Note: The auxiliary equipment such as chiller unit and backing vacuum pump were temporary stopped during measurement.

3. Test result

Type	Maximum noise dB (A)
UTM-350FW/FH UTM-480FW/FH	64
UTM-800FW/FH UTM-1001FW/FH	65
UTM-1400FW	63
UTM-2300FW	62
UTM-3301FW	58
UTM-3302FH	58
UTM-3303FH	55
UTM-6300FH	63
UTM-3500D	53

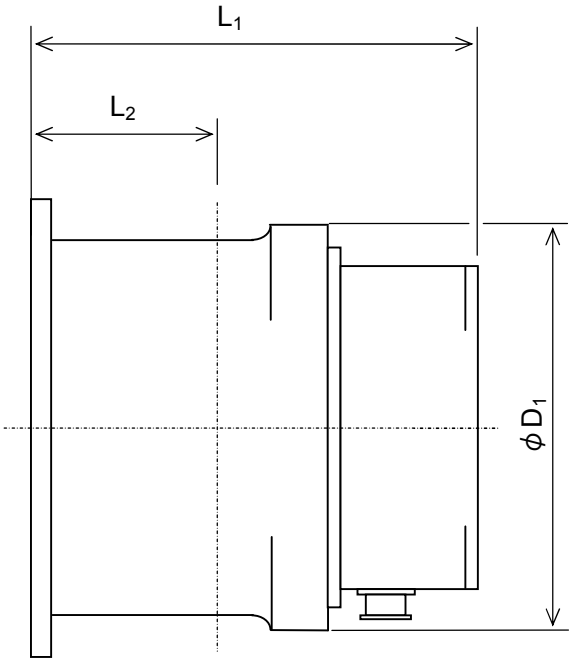
Fig.7 Audio noise measurement



Cooling water port connecting procedure:

1. Couple the joint threaded portion (Rc 3/8) with the joint on device side to connect the TMP cooling water port to the device side.
   To tighten the joints, fix the joint on TMP side firmly with spanner and install the joint on device side.
2. Do not remove the joint and nut. The hydraulic test has been completed to the TMP installation range at our shop.
   Removal of the joint and nut may result in water leakage due to over-tightening of the ferrule, damage to the seal and inclusion of foreign matter. If the removal is unavoidable, please contact us in advance.

Fig.8 Cooling Water Port Connecting Procedure



1． Center of Gravity of the Pump

Model	Inlet flange	Gravity L_2 (mm)	L_1 (mm)	D_1 (mm)
UTM-350FW/FH	JIS VG 100	150	269	190
UTM-350FW/FH	ICF152	156	276	190
UTM-480FW/FH	JIS VG 150	115	234	190
UTM-480FW/FH	ICF203	117	234	190
UTM-800FW/FH	JIS VG 150	165	310	245
UTM-800FW/FH	ICF203	175	324	245
UTM-1001FW/FH	JIS VG 200	140	278	245
UTM-1001FW/FH	ICF253	147	278	245
UTM-1400FW	JIS VG 200	150	300	275
UTM-1400FW	JIS VG 250	148	300	275
UTM-1400FW	ICF253	177	331	275
UTM-2300FW	JIS VG 250	200	375	360
UTM-2300FW	JIS VG 300	175	340	360
UTM-2300FW	ICF305	220	395	360
UTM-3301FW	JIS VG 350	185	376	408
UTM-3302FH	JIS VG 350	185	376	408
UTM-3303FH	JIS VG 350	182	369	418
UTM-6300FH	JIS VG 500	240	414	550
UTM-3500D	JIS VG 350	182	376	408

Fig.9 Center of Gravity of the Pump

12. Contact for Customer Service

We have developed a complete customer supporting system which will bring you satisfaction. Please contact ULVAC, Inc. at either following addresses or phone/fax number according to your needs when required.

Sales:
ULVAC, Inc.
Components Division
Overseas Sales Department
2500, Hagisono, Chigasaki,
Kanagawa 253-8543, Japan
TEL : +81-467-89-2261
FAX : +81-467-89-2279

Technical support:
ULVAC, Inc.
Components Division
Vacuum Pump & Components Engineering Department
2500, Hagisono, Chigasaki,
Kanagawa, 253-8543, Japan
TEL : +81-467-89-2194
FAX : +81-467-57-0737

Supplement A; Coupling-Free Function

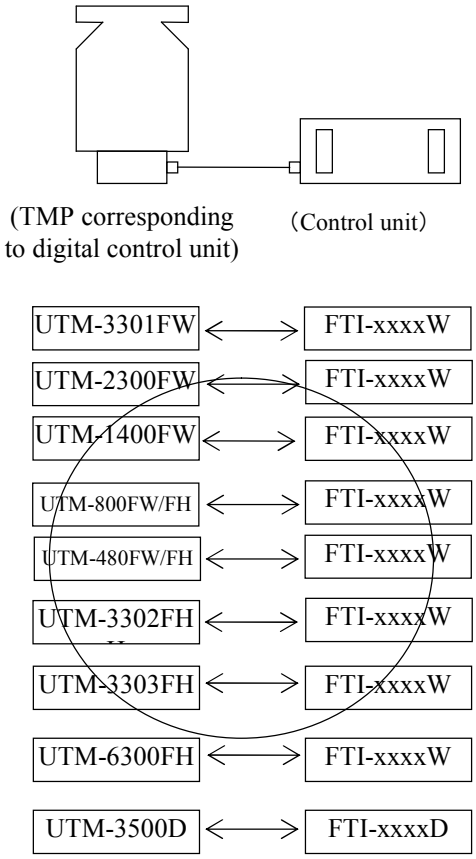
A1. Features

(1) A TMP of dissimilar model can be operated with one digital control unit.
(The TMP must be designed for digital D3R specification.)

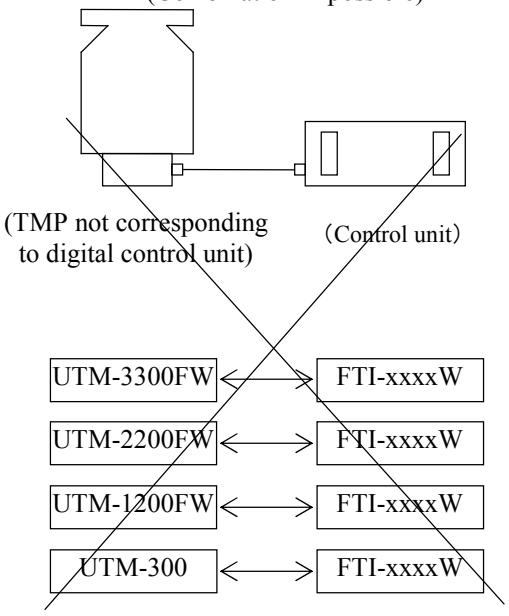
⚠CAUTION	Do not combine the TMP and control unit without coupling-free function, if the model is different. The different rotation can cause accident. The digital control unit can be furnished with the coupling-free function that enables the operation of various models (provided corresponding to digital control unit.) The TMP can be changed to another model by changeover switch.

⚠CAUTION	This digital control unit is not designed for automatic model identification function. Be careful when changing the model setting.

Example of coupling-free function
(Combination possible by changeover)



Example of none coupling-free
(Combination impossible)



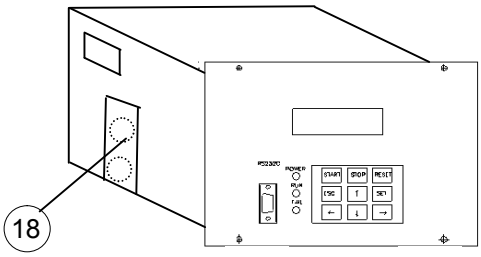
(2) Model setting is changed by switching 2 rotary switches, 5NA and 5NB, on the interior of the control unit side. The switching procedure is as follows:

① Remove 2 cross-slot machine screws for fixing the guard plate for "model change switch ⑱" on the side of control unit.

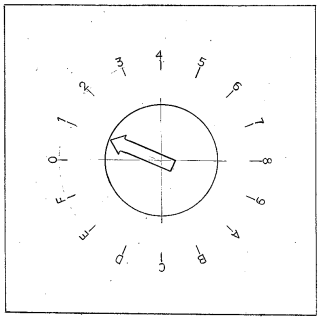
② Function of switch 5NA (lower) corresponds to "0" of the position 01 of rotary switch.

③ Function of switch 5NB (upper) corresponds to "1" of the position 01 of rotary switch.

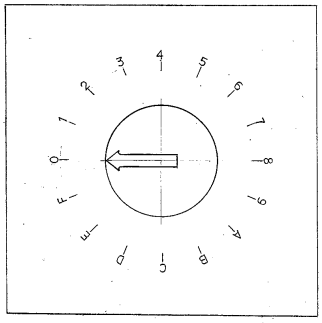
④ Refer to **A.2** for the model setting changing procedure.



Control unit upper.



Control unit upper Switch 5NB.



Control unit lower: Switch 5NA

Control unit lower.

A2. Model Setting Change

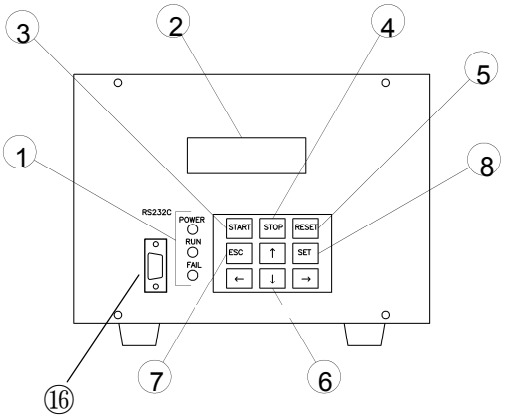
(1) The notch for the model change switch⑱ to change the model setting is installed on the side of control unit.

(2) When change operation, remove fixing the guard plate of the notch for the model change switch.

(3) Change model setting is possible by changing an internal model change switch (5NA and 5NB) of a notch.

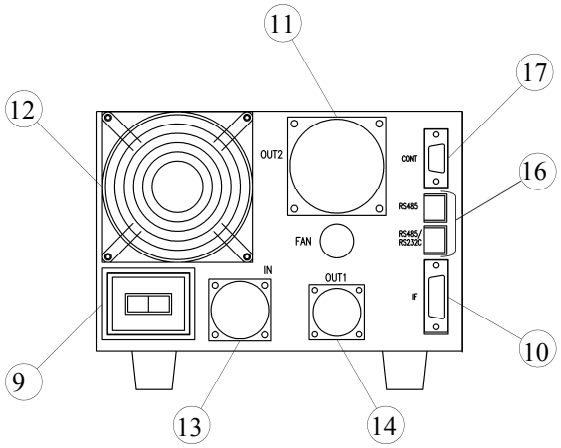
(4) The model setting should be changed before connecting the control unit with the TMP.
For the connection of control unit, see **3.7 Electric Wiring Procedure of control unit.**

(5) Turn Off the Power switch⑨ and make sure that the Power LED ①on the control unit panel goes off.



⚠ CAUTION	Be sure to turn off the power switch on the control unit before changing the model setting.

(6) Adjust the model change switch to the position corresponding to the TMP model to be connected by turning the switch with screwdriver.
The model change switch positions correspond with the TMP models as shown in the table of next.



⚠ CAUTION	Use the screwdriver of high insulation.

(7) Connect the control unit to the input power supply, if not.

(8) Turn on the power switch ⑨. Status LED Power① goes on and the air cooling fan of the control unit starts to rotate.

⚠ CAUTION	The status LCD② displays the set model name. Check that the model name is displayed correctly.

(9) Turn Off the power switch⑨. Connect the control unit with the TMP according to **3.7 Electric wiring procedure of control unit.**

⚠ CAUTION	Never detach the output cable while the power lamp is goes on.

Digital control unit applicable model

Model Change switch position	Model Change switch setting place		Pump model	LCD display
—	5NA	5NB	—	—
—	Control unit upper.	Control unit bottom.	—	—
01	0	1	UTM-350FW/FH UTM-480FW/FH	FTI 480W
02	0	2	UTM-800FW/FH UTM-1001FW/FH	FTI 800W
03	0	3	UTM-1400FW	FTI1400W
05	0	5	UTM-2300FW	FTI2300W
06	0	6	UTM-3301FW	FTI3301W
07	0	7	UTM-3302FH	FTI3302W
0E	0	E	UTM-3303FH	FTI3303W
08	0	8	UTM-6300FH	FTI6300W
0B	0	B	UTM-3500D	FTI3500D

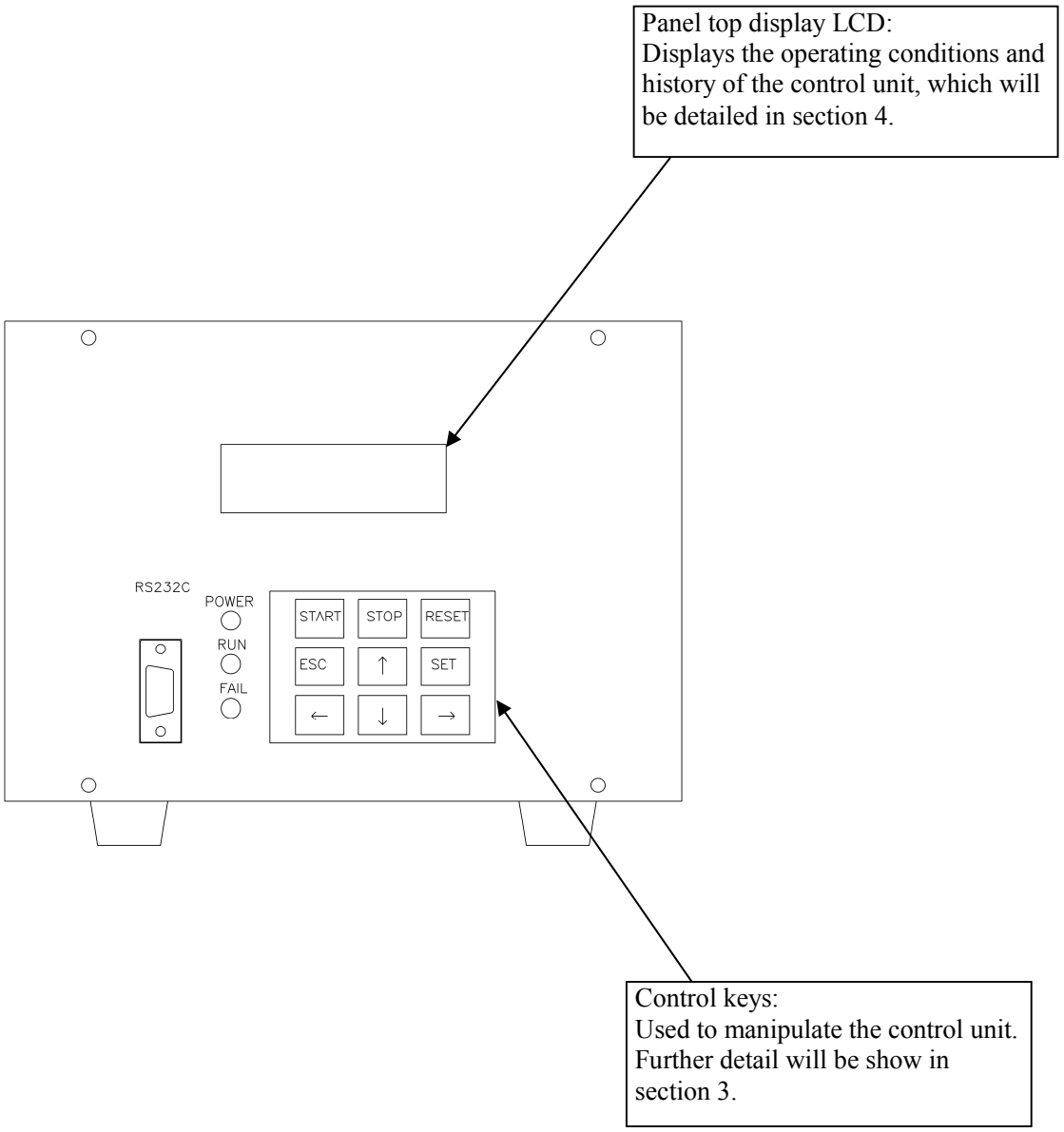
Supplement B ;
Key-controlled Operations and LCD Displayed Items on Operating Conditions

1. Contents

This document discusses the key-controlled operations and items displayed on LCD showing the operating conditions of the control unit D3R series

2. Panel Top Design

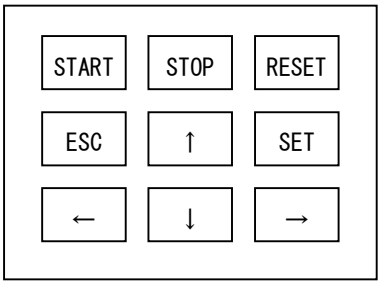
Show below is the design of the panel top of the D3R series (display- and control-related part).



3. Key-controlled Operations

3.1 Key Arrangement

The D3R series has 9 control keys on its panel top, which are arranged as shown below:



3.2 Key-controlled Functions

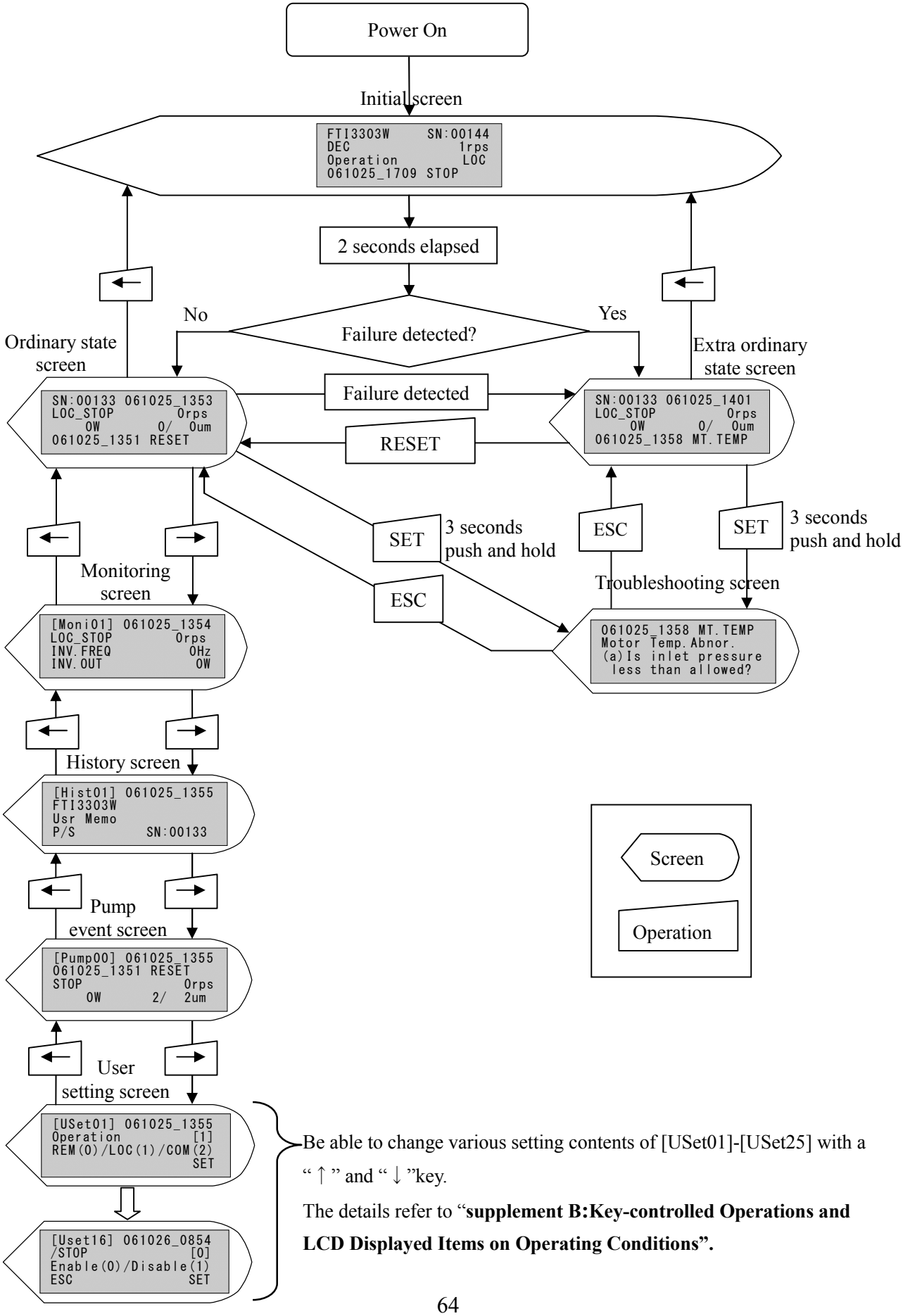
Shown in the table below are key-controlled functions of the D3R series control unit.

Function	Key operation	Condition
TMP Start	“SET”＋”START”	No failure detected and other than "Accelerating" or "Steady Operation"
TMP decelerate & stop	“SET”＋”STOP”	No failure detected and other than "Stopped" or "Decelerating"
Failure reset	“SET”＋”RESET”	Failure detected
Switch LCD displayed item	“↑”, “↓”, “←”, “→”	
Troubleshooting screen	“SET” push and hold	Failure displayed on LCD
End troubleshooting	“ESC”	Troubleshooting screen displayed
Finalize settings	“SET”	During user setting or manufacturer's setting
Cancel settings	“ESC”	During user setting or manufacturer's setting

4. LCD display

4.1 Screen transition summaries

Perform screen change by key operation basically. Show a summary of screen transition in chart below.



Be able to change various setting contents of [USet01]-[USet25] with a " ↑ " and " ↓ "key.

The details refer to "**supplement B:Key-controlled Operations and LCD Displayed Items on Operating Conditions".**

4.2 Details of LCD Display

4.2.1 Initial Screen

The initial screen will be shown for two (2) seconds upon startup. The screen may also be shown after the startup through the use of a key. After two seconds(← Key push) being shown, the initial screen will move on automatically to the ordinary-state screen (extraordinary-state screen upon any detection of a fault). The initial screen will display: (1) model name, (2) serial number, (3) last logged operation mode at the last powering OFF, (4) last logged speed, (5) control location setting-- REMOTE or LOCAL, (6) last logged date and time and (7) latest logged contents.

[Contents displayed]

Model name											S	N	:	Serial No.					
Last logged operation mode											Last logged speed						rps/rpm		
O	p	e	r	a	t	i	o	n					Control location setting						
Last logged date & time (YYMMDD_HHMM)											Latest logged contents								

[Sample display]

F	T	I	3	3	0	3	W					S	N	:	0	0	0	0	1
S	T	O	P													0	r	p	s
O	p	e	r	a	t	i	o	n									L	O	C
0	6	0	5	0	1	_	1	0	3	0		S	T	O	P				

4.2.2 Ordinary-state Screen

Once the control unit has been powered ON, the initial screen will be shown for two seconds and then moves by itself on to the ordinary-state screen. The ordinary-state screen shows: (1) serial number, (2) current date and time, (3) current operation mode, (4) current speed (any of rps or rpm may be selected for display), (5) inverter output (W), (6) upper shaft vibration U ($\mu m^{0\text{-}P}$), (7) lower shaft vibration L ($\mu m^{0\text{-}P}$), (8) logged date and time, and (9) logged contents). The display at the bottom line of the screen may be selected by the use of ↑ and ↓ keys from the latest log through to the last 10th log. If the logged contents shown are of any fault, pressing the 'SET' key will transition the screen to the troubleshooting screen. Pressing the 'ESC' key on the troubleshooting screen will bring you back to the ordinary-state screen.

[Contents displayed]

S	N	:	Serial number							Current date & time (YYMMDD_HHMM)									
Current operation mode									Current speed					rps/rpm					
Inverter output			W						Shaft vibration U			/	Shaft vibration L			u	m	
Logged date & time (YYMMDD_HHMM)											Logged contents								

[Sample display]

S	N	:	0	0	0	0	1		0	6	0	5	0	1	_	1	2	0	0
L	O	C	_	A	C	C								2	0	0	r	p	s
		5	0	0	W							1	0	/		1	0	u	m
0	6	0	5	0	1	_	1	1	3	0		S	T	A	R	T			

[Operation modes]

	Displayed	Description
1	STOP	Stop
2	ACC	Acceleration
3	NOR	Normal operation at the rated speed
4	DEC	Deceleration
5	FREE	Free run

4.2.3 Extraordinary-state Screen

The transition to the extraordinary-state screen will occur in the following cases:

（1） fault is detected with the Any e control unit.

（2） When powering ON the control unit, if any fault was detected with the control unit during the previous powering OFF process, the extraordinary-state screen will appear after two seconds of initial screen display.

The extraordinary-state screen will display: (1) serial number, (2) current date and time, (3) current operation mode, (4) current speed (any of rps or rpm may be selected for display), (5) inverter output (W), (6) upper shaft vibration U ($\mu m^{0\text{-}P}$), (7) lower shaft vibration L ($\mu m^{0\text{-}P}$), (8) date and time of fault occurred, and (9) nature of fault). The fault display at the bottom line of the screen may be selected by the use of ↑ and ↓ keys from the faults currently detected.

Pressing the 'SET' key (3 second push and hold)will transition the screen to the troubleshooting screen. Pressing the 'ESC' key on the troubleshooting screen will bring you back to the extraordinary-state screen.

Pressing the 'RESET' key to reset the fault will get you back to the ordinary-state screen.

[Contents displayed]

S	N	:	Serial number						Current date & time (YYMMDD_HHMM)									
Current operation mode											Current speed			rps/rpm				
Inverter output			W							Shaft vibration U		/	Shaft vibration L			u		m
Date and time of fault occurred (YYMMDD_HHMM)											Nature of fault							

[Sample display]

S	N	:	0	0	0	0	1		0	6	0	5	0	1	_	1	2	4	0
L	O	C	_	D	E	C								2	0	0	r	p	s
				0	W							1	0	/		1	0	u	m
0	6	0	5	0	1	_	1	2	3	5		V	I	B	R	A	T	I	O

[List of faults]

	Displayed	Description		Displayed	Description
1	P.SUSPEN	power failure	11	VIBRATIO	Shaft vibration abnormal
2	P.SUPPLY	Control power abnormal	12	PULSE	Pulse signal abnormal
3	CNV	Converter abnormal	13	O.REV	Over revolution (software trip)
4	CNV.TEMP	Converter temperature abnormal	14	O.FREQ	Over frequency
5	HD.FREQ	Hard over frequency (hardware trip)	15	MT.TEMP	Motor temperature abnormal
6	O.LOAD	Over load	16	SWITCH	Start abnormal
7	ACC.TIME	acceleration time over			
8	DSP.COMM	Internal communication abnormal			
9	INV	Inverter abnormal			
10	OPL	Single phase			

4.2.4 Troubleshooting Screen

Where any fault log is displayed on either the ordinary-state screen or extraordinary screen, pressing the 'SET' key will get the contents of the fault with descriptions on them.

You can use ↑ and ↓ keys for scrolling.

From the troubleshooting screen, pressing the 'ESC' key will bring you back to the ordinary-state screen.

For the details of the display, see item 10.2 of the using instructions.

[Contents displayed]

Date and time of fault occurred (YYMMDD_HHMM)		Nature of fault
Contents of troubleshooting		

[Sample display]

0	6	0	5	0	1	_	1	2	3	5		V	I	B	R	A	T	I	O
A	b	n	o	r	.	V	i	b	r	a	t	i	o	n					
(	a	)	I	s		T	M	P		i	n	s	t	a	l	l	e	d	
f	i	r	m	l	y	?													

4.2.5 Monitoring Screens

From the monitoring screens, you can obtain detailed operating state of the current TMP.
The monitoring screens include a total of six screens from No. 01 through No. 06.
The screen displayed may be selected among them using ↑ and ↓ keys.

(No.01)

The monitoring screen No. 01 displays : (1) current operation mode, (2) current speed (any of rps or rpm may be selected for display), inverter output frequency (Hz) and (4) inverter output (W).

[Contents displayed]

[	M	o	n	i	0	1	]		Current date & time (YYMMDD_HHMM)										
Current operation mode												Current speed					rps/rpm		
I	N	V	.	F	R	E	Q					Output frequency						H	z
I	N	V	.	O	U	T								Inverter output					W

[Sample display]

[	M	o	n	i	0	1	]		0	6	0	5	0	1	_	1	3	0	0
L	O	C	_	N	O	R								7	5	0	r	p	s
I	N	V	.	F	R	E	Q							7	5	0		H	z
I	N	V	.	O	U	T										1	0	0	W

(No.02)

The monitoring screen No. 02 displays: (1) inverter voltage (V), (2) inverter current (A), and motor temperature (deg C).

[Contents displayed]

[	M	o	n	i	0	2	]		Current date & time (YYMMDD_HHMM)										
I	N	V	.	V	O	L	T							Inverter voltage					V
I	N	V	.	C	U	R	R							Inverter current					A
M	O	T	.	T	E	M	P				Motor temperature						d	e	g	C

[Sample display]

[	M	o	n	i	0	2	]		0	6	0	5	0	1	_	1	3	0	0
I	N	V	.	V	O	L	T									1	0	0	V
I	N	V	.	C	U	R	R									1	.	0	A
M	O	T	.	T	E	M	P							6	0	d	e	g	C

(No.03)

The monitoring screen No. 03 displays: (1) acceleration time (minutes), (2) rated operation time (minutes) and (3) deceleration time (minutes) for the previous or present run.

[Contents displayed]

[	M	o	n	i	0	3	]		Current date & time (YYMMDD_HHMM)										
A	C	C	.	T	I	M	E				Acceleration time								m
N	O	R	.	T	I	M	E				Rated operation time								m
D	E	C	.	T	I	M	E				Deceleration time								m

[Sample display]

[	M	o	n	i	0	3	]		0	6	0	5	0	1	_	1	3	0	0
A	C	C	.	T	I	M	E								1	0	.	0	m
N	O	R	.	T	I	M	E								3	0	.	0	m
D	E	C	.	T	I	M	E								1	5	.	0	m

(No.04)

No. 04 The monitoring screen No. 04 shows: (1) upper shaft vibration U ($\mu m^{0\text{-}P}$), (2) lower shaft vibration L ($\mu m^{0\text{-}P}$), , and (3) thrust shaft vibration Th (μm^{rms}).

[Contents displayed]

[	M	o	n	i	0	4	]		Current date & time (YYMMDD_HHMM)								
U															Shaft vibration U	u	m
L															Shaft vibration L	u	m
T	h														Shaft vibration Th	u	m

[Sample display]

[	M	o	n	i	0	4	]		0	6	0	5	0	1	_	1	3	0	0
U																1	0	u	m
L																1	0	u	m
T	h																1	u	m

(No.05)

The monitoring screen No. 05 shows: (1) upper x-direction shaft vibration Ux (μm^{rms}), and (2) upper y-direction shaft vibration Uy (μm^{rms}).

[Contents displayed]

[	M	o	n	i	0	5	]		Current date & time (YYMMDD_HHMM)								
U	x														Shaft vibration Ux	u	m
U	y														Shaft vibration Uy	u	m

[Sample display]

[	M	o	n	i	0	5	]		0	6	0	5	0	1	_	1	3	0	0
U	x																7	u	m
U	y																7	u	m

（No.06）

The monitoring screen No. 06 shows: (1) lower x-direction shaft vibration Lx (μm^{rms}), and (2) lower y-direction shaft vibration Ly (μm^{rms}).

[Contents displayed]

[	M	o	n	i	0	6	]		Current date & time (YYMMDD_HHMM)								
L	x														Shaft vibration Lx	u	m
L	y														Shaft vibration Ly	u	m

[Sample display]

[	M	o	n	i	0	6	]		0	6	0	5	0	1	_	1	3	0	0
L	x																7	u	m
L	y																7	u	m

4.2.6 History Screens

The history screens provide information on the operating history records of the TMP.

The screens include a total six screens from No. 01 through No. 06 and they may be switched from to another using ↑ and ↓ keys.

(No.01)

The history screen No. 01 shows: (1) model name, (2) serial number of the pump proper, (3) user memo that the customer can set at their discretion and (4) serial number of the control unit.

[Contents displayed]

[	H	i	s	t	0	1	]		Current date & time (YYMMDD_HHMM)										
Model name												S	N	:	Pump serial			
U	s	r		M	e	m	o					User memo							
P	/	S										S	N	:	P/S S/N			

[Sample display]

[	H	i	s	t	0	1	]		0	6	0	5	0	1	_	1	3	0	0
F	T	I	3	3	0	3	W					S	N	:	0	0	0	0	1
U	s	r		M	e	m	o					A	B	C	D	E	F	G	H
P	/	S										S	N	:	0	0	0	0	1

(No.02)

History screen No. 02 is done skip of.

(No.03)

History screen No. 03 is done skip of.

(No.04)

The history screen No. 04 shows: (1) start-stop count, (2) touch-down count and (3) air inrush count

[Contents displayed]

[	H	i	s	t	0	4	]		Current date & time (YYMMDD_HHMM)						
S	t	a	r	t	S	t	o	p							Start-stop count
T	o	u	c	h	D	o	w	n							Touch-down count
A	i	r	I	n	r	u	s	h							Air inrush count

[Sample display]

[	H	i	s	t	0	4	]		0	6	0	5	0	1	_	1	3	0	0
S	t	a	r	t	S	t	o	p											5
T	o	u	c	h	D	o	w	n											0
A	i	r	I	n	r	u	s	h											0

(No.05)

The history screen No. 05 shows: (1) cumulative energization time since the control unit shipment (hours), (2) cumulative time operated (hours) and (3) date & time of control unit shipment.

[Contents displayed]

[	H	i	s	t	0	5	]		Current date & time (YYMMDD_HHMM)									
P	/	S			O	n					Cumulative energization time since P/S shipment						H	r
P	/	S			R	u	n				Cumulative operated time since P/S shipment						H	r
				f	r	o	m		P/S shipment date & time									

[Sample display]

[	H	i	s	t	0	5	]		0	6	0	5	0	1	_	1	3	0	0
P	/	S			O	n							1	0	0	.	0	H	r
P	/	S			R	u	n							5	0	.	0	H	r
				f	r	o	m		0	6	0	4	0	1	_	1	7	0	0

(No.06)

The history screen No. 06 shows: (1) cumulative energization time starting at the control unit maintenance (hours), (2) cumulative time operated (hours) and (3) date & time of control unit maintenance. Such values may be reset by the customer.

[Contents displayed]

[	H	i	s	t	0	6	]		Current date & time (YYMMDD_HHMM)									
P	/	S			O	n					Cumulative energization time since P/S maintenance						H	r
P	/	S			R	u	n				Cumulative operated time since P/S maintenance						H	r
				f	r	o	m		Date & time of P/S maintenance									

[Sample display]

[	H	i	s	t	0	6	]		0	6	0	5	0	1	_	1	3	0	0
P	/	S			O	n									4	.	0	H	r
P	/	S			R	u	n								1	.	0	H	r
				f	r	o	m		0	6	0	5	0	1	_	0	9	0	0

4.2.7 Pump Log Screen

The control unit keeps the log of up to 100 events. With the pump log screen, you can display the latest log as well as the last 100 records by using ↑ and ↓ keys.

Items displayed include: (1) date & time of log occurrence, (2) contents of the log, (3) operation mode at the time of the log, (4) speed (either of rps/rpm may be displayed), inverter output (W), (6) upper shaft vibration U ($\mu m^{0\text{-}P}$) and (7) lower shaft vibration L ($\mu m^{0\text{-}P}$).

The log number shown at the first line of the pump log screen is the latest if it is '00' and the larger the number, the older the event log.

[Contents displayed]

[	P	u	m	p	No.	]		Current date & time (YYMMDD_HHMM)											
Date & time of log occurrence (YYMMDD_HHMM)									Contents of log										
Operation mode at time of log									Speed at time of log								rps/rpm		
Inverter output					W				Shaft vibration U			/	Shaft vibration L				u		m

[Sample display]

[	P	u	m	p	0	1	]		0	6	0	5	0	1	_	1	2	0	0
0	6	0	5	0	1	_	1	1	3	0		V	I	B	R	A	T	I	O
N	O	R												7	5	0	r	p	s
		1	0	0	W							1	0	/		8	0	u	m

4.2.8 User Customizing Screen

Through the user customizing screen, you can change the settings of the control unit.
Shown below is the procedure for change.

(1) Use ↑ and ↓ keys to select an item to be changed.
(2) Press 'SET' key to enter into the edit mode.
(3) Use ← and → keys to change the setting.
(4) Press 'SET' key again to confirm the setting change. To cancel the change, press 'ESC' key.

See the following table for the items that you can change.

[Items that allow setting change]

	Displayed	Item of setting	Value of setting	D3R	Note
1	Operation	Control location setting	REM(0)/LOC(1)/ COM(2)	1	
2	Ext.Device	External device communication type	A(0)/ B(1)/ C(2)	0	
3	Ext.Protocol	External device communication protocol	RS-232C(0)/485(1)	0	
4	Ext.Baudrate	Baud rate for communication with external device	96(0)/192(1)/384(2)	0	
5	Ext.Terminate	Existence or non-existence of terminating resistance when using RS-485 for communication with external device	485TERM OFF(0) / ON (1)	0	
6	Ext.485ID No.	Control unit ID number when using RS-485 for communication with external device	1～31	1	
7	O.Lord Current *5	Overload current setting (high emission/ low emission)	Low(0) / High(1)		*1
8	O.Lord Current (Air/Water/ Heater) *6	Overload current setting (pump cooling method)	Air (0) / Wtr (1)/ Htr(2)		*1
9	O.Load Corrent (Ar/N_2)	Overload current setting (type of gas)	Ar(0) / N2 (1)	0	*1
10	Speed CTRL 0	Speed control setting 0	25-100%	100	*2
11	Speed CTRL 1	Speed control setting 1	25-100%	80	*3
12	Speed CTRL 2	Speed control setting 2	25-100%	60	*3
13	Speed CTRL 3	Speed control setting 3	25-100%	40	*3
14	Speed CTRL Output	Speed control signal output	Digital (0) / Analog (1)	0	*4
15	Rotation control	Slip control	Enable(0) / Disable(1)	1	
16	/Stop	/Stop Enable or Disable	Enable(0) / Disable(1)	0	
17	Rev Display Type	Unit for speed display	RPS(0)/RPM(1)	0	
19	P/S Total Time1 RESET	Reset the cumulative P/S maintenance time.	When resetting (1)	-	
20	User Memo	User memo	8 ASCII characters		
21	Date	Current date setting			
22	Time	Current time setting			

*1 Select the setting in accordance with the type of pump and gas used.
*2 The revolution speed may be controlled within a range of 25% - 100% of the rated speed.
*3 Valid with the revolution speed control using the CONT connector.

*4 Select the revolution pulse or analog value for the pump revolution output through the CONT connector.
*5 ① Rotor blade surface treatment choose Low emission (Low (0)) at the time of Non or Ni-plating
*5 ② Rotor blade surface treatment choose High emission (High (1)) at the time of Black Ni-plating or An anode oxidation treatment ,Cation electro coating.
*6 ① Air cooling type chooses Air (0) at the time of Air cooling spec.
*6 ② Water cooling type chooses Wtr (1) at the time of Water cooling spec.
*6 ③ Heating type chooses Htr (2) at the time of Main body internal Heating spec.

4.2.9 Manufacturer's Password Entry Screen and Manufacturer's Setting Screen

The manufacturer's setting screen is protected by the password.
The manufacturer's settings cannot be changed by the customer.

Supplement Ｃ： Outline of Serial Communication Function

C1. Outline

(1) The digital control unit FTI-xxxx-D3 series is equipped with serial interfaces conforming to RS-232C and RS-485.
Various functions can be realized if the control unit is connected to a computer or sequencer (hereinafter called PC) capable of serial communication.

(2) This control unit has three types of modes as communication function.
See **Supplement F: Serial communication function by RS-232C (mode A),**
Supplement G: Serial communication function by RS-232C (mode B),
Supplement H: Serial communication function by RS-485/232C (mode C) for details of each communication mode.
When selecting the communication mode, understand well about the features of each mode as shown in Table C-1, and then use the mode that best fits to the intended application.

Table C-1 Communicate mode function comparison

		Mode A	Mode B	Mode C
LCD ext. device display		A	B	C
Available communication mode	RS-232C	○	○	○
	RS-485	×	×	○ (Chain connection is possible)
Data format		Binary	ASCII	ASCII
Compatibility with the communication mode of a conventional-type control unit (D1, D2)		○	×	×
Communication function	Operation start, stop	Possible	Impossible	Possible
	Rotating-speed setting	Possible	Impossible	Possible
	Failure reset	Possible	Impossible	Possible
	User setting Present time Change and readout of a user memo	Possible	Impossible	Possible
	Other data readout, reset	Possible	→	→

When using communication, use in Mode A and Mode C is recommended.

(3) Loaded modes and functional outline

(a) **Supplement F: Serial communication function by RS-232C (mode A)**

a. The control-unit side D-sub 9 pins and the PC side D-Sub 9 pins need to be connected.
b. The RJ-45 8 pins of control-unit side RS-485/RS-232C and the PC side D-Sub 9 pins need to be connected.

① Operation, stop, change of the rotating speed by the speed variable, and failure reset are possible.
② TMP operation status check, presence of failure occurrence, and acquisition of the cause of failure are possible.
③ Acquisition of the output value to the monitor of various kinds of parameters is possible.

i Acquisition of inverter output frequency, voltage, current, output value to motor, motor temperature
ii Failure occurrence record (maximum of 20 subjects) and various kinds of operation records (atmospheric inrush times, TMP start/stop times, etc.)
iii It is possible to acquire the axial-vibration value (mean squared value for 1 second) of TMP, and to record continuously on PC etc.

(b) **Supplement G: Serial communication function by RS-232C (mode B)**

a. The control-unit side D-sub 9 pins and the PC side D-Sub 9 pins need to be connected.
b. The RJ-45 8 pins of control-unit side RS-485/RS-232C and the PC side D-Sub 9 pins need to be connected.

① TMP operation status check, presence of failure occurrence, and acquisition of the cause of failure are possible.
② Acquisition of the output value to the monitor of various kinds of parameters is possible.

i Acquisition of inverter output frequency, voltage, current, output value to motor, motor temperature
ii Failure occurrence record (maximum of 20 subjects) and various kinds of operation records (atmospheric inrush times, TMP start/stop times, etc.)
iii It is possible to acquire the axial-vibration value (mean squared value for 1 second) of TMP, and to record continuously on PC etc.

(c) **Supplement H: Serial communication function by RS-485/232C (mode C)**

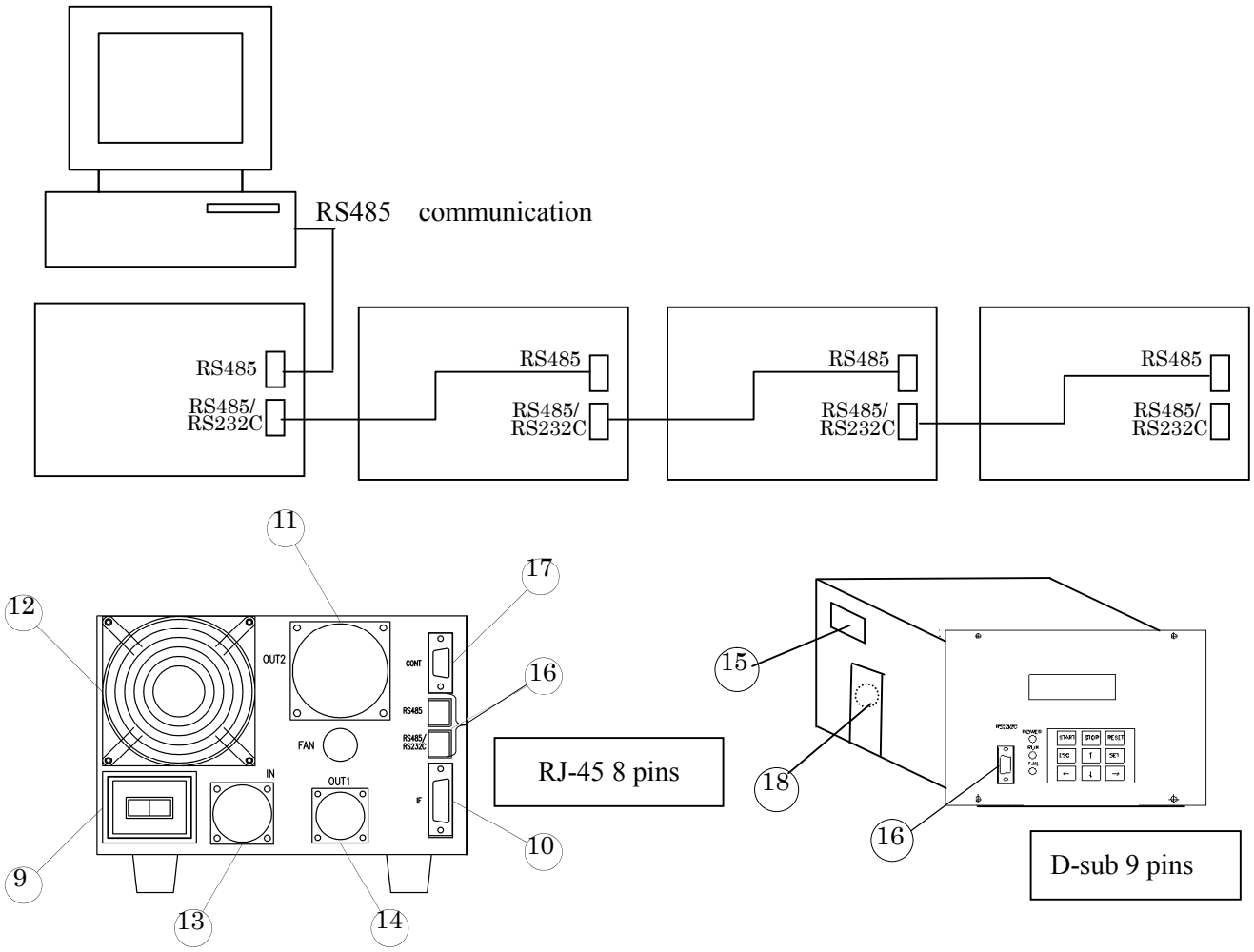
【In the case of RS-232C】

a. The control-unit side D-sub 9 pins and the PC side D-Sub 9 pins need to be connected.
b. The RJ-45 8 pins of control-unit side RS-485/RS-232C and the PC side D-Sub 9 pins need to be connected.

【In the case of RS-485】

a. The RJ-45 8 pins of control-unit side RS-485 and the PC side D-Sub 9 pins need to be connected.
b. The RJ-45 8 pins of control-unit side RS-485/RS-232C and the PC side D-Sub 9 pins need to be connected.
c. It is possible to make the chain connection of two or more control units with the computer by which serial communication is possible.
   In this case, use the RS-485/RS-232C connector and the RS-485 connector to connect between control units, and please do not connect the RS-485/ RS-232C and RS-485/ RS-232C connector.

RS-485 chain connection method



Supplement D; Running State and Record Monitoring Function(1/2)

D1. Features

(1) Digital control unit FTI-xxxx-D3 series are capable to display the running state and record on the running state LCD by operating keys（「↑」. 「↓」）on the panel.

(2) Table D-1 shows the main running state and record displayable and the evaluation reference values and trip values for them. These data can be used as maintenance supporting data.

Table D-1 Displayable Items

No.	Title	Description			Evaluation reference value	Trip value				Noe
						UTM-350FW/FH UTM-480FW/FH	UTM-800FW/FH UTM-1001FW/FH	UTM-1400FW	UTM-2300FW	
1	MOTOR W	Motor output (W)	Water cooling	At N_2 setting	—	270	400	410	585	※1
				At Ar setting	—	220	320	350	550	※1
			Air cooling	At N_2 setting	—	210	190	N/A	360	※1
				At Ar setting	—	150	150	N/A	360	※1
2	MOTOR TEMP	Motor temperature (℃)			—	95				
3	ACC TIME	Acceleration time (min)			※2	10	12	15	20	
4	DEC TIME	Deceleration time (min)			※3	—				
5	P/S ON Hr	Total time of energizing (hour)			—	—				
6	Start Stop	Start/stop times			10000	—				※4
7	Touch Down	Touchdown times			10	—				※4
8	Air Inrush	Atmospheric inrush times			10	—				※4
9	U um	Upper radial vibration ($\mu m^{o\text{-}p}$ indication)			15	50				※5
10	L um	Lower radial vibration ($\mu m^{o\text{-}p}$ indication)			15	50				※5
11	TH um	Thrust vibration (μm^{rms} indication)			11	50				※5
12	—	Monitoring （Refer to No.01～06）			—	—				※6
:	—	History Screens （Refer to No.01～06）			—	—				※6
	—	Pump Log Screen （Max. 100 records）			—	—				※6

*1 The motor output trip value shows the overload trip value at the rated revolution of each model. It is different from the max. value of motor output in acceleration.

*2 The evaluation reference value for the acceleration time varies by model. Refer to the starting time of the basic specification in 11. Technical Data.

*3 The evaluation reference value for the deceleration time varies by model. Refer to the stopping time of the basic specification in 11. Technical Data.

*4 The start/stop times, touchdown times and atmospheric inrush times are dependent on the TMP, so that the controller is not provided with any protective function. Use them as maintenance supporting data.

*5 Allowable vibration value during stationary operation is designed 15 $\mu m^{o\text{-}p}$ (approx. 11 μm^{rms}). The reference value in our pre-shipment inspection is made 7.5 $\mu m^{o\text{-}p}$ in view of actual rigidity of the TMP installed.

*6 Refer to supplement B.

Supplement D; Running State and Record Monitoring Function(2/2)

D1. Features

(1) Digital control unit FTI-xxxx-D3 series are capable to display the running state and record on the running state LCD by operating keys（「↑」. 「↓」）on the panel.

(2) Table D-1 shows the main running state and record displayable and the evaluation reference values and trip values for them. These data can be used as maintenance supporting data.

Table D-1 Displayable Items

No.	Title	Description			Evaluatin reference value	Trip value					Noe
						UTM-3301FW	UTM-3302FH	UTM-3303FH	UTM-6300FH	UTM-3500D	
1	MOTOR W	Motor output (W)	Water cooling	740	—	740	740	790	740	1165	※1
				600	—	630	600	620	740	1165	※1
			Air cooling	N/A	—	N/A	N/A	N/A	N/A	N/A	
				N/A	—	N/A	N/A	N/A	N/A	N/A	
2	MOTOR TEMP	Motor temperature (℃)			—	95					
3	ACC TIME	Acceleration time (min)			※2	25	25	25	60	25	
4	DEC TIME	Deceleration time (min)			※3	—					
5	P/S ON Hr	Total time of energizing (hour)			—	—					
6	Start Stop	Start/stop times			10000	—					※4
7	Touch Down	Touchdown times			10	—					※4
8	Air Inrush	Atmospheric inrush times			10	—					※4
9	U um	Upper radial vibration (μm^{o-p} indication)			15	50					※5
10	L um	Lower radial vibration (μm^{o-p} indication)			15	50					※5
11	TH um	Thrust vibration (μm^{rms} indication)			11	50					※5
	—	Monitoring （Refer to No.01～06）			—	—					※6
:	—	History Screens （Refer to No.01～06）			—	—					※6
	—	Pump Log Screen （Max. 100 records）			—	—					※6

*1 The motor output trip value shows the overload trip value at the rated revolution of each model. It is different from the max. value of motor output in acceleration.

*2 The evaluation reference value for the acceleration time varies by model. Refer to the starting time of the basic specification in 11. Technical Data.

*3 The evaluation reference value for the deceleration time varies by model. Refer to the stopping time of the basic specification in 11. Technical Data.

*4 The start/stop times, touchdown times and atmospheric inrush times are dependent on the TMP, so that the controller is not provided with any protective function. Use them as maintenance supporting data.

*5 Allowable vibration value during stationary operation is designed 15 μm^{o-p} (approx. 11 μm^{rms}). The reference value in our pre-shipment inspection is made 7.5 μm^{o-p} in view of actual rigidity of the TMP installed.

*6 Refer to supplement B.

Supplement E; Speed Variable Function

E1 Features

(1) Speed variable control system (hereinafter referred to “speed controller” for short) provides a function of freely setting the speed of TMP (turbo molecular pump).

(2) The speed controller sets the controller inverter output frequency in % of the rated frequency.

(3) Frequency setting by the speed controller ranges 25 to 100 %.

(4) There are 4 frequency setting points of the speed controller available. The frequency setting at each setting point is changeable by operating keys on the control unit panel or via RS-232C/485 data communication. Changed frequency setting is kept after power off.

(5) Setting point selection is changed by remote operation (opening/closing the contact). If the setting point is selected or the frequency setting is changed during TMP running, the inverter output frequency follows the frequency setting of the setting point.

E2 Operation

E2.1 Controller operation

For the functions and operations of TMP and control unit, refer to the instruction manual.

(1) Startup/stop operation

After start of the control unit, the inverter output frequency follows the frequency setting of the setting point determined by opening/closing the setting point changing contact. Until the controller accepts stop, it follows the setting of the speed controller.

(2) Running display

TMP operation can be checked by controller running state LCD.

When the speed is increased, “ACC” is displayed and the speed % value indication goes up.

When the speed is decreased, “DEC” is displayed and the speed % value indication goes down.

When the speed is under the set value, “ACC” is displayed and the speed is statically determined to the set speed.

When the frequency is statically determined to the set value, “NOR” is displayed.

E2.2 Speed controller operation

(1) Frequency setting change

(a) For remote operation connector "CONT" (17) pin arrangement, see the right figure.

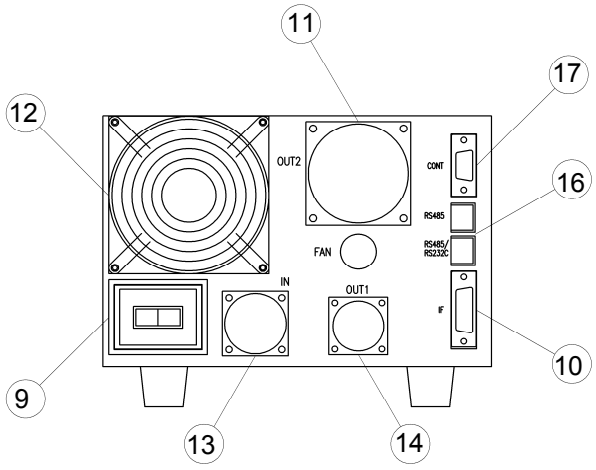
(b) Frequency setting can be changed by operating Keys on the control unit panel and via RS-232C/485 communication.

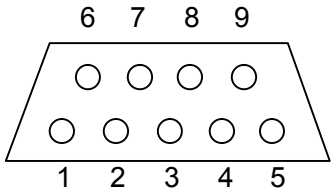
(c) Refer to supplement B：Key-controlled Operations and LCD Displayed items on Operating Conditions.

(d) For the changing procedure via RS-232C/485 communication, see Supplement C; Outline of Serial Communication Function.

(e) Changed frequency setting is saved during power off.

〔Rear panel〕





CONT pin arrangement

(2) Remote operation

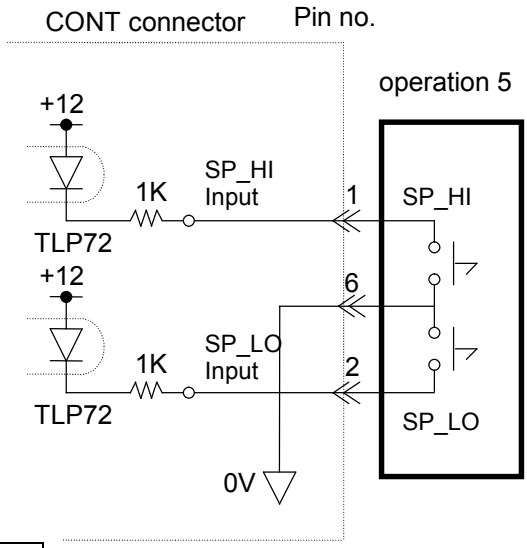
(a) Connection method and operation example are shown in the right figure (Operation 5).

(b) Setting point is selected by the combination of pen/close of the contacts between pin 1 and 6, and 2 and 6 of the "CONT" connector. Use no voltage contact for input.

(c) Relation between the contact open/close combination and the setting point is summarized in the table below.

(3) Speed controller operation

(a) when the setting point selection or the frequency setting is changed during TMP running, the controller output frequency follows the frequency setting of the setting point selected.



Remote control connection

⚠ CAUTION	Never change the frequency setting frequently. Otherwise, the inverter frequency changes continually and the motor and controller can be heated abnormally.

SP_HI pin 1 to 6	SP_LO pin 2 to 6	Setting point No.	Frequency setting, initial value (%)
Open	Open	0	100
Open	Close	1	80
Close	Open	2	60
Close	Close	3	40