

READ FIRST!

Basically the input voltage must not exceed about 1 volt rms!

The output overload lamp comes on when the amplifier begins to apply SPIKE protection and clipping of output current begins. There is also a 3.5 amp slow blow fuse mounted internally to protect amplifier and shaker. There are a further two fuses mounted at the back at the power socket.

In spite of all the above protection it is still possible to damage the shakers and burn them out.

Typically overheating of the coil is the main problem and is more likely to occur as frequency goes up and displacement becomes smaller. The unit has some natural cooling taking place at low freq and large displacements due the air flow created through the side vents. Please let the students be aware that at higher frequencies and high power levels they should use additional cooling if prolonged use is expected.

INSTRUCTION MANUAL

VIBRO PET

— **Model** —

PET-01-0A

PET-01-0AM (with Vibration Meter)

PET-05-05A

PET-05-05AM (with Vibration Meter)

This Instruction Manual applies to systems with the above model numbers.

IMV CORPORATION

No. 1 5 3 7

■ Record of Changes

No.	Date	Description of Changes
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1.5	19 March, 2009	Revised

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■ CONTENTS

1. INTRODUCTION	1
2. INTRODUCTION FOR SAFETY	3
2.1 NOTICE FOR YOUR SAFETY	3
2.2 WARNING LABELS	6
3. OUTLINE OF THE SYSTEM	9
3.1 PRINCIPAL	9
3.2 COMPOSITION OF THE SYSTEM	10
3.3 SPECIFICATION	12
3.4 NAME OF PARTS	15
■ Vibration Shaker	15
■ Power Amplifier	17
4. OPERATION PROCEDURE	19
4.1 PROCEDURES BEFORE OPERATING	19
■ Environment	19
■ Wiring	20
[PET-01-0A/PET-05-05A](General Use)	20
[PET-01-0A/PET-05-05A](With External Input)	22
[PET-01-0AM/PET-05-05AM](General Use)	25
[PET-01-0AM/PET-05-05AM](With External Input)	28
■ Fitting of Excitation Fixture and Specimen	31
■ Fitting of Accelerometer	33
4.2 OPERATION	35
[PET-01-0A/PET-05-05A](General Use)	35
[PET-01-0A/PET-05-05A](With External Input)	37
[PET-01-0AM/PET-05-05AM](General Use)	39
[PET-01-0AM/PET-05-05AM](With External Input)	42
4.3 STOP	44
4.4 REMARKS	45
■ Limitation of Maximum Acceleration	45
■ Limitation of Maximum Displacement	46
■ Limitation of Maximum Acceleration by Accelerometer Sensitivity	46
■ Limitation of Acceleration / Velocity / Displacement at Random Excitation	48
4.5 OPTIONS	49
■ Dumper	49
■ Using as Voltmeter	50
5. MAINTENANCE	51
5.1 DAILY CHECK	51
5.2 SAFETY FUNCTION	53
■ Protective Circuit	53
■ Reset	53
5.3 REPLACE THE FUSE	54
6. OTHER OPERATIONS	55
6.1 SIMPLE CHECK METHOD TO CONFIRM THE SENSITIVITY OF ACCELEROMETER	55
6.2 CONVERSION TABLE (SINE VIBRATION CHART)	57

7. GLOSSARY 59
8. WARRANTY AND AFTER-SALES SERVICE 61

- FACTORY TEST DATA
- COMPANY INFORMATION

1. INTRODUCTION

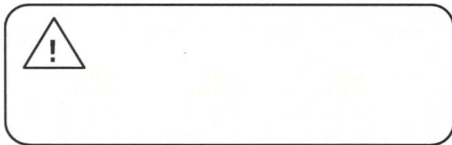
This manual is made for you to operate IMV vibration testing system safely and correctly. If you perform incorrect operation, the system may have any damage. Therefore, we hope you will read this manual surely before you start to use the system.

We hope you will keep the manual at hand during operation.

When you will move the installation place of this testing system to the new site, please check the existence of this manual together.

To use the system more safely and longer, IMV recommends you to perform the periodic or daily maintenance working.

In this manual, the required items to prevent any accident, that may cause serious personal injury or that may cause some damage to the testing system, are described as below.



Specifications and equipment may be subject to change without any notice. Please call to IMV or our sales representative in your country if you have any questions.

2. INTRODUCTION FOR SAFETY

In this chapter, the details of notice and warning labels for safely use of the vibration testing system are described.

Please check the following descriptions before using the testing system.

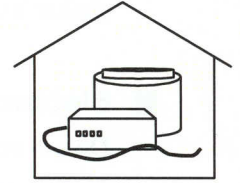
2.1 NOTICE FOR YOUR SAFETY

Note that followings for your safety operation.

■ Space

For your working safety, IMV recommends you to keep “2 meters around area” from the unit and cables in this system as “Dangerous zone”. Keep the zone to be clear and you must not put unnecessary things in the zone.

The person except trained testing operator must not enter to the zone, because acoustic noise due to the system running may affect to his health even if he is staying out of the area.



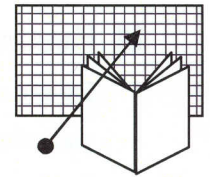
■ Training

To use this system, IMV recommends operation training for the testing operator.

The person, who is not trained, must not operate this system.

Such training is performed when the system is installed on-site.

After the initial training, we hope the operator to take place the required in house training for the other operator.



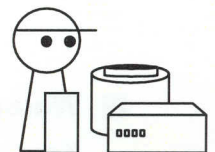
■ Daily pre-operation check

In order to use the system safely, IMV recommends you to perform daily pre-operation check. (see ‘5.1 DAILY CHECK’.)



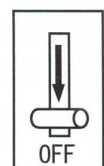
■ Place

Main operation panels for vibration test system should be placed where the operator can see the vibration shaker and the power amplifier by eyes directly.



■ Power supply

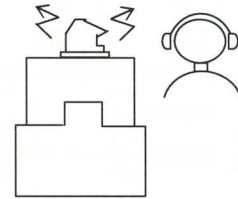
When the facility power supply is newly provided, the power supply voltage and the power current must be set under the specifications. The power supply must be turned OFF when the operations of the equipments are ended.



■ Acoustic noise

Since this testing system generates high level acoustic noise during excitation, all the members on-site must use “Ear Protector” during testing.

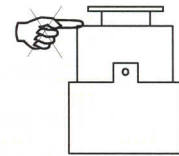
IMV recommends “Acoustic Enclosure / Anti-acoustic Room” for this countermeasure.



■ Mechanical

Do not touch any vibrating part, such as the armature, specimen or fixture during excitation.

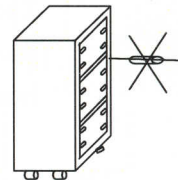
When the shaker is excited in low frequency (lower than 10 Hz), the shaker itself vibrates also. Please pay attention for vibrating part.



■ Electric

Do not remove any cover in the power amplifier, Cabinet, Vibration Shaker and other units.

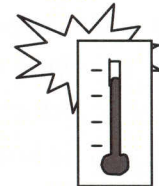
There is “High Voltage Terminal” inside cover and it causes serious personal injury by High Voltage/Current.



■ Heating

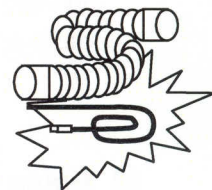
Do not remove any cover in the power amplifier, Cabinet, Vibration Shaker and other units.

Some parts of the system may be heated to high temperature during the operation.



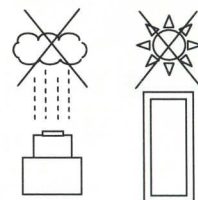
■ Cables and hoses

You must pay attention for your steps when you walk across cables and/or hoses. Do not apply excessive force to the cables and hoses to prevent any damage.



■ Water / Chemicals / Sunshine

Keep away Vibration Shaker and other units from water and chemicals. Do not install the system where water or direct sunshine may affect to the system. There is “High Voltage Terminal” inside cover and it causes serious personal injury and mechanical breakdown by High Voltage/Current. Please call to IMV or our sales representative in your country if it happened.



■ **Hydraulic equipments (hydraulic units)**

The oil must be removed immediately when you touch it at the maintenance.

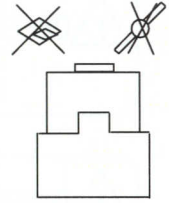
Do not step the split oil on the floor. It may cause an accident by slipping.

The oil must be washed off immediately.



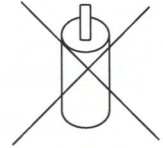
■ **Vibration shaker**

Note that the vibration shaker body has magnetism. You must keep the products, which is affected by magnetic field such as floppy disk or clock, away from the vibration shaker.



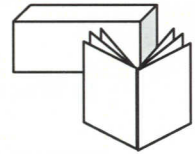
■ **Explosion**

Do not make an environment of explosive gas, corrosive gas or inflammable gas around this testing system.




■ **Equipment from other manufacturer**


The attached instruction manual of the equipment from other manufacturer must be read well before you start to use it.




2.2 WARNING LABELS

To use the system more safely and longer, IMV explains required items to prevent any accident, that may cause serious personal injury or that may cause some damage to the testing system as below.

 **WARNING** This is a precaution to prevent personal injury or damage to the system.

 **OBSERVANC** This is a precaution to prevent personal serious injury or endangerment your life.

 **DANGER** This is a warning to prevent personal serious injury or endangerment your life.




■ Warning Labels




The following warning labels are fitted on the required part in this testing system.

You must keep the labels clean, and must not cover it to prevent to show the warning message.


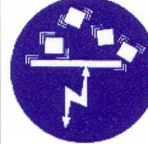
If you are aware of any peeled or dirty warning label, please inform IMV or our sales representative in your country.

1) Warning


 <p>WARNING ELECTRIC SHOCK To avoid electric shock, do not open. You will be struck by electric.</p> <p>PL-011E(1)</p>	<p>Dangerous high voltage 100V over is applied in the cabinet, and it may cause serious personal injury by high voltage electric shock.</p> <p>Do not remove any 'Safety Cover' or each front panel of the power amplifier.</p>
 <p>WARNING ROTATION OF TRUNNION Fix the TRUNNION LOCK BOLTS securely. VIBRATION SHAKER will be turned.</p> <p>PL-041E(1)</p>	<p>Tighten up Trunnion Lock Bolts firmly with the IMV's specified torque.</p> <p>If the bolt is loosen, the vibration shaker body may overturn during excitation and may cause serious personal injury, damage to the system or specimen.</p>
 <p>WARNING DANGER ZONE Do not touch. Take care of your body. You will be injured.</p> <p>PL-021E(1)</p>	<p>Do not catch your finger or cable during the excitation, rotation working of vibration shaker body, or handling of fixture.</p>

 PL-031E(1)	<p>⚠ WARNING OVER-TURNING Do not put on unstable position. Will be over-turned.</p>	<p>This system may overturn during transportation, or by earthquake. IMV recommends you to apply “Floor fixing” to the unit by using anchor bolts.</p>
 PL-051E(1)	<p>⚠ WARNING ROTATION Do not touch. Take care of your body. You will be injured.</p>	<p>Cooling blower and Cooling fan motors have rotational fin blades in it. Do not insert things or your finger into the rotating parts.</p>
 PL-061E(1)	<p>⚠ WARNING HIGH TEMPERATURE Do not touch. You will be burn.</p>	<p>The temperature around here becomes very high. Do not remove the panel and cover.</p>

2) Observance

 PL-071E(1)	<p>⚠ OBSERVANCE NOISE Noise generates. Use ear protector.</p>	<p>This testing system generates acoustic noise by excitation or running of Cooling blower, etc. Use 'Ear Protector' to prevent that the acoustic noise affects to your health.</p>
 PL-081E(1)	<p>⚠ OBSERVANCE VIBRATION Keep away during operation. Will be vibrating.</p>	<p>This testing system generates vibration. Be careful of accident due to dropping or flipping of specimen or fixture itself, or part of them, during excitation.</p>

3) Danger

 PL-091E(1)	<p>⚠ WARNING Do not touch the JOINT when turning VIBRATION SHAKER. Your finger may be caught in.</p>	<p>Your hand or finger may be caught in. Never turn vibrator with holding joint when horizontal slip table is connected.</p>
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3. OUTLINE OF THE SYSTEM

In this chapter, the details of each equipment composing the system are described.

Vibro Pet is the compact vibration test system.

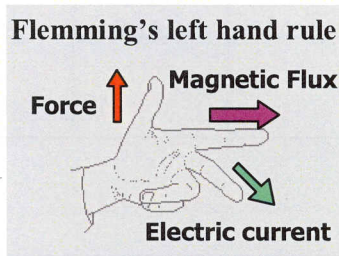
It is designed to excite the wide band frequency to check the resonance point of structure and machine tools and to measure the vibration mode.

It is the electro-dynamic type using permanent magnet in field for driving. Use of accessories will expand the application in wide range.

3.1 PRINCIPLE

The operation of the Electro-dynamic Vibration Test System is the same as that of an audio speaker and “Flemming’s left hand rule” is applied. When electric current flows through the wire across a magnetic flux (magnetic field), the force is generated toward the rectangular direction from the wire as shown below. The force (rated force) vibrates the armature table in the Electro-dynamic vibration test systems.

The electro-dynamic vibration shaker generates its rated force by the flow of an electric AC signal through the Drive Coil that is located in a strong magnetic flux generated by “Permanent magnet” or “Field coil” as shown below.






1. INTRODUCTION
2. INTRODUCTION FOR SAFETY
3. OUTLINE OF THE SYSTEM
4. OPERATION PROCEDURE
5. MAINTENANCE
6. OTHER OPERATIONS
7. GLOSSARY
8. WARRANTY AND AFTER-SALES SERVICE

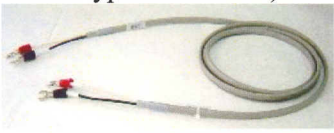



3.2 COMPOSITION OF THE SYSTEM


The system is composed of the following units.

■ Main Composition

SYSTEM MODEL	PET-01 -0A	PET-01 -0AM	PET-05 -05A	PET-05 -05AM
Vibration Shaker The vibration shaker generates its force by the flow of an electric AC signal through the Drive Coil that is located in a strong magnetic flux generated by "Field coil". 	1 (PET-01)	1 (PET-01)	1 (PET-05)	1 (PET-05)
Power Amplifier Power amplifier for driving vibration shaker. 	1 (PET-0A)	—	1 (PET-05A)	—
Power Amplifier (with Vibration Meter) Power amplifier for driving vibration shaker. Vibration Meter is attached optionally. 	—	1 (PET-0AM)	—	1 (PET-05AM)

■ Accessories

SYSTEM MODEL	PET-01 -0A	PET-01 -0AM	PET-05 -05A	PET-05 -05AM
Drive Cable (2m, with arrow type connectors) (Power Amplifier~ Vibration Shaker) An electric AC signal is supplied to Field Coil. 	1	1	1	1
Fuse for Power Amplifier 	1	1	1	1
Conversion Table Other values are calculated from two values among Acceleration / Velocity / Displacement / Frequency by this SINE Vibration Chart. Refer to 6.2 CONVERSION TABLE 	1	1	1	1
Instruction Manual Please keep this manual at hand during the operation. 	1	1	1	1

Factory Test Data The data showing the system have passed the performance check at the shipping from the factory. (It is attached to this manual.)		1	1	1	1

■ Options

SYSTEM MODEL	PET-01-0A	PET-01-0AM	PET-05-05A	PET-05-05AM
Pickup·Low-noise Cable for Pickup For control or monitoring the signals in operation 	(1)	Attached as standard	(1)	Attached as standard
Vibration-isolation Pad Simple and popular isolation effect for vibration shaker. 	(1)	(1)	(1)	(1)
Column Base This item is for fixing the vibration shaker. Also, it is used for fixing the vibration shaker horizontally in horizontal excitation operation. 	(1)	(1)	(1)	(1)
Vertical Auxiliary Table (φ 40×13) For the excitation in horizontal direction. 	(1)	(1)	(1)	(1)
Thrusting Head (φ 20×20) This item is attached to the vibration shaker and operating the vibration test by thrusting to the specimen. 	(1)	(1)	(1)	(1)
Junk Ring 	φ 102×t4mm (1)	φ 102×t4mm (1)	φ 150×t4mm (1)	φ 150×t4mm (1)
Dumper 	φ 102×t2.6mm Spring Stiffness 73.5kN/m (1)	φ 102×t2.6mm Spring Stiffness 73.5kN/m (1)	φ 150×t0.5mm Spring Stiffness 2.2kN/m (1)	φ 150×t0.5mm Spring Stiffness 2.2kN/m (1)
	φ 102×t0.3mm Spring Stiffness 0.19kN/m (1)	φ 102×t0.3mm Spring Stiffness 0.19kN/m (1)	φ 150×t2.8mm Spring Stiffness 98kN/m (1)	φ 150×t2.8mm Spring Stiffness 98kN/m (1)
Dumper Mounting Table 	φ 102× H40mm (1)	φ 102× H40mm (1)	φ 150× H57mm (1)	φ 150× H57mm (1)

3.3 SPECIFICATION

■ Specification of the System

SYSTEM MODEL	PET-01-0A	PET-01-0AM	PET-05-05A	PET-05-05AM
Sine Force	9.8 N		49 N	
Max. Acceleration	490 m/s ²		326 m/s ²	
Max. Displacement	5 mmp-p		5 mmp-p	
Frequency Range	2 ~ 12 000 Hz		2 ~ 14 000 Hz	
Mass of Moving Element	0.02 kg		0.15 kg	
Ambient Condition	<ul style="list-style-type: none"> • Temperature 0 ~ 40 °C • Humidity 0 ~ 85 %RH (No dew condensation) 			
Power Supply	100V AC ±10% 50/60 Hz 0.08kVA		100V AC ±10% 50/60 Hz 0.1kVA	
Painted Color	IMV Standard Color		IMV Standard Color	
Vibration Shaker :	Munsell 4GY 8.5/0.3		Munsell 4GY 8.5/0.3	
Cabinet :	Munsell 4GY 8.5/0.3		Munsell 4GY 8.5/0.3	
Panel :	Munsell 4GY 8.5/0.3		Munsell 4GY 8.5/0.3	
Cover :	Munsell 4GY 8.5/0.3		Munsell 4GY 8.5/0.3	
Protecting Circuit	Over-current Protective Circuit Over-voltage Protective Circuit		Over-current Protective Circuit Over-voltage Protective Circuit	
Notice	At using Accelerometer (VP-32:24g) Max. Acceleration 222 m/s ² Frequency Range 5~5 000 Hz		At using Accelerometer (VP-32:24g) Max. Acceleration 281 m/s ² Frequency Range 5~5 000 Hz	

■ Specification of Vibration Shaker

MODEL	PET-01	PET-05
Excitation Method	Permanent Magnet	Permanent Magnet
Spring Stiffness	9.8 kN/m	15.6 kN/m
Weight	1.3 kg	5 kg
Dimensions	□75×H71.5 mm	□116×H115 mm
Type of Cooling	Natural air cooling	Natural air cooling

■ Specification of Power Amplifier

MODEL	PET-0A	PET-0AM	PET-05A	PET-05AM
Oscillating Method	F/V converter oscillating method		F/V converter oscillating method	
Oscillating Frequency Range	2 ~ 20 000 Hz		2 ~ 20 000 Hz	
Display	5 digit digital LED display		5 digit digital LED display	
Distortion	Less than 1%		Less than 1%	
Amplification Methods	Solid state method		Solid state method	
Output	0.03 kVA		0.045 kVA	
Impedance	Matched with Vibration shaker		Matched with Vibration shaker	
Protective Circuit	Over-current protective circuit Over-voltage protecting circuit		Over-current protective circuit Over-voltage protecting circuit	
Dimensions	W300×H140×D280 mm		W300×H140×D280 mm	
Weight	9 kg		9 kg	
Type of cooling	Natural air cooling		Natural air cooling	

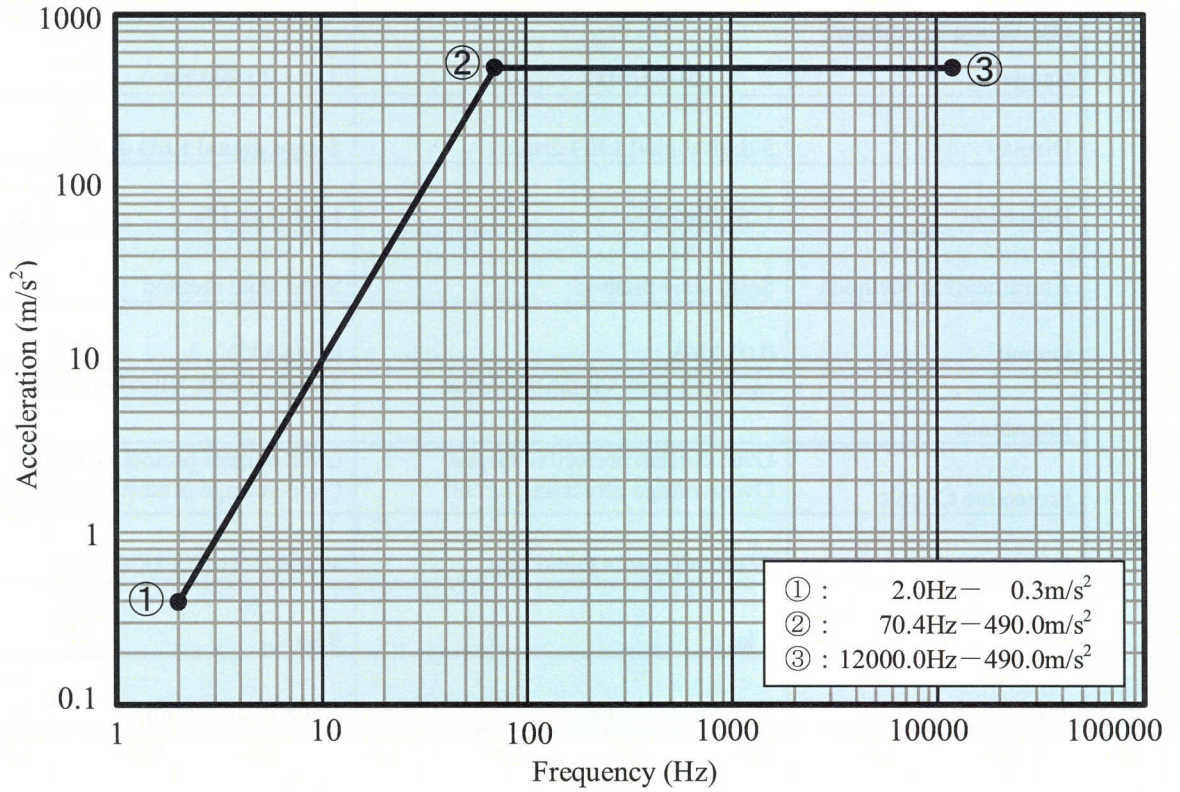
■ Specification of Vibration Meter (Option)

MODEL	PET-0AM	PET-05AM
Input signal	Charge from piezo acceleration pickup	
Input Sensitivity	1~9.99 pC/m/s ²	
Tolerable Input Capacitance	10 000 pF	
Acceleration Measuring Range	10,100,1000 m/s ² (3-range)	
Accuracy	±4%(against full scale of vibration meter)	
Vibration Monitor	2 mV/m/s ²	

■ Maximum Performance Curve

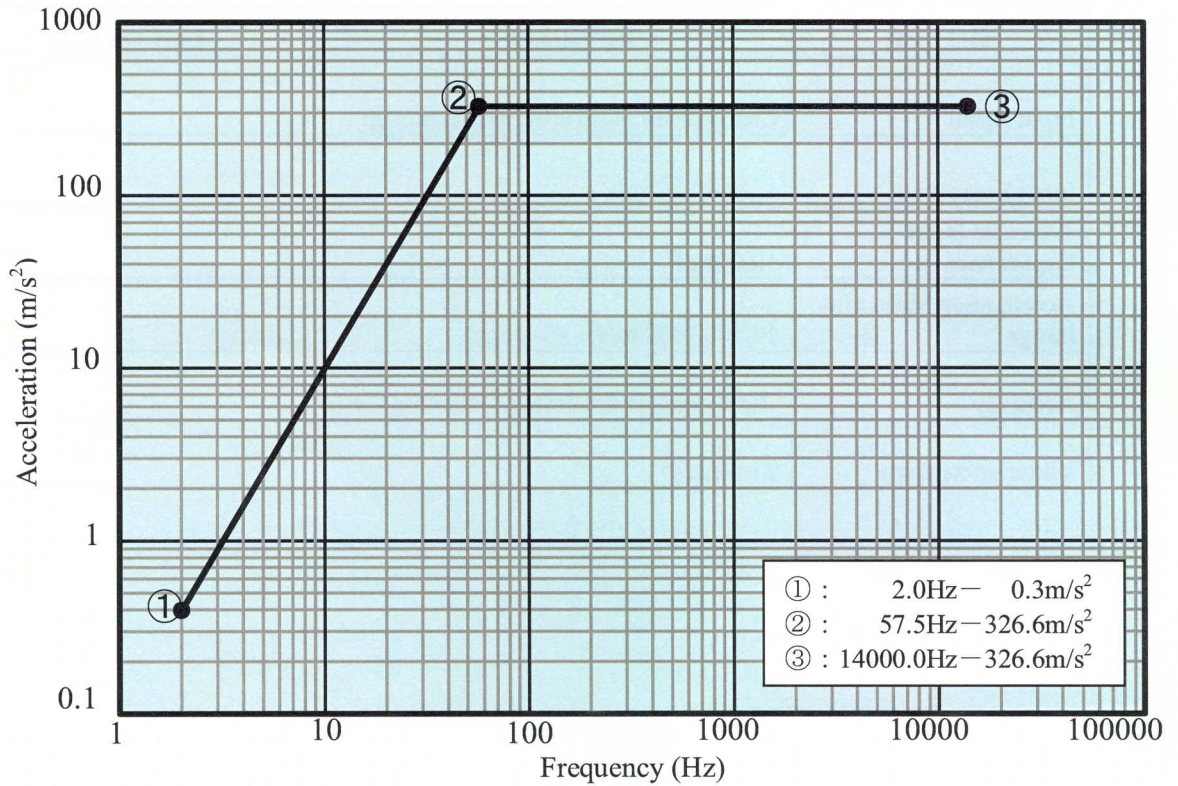
<PET-01-0A>

<PET-01-0AM>



<PET-05-05A>

<PET-05-05AM>



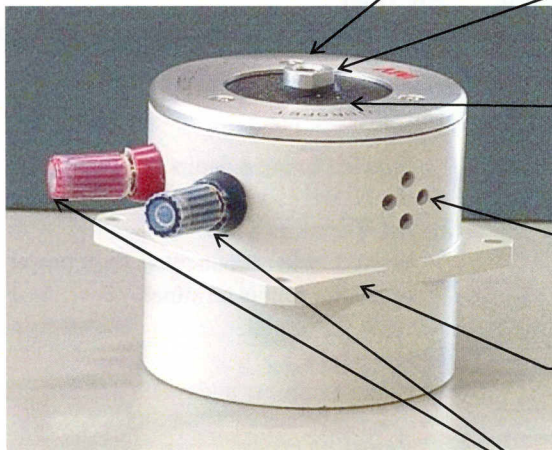
3.4 NAME OF PARTS

According to the system model name of main composition are different. However, the names of each part and function are almost common.

Refer to the equipment that you purchased if the appearance is slightly different.

■ Vibration Shaker

PET-01



Specimen Mounting Screw :

It is used at mounting the specimen by bolts. (13-M6 screw)

Armature Table :

This part moves up and down in excitation.

Dust Cover :

It is for protecting the vibration shaker form the dust.

Air Inlet :

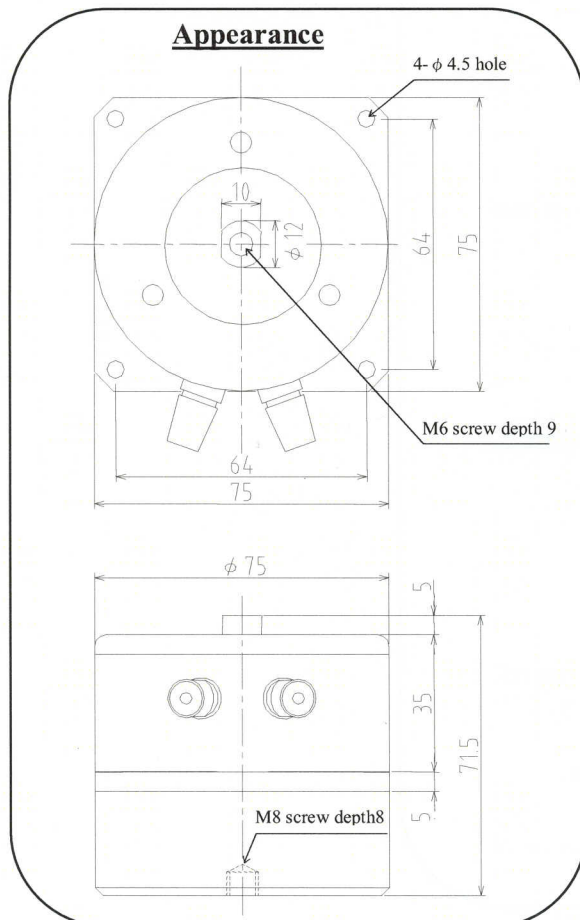
Cooling air comes into the Shaker from this part.

Yoke Plate :

It is for fixing a damper.

Input Terminal :

Drive Cable is connected from power amplifier to this terminal.



1. INTRODUCTION

2. INTRODUCTION FOR SAFETY

3. OUTLINE OF THE SYSTEM

4. OPERATION PROCEDURE

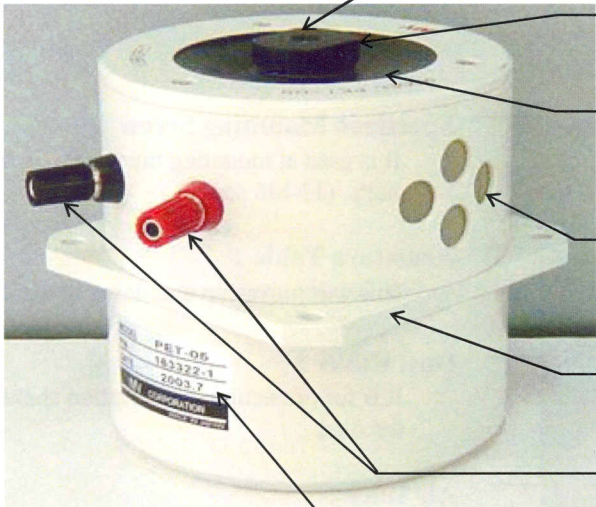
5. MAINTENANCE

6. OTHER OPERATIONS

7. GLOSSARY

AFTER-SALES SERVICE

PET-05



Specimen Mounting Screw :

It is used at mounting the specimen by bolts. (13-M6 screw)

Armature Table :

This part moves up and down in excitation.

Dust Cover :

It is for protecting the vibration shaker form the dust.

Air Inlet :

Cooling air comes into the Shaker from this part.

Yoke Plate :

It is for fixing a damper.

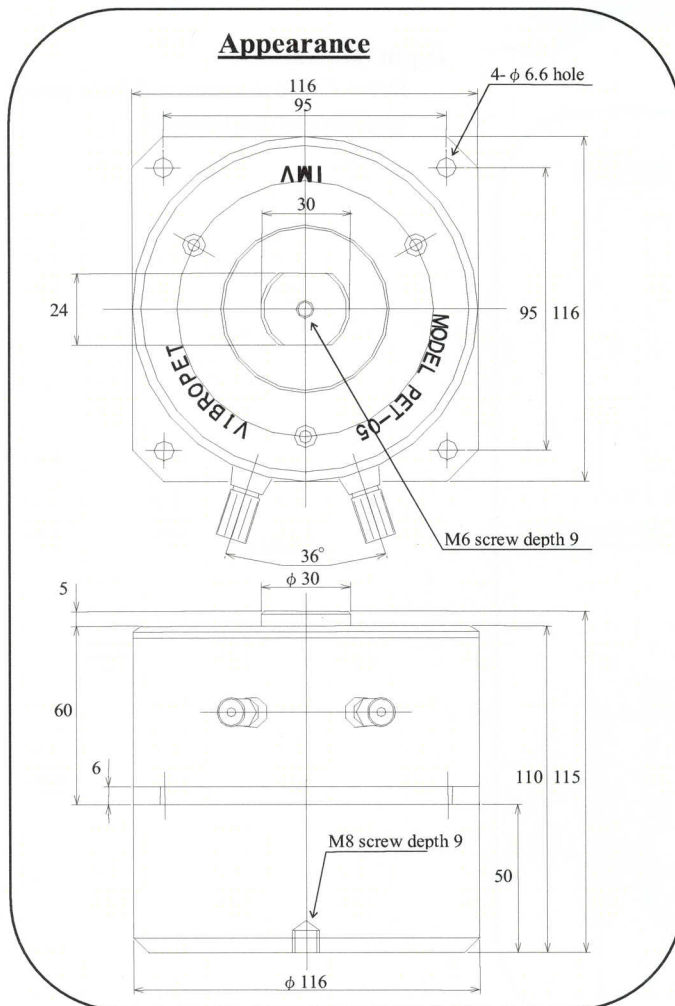
Input Terminal :

Drive Cable is connected from power amplifier to this terminal.

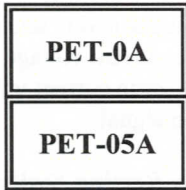
Name plate :

Serial number and manufactured date are written.

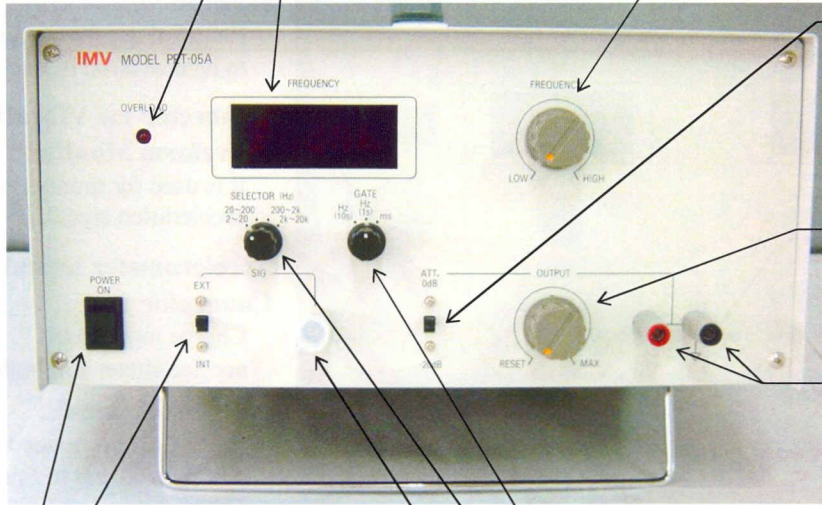
Appearance



■ Power Amplifier



< Front Panel >



Overload Lamp :
This lamp is lit when protective circuit is working.

Frequency Counter

Frequency Dial :
This item is for setting the frequency of oscillator. Also, frequency in higher range is set for 2~3 Hz each according to the resolution.

Output Attenuator :
Output voltage level is selected between 0dB and -20dB according to the test level.

Output Knob :
This item is for adjusting the output level. (common to overload reset switch)

Output Terminal :
Drive Cable is connected from vibration shaker to this terminal.

Frequency Gate Selector :
Frequency display unit is selectable between Hz and msec.

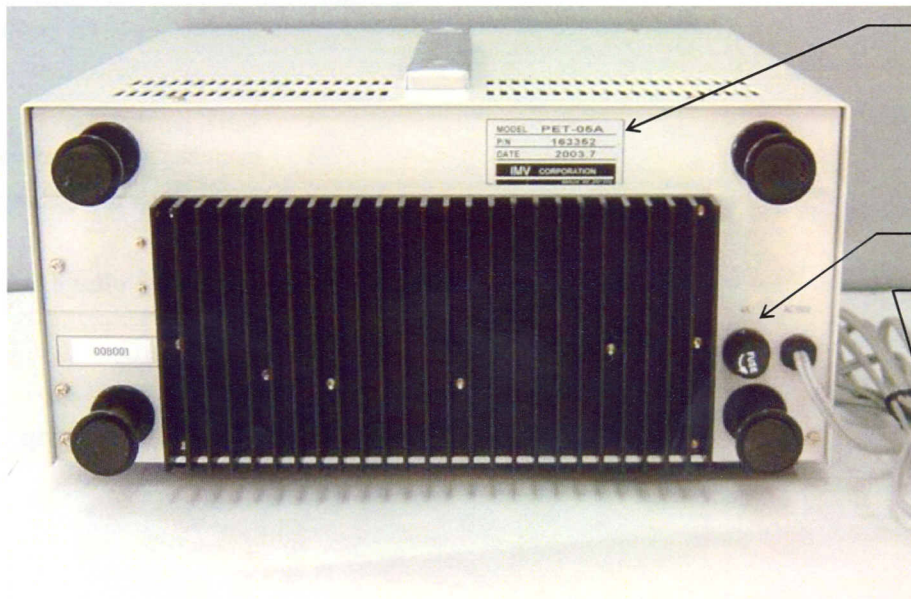
Frequency Range Selector :
This item is for setting the frequency range properly for test contents.

External Signal Input Connector :
A signal is inputted from an external generator such as vibration controller.

Input Signal Selector :
EXT : When an external signal generator such as vibration controller is used.
INT : When the oscillator attached as standard is used.

Power ON / OFF

< Rear Panel >



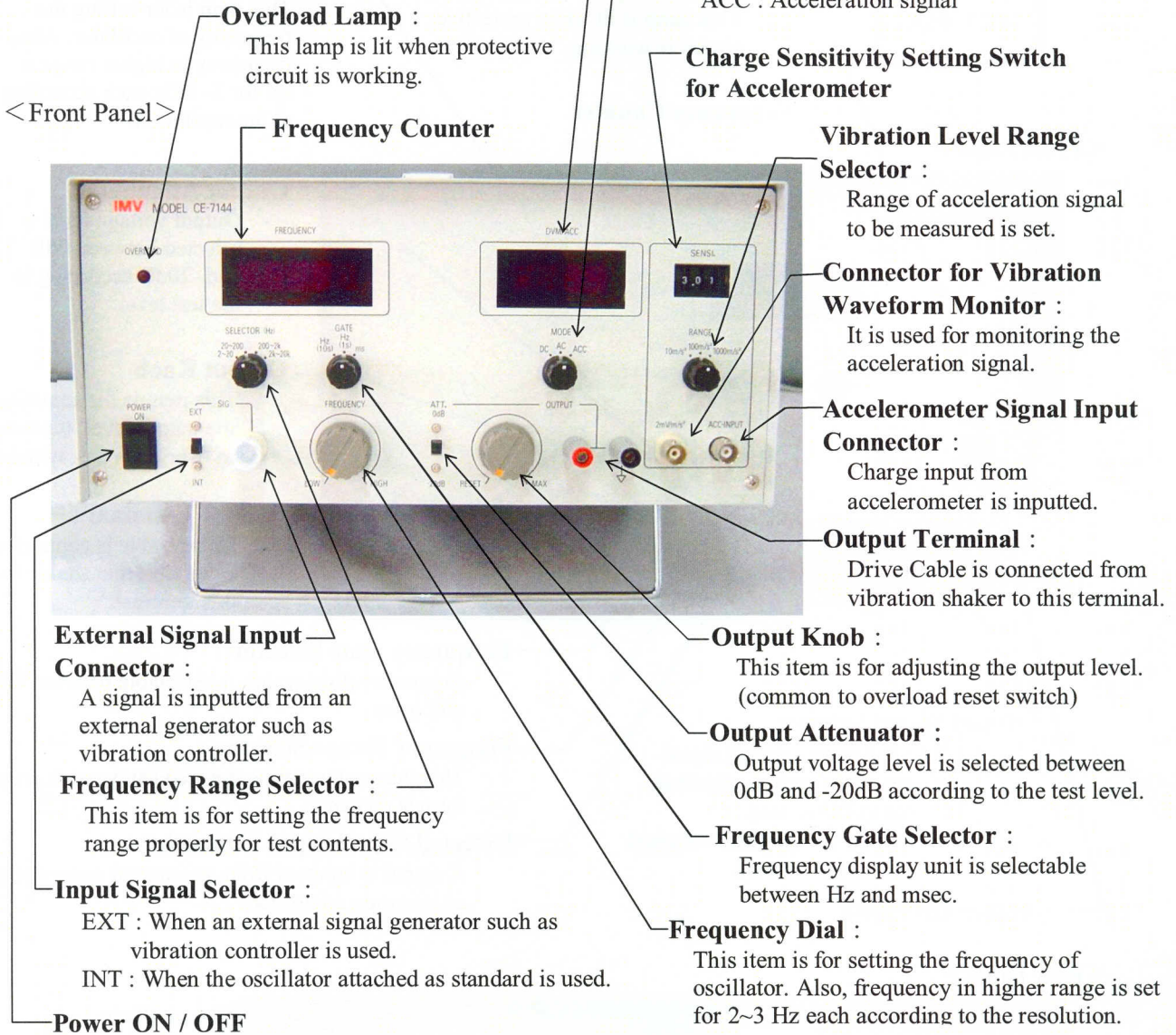
Name Plate :
Serial number and manufactured date are written.

Fuse

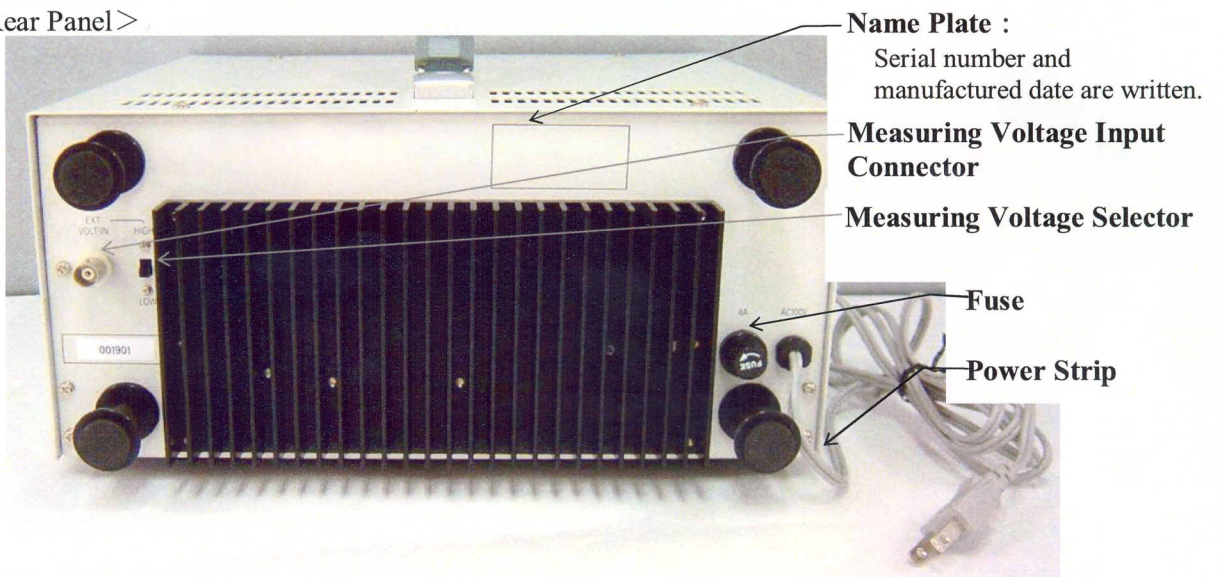
Power Strip

PET-0AM (with Vibration Meter)

PET-05AM (with Vibration Meter)



< Rear Panel >



4. OPERATION PROCEDURE

This chapter describes the concrete procedures of preparation, operation, operation stop and the notice.

4.1 PREPARATION

■ Environment

The procedure of preparation for Vibration Testing System is described. The electric connection of the system is needed to be done correctly according the descriptions as below.

<Power Supply>

Main power supply is required for each system as below ;

PET-01-0A :	1 ϕ	AC 100V $\pm 10\%$	50/60 Hz	0.08 kVA
PET-01-0AM :	1 ϕ	AC 100V $\pm 10\%$	50/60 Hz	0.08 kVA
PET-05-05A :	1 ϕ	AC 100V $\pm 10\%$	50/60 Hz	0.1 kVA
PET-05-05AM :	1 ϕ	AC 100V $\pm 10\%$	50/60 Hz	0.1 kVA

<Installation Site>

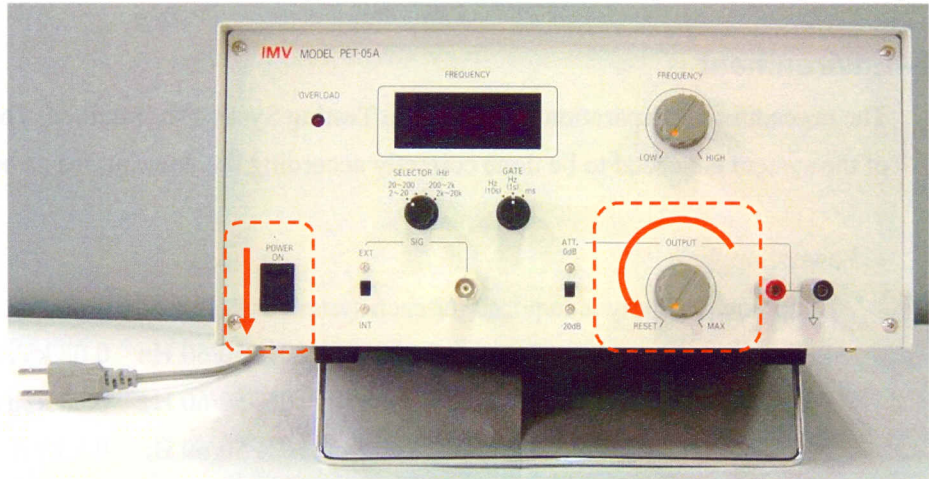
- (1) The system must be placed in the temperature within 0 ~ 40 °C.
- (2) Keep the installation site away from dust and high humidity.
- (3) Designate the place for installation of the system to the sales person of IMV agent at order.
- (4) For smooth installation, the size and the weight of equipment must be checked in advance.
- (5) The vibration is needed to be avoided by Vibration-isolation Pad for reducing the bad influence to the other equipment when Vibration Shaker is placed with the controller or the other measurement equipment together.
- (6) The vibration shaker body has magnetism of permanent magnet. You must keep away from iron powder and things like that.

■ Wiring

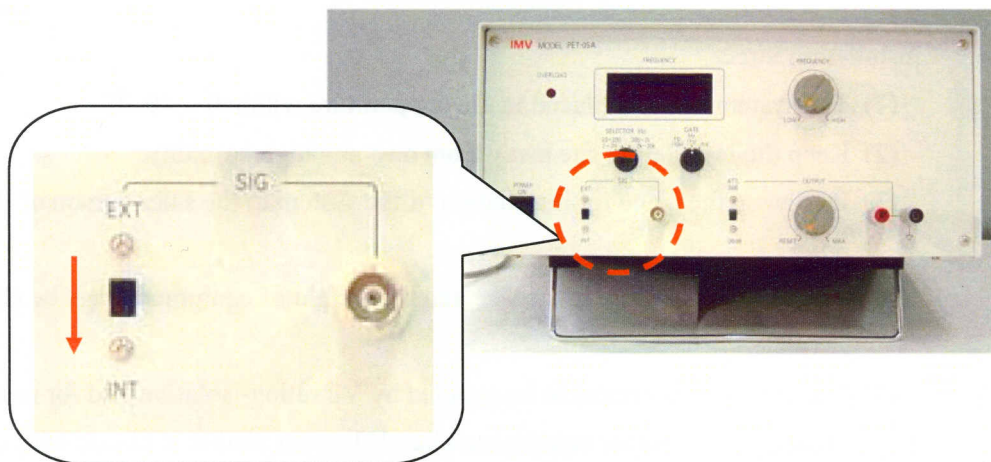
[PET-01-0A / PET-05-05A]

<Using the oscillator attached as standard>

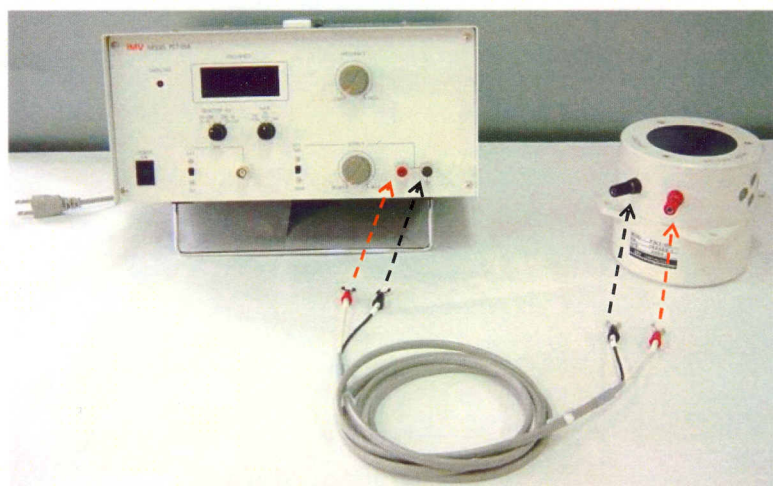
- (1) Turn Power ON/OFF switch at [POWER/OFF]. And set Output Knob at [RESET].



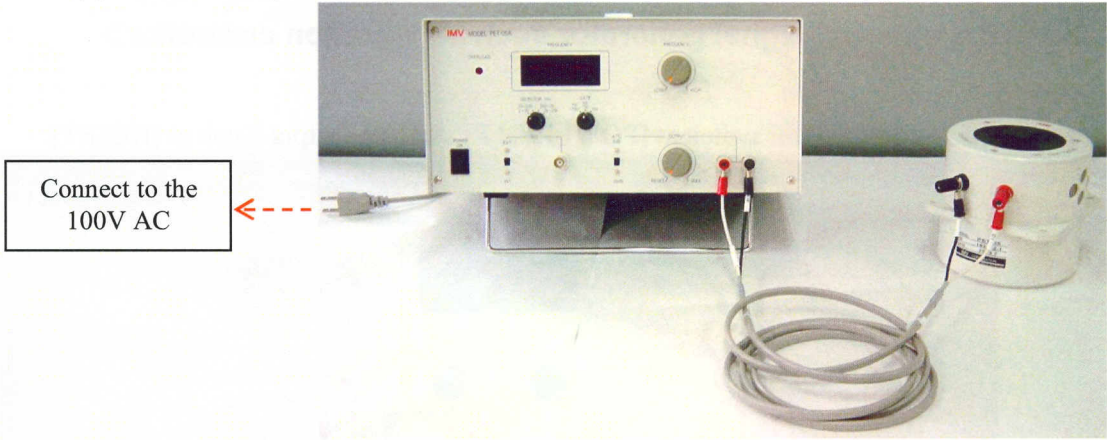
- (2) Set the Input Signal Selector to [INT.(Internal)].



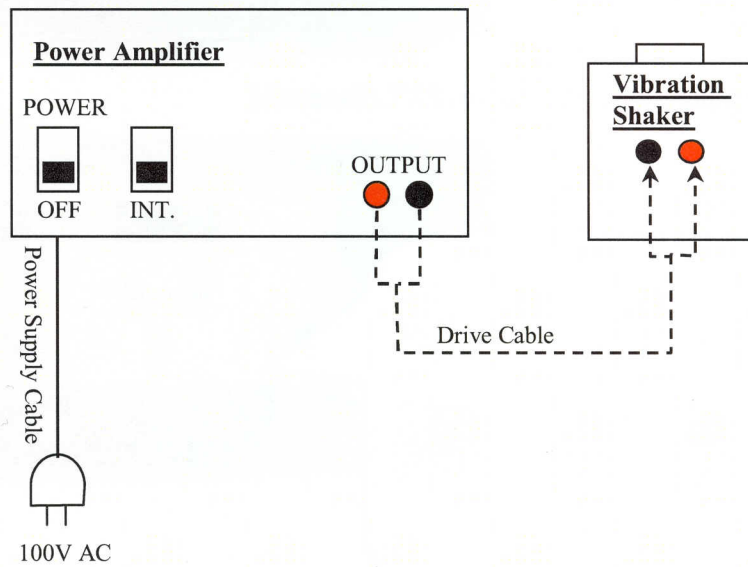
- (3) Connect the output terminal of Power Amplifier with the input terminal of Vibration Shaker by the dedicated drive cable.



(4) Connect the power strip on rear panel with 100V AC Power Supply.



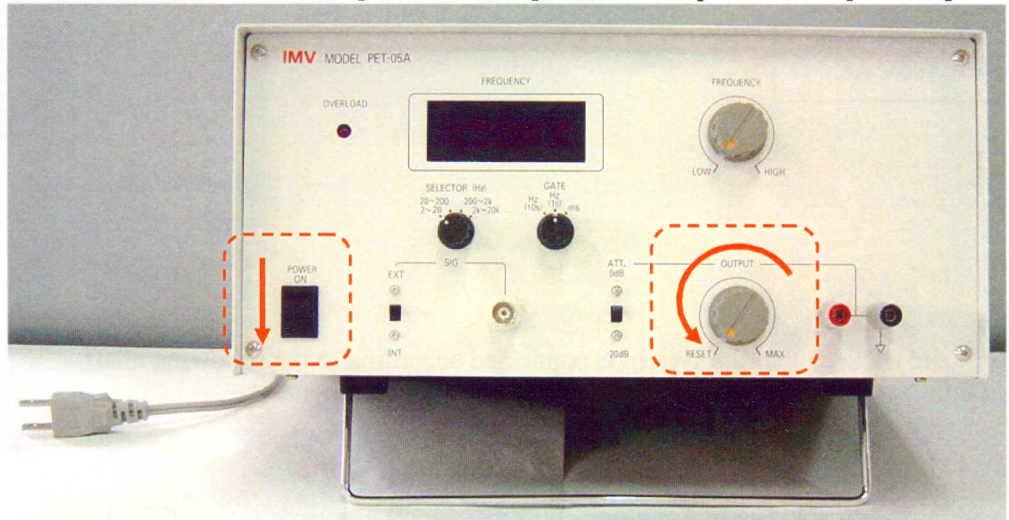
(5) Check that the system is connected according to the following chart.



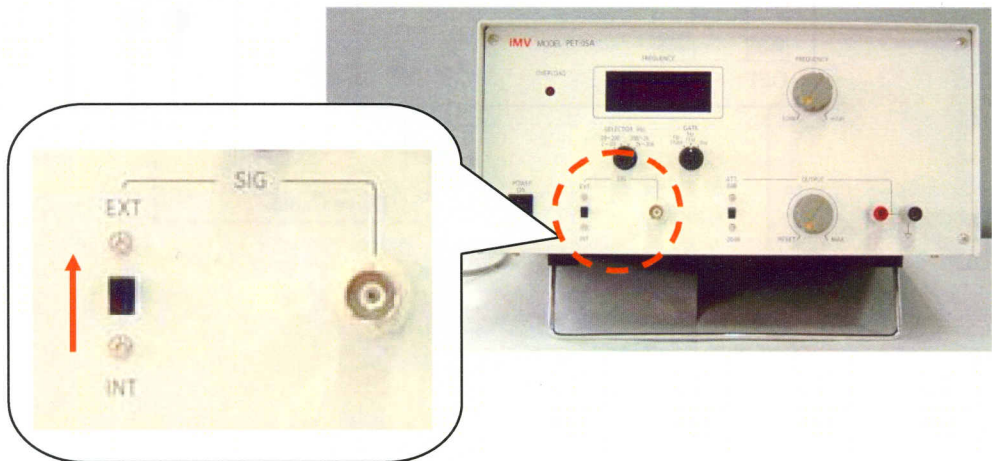
[PET-01-0A / PET-05-05A]

<Using the external signal generator such as vibration controller>

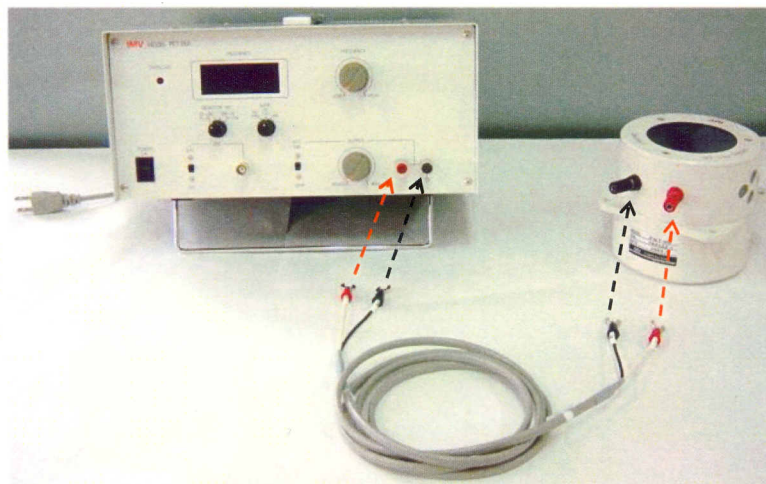
- (1) Turn Power ON/OFF switch at [POWER/OFF]. And set Output Knob at [RESET].



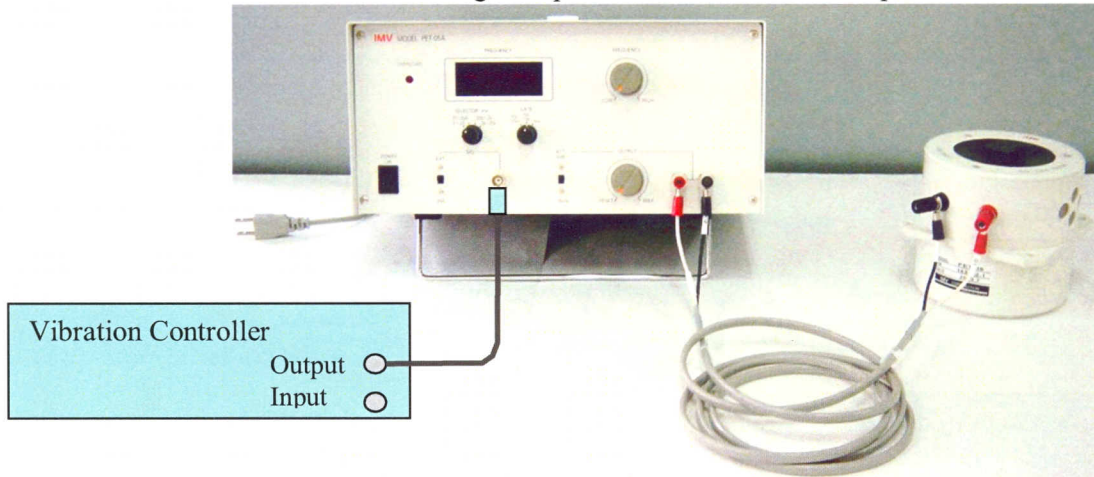
- (2) Set the Input Signal Selector to [EXT.(External)].



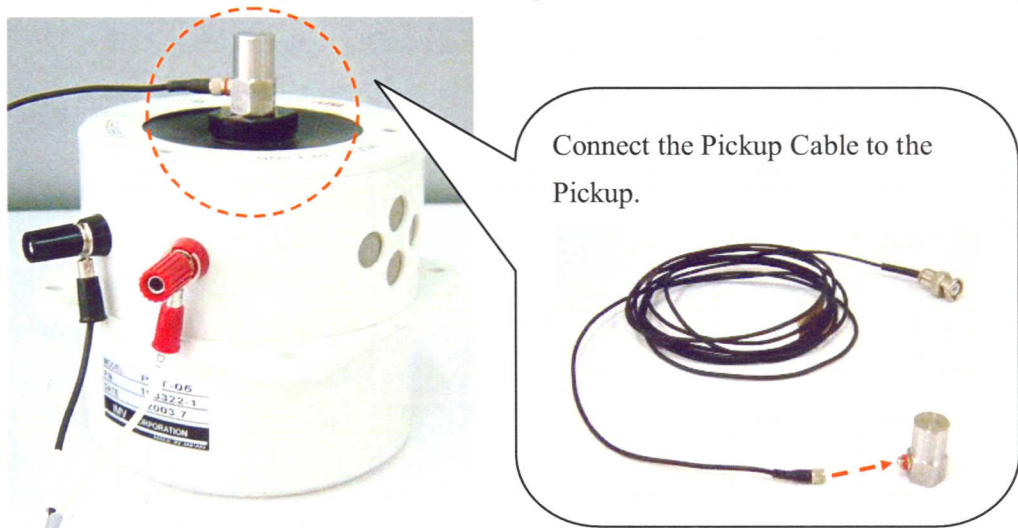
- (3) Connect the output terminal of Power Amplifier with the input terminal of Vibration Shaker by the dedicated drive cable.



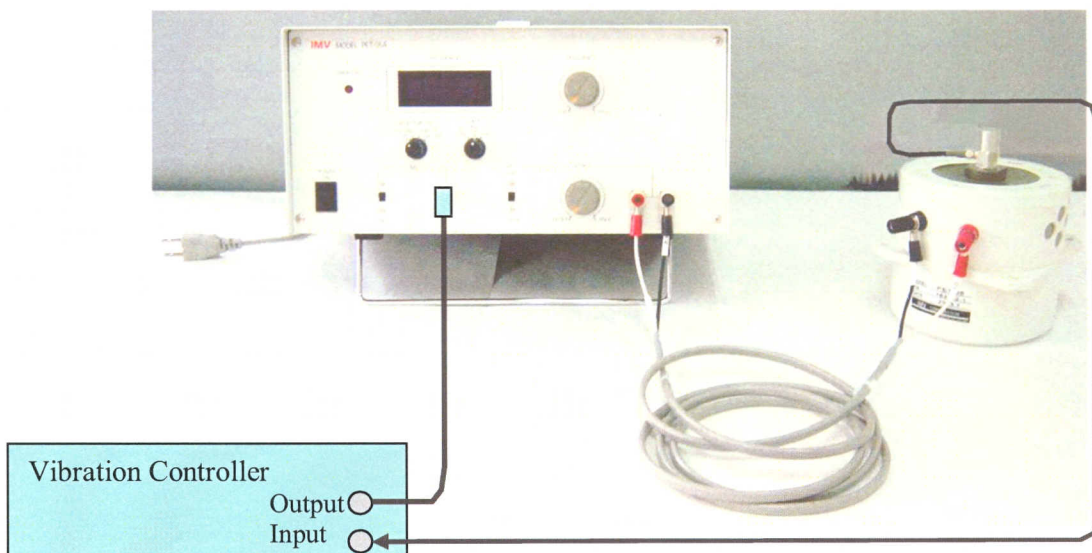
- (4) Connect the signal cable from the output port of signal generator such as vibration controller with the external signal input connector of Power Amplifier.



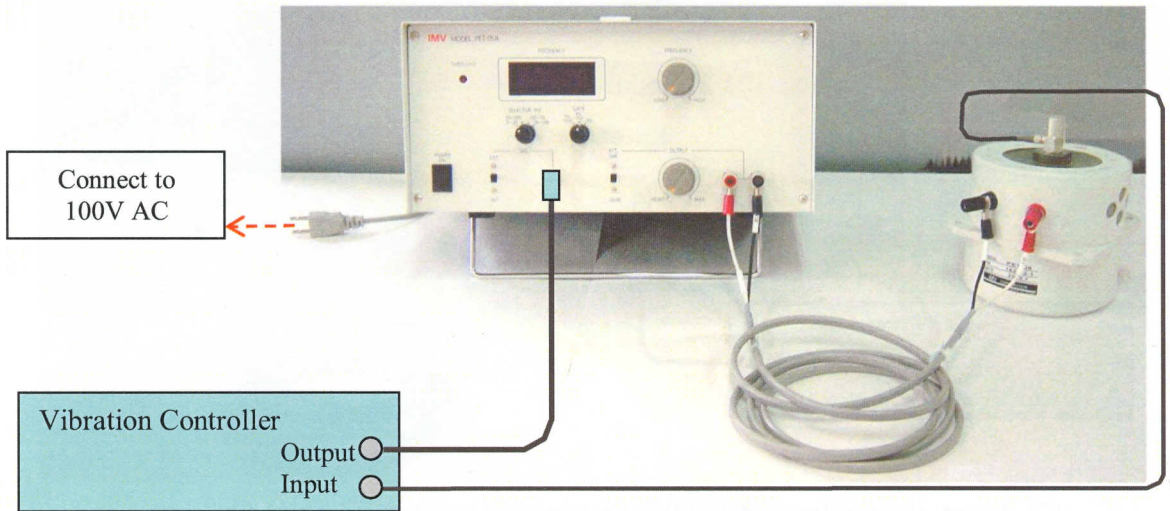
- (5) Mount the accelerometer at the measurement point of Vibration Shaker.
Refer to “4.1 PREPARATION, ■ Fitting of Accelerometer”



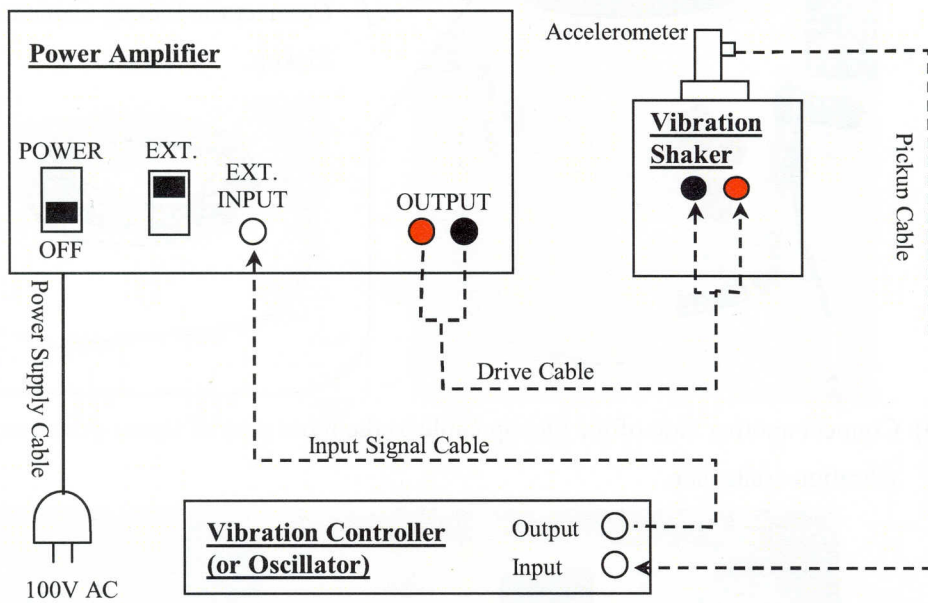
- (6) Connect another side of the pickup cable to the input port of signal generator such as vibration controller.



(7) Connect the Power Strip on rear panel to the power supply 100V AC.



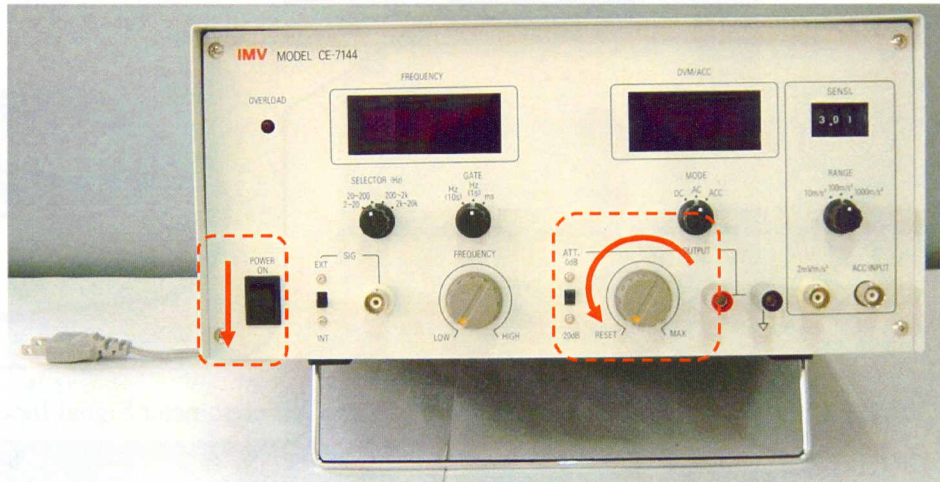
(8) Check that the system is connected according to the following chart.



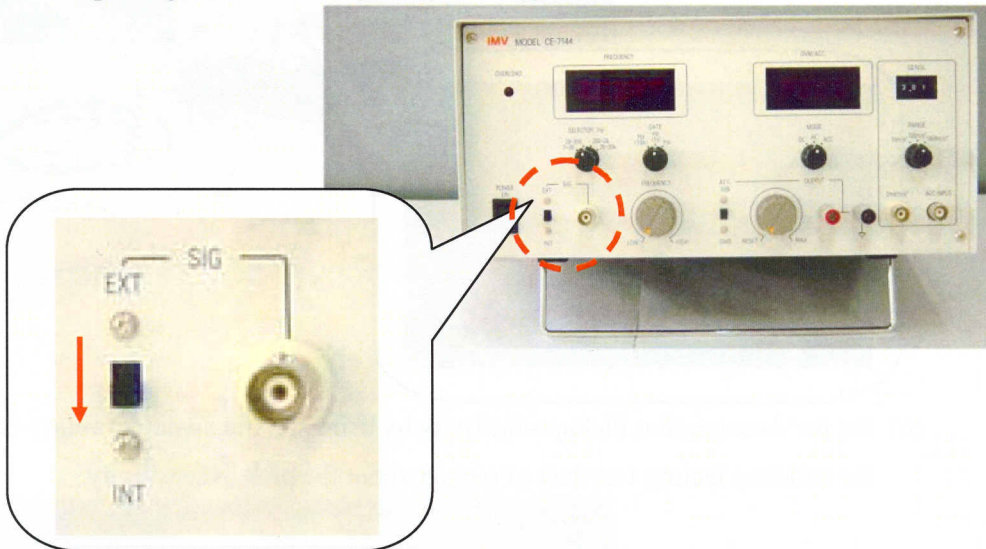
[PET-01-0AM / PET-05-05AM]

<Using the oscillator attached as standard>

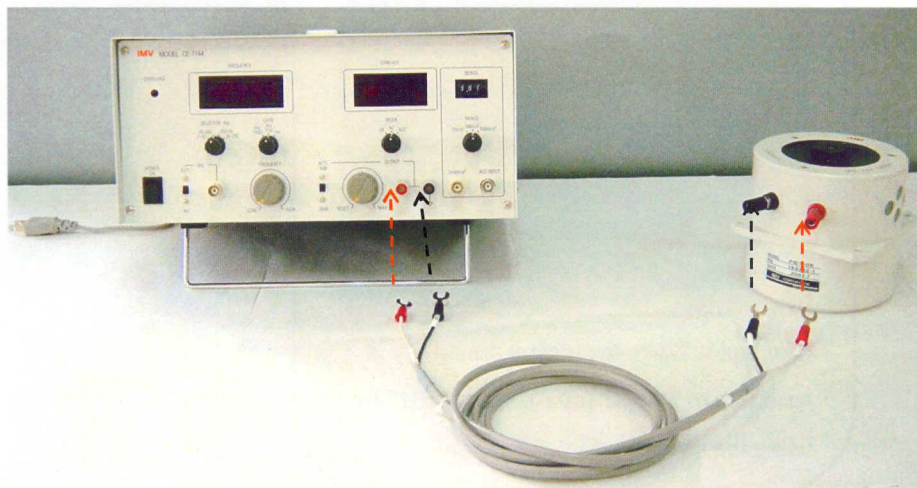
- (1) Turn Power ON/OFF switch at [POWER/OFF]. And set Output Knob at [RESET].



- (2) Set the Input Signal Selector to [INT.(Internal)].

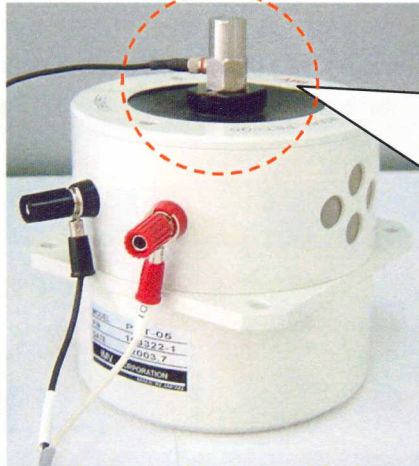


- (3) Connect the output terminal of Power Amplifier with the input terminal of Vibration Shaker by the dedicated drive cable.

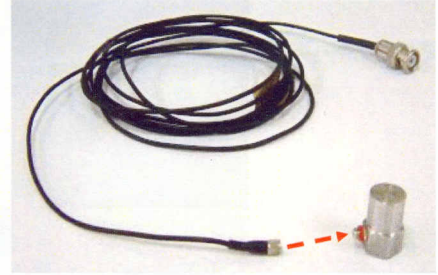


- (4) Mount the accelerometer at the measurement point of Vibration Shaker.

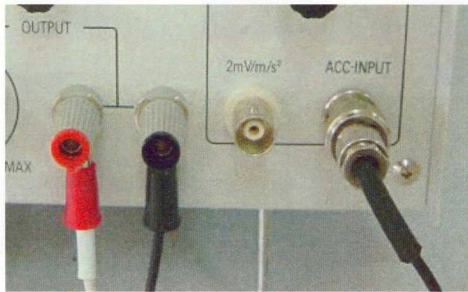
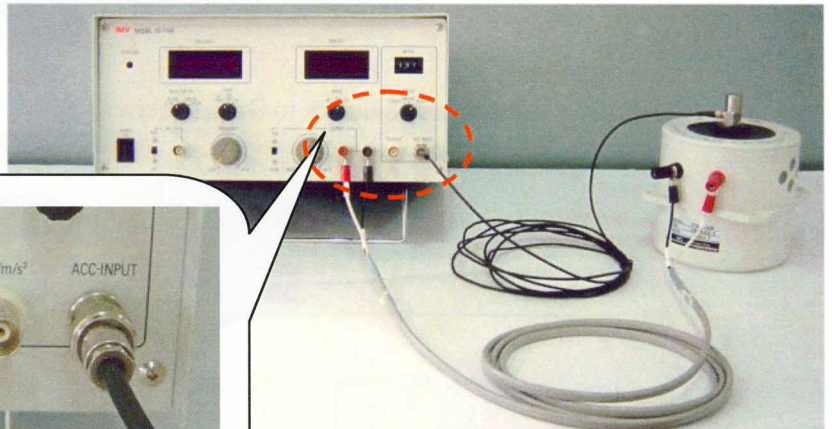
Refer to “4.1 PREPARATION, ■ Fitting of Accelerometer”



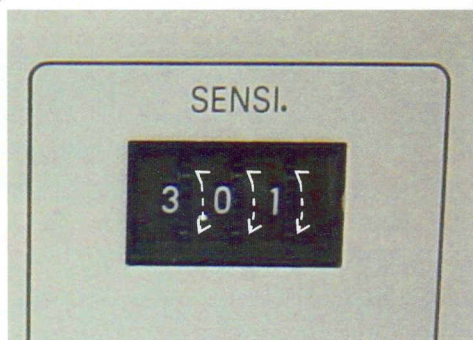
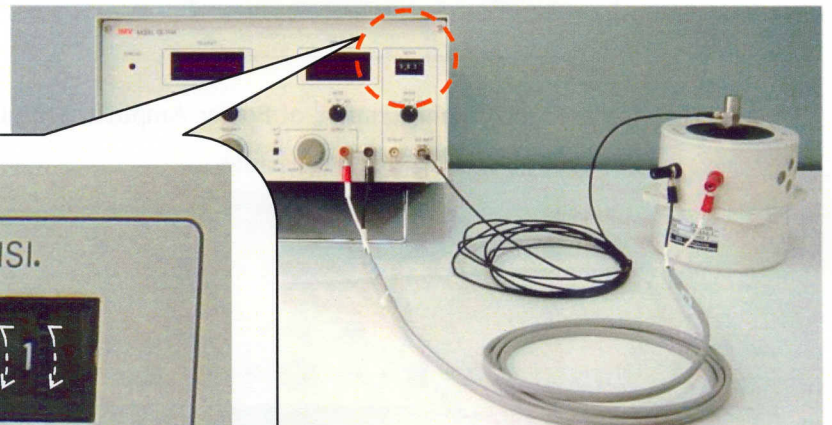
Connect the Pickup Cable to the Pickup.



- (5) Connect another side of the pickup cable to Accelerometer Signal Input Connector.

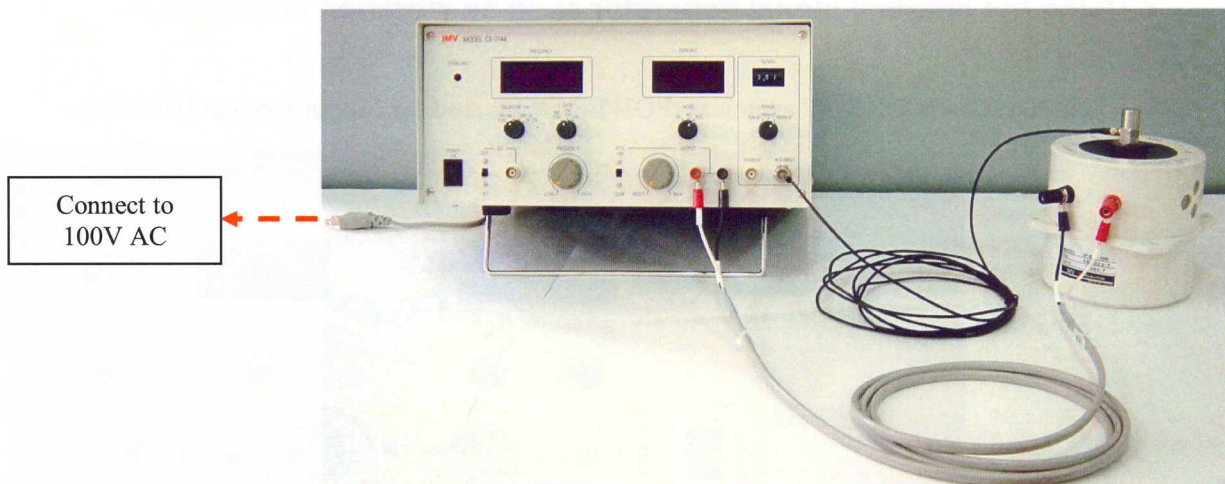


- (6) Set the Acceleration Pickup sensitivity by using the dip switch of rotary method. Refer to the attached factory test data of pickup about the pickup sensitivity.

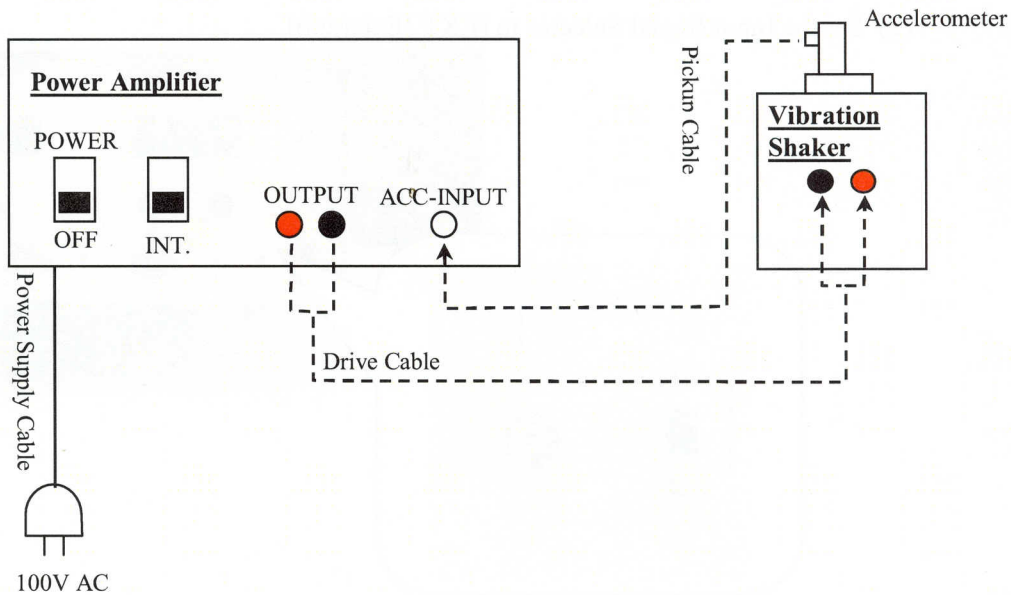


(Example) When the pickup sensitivity is specified to $3.01\text{pC}/(\text{m}/\text{s}^2)$, set as “301” by using the switch.

(7) Connect the Power Strip on rear panel to the power supply 100V AC.



(8) Check that the system is connected according to the following chart.

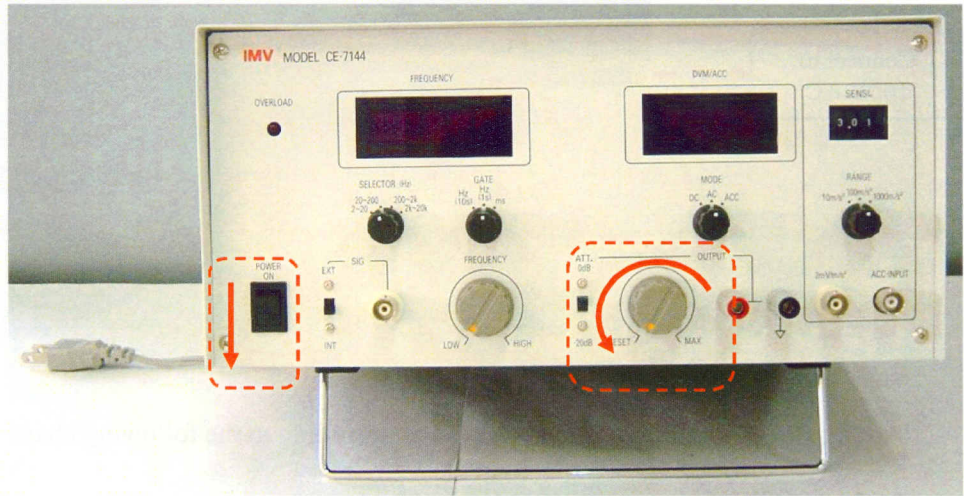


1. INTRODUCTION
2. INTRODUCTION FOR SAFETY
3. OUTLINE OF THE SYSTEM
4. OPERATION PROCEDURE
5. MAINTENANCE
6. OTHER OPERATIONS
7. GLOSSARY
8. WARRANTY AND AFTER-SALES SERVICE

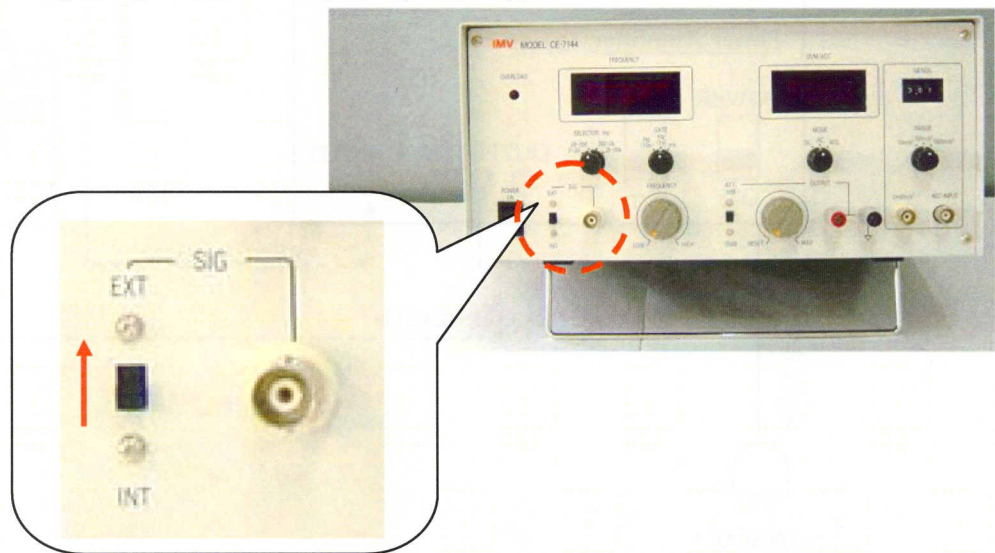
[PET-01-0AM / PET-05-05AM]

<Using the external signal generator such as vibration controller>

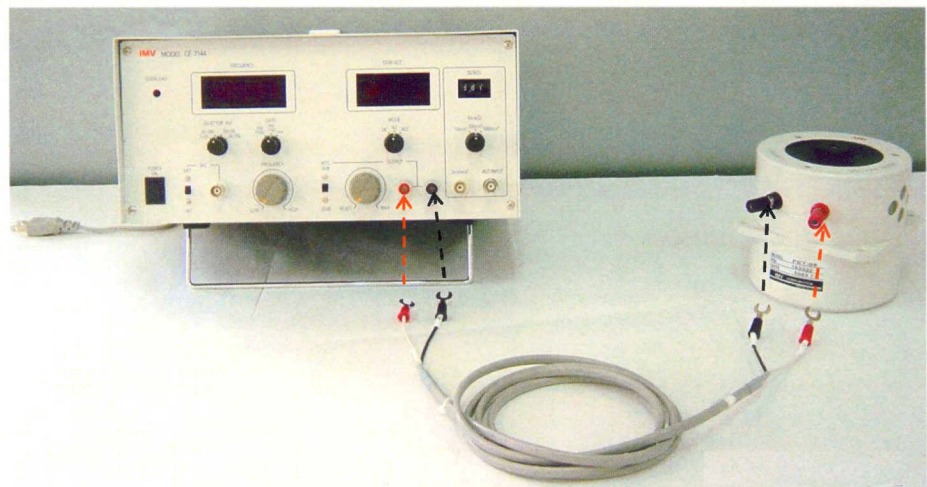
- (1) Turn Power ON/OFF switch at [POWER/OFF]. And set Output Knob at [RESET].



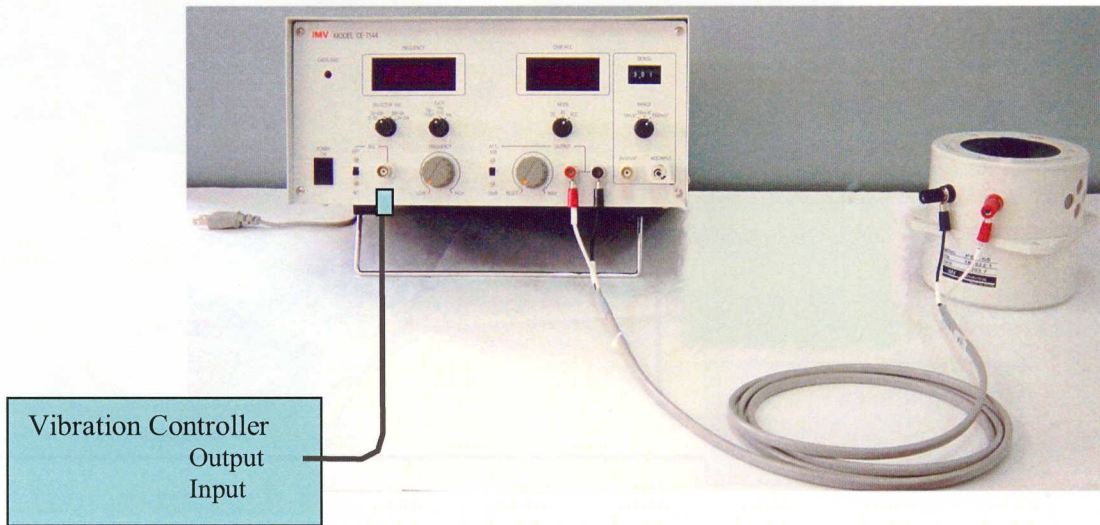
- (2) Set the Input Signal Selector to [EXT.(External)].



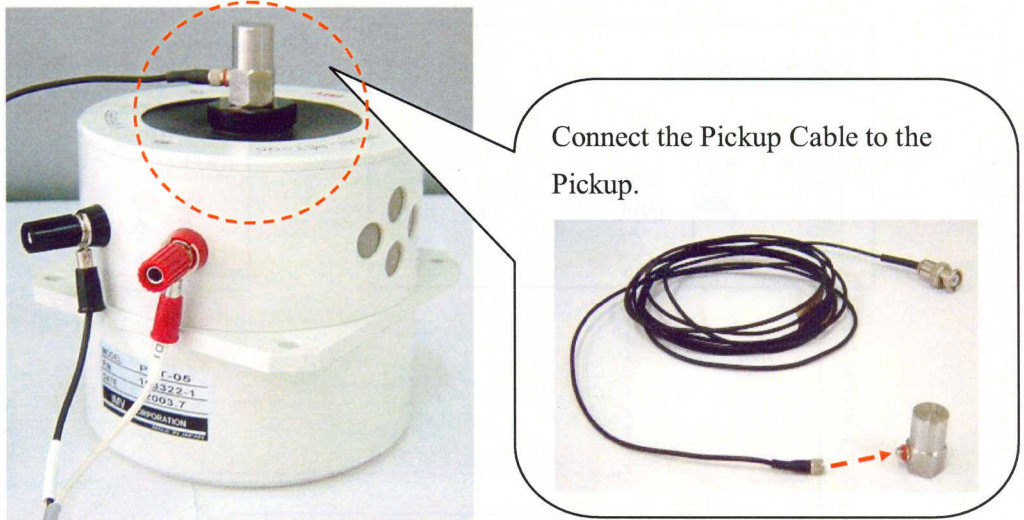
- (3) Connect the output terminal of Power Amplifier with the input terminal of Vibration Shaker by the dedicated drive cable.



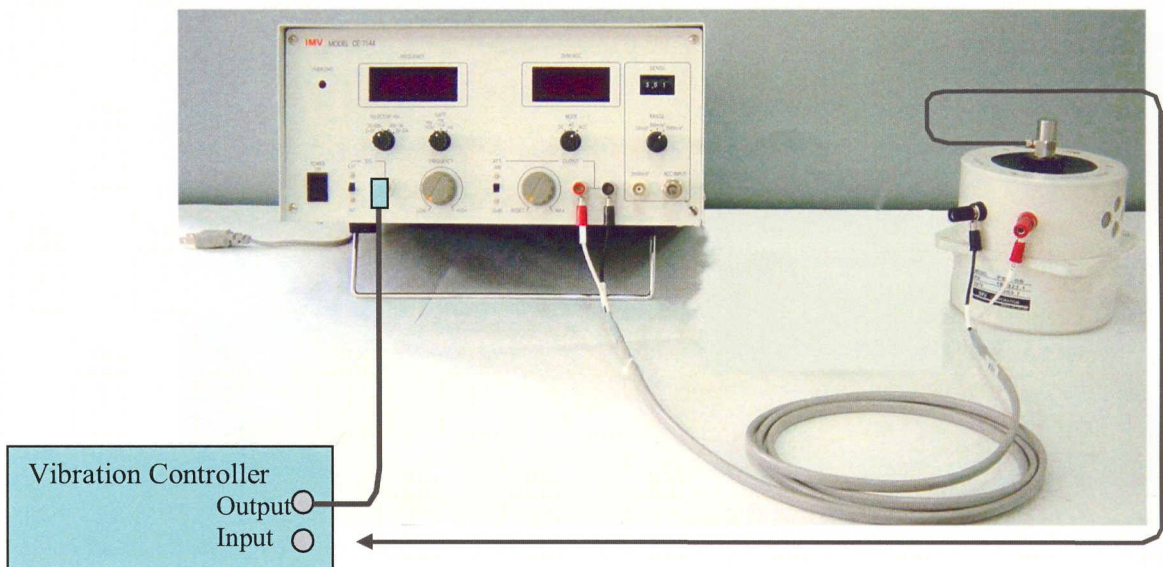
- (4) Connect the signal cable from the output port of signal generator such as vibration controller with the external signal input connector of Power Amplifier.



- (5) Mount the accelerometer at the measurement point of Vibration Shaker. Refer to “4.1 PREPARATION, ■ Fitting of Accelerometer”

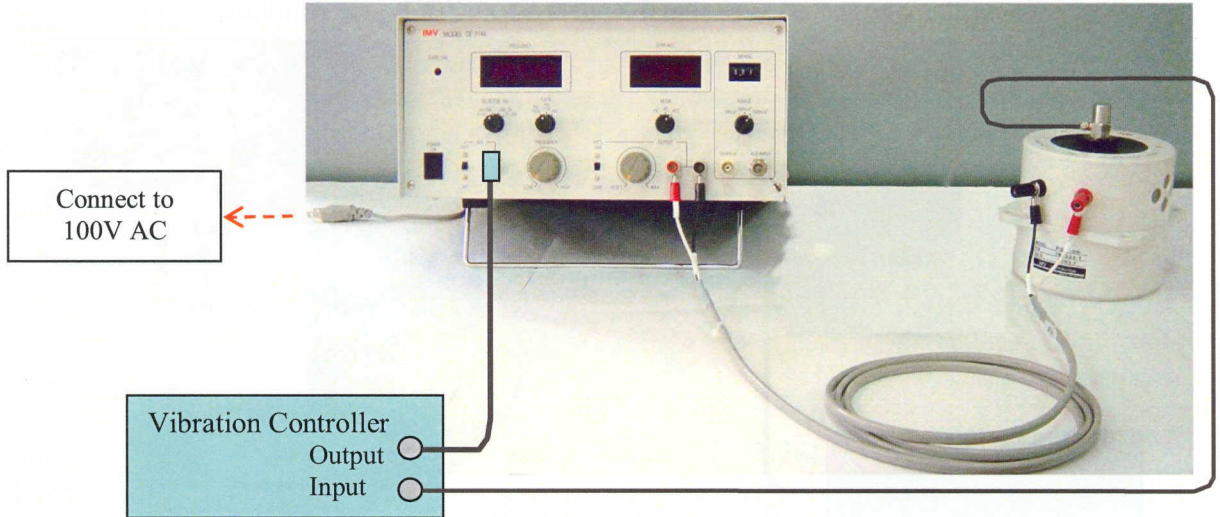


- (6) Connect another side of the pickup cable to the input port of signal generator such as vibration controller.

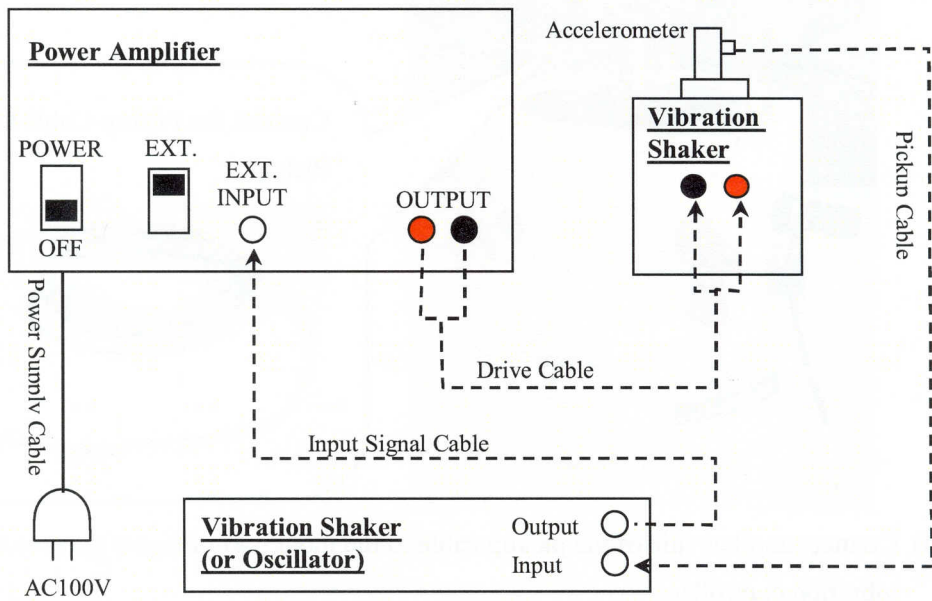


1. INTRODUCTION
2. INTRODUCTION FOR SAFETY
3. OUTLINE OF THE SYSTEM
4. OPERATION PROCEDURE
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8. WARRANTY AND AFTER-SALES SERVICE

(7) Connect the Power Strip on rear panel to the power supply 100V AC.

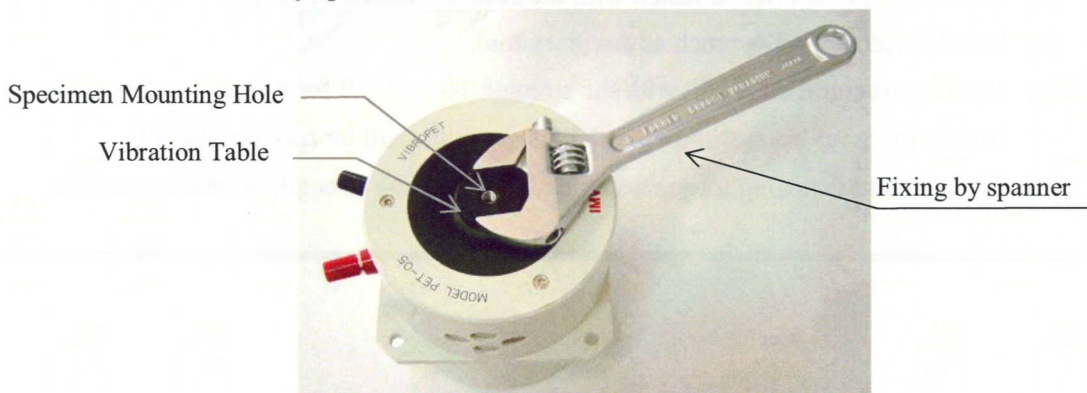


(8) Check that the system is connected according to the following chart.



■ Fitting of Excitation Fixture and Specimen

- (1) In case or volt/screw is mounted on accelerometer or specimen mounting hole, fix the Vibration table by spanner at first and then fit the volt/screw.

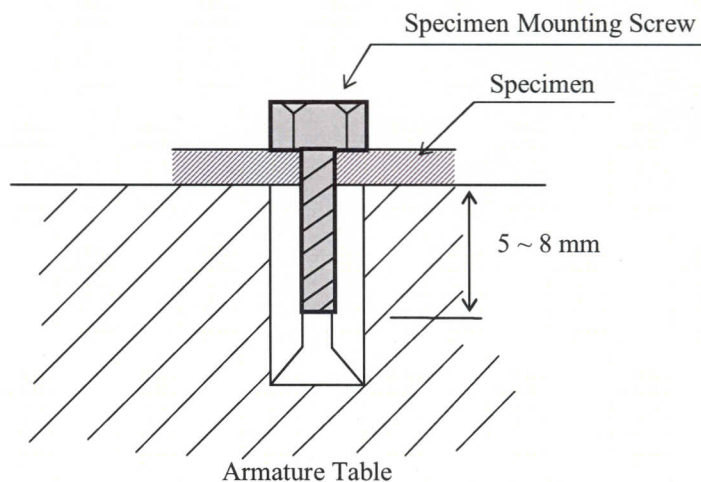


CAUTION

It the screw is fastened without fixing Vibration table, support system for Vibration Shaker will be damaged.

- (2) Mount your fixture and specimen to the vibration table keeping the center of gravity (c.o.g) of them on the vertical center line of table.
- (3) The screw length of fixture bolts should be '5mm to 8mm' from the mounting surface of 'Specimen Mounting Screw Bush' as shown in the following figure. In case longer screw used, enough fixing can not be done. In case of shorter screw used, 'Specimen Mounting Screw Bush' may be broken or specimen may be removed during excitation.
- (4) The standard tighten-up torque values are different according to the material of fitting surface on your specimen against the fixing bolt. Please refer to the following table.

Material	Standard torque value (M6)
Steal, Stainless steel	11.2 N·m
Aluminum, Magnesium	6.8 N·m



Fastening Torque of Bolt

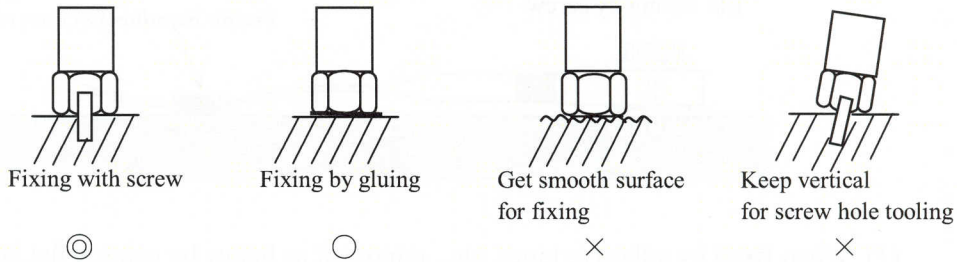
- (1) Use the torque wrench to fasten with the accurate fastening torque.
- (2) Use the accessory T-wrench as auxiliary tool.
- (3) Use the structural steel bolt with the strength 10.9~12.9 for mounting of specimen.
In case the stainless steel bolt is used, its strength shall be A2-70~A2-80.
- (4) The standard fastening torque is decided based on the strength of bearing surface.

■ Fitting of Accelerometer

(1) Fixing

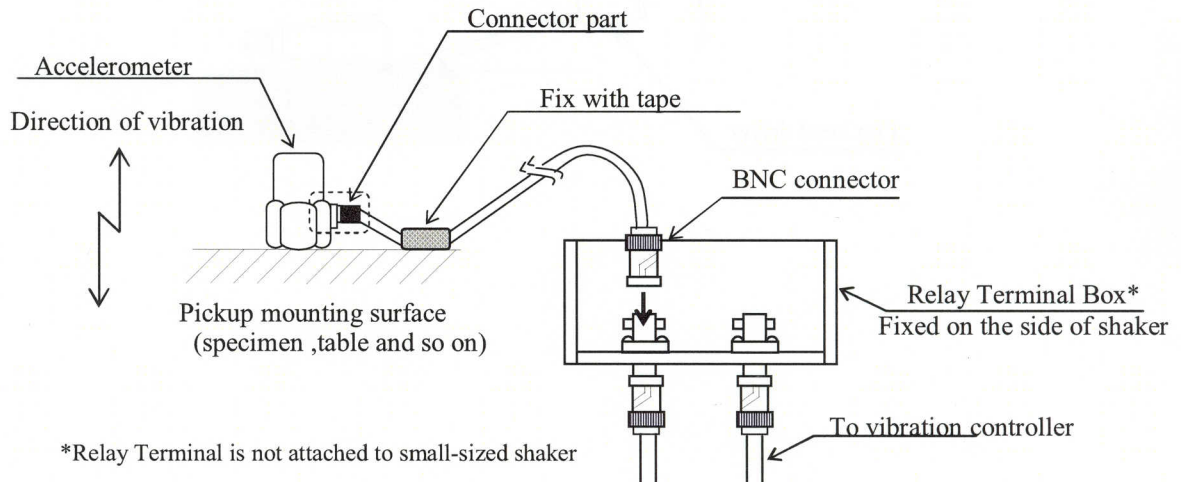
Attach Accelerometer to the control point firmly referring to the following figures. Please refer to the below regarding suitable fastening torque value in case of fixing with the screw.

Diameter of screw	Torque Value
M6	2.4 N·m



(2) Fixing of Pick-up Cable

Big vibration of Pick-up Cable during excitation may break the cable. You must fix the cable especially near around the connector of Accelerometer with adhesive tape.



(3) Waterproofing for Accelerometer

When Accelerometer has any possibility of “water soak” in a combined (climatic and vibration) testing, you must be waterproof around the connector by using Silicon Sealing Agent.

(4) Removing

Remove Accelerometer with Wrench not to give any unacceptable shock or force to casing of Accelerometer.

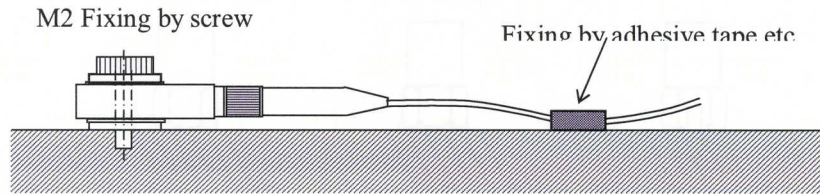
(5) Setting of Input Sensitivity

Accelerometer has its own sensitivity individually. You should set ‘Input Sensitivity’ for your using Accelerometer at the input channel of Vibration Controller or Charge Amplifier.

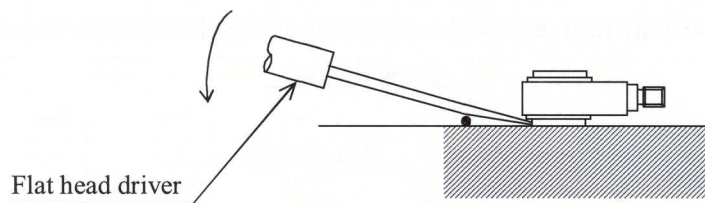
Please refer to ‘6. SUPPLEMENT, 6.1 SIMPLE CHECK METHOD TO CONFIRM THE SENSITIVITY OF ACCELEROMETER’.

<Fitting and Removing of Accelerometer (VP-02S)>

- (1) Fitting by M2 screw is recommended.
- (2) Fix the cable as below near the connector of an accelerometer.



- (1) When fixed by adhesive tapes, etc., remove it as below by using a flat head driver. It may be caused of trouble if it is forced to remove with twisting.



CAUTION

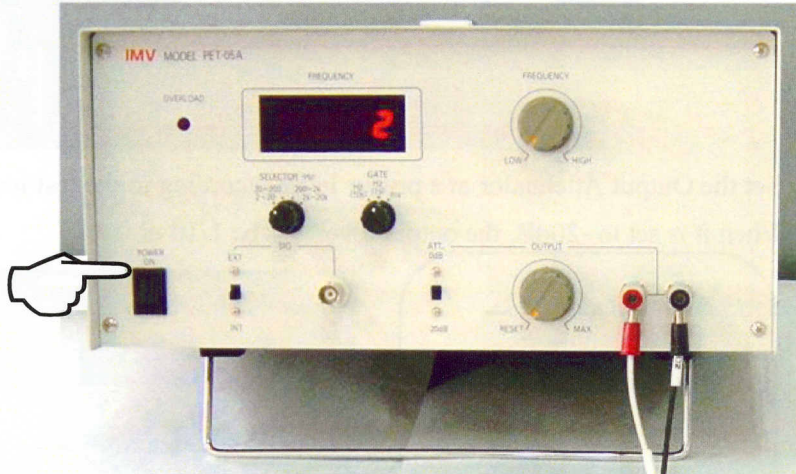
- (1) Accelerometers are precise products. If an accelerometer is subjected to shock due to drop or unacceptable force, it may have damage or its sensitivity characteristics may be changed. Be careful to handle the accelerometers.
- (2) Take care of mounting an accelerometer on the position where it will be interfered with other material under excitation.

4.2 OPERATION

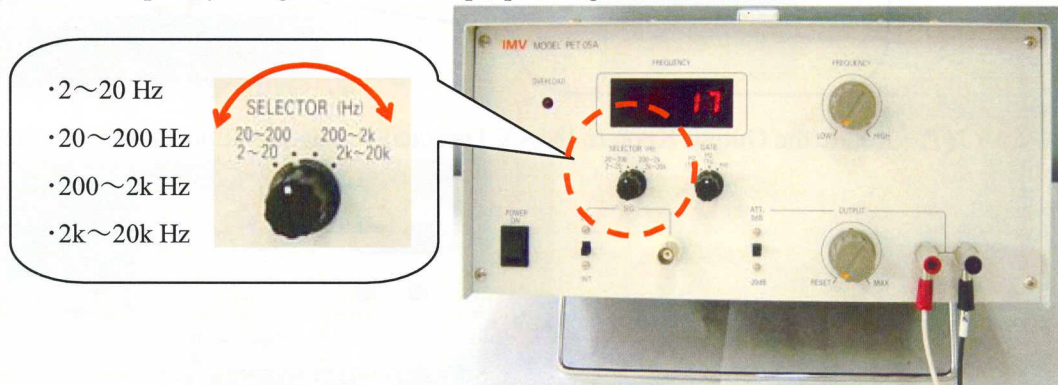
[PET-01-0A / PET-05-05A]

<Using the oscillator attached as standard>

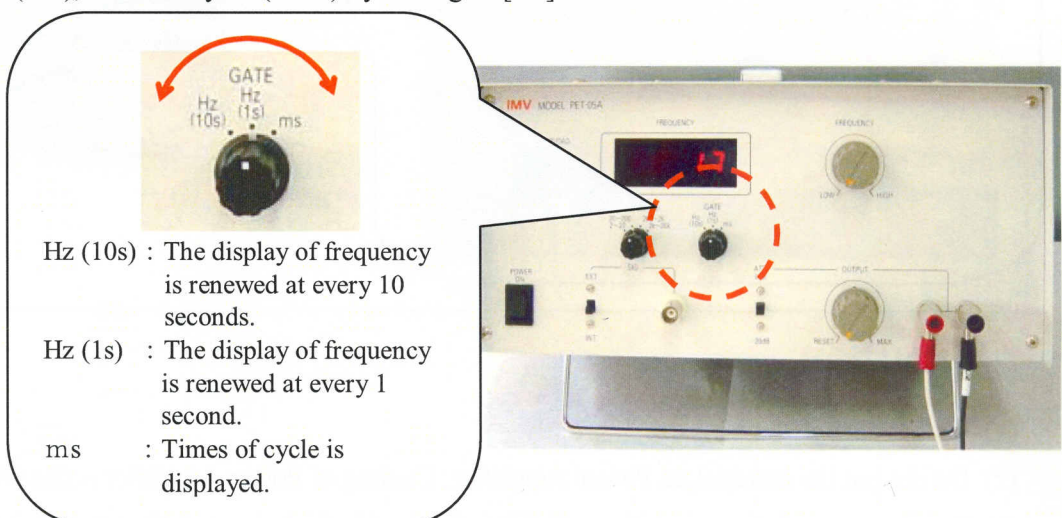
- (1) Check that the system is connected according to '4.1 PREPARATION, ■ Wiring'.
- (2) Turn Power ON/OFF switch at [POWER/ON]. The display of Frequency Counter is lit. Warm up the system for 10~15 minutes.



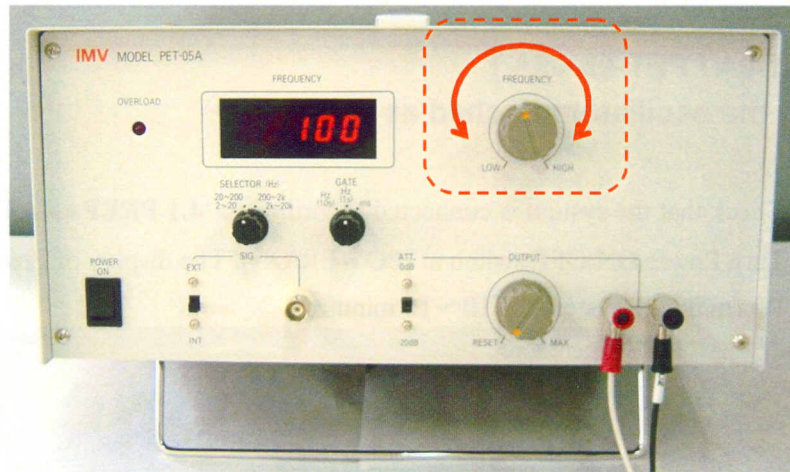
- (3) Set the Frequency Range Selector to a proper range for test contents.



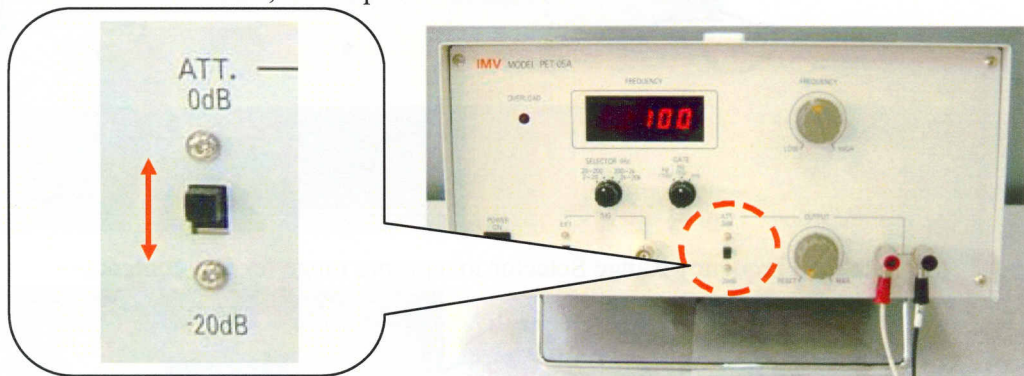
- (4) Set the Frequency Gate Selector. The frequency display unit is Hz by setting of (1s) or (10s), times of cycle (msec) by setting of [ms].



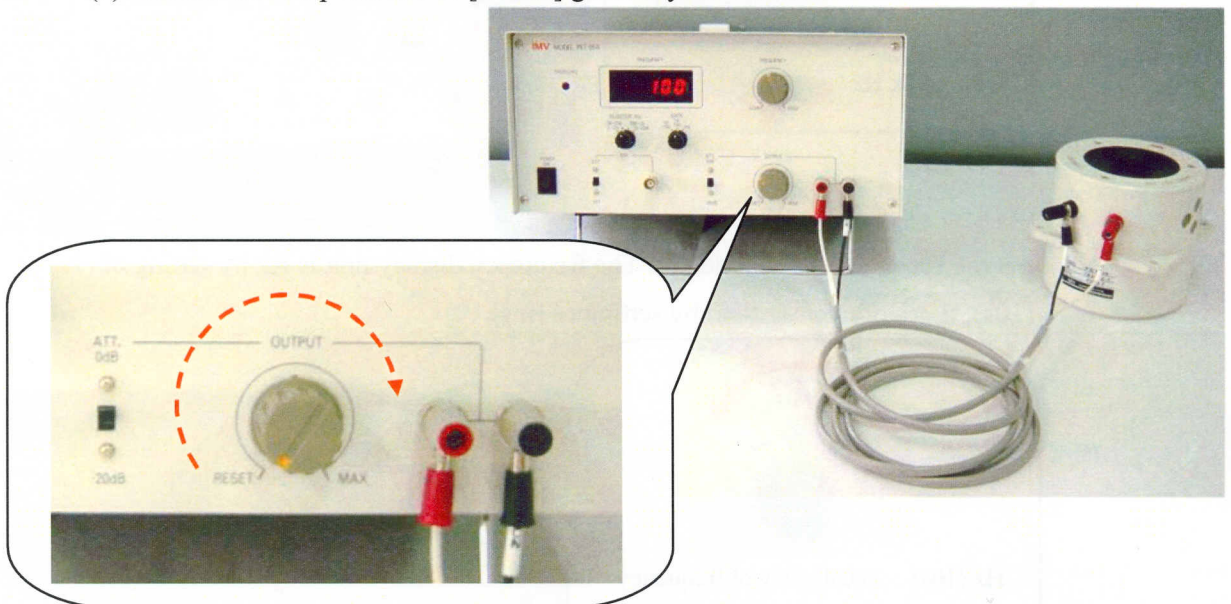
- (5) Set the frequency of Oscillator by rotating the knob of Frequency Dial.



- (6) Set the Output Attenuator at a proper level according to the test level.
When it is set to -20dB, the output level will be 1/10 of 0 dB.



- (7) Rotate the Output Knob to [MAX.] gradually. The vibration shaker is started to excite.



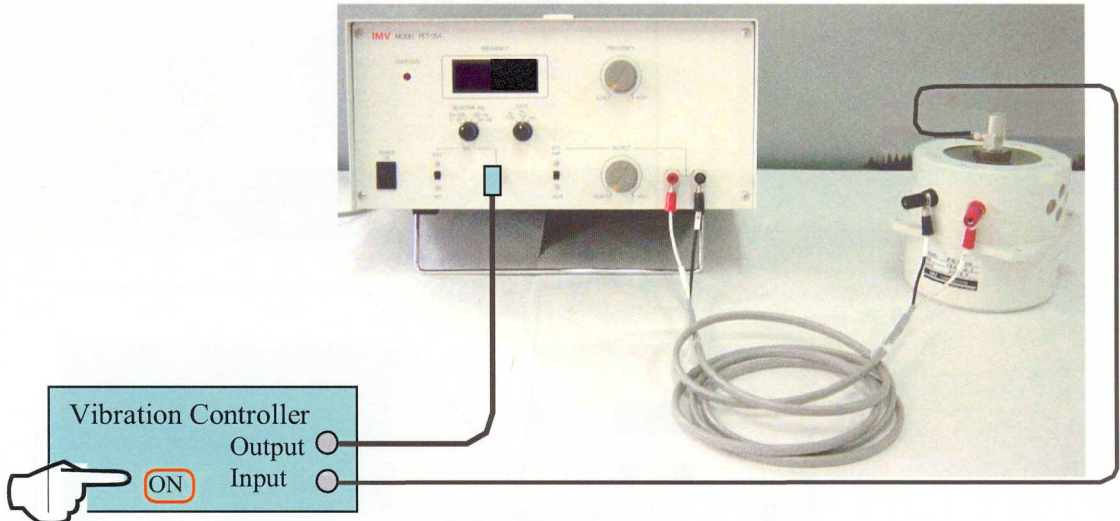
! CAUTION

- (1) Do not change the frequency abruptly.
- (2) Do not put the material on Power Amplifier. Cooling of Power Amplifier is disturbed.
- (3) Be sure to check the connection of cables, fastened bolts and nuts before the excitation.

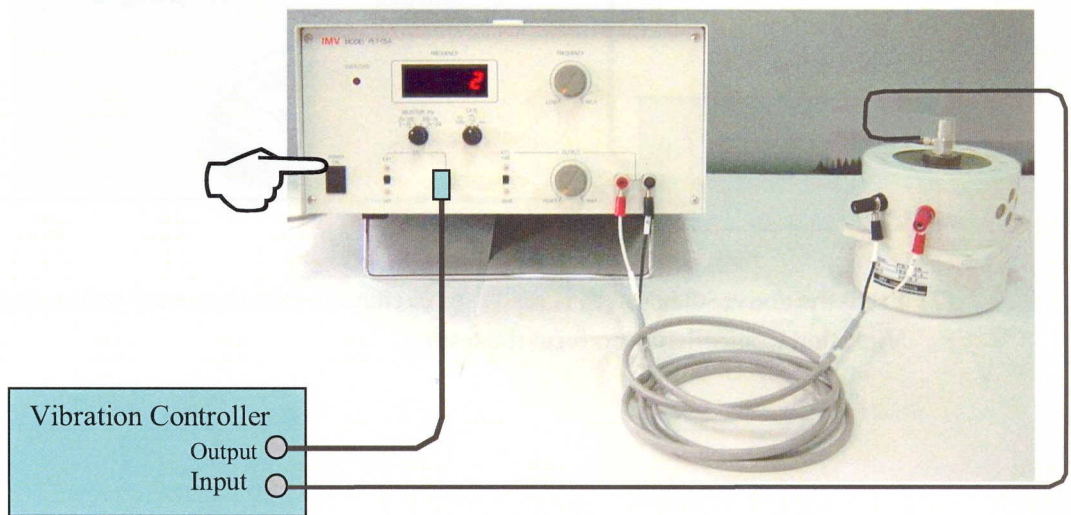
[PET-01-0A / PET-05-05A]

<Using the external signal generator such as vibration controller>

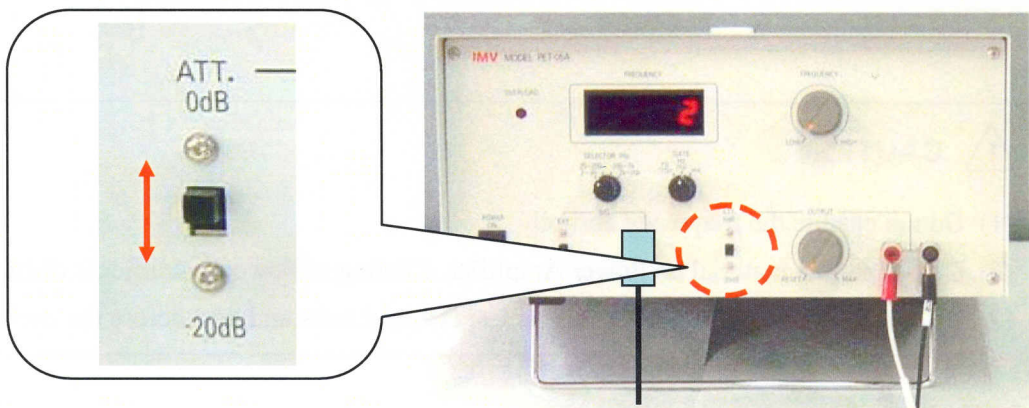
- (1) Check that the system is connected according to '4.1 PREPARATION, ■ Wiring'.
- (2) Turn ON the power of the external signal generator such as vibration controller.



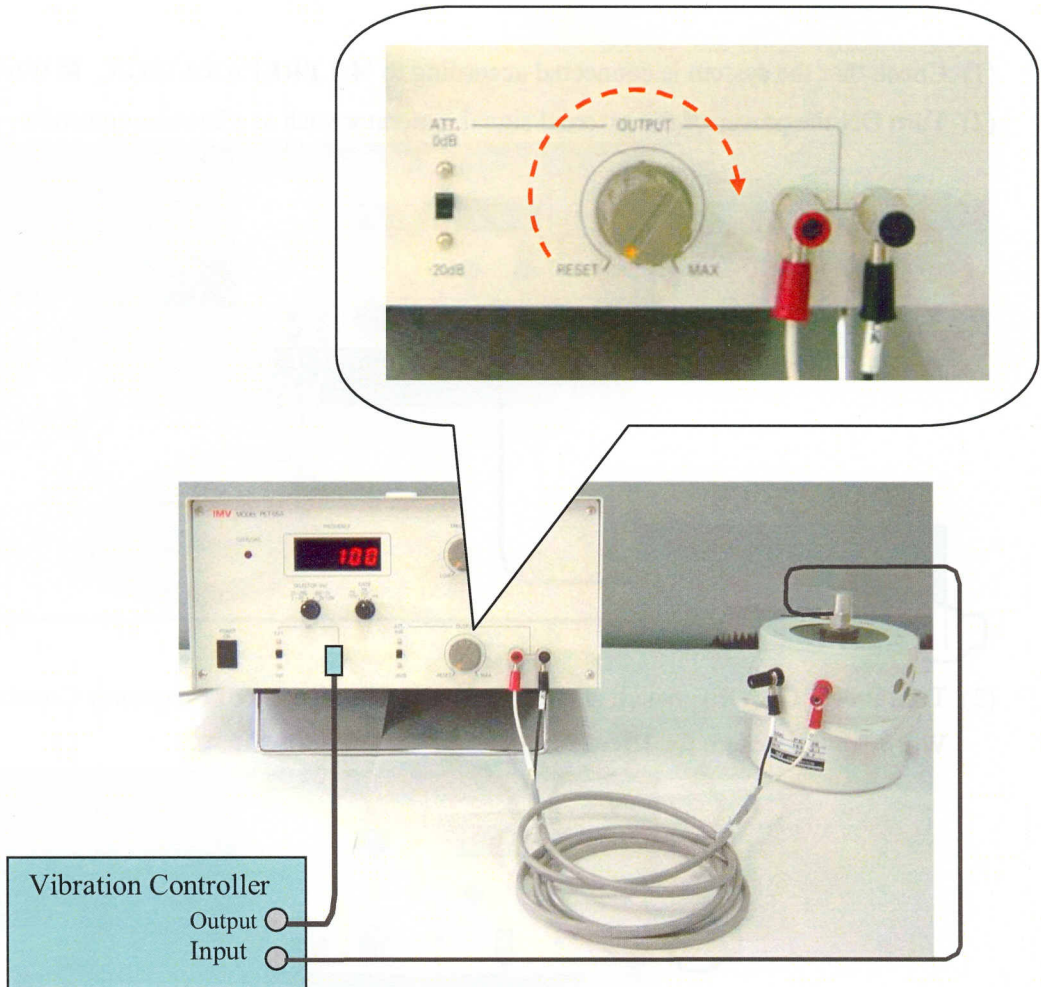
- (3) Turn Power ON/OFF switch at [POWER/ON]. The display of Frequency Counter is lit. Warm up the system for 10~15 minutes.



- (4) Check the output from external signal generator such as vibration controller is zero.
- (5) Set the Output Attenuator at a proper level according to the test level. When it is set to -20dB, the output level will be 1/10 of 0 dB.



- (6) Rotate the Output Knob to [MAX.] gradually. The vibration shaker is started to excite.



- (7) From the above, the system is ready for excitation. Please operate your using Vibration Controller to perform the testing.

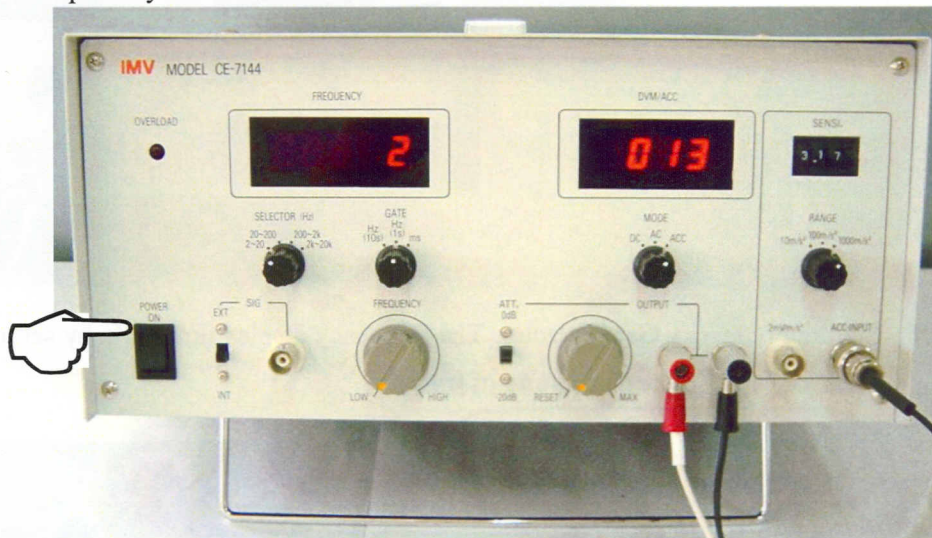
CAUTION

- (1) Do not change the frequency abruptly.
- (2) Do not put the material on Power Amplifier. Cooling of Power Amplifier is disturbed.
- (3) Be sure to check the connection of cables, fastened bolts and nuts before the excitation.

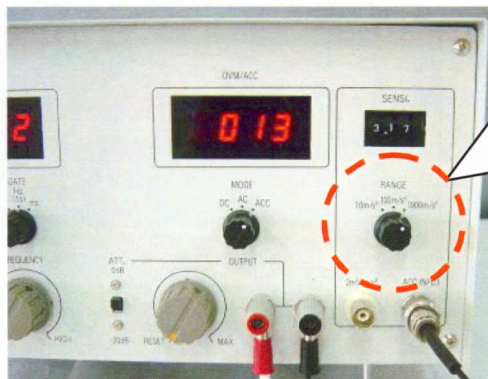
[PET-01-0AM / PET-05-05AM]

<Using the oscillator attached as standard>

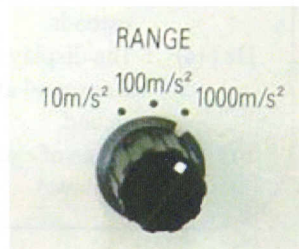
- (1) Check that the system is connected according to '4.1 PREPARATION, ■ Wiring'.
- (2) Turn Power ON/OFF switch at [POWER/ON]. The display of Frequency Counter is lit. Worm up the system for 10~15 minutes.



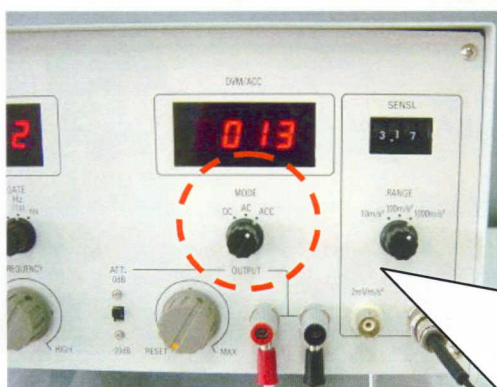
- (3) Set the Vibration Level Range Selector.



Range of acceleration signal to be measured is set.



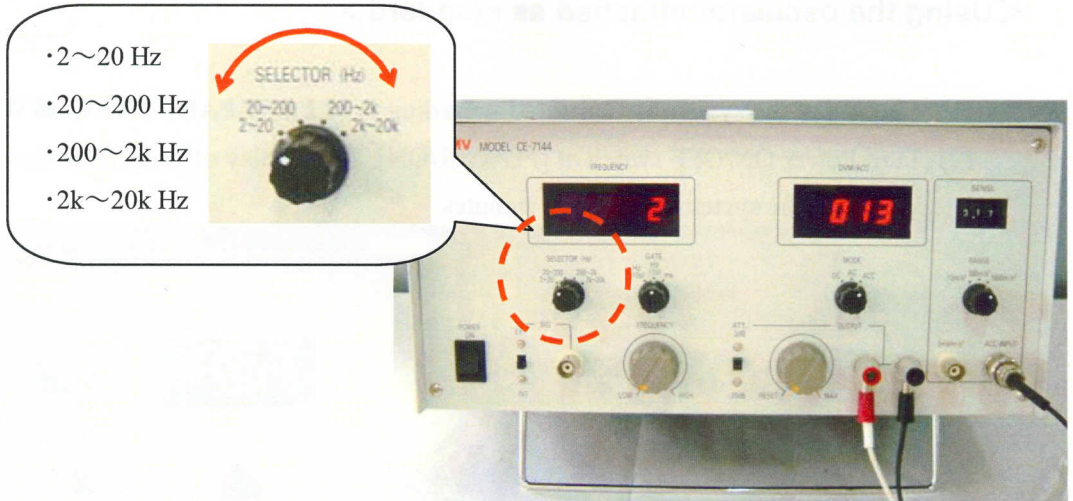
- (4) When the attached Vibrometer unit is used, set the Vibrometer/Voltmeter Selector to ACC.



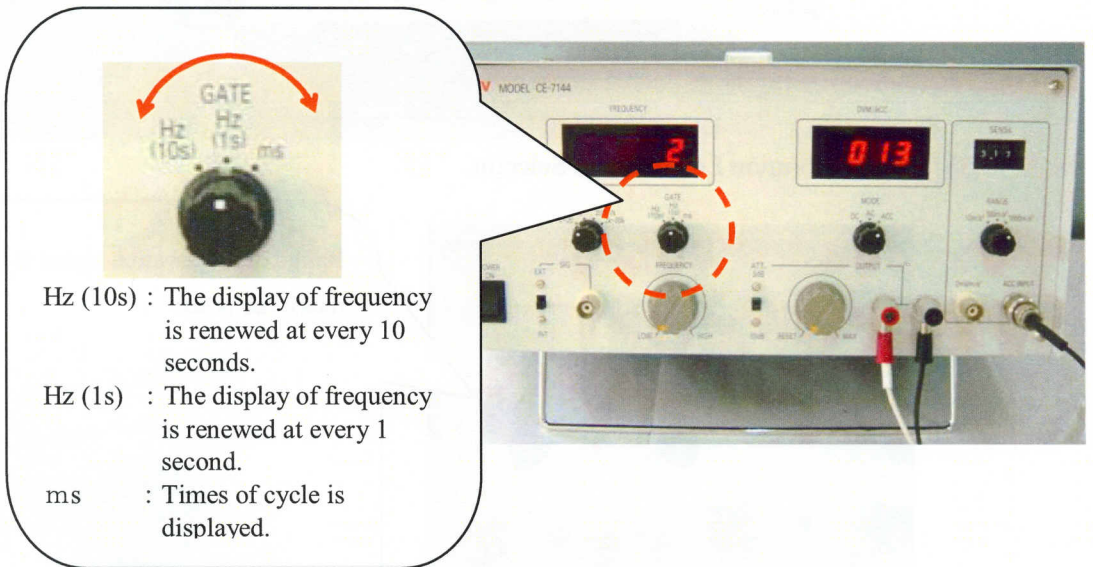
DC : Direct voltage signal is measured.
 AC : Alternating voltage signal is measured.
 ACC : Acceleration vibration is measured.



(5) Set the Frequency Range Selector to a proper range for test contents.

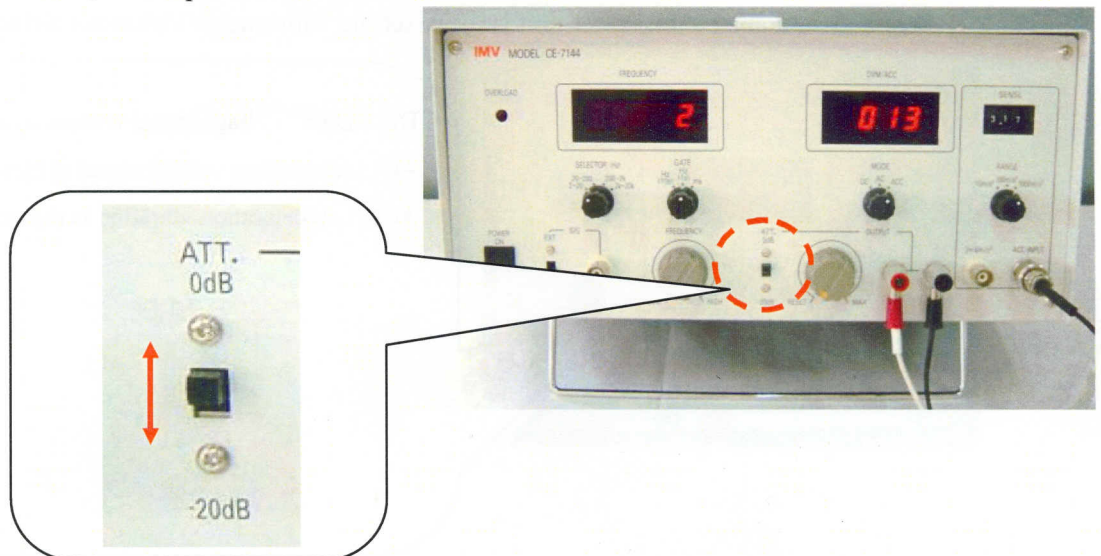


(6) Set the Frequency Gate Selector. The frequency display unit is Hz by setting of (1s) or (10s), times of cycle (msec) by setting of [ms].

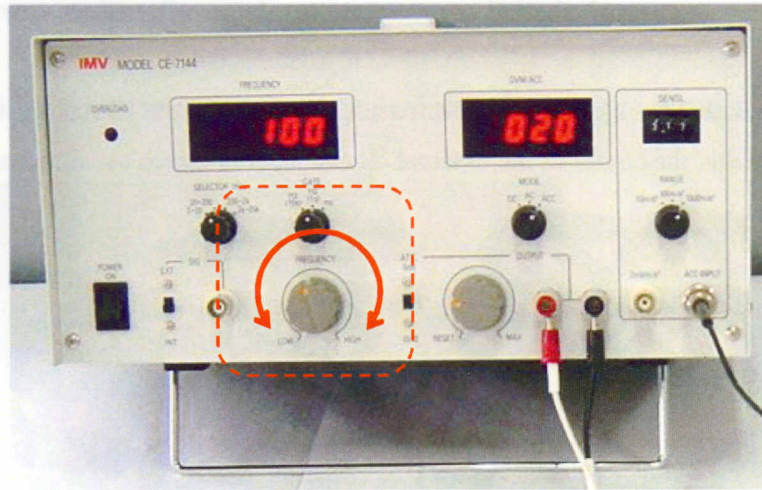


Hz (10s) : The display of frequency is renewed at every 10 seconds.
 Hz (1s) : The display of frequency is renewed at every 1 second.
 ms : Times of cycle is displayed.

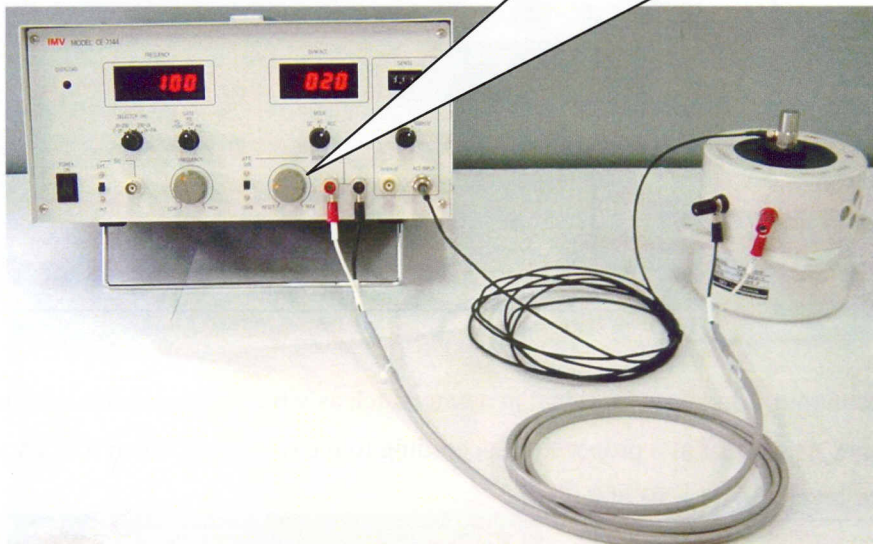
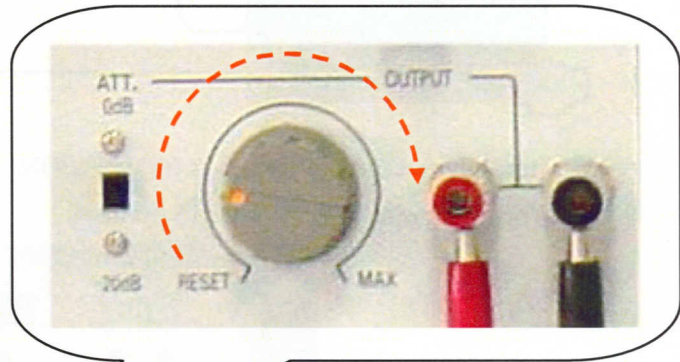
(7) Set the Output Attenuator at a proper level according to the test level. When it is set to -20dB, the output level will be 1/10 of 0 dB.



(8) Set the frequency of Oscillator by rotating the knob of Frequency Dial.



(9) Rotate the Output Knob to [MAX.] gradually. The vibration shaker is started to excite.



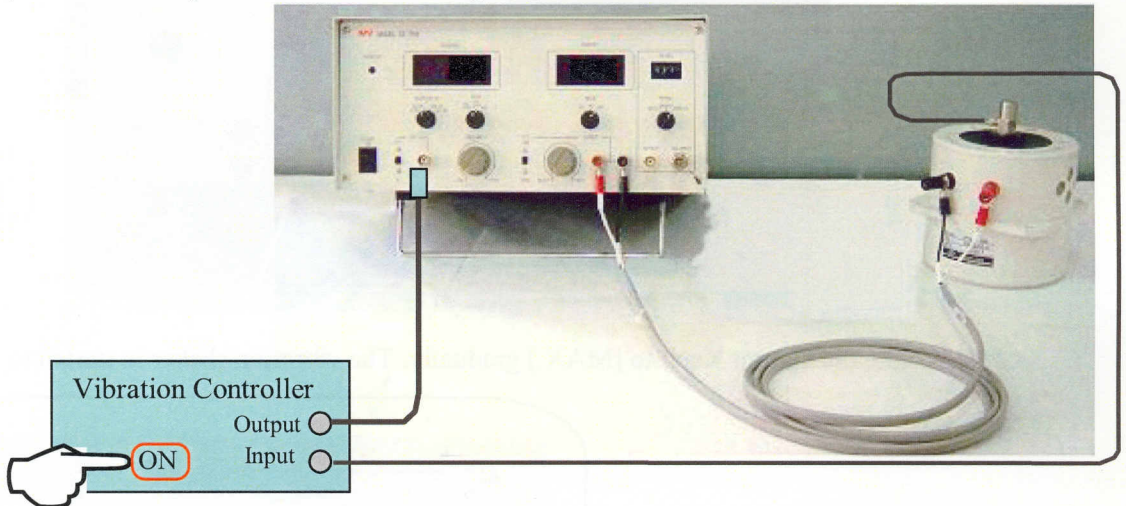
! CAUTION

- (1) Do not change the frequency abruptly.
- (2) Do not put the material on Power Amplifier. Cooling of Power Amplifier is disturbed.
- (3) Be sure to check the connection of cables, fastened bolts and nuts before the excitation.

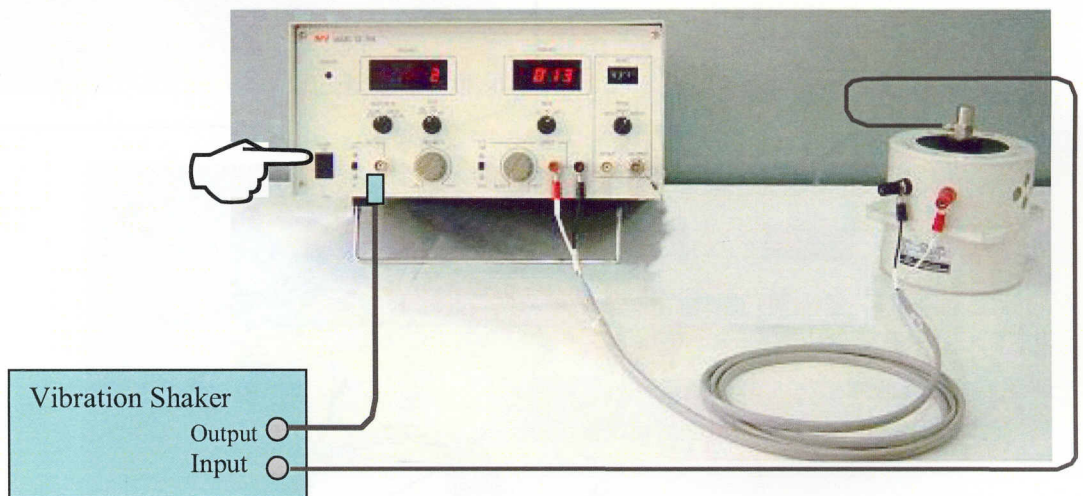
[PET-01-0AM / PET-05-05AM]

<Using the external signal generator such as vibration controller>

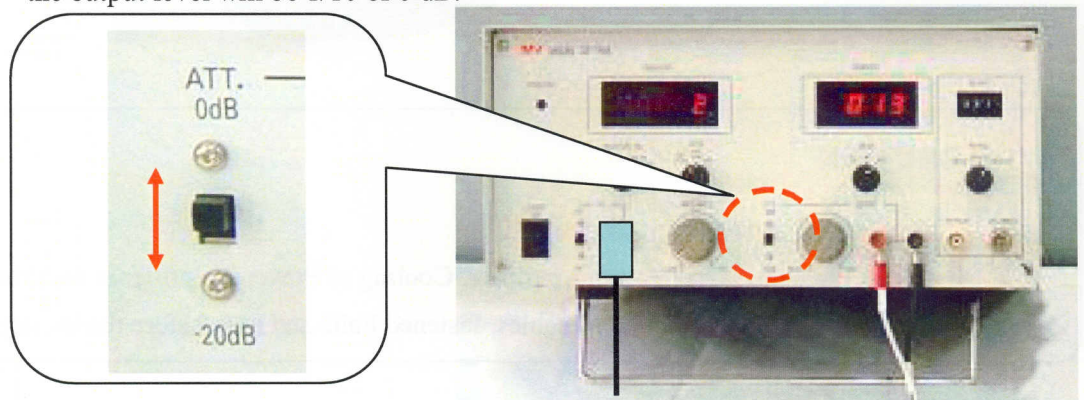
- (1) Check that the system is connected according to '4.1 PREPARATION, ■ Wiring'.
- (2) Turn ON the power of the external signal generator such as vibration controller.



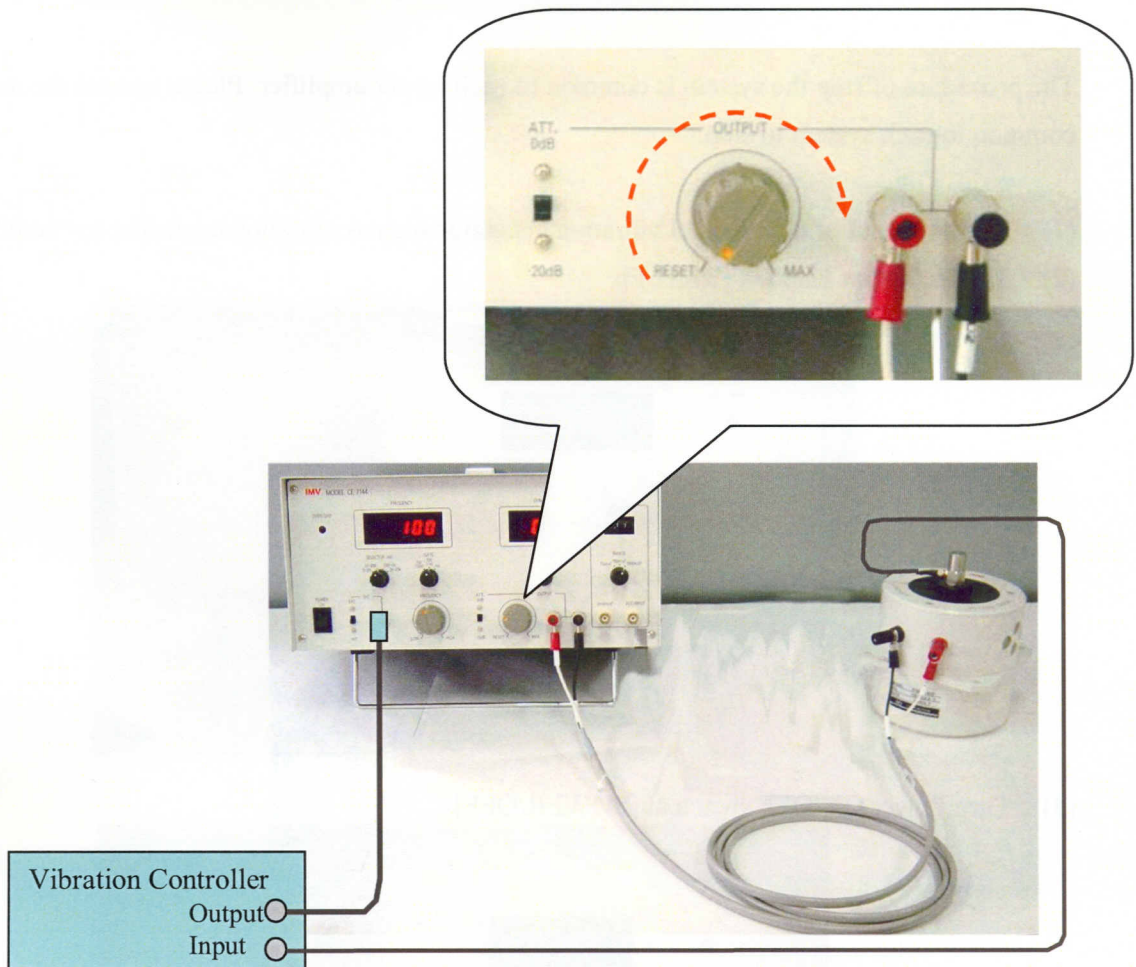
- (3) Turn Power ON/OFF switch at [POWER/ON]. The display of Frequency Counter is lit. Warm up the system for 10~15 minutes.



- (4) Check the output from external signal generator such as vibration controller is zero.
- (5) Set Output Attenuator at a proper level according to the test level. When it is set to -20dB, the output level will be 1/10 of 0 dB.



(6) Rotate Output Knob to [MAX.] gradually. The vibration shaker is started to excite.



(7) From the above, the system is ready for excitation. Please operate your using Vibration Controller to perform the testing.

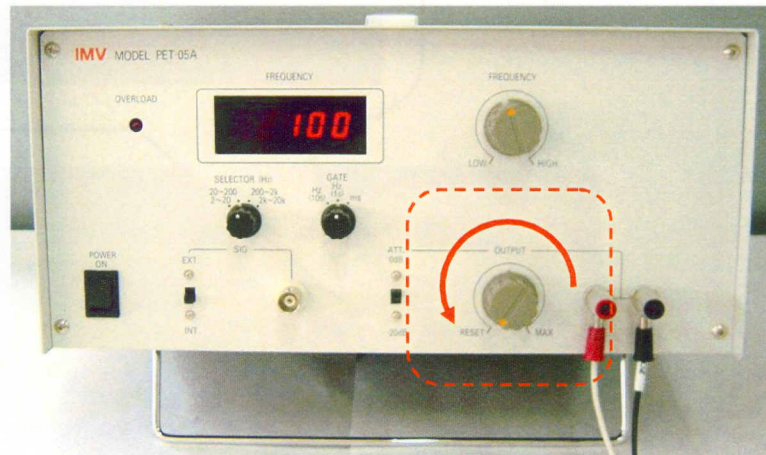
! CAUTION

- (1) Do not change the frequency abruptly.
- (2) Do not put the material on Power Amplifier. Cooling of Power Amplifier is disturbed.
- (3) Be sure to check the connection of cables, fastened bolts and nuts before the excitation.

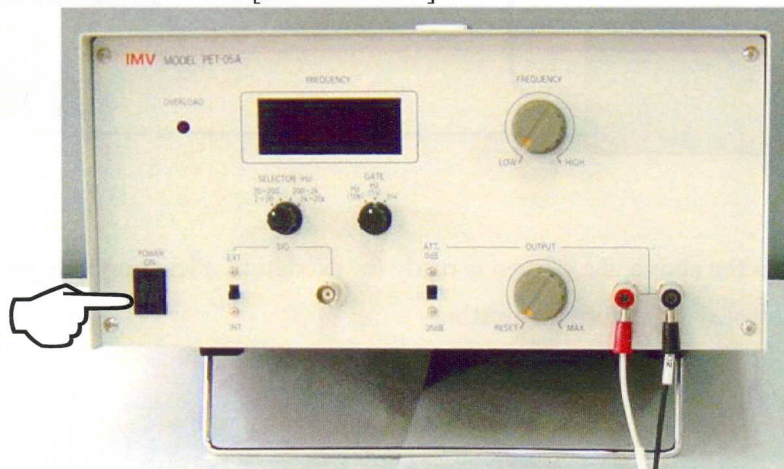
4.3 STOP

The procedure of stop the system is common to each power amplifier. Please operate the item common to each system to stop.

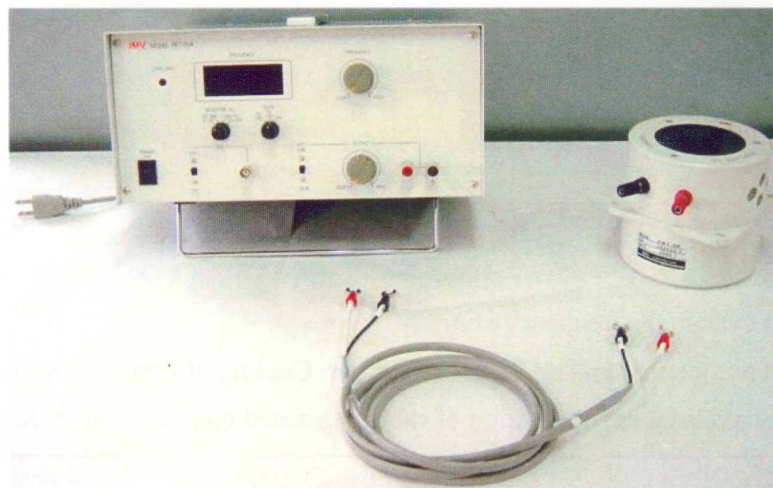
- (1) Set the output of the external vibration generator such as vibration controller to “zero”.
- (2) Set the Output Knob at [RESET].



- (3) Turn Power ON/OFF switch at [POWER/OFF].



- (4) Pull out the power strip from the 100V AV plug.
- (5) Detach the external cable from Vibration Shaker and Power Amplifier.



4.4 REMARKS

■ Limitation of Maximum Acceleration

The maximum acceleration is limited by the mass of specimen and fixture.

Please calculate as below to estimate the allowable maximum acceleration level.

$$a = \frac{F}{m + M}$$

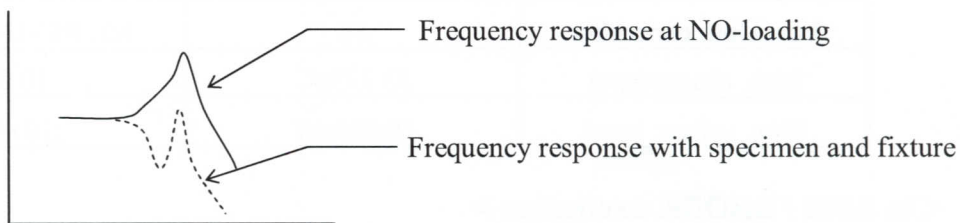
F : Rated Sine Force [N]
 A : Allowable maximum acceleration level [m/s²]
 m : Mass of Armature [kg]
 M : Total Mass of specimen and fixture [kg]

The value of F and m varies according to the system. The allowable maximum acceleration level is obtained as below ;

SYSTEM MODEL	PET-01-0A	PET-01-0AM	PET-05-0A	PET-05-0AM
F : Rated Sine Force [N]	9.8	9.8	49	49
m : Mass of Armature [kg]	0.02	0.02	0.15	0.15
a : Allowable maximum acceleration level [m/s ²]	$\frac{9.8}{0.02+M}$	$\frac{9.8}{0.02+M}$	$\frac{49}{0.15+M}$	$\frac{49}{0.15+M}$
Total mass of specimen and fixture is 2 [kg]	$\frac{9.8}{0.02+2}$ ≒ 4.9	$\frac{9.8}{0.02+2}$ ≒ 4.9	$\frac{49}{0.15+2}$ ≒ 22.8	$\frac{49}{0.15+2}$ ≒ 22.8

Usable Maximum Frequency

When specimen and/or fixture is attached to the armature, it may occur that the required acceleration level can not be reproduced within the usable frequency range because of resonance or anti-resonance of the attached specimen and / or fixture.



In such case, you should consider to change the mounting point of vibration control accelerometer, to change shape of the fixture, or to change attachment position of specimen on the fixture.



CAUTION

Testing operation should not be done over the maximum acceleration. Or, it may damage the system.

■ Limitation of Maximum Displacement

Under the vertical excitation with loading weight, the maximum displacement of this vibrator is reduced and limited as below.

In such case, the possible maximum displacement value : X (mmp-p) can be calculated from the following formula ;

$$X = L - \frac{2 \times 9.8 \times M}{K}$$

X : Possible Maximum Displacement [mmp-p]

L : Max. Displacement [mmp-p]

M : The loading weight [kg]

K : Stiffness of Armature Suspension System [N/m]

The value of L and K varies according to the system. Refer to the table as below ;

SYSTEM MODEL	PET-01-0A	PET-01-0AM	PET-05-0A	PET-05-0AM
L : Max. Displacement [mmp-p]	5	5	5	5
K : Stiffness of Armature Suspension System [kN/m]	9.8	9.8	15.6	15.6
X : Possible Maximum Displacement [mmp-p] When Total Mass of specimen and fixture is 2 [kg]	$5 - \frac{2 \times 9.8 \times 2}{9.8} = 1$	$5 - \frac{2 \times 9.8 \times 2}{9.8} = 1$	$5 - \frac{2 \times 9.8 \times 2}{15.6} = 2.4$	$5 - \frac{2 \times 9.8 \times 2}{15.6} = 2.4$

■ Limitation of Maximum Acceleration by Accelerometer Sensitivity

The maximum acceleration is limited by sensitivity of accelerometer to be used. The maximum charge input and maximum voltage input of controller vary depending on the types of controllers.

When exceeding this level, the controller stops the output. (The Vibration Test System is stopped.)

Vibration controller	F2	K2, RC-1120, SC-1000
Max. charge input	33 333pC	10 000pC
Max. voltage input	10 000mV	10 000mV

<In SINE / SHOCK excitation>

(1) Using the accelerometer having charge sensitivity : X [pC/(m/s²)] ([pC/G]), the limited acceleration is calculated as below; Gravity Unit

$$\left(\begin{array}{l} A : \text{Acceleration [m/s}^2\text{]} \quad \text{[G]} \\ X : \text{Charge sensitivity [pC/(m/s}^2\text{)]} \quad \text{[pC/G]} \end{array} \right)$$

Vibration controller	F2	K2, RC-1120, SC-1000
Limited acceleration	$A = \frac{33\,333}{X} [\text{m/s}^2] ([\text{G}])$	$A = \frac{10\,000}{X} [\text{m/s}^2] ([\text{G}])$

- (2) Using the accelerometer having voltage sensitivity : Y [mV/(m/s²)] ([mV/G]), the limited acceleration is calculated as below;

$$\left(\begin{array}{l} \text{A : Acceleration [m/s}^2\text{]} \\ \text{Y : Voltage sensitivity [mV/(m/s}^2\text{)]} \end{array} \begin{array}{l} \text{Gravity Unit} \\ \text{[G]} \\ \text{[mV/G]} \end{array} \right)$$

Vibration controller	F2	K2, RC-1120, SC-1000
Limited acceleration	$A = \frac{10\,000}{Y} [\text{m/s}^2] ([\text{G}])$	$A = \frac{10\,000}{Y} [\text{m/s}^2] ([\text{G}])$

- < Example 1 > Charge sensitivity : 5[pC/(m/s²)] (50[pC/G])

$$\left(\begin{array}{l} \text{A : Acceleration [m/s}^2\text{]} \\ \text{X : Charge sensitivity [pC/(m/s}^2\text{)]} \end{array} \begin{array}{l} \text{Gravity Unit} \\ \text{[G]} \\ \text{[pC/G]} \end{array} \right)$$

Vibration controller	F2	K2, RC-1120, SC-1000
Limited acceleration	$A = \frac{33\,333}{5} \div 6\,666 [\text{m/s}^2]$ (666[G])	$A = \frac{10\,000}{5} \div 2\,000 [\text{m/s}^2]$ (200[G])

Testing operation should not be done over the limited acceleration value for control in above.

<In RANDOM excitation>

- (1) Using the accelerometer of charge sensitivity : X [pC/(m/s²)] ([pC/G]), the limited acceleration is calculated as below. When the crest-factor considered statistical variation is 4, the peak level of four times of RMS level is output.

$$\left(\begin{array}{l} \text{B : Acceleration RMS value [m/s}^2\text{ rms]} \\ \text{X : Charge sensitivity [pC/(m/s}^2\text{)]} \end{array} \begin{array}{l} \text{Gravity Unit} \\ \left(\begin{array}{l} [\text{G rms}] \\ [\text{pC/G}] \end{array} \right) \end{array} \right)$$

Vibration controller	F2	K2, RC-1120, SC-1000
Limited acceleration	$B = \frac{33\,333}{4X} [\text{m/s}^2\text{ rms}]$ ([G rms])	$B = \frac{10\,000}{4X} [\text{m/s}^2\text{ rms}]$ ([G rms])

- (2) Using the accelerometer of voltage sensitivity : Y [mV/(m/s²)] ([mV/G]), the limited acceleration is calculated as below. When the crest-factor considered statistical variation is 4, the peak level of four times of RMS level is output.

$$\left(\begin{array}{l} \text{B : Acceleration RMS value [m/s}^2\text{ rms]} \\ \text{Y : Voltage sensitivity [mV/(m/s}^2\text{)]} \end{array} \begin{array}{l} \text{Gravity Unit} \\ \left(\begin{array}{l} [\text{G rms}] \\ [\text{mV/G}] \end{array} \right) \end{array} \right)$$

4.5 OPTIONS

■ Dumper

The procedure of fitting damper is as below.

(1) Junk Ring



(2) Dumper



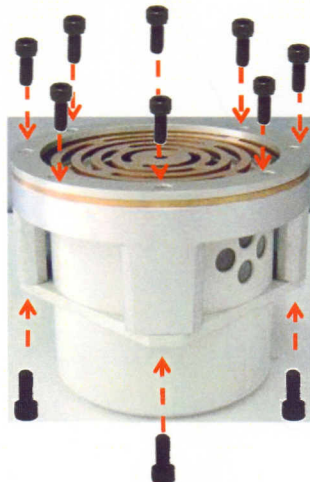
(3) Dumper Mounting Table



(4) Vibration Shaker



(5) Fit these items to the vibration shaker with bolts in order.



(6) Attach the vertical auxiliary table or the thrusting head.



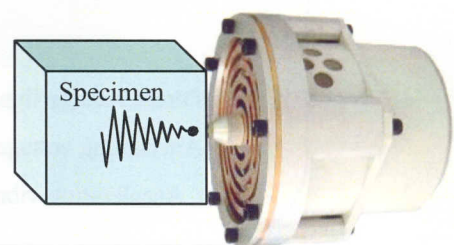
(7) [with Vertical Auxiliary Table]



[with Thrusting Head]



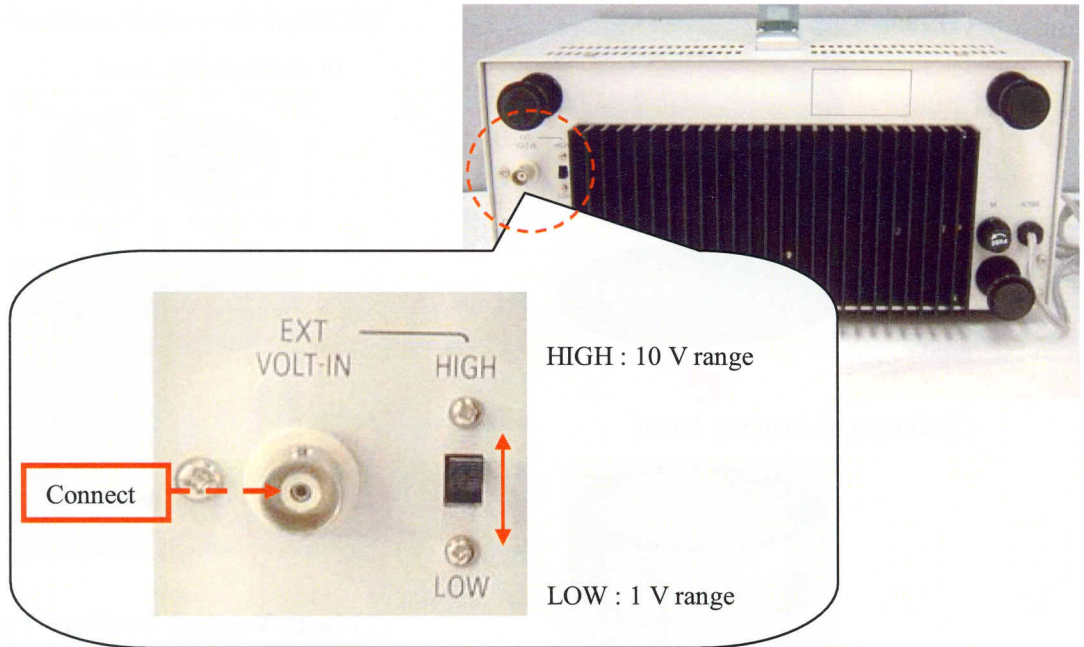
Push against the specimen.



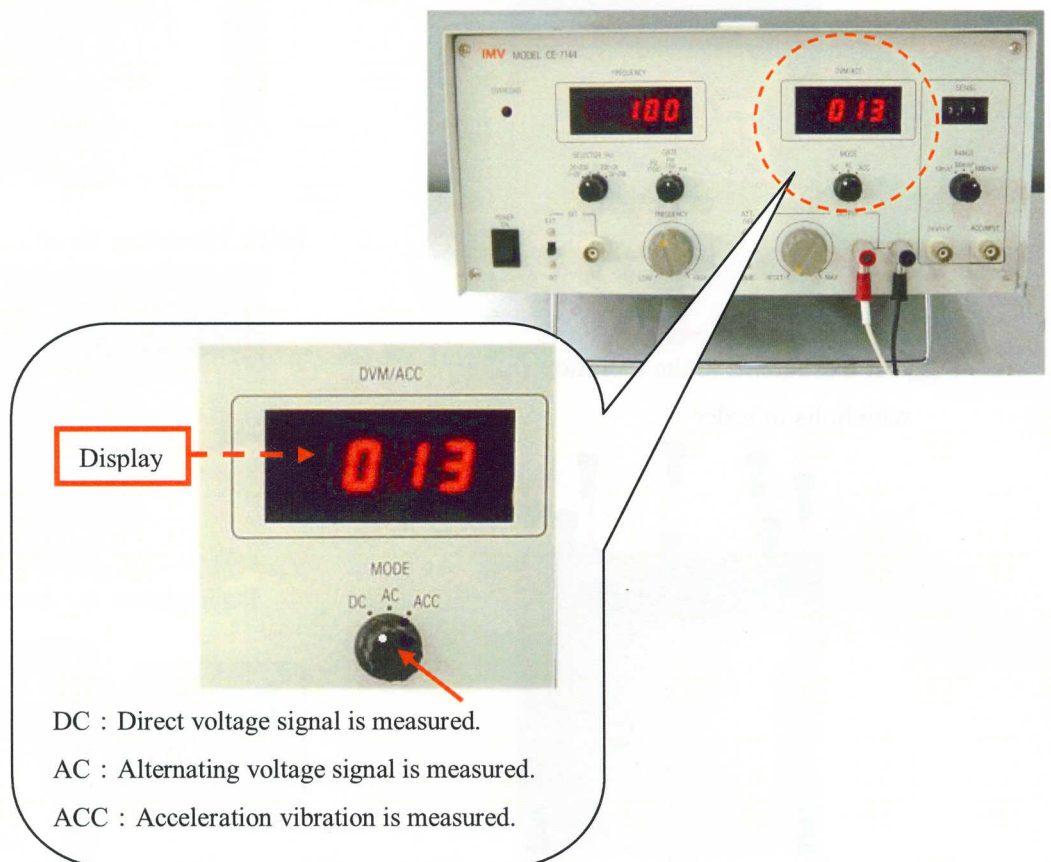
■ Using as Voltmeter

<Using PET-0AM / PET-05AM as Voltmeter>

- (1) Connect the external voltage input to Measuring Voltage Input Connector on rear panel of Power Amplifier. And set Measuring Voltage Selector to [HIGH] or [LOW].



- (2) Set Vibrometer / Voltmeter Selector on front panel of Power Amplifier to AC or DC. (Do not select ACC.) The measured voltage is displayed.



5. MAINTENANCE

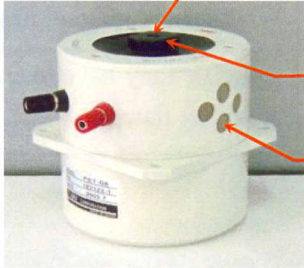
To use the Vibration testing system longer and more safely, please check the following items when you carry out pre-check working before testing.

5.1 DAILY CHECK

Please check the following items of each equipment.


■ Vibration Shaker

Please give your call to IMV or our Sales Agent if you can be aware of any abnormal situations in the vibration testing system.

Item		Check
 <p>Vibration Shaker</p>	Specimen Mounting Screw Bush	Whether each bush has damage.
	Vibration Table	Whether there is any metal powder, dust or oil.
	Cooling Air Inlet	Whether there is any dust or trash for air flow.
	Acoustic sound by excitation	Whether you can listen some unusual sound during the excitation.



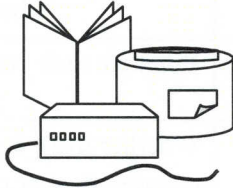
■ Power Amplifier

Please give your call to IMV or our Sales Agent if you can be aware of any abnormal situations in the vibration testing system.

Item		Check
 <p>Power Amplifier</p>	Appearance and motion	Whether there are no abnormal phenomena at display, operation switch and buttons.

■ Accessories

Please give your call to IMV or our Sales Agent if you can be aware of any abnormal situation in the vibration testing system.

Item		Check
 <p>Cables</p>	Drive Cable	Whether there is any broken part on covering. Whether there is any broken cable.
 <p>Accelerometer</p>	Accelerometer	
 <p>Others</p>	Low Noise Cable	Whether there is any broken part on covering. Whether there is any broken cable.
	Caution or Notice Labels	Whether there is any dirty or damaged part on each seal.
	Instruction Manual	Whether the manual has been lost.
	Bolts, Nuts and Screws	Whether they have been loosen or have any damage.

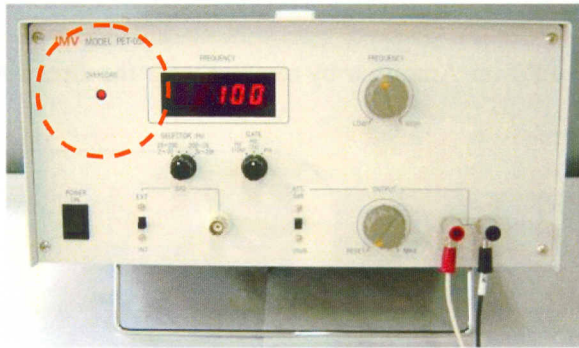
5.2 SAFETY FUNCTION

When the fault occurs in the system, the protective circuit of Power amplifier operates. It makes turn <POWER> switch to 'OFF' and stop excitation automatically.

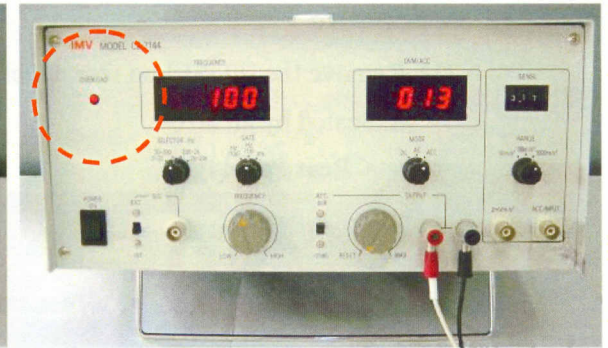
■ Protective Circuit

- (1) When unusual phenomenon occur in the circuit, Protective Circuit of the system is executed and Over Load lamp of Power Amplifier is lit in red.

[PET-0A/PET-05A]

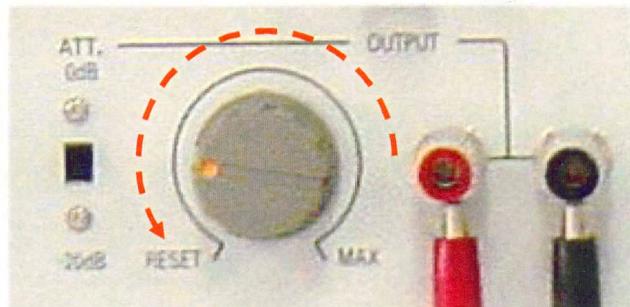


[PET-0AM/PET-05AM]



■ Reset


- (1) Stop the output from the signal generating system such as vibration controller.
- (2) Set Output Knob to [RESET]. (Over Load lamp goes out with a clicking sound.)



- (3) Push [POWER-ON] switch to restart the test. Refer to 4.2 OPERATION.

5.3 REPLACE THE FUSE

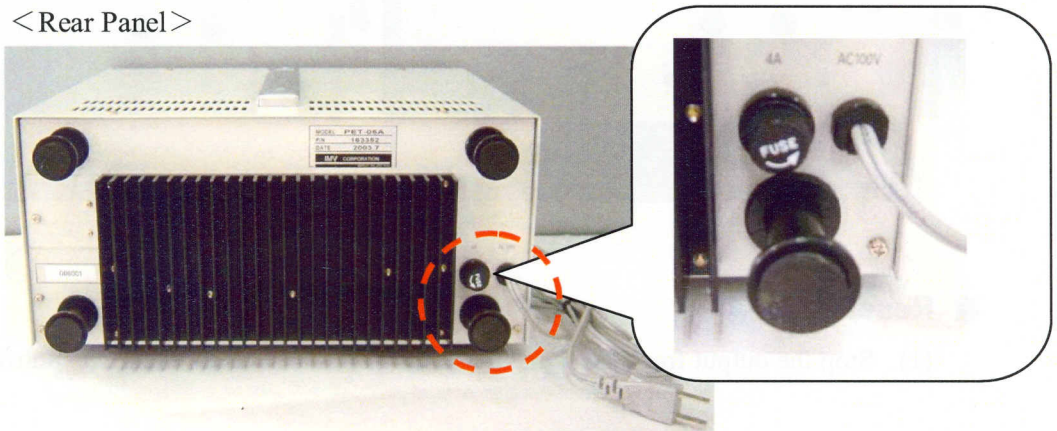
Replace the fuse if it is necessary. The procedure is shown as below.

Name	Place / Number
Fuse 	Inside of Power Amplifier. (Refer to '3.2 COMPOSITION OF THE SYSTEM')

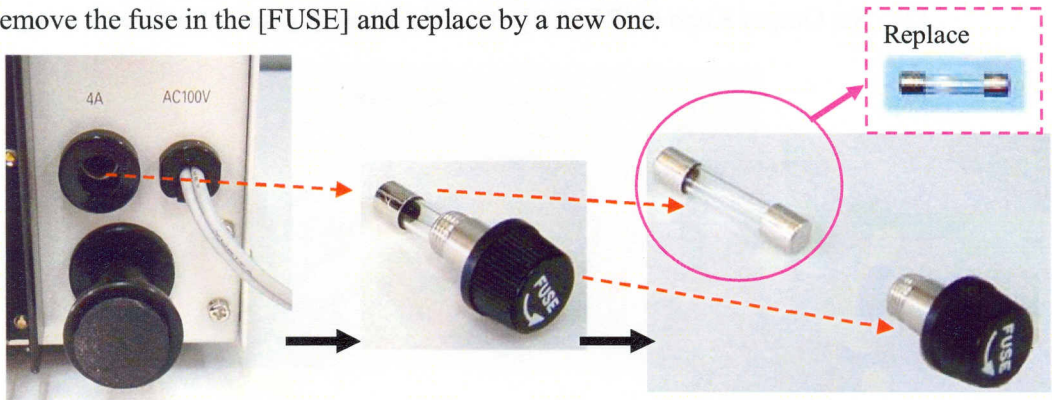
■ Procedure

- (1) Remove the [FUSE] on rear panel of Power Amplifier by rotating it for the direction indicated by an arrow.

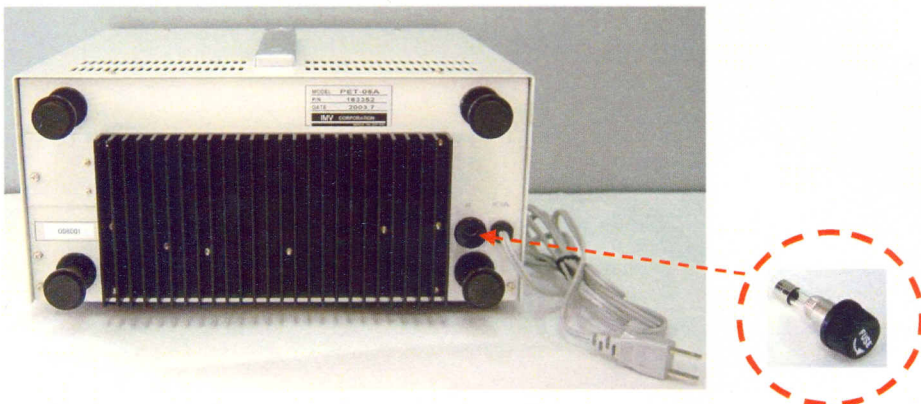
< Rear Panel >



- (2) Remove the fuse in the [FUSE] and replace by a new one.



- (3) Attach the [FUSE] on rear panel of Power Amplifier.



6. OTHER OPERATIONS

This clause describes that the purpose and the use of accessories for the system.

6.1 SIMPLE CHECK METHOD TO CONFIRM THE SENSITIVITY OF ACCELEROMETER

■ Purpose

The sensitivity of accelerometer may change by secular change or any dropping shock. The following method is used to check the sensitivity of Accelerometer periodically. However, this check method should be performed as a simple check method by customer. (Please contact with IMV as for the calibration according to your National Standard.)

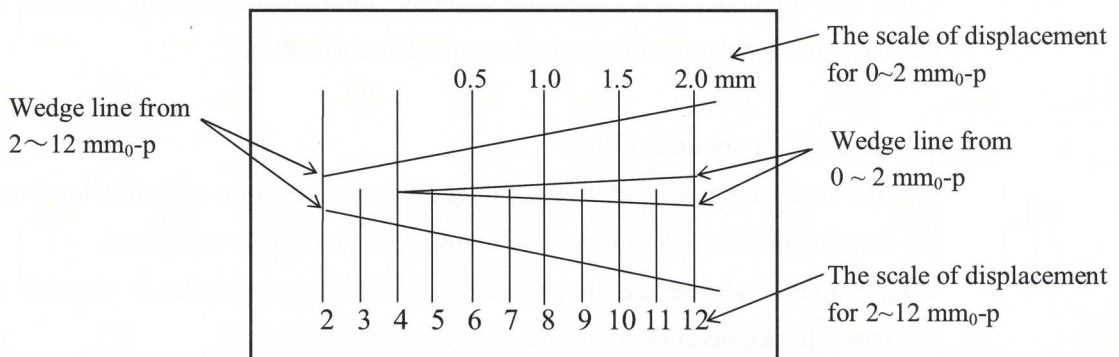
■ Wedge Scale Seal

You can observe the displacement under sine excitation with 'Wedge scale seal' as shown in the following figure.

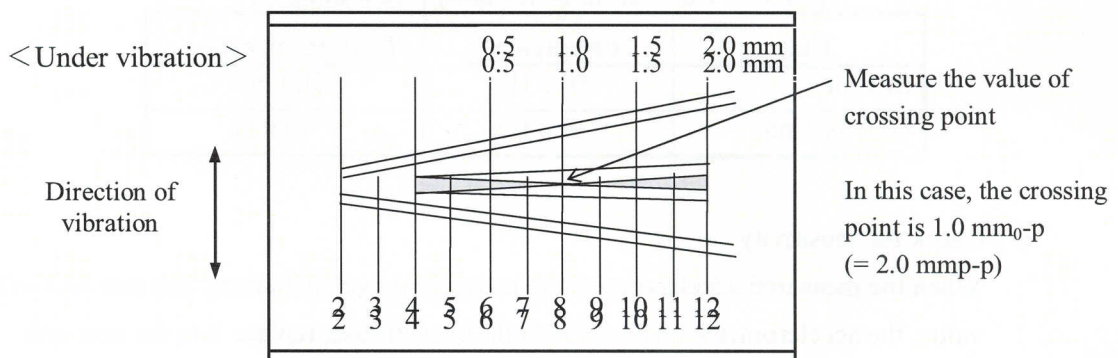
(1) Scale

The displacement indicated on the wedge scale seal is scaled as 'single amplitude' [$\text{mm}_0\text{-p}$] (millimeter in 'zero to peak' amplitude).

If you need double amplitude' [mmp-p] (a full amplitude in 'peak to peak') value, please calculate the acquired value by twice.



(2) Measurement (By using your afterimage of vibration)

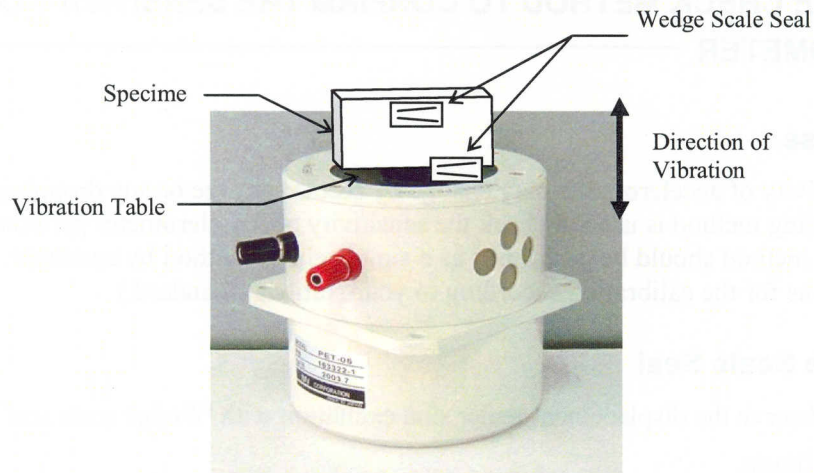


* The accuracy of measured data will be about 5 % order.

■ Check Method

(1) Attachment of the wedge scale seal.

Fit this adhesive wedge scale seal on the specimen or fixture to be the same direction between the direction of vibration and the measurement direction on the seal.



(2) Measurement of displacement under excitation

(a) In case of SI unit system

Run the sine excitation at 50.3 Hz of frequency and adjust the vibration level to obtain the crossing point at 1.0 mm_{0-p} ($=2.0 \text{ mmp-p}$) displacement on the seal.

(Refer to the previous page (2) Measurement.)

Then, read the indicated acceleration value by vibration controller or vibration meter. In this case, the acceleration at the seal is equivalent to 100 m/s^2 .

(b) In case of Gravity unit system

Run the sine excitation at 49.8 Hz of frequency and adjust the vibration level to obtain the crossing point at 1.0 mm_{0-p} ($=2.0 \text{ mmp-p}$) displacement on the seal.

Then, read the indicated acceleration value by vibration controller or vibration meter. In this case, the acceleration at the seal is equivalent to 10 G.

[Simple calibration at 1.0 mm_{0-p} (2.0 mmp-p)]

Unit	Frequency	True acceleration
SI Unit	50.3 Hz	100 m/s^2
Gravity Unit	49.8 Hz	10.0 G

(3) Check for sensitivity

When the measured acceleration value is deviated over 10% from 'the true acceleration' value, the accelerometer seems to be fault. In such case, replace it to the new one.

6.2 CONVERSION TABLE (SINE VIBRATION CHART)

■ Purpose

When you derive acceleration, velocity, displacement ('zero-peak' value) and frequency in sine vibration, you can use the conversion table (Sine Vibration Chart) as attached. If any 2 parameters among acceleration, velocity, displacement ('zero-peak') and frequency in sine vibration is known, you can derive the other 2 parameters from the conversion table.

■ Conversion Table

Use the conversion table to obtain each value. However, note that the displacement quantity is a single displacement [mm0-p].

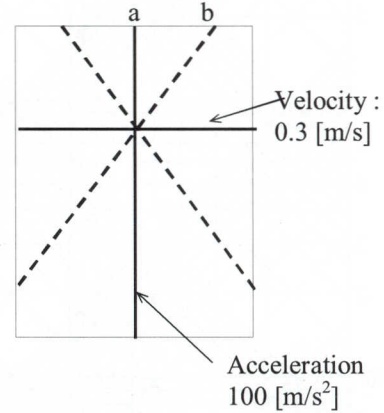
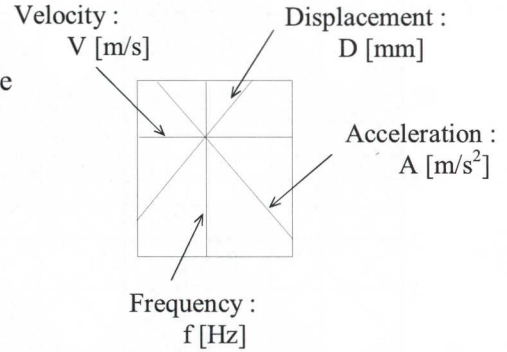
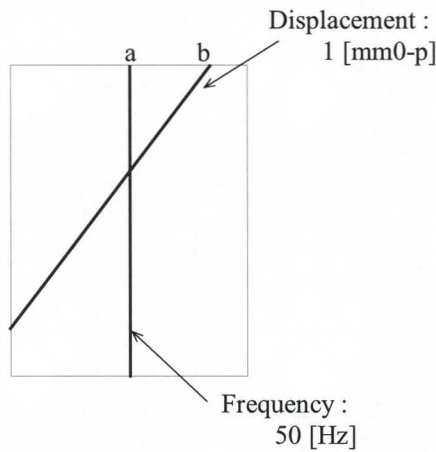
<Example>

Frequency : $f = 50$ [Hz]

Displacement : $D = 1$ [mm0-p]

Acceleration A and velocity V values will be derived ;

- (1) Draw a line 'a' of frequency 50Hz and a line 'b' of displacement 1 [mmp-p]
- (2) Read the velocity value on velocity axis from the crossing point of the line 'a' and 'b'. In this example, the values become as acceleration 100 [m/s^2] and d velocity 0.3 [m/s]



<Calculation>

The conversion table gives approximate values only. Please calculate the accurate values by using the following formulas if you need them.

$$\text{Velocity } V = \frac{2\pi f}{1000} D$$

A : Acceleration [m/s^2]

$$\text{Acceleration } A = \frac{(2\pi f)^2}{1000} D$$

V : Velocity [m/s]

D : Displacement [mm0-p]

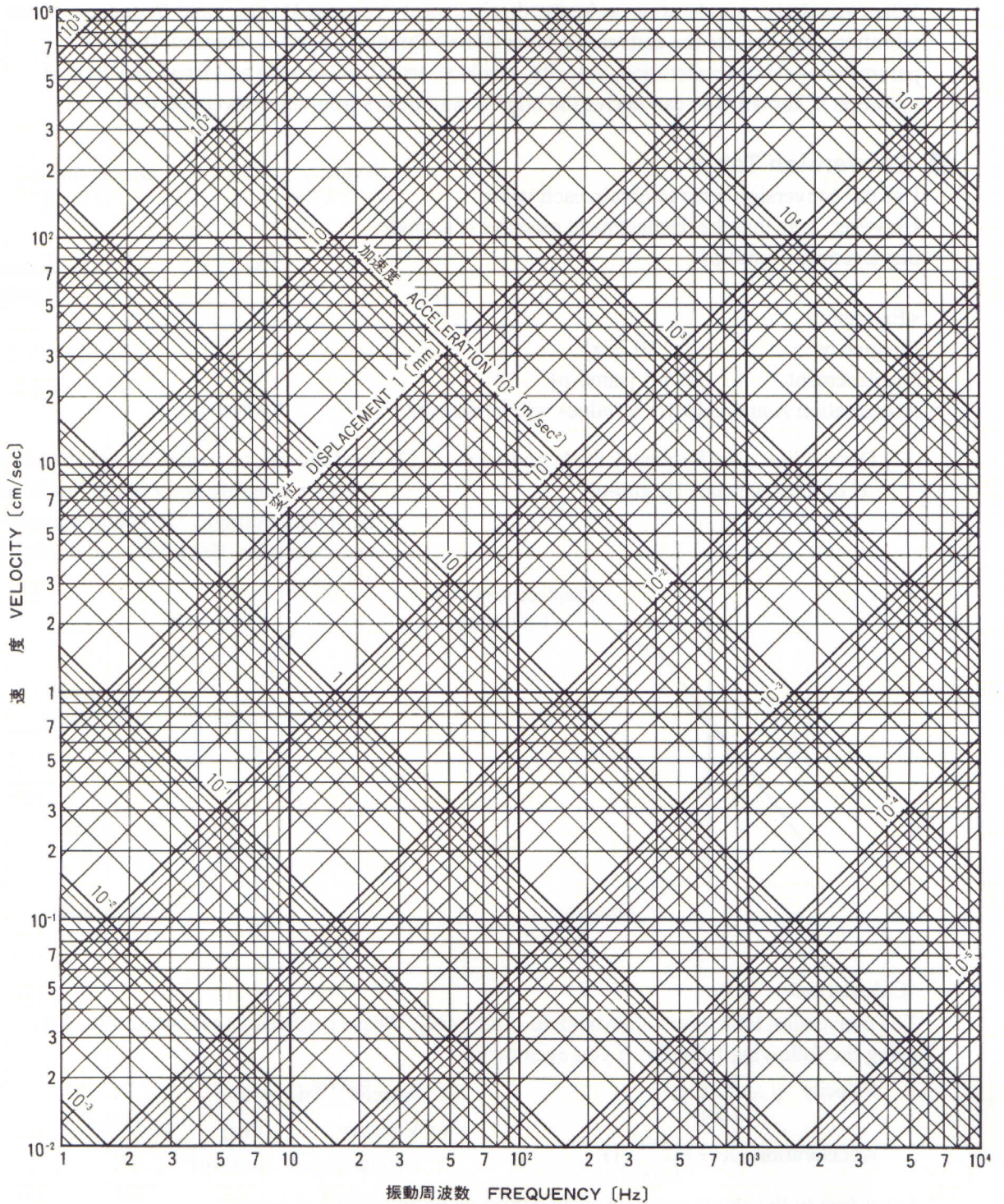
According to the above example, each value can be calculated as below ;

$$V = \frac{2 \times \pi \times 50 \times 1}{1000} = 0.314 \text{ [m/s]}$$

$$A = \frac{(2 \times \pi \times 50)^2 \times 1}{1000} = 98.7 \text{ [m/s}^2\text{]}$$

SINE VIBRATION CHART

CONVERSION TABLE



Displacement $D = d$ [mm]

Velocity $V = \frac{2\pi f d}{10}$ [cm/sec]

Acceleration $A = \frac{(2\pi f d)^2}{1000} d$ [m/sec²]

f : Frequency [Hz]

Note : D, V, A are Single Amplitude.

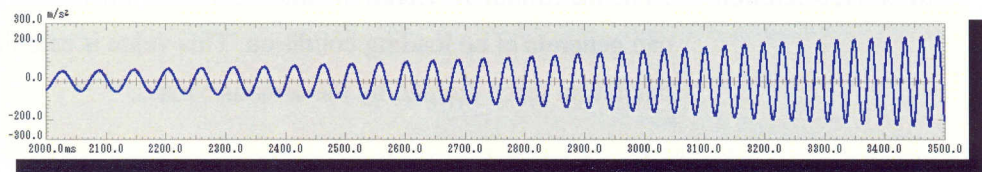
Example

- 1) When $f = 50$ Hz, $D = 1$ mm,
 $V = 31$ cm/sec, $A = 99$ m/sec²
- 2) When $f = 100$ Hz, $V = 100$ cm/sec,
 $D = 1.6$ mm, $A = 630$ m/sec²
- 3) When $f = 600$ Hz, $A = 60$ m/sec²,
 $D = 0.0042$ mm (4.2μ m), $V = 1.6$ cm/sec

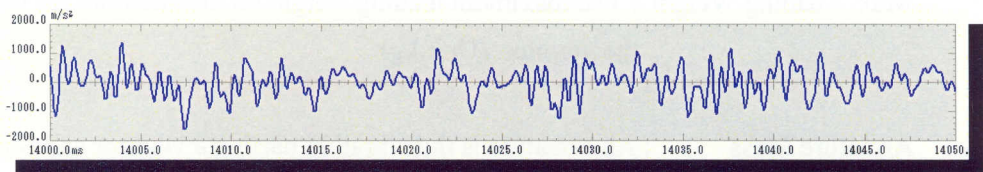
7. GLOSSARY

- Frequency Range** : The frequency range that the manufacturer (maker) of vibration test system defines the rated force, the maximum acceleration, the maximum velocity and the maximum displacement of the system.
- Rated Force** : The force that the vibration test system can generate. (Unit:kN) The force is defined as 'peak value' in case of SINE vibration and 'RMS value' (Root Mean Square) in case of RANDOM vibration.
- Max. Acceleration** : The maximum acceleration value (Unit:m/s²) that the vibration test system can generate at no loading condition. This value is calculated by the rated excitation force divided by the armature mass.
- Max. Velocity** : The maximum velocity value (Unit:m/s) that the vibration test system can generate.
- Max. Displacement** : The maximum displacement value (Unit:mm-p) that the vibration test system can generate. This value is limited by the allowable mechanical stroke of the vibrator's armature and usually described in double amplitude (peak-to-peak) value.
- Max. Loading Weight** : The maximum loading weight on the armature (or the vibration table) of the vibrator. (Unit:kg)
- Armature Mass** : An armature is the vibration parting a vibrator and is assembled of 'Vibration table' that specimens or fixtures are mounted, and 'Drive coil'. When the rated force is the same, the smaller mass armature vibration systems the larger acceleration can be tested.
- Allowable Overturning Moment** : The eccentricity (off-centered) moment value that the guidance system for the vibration table allows.
- Stiffness of Armature Suspension System** : Stiffness of suspension system when the mass is added on the armature in vertical direction. (Unit : kN/m)
- Maximum Performance Curve** : The graph having 'Horizontal axis – Frequency' and 'Vertical axis – Acceleration' expresses the maximum performance of vibration test (sine excitation without loading).

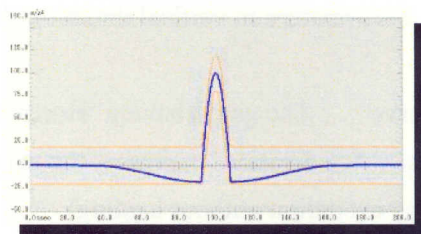
SINE Vibration Test : The two type test methods are done ; the one is SWEEP (Frequency Sweep or Swept SINE) test, that changes the excitation frequency continuously according to the frequency sweep method specified in the test, and the other is the fixed excitation frequency test. SINE vibration tests are performed for ordinal industrial standard vibration tests including measurement of dynamic motion characteristics of specimens, such as in JIS or IEC. RESONANCE DWELL test, that performs measurement and tracking of change of resonance frequency of the specimen automatically and that performs the SINE vibration durability test at the changed new resonance frequency, is also done. (JIS C 0040, IEC 68-2-6, etc.)



RANDOM Vibration Test : Real vibration is not a simple or periodic vibration waveform, like SINE vibration. Rather, real vibration waveform is of a random or transient shock waveform, including many vibration spectra. In SINE vibration tests, only the one frequency resonance of specimens can be excited. In RANDOM vibration tests, specimens are subjected to vibration energy spectra in a wide frequency range and excited at many response frequencies simultaneously. (JIS C 0036, IEC 68-2-64, etc.)



SHOCK Test : Like RANDOM vibration, SHOCK waveform has wide frequency range spectrum and enables to excite lots of resonance of the specimen simultaneously at many frequencies. In case of RANDOM vibration, the excitation gives so-called 'Gaussian Distribution' type vibration that is very close to long time real vibration waveform. In case of SHOCK tests using real transient waveform, outstanding field failure due to the stress can be reproduced on the testing system. (Shock of vehicle or handling, etc.) (JIS C 0041, IEC 68-2-27, etc.)



8. WARRANTY AND AFTER-SALES SERVICE

The following description must be read well.

■ Warranty

The system is shipped after severe testing and checking for the ability of the system that satisfies the rating value by IMV Corporation. The warranty of the system is described as below ;

(1) Guarantee period

Warranty period is 24 months at the maximum from the date when the equipment arrives at your port (no charge for after sales service). After expiry of the warranty period, repair or replace of a defective part is done for value.

(2) Range of guarantee

In case of defects / faults quality, material or workmanship within the above guarantee period will repair or replace such defective parts without any charge.

However, our guarantee shall not be applied even in the guarantee period for the damage due to accident , importers incorrect handling ,or wrong unreasonable operation of the system.

(3) Responsibility

The followings are out of our responsibility.

- 1) The accident during attachment / removing of specimen or fixture, or due to dropping of them to the system.
- 2) The accident due to customer's utilities for the system.
(Due to extend duct hose, Cooling water, power supply, Earth facility, or air conditioning, etc.)
- 3) The accident due to customer's operation out of the rated specifications.
- 4) The accident due to some corrosive environment by direct sunlight, water leakage and salty or some chemical atmosphere, or due to some particular environment.
- 5) The accident due to unreasonable operation or incorrect handling.
- 6) The accident due to customer's specimen.

Please call to IMV or our sales representative company in your country if you have any questions regarding the above.

■ Maintenance and Calibration

By performance of periodic Maintenance, Electro-dynamic vibration test systems can be used for a long time and with high-quality performance. The periodic maintenance and calibration workings are essential for the customers to keep the test systems under the original traceabilities. For this, IMV recommends the customers to perform periodic maintenance and calibration of the installed vibration test systems every year.

FACTRY TEST DATA

NAME VIBROPET
MODEL PET-01, ~~0A, 0AM~~
Inspection Data Sep. 2010
Serial No. 14101061-3

Authorized
<i>Good</i>

1. Quantity Check

Check the quantity of items that composing the system.

2. Visual Check

Check the each dimensions based on the dimensions mentioned in specifications and the painting.

3. Function Check

Check the following points.

~~3-1 Check that operation of each switch is normal.~~

~~3-2 Check that operation knob is fitted normally without looseness and play.~~

3-3 Check that plug socket is fitted normal and is matched with connected unit.

4. Performance Check

Check that the specifications of each items is as below and check the performance.

4-1 Max. Force Output Over 9.8 N (Measure at 100 Hz)

4-2 Max. Displacement Over 5 mm (Measure at 20 Hz)

~~4-3 The Operation of Over-current Protective Circuit~~

~~4-4 The lighting of Over-load Lamp~~

~~4-5 Distortion factor of Oscillator/Amplifier~~

~~Less than 0.5% (Measure at 20Hz, 200Hz, 2kHz)~~

FACTRY TEST DATA

NAME VIBROPET
MODEL P E T - 0 5 , 0 5 A , 0 5 A M
Inspection Data _____
Serial No. _____

Authorized

1. Quantity Check

Check the quantity of items that composing the system.

2. Visual Check

Check the each dimensions based on the dimensions mentioned in specifications and the painting.

3. Function Check

Check the following points.

3-1 Check that operation of each switch is normal.

3-2 Check that operation knob is fitted normally without looseness and play.

3-3 Check that plug socket is fitted normal and is matched with connected unit.

4. Performance Check

Check that the specifications of each items is as below and check the performance.

4-1 Max. Force Output Over 49 N (Measure at 100 Hz)

4-2 Max. Displacement Over 5 mm (Measure at 20 Hz)

4-3 The Operation of Over-current Protective Circuit

4-4 The lighting of Over-load Lamp

4-5 Distortion factor of Oscillator/Amplifier

Less than 0.5% (Measure at 20Hz, 200Hz, 2kHz)

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