



FREQUENCY INVERTER

FU-162A/162

INSTRUCTION MANUAL

en



<http://www.mikasa.com>

Contents of "Declaration of Conformity"
Please refer the EC DECLARATION OF CONFORMITY
in this manual as well.

102-01205



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1. INTRODUCTION

- This operation manual describes correct handling method, easy inspection and care of FU-162A /162 high frequency inverter. In order to utilize the excellent performance of this machine and also to improve your work efficiency for more effective work, please read this operation manual before you use this machine.
- After reading the manual, please keep it in a handy location for easy reference.
- For the handling the engine, please refer to the separate engine operation manual.
- For inquiries about repair parts, parts lists, service manuals, and repairs, please contact the store where you purchased the product, our sales office, or the Mikasa Parts Service Center. For parts lists, please visit our homepage at: <http://www.mikasas.com/> where you can access Mikasa WEB parts lists.

The illustrations in this manual might slightly differ in part from the machine you actually purchased due to design changes.

2. APPLICATION, STRUCTURE AND POWER TRANSMISSION

Application

This product with built-in high frequency induction motor, is a special inverter to convert single phase AC90-110V and single phase AC180-220V power to the voltage and frequency suitable for use by a high frequency vibrator and high frequency self vibrating motor to drive the concrete vibrator (high frequency vibrator) and high frequency self vibrating motor for concrete compaction. The output frequency can be varied from 100Hz to 240Hz. This small and light weight inverter is portable, and it is suitable for use at every concrete casting site.

Warning About Incorrect Applications And Techniques

A connectable concrete vibrator for concrete compaction is either a vibrator (high frequency vibrator) for internal use that gives vibration to the concrete directly when inserted into the concrete or a high frequency self vibrating motor that gives vibration indirectly to the concrete after it is attached to a formwork or a table. This machine should be connected only to the specified work machines.

As input power source, use general commercial power and power generator that is equivalent to the general commercial power. Do not connect to other power sources. Also, you are not allowed to use this machine beyond the allowable input voltage of the inverter. Otherwise, the vibrator and the inverter will be damaged.

Do not try to connect to a vibrator having a motor with different specification or a work machine using general commercial power by altering the plug and the outlet for connection. The work machine and this product might get damaged, and also there is a danger of electric shock.

Structure


Electric parts other than the external cooling fan, output outlet and power cable are placed inside the dust and water proof box. For protection of the box, a pipe frame is provided.






The power cable led inside the box is connected to the relay substrate. Via the relay substrate, the cable is connected to the circuit protector, then to the voltmeter. The output from the circuit protector is connected to the output outlet via the rectifier, smoother, inverter circuit, and control circuit.

Power Transmission

Convert the commercial power (single phase AC) and single phase AC power from a generator into direct current, then by electronic control convert it again to high frequency power (AC) suitable for a work machine. Commercial power (single phase AC) enters through the power cable, and when the attached breaker switch is turned on, electric current flows through the circuit. This current is converted to direct current via the rectifier and the condenser. This direct current is converted again by the transistor switching control to alternate current suitable for a work machine such as a high frequency vibrator and high frequency self vibrating motor, then the power is outputted to the output outlet, from which, the power is supplied to the work machine.

3. WARNING SIGNS

The triangle shaped  marks used in this manual and on the decals stuck on the main body indicate common hazards. Be sure to read and observe the cautions described.

 Warning labels indicating hazards to humans and to equipment.	
 DANGER	Denotes an extreme hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, is likely to result in serious injury or death.
 WARNING	Denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in serious injury or death.
 CAUTION	Denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury to people and may damage or destroy the product.
CAUTION (without at )	Failure to follow the instructions may result in damage to property.

4. CAUTIONS FOR SAFETY

4.1 General Cautions

WARNING

- Do not work with this machine, when
 - you are tired or sick and not feeling well,
 - you have taken medicine or drug, or
 - you have had a drink.



CAUTION

- Please read the operation manual well and work safely by using the machine properly.
- Prevent the operation of the machine by someone who does not have sufficient knowledge of operation.
- Always use protective gear (helmet, protective goggles, safety shoes, anti-vibration gloves, etc.) for safe operation of the machine, and wear appropriate work clothes.
- For outdoor work, rubber gloves and slip-resistant shoes are recommended.
- Long hair should be covered with a cap or hair cover.
- When doing work that generates high level of noise, wear noise suppressing devices such as ear plugs or ear muffs.
- Check also the cabtyre cord to make sure the conducting part is not exposed due to wear or crack. As the cabtyre cord wears relatively quickly, please replace with a new one at early timing. Also check the power outlet and the plug for breakage, deformation, burn or damage at the cord connection area.



4.2 Cautions Before Work

CAUTION

- **Location to set the motor**
Select a stable area free from rain or water, with no water puddle on the surface. Do not use electronic devices such as a computer near the inverter. The noise from the inverter might interfere or damage such devices.

⚠ WARNING

● **When using an engine generator for input power**

Emission gas from the engine contains poisonous substance such as carbon monoxide. Do not run the engine indoor or inside a tunnel where ventilation is poor. Also, be careful that the operator as well as the people and animals nearby will not be exposed to the emission gas while the engine is run.

When using a single phase 90-110V power, select an engine generator of 2.2 KVA or higher <2.5 KVA or higher recommended>. When using single phase 200V power, select an engine generator of 3.0KVA or higher.

● **When using a generator having engine welding function for input power**

- When supplying power by using both welding and single phase AC power source, because of the selected welding current, depending on the machine type, the output of the single phase AC power might get lowered or it becomes impossible to use both simultaneously. Please check with the generator manufacturer before use.
- If the power source is a generator, FU162A model might not be able to use properly due to the problem of feed waveform of generator or the damage/wear of generator, but this phenomenon is not the malfunction of this product.



⚠ DANGER

Before use, check the following. The following items should be checked before inserting the plug.

● **Connecting to input power**

○ **Check the power used**

Always use the power that is shown on the nameplate.

Referring to this list, select the applicable power supply and connect to it.



Model	Power supply specifications		Voltage range
FU-162	Single phase	50/60Hz 100V	80~120V
		50/60Hz 200V	180~220V
FU-162A		50/60Hz 100~120V	80~130V
		50/60Hz 220~240V	180~250V

If used at a voltage exceeding the above table, the inverter board and parts may be damaged.

If the voltage used is low, the inverter output gets lowered, and the performance of the work machine such as a concrete vibrator and self vibrating motor will become lowered, making it difficult to do efficient concrete casting. Also, the inverter substrate and parts might be damaged.

Do not use the same power source used by the inverter for other electronic devices such as a computer. By the noise from the inverter, interference and damage might occur in the electronic device.

○ **Grounding**

Always do grounding. Otherwise, electric shock might occur if the insulating performance of the machine gets low or insulator deterioration occurs.



⚠ WARNING

● **Inspection of cable and plug**

Inspect the power plug and cable. Check to see if the insulator and conductor are exposed by the wear and crack of the sheath. Also check for deformation, such as crushing, of power plug and cable. If the conducting part is exposed, electric shock or fire by short circuit might occur. If the cable is deformed, cable breakage and short circuit might occur.

If both the power plug and cable are damaged, replace them with new one. After replaced, check to see if it operates normally before using.



Use of Mikasa genuine Cabtyre cable is recommended.

⚠ WARNING

● **Inspection of the machine body**

Check the output panel outlet and box for deformation and breakage. If there is such abnormality, water might enter inside the machine, leading to electric shock and malfunction.

⚠ DANGER

● **Check of earth leakage breaker**

For moving type or transportable electric machines and instruments that are used on highly conductive surface such as iron sheet, iron frame or surface plate or in an environment wet with water or highly conductive liquid, use of an earth leakage breaker is required by law. Always use an earth leakage breaker. The use of highly sensitive and high speed earth leakage breaker is recommended.

⚠ WARNING

● **Make sure the circuit protector switch is turned off.**

If you insert the power plug into the power outlet without knowing the switch is turned on, the work machine connected to the inverter might start suddenly, which might result in unpredicted accident. Check to make sure that the switch is always turned off.

● **Check of power plug and power outlet on supply side**

If you notice looseness when the power plug is inserted, you need to repair or replace. If keep using without repair or replacement, overheating occurs, leading to an accident.

⚠ CAUTION

● **Input connection (extension) cable**

- The connection (extension) cable you use should be free of any damage.
- If the extension cable is wet, dry well before use.
- If the power source is far away and you need an extension cable, select the one that has sufficient thickness and size for the current required, and try to keep its length as short as possible to maximize the efficiency of the inverter and to prevent malfunction. (Use of grounding is recommended.)
- Cabtyre cable for extension should be the one with a core of AWG14 or more.
- In proportion to the length of the cable, the voltage becomes lowered, leading to lowering of inverter output.

Generator

FU-162A (including 162) inverters cannot be used with generators equipped with GFCI (Ground-Fault Circuit Interrupter). Replace with a generator not equipped with GFCI and use it. GFCI has very high sensitivity and high-speed ground-fault circuit characteristics ($5 \pm 1\text{mA}$, 0.25 seconds), so the inverter cannot be started.

4.3 Precautions During Work

⚠ WARNING

● **Circuit protector switch**

Never use an inverter that cannot be started or stopped with the circuit protector switch.

Contact the dealer or the renter of the inverter if you notice such phenomenon to ask for inspection and repair.

⚠ CAUTION

● **Work carefully when transporting or moving.**

Do not pull or lift the inverter by the cable only. Cable damage and short circuit might occur.

Make the cable into a bundle, then hold the middle handle of the inverter when transporting or moving. Make sure that the inverter will not touch the nearby objects such as iron frames and bars.



DANGER

- **Stop your work when abnormality is found.**

When you notice the inverter is not operating properly or you hear abnormal noise, etc. immediately turn off the switch to stop using the inverter. Then contact the dealer or renter for inspection and repair.

- **When not used, always turn off the switch.**

- **The number of the machines that can be used should be limited to the number specified.**

The maximum number of the vibrators and self vibrating motors that can be used with the inverter is the number determined and specified for the inverter. If this number is exceeded, malfunction of inverter might occur. So, please do not try to use more than this number.

- **Do not do overloaded operation.**

When the inverter output has exceeded the specified value, lower the output frequency and reduce the number of machine vibration to protect the inverter and the work machine (vibrator, self vibrating motor, etc.).

- **When a red LED lamp lights up during work**

Stop the use of inverter to check the cause of the LED warning lamp.

Check the information of LED shown on the back of the inverter. Read the inverter's operation caution nameplate and "Input Power Voltage Condition and Abnormality Display Function・Troubleshooting" section in the operation manual to take necessary action.

- **When protection function is activated.**

The inverter has various protection functions.

When protection function is activated, check well the status of LED lamp (lamp color, lighted ⇔ blinking) and the work situation. Then correct or remove the factor that has triggered the protection function.

- **Direct sunlight and rain**

Use the inverter away from direct sunlight, dust and rain.

This product is of dust and water proof structure equivalent to JIS IP56, but if water is splashed during operation or used on water puddle, damage might occur.

The water proofing level of this inverter does not guarantee operation in rain or on water puddle.

- **Power supply with generator with welding function**

In case of a generator with welding function, power waveform is sometimes very bad, which might cause inverter protection circuit malfunction, making the inverter to stop.

When selecting such generator, explain the purpose of use to the generator manufacturer. Then check the capacity of the generator before use.

- **Insulation resistance check**

In principle, never do insulation resistance check.

4.4 Precautions After The Work

CAUTION

- **Caution about storing**

Do not put heavy objects (iron frame, etc.) on the inverter power plug and cable. Breakage or damage might occur.

4.5 Maintenance Precautions

DANGER

- **Cleaning of parts**

To prevent fire, use non-flammable washing oil for parts cleaning. After cleaning, wipe off the oil well to remove the oil completely.

CAUTION

- **Read operation manual and service manual.**

Before doing inspection or maintenance, read the operation manual or service manual well to fully understand the maintenance method. Do inspection and maintenance by paying attention to your safety. Incorrect maintenance work might lead to machine damage as well as accident resulting in injury or death.





● **Do maintenance carefully.**

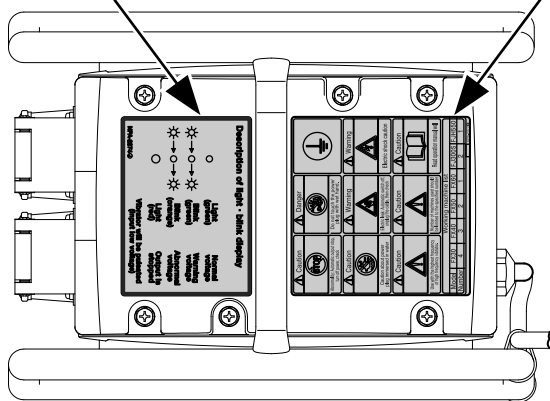
- Check the cable regularly. If damage is found, contact the dealer to ask for repair.
If repair is done by someone without repair knowledge or skill, the inverter will not be able to show its performance properly, and accident and injury might occur.
- When using a connection (extension) cable, inspect regularly. If damage is found, replace with a new one. Also, if found to be wet, dry well before use.
- The holding part has to be always kept dry and clean, free of oil and grease.
- If the terminal (contact) inside the output outlet is dirty or broken, repair or replace.

● **Doing regular inspection**

- Do regular inspection and maintenance as instructed by the manufacturer to maintain each part in good condition. If the instruction is not followed, accident or machine damage might occur by lack of maintenance.
- Before inspection and care, turn off the switch and unplug the power plug. The condenser of the inverter does not get discharged immediately after the power is turned off. Wait for a few minutes before doing inspection and maintenance.
- Please contact with Mikasa distributor or Mikasa website (<http://www.mikasas.com/>) for repair and replacement parts.

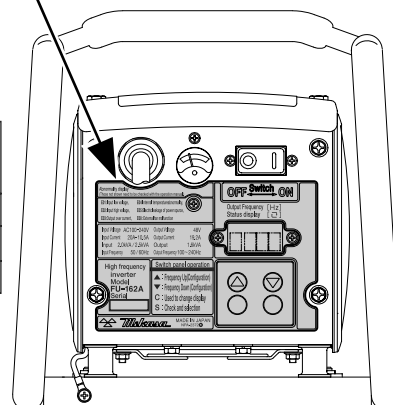
4.6 Label Attachment Position

PART NAME	DECAL, LED EXPLAIN /FU-162	
MODEL	FU-162A	FU-162
PART NUMBER	9202-23740	9201-10740
DECAL NUMBER	NPA-2374	NP-1074

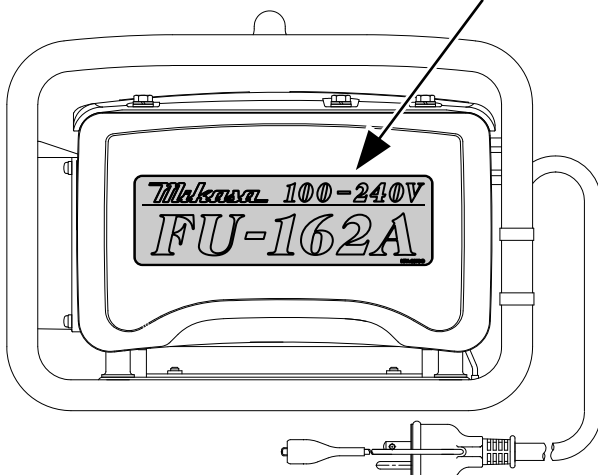


PART NAME	DECAL, CONNECTION MODEL	
MODEL	FU-162A	FU-162
PART NUMBER	9202-23770	9201-12660
DECAL NUMBER	NPA-2377	NP-1266

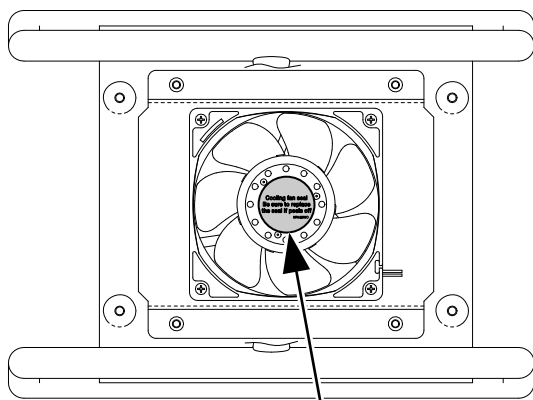
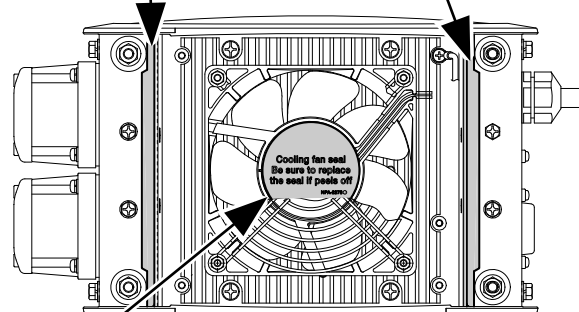
PART NAME	DECAL, SERIAL / FU-162	
MODEL	FU-162A	FU-162
PART NUMBER	9202-23720	9201-12920
DECAL NUMBER	NPA-2372	NP-1292



PART NAME	DECAL, MODEL / FU-162A	DECAL, MODEL / FU-162
MODEL	FU-162A	FU-162
PART NUMBER	9202-23730	9201-12910
DECAL NUMBER	NPA-2373	NP-1291



PART NAME	DECAL, WATERPROOF SEAL (SW PANEL)	
MODEL	FU-162A	FU-162
PART NUMBER	9202-23750	9201-10490
DECAL NUMBER	NPA-2375	NP-1049



PART NAME	DECAL, WATERPROOF SEAL (FAN)	
MODEL	FU-162A	FU-162
PART NUMBER	9202-23760	9201-10570
DECAL NUMBER	NPA-2376	NP-1057

※ The illustration shown is for model, "FU-162A"
 ※ Please put the English decals included in the packing box from over the original Japanese one which put on the product. Removing the original decals which put on the product may impair the waterproof and dustproof properties.

4.7 Label Description



Connection of grounding wire

When using the inverter, for prevention of electric shock to the worker, always use the grounding wire.



Electric leak: Automatic switch off, unplug the cable, then check

If electric leak occurs while the inverter is used, unplug from the power and check the leaking area. Use after repair is done.



Abnormality: Automatic output stop, turn off power, check.

At the time of inverter abnormality and power source abnormality, the inverter output stops automatically. Turn off the switch, and unplug the input/output plug, then check the abnormality area. Use after safety is checked.



Caution about power plug immersed in water

Be careful not to let the power plug immersed in water. If immersed in water or soaked with water, dry well. Use after making sure there is no electric conduction for every phase.



Caution about electric shock

Be careful about electric shock when using the inverter.



Read operation manual well.

Read the operation manual before use, then operate and use the inverter safely.



Number of machines used should be limited to the specified number

The number of work machines that can be connected is specified. Limit the number of the machines to this specified number.



Use with the highest frequency of high frequency vibrator.

When used with a high frequency vibrator, to maximize the performance of the work machine, use the highest frequency.



Do not touch the power plug with wet hand.

Do not plug/unplug the power plug with wet hand.

スイッチパネル操作

- ▲：周波数UP(設定)
- ▼：周波数DOWN(設定)
- C：表示項目選択
- S：確認・決定

Switch panel operation

▲▼ is used for output frequency adjustment (100Hz to 240Hz) and check of error date/time when error is displayed.

“C” is used to change display of input voltage, input current and output current at normal operation condition.

“S” is used for check and selection of numerical values and setting change, but normally no need to use.

異常表示 (表記以外は取扱説明書にて確認)

E01：入力低電圧	E04：内部温度異常
E02：入力高電圧	E05：電源漏電
E03：出力過電流	E08：外部ファン故障

Abnormality display

(Those not shown need to be checked with the operation manual.)

Inverter abnormality is shown by LED. Check the description of the error on the nameplate and in the operation manual. Inspect and check the area of abnormality and do repair. Use again after safety is checked.

(E01: Input low voltage, E02: Input high voltage, E03: Output over current, E04: Internal temperature abnormality, E05: Electric leakage of power source, E08: External fan malfunction)

点灯・点滅表示内容

- 点灯(緑) 正常電圧
- ☆→○→☆ 点滅(緑) 警告電圧
- ☆→○→☆ 点滅(オレンジ) 異常電圧
- 点灯(赤) 出力停止

NP-1074

低電圧時はハイブレーターが駆動します

Description of light・blink display

Light (green): Indicating the voltage is within the normal voltage range.

Blink (green): Indicating the voltage is at a warning level. Check the power source condition, then correct if there is any problem.

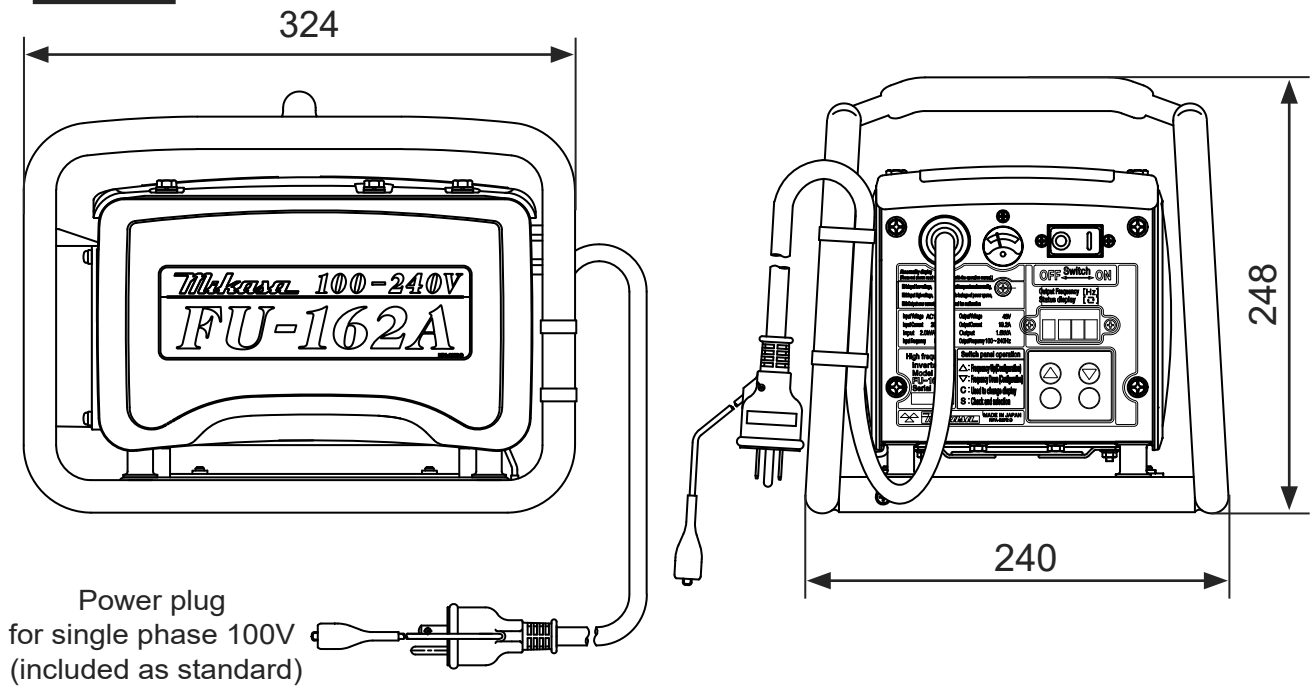
Blink (orange): Indicating the voltage is abnormal. Stop using the inverter and check the power supply. Replace the power source if necessary.

Blink (red): Indicating that the output is stopped. Power source voltage is abnormal or abnormality of inverter or work machine. Stop your work to check the area of abnormality. Check for malfunction, and do repair as needed. Use after safety is checked.

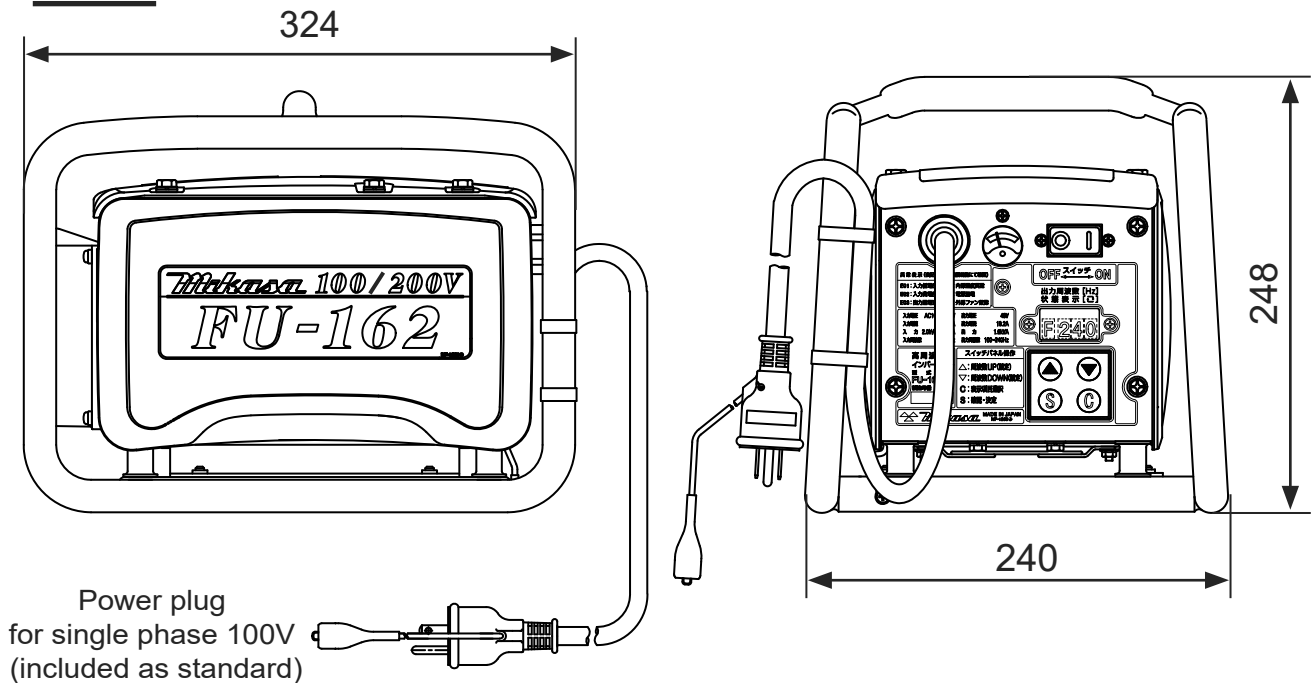
5. APPEARANCE

5.1 Appearance Dimension

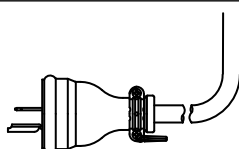
FU-162A



FU-162

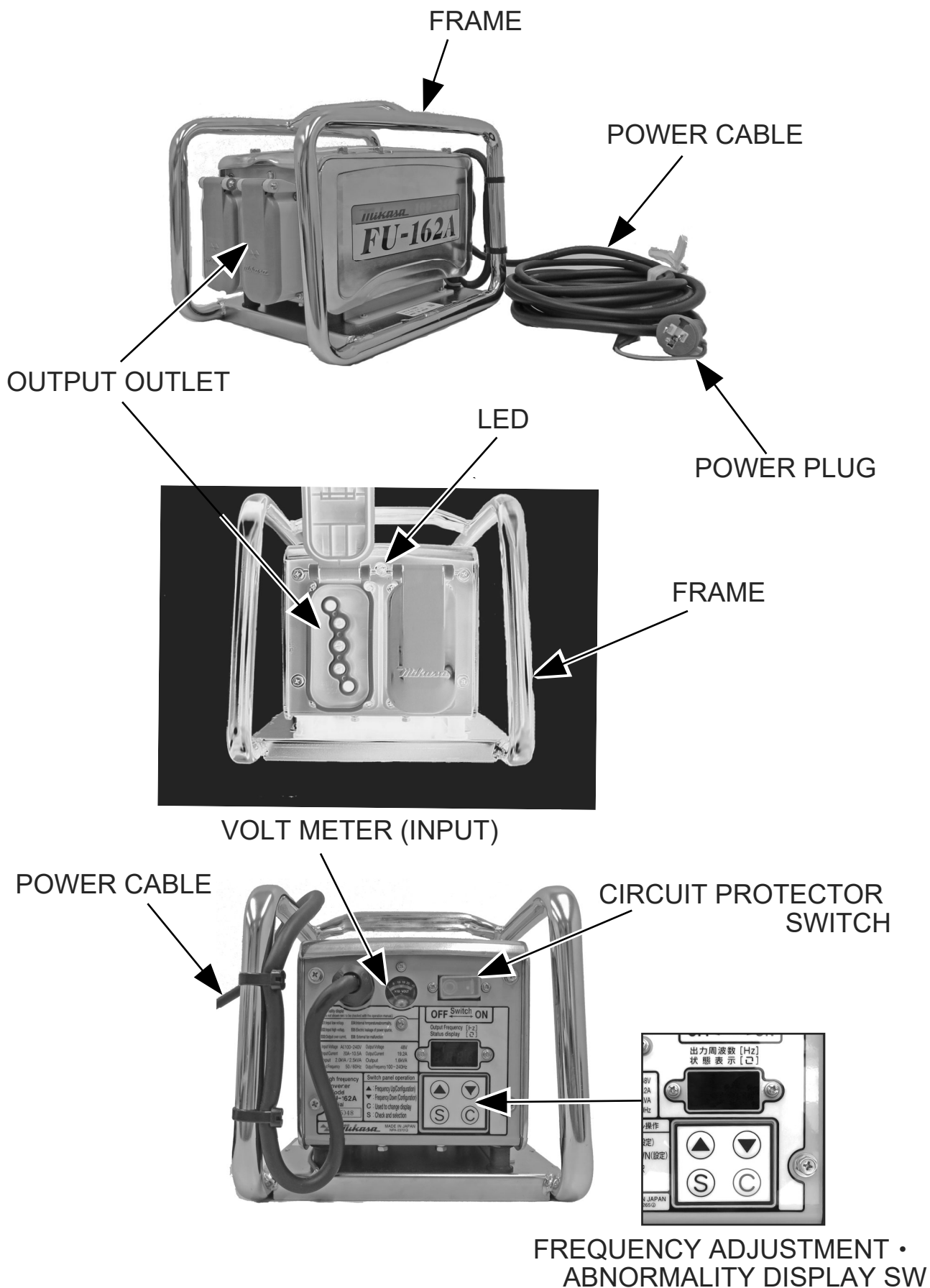


Power plug
for single phase 200V
(sold separately)



※ The illustration shown is for model, "FU-162A"

5.2 Control Unit Positions And Names



※ The illustration shown is for model, "FU-162A"

5.3 Specification

MODEL			FU-162A	FU-162
Input	Phase		SINGLE PHASE	SINGLE PHASE
	Voltage	V	100~120 / 220~240	100 / 200
	Current	A	20 / 14	
	Input	KVA	2.0 / 2.8	
	Frequency	Hz	50 / 60	
Output	Phase		THREE PHASE	
	Voltage	V	48	
	Current	A	19.2	
	Input	KVA	1.6	
	Frequency	Hz	100~240	
Dimension (LxWxH)		mm	324x240x248	
Total weight		kg	8.7	
Numbers of receptacles			2	
Ambient temperature condition			-10°C~+40°C	
Ambient humidity condition			80% of less (No condensation)	
Overload protection			CURRENT CONTROL	
Machine cooling method			FORCED AIR COOLING	

Length And Cord Size
(extension cord between inverter and vibrator.)

Size of cable cord (AWG)	Length (m)			
	FU-162A		FU-162	
	Single phase 100~120V	Single phase 220 ~240V	Single phase 100V	Single phase 200V
AWG14	14	20	14	20
AWG12	25	35	25	35
AWG10	38	55	38	55
AWG8	56	80	56	80

Number Of Utilizable Units

Type	FX / FXS / FXB				FJH	
	30	40	50	60	550	750
FU-162A/162	4	3	2	1	1	—

6. OPERATION

1. Check to see if the power source matches the specification of this inverter and the voltage is within the normal voltage range of this product. When a generator is used, check to see if it is of or above the rated output shown at “4.2 Cautions before Work” of this manual.

Power supply specifications	Single-phase supply (AC)		
Model	Frequency	Voltage	Current
FU-162	50/60Hz	110V	20A
		220V	14A
FU-162A		230V	11A
		240V	10.5A

2. Connect the power plug to the power source, then check to see if the inverter's voltmeter shows the value within the green zone. Always connect the grounding wire. For single phase 100V outlet of non-grounding type (without grounding wire), use the grounding clip attached to the power plug to connect to the grounding wire.

Model	Power supply specifications		Voltage range
FU-162	Single phase	50/60Hz 100V	80~120V
		50/60Hz 200V	180~220V
FU-162A		50/60Hz 100~120V	80~130V
		50/60Hz 220~240V	180~250V

3. Turn on [ON] the inverter circuit protector switch. (Photo 1)
Make sure that the cooling fan starts and the green LED lamp lights up (normal voltage range). If the green or orange LED lamp is blinking or the red LED is lighted, there must be some abnormality in power source, etc. Stop using immediately. Then correct the cause of abnormality before operation.

REFERENCE

For the description of LED display, refer to “Input power voltage condition display function” of page 17.

CAUTION

When quickly turned [OFF] when the circuit protector switch is turned on, correct the cause of this trouble, then turn [ON] the circuit protector switch.

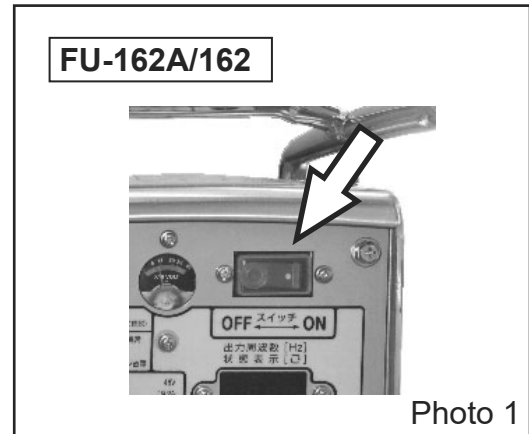


Photo 1

4. When the inverter circuit protector switch is turned [ON], frequency (when normal) and error information (at the time of error) is displayed at “Frequency Adjustment・Abnormality Display SW”. For operation method, refer to “Operation Method of Frequency Adjustment・Abnormality Display SW” of page 17. (Photo 2)

CAUTION

When using FX type high frequency vibrator, always use the frequency of 240Hz. Do not set to the frequency other than 240Hz.



Photo 2

5. Make sure that the switch of the work machine (vibrator, self vibrating motor) is turned [OFF].

6. Insert the male plug of the work machine securely into the end of the inverter output outlet.(Photo 3)



Photo 3

7. Check to see if the output side outlet cover claw is properly engaged into the male plug, and it does not come off when pulled lightly. (Photo 4)



Photo 4

8. When the work machine is a vibrator, hold the hose and hang the vibration head (vibrator end portion). When doing so, make sure there is no one nor obstacle nearby and it is safe to operate.
When the work machine is a self vibrating motor, make sure that the machine is stably placed and the motor is attached securely before operating.

9. After reconfirming that the inverter input side power voltage is in the normal voltage range and the green LED lamp is lighted, turn the switch of work machine [ON] one after another to start casting. During your work if the vibrator starts to pulsate and the green LED lamp starts to blink or the red LED lights up, abnormality might have occurred in the power source or in the machine. Correct the cause of the trouble before resume your work.

10. After the casting work is finished, turn off the switch of work machine [OFF] one by one, then unplug the vibrator male plug from the inverter output side outlet. Because the output outlet cover claw is catching the plug, raise the cover to disengage the claw before unplugging. (Photo 5)

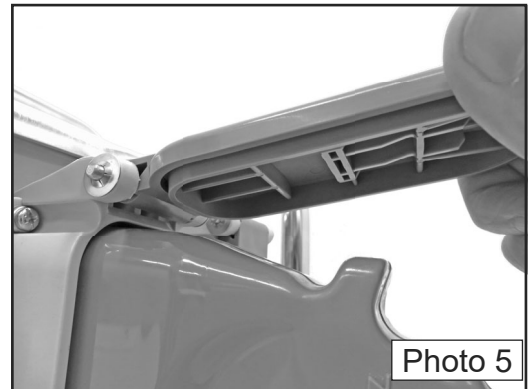


Photo 5

11. Turn [OFF] the inverter circuit protector switch and unplug the power plug. When unplugging, do not hold the cable. Unexpected trouble such as cable breakage might occur. (Photo 6)

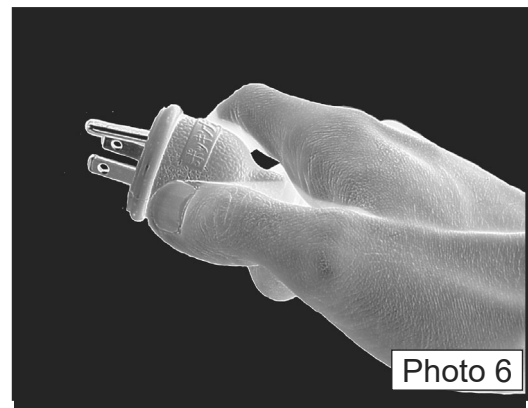


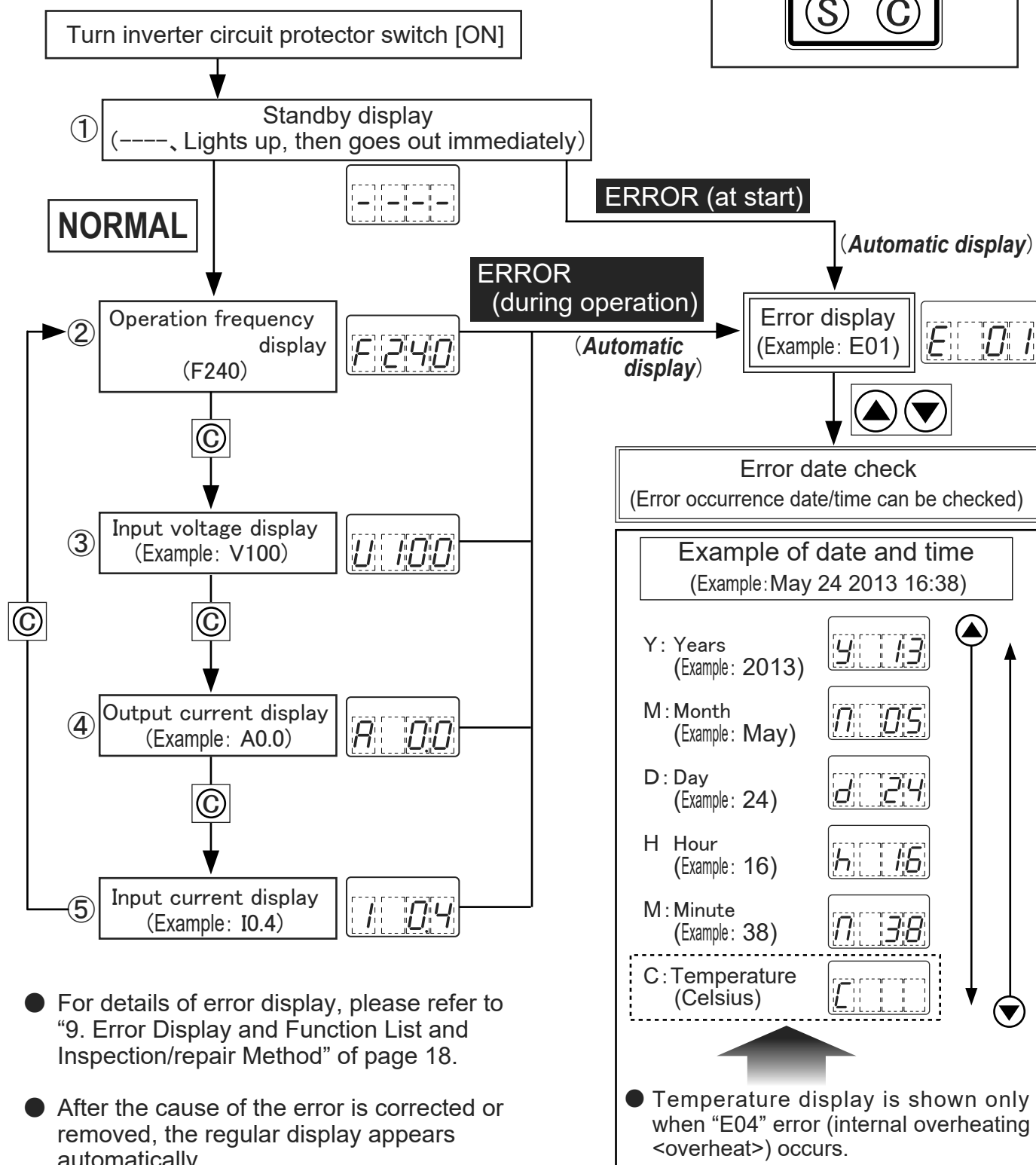
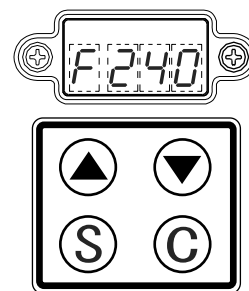
Photo 6

Operation Method of Frequency Adjustment・Abnormality Display SW

After the inverter circuit protector switch is turned [ON], operation frequency is displayed. By the “C” key, inverter power source condition and output current can be checked.

Also, when an error occurs, error code is displayed. If that happens, check the description of the error and correct the cause of abnormality.

Frequency Adjustment・ Abnormality Display SW



7. MAINTENANCE AND SAFEKEEPING

Check the following items before and after use.

- (1) Check power plug and contact for dirt, rust, deformation and breakage.
- (2) Check power cable for wear, crushing, crack, etc.
- (3) Open the output outlet cover to check inside and terminal part for dirt, etc.
Check bolts and nuts used on inverter for looseness, deformation, etc. Also check the output outlet cover for smooth open/close movement.
- (4) Check circuit protector switch to see if it properly switches ON-OFF, and the green LED is lighted. (After inspection, always turn the switch to OFF.)
- (5) Connect to a vibrator and check to see if the vibrator operates normally.
- (6) Check anti-vibration rubber for deformation and crack.
- (7) **Conduction resistance between power plug contacts when circuit protector is OFF**
For safety purpose, the input voltmeter needle moves when the power plug is inserted into the power source (outlet) even if the circuit protector is turned OFF. Therefore, during inspection before operation, if conduction resistance between power plug contacts is measured to check for conduction trouble between power plug, the tester needle will point to around 200 to 300Ω. This is the impedance (resistance) of the voltmeter, not conduction trouble. This value pointed by the tester may vary slightly depending on the detection method and accuracy of the tester.
- (8) **In principle, insulation resistance check should not be done.**
On the control substrate of the inverter, a surge absorber is mounted. Depending on the specification, some of the insulation resistance testers can change the rated measurement voltage range (for example, DC1000V to 50V). With such testers, applied test voltage is absorbed by the surge absorber, and correct insulation resistance is not shown. Instead, the value shown is lower than the actual value by about 10 to 100MΩ. Also, if high voltage is applied repeatedly, the surge absorber is deteriorated and its performance is lowered. For maintenance purpose, if you need to check insulation resistance, use the setting given below for the rated measurement voltage before doing the check.

Rated measurement voltage 500V or less

《What is surge absorber》

When hit by a lightning, in a very short time (normally in micro second (μs) or in mili-second (ms)), abnormally high voltage (surge voltage) is transmitted to the power source and the ground, which is then inputted to the inverter, damaging the inverter electronic circuit. The surge absorber is a circuit that lets the sudden abnormally high voltage escape to prevent damage of inverter. It can protect the inverter from induced lightning and counter current lightning, but in the case of abnormally high voltage lightning or lightning strike that occurs in proximity, it might become unable to protect the inverter.

- (9) While doing concrete casting, promptly remove the concrete attached on the inverter. When washing the inverter with water, pay attention to the following point.

Do not wash with water if there is deformation or breakage on the inverter, or when the female panel outlet cover does not close securely.

- Check the bolts, screws, switches and input cable of the inverter for looseness.
- Check the parts of the inverter (front panel, switch panel, top surface cover, side surface cover) for deformation and crack. If there is deformation or breakage, dust and water proofing performance will be lowered, and water might enter inside during washing with water, leading to trouble of electronic parts.
- Check the output side outlet cover to make sure it closes. if it does not close properly, water might enter inside through the terminal part. When washing, close the output side outlet.
- Splash water from the top to wash with the inverter kept upright position. If washed with the inverter set on its side or put upside down, the cooling fan will be immersed in water, leading to malfunction of the fan. Do not put water nozzle directly to the intake/exhaust holes at the bottom.
- Pay attention to the amount and pressure of the water used for washing to maintain them at the level specified by JIS standard IP56.

《**What is IP56**》

The first number “5 (IP5X)” indicates class 5 of dust proof structure protection class (no effect on machine when exposed in talc dust for 8 hours), and the ending number “6 (IPX6)” indicates class 6 of water proof performance protection class (no abnormality in the machine when the machine body installed normally is injected with water from outside from every direction for more than 3 minutes at a rate of 100 liter per surface area of 1m² per minute with a water spray nozzle having a diameter of 12.5mm positioned 2.5 to 3.0m away from the machine body).

- ***After washing, wipe off the water and let the inverter dry. Wipe off water also from the inside of the output side outlet cover and the terminal holes. If water is remaining, electric shock and electric leak might occur.***

- (10) Clean the output outlet terminal insertion holes. If mortar is adhered, conduction trouble that causes single phase run or terminal disturbance due to spark might occur, and the malfunction of inverter protection function and burning of vibrator might result.

Please contact with Mikasa distributor or Mikasa website (<http://www.mikasas.com/>) for repair and replacement parts.

8. INPUT POWER VOLTAGE CONDITION AND ABNORMALITY INDICATION FUNCTION

<<Input power voltage condition display function>>

FU-162A/162 model has three color high intensity LED lamps on the panel outlet side of the main unit to display input power voltage condition and inverter abnormality in four different modes. In addition, at the time of abnormality, the frequency display function on the back surface of the inverter is switched to LED to show error situation.

As function of FU-162A/162 model, in addition to the blinking of LED lamp, the vibrator will be pulsated by the inverter control when the power source voltage is abnormally low to warn the worker of abnormality by sound and vibration.

Items displayed are as follows.

Input power voltage condition display function

Input voltage condition	LED lamp lighting status	Operating voltage			
		FU-162A		FU-162	
		Single phase 100 - 120V	Single phase 220 - 240V	Single phase 100V	Single phase 200V
Normal voltage	Green light	About 80 - 130V	About 180 - 250V	About 80 - 120V	About 180 - 220V
Warning voltage	Green Blinking	About 70 - 80V and About 130 - 140V	About 160 - 180V and About 250 - 260V	About 70 - 80V and About 120 - 130V	About 160 - 180V and About 220 - 240V
Abnormal voltage	Orange Blinking	About 60 - 70V* and About 140 - 160V	About 140 - 160V and About 260 - 270V	About 65 - 70V* and About 130 - 145V	About 145 - 160V and About 240 - 270V
Stop voltage	Red light	About 60V or less and About 270V or more (Error display:E01,E02)		About 60V or less and About 270V or more (Error display:E01,E02)	

* High frequency vibrator・self vibrating motor pulsates.

CAUTION

When the power source is a generator, by the problem of feed waveform of the generator or the damage/wear of the generator, you might not be able to get proper display, but such phenomenon is not the malfunction of this product.

Abnormality indication display function

Abnormal condition	LED lamp lighting status	Description of display (lighting)	Error display
			FU-162A/162
Load side abnormality or machine body abnormality	Red light	Input voltage drop	E01
		Load short	E03 or E13
		Internal over-heating	E04
		Power source electric leak	E05*
		External fan malfunction	E08
		Abnormality (substrate trouble, etc.)	E15 ~ E26
	Green light	Battery error	E14

* If you already have leakage has begun, there are times when error memory of the E05 is insufficient by the power supply time.

9. INSPECTION AND COUNTERMEASURE AT THE TIME OF THE ERROR

Error (LED) display	Description of abnormality	LED lamp lighting status	Machine behavior	Inspection/ countermeasure for abnormality	Inverter restart method and required action
E01 Blinking	Input low voltage	Red light	Output stop	Power source inspection/replacement	Auto reset
E02 Lights up and immediately goes out	Input high voltage	Red light	Inverter stop and circuit protector OFF	Power source inspection/replacement	Circuit protector ON again
E03 Blinking	Output overcurrent	Red light	Output stop	Machine body inspection/ repair and replacement	Circuit protector OFF, then ON again
E04 Blinking	Internal over-heating	Red light	Output stop	External fan and other inspection	After machine body cools down, circuit protector OFF, then ON again
E05 Lights up and immediately goes out	Power source electric leak	Unlighted	Inverter stop and circuit protector OFF	Electric leakage location inspection and repair, or power source change	Circuit protector ON again
E08 Blinking	External fan malfunction	Red light	Output stop	External fan inspection/change	Circuit protector OFF, then ON again
E14 Blinking	Battery charging capacity insufficient	Green light	—————	Installed battery change	—————
E15 ~ E26 Blinking	Abnormality of machine body	Red light	Inverter stop and circuit protector OFF (In some cases, circuit protector OFF)	Immediately stop using, machine body inspection and repair	Inspection or repair without doing restarting

10. TROUBLESHOOTING

10.1 The Inverter Does Not Run Even When The Circuit Protector Switch Is ON

1.1 No power

- | | |
|--|---|
| Input plug is not connected to the power source. | Connect to the power source that matches the rating of the machine. |
| Main power is cut. (Main breaker is OFF.) | Turn on the main power [main breaker ON]. |
| Power cable of this machine is broken [open phase] or short circuit inside the input plug mold | Power plug or power cable replacement or repair. Depending on the failure condition, replace or repair the substrate assembly. LED lamp does not light up, with no error display. |

1.2 Power is turned on

1.2.1 Circuit protector is ON

- | | |
|--|--|
| Power cable of this machine is broken [open phase] or short circuit inside the input plug mold | Power plug or power cable replacement or repair. Depending on the failure condition, replace or repair the substrate assembly. LED lamp does not light up, with no error display. |
| Voltmeter does not give normal display. | Change the voltmeter. |
| Circuit protector switch breakage | Immediately stop using, and inspect the wiring and control substrate. Replace the circuit protector (depending on the breakage condition, the substrate may be replaced.) |
| External cooling fan malfunction | Replace the cooling fan assembly (red LED lamp light, abnormality description [error display: External fan → E08] is displayed, output of the machine stops.) |
| Frequency display substrate trouble (breakage, damage) | Immediately stop using, replace the frequency display substrate assembly (LED lamp not lighted, no error display) |
| Power source and control substrate trouble (mounted parts and circuit breakage, etc.) | Immediately stop using, inspect and repair the machine (② red LED lamp lighting, abnormality description [error display: E15~E26] is displayed to indicate trouble situation, output of the machine stops. However, depending on the trouble condition of the substrate, LED lamp does not light up and no error display.) |
| Power source and control substrate trouble (mounted parts and circuit breakage, etc.) | Immediately stop using, inspect and repair the machine (② red LED lamp lighting, abnormality description [error display: E15~E26] is displayed to indicate trouble situation, output of the machine stops. However, depending on the trouble condition of the substrate, LED lamp does not light up and no error display.) |

1.2.2 Circuit protector is OFF

— Circuit protector switch is not ON.	— Circuit protector switch ON
— Circuit protector switch is not functioning.	— Immediately stop using, inspect the wiring and control substrate, replace the circuit protector switch assembly (depending on the condition of breakage, the substrate may be replaced.)
— Power source and control substrate trouble (mounted parts and circuit breakage, etc.)	— Immediately stop using, inspect and repair this machine. (When the circuit protector switch is OFF due to the substrate trouble, LED lamp does not light up and no error displayed.)

1.2.3 Circuit protector gets OFF

— Machine dropped or strong impact applied	— Before turning on the input power, check outside and inside of this machine for damage and breakage. Turn on power after safety is checked. If abnormality is detected, immediately stop using, then inspect and repair.
— Circuit protector failure	— Immediately stop using, inspect the wiring and control substrate. Replace the breaker switch assembly (depending on the condition of breakage, the substrate may be replaced.)
— Power source electric leakage (inside the machine or work machine side)	— Immediately stop using, check the area of electric leakage and replace or repair this machine. After LED lamp lights up, it immediately goes out. Abnormality description [error display: E05] is saved, and circuit protector switch is automatically turned OFF, this machine stops. If you already have leakage has begun, there are times when error memory of the E05 is insufficient by the power supply time.
— Input power high voltage	— Stop your work. After checking the power source voltage, correct the situation that has caused power source voltage drop or replace power source. (After the red LED lamp lights up, it goes out immediately. Abnormality description [error display: E02] is saved, and the circuit protector switch is turned off automatically, then the machine output stops.)
— Power source and control substrate trouble [mounted parts and circuit breakage, etc.]	— Immediately stop using. Inspect and repair this machine. (When the circuit protector switch is turned OFF by the failure of the substrate, LED lamp does not light up and no error display is shown.)

10.2 When Water (Liquid) And Dust Enters Inside Of The Machine

2.1 Immersed in water due to natural disaster or accident

— Immersion in water due to mud flow, mud water and dirty water by natural disaster and accident.	— Because of the danger of electric shock and electric leakage, never turn on the power. With the power cut, contact the specified service factory or our parts service center for inspection and repair.
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2.2 Damage, deformation, breakage and repair, inspection, reassembly of the inverter itself

- Breakage and deformation of output panel outlet and housing
 - Deterioration and breakage of water proof packing and seal of each part
 - Insufficient tightening or forgotten tightening of fastening bolts used on the top surface cover and side surface cover at the time of repair and inspection.
- Because of the danger of electric shock and electric leakage, never turn on the power. Please contact with Mikasa distributor or Mikasa website (<http://www.mikasa.com/>) for repair and replacement parts.

10.3 Cooling Fan Troubleshooting

3.1 Power is not on

- Power plug is not connected to the power source. — After making sure the work machine's switch is OFF, connect to the power source. (If the switch is ON, always turn it OFF.)

3.2 Power is on

3.2.1 When inverter starts, the revolution of external cooling fan fluctuates.

- Fan revolution fluctuates from high speed to low speed. — Cut the power source, then check the fan rotation part for foreign object (string-like object) that might be trapped there. If a trouble is found, immediately stop using and replace the fan.

3.2.2 External cooling fan does not run.

- Cooling fan power relay connector is not connected. — Check the relay power connector for breakage and damage. If there is no abnormality, reconnect. (LED lamp does not light up. Reconnect. If the machine does not run, inspect and repair. If continuously used with the fan stopped condition, with the increase in the internal temperature, the red LED lamp will light up. Abnormality is displayed [error display: E04 or E08] to show the condition. Output of this machine stops.)
- Cooling fan wiring is broken or short circuited. — Repair the broken part by paying sufficient attention to water proofing, or replace the cooling fan assembly and wiring assembly with relay connector. (③ red LED lamp lights up. Abnormality description [error display: E08] is displayed to show the condition of breakage. Output of this machine stops.)
- Cooling fan power relay connector is broken, damaged or dirty. — Replace the wiring assembly having relay connector and cooling fan assembly (same as 3.2.2③)

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Cooling fan rotation part was broken, damaged or deformed because of the foreign matter entered into the cooling fan rotation part or because the machine was dropped or a strong impact was applied to it, which results in rotation lock and abnormal drop of revolution.

Replace cooling fan assembly (same as 3.2.2③)

Burning of cooling fan motor and fan substrate breakage [shortening of cooling fan life included]

Replace cooling fan assembly (same as 3.2.2③)

Damage caused by the water [sewage water, washing water, etc.] and mortar entered into cooling fan.

10.4 Operation Trouble Of Workmachine

4.1 Power is not on

Power plug is not connected to the power source.

After making sure the work machine's switch is OFF, connect to the power source. (If the switch is ON, always turn it OFF.)

4.2 Power is on, but the work machine does not run

4.2.1 Output plug is not connected

Output plug is not connected.

After turning the work machine's switch OFF, connect the output plug.

4.2.2 To the output plug, male plug of the work machine is connected

Work machine switch is not turned ON.

Turn the switch of work machine ON.

Output overcurrent [work machine failure, wrong connection or contact problem of male plug and output outlet.]

Inspect the work machine. Check for damaged machine, and after checking, replace or repair the damaged machine. Or check the male plug and output outlet terminal [contact] for damage. Replace or repair. (Red LED lamp lights up. Abnormality description [error display: E03・E13] is displayed. Output of this machine stops.)

Input power low voltage

After checking the power source voltage, increase or correct the voltage or replace the power source. [Red LED lamp lights up. Abnormality description [error display: E01] is displayed, output of this machine stops. After the power source voltage increases, this machine automatically resumes its operation.)

Input power high voltage

Stop your work, and after checking the power source voltage, lower the voltage of replace the power source. (Red LED lamp lights up, then goes out immediately. Abnormality description [error code: E02] is saved. Breaker switch is turned OFF automatically. This machine stops.)

Power source and control substrate trouble [mounted parts and circuit breakage, etc.]

Immediately stop using. Inspect and repair this machine.

4.3 Though the power is turned on, the operation of the work machine is not stable, and the revolution is low

SOFT-START OPERATION (Protective function)

In case you use a large number of vibrators (FX/FJ/FJH) in same time, when the unit after the second is started, the other working units are controlled at the moment. It is intended to protect Inverter by automatically control, not defect or abnormality.

4.3.1 To the output plug (outlet), the male plug of the work machine is connected

Input power voltage low	After checking the power source voltage, increase or correct the voltage or replace the power source. (Green or orange LED lamp blinks. When the orange lamp is blinking, the work machine pulsates.)
Power source and machine's extension cable [primary side] are not connected by a cable of appropriate length and size.	Check the operation manual. Make sure the length and size of the extension cable are appropriate, and if not appropriate, replace the cable. (When power source voltage is low only at the primary side, the green or orange LED lamp blinks. and the work machine starts to pulsate. If it is at the secondary side, LED lamp does not blink and the work machine does not pulsate.)
This machine and work machine side extension cable [secondary side] are not connected by a cable of appropriate length and size.	
The number of various work machines connected to this machine exceeding the allowable number of work machines that can work with this machine.	Check the number of work machines that can be connected by reading the work machine list nameplate on the top surface of this machine. Or check with the operation manual to make adjustment about the number of work machines that can be used with this machine.
Circuit protector switch malfunction	Immediately stop using. Inspect the wiring and control substrate. Replace the breaker switch assembly. (Depending on the condition of breakage, the substrate may be replaced.)
Power source and control substrate trouble [mounted parts and circuit breakage, etc.]	Immediately stop using. Inspect and repair this machine. (Depending on the condition of the trouble of the substrate, red LED lamp lights up. Output of this machine stops. However, depending on the condition of the trouble of the substrate, LED lamp does not light up.)

4.4 Power is turned on, but the work machine stops running

4.4.1 Main power source is cut suddenly

Main power is cut [Circuit protector switch is turned OFF.]	Check the power source voltage and the area of electric leakage, and also do inspection and check of the equipment and machine using the same power source. If there is no problem, turn on the main power. [Circuit protector switch is turned ON.] If abnormality is found with the power source, replace the power source.
Power source electric leakage [inside of this machine or work machine side]	Immediately stop using. Check the area of electric leakage, and replace or repair.
Power source and control substrate trouble [mounted parts and circuit breakage, etc.]	Immediately stop using. Inspect and repair this machine. (Same as 1.2.1②)

4.4.2 Damage or breakage of main work machine and this machine

Contact trouble inside the male plug of the work machine or power cable [15m or 20m] during operation. Contact trouble of male plug and output plug, and failure of work machine itself.	Inspect and identify the breakage of stopped work machine and the area of trouble. Replace or repair. (Depending on the condition of trouble, the red LED lamp lights, and the output stops.)
Trouble of control substrate [mounted parts and circuit breakage, etc.]	Immediately stop using. Inspect and repair this machine. (Same as 1.2.1②)
Circuit protector switch trouble	Immediately stop using. Inspect the wiring and control substrate. Replace circuit protector (depending on the condition of breakage, the substrate may be replaced.)

4.4.3 Input plug of this machine came off from the power source

Power plug not securely connected to main power source.	After turning OFF the circuit protector of this machine and the switch of the work machine, connect the male plug to the main power source securely.
---	--

4.4.4 Male plug of work machine came off from the output outlet

Male plug of the work machine is not securely connected to the output outlet.	After turning the work machine switch OFF, securely connect the male plug.
The plug cover of output outlet is not properly engaged to the claw of the male plug of work machine. Or the male plug claw is worn or damaged.	After turning the work machine switch OFF, connect the male plug securely, then make sure the claw is properly engaged. If the claw is worn or damaged, replace the male plug.

4.4.5 Dropping of this machine, etc.

This machine is dropped or a strong impact was applied.	Before turning on the input power again, check inside and outside of this machine for damage and breakage. If abnormality is detected, immediately stop using, then inspect and repair.
---	---

10.5 Operation Frequency [LED Display] Is Not Shown

5.1 Power is not coming

Power plug is not connected to the power source.	After making sure the switch of this machine is turned OFF, connect to the power source. Then check the display. (If the switch is ON, turn it OFF.)
--	--

5.2 Power is coming

Relay power connector on frequency display substrate is disconnected.	Check the relay power connector for breakage and damage. Then reconnect.
Relay power connector on frequency display substrate is damaged, broken or get dirty.	Replace frequency display substrate assembly and Frequency Adjustment・Abnormality Display SW.
LED letters are missing.	

10.6 Operation Of Frequency Adjustment Switch (▲・▼) Is Disabled

6.1 Power is not coming

- | | |
|--|--|
| Power plug is not connected to the power source. | After making sure the switch of this machine is turned OFF, connect to the power source. (If the switch is ON, turn to OFF.) |
|--|--|

6.2 Power is coming

6.2.1 Operation of frequency adjustment switch (▲・▼) is disabled

- | | |
|--|--|
| Frequency Adjustment・Abnormality Display SW wiring is disconnected. | Check the wiring for damage and breakage. Then reconnect. |
| Frequency Adjustment・Abnormality Display SW trouble | Replacement of Frequency Adjustment・Abnormality Display SW |
| Frequency display substrate, power source and control substrate trouble [mounted parts and circuit breakage, etc.] | Immediately stop using. Inspect and repair this machine. |

6.2.2 Unable to adjust frequency. (▲ : Only upward adjustment possible ▼ : Only downward adjustment possible)

- | | |
|---|--|
| Trouble of Frequency Adjustment・Abnormality Display SW | Replacement of Frequency Adjustment・Abnormality Display SW |
| Trouble of frequency display substrate, power source and control substrate [mounted parts and circuit breakage, etc.] | Immediately stop using. Inspect and repair this machine. |

10.7 Display Item Selection・Check・Confirmation (Ⓒ,Ⓔ) Switch Is Not Working

7.1 Power is not coming

- | | |
|--|---|
| Power plug is not connected to power source. | After making sure the switch of this machine is OFF, connect to the power source. (If the switch is ON, turn it OFF.) |
|--|---|

7.2 Power is coming

7.2.1 Display item selection・check・confirmation switch (Ⓒ,Ⓔ) is not working

- | | |
|---|--|
| Wiring of Frequency Adjustment・Abnormality Display SW is disconnected. | Check the wiring for breakage and damage. Then reconnect. |
| Trouble of Frequency Adjustment・Abnormality Display SW | Replacement of Frequency Adjustment・Abnormality Display SW |
| Trouble of frequency display substrate, power source and control substrate [mounted parts and circuit breakage, etc.] | Immediately stop using. Inspect and repair this machine. |

10.8 Anti-Vibration Rubber Trouble

8.1 When the anti-vibration rubber is broken

- | | |
|---|--------------------------------------|
| Breakage and separation of anti-vibration rubber due to strong impact applied and falling of the machine during transportation and handling | Replacement of anti-vibration rubber |
|---|--------------------------------------|

8.2 External cooling fan is damaged due to broken anti-vibration rubber

Due to breakage and separation of anti-vibration rubber, external cooling fan and internal cooling fan are damaged, unable to operate.

Replacement of anti-vibration rubber and inspection/replacement of broken or damaged external cooling fan. (Depending on the condition of the breakage of external cooling fan, the red LED lamp lights up. Abnormality description [error display: E08] is displayed to show the condition of trouble. Output of this machine stops.

10.9 Other Troubles

9.1 When damage is found on part of pipe frame and housing

Damage, breakage and failure that hinders the use of the product.

Replace or repair the damaged or broken part before use.

11. INSPECTION, MAINTENANCE AND REPAIR OF INVERTER

1. According to the type of repair (replacement of power source and control substrate or other parts), prepare appropriate tools and electric measurement instruments.
2. When this machine is wet, to prevent electric leakage, dry the machine well before turning the power on.
3. When turning on the power, check to see if the voltage and electric capacity of the power source are appropriate.
4. Before working, cut the input power properly, then start your work after sufficiently discharged.
5. When assembling, pay attention to wiring and terminal connection for any mistake or looseness. Also watch for damage of wire.
6. Please contact with Mikasa distributor or Mikasa website (<http://www.mikasa.com/>) for repair and replacement parts.
7. When contacting, make sure to have the information about the model and production number of the product at hand. If production number is not known, check by removing the top cover of this machine.
8. When using this machine with single phase 200V, use a special power plug (sold separately).

**Single phase 200V power plug
(sold separately)**

MALE : PART No. 1720-30230
FEMALE: PART No. 1720-30240

CAUTION

It is recommended to use a qualified electrician when replacing single phase 100V power plug with a single phase 200V power plug in order to secure safe handling of electric parts.

**Single phase 200V power plug
(sold separately)**

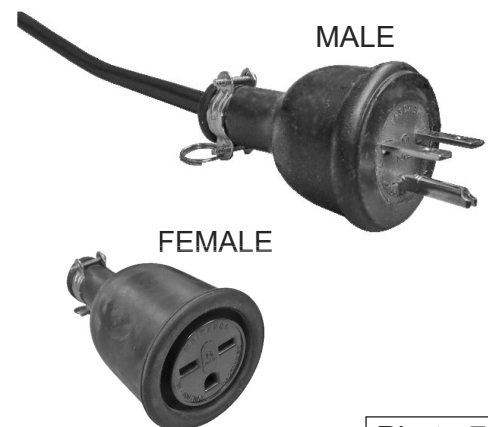


Photo 7

Mikasa

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