



**TRANSISTORIZED INVERTER
INSTRUCTION MANUAL**

**RATIO SETTER
FR-FH**

Thank you for choosing this Mitsubishi transistorized Inverter option.
This instruction manual gives handling information and precautions for use of this equipment.

Incorrect handling might cause an unexpected fault. Before using the equipment, please read this manual carefully to use the equipment to its optimum.

Please forward this manual to the end user.

This section is specifically about safety matters

Do not attempt to install, operate, maintain or inspect this product until you have read through this instruction manual and appended documents carefully and can use the equipment correctly.

Do not use this product until you have a full knowledge of the equipment, safety information and instructions.

In this instruction manual, the safety instruction levels are classified into "WARNING" and "CAUTION".



WARNING

Assumes that incorrect handling may cause hazardous conditions, resulting in death or severe injury.



CAUTION

Assumes that incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause physical damage only.

Note that the CAUTION level may lead to a serious consequence according to conditions. Please follow the instructions of both levels because they are important to personnel safety.

SAFETY INSTRUCTIONS

1. Electric Shock Prevention

WARNING

- While power is on or when the inverter is running, do not open the front cover. You may get an electric shock.
- Do not run the inverter with the front cover removed. Otherwise, you may access the exposed high-voltage terminals or the charging part of the circuitry and get an electric shock.
- If power is off, do not remove the front cover except for wiring or periodic inspection. You may access the charged inverter circuits and get an electric shock.
- Before starting wiring or inspection, switch power off, wait for more at least 10 minutes and check for the presence of any residual voltage with a meter etc.
- Earth the option unit.
- Any person who is involved in the wiring or inspection of this equipment should be fully competent to do the work.
- Always install the inverter before wiring. Otherwise, you may get an electric shock or be injured.
- Operate the switches with dry hands to prevent an electric shock.
- Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Otherwise, you may get an electric shock.

2. Fire Prevention

CAUTION

- Mount the option unit on an incombustible surface. Installing the inverter or option unit directly on or near a combustible surface could lead to a fire.
- If the inverter has become faulty, switch off the inverter power. A continuous flow of large current could cause a fire.

3. Injury Prevention

CAUTION

- Apply only the voltage specified in the instruction manual to each terminal to prevent damage etc.
- Ensure that the cables are connected to the correct terminals. Otherwise, damage etc. may occur.
- Always make sure that polarity is correct to prevent damage etc.
- While power is on and for some time after power-off, do not touch the option unit as they are hot and you may get burnt.

4. Additional instructions

Also note the following points to prevent an accidental failure, injury, electric shock, etc.:

(1) Transportation and installation

⚠ CAUTION

- When carrying products, use correct lifting gear to prevent injury.
- Do not stack the inverter boxes higher than the number recommended.
- Ensure that installation position and material can withstand the weight of the option unit. Install according to the information in the Instruction Manual.
- Do not operate if the option unit is damaged or has parts missing.
- Do not stand or rest heavy objects on the option unit.
- Check the option unit mounting orientation is correct.
- Prevent screws, wire fragments, conductive bodies, oil or other flammable substances from entering the option unit.
- Do not drop the option unit, or subject it to impact.
- Use the inverter under the following environmental conditions:

Environment	Ambient temperature	-10°C to +50°C (non-freezing)
	Ambient humidity	90%RH or less (non-condensing)
	Storage temperature	-20°C to +65°C*
	Ambience	Indoors (free from corrosive gas, flammable gas, oil mist, dust and dirt)
	Altitude, vibration	Maximum 1000m above sea level for standard operation. 5.9 m/s ² or less (conforming to JIS C0911)

*Temperatures applicable for a short time, e.g. in transit.

(2) Trial run

⚠ CAUTION

- Check all parameters, and ensure that the machine will not be damaged by a sudden start-up.

(3) Operation

⚠ CAUTION

- Do not modify the equipment.

(4) Emergency stop

 **CAUTION**

- Provide a safety backup such as an emergency brake which will prevent the machine and equipment from hazardous conditions if the inverter or option unit fails.

(5) Maintenance, inspection and parts replacement

 **CAUTION**

- Do not carry out a megger (insulation resistance) test on the control circuit of the option unit.

(6) Disposing of the inverter

 **CAUTION**

- Treat as industrial waste.

(7) General instructions

Many of the diagrams and drawings in this instruction manual show the inverter without a cover, or partially open. Never run the inverter like this. Always replace the cover and follow this instruction manual when operating the inverter.

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FR-FH RATIO SETTER

Incorporating five ratio setter circuits, a single FR-FH ratio setter can operate up to five inverters at different ratios.

1. STRUCTURE

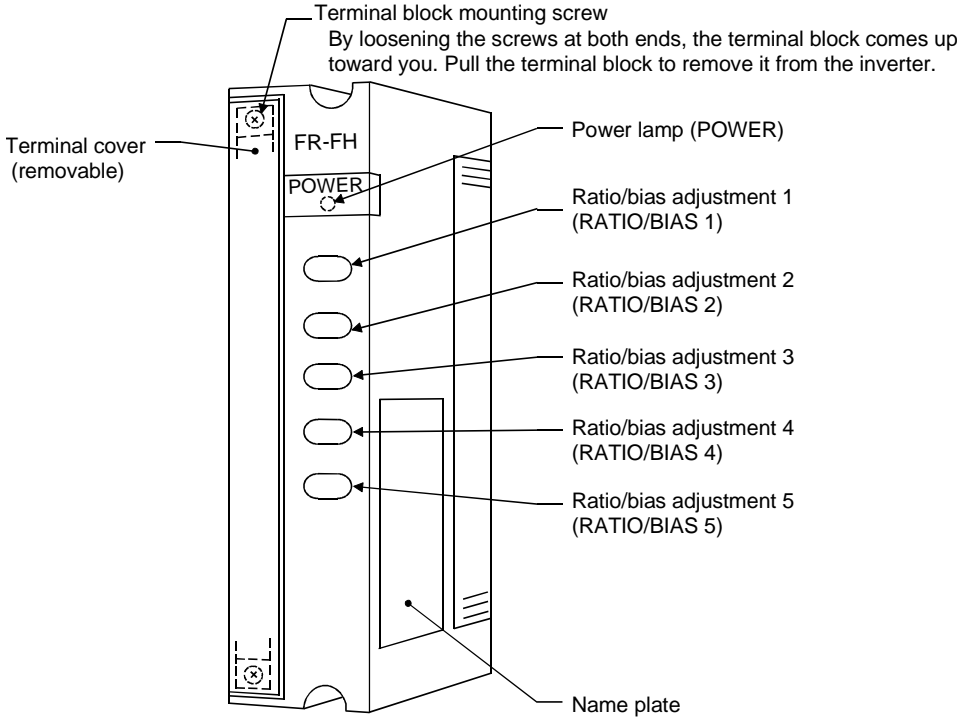


Fig. 1 Structure

2. INSTALLATION

- (1) Avoid direct sunlight, high temperature, high humidity, much dust and much gas, and select a clean, dry place to install. (The unit is not a totally enclosed type.)
- (2) Select a place of installation where heat will not build up, and install the unit with the minimal wiring distance from the inverter (e.g. install the unit within the control box where the inverter is installed).
- (3) When wiring, take the wiring space of the cables into consideration as the cables will come out on the left side.

3. WIRING

- (1) Remove the terminal cover. The terminal cover comes off by pulling the left-hand side recesses toward you as shown in Fig. 2.
- (2) You can use a power supply of either single-phase 200V or 115V. When using a 200V power supply, wire it across terminals 200V-0. When using a 115V power supply, wire it across terminals 115V-0. Note that wrong wiring may burn the internal transformer. (Refer to Fig. 3 Wiring Diagram.)
- (3) When relay contacts are required in the signal line, connect two micro-current switching relay contacts in parallel (or a twin contact) to prevent a contact fault.
- (4) Use twisted or shielded cables as signal cables and run them away from the power cables.

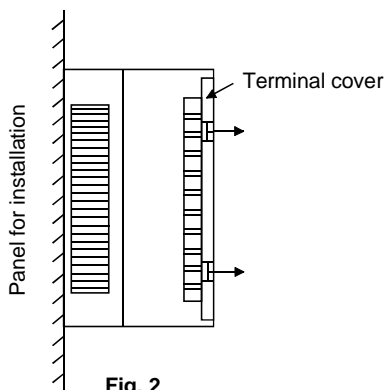


Fig. 2

4. CIRCUIT STRUCTURE

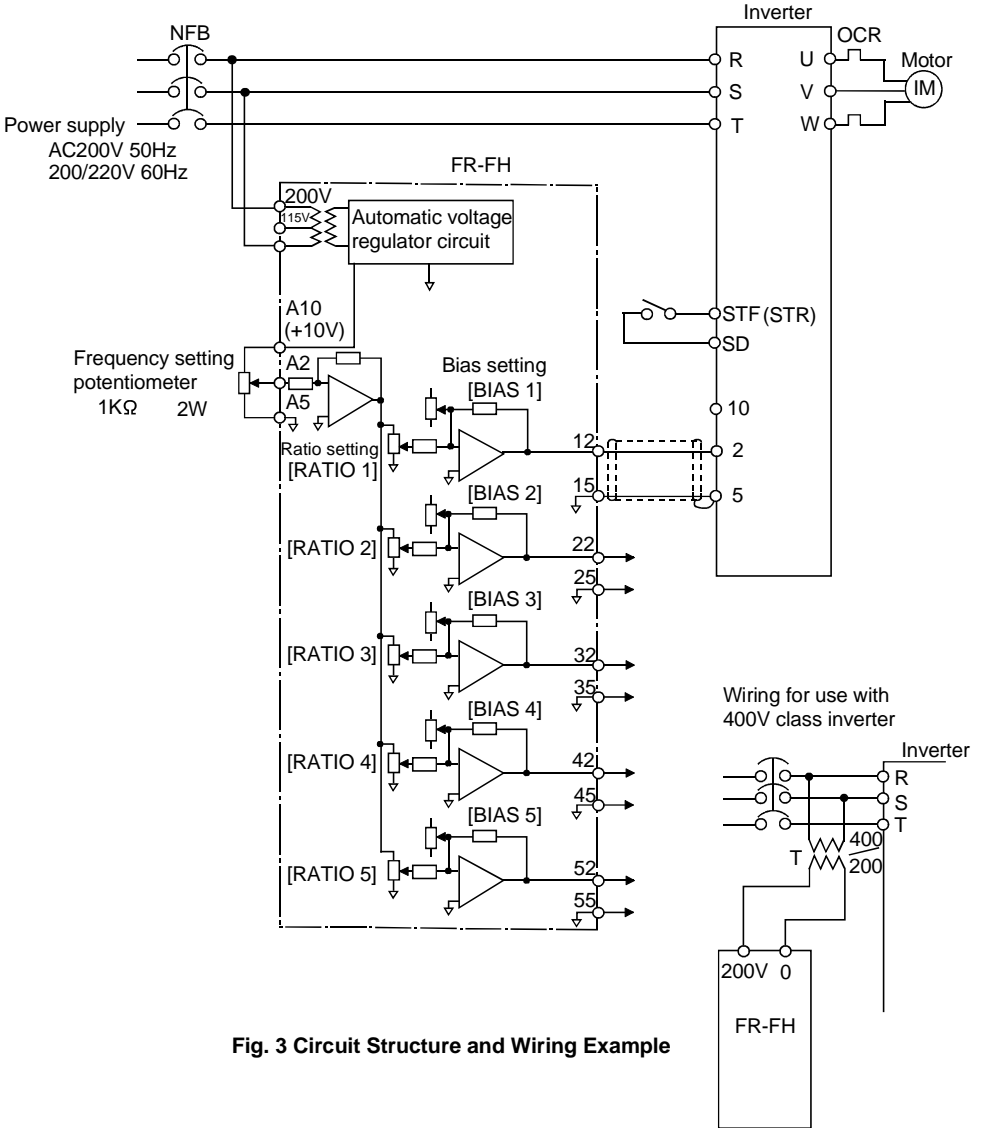


Fig. 3 Circuit Structure and Wiring Example

5. CIRCUIT EXPLANATION

The ratio setter has five ratio setter circuits consisting of operational amplifiers as shown in Fig. 3. Each circuit is provided with the ratio setting potentiometer (RATIO) and bias setting potentiometer (BIAS) which enable independent setting. The relationships (gains) between the input and outputs of each circuit are as follows. Note that this applies to the bias of 0.

Input Signal (across Terminals A2-A5)	*Output Signal (across Terminals 12-15 to 52-55)
5VDC	Adjustable in the range 0 to 10VDC
10VDC	Adjustable in the range 0 to 10VDC

*Input of a negative voltage outputs a negative voltage. (Refer to page 5)

Bias setting allows 10VDC to be increased or decreased to or from the output, independently of the ratio setter. (Refer to page 6)

6. ADJUSTMENT

When the input voltage to the ratio setter is varied in the range 0 to 100% (0 to 5V or 0 to 10V) with the frequency setting potentiometer (1K 2W Ω variable resistor), its output characteristic is adjustable within the ranges shown in Figs. 4, 5 and 6. The I/O characteristics, which are described in the typical circuit, can be adjusted in the same procedure for all the five circuits.

(1) Ratio setting (RATIO): Changing the slope of the characteristic

After the input voltage (across terminals A2-A5) has been set to 0V with the frequency setting potentiometer and the voltage across frequency terminals 12-15 adjusted to 0V with the bias setting potentiometer (BIAS), any of the characteristics (within the diagonally shaded area) shown in Fig. 4 can be obtained according to the setting position (input) of the frequency setting potentiometer. This indicates that the setting of "RATIO" provides the slope of 0 to 100%.

When the slope you need is other than the standard setting, adjusting the "RATIO" potentiometer enables the frequency setting output signal (across terminals 12-15) to be 5V at the input voltage (across terminals A2-A5) of 10V.

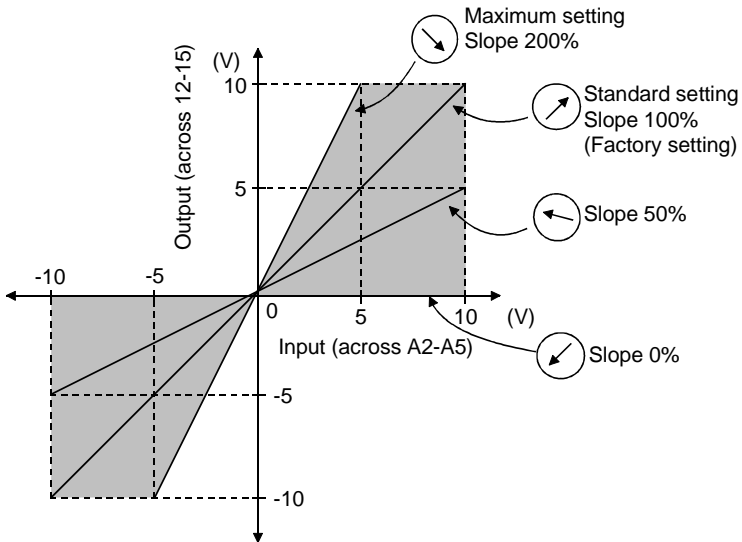
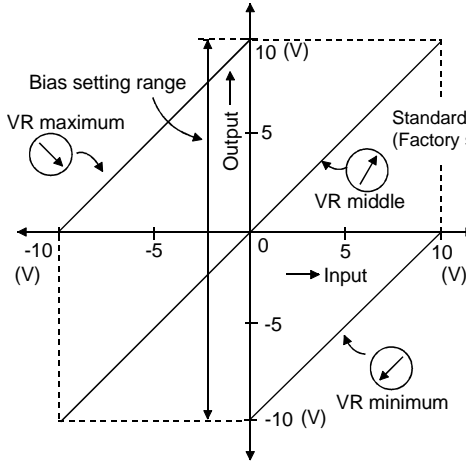


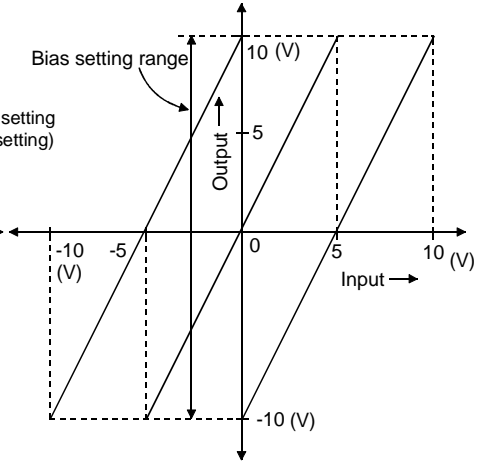
Fig. 4 "RATIO" Setting (at Bias of 0)

(2) Bias setting (BIAS): Translating the characteristic vertically

With the "RATIO" potentiometer in the standard setting position as shown in (1), turning the "BIAS" potentiometer translates the output characteristic vertically as shown in Fig. 5 and 6. This bias adjustment can be made within the range +10V to -10V. A clockwise turn of the "RATIO" potentiometer decreases the output voltage and a clockwise turn increases.



**Fig. 5 "BIAS" Setting
(At Standard Setting of "RATIO")**



**Fig. 6 "BIAS" Setting
(At Maximum Setting of "RATIO")**

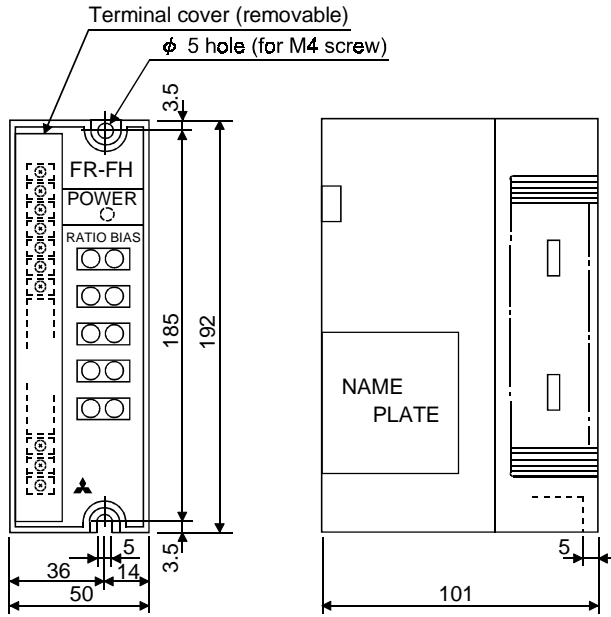
7. OPERATING INSTRUCTIONS

- (1) If you make the bias setting onto the negative side or enter a negative voltage to the input terminal, full attention should be paid to the connected equipment since the frequency setting signal (output) will be a negative voltage.
- (2) When connecting a variable resistor to the main speed setting input, use the one of a rating of 1K Ω to 2K Ω at 1W or more.

8. SPECIFICATIONS

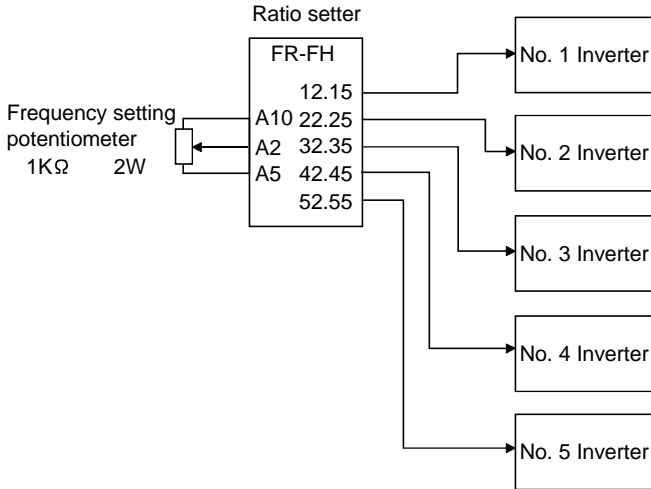
Power supply voltage	200VAC 50Hz, 200/220VAC 60Hz 115VAC 60Hz
Power consumption	3VA
Frequency setting input signal [Terminal A2]	0 to 10VDC, 0 to 5VDC input resistance 10K Ω
Frequency setting power supply [Terminal A10]	10VDC, 10mA permissible load current
Number of ratio setting circuits	5 circuits
Frequency setting output signal	Adjustable in the range 0 to \pm 10VDC (5mA) per circuit
Adjustment functions	RATIO setting (range 0 to 200%) ... Refer to page 5 BIAS setting (range 0 to \pm 10VDC) ... Refer to page 6

9. OUTLINE DRAWING



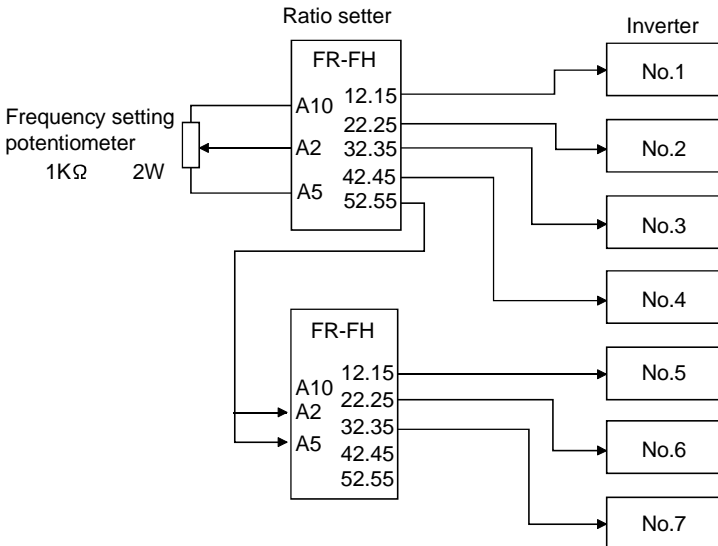
10. APPLICATION EXAMPLE

(1) Running 5 inverters



*You can connect up to five inverters to one ratio setter.

(2) Running 7 inverters



*When connecting more than five inverters, use two or more ratio setters.

Two FR-FH units allows connection of up to nine inverters.

Maximum number of inverters that may be connected using "n" FR-FH units
 $4n+1$ [units]

REVISIONS

*The manual number is given on the bottom left of the back cover.

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Jul., 2000	IB(NA)-0600044-A	First edition