# MITSUBISHI

## General Purpose Inverter

## FREQROL-U100

## Instruction Manual

## (Multi-function Series)

Thank you for choosing this Mitsubishi Inverter.
This manual gives handling, safety and operating instructions.

## This section is specifically about safety matters

Read this manual carefully and become familiar with the inverterbefore operation, pay special attention to the safety information marked Warning.


This warning symbol indicates the presence of dangerous voltage. It informs you of high voltage conditions, situations and locations that may cause death or serious injury if you do not follow precautions.


This symbol indicates a general warning. Serious injury may occur if precautions are not followed.

Where these Wamings are written, pay special attention to the precautions detailed.

## Operator Safety

1. Electric shock prevention

| ⚠ WARNING HIGH VOLTAGE |
| --- |
| ⚠ Do not remove the front cover while there is power supplied to the inverter, there are high voltage terminals which can be accessed. Please check the wiring when the inverter is not powered.<br>⚠ There are high voltage capacitors in the main circuit which remain charged after the inverter has been turned off, wait 10 minutes after the Power Lamp has gone out and check for no residual voltage actoss terminals "P/+" and "-" ("P" and "N") before touching wires.<br>⚠ Use good earthing. Earth the inverter before wiring the Power circuits and control circuits.<br>⚠ Do not operate with wet hands.<br>⚠ Do not damage, cut, trap, or degrade the cables. |

2. Fire Prevention

| ⚠ WARNING |
| --- |
| ⚠ Do not mount on or near combustible material (such as wood)<br>⚠ Use a circuit breaker on the supply side of the inverter to prevent high current flow in the case of a fault.<br>⚠ Do not connect a resistor directly to terminals "P" and "N". |

3. Injury Prevention

| ⚠ WARNING |
| --- |
| ⚠ Only supply the inverter with the voltage on the nameplate and in the Manual Specification section.<br>⚠ Other voltages may cause the inverter to fail.<br>⚠ Care should be taken when wiring to ensure correct terminals are used. Check polarity etc.,.<br>⚠ Do not touch the inverter while it is powered as certain parts become hot. |

4. Other points

To prevent injury, damage, or product failure please note the following points.

(1) Transportation and mounting

| ⚠ WARNING |
| --- |
| ⚠ Take care when carrying products, use correct lifting gear.<br>⚠ Do not stack the inverter boxes higher than the number recommended.<br>⚠ Ensure the installation position and material can with stand the weight of the inverter. Install according to the information in the Instruction Manual.<br>⚠ Do not operate if the inverter is damaged or has parts missing.<br>⚠ Do not life the inverter with the front cover attached, it may fall off.<br>⚠ Do not stand or rest heavy objects on the inverter.<br>⚠ Check the inverter mounting orientation is correct.<br>⚠ Prevent any dust, wire fragments or other foreign bodies from dropping into the inverter during wiring up and commissioning. |

## ⚠ WARNING

⚠ Do not drop the inverter, or subject it to impacts.
⚠ Environmental limitations, Check the ambient temperature, humidity, storage temperature, atmosphere, altitude, vibration. −10℃ to +50℃ (without freezing) −10℃ to +40℃ for enclosed specification.
Less than 90% Relative Humidity without condensation.
Ensure the environment is −20℃ to +65℃ (short time storage temperature), no corrosive or flammable gasses, altitude less than 1000m above sea level, vibration is less than 5.9m/s 2 {0.6 G} (based on JIS C 0911)

(2) Wiring

## ⚠ WARNING

⚠ Do not fit power factor correction capacitor, or RFI filter to the output of the inverter.
⚠ The connection orientation of the output cables U, V, W to the motor will effect the direction of rotation of the motor.

(3) Trial run

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

(4) Operation

| ⚠ WARNING |
| --- |
| ⚠ When retry function is selected the inverter will try to restart the machine up to 10 times over a 1 hour period. Ensure operator safety with other devices.<br>⚠ The stop key can only be used at all times to stop the inverter when a parameter has been set, therefore use an external emergency stop button. Switch off start signal when resetting the inverter, failure to do so may start the motor immediately after reset.<br>⚠ The Electronic motor thermal protection does not guarantee to prevent motor burn out. |

## ⚠ WARNING

⚠ Do not use a contactor in the inverter input for frequent start /stopping of the inverter, use control signals.
⚠ To reduce the effect of mains conducted electromagnetic interference use a RFI noise filter.
⚠ Take care to ensure electromagnetic radiation from the inverter does not damage or effect the operation of nearby electrical equipment.
⚠ Use an input line reactor when the power supply capacity is large, or where harmonics from the inverter will cause problems.
⚠ Take countermeasures to prevent motor insulation damage from micro surge voltages in the supply cable.
⚠ Reset the inverter before starting set-up, initialises the parameters to factory set values.
⚠ Do not use the inverter and motor at high speed until the machine has been checked.
⚠ The inverter does not have a holding stop facility. For emergency stop another circuit must be used.

(5) Emergency stop

| ⚠ WARNING |
| --- |
| ⚠ Use a circuit and mechanical brake etc. which will protect the operator of the machine should the inverter fail. |

(6) Maintenance and inspection

| ⚠ WARNING |
| --- |
| ⚠ Do not carry out a megga (insulation resistance) test on the control circuit of the inverter. |

(7) Disposing of the inverter.

| ⚠ WARNING |
| --- |
| ⚠ Treat as industrial waste. |

(8) General

Many of the diagrams and drawings in the instruction manual show the inverter without a cover, or partially open, never run the inverter like this. Always replace the cover and ensure adequate cooling etc. before using the inverter.

Thank you for purchasing the Mitsubishi general purpose inverter FREQROL-U100.
For safe operation, please read this manual thoroughly before using this device.

## Table of Contents

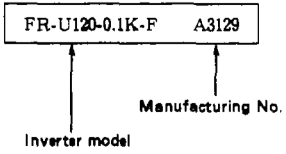
# 1. INSPECTION AT DELIVERY

Confirm the following points when unpacking the device.

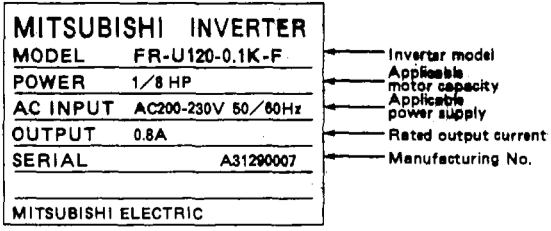
(1) Check the model plate on the front of the inverter and the rating plate on the side and check that the delivered device is the same as that ordered.

(2) Check for damage caused during shipment.

If there any unclear points or damage is found in the device, please contact the place of purchase or your nearest Mitsubishi dealer.

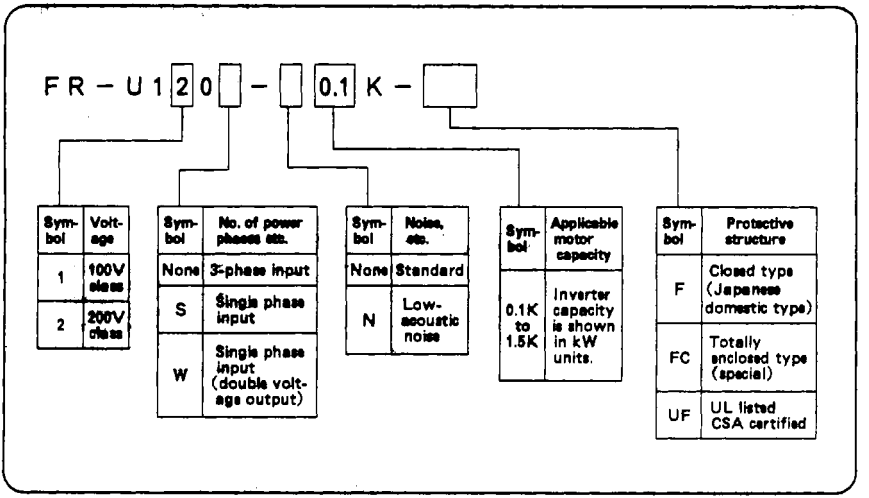



**Details of model plate**




**Details of rating plate**

## Details of model




| Symbol | Voltage |
|---|---|
| 1 | 100V class |
| 2 | 200V class |

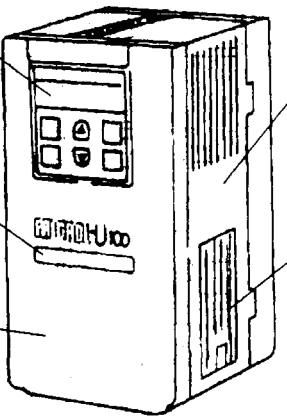
| Symbol | No. of power phases etc. |
|---|---|
| None | 3-phase input |
| S | Single phase input |
| W | Single phase input (double voltage output) |

| Symbol | Noise, etc. |
|---|---|
| None | Standard |
| N | Low-acoustic noise |

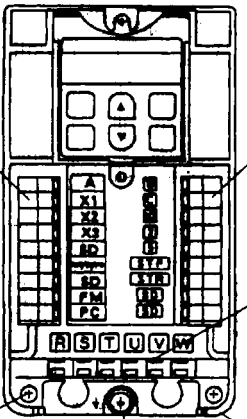
| Symbol | Applicable motor capacity |
|---|---|
| 0.1K to 1.5K | Inverter capacity is shown in kW units. |

| Symbol | Protective structure |
|---|---|
| F | Closed type (Japanese domestic type) |
| FC | Totally enclosed type (special) |
| UF | UL listed CSA certified |

# 2. NAMES AND FUNCTIONS OF EACH PART



**State with front cover removed**
(For FR-U$_{120}$-[ ]-F)




**Terminal block for control circuit (TB1)**

Function selection input, operation status output and display meter connection are available through these terminals.

**Terminal block for control circuit (TB2)**

The start signals and frequency setting signal, etc., are connected to these terminals.

**Terminal block for power supply and motor**

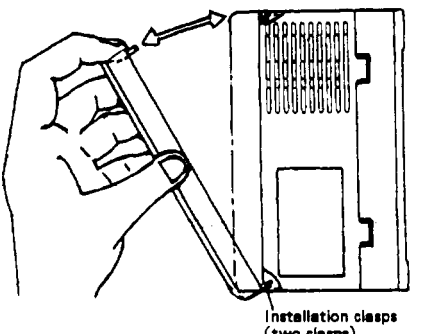
Power supply and motor are connected to these terminals.

Installation hole (three holes)

Grounding terminal (M4)

Front cover inlet (two inlets)

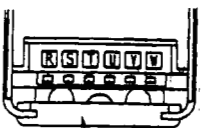
## How to remove/mount front cover

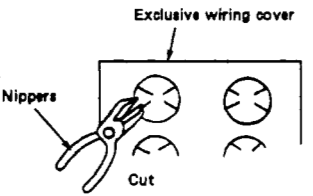



The cover can be removed by pushing the top and pulling it forward. To mount the cover, insert the two installation clasps on the bottom of the cover into the inlets on the main unit cover, and press on the cover.

**Specifications for totally enclosed type**

There is an exclusive wiring cover as shown below. Cut the wiring cover windows with nippers or cutters when wiring.



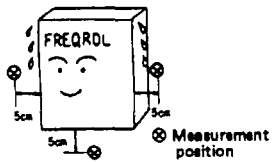



# 3. INSTALLATION

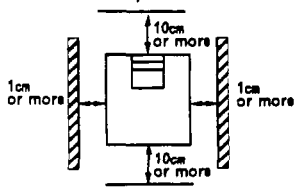
● **Install the inverter vertically.**
Non-vertical installation methods will cause the inverter's heat dissipating effect to decrease, and may cause unforeseen problems and breakdowns.


● **Keep the ambient temperature within the permissible temperature range.**
If the inverter's ambient temperature rises due to installation near a heat generating object or installation in a panel will cause the inverter life to decrease remarkably.
Take cooling methods and panel dimensions into consideration when installing the inverter in a panel.

- Tolerable ambient temperature : −10 to 50℃ (−10 to +40℃ for totally enclosed type)
- Points for measuring ambient temperature




- Ambient space



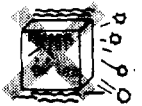

**Note** : The inverter was designed for use in separately earthed enclosure.
Precautions must therefore be taken at point of installation to minimise risk of hazard to users.

● **Avoid installation in the following places**

- Where the inverter is subject to direct sunlight
- Humid places

- Places contaminated with oil mist, dust, lint or corrosive gases. Where the inverter is subject to wind containing salt.

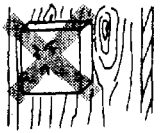
- Places that vibrate



Pay attention to carriages or press machines, etc.

- Places where explosive gases exist.

- Installation on flammable material such as wood.



# 4. WIRING

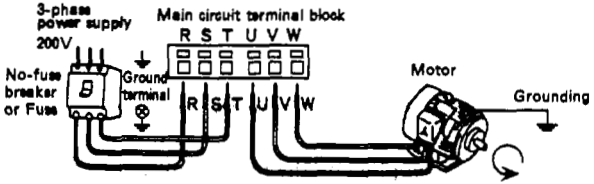
## ■ Precautions for wiring

Pay attention to the following items during wiring to prevent mistaken wiring and mistaken usages.

*Precautions for wiring*

(1) When the power supply is applied on the inverter output terminals (U, V and W), the inverter will be damaged. Never wire the power supply to these terminals.
(2) Use a shield or twisted wire for the wiring to the control circuit terminal, and separate the wires from the main circuit or power distribution circuit (200V relay sequence circuit, etc.).
(3) Cover the slits on the inverter so that the wire waste does not enter the inverter during wiring.
(4) Confirm that the display lamp on the key pad has gone out before changing the wiring after operation, and wait at least two minutes before starting the wiring. (It takes more than one minutes for discharge of the internal capacitors after disconnecting power supply.)

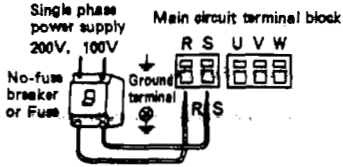
## ■ Connecting power supply and motor



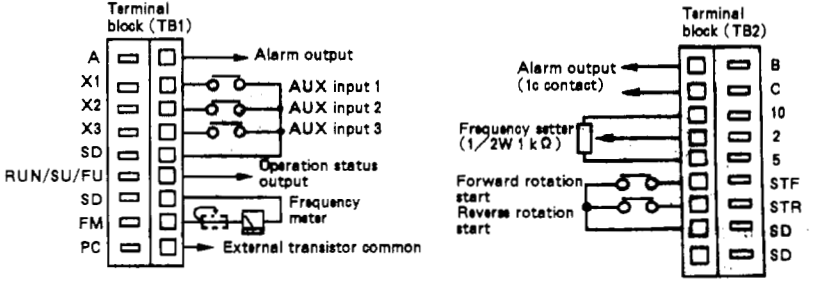

Always connect the power supply wires to R, S and T. Never connect to U, V and W as the inverter will be damaged.
(The phases do not need to be matched.)

Connect the motor to U, V and W.
The motor rotation direction will be counterclockwise(direction of the arrow, shown above)looking from the load shaft when the wires are connected as shown above and the forward rotation switch (signal) is turned on.

Single phase input series



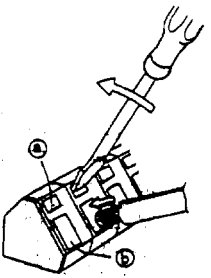
## ■ Connecting control signals




(Note 1) The function of the AUX input terminals (X1, X2, X3) is selected with the input teminal function selector 60.

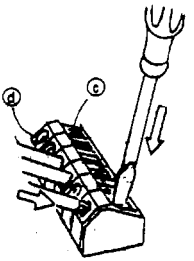
(Note 2) 2W1kΩ is recommended if the frequency setting is to be changed frequently.

(Note 3) The terminal block TB1 and TB2 terminals SD are connected inside the inverter.




**Connection of main circuit terminals**

Use a small minus screwdriver (with blade width 2.5 to 3 ㎜).
It is introduced in the upper slot ⓐ and it's blade holds the spring open so that the stripped power supply wire can be introduced into the terminal ⓑ.
Withdraw the screwdriver, the conductor is clamped.




**Connection of control circuit terminal**

Insert a small minus screwdriver (with blade width 2.5 to 3 ㎜) into the right hole ⓒ, and insert the stripped wire into ⓓ while pressing the screwdriver in the direction of the arrow. Remove the screwdriver when the wire has been inserted.

(Note) Use a small flat-blade screwdriver (blade width 2.5 to 3㎜).

## ■ Wire size and peeling length

### ● Applicable wire size for terminal block

| | Main circuit (Note 1) | Control circuit |
|---|---|---|
| Wire size | Solid wire : φ0.3 to φ1.8 mm<br>Strand : 0.08 to 2.5 mm² | Solid wire : φ0.4 to φ1.0 mm<br>Strand : 0.3 to 0.75 mm² |
| Wire sheath peeling length | 5 to 6 mm | 8 to 10 mm |

Screwless terminal is standard feature for the terminal blocks excluding the grounding terminal.
Connected with rod terminals* or with only the wire instead of using crimp terminals.
(When using strands, make sure that the strands do not loosen to avoid a short circuit.)
Use a crimp terminal for only the grounding terminal.

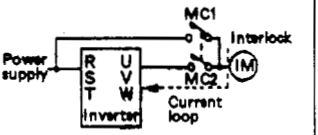
(Note 1)
The wire sizes shown above are available, but a 2 mm² wire is recommended in terms of reliability.

*Example of rod terminals

| Circuit | Applicable terminal name | Applicable wire size | | Manufacturer |
|---|---|---|---|---|
| | | Solid wire (mm) | Strand wire (mm²) | |
| Main circuit terminal | TC−1.25 (S) | φ0.57 to φ1.44 | 0.25 to 1.65 | Nichifu Terminal |
| | TC−2 (S) | φ1.14 to φ1.82 | 1.04 to 2.36 | |
| | TUB−1.25 | φ0.57 to φ1.44 | 0.55 to 1.65 | Japan Solderless Terminal |
| Control circuit terminal | TC−0.5 | φ0.57 to φ0.7 | 0.25 to 0.75 | Nichifu Terminal |
| | H0.25/10 | φ0.57 | 0.25 | Japan Weidmuller |

## *Details to be checked in wiring planning*

(1) When the circuit has current loop in the power supply due to a mistaken connection as well as to a commercial selector circuit as shown on the right, the inverter will be damaged. Always create an electrical and mechanical interlock for MC1 and MC2.




(2) If a power failure occurs and the start signal (start switch) is retained, the inverter will automatically resume operation when the power is restored. If the machine must be prevented from restarting with power restoration, install a magnetic contactor MC on the primary side of the inverter, and design a sequence to prevent the start signal from turning ON.

(3) Use two contacts in parallel or a twin contact to prevent an imperfect contact for the input signal of the control circuit.

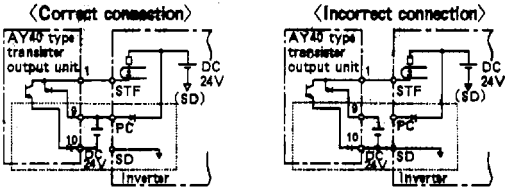
(4) Do not input a voltage on the contact input terminal (STF, etc.) of the control circuit.

(5) Do not apply the voltage directly onto the alarm output signal terminal (B, C). Pass the voltage through a relay coil or ramp.

(6) When directly connecting the open collector output such as that from a sequence controller into the inverter input terminal, make sure that a backflow current does not occur.

**Use of PC terminal**

If the external power common for transistor output is connected to this terminal, malfunctions caused by a backflow currents can be prevented.

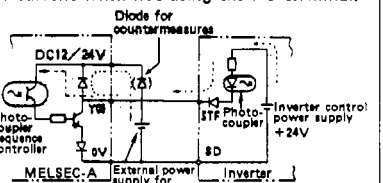



(Note) A DC24V power supply is required for the AY40 type unit.

Use the following countermeasures to prevent a backflow current when not using the PC terminal.

**Countermeasures**

(1) Insert a diode to prevent the backflow current.
(2) Use an all-point isolated type output unit.
(Ex. AY40A, etc.)
(3) The external power supply voltage must be higher than the inverter's control power supply.
(4) Use a PC terminal (external transistor common).

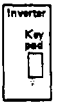
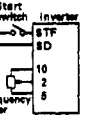
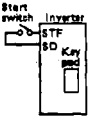
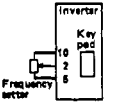



⚠ [CAUTION] REMOVAL OF COVER WHEN UNIT IS POWERED GIVES ACCESS TO HIGH VOLTAGES. PLEASE ISOLATE INVERTER FROM POWER BEFORE PERFORMING ANY ADJUSTMENTS TO WIRING, ETC. WAIT AT LEAST 3 MINUTES AFTER ISOLATION BEFORE REMOVING FRONT COVER.

# 5. OPERATION

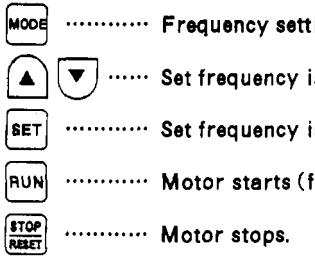
## ■ Operation methods

The following operation methods can be used. Select the method according to the application and operation specifications.

| Operation method | Details | Remarks |
|---|---|---|
| Operation with key pad | Start/stop and operation frequency setting with key pad. | Factory-set to select this mode at power on.   |
| Operation with external input signal | Start with external switch and operation frequency is adjusted with the external frequency setter connected to the inverter control terminal. |   |
| Combined use of Operation with external input signals and key pad. (Refer to Pr.79) | Start with external switch and setting of operation frequency with key pad. | The external frequency setter and key pad RUN and STOP keys are not accepted.   |
| | Start/stop with key pad. setting of operation frequency with external frequency setter. | The external start switch command is ignored.   |

## Operation with key pad

The key pad operation (parameter No. 79 "1" ) is selected as the factory setting.

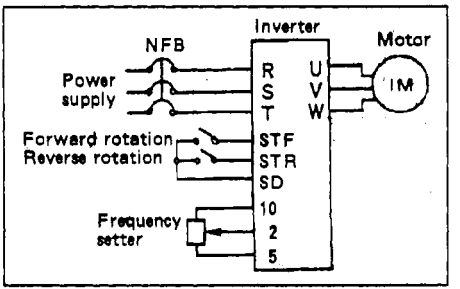



(Note)

To drive the motor in the reverse direction with the RUN key, short-circuit between STR and SD on the terminal block, or set parameter No.78 to "2".

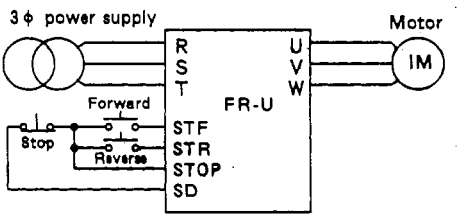
## Operation with external input signal

- Set external operation mode (parameter No.79 "2" ). (Refer to the following explanation for the setting method. ) The start signals and frequency are input with external switches and frequency setting potentiometer. The motor will operate when a signal is input into STF (forward rotation) or STR (reverse rotation) and the frequency setter is operated.

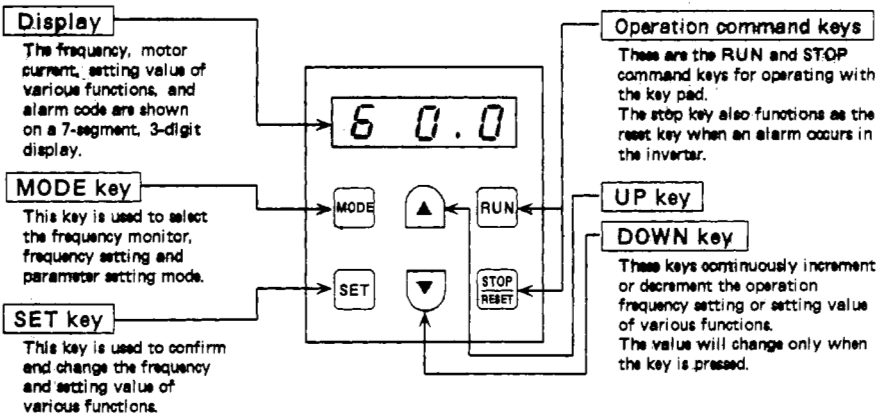



**Note**

The start signal self-holding function can be slected (for details see Pr.61)

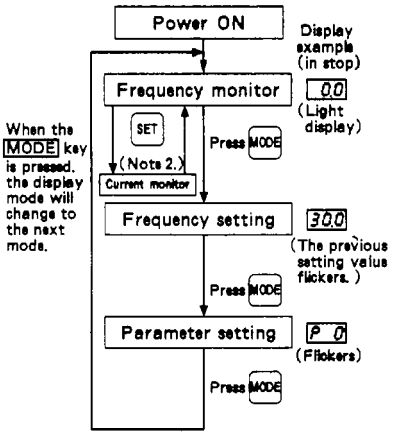


## ■ How to use the key pad




⚠[CAUTION] DO NOT USE ANY SHARP OBJECTS ON THE KEY PAD, OR IT MAY DAMAGE THE MEMBRANE.

## ■ Monitor and parameter settings




**Monitoring method**

50.0 ····· The output frequency is displayed.

↕ Hold down SET.

1.7 ····· The output current will display only while the SET key is pressed.
(The display shows 1.7A)

**Frequency setting method**

《To change set frequency from 30Hz to 60Hz》

30.0 ····· Display the set frequency. (When set to 30Hz)

↕ : Change the setting with the UP or DOWN key.

60.0 ····· Adjust the frequency. (To set to 60Hz)

↓ SET (The display will flicker until the setting is completed.)

( F / 60.0 ) ····· Complete the frequency setting.
Flickers alternately.

**Parameter setting method**

《To change operation mode to external operation》
Display the parameter setting mode with the MODE key.

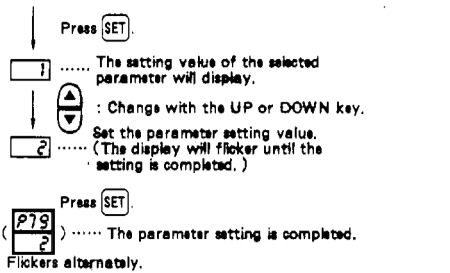
P 0 ····· Parameter number (Note 1.)

↕ : Change with the UP or DOWN key.

P79 ····· Set the parameter number.
(To set to operation mode)

(Note)

1) Pressing UP or DOWN key will increment or decrement displayed parameter number by one in order of the parameter list. (P0 will display if the UP key is pressed when CLr is displayed.)
2) The current monitor displays only when the SET key is pressed in the frequency monitor mode.




● When alarm (Er 1 to 3) is displayed
(The alarm can be canceled by pressing the mode key, not canceled by RESET key.)

| Alarm display | Type | Details |
|---|---|---|
| Er1 | Write prohibit alarm | Writing was attempted during the pr.77 "1" state (write prohibit) |
| Er2 | Write alarm during operation | Pr.79 was rewritten or all clear was executed during operation. |
| Er3 | Calibration error | The calibration value for C-2 and C-3 was too close. * |

* The calibration error will occur if the difference of the input voltage for the C-2 to C-3 calibration value is approximately 0.5V or less.

# 6. Functions

## ■ List of functions

| Function No. (parameter) | Function name | Setting range | Setting unit | Factory setting | User setting |
|---|---|---|---|---|---|
| 0 | Torque boost (manual) | 0 to 15% | 1 % | 6 % | |
| 1 | Upper limit frequency | 0 to 120 Hz | 0.1 Hz | 120 Hz | |
| 2 | Lower limit frequency | 0 to 60 Hz | 0.1 Hz | 0 Hz | |
| 3 | Base frequency | 50 to 120 Hz | 0.1 Hz | 60 Hz | |
| 4 | 3-speed setting (high) | 0 to 120 Hz | 0.1 Hz | 60 Hz | |
| 5 | 3-speed setting (medium) | 0 to 120 Hz | 0.1 Hz | 30 Hz | |
| 6 | 3-speed setting (low) | 0 to 120 Hz | 0.1 Hz | 10 Hz | |
| 7 | Acceleration time | 0, 0.1 to 999 sec. | 0.1 sec. | 5.0 sec | |
| 8 | Deceleration time | 0, 0.1 to 999 sec. | 0.1 sec. | 5.0 sec | |
| 9 | Electronic thermal relay | 0 to 15A | 0.1 A | Rated current | |
| 10 | PWM mode (Note 6) | 0 to 15, – – – | 1 | 3 | |
| 11 | DC dynamic braking operation time | 0 to 10 sec. | 0.1 sec. | 0.5 sec. | |
| 12 | DC dynamic braking voltage | 0 to 15% | 1 % | 8 % | |
| 15 | JOG frequency | 0 to 120 Hz | 0.1 Hz | 5 Hz | |

| Function No. (parameter) | Function name | Setting range | Setting unit | Factory setting | User setting |
|---|---|---|---|---|---|
| 16 | JOG acceleration/deceleration time | 0, 0.1 to 999 sec. | 0.1 sec | 0.5 sec | |
| 17 | External thermal relay input selection | 0, 1 | 1 | 0 | |
| 19 | Base frequency voltage | 0 to 500V, --- | 1 V | --- | |
| 20 | Acceleration/deceleration reference frequency | 1 to 120 Hz | 0.1 Hz | 60 Hz | |
| 21 | Frequency setting voltage bias | 0 to 60 Hz | 0.1 Hz | 0 Hz | |
| 22 | Frequency setting voltage gain | 0 to 120 Hz | 0.1 Hz | 60 Hz | |
| 23 | Stall prevention operation level | 0 to 10 | 1 | 5 | |
| 24 | Multi-speed setting (4th speed) | 0 to 120Hz, --- | 0.1 Hz | --- | |
| 25 | Multi-speed setting (5th speed) | 0 to 120Hz, --- | 0.1 Hz | --- | |
| 26 | Multi-speed setting (6th speed) | 0 to 120Hz, --- | 0.1 Hz | --- | |
| 27 | Multi-speed setting (7th speed) | 0 to 120Hz, --- | 0.1 Hz | --- | |
| 37 | Speed display | 0, 0.1 to 999 | 0.1 | 0 | |
| 42 | Up-to-frequency sensitivity | 1 to 100% | 1 % | 10% | |
| 43 | Output frequency detection | 1 to 120 Hz | 0.1 Hz | 6 Hz | |
| 44 | Output frequency detection during reverse rotation | 1 to 120Hz, --- | 0.1 Hz | --- | |

| Function No. (parameter) | Function name | Setting range | Setting unit | Factory setting | User setting |
|---|---|---|---|---|---|
| 46 | No.2 acceleration/deceleration time | 0, 0.1 to 999 sec., ---- | 0.1 sec. | ---- | |
| 47 | No.2 deceleration time | 0, 0.1 to 999 sec., ---- | 0.1 sec. | ---- | |
| 48 | No.2 torque boost | 0 to 15%, ---- | 1 % | ---- | |
| 49 | No.2 V/F (Base frequency) | 50 to 120 Hz, ---- | 0.1 Hz | ---- | |
| 50 | Retry selection | 0, 1, 2, 3 | 1 | 0 | |
| 51 | No. of retries at alarm | 0, 1 to 10, 101 to 110 | 1 | 0 | |
| 52 | Retry execution wait time | 0 to 360 sec. | 0.1sec. | 1 sec. | |
| 53 | No. of retry execution time display clear | 0 | 0 | 0 | |
| 55 | Frequency monitor reference | 0 to 120 Hz | 0.1 Hz | 60 Hz | |
| 56 | Current monitor reference | 0 to 200% | 1 % | 150% | |
| 59 | Remote setting function selection | 0, 1 | 1 | 0 | |
| 60 | Input terminal function selection | 0 to 8 | 1 | 0 | |
| 61 | Input terminal allocation | 0 to 999 ---- | 1 | ---- | |
| 70 | FM output terminal function selection | 0, 1 | 1 | 0 | |
| ★71 | Tone selection | 0, 1 | 1 | 0 | |

| Function No. (parameter) | Function name | Setting range | Setting unit | Factory setting | User setting |
|---|---|---|---|---|---|
| ★ 72 | PWM carrier frequency | 2.3 to 14.5 kHz | 0.1 kHz | 7.0 kHz | |
| 75 | Stop key function | 0, 14 | 1 | 14 | |
| 76 | Output signal selection | 0, 1, 2 | 1 | 0 | |
| 77 | Write prohibit selection | 0, 1 | 1 | 0 | |
| 78 | Reverse rotation prevention selection | 0, 1, 2 | 1 | 0 | |
| 79 | Operation mode selection | 1, 2, 3, 4 | 1 | 1 | |
| CLr | Parameter clear | 0, 1, 2 | 1 | 0 | |
| C-1 | Frequency meter scale calibration | — | — | — | |
| C-2 | Frequency setting bias calibration | 0 to 60 Hz | 0.1 Hz | 0 Hz | |
| C-3 | Frequency setting gain calibration | 0 to 120 Hz | 0.1 Hz | 60 Hz | |

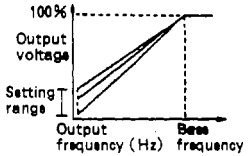
**(Note)**

1. The factory setting for Pr.79 operation mode selection is "1" (key pad mode).
2. The reset key on the key pad is accepted only during an alarm stop.
3. All parameters, excluding Pr.79, Pr.60 and Pr.CLr parameter clear, can be written during operation. (When Pr.77 = 0)
   Writing is invalid when Pr.77=1, except for Pr.77.
4. The setting value "– – –" indicates "no function operation".
5. The parameters marked with ★ are displayed only for the low-acoustic noise model.
6. The Pr.10 setting "– – –" can be set only for the low-acoustic noise model.
   Pr.72 can be read and written when "– – –" is set in Pr.10.
   The factory setting for the low-acoustic noise model is – – –.

## ■ Explanation of functions

● **Torque boost (manual)** [0] ● **No.2 torque boost (manual)** [48]

The low frequency band motor torque can be adjusted to the load.




(Note)

If the setting value is too large. the overcurrent protective function may activate. The setting value can be adjusted while confirming the motor current with the monitor function.

The No.2 torque boost is valid when terminals RT-SD[3] close if the No.2 acceleration/deceleration time Pr.46 is set.

[Factory setting]

Torque boost (manual) ····· 6 %

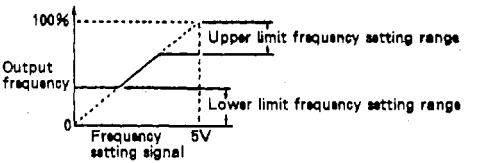
No.2 torque boost (manual) ····· — — —

● **Upper limit frequency** [1] ● **Lower limit frequency** [2]

The upper and lower limit clamps of the output frequency can be set.

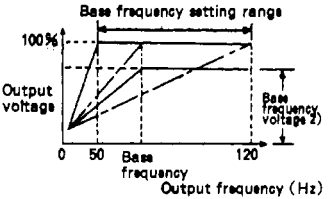
[Factory setting]

- Upper limit frequency ····· 120Hz
- Lower limit frequency ····· 0 Hz

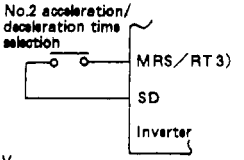


- **V/F (base frequency)** [3] ● **Base frequency voltage** [19]
- **No.2 V/F (base frequency)** [49]

The base frequency (reference frequency at motor rated power) can be set freely between 50 and 120Hz according to the motor rating. The No.2 V/F is valid when terminals RT-SD[3] Close if the No.2 acceleration/deceleration time Pr.46 is set. [1]




[Factory setting]
V/F (base frequency)····· 60Hz
Base frequency voltage ····· – – –
No.2 V/F ([49] ) ····· – – –

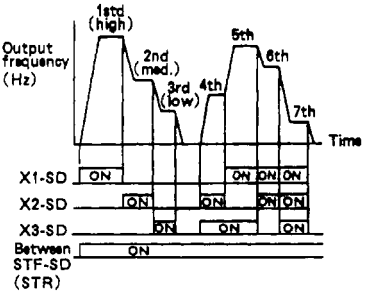



(Note)

1) If the No.2 acceleration/deceleration time is not set, the No.2 V/F will not function even if No.2 V/F value is set and terminals RT-SD are closed.
2) The maximum output voltage will be the power supply voltage when "– – –" (factory setting) is set in Pr.19.
3) Terminal MRS/RT function is specified with the input terminal function selection Pr.60.

- 3-speed setting (high) [4]
- 3-speed setting (medium) [5]
- 3-speed setting (low) [6]
- Multi-speed setting (4th speed) [24]
- Multi-speed setting (5th speed) [25]
- Multi-speed setting (7th speed) [26]
- Multi-speed setting (7th speed) [27]

Each speed can be selected (between terminals X1-SD, X2-SD, and X3-SD) by changing the contact signal from an external switch. Each speed (frequency) can be set freely within 0 to 120Hz during the inverter (motor) operation.




(Note)

1. The 4th to 7th speed cannot be selected if "- - - -" is set (factory setting).
2. If two or three speeds are selected for the 3-speed setting, the low speed side frequency will be selected.
   (Example) If high speed (X1) 40Hz and low speed (X3) 50Hz are set, when X1-SD and X3-SD turn ON simultaneously. 50Hz will be output.
3. If the multi-speed signal and external frequency signal are input, the multi-speed signal has priority.
4. The terminals X1 (high), X2 (medium) and X3 (low) are selected with the input terminal function selection [60]

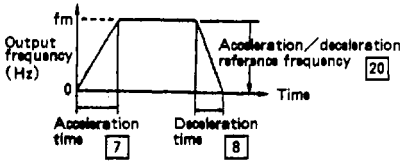
● Acceleration time 7 ● Deceleration time 8

● Acceleration/deceleration reference frequency 20

Pr.7 and 8 can be set between 0.1 and 999 seconds.

Acceleration time is the time (inclination) taken for acceleration to the frequency (fm) set in acc./dec. reference frequency Pr.20.

If the acceleration/deceleration time is set to 0, the time will be 0.04 seconds.




[Factory setting]

Acceleration time ..... 5.0 sec.

Deceleration time ..... 5.0 sec.

Acceleration/deceleration reference frequency ..... 60Hz

● **Electronic thermal relay** [9]

The setting value can be set as a current value (A) for the motor's overheating protection. Optimum protection characteristics, including a drop in the motor cooling performance at low speed operation, can be obtained. The motor protection function will not operate when set to 0 (A). (The output transistor protection function will operate.)

Set the motor rating current at 50Hz for a triple-rating motor.

Set to 0 (A) when using the external thermal relay.

[Factory setting] ····· (Inverter rated output current)

● **PWM mode** [10]

By changing PWM mode setting, it is possible to select motor sound appropriate for load and to reduce resonant vibration for the standard acoustic noise model. Available in sixteen settings.

| Setting value | Carrier frequency | Setting value | Carrier frequency | Setting value | Carrier frequency |
|---|---|---|---|---|---|
| 0 | 0.7 kHz | 6 | 1.3 kHz | 12 | 1.9 kHz |
| 1 | 0.8 kHz | 7 | 1.4 kHz | 13 | 2.0 kHz |
| 2 | 0.9 kHz | 8 | 1.5 kHz | 14 | 2.1 kHz |
| 3 | 1.0 kHz | 9 | 1.6 kHz | 15 | 2.2 kHz |
| 4 | 1.1 kHz | 10 | 1.7 kHz | (Note) 2. ——— | For the low-acoustic noise model |
| 5 | 1.2 kHz | 11 | 1.8 kHz | | |

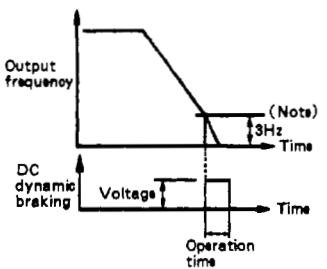
[Factory setting] ····· 3 (Low accoustic noise type ····· "———")

(Note)

1. The motor tone will increase in pitch when the setting value is increased.
2. If the carrier frequency is changed for the low-acoustic noise type, set "- - -". If "- - -" is set, the carrier frequency Pr.72 can be read and changed.
3. The setting cannot be changed from "- - -" to "0 to 15" during operation. Always stop before making changes. Note that the setting can be changed from "0 to 15" to "0 to 15".

● **DC dynamic braking operation time** 11 ● **DC dynamic braking voltage** 12

By setting the DC dynamic braking torque (voltage) and the operation time, accuracy in stop position can be adjusted matching the load.




(Note)

The DC dynamic braking operation frequency is fixed to 3Hz.
Set the operation time to "0" when the DC dynamic braking is not required.

[Factory setting]

DC dynamic braking operation time ··· 0.5 sec.
DC dynamic braking voltage ····· 8 %

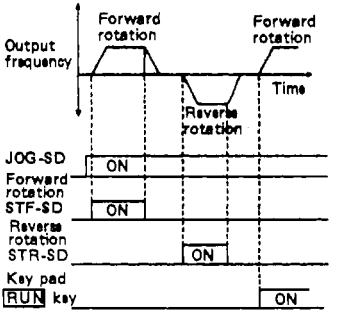
● **JOG frequency** 15 ● **JOG acceleration/deceleration time** 16

Jogging operation will start and stop when the JOG mode is selected (short circuit between terminals JOG-SD), and the start signal (terminal STF or STR) is input.

(**Note**)

1. JOG operation via key pad is also available.

When using she terminal JOG/OH for "JOG", set the external thermal relay input selection 17 to "0". If set to "1", the setting will be for the external thermal relay input selection.




[Factory setting]

JOG frequency ..... 5Hz

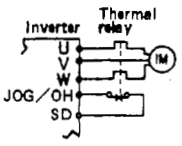
JOG acceleration/deceleration time ..... 0.5 sec.

(**Note**)

1. Terminal JOG/OH is selected with the input terminal selection function 60 .

● **External thermal relay input selection** 17

Set 1 in this parameter and set 0 in Pr.9 when extemal motor overload protector is used. Trip of an overload relay installed or motor thermostat, which opens on an overtemperature condition, prevents drive operation.
(The alarm signal will also be output.)
Restarting will not be possible unless resetting is performed even if the thermal relay contact is restored. Therefore, this can be used as an emergency stop signal input from an external source. The inverter will stop when terminals JOG/OHSD open.



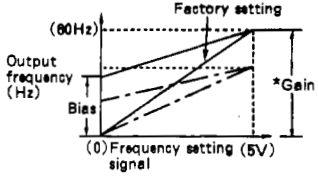

**(Note)**
When using terminal JOG/OH as an "external thermal relay input", set Pr.17 to "1".

**(Note)**
1. Select terminal JOG/OH with input terminal function selection 60

● **Frequency setting voltage bias** 21

● **Frequency setting voltage gain** 22

The output frequency (ratio) for the frequency setting signal (DC 0 to 5V) can be set freely.




★When setting the bias and gain, the frequency setting signal need not be input.

● **Stall prevention operation levle** 23

An overload (excessive torque) can be prevented when driving a motor with a capacity smaller than the inverter by changing the stall prevention operation current level. This will also function during acceleration/deceleration.
The operation current level is set with setting values (codes).

| Setting value | Operation level | Setting value | Operation level | Setting value | Operation level |
|---|---|---|---|---|---|
| 1 | 110% | 5 | 150% | 9 | 190% |
| 2 | 120% | 6 | 160% | 10 | 200% |
| 3 | 130% | 7 | 170% | 0 | Stall prevention is not activated. |
| 4 | 140% | 8 | 180% | | |

[Factory setting] ····· 5 (150%)

• The operation level % indicates the ratio to the inverter rated output current

● **Multi-speed setting** 24, 25, 26, 27 → **Refer to 3-speed setting** 4

● **Speed display** 37

The monitor display can be changed from frequency (Hz) to the speed of the load axis or to the line speed (m/min)

**Example**

〈Line speed display〉

• For 55m/min at 60Hz

Setting value → 5 5

| Setting value 0 | Output frequency (Hz) display |
|---|---|
| Setting value 0.1 to 999 | Display of load speed* |

[Factory setting] ····· 0

* Input the speed during 60Hz. The display may not match the actual speed due to the effect of motor slippage. When the load speed display has been selected, any function to be set in frequency (Hz) must be set in frequency.

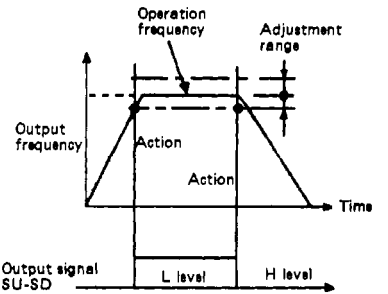
**(Note)**

Always set the speed at 60Hz. An input out of the range 0.1 to 999 is not possible.

● **Up-to-frequency sensitivity** 42

An output signal is available whenever the output frequency reaches a value selectable between ±100% of the operating frequency. (Setting from ±1% is possible)

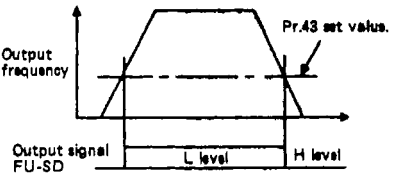
[Factory setting] ····· 10%



● **Output frequency detection** 43

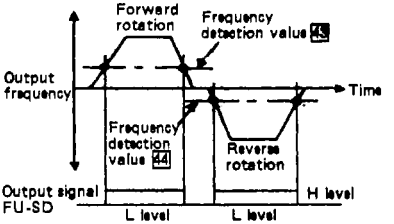
The frequency to be detected can be set between 1 to 120Hz.
When the output frequency exceeds this frequency, the terminals FU-SD will become the L level, and when lower, will become the H level.
This can be used as a signal for actuation and release of a mechanical brake.

[Factory setting] ····· 6Hz



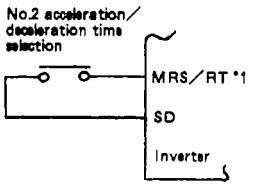

● **Output frequency detection during reverse rotation** 44

The timing for the electromagnetic brake operation during forward rotation (lifting) and reverse rotation (lowering) can be changed. The factory setting is "---" that detects output frequency of 6Hz for both forward and reverse rotation.



● **No.2 acceleration/deceleration time** 46 ● **No.2 deceleration time** 47

The No.2 acceleration/deceleration time can be selected with an external contact signal. To do so, set Pr.46 and close terminals RT and SD. *1
When using the terminal MRS/RT for the "No.2 function", set the No.2 acceleration/deceleration time 46 within the range of "0 to 999". MRS (output stop function) will be applied if the setting is "---".




- To set deceleration time different from acceleration time, set function No. 46 as the acceleration time and 47 as the deceleration time.

**(Note)**

*1 Terminal MRS/RT is selected with the input terminal function selection 60.

*2 If function No. 47 is set to "---" (factory setting), the acceleration/deceleration time will be the same as that set in 46.

[Factory setting]

No.2 acceleration/deceleration time ····· "---" (terminal MRS/RT has output stop function)
No.2 deceleration time ····· "---"

● **Retry selection** 50

This is set to automatically reset the inverter when an inverter alarm occurs so that operation is resumed and continued. "OPT" will display during the retry operation.

| | |
|---|---|
| **Setting value 0** | No retry function |
| **Setting value 1** | Retry after regenerative overvoltage trip (OVT) only |
| **Setting value 2** | Retry after overcurrent trip (OCT) only |
| **Setting value 3** | Retry after regenerative overvoltage trip (OVT) and overcurrent trip (OCT). |

[Factory setting] ····· 0

● **No. of retries at alarm** 51

Set the number of retries and select the alarm signal output or not at alarm occurrence.

| Setting value | Alarm signal output during alarm | No. of retries |
|---|---|---|
| 0 | — | No retry |
| 1 to 10 | Not available | 1 to 10 |
| 101 to 110 | Available | 1 to 10 |

[Factory setting] ····· 0

● **Retry execution wait time** 52

The time to wait before restarting after an inverter alarm occurs can be set.

[Factory setting] ····· 1 sec.

● **No. of retry execution time display clear** 53

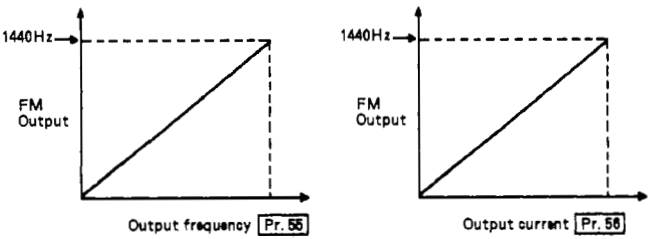
The cumulative number of restart times made by retry can be read through reading this parameter and it can be cleared by setting 0.

**(Note)**

1. The monitor display after retrying will be the operation frequency display.
2. If an alarm other than that set in Pr.50 (retry selection) occurs during retry waiting, an alarm will display and the retry will stop.
3. The inverter will automatically start operation after the time set in Pr.52 (retry execution wait time), and thus caution is required by the operators when using this function.

● **Frequency monitor reference** 55 ● **Current monitor reference** 56

Terminal FM provides the frequency or current monitor function. Set the frequency or current value which is referenced for monitor in Pr.55 or Pr.56. (The frequency or current can be selected with Pr.70 (FM output terminal function selection).)



● **Remote setting function selection** 59

The functions for terminals X1, X2 and X3 can be changed to the remote setting input function by setting 1 in Pr.60 (input terminal function selection).
This allows the acceleration, deceleration and setting clear setting operations in the remote setting box FR-FK (optional) to be done just with parameter settings.

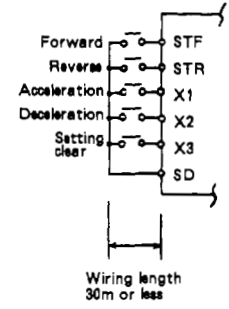
| Pr. 59 setting value | Operation description | |
|---|---|---|
| | Remote setting function | Frequency setting value storage function (Note) |
| 0 | ∨ | ∨ |
| 1 | ∨ | — |

— : No function ∨ : Function available

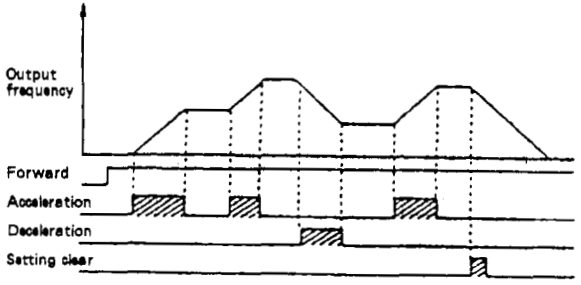
(Note)

If the terminals of acceleration-SD and deceleration-SD are left open for approximately one minute or longer, the operation frequency setting value of that point will be registered in the memory. Operation will restart with that setting value even if the power supply is turned off and on once.

**Connection**




**Example of operation**




(**Note**)

The frequency setting value up/down times with the acc./dec. operation are set in Pr.46 (No.2 acceleration/deceleration time) and Pr.47 (No.2 deceleration time), but the output frequency acc./dec. times in Pr.7 and Pr.8.
Therefore, the actual acc./dec. times become the longer setting values respectively.

● **Input terminal function selection** 60

The functions of terminals (X1, X2, X3) can be selected from the following nine types.

| Terminal | Setting value | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| X1 | RH | Acceleration | RES | RH | RH | RH | RH | RH | RH |
| X2 | RM | Deceleration | MRS/RT | RM | RM | RM | MRS/RT | JOG/OH | MRS/RT |
| X3 | RL | CLR | JOG/OH | JOG/OH | MRS/RT | RES | RES | RES | JOG/OH |
| | Multi speed | Remote setting | | | | | | | |

(Note)

This parameter cannot be written during operation (writing is possible only when stopped).

Refer to the following page for the functions selected with the X1, X2 and X3 input terminals.

● List of function selections

| Pr. 60 | Mode | X1 | X2 | X3 | Function | Related parameters |
|---|---|---|---|---|---|---|
| 0 | Multi-speed mode | OFF | OFF | OFF | Frequency reference 0 to 5V | — |
| | | ON | OFF | OFF | 3-speed setting (high) | Pr. 4 |
| | | OFF | ON | OFF | 3-speed setting (middle) | Pr. 5 |
| | | OFF | OFF | ON | 3-speed setting (low) | Pr. 6 |
| | | OFF | ON | ON | Multi-speed setting (4th speed) | Pr.24 |
| | | ON | OFF | ON | Multi-speed setting (5th speed) | Pr.25 |
| | | ON | ON | OFF | Multi-speed setting (6th speed) | Pr.26 |
| | | ON | ON | ON | Multi-speed setting (7th speed) | Pr.27 |
| 1 | Remote setting mode | OFF | OFF | OFF | 0 to 5V input setting | — |
| | | ON | OFF | OFF | Frequency rise | — |
| | | OFF | ON | OFF | Frequency lower | — |
| | | OFF | OFF | ON | Frequency setting clear | — |
| | | OFF | ON | ON | Frequency setting clear | — |
| | | ON | OFF | ON | Frequency setting clear | — |
| | | ON | ON | OFF | No operation | — |
| | | ON | ON | OFF | Frequency setting clear | — |
| 2 | RES • MRS/OH • JOG/DH mode | OFF | OFF | OFF | 0 to 5V input setting | — |
| | | ON | OFF | OFF | RES | — |
| | | OFF | ON | OFF | MRS/RT | Pr.46 |

| Pr. 60 | Mode | X1 | X2 | X3 | Function | Related parameters |
|---|---|---|---|---|---|---|
| 2 | RES • MRS/OH • JOG/OH mode | OFF | OFF | ON | JOG/OH | Pr.17 |
| | | OFF | ON | ON | MRS/RT, JOG/OH | Pr.17, Pr.46 |
| | | ON | OFF | ON | RES | — |
| | | ON | ON | OFF | RES | — |
| | | ON | ON | ON | RES | — |
| 3 | JOG/OH • Multi-speed mode | OFF | OFF | OFF | 0 to 5V input setting | — |
| | | ON | OFF | OFF | 3-speed setting (high) | Pr. 4 |
| | | OFF | ON | OFF | 3-speed setting (middle) | Pr. 5 |
| | | OFF | OFF | ON | JOG/OH | Pr.17 |
| | | OFF | ON | ON | JOG/OH | Pr.17 |
| | | ON | OFF | ON | JOG/OH | Pr.17 |
| | | ON | ON | OFF | Multi-speed setting (6th speed) | Pr.26 |
| | | ON | ON | ON | JOG/OH | Pr.17 |
| 4 | MRS/RT • Multi-speed mode | OFF | OFF | OFF | 0 to 5V input setting | — |
| | | ON | OFF | OFF | 3-speed setting (high) | Pr. 4 |
| | | OFF | ON | OFF | 3-speed setting (middle) | Pr. 5 |
| | | OFF | OFF | ON | MRS/RT | Pr.46 |
| | | OFF | ON | ON | MRS or middle speed, RT | Pr. 5, Pr.46 |
| | | ON | OFF | ON | MRS or high speed, RT | Pr. 4, Pr.46 |
| | | ON | ON | OFF | Multi-speed setting (6th speed) | Pr.26 |
| | | ON | ON | ON | MRS or 6th speed, RT | Pr.26, Pr.46 |

| Pr. 60 | Mode | X1 | X2 | X3 | Function | Related parameters |
|---|---|---|---|---|---|---|
| 5 | RES • Multi-speed mode | OFF | OFF | OFF | 0 to 5V input setting | |
| | | ON | OFF | OFF | 3-speed setting (high) | Pr. 4 |
| | | OFF | ON | OFF | 3-speed setting (middle) | Pr. 5 |
| | | OFF | OFF | ON | RES | |
| | | OFF | ON | ON | RES | |
| | | ON | OFF | ON | RES | |
| | | ON | ON | OFF | Multi-speed setting (6th speed) | Pr.26 |
| | | ON | ON | ON | RES | |
| 6 | MRS/RT • RES • Multi-speed mode | OFF | OFF | OFF | 0 to 5V input setting | — |
| | | ON | OFF | OFF | 3-speed setting (high) | Pr. 4 |
| | | OFF | ON | OFF | MRS/RT | Pr.46 |
| | | OFF | OFF | ON | RES | — |
| | | OFF | ON | ON | RES | — |
| | | ON | OFF | ON | RES | — |
| | | ON | ON | OFF | MRS or high speed, RT | Pr. 4, Pr.46 |
| | | ON | ON | ON | RES | — |

| Pr. 60 | Mode | X1 | X2 | X3 | Function | Related parameters |
|---|---|---|---|---|---|---|
| 7 | JOG/OH • RES • Multi-speed mode | OFF | OFF | OFF | 0 to 5V input setting | — |
| | | ON | OFF | OFF | 3-speed setting (high) | Pr. 4 |
| | | OFF | ON | OFF | JOG/OH | Pr.17 |
| | | OFF | OFF | ON | RES | — |
| | | OFF | ON | ON | RES | — |
| | | ON | OFF | ON | RES | — |
| | | ON | ON | OFF | JOG/OH | Pr.17 |
| | | ON | ON | ON | RES | — |
| 8 | MRS/RT • JOG/OH • Multi-speed mode | OFF | OFF | OFF | 0 to 5V input setting | — |
| | | ON | OFF | OFF | 3-speed setting (high) | Pr. 4 |
| | | OFF | ON | OFF | MRS/RT | Pr.46 |
| | | OFF | OFF | ON | JOG/OH | Pr.17 |
| | | OFF | ON | ON | MRS/RT, JOG/OH | Pr.46, Pr.17 |
| | | ON | OFF | ON | JOG/OH | Pr.17 |
| | | ON | ON | OFF | MRS or high speed, RT | Pr. 4, Pr.46 |
| | | ON | ON | ON | MRS/RT, JOG/OH | Pr.46, Pr.17 |

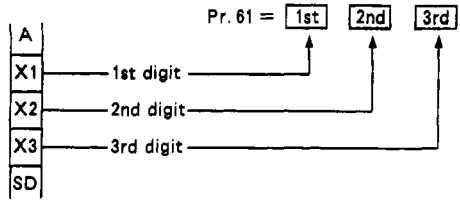
(Note) ON : Short with terminal SD.
OFF : Open
(When function OH has been selected (1 in Pr.17), ON indicates open.)

● **Allocation input terminals 61**

The function of the input to terminals RH, RM, RL, OH, STOP, MRS, RT, and JOG can be allocated from the 8 functions in the table below.

| Pr. No | Setting range | Setting Unit | Factory Setting | Function |
|---|---|---|---|---|
| 61 | 0 to 999<br>, – – – | 1 | – – – | – – – : The functions are as terminal name.<br>1 : RH<br>2 : RM<br>3 : RL<br>4 : OH<br>5 : STOP<br>6 : MRS<br>7 : RT<br>9 : JOG |

Setting is made by a 3 digit number set in Pr61, each digit represents the function to be allocated to individual terminals. (note1)

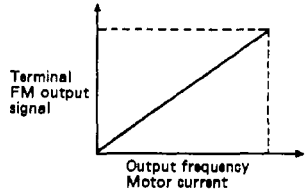



**Note 1)** When two or more digits of Pr.61 are set to the same number, the function is actived by turning on one of them.

**Note 2)** When a value "0 to 999" is set in Pr.61, the set values of Pr.60 is ignored.

● **FM output terminal function selection 70**

Terminal FM provides pulse output and is used to connect an indicator that monitors frequency or current. (Refer to p.56. 57) The frequency or current can be selected through this parameter.




| | |
|---|---|
| **Setting value 0** | Output frequency |
| **Setting value 1** | Motor current (output current) |

[Factory setting] ····· 0

**(Note)**

When the frequency has been selected, terminal FM output can be adjusted with Pr.55, when the current has been selected, it can be adjusted with Pr.56.

● **Tone modulation selection** 71

**(This parameter is a function number for the low-acoustic noise series)**

The tone control that changes the motor tone can be selected with the key pad.

| Setting value | Tone selection |
|---|---|
| 0 | No tone control |
| 1 | Tone control |

- The tone control changes the motor noise from a metallic tone to a composite sound that is easy to listen to.
- When the tone control is selected, the motor tone will be easy to listen to even with the same carrier frequency.
- The tone control is effective when the carrier frequency is low.

[Factory setting] ····· 0

● **PWM carrier frequency** 72

**(This parameter is a function number for the low-acoustic noise series)**

The PWM carrier frequency is 7.0 kHz but this frequency can be changed with Pr. 72 if necessary in relation to the load or motor resonance frequency.

**(Note)** If the PWM carrier frequency is lowered, the motor noise will increased, but the noise generated from the inverter and the leakage current will decrease. (Refer to the precautions on page 58 when setting the PWM carrier frequency to a higher value.)

**(Note)**

This parameter can be read and written when the PWM mode Pr.10 setting is "– – –".

[Factory setting] ····· 7.0 kHz

● **Stop key function** 75

When "stop key" is pressed in external operation mode, motor is decelerated to a stop.

| Setting value | Stop key function |
|---|---|
| 0 | The stop key only functions in PU op or counbinel mode |
| 14 | When stop key is pressed in any operation mode, motor stops. |

**Note 1** ) To restart after "stop key stopping" in ext mode.

① Turn off the start signal (STF/STR) after the motor has stopped.

② Press the "SET" key.

③ Turn on the start signal (STF/STR).

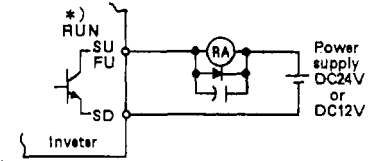
**Note 2** ) When motor is stoped by using the stop key in external operation mode, "E 0" is displyed.

● **Output signal selection** 76

The inveter running, up-to-frequency or frequency detection signal can be selected for the open collector output signal (terminal RUN/SU/FU).

| Setting value 0 | Inverter running (RUN) |
|---|---|
| Setting value 1 | Up-to-frequency (SU) |
| Setting value 2 | Frequency detection signal (FU) |

[Factory setting] ····· 0




**(Note)** The inverter will be damaged if the voltage application direction is mistaken. Also, take care to prevent mis-wiring such as of the diode connection direction.

● **Parameter write prohibit selection 77**

Prevents parameters from being written via the key pad.

| Setting value | Write prohibition function |
|---|---|
| 0 | Parameter writing permitted (during operation and stop) |
| 1 | Parameter write prohibited (Note) |

[Factory setting] ····· 0

**(Note)**

Parameter No. 77 can be written in. Er1 will display when writing of other parameters is attempted. (Release the error display with the MODE key.)

● **Reverse rotation prevention selection 78**

This is set to prevent reverse rotation fault resulting from the mis-input of the start signal.

| Setting value | Rotation direction |
|---|---|
| 0 | Both forward/reverse rotation |
| 1 | Reverse rotation prohibited |
| 2 | Forward rotation prohibited (Note) |

**(Note)**

The inverter will drive the motor in reverse with the RUN key when set to "2".

[Factory setting] ····· 0

This function is valid for both the key pad operation and external operation.

● **Operation mode selection** 79

The inverter operation modes include operation with external signals and operation with key pad. Operation can be limited to one mode or can be carried out with both modes.

| | |
|---|---|
| **Setting value 1** | Operation only with key pad |
| **Setting value 2** | Operation only with external signals |
| **Setting value 3** | Operation frequency ··· Set with key pad (direct setting or ▲▼ keys)<br>Start signal ··· External signal input (STF, STR terminals) |
| **Setting value 4** | Operation frequency ··· External signal input (DC0 to 5V between terminals2-5)<br>Start signal ··· Input with key pad (RUN key) (Note) 4. |

[Factory setting] ····· 1

**(Note)**

1. This parameter cannot be rewritten during operation. Er2 will display if writing is attempted.
2. Setting values 3 and 4 are set to use the external signals and key pad operation for the operation frequency setting and start signals.
3. When set to 3, the operating frequency is set via key pad and analog signal input is ignored.
4. When set to 4, the operating frequency is set via analog signal input, multi-speed setting or JOG frequency setting.

● **Parameter clear/calibration** CLr

The parameter-all-clear or frequency setting signal calibration mode can be selected. The parameter-clear cannot be executed during operation, and Er2 will display.

| Setting value | Details |
|---|---|
| 0 | Not executed. |
| 1 | Parameters are all cleared (initialized). * |
| 2 | Frequency setting signal calibration mode is selected. |

* Parameter No. 77, 21, 22 cannot be cleared.

- The following adjustment can be performed by selecting the calibration mode (setting value 2).
(Refer to page 55 for details.)

C-1 Display: Frequency meter scale calibration
C-2 Display: Frequency setting bias calibration (Pr.21 will be rewritten simultaneously.)
C-3 Display: Frequency setting gain calibration (Pr.22 will be rewritten simultaneously.)

If the difference of the input voltages for the bias and gain calibration is less than 0.5V, the calibration error will occur (Er3 will display).

○ Example of parameter-all-clear/calibration operation

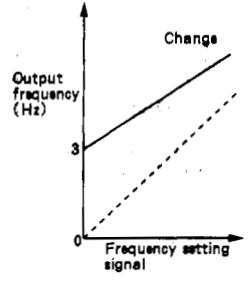
| | Selection of display mode | | Selection of function number | Read out of current value |
|---|---|---|---|---|
| Key operation | MODE → | MODE → | ▼ → | SET |
| Display | 60.0 | P 0 | CLr | 0 |

Parameter-clear

| Change to 1 | Write in |
|---|---|
| ▲ | SET |
| 1 | CLr<br>↕ Displays alternately<br>1 |

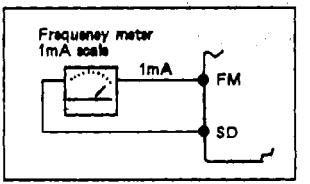
To change Pr.C-2 from 0 Hz to 3 Hz.

| Change to 2 | Write in (Select calibration mode) | Read out of current value | Change to 3Hz | Write in |
|---|---|---|---|---|
| ▲ ▲ | SET | SET | ▲ Changes while held down | SET |
| 2 | C-2 | 0 | 3 | C-2<br>↕ Displays alternately<br>3 |



● **Frequency meter scale calibration** C-1

Allows a meter connected to FM to be calibrated through this parameter, without a calibration potentiometer. Using Pr. C-1, press ▲ or ▼ key to vary pulse train frequency. Then average of output voltage changes, and the meter is calibrated.

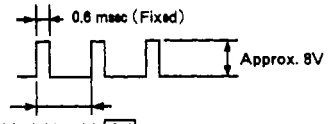


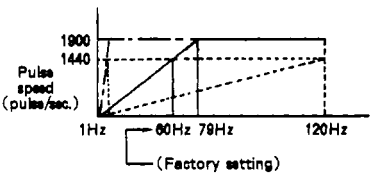

(Note)

1. Terminal FM output is a 1440Hz at output frequency of 60Hz as the factory setting.
2. If terminal FM-SD is measured with a tester, approx. 5V (average value) will be indicated at the max. Output frequency. (When indicator is not connected.)

*FM terminal pulse output specifications*

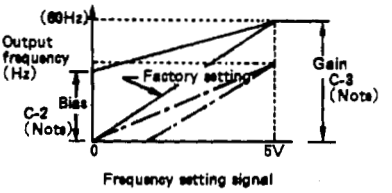
Connection of a digital counter allows for digital indication of frequency (Hz) or speed (m/min.).



- **Frequency setting bias calibration** C-2
- **Frequency setting gain calibration** C-3

Allows the output frequency to be set in relation to the frequency setting signal (DC 0 to 5V).




〈Bias〉

The output frequency for the setting signal input between terminals 2-5 will be set.

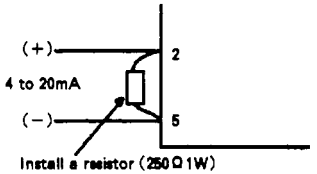
〈Gain〉

The output frequency for the setting signal input between terminals 2-5 will be set. If the input signal is 0V, it is judged to be 5V input.

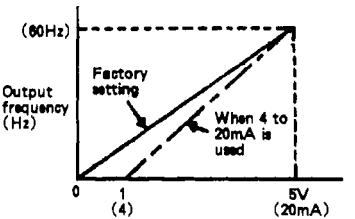
(Note)

- When this C-2 or C-3 is specified, value set for "frequency setting voltage bias" (function No. 21) or "frequency setting voltage gain" (function No.22) will be automatically rewritten.

**Remarks** To set frequency with current input (4 to 20mA)




1. Place a resistor between 2-5, and convert the current into a voltage. (4 to 20ma → 1 to 5V)
2. Adjust C-2 (bias) as below.
   (Pr.21 will be rewritten simultaneously.)

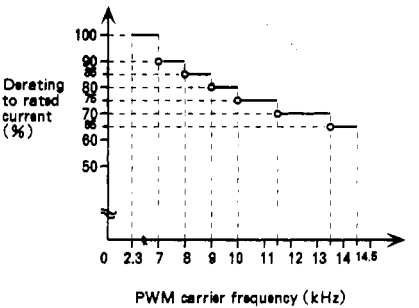


**Precautions**

1. **It is necessary to accept a reduction of load torque when setting the PWM carrier frequency to a higher value.**

(1) When setting the PWM carrier frequency (Pr.72) to 7.1kHz or more to lower the motor acoustic noise, the rated output should be derated as shown on the right.
Also change the electronic thermal relay (Pr. 9) setting.

(2) If the PWM carrier frequency is increased, the acoustic noise from the motor will lower, but the noise generated by the inverter and the leakage current will increase.



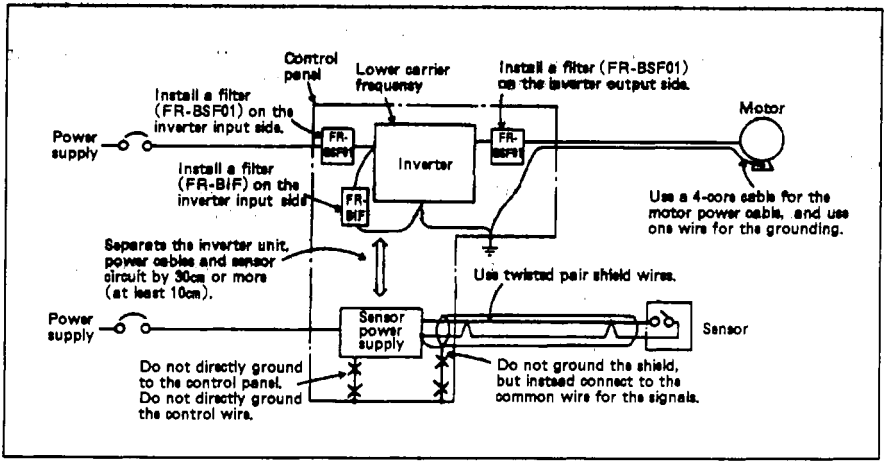
## 2. Noise

There is noise that enters from outside and causes the inverter to malfunction and that which is generated from the inverter and causes the peripheral equipment to malfunction. The inverter is designed so that it is not easily affected by noise, but as it is an electronic device which handles weak signals, the following general countermeasures will be required.

◆ General countermeasures

- Avoid laying the inverter's power cables (input/output) in parallel with the signal wires and avoid bundling the power cables and signal wires.
- Use twisted pair shield wires for the connection wires with the sensor and for the control signal wires. Connect the sheath of the shield wire to terminal SD.
- Use one-point grounding for the inverter and motor, etc.

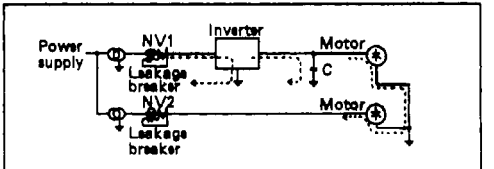
## ◆Example of noise countermeasures



### 3. Leakage current

Leakage current will flow through stray capacity which exists between the ground and a cable, motor, etc. The value of the leakage current depends on the cable length, wiring method and inverter carrier frequency, and will increase when using a low-acoustic noise inverter, so use the following countermeasures.

(1) Leakage current to the ground
The leakage current will not affect only the inverter but may pass into other equipments through the grounding cables and may cause a leakage breaker or relay unnecessary trip.



Route of leakage current

■ Countermeasures

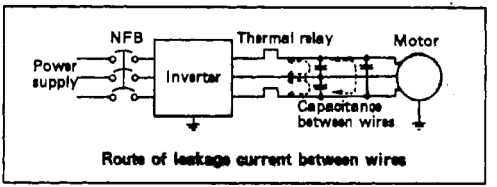
- Lower the inverter's carrier frequency (Pr. 72). Note that this will increase the motor acoustic noise.
- Use a leakage breaker that corresponds to high harmonics and surges (Mitsubishi New Super NV Series, etc.) for the inverter or other lines when using the low-acoustic noise model (with high carrier frequency).

(2) Leakage current across the line

The harmonics of leakage current which flows through stray capacity across the inverter output lines may cause an external thermal overload protector trip. When the cable length is long (50m or more), the ratio of leakage current to the motor's rated current becomes large, and trip is liable to occur.

■ Countermeasures

- Use the electronic thermal relay on the inverter.
- Lower the carrier frequency. Note that this will increase the motor noise.



Route of leakage current between wires

Against the trip due to leakage current, the preferred method of motor overload protection is a thermistor protection with temperature detectors in the motor or motor protection switch with bi-metal release, etc.

# 7. SPECIFICATIONS

## ■ Standard series

| Model FR-U120-□-F(C), -(UF) | | | 0.1K | 0.2K | 0.4K | 0.75K | 1.5K |
|---|---|---|---|---|---|---|---|
| Applicable motor capacity (kW)/(HP) *1 | | | 0.1/1/8 | 0.2/1/4 | 0.4/1/2 | 0.75/1 | 1.5/2 |
| Output | Rated capacity (kVA) | *2 | 0.3 | 0.5 | 0.9 | 1.5 | 2.6 |
| | Rated output current (A) | | 0.8 | 1.4 | 2.4 | 4.1 | 7 |
| | Overload current rating | *3 | 150% 60 sec. 200% 0.5 sec. (inverse time characteristic) | | | | |
| | Rated output voltage | *4 | 3-phase 200 to 230V (The 1.5k model of the fully enclosed type is 200 to 220V.) | | | | |
| Power supply | Rated input AC voltage | | 3-phase 200 to 230V, 50/60Hz (The 1.5k model of the fully enclosed type is 3-phase 200V 50Hz, 3-phase 200 to 220V 60Hz.) | | | | |
| | Tolerable AC voltage fluctuation | | 180 to 253V, 50/60Hz (The 1.5k model of the fully enclosed type is 180 to 220V 50Hz, 180 to 242V 60Hz.) | | | | |
| | Tolerable frequency fluctuation | | ±5% | | | | |
| | Power supply capacity (kVA) | *5 | 0.4 | 0.7 | 1.2 | 2.1 | 4.0 |
| Enclosure | | | Enclosed type (IP20) Fully enclosed type is IP40.) | | | | |
| Cooling method | | | Self-cooling (Without cooling fan) (The 1.5k model of the fully enclosed type is force-cooled.) | | | | |
| Weight (kg) | | | 0.5 | 0.6 | 0.7 | 0.9 | 1.7 |

## ■ Low-acoustic noise series

| Model FR-U120-N□-F(C), -(UF) | | 0.1K | 0.2K | 0.4K | 0.75K | 1.5K |
|---|---|---|---|---|---|---|
| Applicable motor capacity (kW)/(HP) *1 | | 0.1/1/8 | 0.2/1/4 | 0.4/1/2 | 0.75/1 | 1.5/2 |
| Output | Rated capacity (kVA) *2 | 0.3 | 0.5 | 0.9 | 1.5 | 2.6 |
| | Rated output current (A) | 0.8 | 1.4 | 2.4 | 4.1 | 7 |
| | Overload current rating *3 | 150% 60 sec. 200% 0.5 sec. (inverse time characteristic) | | | | |
| | Rated output voltage *4 | 3-phase 200 to 230V | | | | 3-phase 200 to 220V (The 1.5K model of UF type is 200 to 230V) |
| Power supply | Rated input AC voltage | 3-phase 200 to 230V, 50/60Hz | | | | 3-phase 200V, 50Hz 200 to 220V, 60Hz (UF type is 200V, 50Hz 200 to 230V, 60Hz) |
| | Tolerable AC voltage fluctuation | 180 to 253V, 50/60Hz | | | | 180 to 220V, 50Hz 180 to 242V, 60Hz (UF type is 180 to 220V, 50Hz 180 to 253V, 60Hz) |
| | Tolerable frequency fluctuation | ±5% | | | | |
| | Power supply capacity (kVA) *5 | 0.4 | 0.7 | 1.2 | 2.1 | 4.0 |
| Enclosure | | Enclosed type (IP20) (Fully enclosed type is IP40.) | | | | |
| Cooling method | | Self-cooling (Without cooling fan) | | | | Fan cooled |
| Weight (kg) | | 0.6 *7 | 0.7 *7 | 0.9 *7 | 1.7 | 1.9 |

(Note) The power supply specifications for 1.5K differ from those for 0.75K or less, caution should be observed.

## ■ Single phase 100V input series

| | | | | |
|---|---|---|---|---|
| Model | Standard series FR-U110W-□-F, -(UF) | 0.1K | 0.2K | 0.4K |
| | Low-acoustic noise series FR-U110W-N□-F, -(UF) | 0.1K | 0.2K | 0.4K |
| Applicable motor capacity (kW)/(HP) *1 | | 0.1/1/8 | 0.2/1/4 | 0.4/1/2 |
| Output | Rated capacity (kVA) *2 | 0.3 | 0.5 | 0.9 |
| | Rated output current (A) | 0.8 | 1.4 | 2.4 |
| | Overload current rating *3 | 150% 60 sec. 200% 0.5 sec. (inverse time characteristic) | | |
| | Rated output voltage *4 | 3-phase 200 to 220V *6 (The model of UF type is 200 to 230V) | | |
| Power supply | Rated input AC voltage | Single phase 100V 50Hz, 100 to 110V 60Hz (UF type is 100 to 115V, 50/60Hz) | | |
| | Tolerable AC voltage fluctuation | 90 to 110V 50Hz, 90 to 121V 60Hz (UF type is 90 to 126.5V, 50/60Hz) | | |
| | Tolerable frequency fluctuation | 5 % | | |
| | Power supply capacity (kVA) *5 | 0.5 | 0.9 | 1.5 |
| Enclosure | | Enclosed type (IP20) | | |
| Cooling method | | Self-cooling (without cooling fan) | | |
| Weight (kg) | | 0.6 | 0.7 | 0.9 |

## ■ Single phase 200V input series

| | | | | | |
|---|---|---|---|---|---|
| Model | Standard series FR-U120S-□-F, -(UF) | 0.1K | 0.2K | 0.4K | 0.75K |
| | Low-acoustic noise series FR-U120S-N□-F, -(UF) | 0.1K | 0.2K | 0.4K | 0.75K |
| Applicable motor capacity (kW)/(HP) *1 | | 0.1/1/8 | 0.2/1/4 | 0.4/1/2 | 0.75/1 |
| Output | Rated capacity (kVA) *2 | 0.3 | 0.5 | 0.9 | 1.5 |
| | Rated output current (A) | 0.8 | 1.4 | 2.4 | 4.1 |
| | Overload current rating *3 | 150% 60 sec. 200% 0.5 sec. (inverse time characteristic) | | | |
| | Rated output voltage *4 | 3-phase 200 to 220V (The model of UF type is 200 to 230V) | | | |
| Power supply | Rated input AC voltage | Single phase 200V 50Hz, 200 to 220V 60Hz (UF type is 200 to 230V, 50/60Hz) | | | |
| | Tolerable AC voltage fluctuation | 180 to 220V 50Hz, 180 to 242V 60Hz (UF type is 180 to 253V, 50/60Hz) | | | |
| | Tolerable frequency fluctuation | 5 % | | | |
| | Power supply capacity (kVA) *5 | 0.5 | 0.9 | 1.5 | 2.5 |
| Enclosure | | Enclosed type (IP20) | | | |
| Cooling method | | Self-cooling (without cooling fan) | | | |
| Weight (kg) | | 0.6 | 0.7 | 0.9 | 1.7 |

(Note)

*1. The maximum applicable capacity is for the Mitsubishi standard motor 4P. This may not apply to the 6P motor, so refer to the rated output current.
*2. The rated capacity is shown for the output voltage of 220V (60Hz).
*3. The overload current value % shows the ratio to the inverter's rated output current.
*4. The output voltage cannot exceed the power supply voltage.
*5. The necessary power capacity will differ according to the impedance on the power supply side (including reactor and power wires on input side). Prepare a power supply capacity higher than the noted value.
*6. If a load is applied on the motor, the output voltage will drop approx. 10 to 15%, so the load must be reduced when using a general purpose motor.
*7. The low-acoustic noise, fully enclosed type will be 0.1kg heavier.

## ■ Common specifications

| | | | |
|---|---|---|---|
| Control specifications | Control method | | Sinusoidal wave PWM control ＊10 |
| | Output frequency range | | 0.5 to 120Hz (starting frequency fixed at 0.5Hz) |
| | Frequency setting resolution | Digital input | 0.1Hz (less than 100Hz), 1Hz (100Hz and more) with key pad operations |
| | | Analog input | 1/500 of maximum setting frequency |
| | Frequency stability | Digital input | Within ±0.5% of set output frequency (−10 to +50℃) with key pad operations |
| | | Analog input | Within ±1% of maximum output frequency (25℃±10℃) |
| | Voltage/frequency characteristics | | Base frequency between 50 and 120Hz selectable |
| | Torque boost | | Manual torque boost 0 to 15% selectable |
| | Acceleration/deceleration characteristics | | 0, 0.1 to 999 sec. selectable (acceleration/deceleration set separately) |
| | Braking torque | Regenerative ＊8 | 0.1K, 0.2K···150% or more, 0.4K, 0.75K···100% or more, 1.5K···50% or more |
| | | DC injection | 3Hz or less Operation time, operation voltage adjustable |
| | Stall prevention operation level | | Operation current level (110 to 200%) selectable |
| Operation specifications | Frequency setting signal | | DC 0 to 5V |
| | Input signal | Starting signal | Forward/reverse rotation commanded separately |
| | | Input signal selection (X1, X2, X3) | Select RH, RM, RL, JOG/OH, MRS/RT, RES, accelerations, deceleration and CLR from the combinations shown on page 44. |
| | Output signal | Alarm | 1c contact output |
| | | Operation status | Select from operating (RUN), frequency reached (SU) and frequency detection (FU) |
| | | Monitor ＊12 | For analog (1mA full scale) or digital (1440Hz/60Hz) meter |

| | | | |
|---|---|---|---|
| Display | Key pad | Operation status | Output frequency, output current *11, operation speed selectable |
| | | Alarm | Alarm code when protective function has been activated. |
| Protection/warning function | | | Overcurrent shut down (during acceleration/deceleration/constant speed), regenerative overvoltage shut off, electronic thermal overload, stall prevention |
| Environment | Ambient temperature | | −10 to +50℃ (with no freezing) |
| | Ambient humidity | | 90% RH or less (with no dew condensation) |
| | Storage temperature *9 | | −20 to +65℃ |
| | Atmosphere | | Indoors with no corrosive or flammable gases, oil mist or dust |
| | Altitude/vibration | | Less than 1000m above sea level, 5.9m/S²(0.6G) or less |

(Note)

*8. The braking torque shows the short time average deceleration torque when the motor without load is decelerated in the shortest time from 60Hz (changes due to motor's loss), and is not the continuous regenerative torque. For deceleration from a frequency that exceeds the base frequency, the average deceleration torque value will decrease.
A brake resister is not built-in and cannot be extemally installed.
1.5K is not available for the single phase input series.

*9. This is a short time temperature for during transportation, etc.

*10. The low-acoustic noise series use the high carrier frequency sinusoidal PWM control.

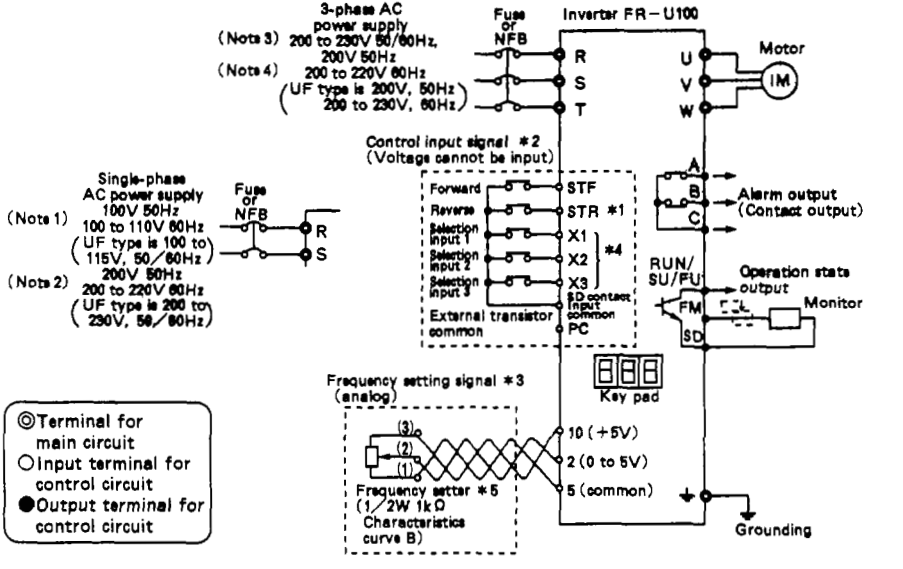
*11. The output current is displayed only while the SET key is being pressed.

*12. Select the monitor of either the output frequency or motor current via the key pad (function No.70).

*13. Short Cirunit Ratings
The drive is suitable for use on a circuit capable of delivering not move than * RMS symmetrical Amperes.

| HP rating | * |
|---|---|
| 0 to 1 | 1,000 |
| 2 | 5,000 |

## ■ Terminal wiring diagram



*1. Short-circuit between terminals STR-SD to perform reverse rotation with key pad operation. When Pr.78 is set to "2" (forward rotation prohibited), the motor will rotate in the reverse direction with the key pad operation even if STR-SD are not short circuited. (When Pr.79 is 1 or 4)

*2. Valid when parameter No.79 is set to "2" or "3" via key pad.

*3. Valid when parameter No.79 is set to "2" or "4" via key pad.

*4. Input terminals X1, X2 and X3 are selection input terminals, specified with Pr.60. (Refer to page 44.)

*5. 2W1kΩ is recommended if the frequency setting is to be changed frequently.
(Note 1) For single phase 100V power input series.
(Note 2) For single phase 200V power input series.
(Note 3) When using the low-acoustic, fully enclosed type multi-function series, or 0.1K to 0.75K models of the low-acoustic noise, fully enclosed type series.
(Note 4) When using the low-acoustic noise, fully enclosed type or 1.5K model of the low-acoustic noise, fully enclosed type series.

## ■ Explanation of terminal specifications

| Terminal symbol | | Terminal name | Details |
|---|---|---|---|
| Main circuit | R, S, T | AC power input terminal | Connect to a commercial power supply. |
| | U, V, W | Inverter output terminal | Connect a 3-phase motor. |
| | ⏚ | Grounding terminal | Ground for inverter body. Ground this. |
| Control circuit (Input signal) | STF | Forward rotation starting terminal | Contact input terminal for the forward run command. The motor will forward rotate when STF-SD are short circuited, and will stop when released. |
| | STR | Reverse rotation starting terminal | Contact input terminal for the reverse run command. The motor will reverse rotate when STR-SD are short circuited, and will stop when released. |
| | SD (Note 1) | Contact input common terminal | Common terminal for the contact input signal. This is not insulated from the frequency setting input common terminal 5. |
| | 10 | Power supply teminal for frequency setting | DC5V. Tolerable load current 10mA. |
| | 2 | Frequency setting terminal (Voltage signal) | Output frequency will be the maximum when DC 5V is input, and the input/output will be in proportion.<br>Input resistance : 10kΩ<br>Max. tolerable input voltage : 10V |

| Terminal symbol | | Terminal name | Details |
|---|---|---|---|
| Control circuit (Input signal) | 5 | Frequency setting input common terminal | Common terminal for the frequency setting signal. This is not insulated from the contact input common SD. |
| | X1, X2, X3 | AUX input terminal | The terminal specifications will change according to the parameter No.60 setting. (Refer to page44 for the selection). (The specification will be RH, RM, RL, JOG/OH, MRS/RT, RES, acceleration, deceleration or CLR.) |
| | PC | External transistor common terminal | When connecting to the transistor output (open collector output) of a sequencer, etc., if the external power common for transistor output is connected to this terminal, malfunctions caused by backflow currents can be prevented. (Refer to page 16.) |
| | RH, RM, RL (Note 2) | Multi-speed selection terminal | A maximum of seven speeds selectable with the combination of RH-SD, RM-SD and RL-SD short circuiting. |
| | JOG/OH (Note 2) | JOG mode selection or external thermal relay | JOG operation is selected when terminals JOG-SD turn ON, and jog operation starts with the start signal (STF or STR). The thermal relay contact input terminal can be selected for stopping the inverter by operating the externally connected thermal relay. |
| | MRS/RT (Note 2) | Output stop or No.2 acceleration/deceleration time selection | The inverter output will stop when MRS-SD are short-circuited. This terminal is set with Pr.46 for the No.2 acceleration/deceleration time selection (RT). The No.2 acceleration/deceleration time can be selected by short-circuiting between RT-SD. |

| Terminal symbol | | Terminal name | Details |
|---|---|---|---|
| Control circuit (Input signal) | RES (Note 2) | Reset terminal | This is used to reset the hold state during operation of the protection circuit. Short-circuit between RES-SD for 0.1sec. or longer, and then open. (Resetting is also possible with the RESET key on the key pad.) |
| | Acceler-ation, deceler-ation, CLR (Note 2) | Remote setting terminal | These can provide remote operator control for the following functions. When terminals acceleration-SD are short-circuited, the frequency will increase, and will decrease when terminals of deceleration-SD are short-circuited. When CLR-SD are short-circuited, the speed will return to the reference speed (frequency set with frequency setting signal or input from key pad.) The frequency increment/decrement speed is set with Pr.46 (acceleration) and Pr.47 (deceleration). |
| Control circuit (Output signal) | A, B, C | Alarm output terminal | 1c contact output that indicates that the inverter protection circuit has functioned and output has stopped.<br>B-C opened, A-C closed during alarm<br>B-C closed, A-C opened during normal operation<br>Contact capacity AC230V 0.3A, DC30V 0.3A |
| | FM | Display meter connection terminal | The output is set to be approximately 5V at 60Hz without display meter, and will be proportional to the output frequency. The output voltage has a pulse waveform, so a digital display meter can be connected.<br>Pulse specifications : 8V (peak), 1440Hz/60Hz.<br>(Refer to page 55. 56. 57) |

| Terminal symbol | | Terminal name | Details |
|---|---|---|---|
| Control circuit (Output signal) | RUN<br>SU<br>FU | Operation state output terminal | One of the inverter operating (RUN), frequency reached (SU) or frequency detection (FU) output selectable.<br>• Inverter operating (RUN) is at L level when above the starting frequency, and is at H level when stopped or during DC braking.<br>• Frequency reached (SU) is at L level when the output frequency reaches the set frequency, and is at H level when stopped or during acceleration/deceleration.<br>• The frequency detection (FU) is at L level when the output frequency exceeds the set detection frequency, and is at H level when lower than the set frequency.<br>Open collector output tolerable load : DC24V 0.1A |
| | SD<br>(Note 1) | Output common terminal | Common terminal for RUN, SU, FU, FM |

(Note)

*1 The input and output common terminal SD are connected in the inverter.

*2 This terminal is selected with the Pr.60 setting. (Refer to page 44.)
(The X1, X2, X3 selection input terminal will change to the selected function.)

The terminals are screwless type, so prepare a small flat-tip screwdriver (tip width 2.5 to 3mm) before wiring.

## ■ Protective function

The following protection functions are built in to protect the inverter. If the protective circuit functions, the inverter output will stop, alarm will display, and alarm signal will be output. The motor will coast to a stop. The inverter must be reset to resume operations.

| Function name | | Details | | Display (Key pad) |
|---|---|---|---|---|
| Overcurrent shut down | | The protective circuit functions during acceleration, deceleration or constant speed when the motor output current exceeded approximately 200% of the rated current, and the inverter output stops. | During acceleration | OC1 (OC1) |
| | | | During constant speed | OC2 (OC2) |
| | | | During deceleration | OC3 (OC3) |
| Regenerative overvoltage shut down | | The protective circuit functions when the DC voltage in the main circuit of the inverter exceeds the trip point with the regenerative energy during braking, and the inverter output stops. | | OuT (OVT) |
| Overload shut down (Electronic thermal relay) (*1) | Motor | The electronic thermal relay in the inverter detects overheating of the motor caused by overload or the additional heating at low speeds due to fan action, and stops the inverter output. Install a thermal relay on the output side of the inverter when using a 6 or more pole motor or when groups of motors are connected to one drive. | | THM (THM) |

| Function name | Details | Display (Key pad) |
|---|---|---|
| Overload shut down (Electronic thermal relay) (*1) Inverter | The electronic thermal relay functions with the inverse time characteristic to protect the output transistor when 150% or more of the inverter rated output current flows but the overcurrent shut down is not activated (under 200%). | THT (THT) |
| External thermal relay input (*3) | System can be designed to prevent drive operation when external motor overload protector or thermoswitch in the motor opens on an overtemperature condition. Even if the relay contact is automatically restored, the inverter will not restart unless reset. | OHT (OHT) |
| EEPROM breakage | The output will stop when the EEPROM which stores the parameter set values breaks. | PE (PE) |
| Stall prevention | When 150% (*2) or more of the inverter rated current flows to the motor during acceleration (or constant speed operation), this function stops increasing of frequency (or reduces frequency) until the load current decreases, to prevent the inverter from overcurrent tripping. When the load current has decreased below 150%, this function allows the inverter to return to and continue the previous operation. During deceleration, in contrast, if DC voltage in the inverter exceeds the rated value, this function stops reducing frequency to prevent the regenerative overvoltage shut off from being activated. When the regenerative energy becomes low, this function continues deceleration again. | OLT (OLT) When stopped due to this function from a constant speed operation. |

| Function name | Details | Display (Key pad) |
|---|---|---|
| Insufficient voltage warning (*4) | The control circuit will not function properly if the inverter power voltage drops, and will also cause an insufficient motor torque and increased heat generation. The inverter output will stop when the power voltage drops below approx. AC 115V. Operation will resume when the power voltage is restored to a correct value. | UU (UV) |
| In retry | Retry is executed when the retry function is selected, and that inverter alarm occurs. This indicates that the retry is functioning. (The display will show the time set in Pr.52 retry execution wait time.) | OPr (OPT) |

(Note)

*1. The heat cumulative data in the electronic thermal relay will be initialized when the inverter is reset.

*2. The stall prevent operation current can be set freely. The default setting is 150%.

*3. This functions only when the function "external thermal relay input selection" is set.

*4. An alarm signal will not be output when this protective function activates. If the voltage is insufficient (main circuit DC voltage is 230V or less) when the power is turned on, "0.0" will display for approximately 10 seconds and then the insufficient voltage display "UU" will appear. (No key pad operation will be accepted during the display of "0.0".)
If the main circuit DC voltage is higher than standard tolerance when the power is turned on, the display "FrU" will appear, and if the voltage does not lower within 10 seconds, the display "OUF" (overvoltage shut down) will appear.

- **Retention of alarm output signal**
  If the no-fuse breaker on the inverter's power supply side is turned OFF when the protective function activates, the inverter control power supply will be lost, and the alarm output will not be held. If the output must be held, create a sequence that will hold the alarm output signal with an external equiqment.

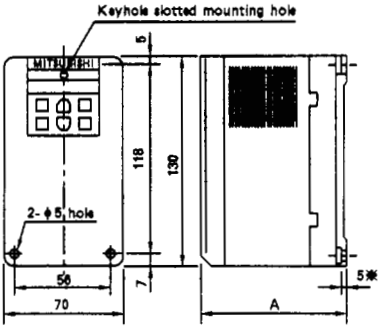
- **Alarm display**
  The display on the key pad will automatically change when the protective function operates. (Only during monitoring.)

- **Resetting methods**
  The inverter output stop state will be retained if the protective function operates, and the inverter will not restart unless it is reset. Turn the power off and on once or press the RESET key on the key pad. If the RES terminal is set with Pr.60 (input terminal function selection), resetting will be possible by opening reset terminal RES-SD after short-circuiting for approximately 0.1 second or more. If the short circuited state between terminal RES-SD is continued, " $Fr\bar{U}$ " will display (light) and indicate that the reset state has been entered.

# 8. DIMENSIONAL OUTLINE DRAWING

■ **Standard series** FR−U120−[ ]−F, − (UF)

0.1 to 0.75K | Installation screw M4 (Q'ty 3 mounting holes) (Unit : mm)

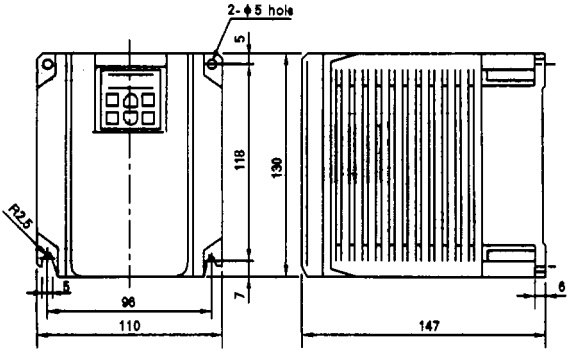



Keyhole slot dimensions


| Capacity | A |
|---|---|
| 0.1K | 81 |
| 0.2K | 86 |
| 0.4K | 101 |
| 0.75K | 121 |

*4.5 only for 0.1K.

1.5K Installation screw M4 (4 places) (Unit : mm)



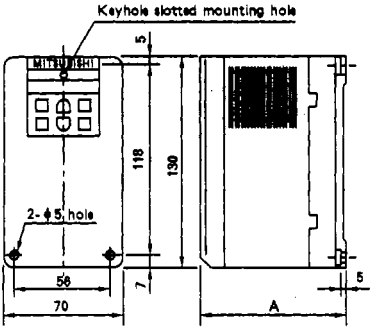

**(Note)**

For 1.5K drive, heatsink is provided on the left and right and it will get HOT at heavy loads. Do not hold heatsink with bare hand.

## ■ Low-acoustic noise series FR−U120−N[ ]−F, − (UF)

0.1 to 0.4K | Installation screw M4 (3 places)

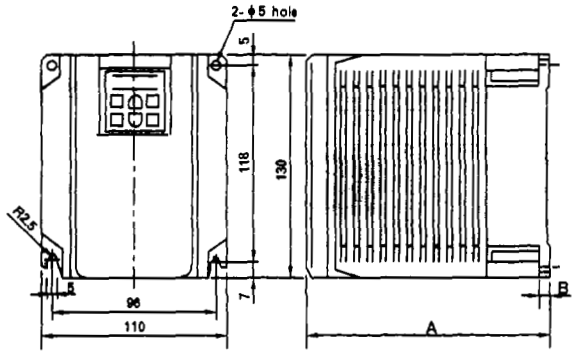
(Unit : mm)




Keyhole slot dimensions


| Capacity | A |
|---|---|
| 0.1K | 86 |
| 0.2K | 101 |
| 0.4K | 121 |

**0.75, 1.5K** Installation screw M4 (4 places) (Unit : mm)




| Capacity | A | B |
|---|---|---|
| 0.75K | 147 | 6 |
| 1.5K | 155 | 14 |

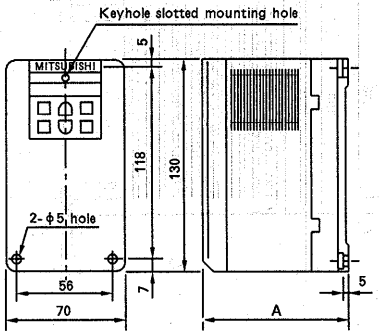
**(Note)**
The 1.5K drive comes equipped with a fan.

**(Note)**
For 0.75K and 1.5K drive, heatsink is standard on the left and right and it will get HOT at heavy loasd. Do not hold heatsink with bare hand.

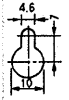
## ■ Single phase 200V power input series FR−U120S−[ ]−F, − (UF)

0.1 to 0.4K | Installation screw M4 (3 places)

(Unit : mm)

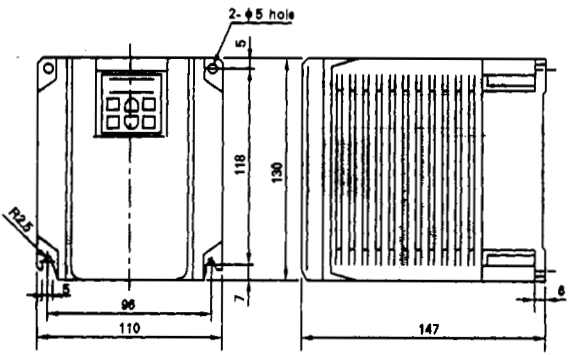



Keyhole slot dimensions




| Capacity | A |
|---|---|
| 0.1K | 86 |
| 0.2K | 101 |
| 0.4K | 141 |

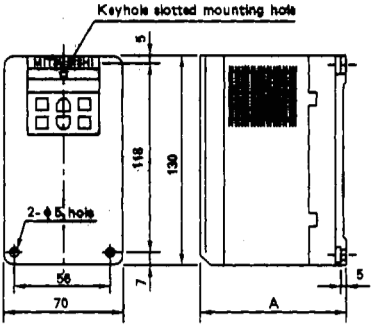
0.75K | Installation screw M4 (4 places) (Unit : mm)




**(Note)**
For 0.75K drive, heatsink is standard on the left and right and it will get HOT at heavy loads.

## ■ Single phase 100V power input series FR−U110W−[ ]−F, − (UF)

0.1 to 0.4K | Installation screw M4 (3 places) | (Unit : mm)



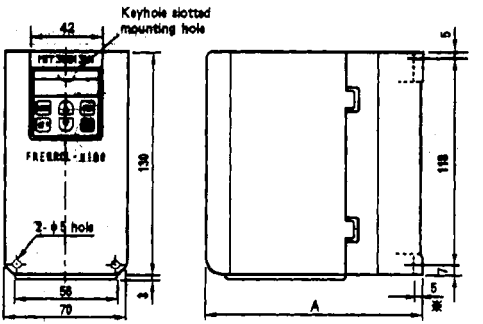

Keyhole slot dimensions

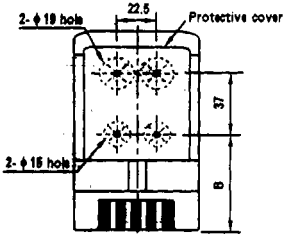

| Capacity | A |
|---|---|
| 0.1K | 86 |
| 0.2K | 121 |
| 0.4K | 141 |

## ■ Fully enclosed type series FR-U120-[ ]-FC

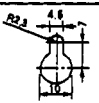
0.1 to 0.75K Installation screw M4 (3 places)

(Unit : mm)



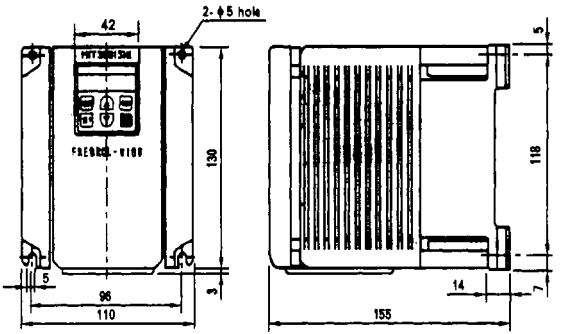

Keyhole slot dimensions

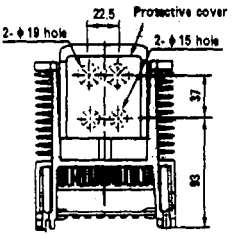



| Capacity | A | B |
|---|---|---|
| 0.1K | 101 | 38 |
| 0.2K | 106 | 43 |
| 0.4K | 121 | 58 |
| 0.75K | 141 | 78 |

*4.5 only for 0.1K.

1.5K Installation screw M4 (4 places) (Unit : mm)



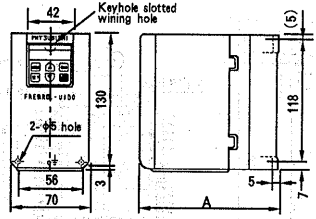

(Note) For 1.5K drive, heatsink is standard, so the temprerature will rise by approx. 30 degrees depending on the usage conditions.

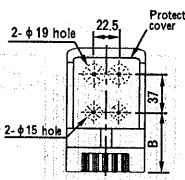
(Note) The 1.5K drive comes equipped with a fan.

## ■ Multi-function low-acoustic noise, fully enclosed type series FR−U120−N□−FC

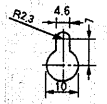
**0.1 to 0.4K** Installation screw M4 (3 places)

(Unit : mm)



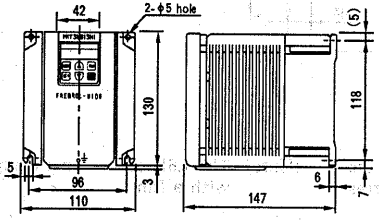



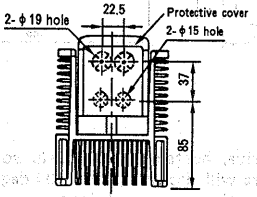

Keyhole slot dimensions



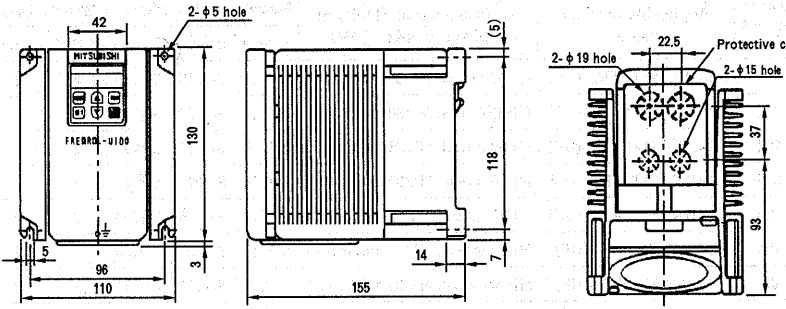

| Capacity | A | B |
|---|---|---|
| 0.1K | 106 | 43 |
| 0.2K | 121 | 58 |
| 0.4K | 141 | 78 |

**0.75K** Installation screw M4 (4 places)



1.5K Installation screw M4 (4 places) (Unit : mm)




(**Note**) For 0.75 and 1.5K drive, heatsink is standard, so the temprerature will rise by approx. 30 degrees depending on the usage conditions.

(**Note**) The 1.5K drive comes equipped with a fan.

# 9. SELECTION OF PERIPHERAL DEVICES

## ■ Selection of peripheral devices

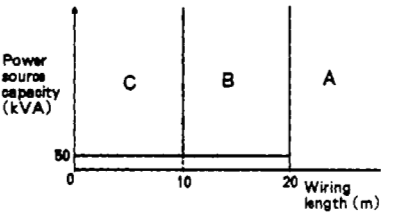
(The selection will differ according to the inverter power supply input specifications.)

| Power input | Motor output (kW) | Applicable inverter model | No-fuse breaker (NFB) or Leakage breaker (NV) | Magnetic contactor (MC) | | | Wining (㎟) | |
|---|---|---|---|---|---|---|---|---|
| | | | | A area | B area | C area | R, S, T | U, V, W |
| 3-phase 200V | 0.1 | FR-U120-N0.1K-F(c), -(UF) | NF30 model, NV30 model 5A | S-K11 | S-K18 | S-K20 | 2 | 2 |
| | 0.2 | FR-U120-N0.2K-F(c), -(UF) | NF30 model, NV30 model 5A | S-K18 | S-K20 | S-K20 | 2 | 2 |
| | 0.4 | FR-U120-N0.4K-F(c), -(UF) | NF30 model, NV30 model 5A | S-K18 | S-K21 | S-K21 | 2 | 2 |
| | 0.75 | FR-U120-N0.75K-F(c), -(UF) | NF30 model, NV30 model 10A | S-K18 | S-K21 | S-K21 | 2 | 2 |
| | 1.5 | FR-U120-N1.5K-F(c), -(UF) | NF30 model, NV30 model 15A | S-K21 | S-K25 | S-K50 | 2 | 2 |
| Single phase 200V | 0.1 | FR-U120S-N0.1K-F, -(UF) | NF30 model, NV30 model 5A | S-K18 | S-K20 | S-K20 | 2 | 2 |
| | 0.2 | FR-U120S-N0.2K-F, -(UF) | NF30 model, NV30 model 10A | S-K18 | S-K21 | S-K21 | 2 | 2 |
| | 0.4 | FR-U120S-N0.4K-F, -(UF) | NF30 model, NV30 model 10A | S-K21 | S-K25 | S-K50 | 2 | 2 |
| | 0.75 | FR-U120S-N0.75K-F, -(UF) | NF30 model, NV30 model 15A | S-K21 | S-K25 | S-K50 | 2 | 2 |
| Single phase 100V | 0.1 | FR-U110W-N0.1K-F, -(UF) | BH-K model, NV30 model 10A | S-K18 | S-K21 | S-K21 | 2 | 2 |
| | 0.2 | FR-U110W-N0.2K-F, -(UF) | BH-K model, NV30 model 15A | S-K21 | S-K25 | S-K25 | 2 | 2 |
| | 0.4 | FR-U110W-N0.4K-F, -(UF) | BH-K model, NV30 model 20A | S-K21 | S-K25 | S-K50 | 2 | 2 |

| Power input | Motor output (kW) | Applicable inverter model | Power factor improvement AC reactor | Low-acoustic noise output reactor | Fuse Rating | |
|---|---|---|---|---|---|---|
| | | | | | Class | Amp./Volt |
| 3-phase 200V | 0.1 | FR-U120-N0.1K-F(c), -(UF) | FR-BAL-0.4K (Note4) | FR-BOL-0.4K | K5 or H | 3A/250V |
| | 0.2 | FR-U120-N0.2K-F(c), -(UF) | FR-BAL-0.4K (Note4) | FR-BOL-0.4K | K5 or H | 5A/250V |
| | 0.4 | FR-U120-N0.4K-F(c), -(UF) | FR-BAL-0.4K | FR-BOL-0.4K | K5 or H | 8A/250V |
| | 0.75 | FR-U120-N0.75K-F(c), -(UF) | FR-BAL-0.75K | FR-BOL-0.75K | K5 or H | 15A/250V |
| | 1.5 | FR-U120-N1.5K-F(c), -(UF) | FR-BAL-1.5K | FR-BOL-1.5K | K5 or H | 25A/250V |
| Single phase 200V | 0.1 | FR-U120S-N0.1K-F, -(UF) | FR-BAL-0.4K (Note4) | FR-BOL-0.4K | K5 or H | 5A/250V |
| | 0.2 | FR-U120S-N0.2K-F, -(UF) | FR-BAL-0.4K (Note4) | FR-BOL-0.4K | K5 or H | 8A/250V |
| | 0.4 | FR-U120S-N0.4K-F, -(UF) | FR-BAL-0.75K (Note4) | FR-BOL-0.4K | K5 or H | 15A/250V |
| | 0.75 | FR-U120S-N0.75K-F, -(UF) | FR-BAL-1.5K (Note4) | FR-BOL-0.75K | K5 or H | 25A/250V |
| Single phase 100V | 0.1 | FR-U110W-N0.1K-F, -(UF) | FR-BAL-0.4K (Note4) | FR-BOL-0.4K | K5 or H | 8A/250V |
| | 0.2 | FR-U110W-N0.2K-F, -(UF) | FR-BAL-0.75K (Note4) | FR-BOL-0.4K | K5 or H | 15A/250V |
| | 0.4 | FR-U110W-N0.4K-F, -(UF) | FR-BAL-1.5K (Note4) | FR-BOL-0.4K | K5 or H | 25A/250V |

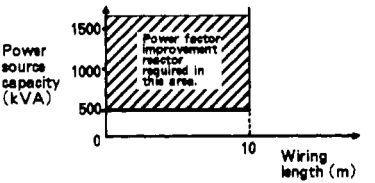
(Note)

1. The wiring sizes are shown for a 20m length.
2. When installing an MC on the inverter power supply, select the model according to power supply capacity and wiring distance as shown on the right.
   The A, B, C areas in the figure correspond to those in the above table. S-K10 is selected when using a power factor improvement reactor FR-BAL on the 0.4 to 1.5K models.
3. Use a $\phi$0.4 to $\phi$1.0 solid wire or 0.3 to 0.75mm² stranded wire for the control lead.
4. The power factor may drop slightly below 0.9.



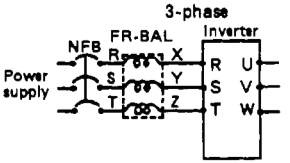

(Note)
The figure shown is based upon wire sizes recommended in the above table.

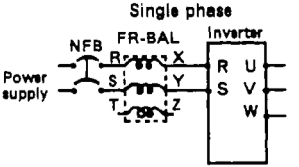
- An excessive peak current will flow to the power supply input circuit when the inverter is directly connected to a large capacity power supply transformer (500kVA or more, wiring 10m or less), and the inverter may be damaged. Always install the optional power factor improvement reactor FR-BAL in this case. (Use the 0.4kW FR-BAL for 0.1K and 0.2K.)




- The wiring length between the inverter and motor must be less than 100m. The control line must be 30m or less and must be separated from the main power wire. Use a twisted pair wire for external frequency setting signal input.

- Connect as shown below when installing.



Revision

| Publication date | Instruction manual No. | Details of revision |
|---|---|---|
| SEPT. 1994 | IB(NA)-66443-A | First edition |
| MAR. 1995 | IB(NA)-66443-B | Addition : Page 20, 64, 65, 66, 69 |
| JULY. 1995 | IB(NA)-66443-C | Addition : Stop key function Pr.75<br>3 Wire control |
| | | |

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HEAD OFFICE:MITSUBISHI DENKI BLDG. MARUNOUCHI TOKYO 100 TELEX:J24532 CABLE MELCO TOKYO

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