

# 取扱説明書

# Instruction Manual

工作機械用ベクトル制御スピンドルドライブシステム

VECTOR-CONTROLLED SPINDLE DRIVE SYSTEM FOR MACHINE TOOLS

## FRENIC 5000MS5

トルクベクトル制御M5シリーズ  
TORQUE VECTOR CONTROL  
M5 SERIES

高性能ベクトル制御V5シリーズ  
HIGH PERFORMANCE VECTOR CONTROL  
V5 SERIES

パッケージドライブユニット  
PACKAGE DRIVE UNIT

1.1kW/FRN1.1M5-2～5.5kW/FRN5.5M5-2  
3.7kW/FRN3.7M5-4, 5.5kW/FRN5.5M5-4

ドライブユニット  
DRIVE UNIT

5.5kW/FRN5.5MC5-2～30kW/FRN30MC5-2  
7.5kW/FRN7.5MC5-4～18.5kW/FRN18.5MC5-4

パッケージドライブユニット  
PACKAGE DRIVE UNIT

2.2kW/FRN2.2V5-2～5.5kW/FRN5.5V5-2

ドライブユニット  
DRIVE UNIT

5.5kW/FRN5.5VC5-2～55kW/FRN55VC5-2

コンバータシリーズ  
CONVERTER SERIES

電源回生コンバータユニット  
REGENERATING CONVERTER UNIT  
5.5kW/FRN5.5PR5-2～55kW/FRN55PR5-2

発電制動コンバータユニット  
DYNAMIC BRAKING CONVERTER UNIT  
7.5kW/FRN7.5PD5-2～18.5kW/FRN18.5PD5-2  
7.5kW/FRN7.5PD5-4～18.5kW/FRN18.5PD5-4

この取扱説明書は、和文・英文併記しています。和文は1～58ページ、英文は59～117ページに掲載します。  
This Instruction manual is written in Japanese on pages 1 to 58 and English on pages 59 to 117.

この取扱説明書の内容は、製品改良などのために変更することがありますので、ご了承ください。  
Information in this manual is subject to change without notice.



# Foreword

The FRENIC5000MS5 series is used for vector control spindle drive system for machine tool, and consist of a motor and its driver.

This manual is a instruction manual for the driver.

This Instruction Manual contains the treatment methods as shown in the contents. As for the other items, refer to "Instruction of the machine".

Use this equipment correctly. Misuse may result in abnormal operation or cause troubles and reduction of life. When necessary, read this Instruction Manual repeatedly even if after reading. Therefore, keep this Instruction Manual where the operator can refer to it.

## Safety

The following format is used on the equipment or found in this manual. Read all of safety information and follow the directions on them whenever working on the equipment.

**WARNING** : Denotes operating procedures and practices that may result in personal injury or loss of life if not correctly followed.

**CAUTION** : Denotes operating procedures and practices that, if not strictly observed, may result in damage to, or destruction of the equipment.

**NOTE** : Notes call attention to information that is especially significant in understanding and operating the equipment.

## WARNING, CAUTION AND NOTE PARAGRAPHS WITHIN THIS INSTRUCTION MANUAL

The above paragraphs list some general safety reminders and safety recommendations to be followed when operating or installing this equipment. These safety recommendations will be repeated throughout this instruction manual where applicable.



# Safety Precautions



## WARNING

Improper lifting practices can cause serious or fatal injury. Lift only with adequate equipment and trained personnel.

Being afraid of electric shock when power is applied or when charge indicator lit even after power off, do not remove the front cover. Failure to do so may result in death or serious injury.

If the alarm reset is input when the operation command is ON (close) after removing the cause activating the protection function, the unit will go to starting.

Being afraid of disaster such as injury, be sure that the operation command is OFF (open) and then reset the alarm.

When an abnormality occurs and is spreading, disabling to insure safety, causing or being afraid of causing a disaster such as fire, promptly switch OFF the circuit breaker on the power supply side.

Do not touch the electrical circuits or parts, or do not insert foreign bodies through the openings when applying power. It may result in electrical shock, burn by generated arc, and damage of the equipment.

When using instruments such as oscilloscope to work on live equipment, the oscilloscope's chassis should be grounded and a differential amplifier input should be used.

Care should be used in the selection of probes and leads and in the adjustment of the oscilloscope so that accurate readings may be made.

See instrument manufacture's instruction book for proper operation and adjustment to the instrument.

Before inspection and removing abnormality cause, disconnect and lock out power from the unit. Failure to disconnect power may result in death or serious injury.

A DC link circuit charge light provides visual indication that DC link voltage is present with the charged DC link capacitor; verify the DC link voltage level by measuring the voltage between power terminals P(+) and N(-) using an analog meter.

Do not attempt to service the unit until the charge indicator has extinguished and DC link voltage has discharged to zero volts.



## CAUTION

Do not use equipment in which some parts are damaged or missing. Using the equipment results in injury or damage.

If the unit's Fault Alarm is activated, consult the Troubleshooting section of this instruction manual, and after correcting the problem, resume operation.

The cooling fins of the unit are heated to a high temperature in operation and touching the fins may cause burn. Keep a sufficient time after stopping the unit when touching the fins.

Do not put foreign things such as dusts, oil mist, and metal pieces into the unit, or do not touch them to the cooling fins.

Disaster such as fire may be caused because of insulation fault or reduction or cooling ability.

Do not perform a megger test between the unit terminals or control circuit terminals.



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## 1 Unit Description and Specifications

### ⚠ WARNING

Improper lifting practices can cause serious or fatal injury. Lift only with adequate equipment and trained personnel.

### ⚠ CAUTION

Do not use equipment in which some parts are damaged or missing. Using the equipment results in injury or damage.

When identifying an unit at hand, refer to the nameplate attached on the front cover.

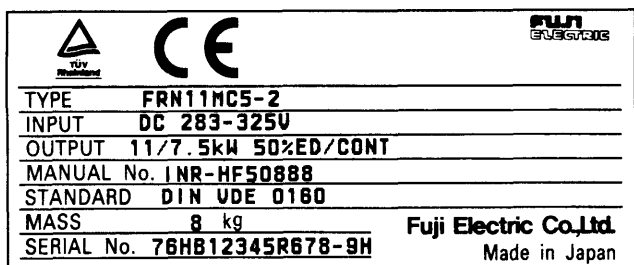


Fig. 1-1 Nameplate

- ← Unit type
- ← Input specification
- ← Output specification
- ← Instruction manual number
- ← Applied standard
- ← Mass
- ← Manufacturer's serial number

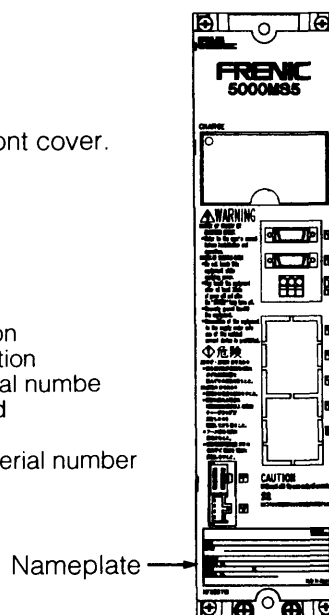


Fig. 1-2 Nameplate position



### Unit type designation

**FRN11MC5-2**

- Voltage series : 2 → 200V, 4 → 400V
- Series name : M5 → M5 series package drive unit  
: V5 → V5 series package drive unit  
: MC5 → M5 series drive unit  
: VC5 → V5 series drive unit  
: PR5 → Regenerating converter unit  
: PD5 → Dynamic braking converter unit
- Motor rated capacity (50% ED) : 1.1 → 1.1 kW to 55 → 55 kW  
In detail, refer to Table 1-1.
- Product type : FRENIC5000

### Manufacturer's series number

**7 6 H B 1 2 3 4 5 R 6 7 8 - 9 H**

- Product number
- Manufacture classification number
- Manufactured month : 1 to 9, X → 10, Y → 11, Z → 12
- Manufactured year : 1st digit of AD, 1997 → 7

There are the torque vector control type "M5 series", the high performance vector control type "V5 series", and the power supply part "Converter series" in "FRENIC5000MS5 Vector Controlled Spindle Drive System for Machine Tools".

These series are consisted of "Package driver", which contains the driver part and the power supply part in one case, and "Combination driver", which contains each part individually in the separate case, depending on the capacity.

The unit of the package driver is designated as "Package drive unit", the drive part of the combination driver as "Drive unit", and the power supply part (Converter series) as "Converter unit". "Dynamic braking system" in which kinetic energy is dissipated in the braking resistor on braking operation is provided by the package drive unit. Either "Dynamic braking system" or "Regenerating system" in which kinetic energy is regenerated to power supply is provided by the converter unit.

**Table 1-1 Unit type table**

| Motor rated capacity<br>[kW]<br>(50%ED/<br>Continuous |          | M5 series                            |              | V5 series                            |              | Converter series            |                                |
|---|----------|--------------------------------------|--------------|--------------------------------------|--------------|-----------------------------|--------------------------------|
|   |          | Package drive unit (Dynamic braking) | Drive unit   | Package drive unit (Dynamic braking) | Drive unit   | Regenerating converter unit | Dynamic braking converter unit |
| 200V series   | 1.1/0.75 | FRN1.1M5-2                           | —————        | —————                                | —————        | —————                       | —————                          |
|   | 2.2/1.5  | FRN2.2M5-2                           |              | FRN2.2V5-2                           |              |                             |                                |
|   | 3.7/2.2  | FRN3.7M5-2                           |              | FRN3.7V5-2                           |              |                             |                                |
|   | 5.5/3.7  | FRN5.5M5-2                           | FRN5.5MC5-2  | FRN5.5V5-2                           | FRN5.5VC5-2  | FRN5.5PR5-2                 |                                |
|   | 7.5/5.5  | —————                                | FRN7.5MC5-2  | —————                                | FRN7.5VC5-2  | FRN7.5PR5-2                 | FRN7.5PD5-2                    |
|   | 11/7.5   |                                      | FRN11MC5-2   |                                      | FRN11VC5-2   | FRN11PR5-2                  | FRN11PD5-2                     |
|   | 15/11    |                                      | FRN15MC5-2   |                                      | FRN15VC5-2   | FRN15PR5-2                  | FRN15PD5-2                     |
|   | 18.5/15  |                                      | FRN18MC5-2   |                                      | FRN18.5VC5-2 | FRN18.5PR5-2                | FRN18.5PD5-2                   |
|   | 22/18.5  |                                      | FRN22MC5-2   |                                      | FRN22VC5-2   | FRN22PR5-2                  | —————                          |
|   | 30/22    |                                      | FRN30MC5-2   |                                      | FRN30VC5-2   | FRN30PR5-2                  |                                |
|   | 37/30    |                                      | —————        |                                      | FRN37VC5-2   | FRN37PR5-2                  |                                |
|   | 45/37    |                                      |              |                                      | FRN45VC5-2   | FRN45PR5-2                  |                                |
|   | 55/45    |                                      |              |                                      | FRN55VC5-2   | FRN55PR5-2                  |                                |
| 400V series   | 3.7/2.2  | FRN3.7M5-4                           | —————        | —————                                | —————        | —————                       | —————                          |
|   | 5.5/3.7  | FRN5.5M5-4                           | —————        |                                      |              |                             | —————                          |
|   | 7.5/5.5  | —————                                | FRN7.5MC5-4  |                                      |              |                             | FRN7.5PD5-4                    |
|   | 11/7.5   |                                      | FRN11MC5-4   |                                      |              |                             | FRN11PD5-4                     |
|   | 15/11    |                                      | FRN15MC5-4   |                                      |              |                             | FRN15PD5-4                     |
|   | 18.5/15  |                                      | FRN18.5MC5-4 |                                      |              |                             | FRN18.5PD5-4                   |



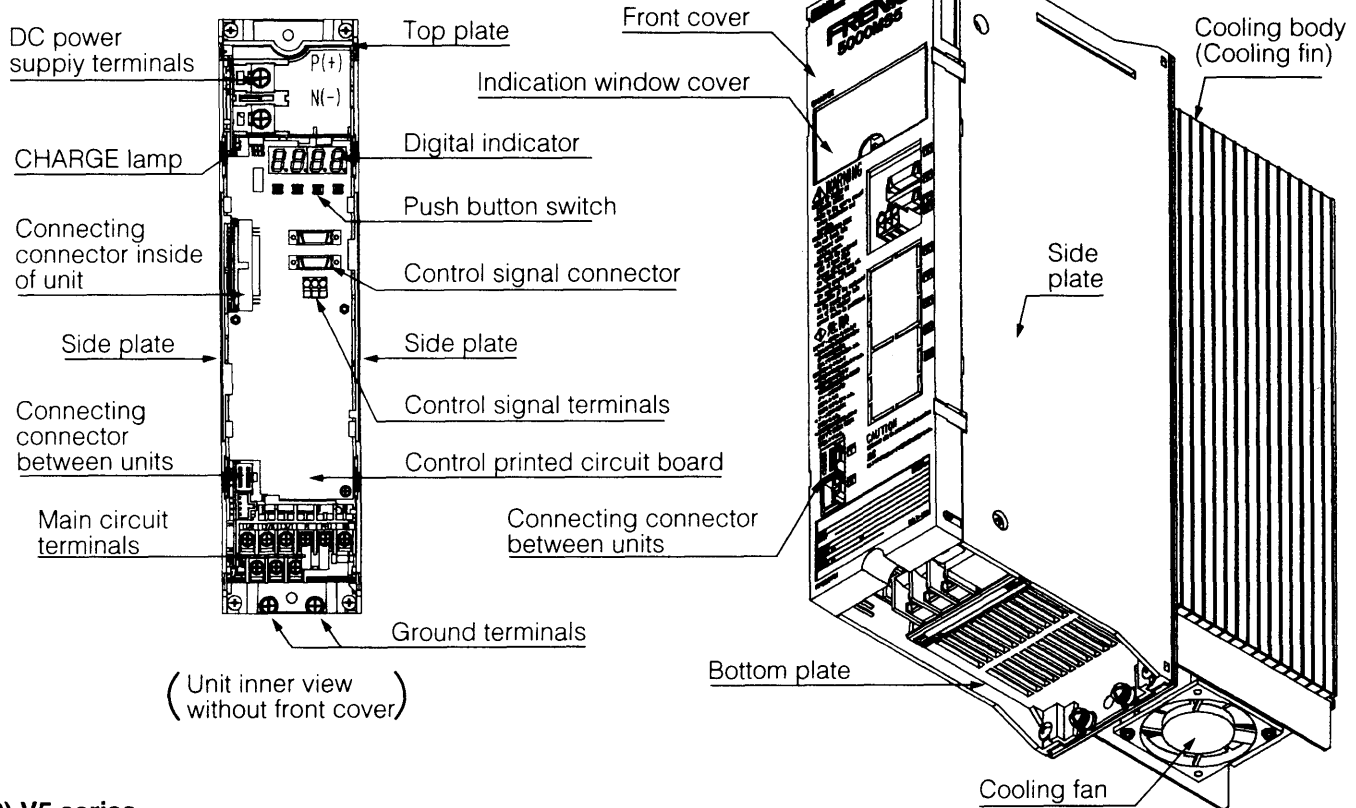
## 2 Unit Outer View

### a) Package drive unit

#### 1) M5 series

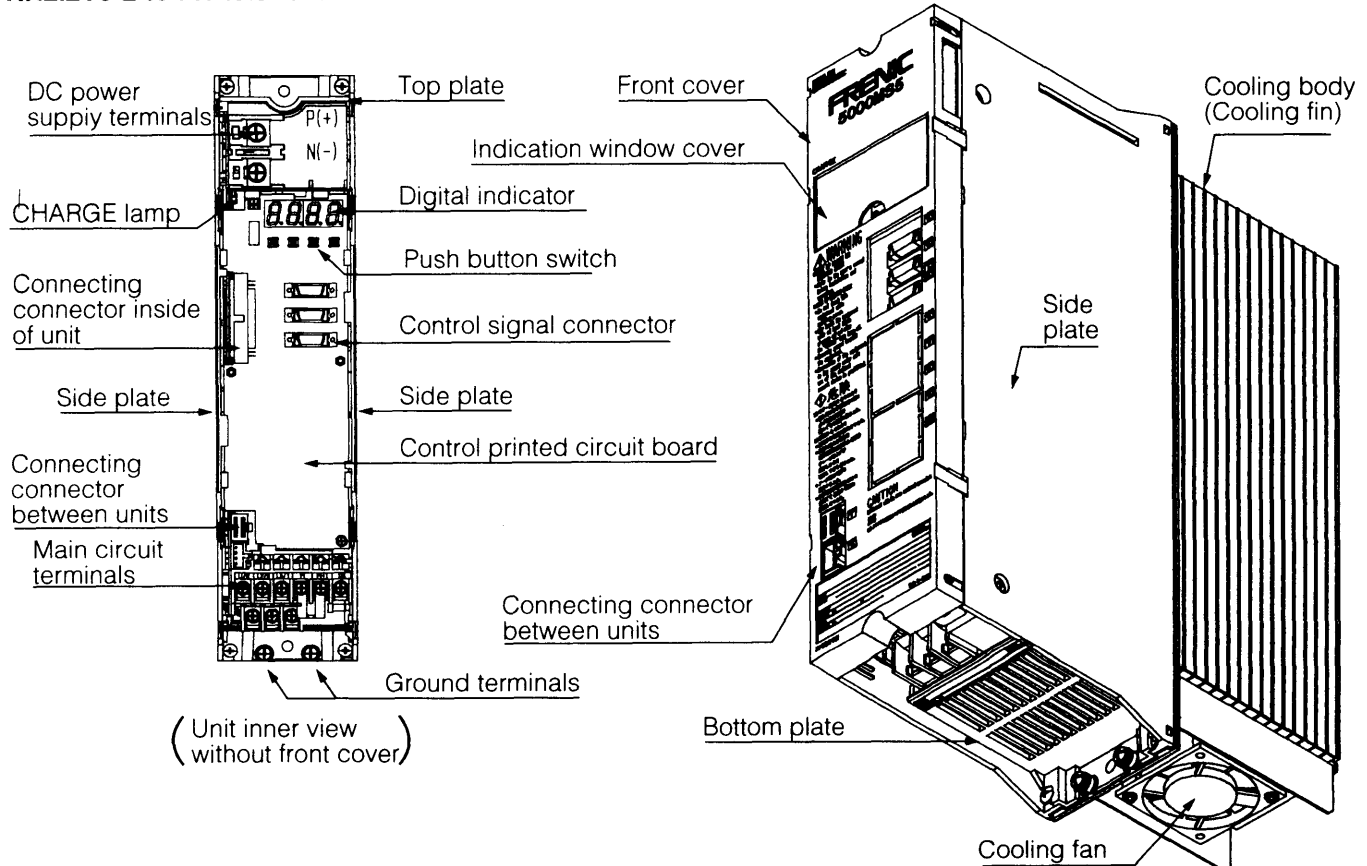
FRN1.1M5-2 to FRN5.5M5-2

FRN3.7M5-4, FRN5.5M5-4



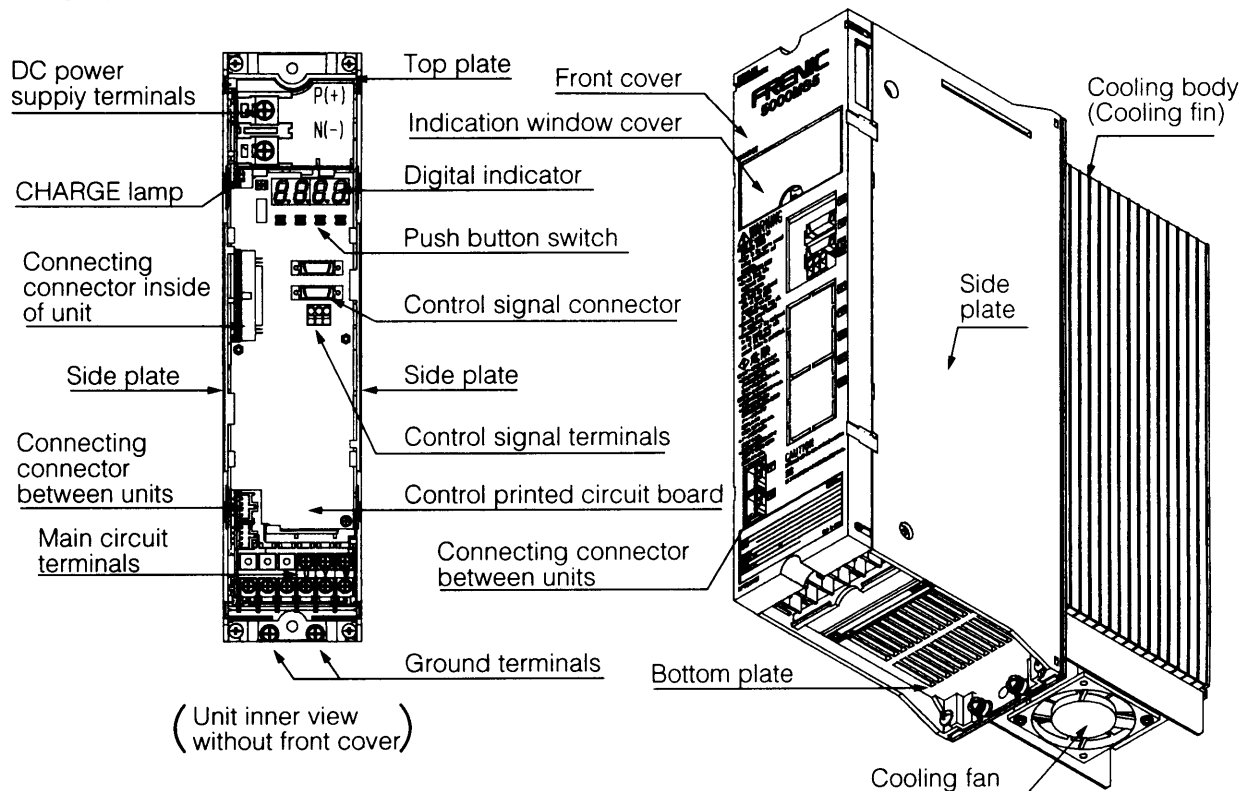
#### 2) V5 series

FRN2.2V5-2 to FRN5.5V5-2

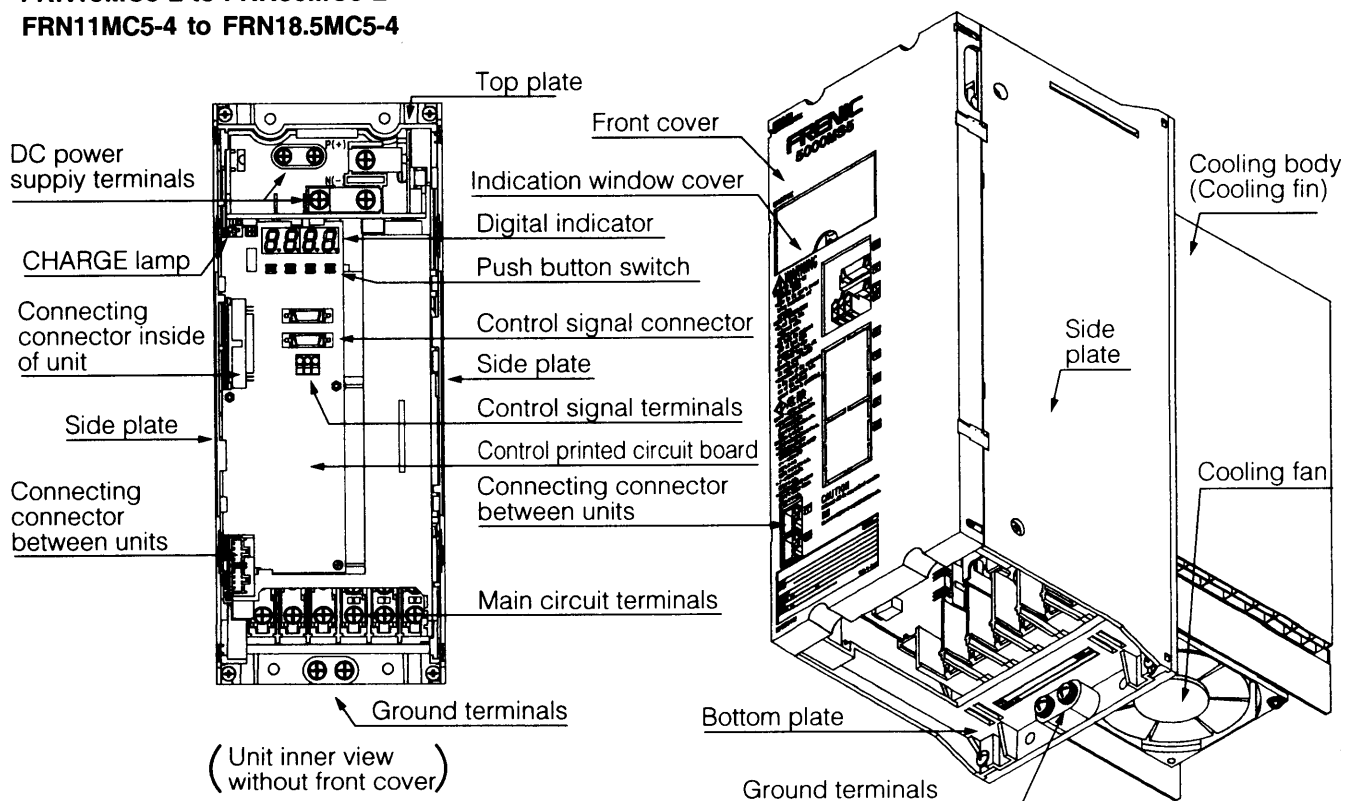




**b) Drive unit**  
**1) M5 series**  
**FRN5.5MC5-2 to FRN11MC5-2**  
**FRN7.5MC5-4**



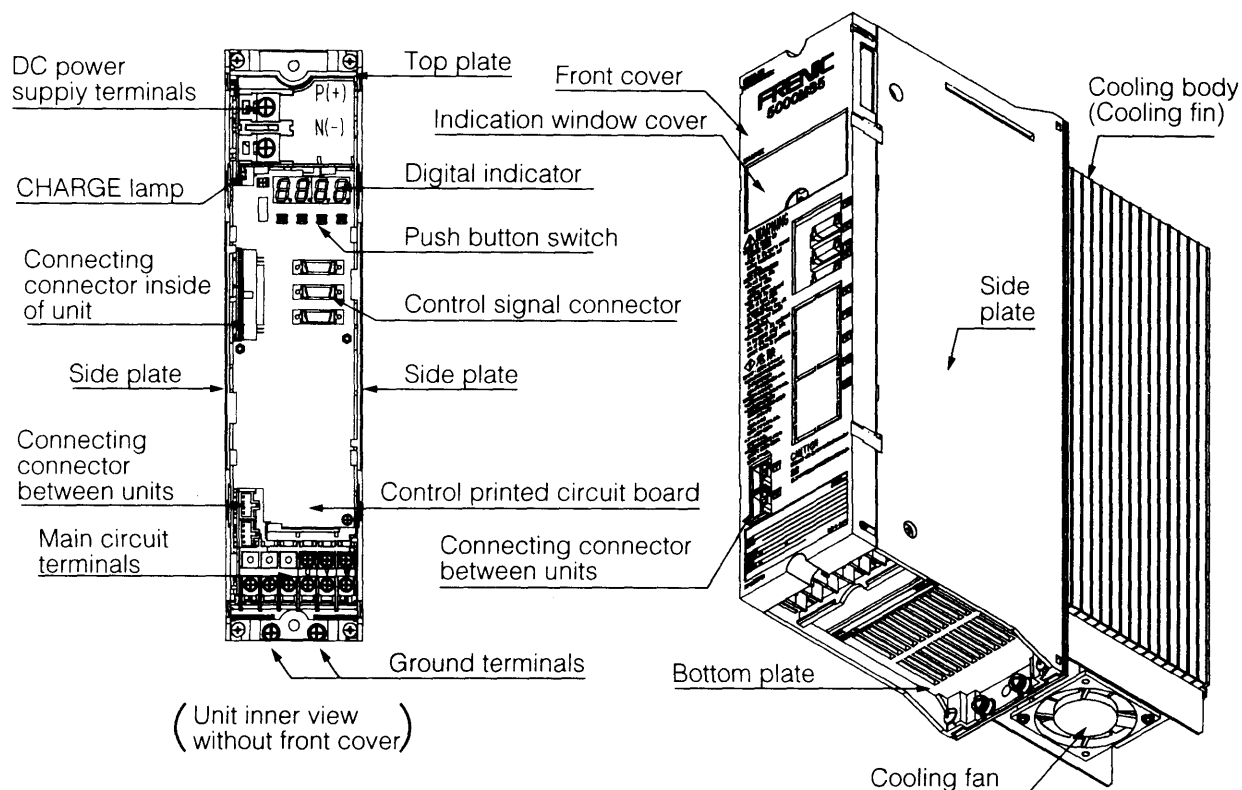
**FRN15MC5-2 to FRN30MC5-2**  
**FRN11MC5-4 to FRN18.5MC5-4**



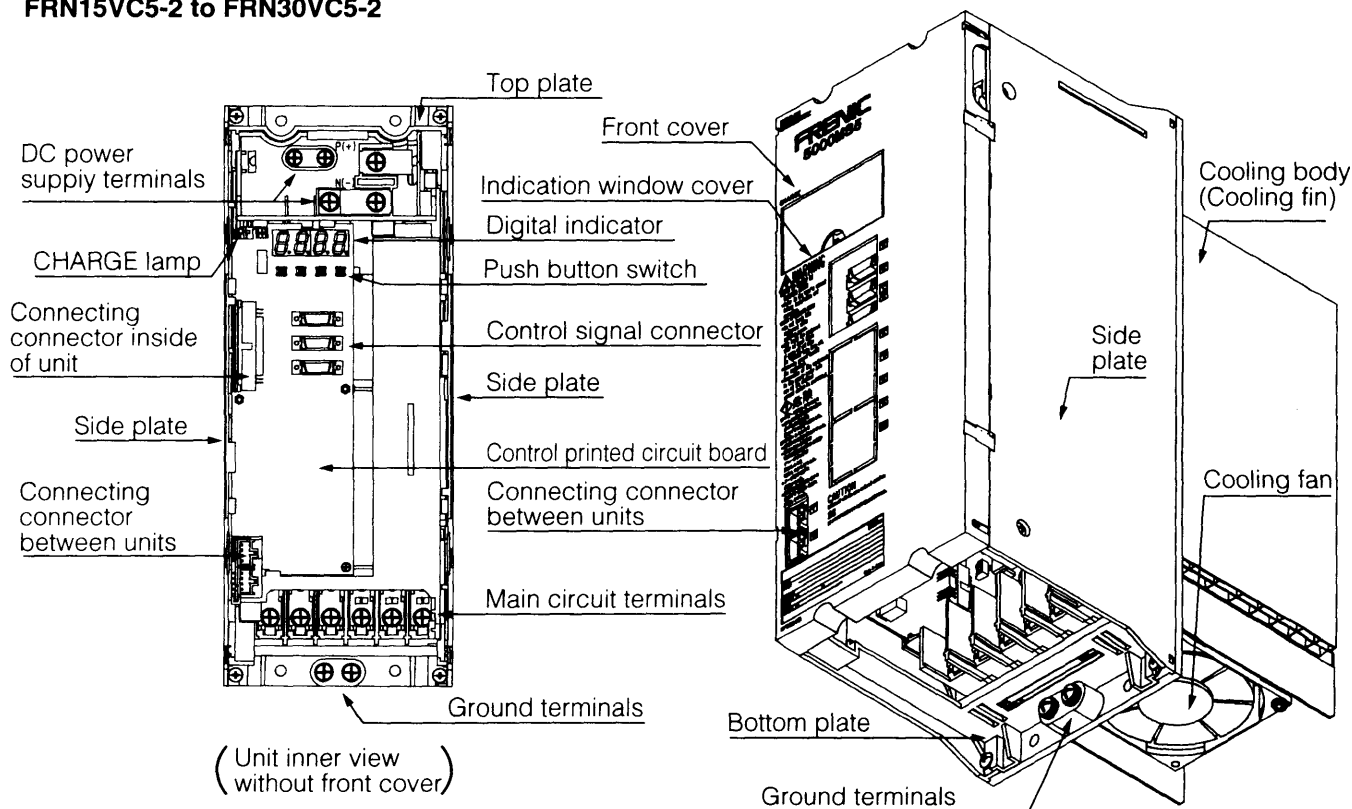


## 2) V5 series

### FRN5.5VC5-2 to FRN11VC5-2

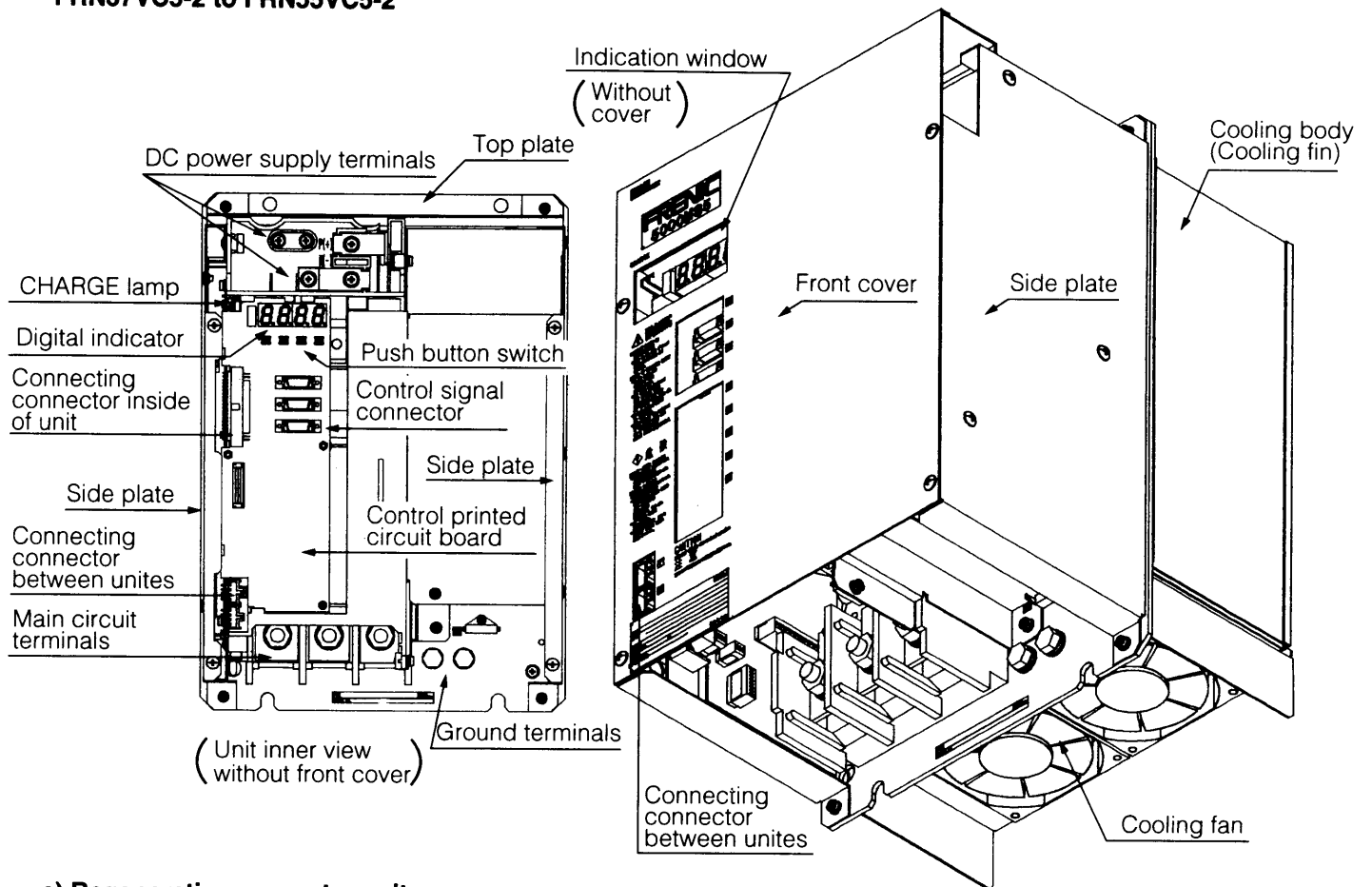


### FRN15VC5-2 to FRN30VC5-2

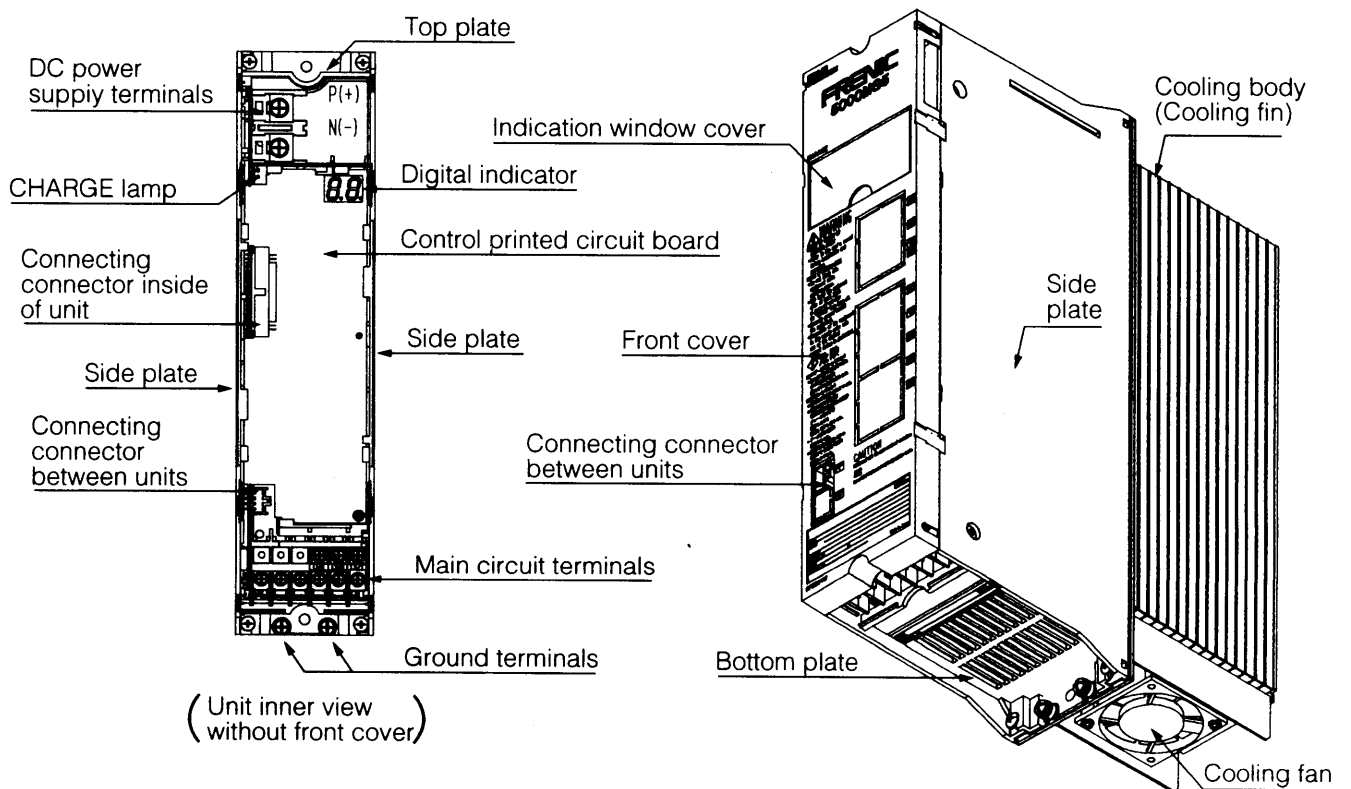




## FRN37VC5-2 to FRN55VC5-2

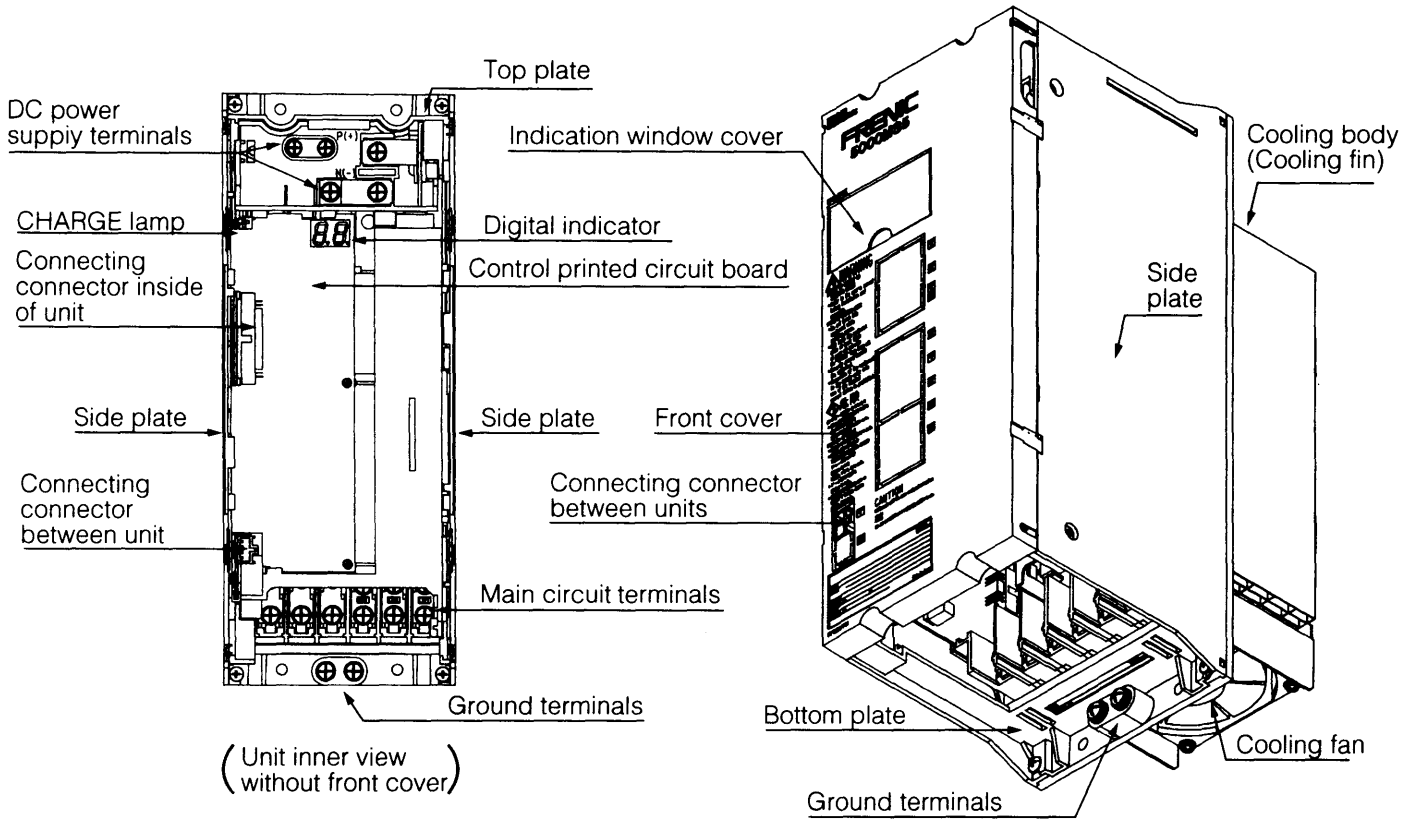


## c) Regenerating converter unit FRN5.5PR5-2 to FRN11PR5-2

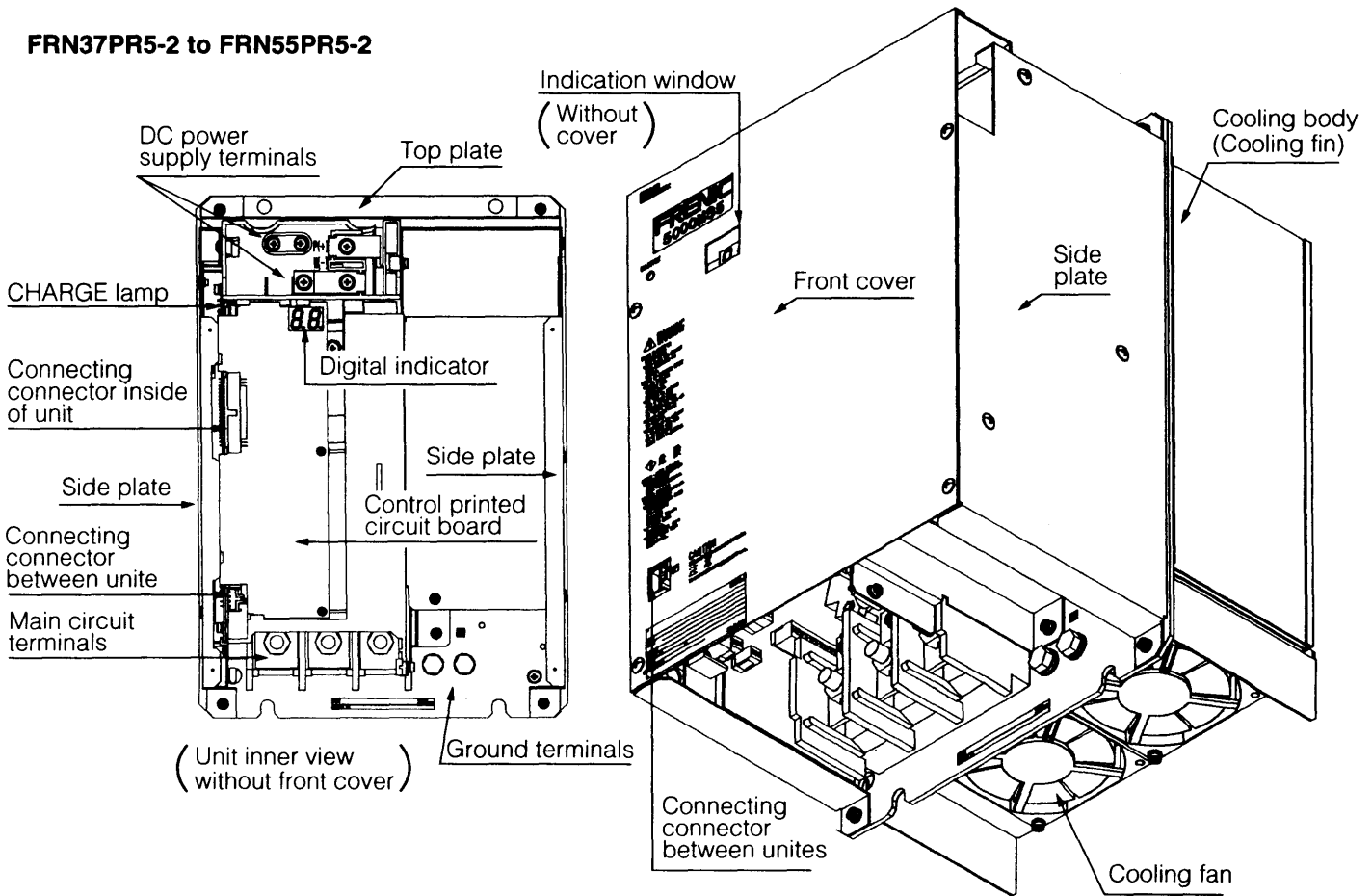




**FRN15PR5-2 to FRN30PR5-2**



**FRN37PR5-2 to FRN55PR5-2**

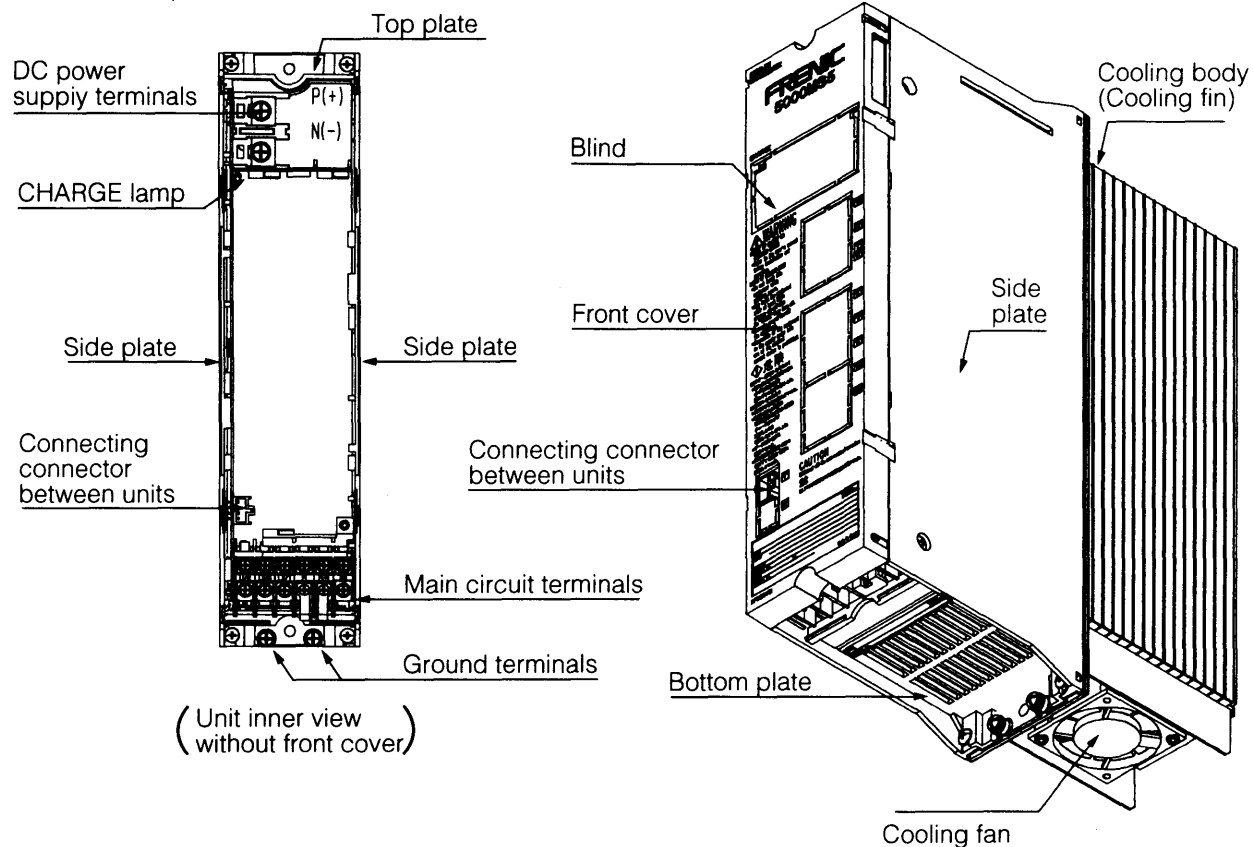




**d) Dynamic braking converter unit**

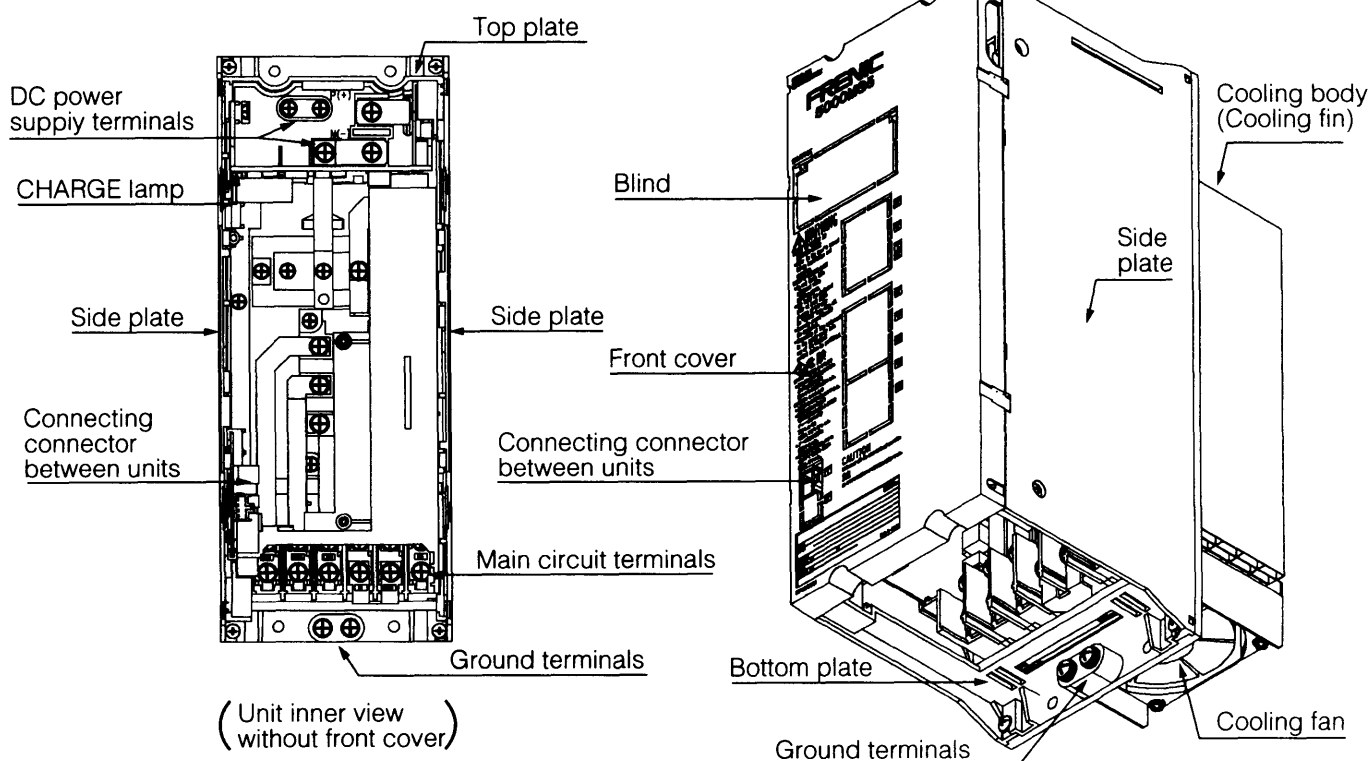
**FRN7.5PD5-2, FRN11PD5-2**

**FRN7.5PD5-4, FRN11PD5-4**




**FRN15PD5-2, FRN18.5PD5-2**

**FRN15PD5-4, FRN18.5PD5-4**





# 3 Data Indicating and Setting Part Handling

 **WARNING**

Being afraid of electric shock when power is applied or when charge indicator lit even after power off, do not remove the front cover. Failure to do so may result in death or serious injury.

Data indicating and setting part is composed of a digital indicator and a push button switch on the printed circuit board, which can be seen through the indication window on the front cover.

This data indicating and setting part is attached on "Package drive unit", "Drive unit" and "Regenerating converter unit", but not on "Dynamic braking converter unit".

The package drive unit and the drive unit select the function codes and data concerning the operation data, parameter, alarm, etc. and indicate them.

The regenerating converter unit indicates the alarm codes.

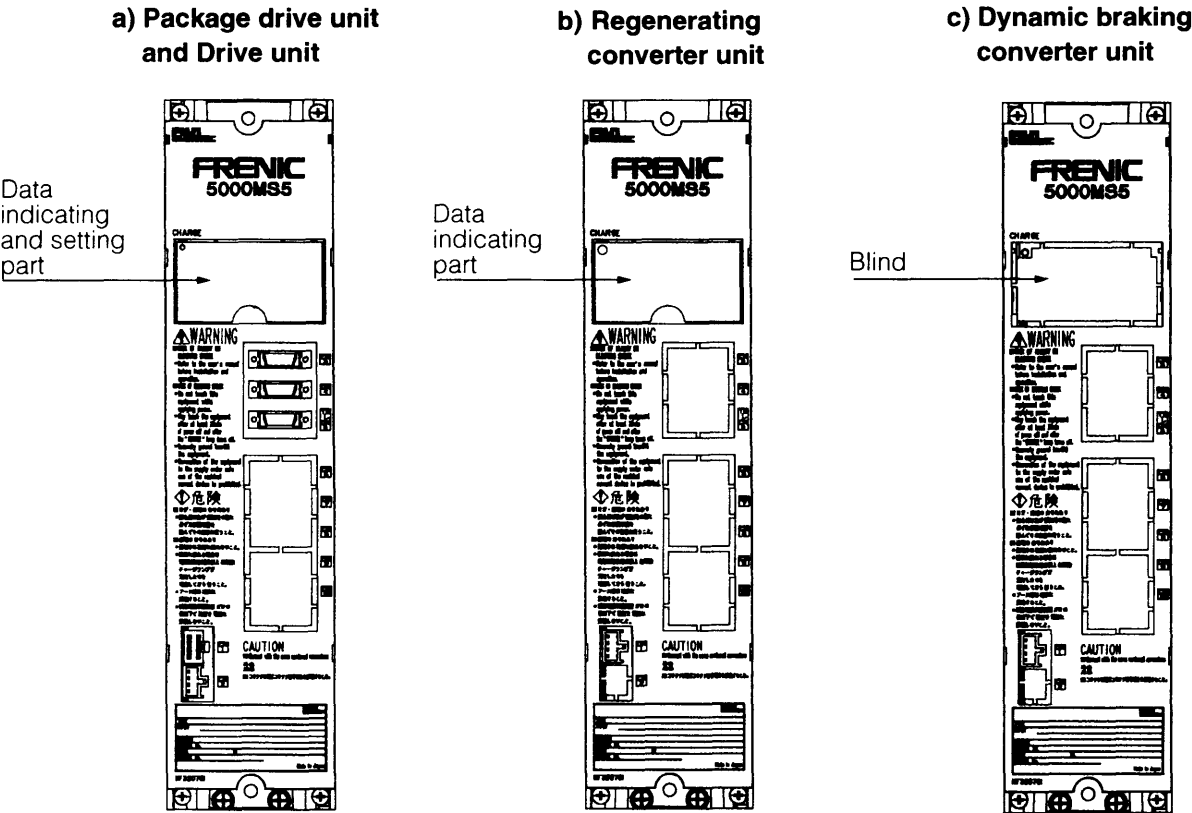


Fig. 3-1-1 Arrangement of data indicating and setting part



### 3-1 Data indicating and setting part function

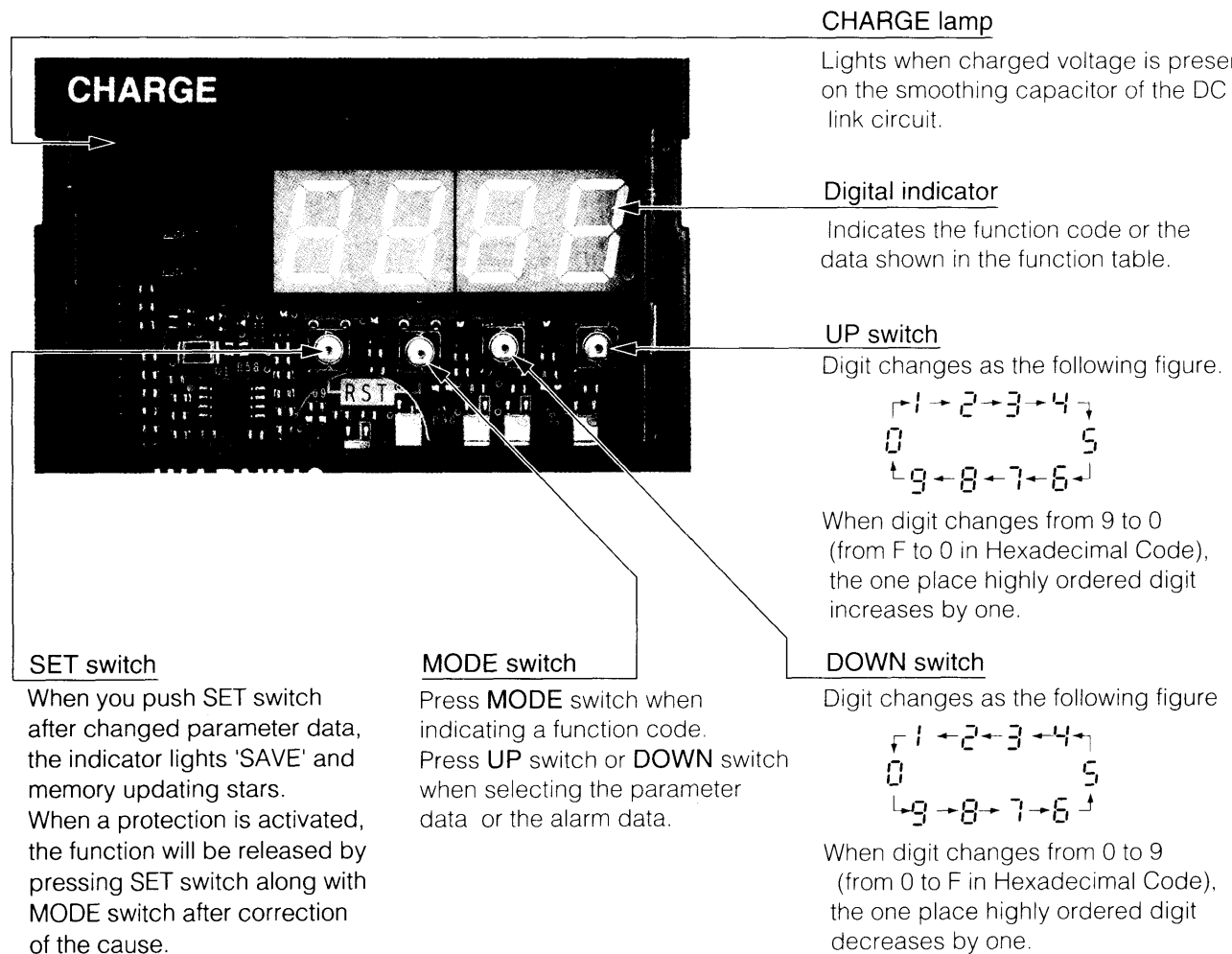


Fig. 3-1-2 Data indicating and setting part of Package drive unit and drive unit

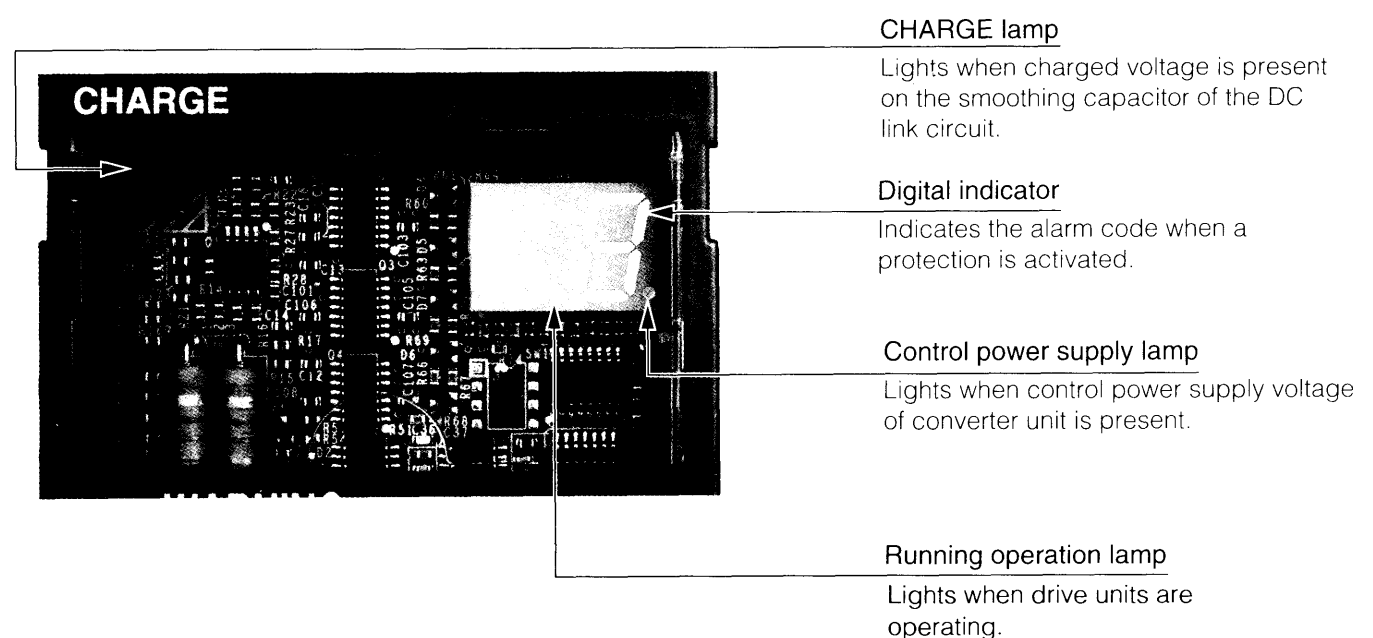


Fig. 3-1-3 Data indicating part of Regenerating converter unit



## 3-2 Preparation of monitoring

**NOTE :** When driving machine, follow the instruction of "Machine instruction manual".

When the power supply is already supplied and the data is indicated, read from "3-3 Handling of indication window cover".

When switching on the power supply so as to monitor the data, prepare and check the following points.

- Make sure that the operation command is OFF (open).
- Check for the safety.
- Switch ON (close) the circuit breaker on the power circuit.  
Switch ON (close) the magnetic contactor also, if present.
- Data can be monitored in about 2 seconds after switching on the power supply.  
Check for the following.
  - CHARGE lamp lit
  - Data indication on the indicator
  - Cooling fan running
  - Check for a while for smoke, abnormal noise, abnormal vibration, abnormal heating, odor, etc.

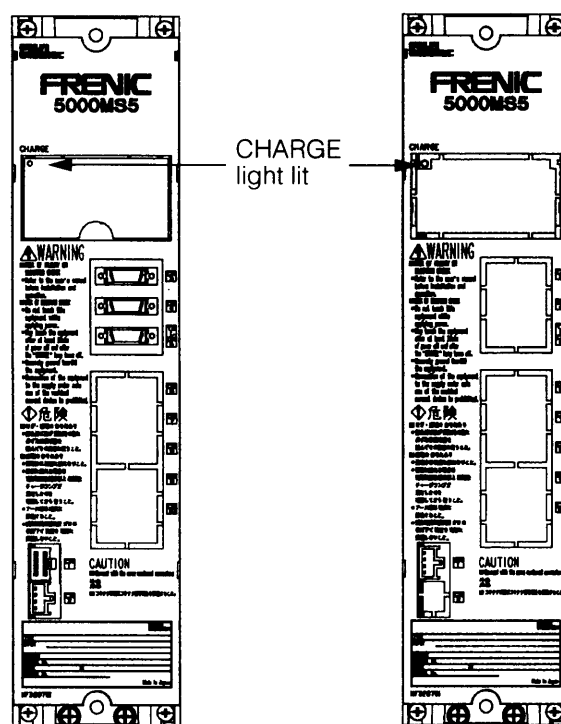


FIG. 3-2 Indication when power is supplied.

If there is any abnormality, switch OFF (open) the circuit breaker and remove the cause of the abnormality.

## 3-3 Handling of indication window cover

The window covers are not put on the indication windows of the V5 series drive units FRN37VC5-2, FRN45VC5-2 and FRN55VC5-2, and the converter series regenerating converter units FRN37PR5-2, FRN45PR5-2 and FRN55PR5-2. Those windows are opened. The other units have the windows with the transparent covers attached. (Refer to "Unit Outer View" p.63 to 68).

When pushing the push button switch on the unit with indication window, open the cover according to the following way.

- Put the fingertip into the half-round hole at the bottom of the indication window cover.
- Move slowly the finger upwards fixing the top of the cover.
- At the position where the window cover is turned by 90°, the cover is stopped and fixed.

After the window cover is fixed, the operation of the push button switch is possible.

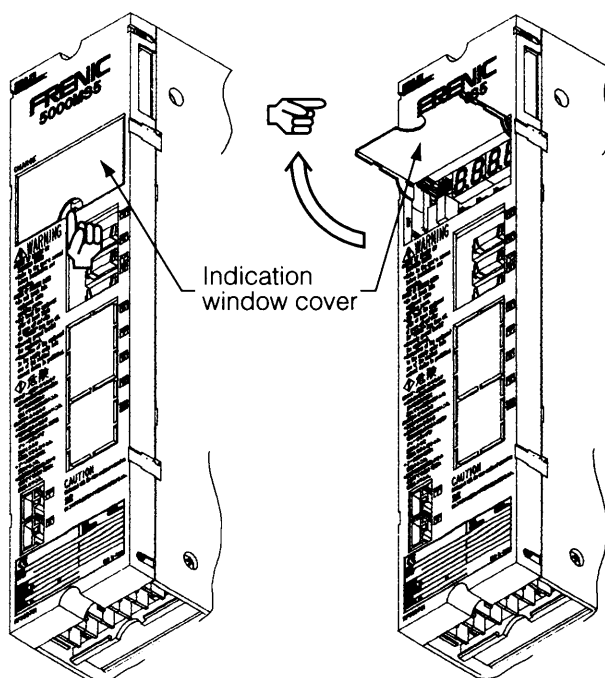


fig. 3-3 Handling of indication window cover



### 3-4 Data monitoring

This "3-4 Data monitoring" has an object for the package drive unit and the drive unit.

The regenerating converter unit indicates only the alarm data. In detail, refer to "3-5 Alarm indication and operation, b) Regenerating converter unit"(p.78).

**Table 3-1-1 Letters of Indicator**

| Number | Indicated letter | Number | Indicated letter | English letter | Indicated letter | English letter | Indicated letter | English letter | Indicated letter |
|--------|------------------|--------|------------------|----------------|------------------|----------------|------------------|----------------|------------------|
| 0      | 0                | 5      | 5                | A              | A                | F              | F                | P              | P                |
| 1      | 1                | 6      | 6                | B              | b                | H              | H                | R              | r                |
| 2      | 2                | 7      | 7                | C              | C                | L              | L                | S              | S                |
| 3      | 3                | 8      | 8                | D              | d                | N              | n                | U              | U                |
| 4      | 4                | 9      | 9                | E              | E                | O              | o                | V              | U                |

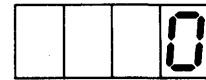
**NOTE :** The same character is indicated each for 5 and S, and U and V.

The following expressions are used to simplify the explanation.

- Digital indicator : Indicator
- Push button switch : **SET, MODE, UP, DOWN**
- Individual function : Function code such as C001, P001, and F013

When the selection operation of function is not conducted, the indicator displays the function data of the selected operation data.

However, the data of C000 (motor speed) is indicated when the power supply is ON.



**Fig. 3-4-1**  
Indication when power supply is turned on

When monitoring the data of the other functions, begin with the selection operation of the function. As for the operation data and the parameter alarm data, the selection operation and the data are indicated in the different meaning as shown in Table 3-4-1.

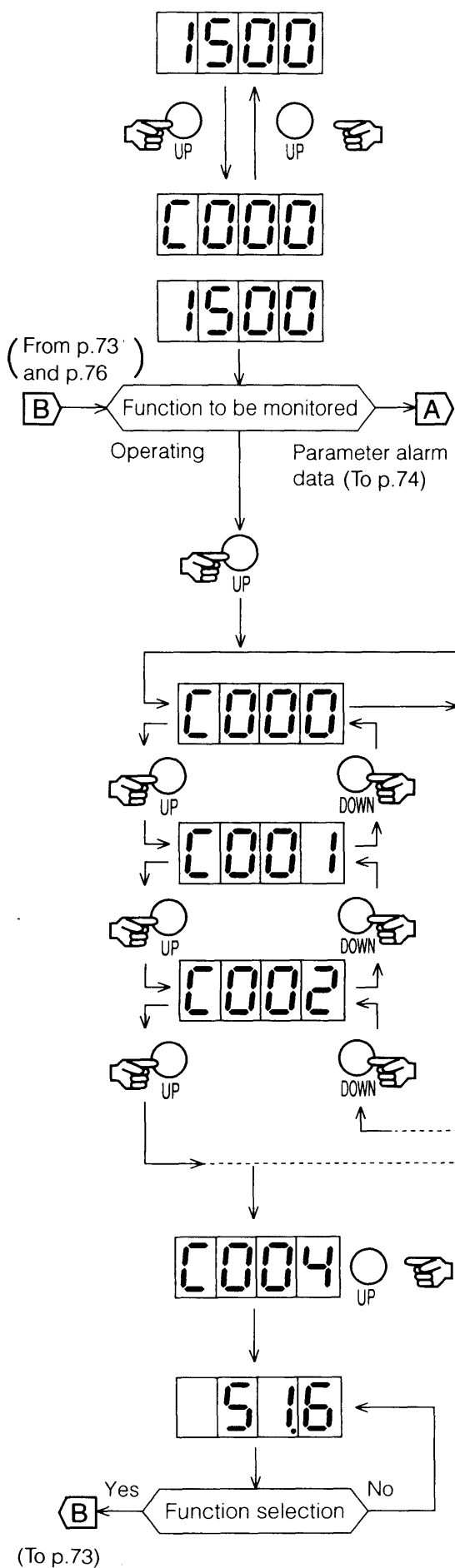
**NOTE :** In this "3-4 Data monitoring", the function code is called as code.

**Table 3-4-2**  
**Difference of selection operation and data indication**

| Function                     | Operation data   | Parameter alarm data  |
|------------------------------|--|---|
| Selection operation          | Press only <b>UP</b> or <b>DOWN</b>                            | Press <b>UP</b> or <b>DOWN</b> pressing <b>MODE</b>                             |
| Indicating the selected data | The operation data is kept until the next function is selected | Returns to the indication of operation data after being indicated for 4 seconds |



**a) Operation data (code C000 to C013)**



Indication example :

When the during monitoring C000, motor speed is 1500r/min

|                                     |   |
|-------------------------------------|---|
| Indicating monitoring function code | Press <b>UP</b> or <b>DOWN</b> once.<br>Indicates the code of the present indicating data.                      |
| Returning to the data indication    | The data of the presently monitoring function is indicated 1 second after <b>UP</b> or <b>DOWN</b> is released. |

|  |   |
|--|---|
| <p>Selecting code to be monitored.</p> | <p>Press <b>UP</b> or <b>DOWN</b>.<br/> The code changes and the function is selected per each press.<br/> When <b>UP</b> or <b>DOWN</b> is continuously pressed, the code quickly changes.</p> |
|--|---|

|                         |  |
|-------------------------|--|
| <p>Indicating data.</p> | <p>Release <b>UP</b> or <b>DOWN</b> when the code to be monitored appears.</p>   |
|                         | <p>The data of the selected function is indicated 1s after <b>UP</b> or <b>DOWN</b> is released.<br/>The indicated data is kept until the next function is selected.</p> |

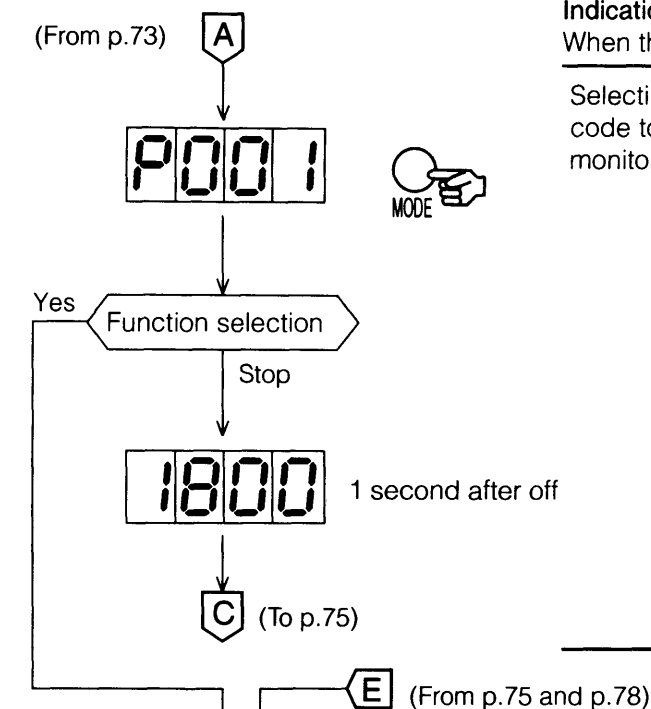
Indication example :

When the output current is 51.6A in the selection of C004.



### b) Parameter and alarm data (code P000 to F012)

(From p.73)



**Indication example :**

When the last selection is P001 and the data is 1800.

Selecting  
code to be  
monitored.

Press **MODE**.

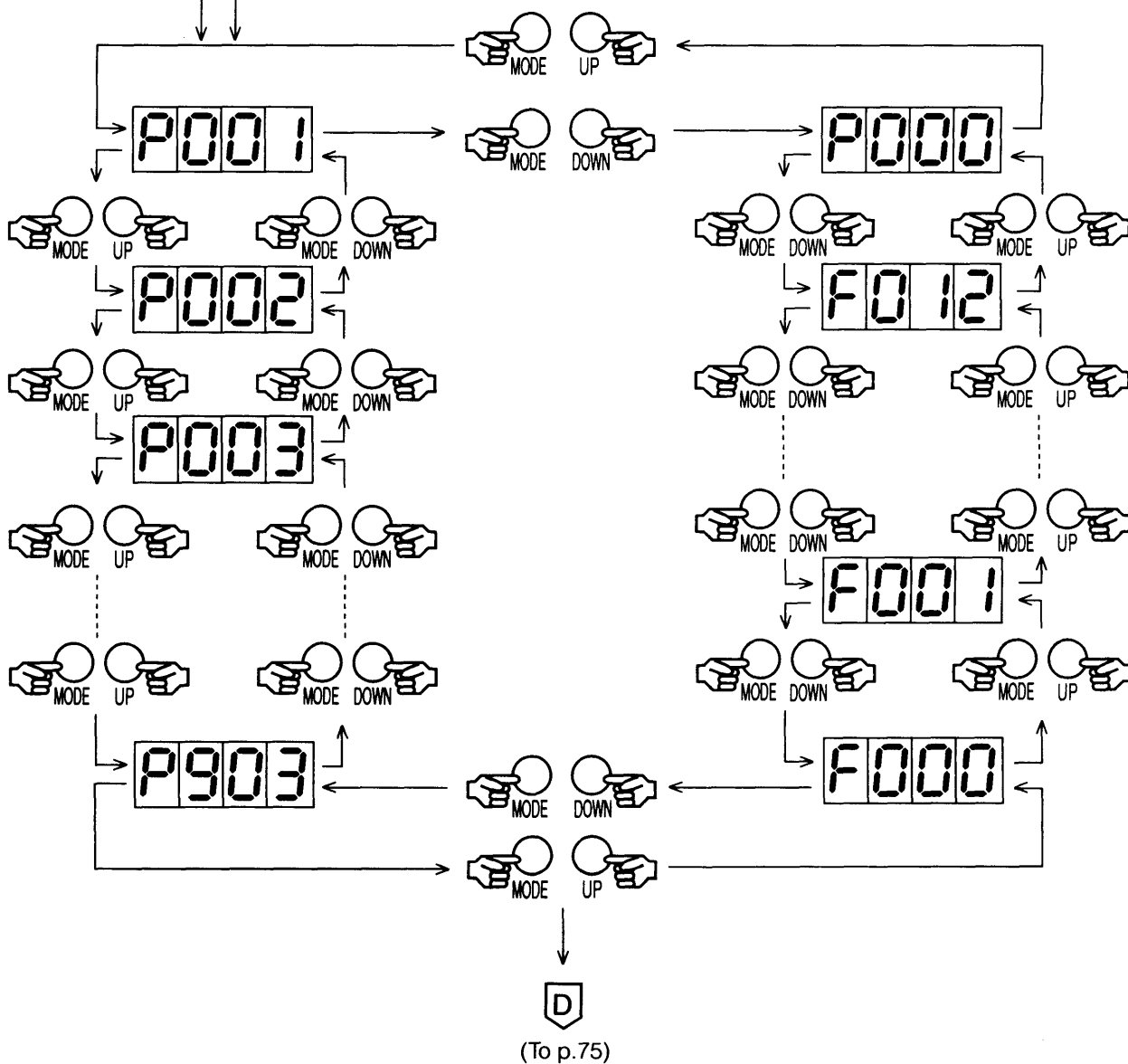
The code of parameter or alarm code, which has been selected before the selection of the new code, is indicated irrespective of the selection and indication of the operation data.

When **MODE** is pressed first after the power supply is ON, P000 is indicated. When **MODE** is continuously pressed, the same code is kept.

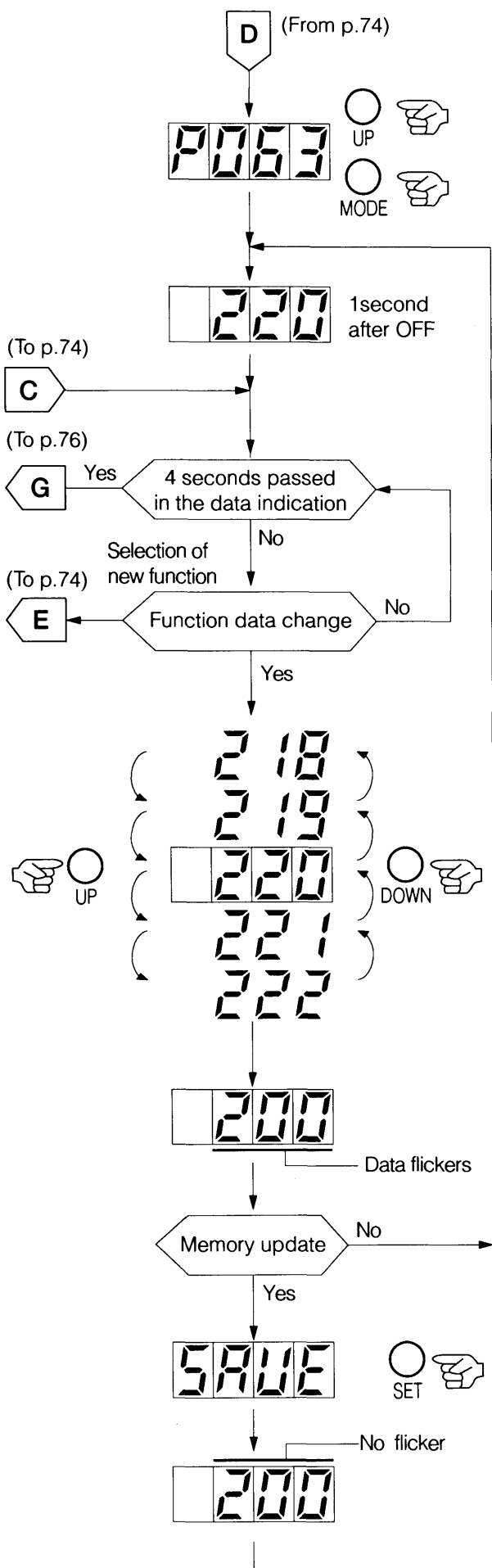
The data of the indicated code is displayed 1 second after **MODE** is released.

Press **UP** or **DOWN** pressing **MODE**.

The code changes in the order of the function table per each **UP** or **DOWN** press. When **MODE**, **UP**, or **DOWN** is continuously pressed, the code quickly changes.







Indicating data

When the monitored code appears, release UP, DOWN, and MODE.

Indication example: When the data is 220V in the selection of P063.

The data of the selected code is indicated 1 second after the key is released.

The data is indicated for 4 seconds.

NOTE: When the data of the code P100.

P200, P300, P400 and P500 are 0 (Nonindication), the function in each block are not indicated.

Changing data

Press UP or DOWN while function data is indicated, you can change the data of the selected code.

If the data of selected code flicks, it shows the data was changed.

When you press SET to update the memory, the indication shows 'SAVE'.

When the memory is updated, the set data is indicated again.

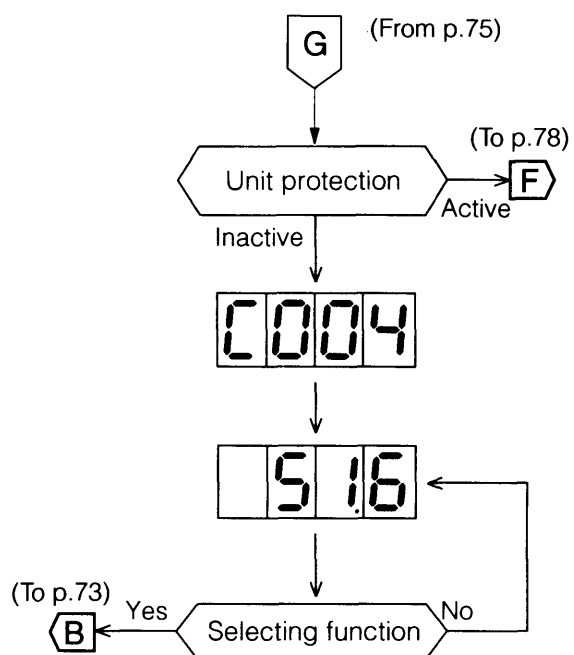
Notes

When the data of the code P000 is 0 (Data protection), you cannot change the another code data.

And the data of almost code is not able to change during operation.

The drive unit will be operated by the data indicated on the display even if you fail to press SET. But the data will be changed to the former data, if you turn off the power once.





Returning to  
operating  
data  
indication

After 4 seconds the code, which was indicated for monitoring for 5 seconds or more, is indicated.  
It does not change to a function of operation data which passed as in the selecting operation (indication for less than 5 seconds).

After 1 second the data of the indicated code is displayed. This display continues until a new function is selected or a protection of the unit is active.



### 3-5 Alarm indication and operation

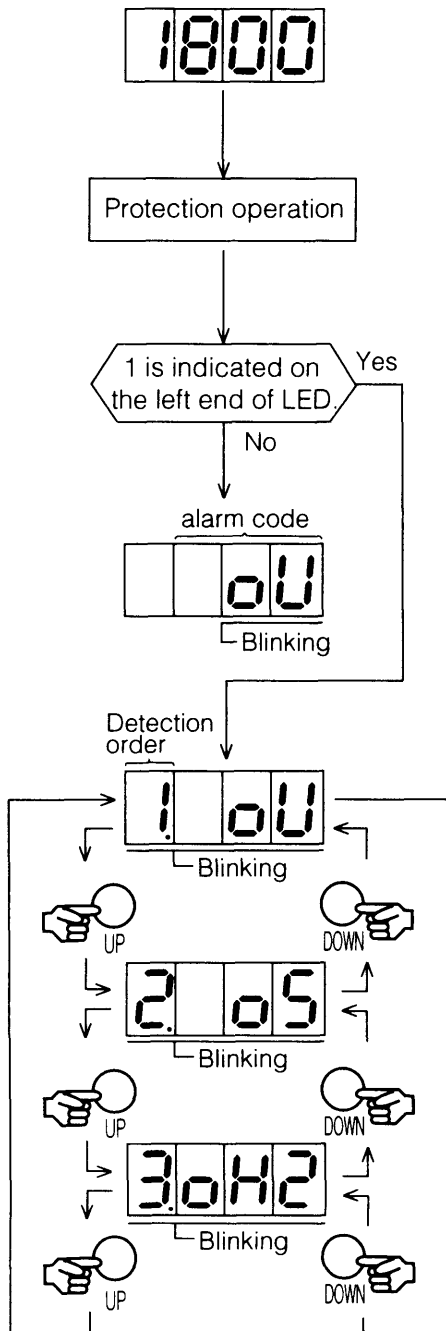
**⚠ WARNING**

**Being afraid of disaster such as injury, be sure that the operation command is OFF (open) and then reset the alarm.**

**a) Package drive unit and drive unit**  
If unit protection is activated, the indicator will immediately indicate the alarm code corresponding to the activated cause even when data is being monitored.

When protection is operating, alarm data and parameter can be monitored, but operation data can not be monitored.

### 1) Alarm content identifying



Only alarm code is indicated in the case of one activated cause.

|                        |  |
|------------------------|--|
| Identifying alarm code | Identify alarm code.<br>Alarm code blinks while protection is operating. |
|------------------------|--|

**Indication example :** When overvoltage protection is activated during monitoring "C000 Motor speed" (1800/min).

Detection order and alarm code are indicated in the case of two or more activated causes.

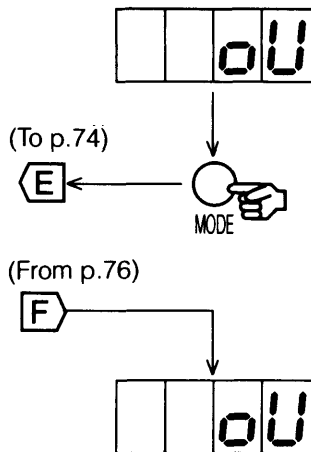
|                             |  |
|-----------------------------|--|
| Identify alarm code         | <p>The first detection order and the first detected alarm code are indicated.</p> <p>The detection order and the alarm code blink during protection activation.</p>  |
| Retrieval of alarm contents | <p>Press <b>UP</b>.</p> <p>Identify the alarm code of the second detection order.</p> <p>The detection order will change from 2 to 3 per pressing <b>UP</b>, indicating the relevant alarm code. Returns to the first detection order and the first order code indication if all causes have been removed.</p> <p>When pressing <b>DOWN</b>, the indication order will be indicated in reverse order, for instance, 1→3 →2 →1.</p> |

### Indication example

| Detection order | Alarm name           |
|-----------------|----------------------|
| 1               | Overvoltage          |
| 2               | Overspeed            |
| 3               | External alarm input |



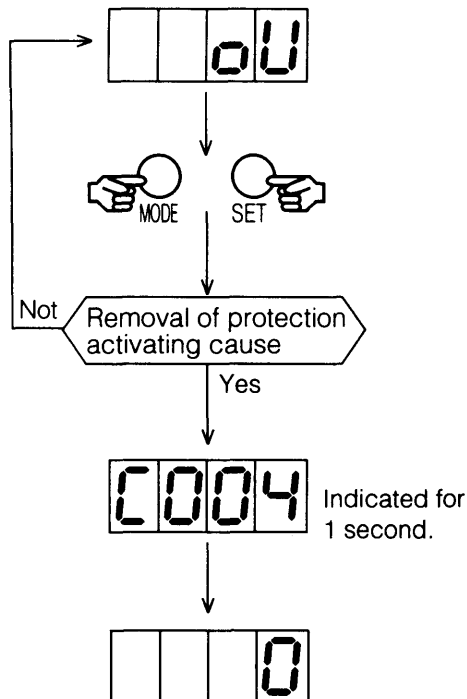
## 2) Parameter and alarm data monitoring



It is possible to monitor the function of the parameter and the alarm data shown in the function table.

The monitoring method is the same as explained in "3-4 Data monitoring" (p.72).

## 3) Reset operation



After identifying the alarm code and removing the protection activating causes, press **SET** first and press **MODE** pressing **SET**.

Then, the protection activated status is released and the operation mode will start.

The indicator returns to the indication of the operation data which was monitored before the protection activation.

If regenerating unit is connected, the protection function of the unit also is simultaneously released.

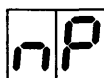
**NOTE :** If **MODE** is pressed before **SET**, it goes to monitoring the parameter and alarm data.

The protection activated status will not be released even if the reset operation is conducted without removing the protection activating causes.

Therefore, the indication continuously indicates the alarm code.

## b) Regenerating converter unit

### 1) Alarm contents



Only alarm contents are indicated. There is no other indication.

As for the alarm code, refer to "Table 5-1-2 Protective function of regenerative converter unit" (p.95).

### 2) Reset operation

The operation should be started from the drive unit.

Refer to "a) Package drive unit and drive unit, 3) Reset operation" (p.78).

The indicator goes out after resetting.



### 3-6 Function table

| groupe                 | Function |   | Data range   | Increment | Factory writing | Comment   |
|------------------------|----------|---|--|-----------|-----------------|---|
|                        | Code     | Name  |  |           |                 |   |
| Monitor                | C000     | Motor speed                                       | 0 to 20000r/min  | (Note1)   | —               | M5: Synchronous speed<br>M5(PE vector). Calculated value, V5: Measured value.                                     |
|                        | C001     | Motor speed (Reference value)                     | 0 to 20000r/min  | (Note1)   | —               |   |
|                        | C002     | Spindle speed                                     | 0 to 20000r/min  | (Note1)   | —               | Calculated value from P080 to P083 data   |
|                        | C003     | Load meter  | 0 to 255%  | 1         | —               | Indicates % value for 50% ED motor capacity   |
|                        | C004     | Output current                                    | 0 to 255%  | 1         | —               | Indicates % value for continuous capacity of drive unit.  |
|                        | C005     | Input signal status (Control)                     | Corresponding LED indication   | —         | —               | Refer to p.85   |
|                        | C006     | (Option)  | Corresponding LED indication   | —         | —               |   |
|                        | C007     | Output signal status                              | Corresponding LED indication   | —         | —               |   |
|                        | C008     | Stop position (Reference value)                   | 0000 to 1FFF   | 1         | —               | P203 data 0:1 pulse = 360°/4096   |
|                        | C009     | 0° Spindle position                               | 0000 to 1FFF   | 1         | —               | P203 data 1:1 pulse = 360°/8192   |
|                        | C010     | Spindle position deflection                       | 0000 to 1FFF   | 1         | —               |   |
|                        | C011     | Synchronous position deflection                   | 0000 to 1FFF   | 1         | —               |   |
|                        | C012     | DBR %ED   | 0 to 100%  | 1         | —               |   |
|                        | C013     | ROM version                                       | 0.00 to 99.99  | 0.01      | —               | Indicated as 4digits code.  |
| Protection             | P000     | Data protection                                   | 0 : Release<br>1 : Protection  | 1         | 1               |   |
| Max. speed             | P001     | Motor max. speed                                  | 100 to 20000r/min  | (Note 1)  | 4500r/min       |   |
| Acc./dec.              | P002     | Accerelation time                                 | 0.1 to 120.0s  | 0.1       | 5.0s            |   |
|                        | P003     | Decerelation time                                 |  | 0.1       | 5.0s            |   |
|                        | P004     | Acc./Dec. mode (Mode select.)                     | 0 : Step response<br>1 : S-curve acc./dec.<br>2 : Polygonal line acc./dec. | 1         | 1               |   |
|                        | P005     | S-curve acc./dec. (Width) (Acc.)                  | 0 to 50%   | 1         | 10%             | For torque limit acc./dec.  |
|                        | P006     | (Dec.)  |  | 1         | 10%             |   |
|                        | P007     | Ratio of acc./dec. speed N1                       | 1 to 99%   | 1         | 5%              | N1 <N2 <N3 <N4 <N5 should be kept<br>If the above relation is not kept, linear acc./dec. patern will be selected. |
|                        | P008     | N2  |  | 1         | 50%             |   |
|                        | P009     | N3  |  | 1         | 75%             |   |
|                        | P010     | N4  |  | 1         | 80%             |   |
|                        | P011     | N5  |  | 1         | 90%             |   |
|                        | P012     | Ratio of acc./dec. time K1                        | 1 to 99%   | 1         | 10%             | K1 <K2 <K3 <K4 <K5 should be kept<br>If the above relation is not kept, linear acc./dec. patern will be selected. |
|                        | P013     | K2  |  | 1         | 20%             |   |
|                        | P014     | K3  |  | 1         | 40%             |   |
|                        | P015     | K4  |  | 1         | 50%             |   |
|                        | P016     | K5  |  | 1         | 70%             |   |
|                        | P017     | Acc./dec. ratio (M gear)                          | 1.0 to 9.9   | 0.1       | 2.0             |   |
|                        | P018     | (L gear)  |  | 0.1       | 4.0             |   |
|                        | P019     | (LL gear)   |  | 0.1       | 4.0             |   |
| Boost                  | P020     | Torque boost                                      | 0 : Auto-torque boost<br>1 to 150 : Manual                                 | 1         | 0               |   |
| Speed setting override | P021     | Analog input filter                               | 1 to 1000ms  | 1         | 200(20)ms       |   |
|                        | P022     | Adj. of speed setting offset (Activation select.) | 0 : Inactive<br>1 : Active (Automatic adjust.)                             | 1         | 0               |   |
|                        | P023     | Adj. of speed setting gain (at + signal)          | 0.00 to 11.00V   | 0.01      | 10.00           | Automatical adjustment by writing input voltage value.  |
|                        | P024     | (at - signal)                                     |  | 0.01      | 10.00           | Automatical adjustment by writing minus input voltage value (V5).   |
|                        | P025     | Adj. of override offset (Activation select.)      | 0 : Inactive<br>1 : Active (Automatic adjust.)                             | 1         | 0               |   |
|                        | P026     | Override setting band                             | 0 to 50%   | 1         | 0%              | Setting with absolute value.  |
| Magnetic flux          | P027     | Magnetic flux level (Constant speed)              | 10 to 100%   | 1         | 50%(25%)        |   |
|                        | P028     | (Time constant during deceleration)               | 0 to 250ms   | 1         | 100ms           |   |
|                        | P029     | (ORT)   | 10 to 100%   | 1         | 50%             |   |
|                        | P030     | (Rigid)   | 10 to 100%   | 1         | 100%            |   |



| groupe             | Function |   | Data range   | Increment | Factory writing       | Comment   |
|--------------------|----------|---|--|-----------|-----------------------|---|
|                    | Code     | Name  |  |           |                       |   |
| Torque limit       | P031     | Torque limit (Driving)                      | 10 to 200%   | 1         | Depending on capacity | 100% value is 50% ED rated torque of the motor.                         |
|                    | P032     | (Braking)                                   |  | 1         | Depending on capacity | 100% value is 50% ED rated torque of the motor.                         |
|                    | P033     | External torque limit (H level)             | 10 to 200%   | 1         | 120%                  | 100% value is 50% ED rated torque of the motor.                         |
|                    | P034     | (L level)                                   |  | 1         | 50%                   | 100% value is 50% ED rated torque of the motor. (Available only for V5) |
|                    | P035     | Output power limit pattern                  | 0 to 5   | 1         | 0                     |   |
|                    | P036     | Output power limit value                    | 0 to 150%  | 1         | 120%                  | 100% value is 50% ED rated torque of the motor.                         |
| DC injection brake | P037     | DC injection brake (Voltage)                | 0 to 100%  | 1         | 20%                   | Not available in PE MGORT   |
|                    | P038     | (Time)                                      | 0.0 to 30.0s   | 0.1       | 1.0s                  | Not available in PE MGORT   |
| Pre-excitation     | P039     | Pre-excitation (Level)                      | 50 to 200%   | 1         | 100%                  |   |
|                    | P040     | (Time)                                      | 0.0~5.0s   | 0.1       | 0.0s                  |   |
| Digital output     | P041     | Speed detection (Level)                     | 1 to 100%  | 1         | 75%                   |   |
|                    | P042     | Speed equivalence detection (Width)         | 2 to 15%   | 1         | 5%                    |   |
|                    | P043     | Zero-speed detection (Level)                | 0.2 to 2.0%  | 0.1       | 0.3%                  |   |
|                    | P044     | Torque detection (Level)                    | 0 to 150%  | 1         | 100%                  | 100% value is 50% ED rated torque of the motor. (Available only for V5) |
| Analog output      | P045     | Ammeter/load meter selection                | 0 : Ammeter<br>1 : Standard load meter<br>2 : Special load meter | 1         | 1                     |   |
|                    | P046     | Speed meter gain                            | 50 to 150%   | 1         | 100%                  |   |
|                    | P047     | Ammeter/load meter gain                     | 50 to 200%   | 1         | 100%                  |   |
|                    | P048     | Analog meter test                           | 0 : Inactive<br>1 : Active                                       | 1         | 0                     | Fullscale output by writing 1   |
|                    | P049     | Ammeter/load meter filter                   | 10 to 1000ms   | 10        | 100ms                 |   |
| Simple-ORT         | P050     | S-ORT creeping speed                        | 15 to 300r/min   | 1         | 30r/min               |   |
|                    | P051     | S-ORT stopping signal ON delay timer        | 0 to 1000ms  | 10        | 500ms                 |   |
|                    | P052     | S-ORT completion ON-delay timer             | 0 to 1000ms  | 10        | 100ms                 |   |
| Motor 1            | P053     | Motor code (Type · Capacity)                | Depending on capacity code                                       |           | Depending on capacity | Motor: MVE/MVS/V3/coil-switch/General-purpose                           |
|                    | P054     | Base speed                                  | 100 to 20000r/min  | (Note1)   | Depending on capacity | Automatically rewritten by changing P053 'Motor code'                   |
|                    | P055     | Rated voltage                               | 120 to 230V (200V series)<br>240 to 460V (400V series)           | 1         | Depending on capacity |   |
|                    | P056     | Rated current (Cont.)                       | 0.1 to 500.0A  | 0.1       | Depending on capacity |   |
|                    | P057     | Rated torque current (Cont.)                | 0.1 to 500.0A  | 0.1       | Depending on capacity |   |
|                    | P058     | Exciting current                            | 0.1 to 500.0A  | 0.1       | Depending on capacity |   |
|                    | P059     | %R1   | 0.00 to 50.00%   | 0.01      | Depending on capacity |   |
|                    | P060     | %L σ  | 0.00 to 50.00%   | 0.01      | Depending on capacity |   |
|                    | P061     | Number of poles                             | 2,4,6,8,10,12  | 2         | Depending on capacity |   |
|                    | P062     | Max. speed                                  | 100 to 20000r/min  | (Note1)   | Depending on capacity | (Specified max. speed corresponding to motor type.)                     |
|                    | P063     | Max. output voltage                         | 120 to 230V (200V series)<br>240 to 460V (400V series)           | 1         | Depending on capacity |   |
|                    | P064     | D operation constants                       | 0000 to FFFF   | 1         | Depending on capacity |   |
|                    | P065     | Slip frequency (Driving)                    | 0.00 to 5.00Hz   | 0.01      | Depending on capacity |   |
|                    | P066     | (Braking)                                   | 0.00 to 5.00Hz   | 0.01      | Depending on capacity |   |
|                    | P067     | Coefficient 1                               | 0000 to FFFF   | 1         | Depending on capacity |   |
|                    | P068     | 2   |  | 1         | Depending on capacity |   |
|                    | P069     | 3   |  | 1         | Depending on capacity |   |
|                    | P070     | 4   |  | 1         | Depending on capacity |   |
|                    | P071     | 5   |  | 1         | Depending on capacity |   |
|                    | P072     | Auto tuning (%R1, %L σ)                     | 0,1,2  | 1         | 0                     |   |
| Hard adj.          | P073     | Motor speed adj. (Low)                      | 0,1,2  | 1         | 0                     | 1: 50r/min, 2: Stopping   |
|                    | P074     | Tuning (Current detection)                  | 0 : Inactive<br>1 : Active                                       | 1         | 0                     | Gain balance adjustment   |
|                    | P075     | (Voltage detection)                         | 0 : Inactive<br>1 : Active                                       | 1         | 0                     | Offset gain total adjustment  |
| Definition         | P076     | Drive unit capacity                         | Depending on capacity code                                       | -         | Depending on capacity |   |
|                    | P077     | Over speed deflection alarm ((Mode select.) | 0 : Non-use<br>1 : Use   | 1         | 1                     |   |
|                    | P078     | PE feedback control (Mode select)           | 0 : Non-use<br>1 : Use   | 1         | 0                     |   |
|                    | P079     | NTC thermistor (Mode select)                | 0 : Non-use<br>1 : Use   | 1         | 1                     |   |



| groupe                            | Function |  | Data range   | Increment | Factory writing | Comment  |
|-----------------------------------|----------|--|--|-----------|-----------------|--|
|                                   | Code     | Name   |  |           |                 |  |
| Spindle /<br>motor speed<br>ratio | P080     | Spindle/ motor speed ratio (H gear)                  | 0000 to FFFF   | 1         | 0800            | Set by HEXDECIMAL code as follows;<br>(Max. speed of motor)×2048/(Max. speed of spindle) |
|                                   | P081     | (M gear)   |  | 1         | 0800            |  |
|                                   | P082     | (L gear)   |  | 1         | 0800            |  |
|                                   | P083     | (LL gear)  |  | 1         | 0800            |  |
| ASR Rigid                         | P100     | Function block (P101~P126) select<br><ASR>           | 0 : Non-indication<br>1 : Indication   | 1         | 0(1)            |  |
|                                   | P101     | ASR P-gain (H gear)                                  | 0 to 150 times   | 1         | 20 times        |  |
|                                   | P102     | (M gear)   |  | 1         | 20 times        |  |
|                                   | P103     | (L gear)   |  | 1         | 20 times        |  |
|                                   | P104     | (LL gear)  |  | 1         | 20 times        |  |
|                                   | P105     | (Rigid)  |  | 1         | 20 times        |  |
|                                   | P106     | (ORT H gear)   |  | 1         | 40 times        |  |
|                                   | P107     | (ORT M gear)   |  | 1         | 40 times        |  |
|                                   | P108     | (ORT L gear)   |  | 1         | 40 times        |  |
|                                   | P109     | (ORT LL gear)  |  | 1         | 40 times        |  |
|                                   | P110     | ASR Integration time (H gear)                        | 0 to 200ms   | 1         | 20ms            |  |
|                                   | P111     | (M gear)   |  | 1         | 20ms            |  |
|                                   | P112     | (L gear)   |  | 1         | 20ms            |  |
|                                   | P113     | (LL gear)  |  | 1         | 20ms            |  |
|                                   | P114     | (Rigid)  |  | 1         | 20ms            |  |
|                                   | P115     | (ORT H gear)   |  | 1         | 100(20)ms       |  |
|                                   | P116     | (ORT M gear)   |  | 1         | 100(20)ms       |  |
|                                   | P117     | (ORT L gear)   |  | 1         | 100(20)ms       |  |
|                                   | P118     | (ORT LL gear)  |  | 1         | 100(20)ms       |  |
|                                   | P119     | ASR Input filter                                     | 1 to 1000ms  | 1         | 20ms            |  |
|                                   | P120     | Motor max speed (Rigid)                              | 100 to 20000r/min  | (Note1)   | 4500r/min       |  |
|                                   | P121     | Analog input filter (Rigid)                          | 1 to 1000ms  | 1         | 1ms             |  |
|                                   | P122     | ASR Input filter (Rigid)                             | 1 to 1000ms  | 1         | 1ms             |  |
|                                   | P123     | Speed detection filter (H gear)                      | 1 to 50ms  | 1         | 10(5)ms         |  |
|                                   | P124     | (M, L, LL gear, rigid)                               |  | 1         | 10(5)ms         |  |
|                                   | P125     | (ORT H gear)   |  | 1         | 10(5)ms         |  |
|                                   | P126     | (ORT M, L, LL gear)                                  |  | 1         | 10(5)ms         |  |
| Orientation                       | P200     | Function block (P201 ~ P228) select<br><Orientation> | 0 : Non-indication<br>1 : Indication   | 1         | 0               |  |
|                                   | P201     | PE (Spindle/PE ration)                               | 1 : 1 : 1<br>2 : 2 : 1   | 1         | 1               |  |
|                                   | P202     | (A/B phase select)                                   | 0 : Phase A leading in forward revolution<br>1 : Phase B leading in forward revolution | 1         | 0               |  |
|                                   | P203     | (Pulse select)                                       | 0 : 1024<br>1 : 2048   | 1         | 0               |  |
|                                   | P204     | Acc./Dec.mode (Mode select)                          | 0 : Non-use<br>1 : Use   | 1         | 0               |  |
|                                   | P205     | Internal stop position                               | 0000 to 1FFF   | 1         | 0000            |  |
|                                   | P206     | Automatic reading of internal stop position          | 0 : Inactive<br>1 : Active   | 1         | 0               | Present position is automatically written in P205.                                       |
|                                   | P207     | Torque boost   | 0 : Automatic torque boost<br>1 to 150 : Manual  | 1         | 0               | Available only in M5 series  |
|                                   | P208     | ASR Input filter                                     | 1 to 1000ms  | 1         | 1ms             |  |
|                                   | P209     | 1st Creeping speed (ORT H gear)                      | 0 to 3000r/min   | 1         | 500r/min        |  |
|                                   | P210     | (ORT M gear)   |  | 1         | 600r/min        |  |
|                                   | P211     | (ORT L gear)   |  | 1         | 750r/min        |  |
|                                   | P212     | (ORT LL gear)  |  | 1         | 250r/min        |  |
|                                   | P213     | 2st Creeping speed (MGORT H gear)                    | 0 to 1200r/min   | 1         | 100r/min        |  |
|                                   | P214     | (MGORT M gear)                                       |  | 1         | 120r/min        |  |
|                                   | P215     | (MGORT L gear)                                       |  | 1         | 150r/min        |  |
|                                   | P216     | (MGORT LL gear)                                      |  | 1         | 50r/min         |  |



| groupe                | Function |   | Data range   | Increment | Factory writing       | Comment  |
|-----------------------|----------|---|--|-----------|-----------------------|--|
|                       | Code     | Name  |  |           |                       |  |
| Orientation           | P217     | APR P-gain (ORT H gear)                                     | 0 to 255 times   | 1         | 20 times              | P203 data 0: 1 pulse = 360°/4096<br>P203 data 1: 1 pulse = 360°/8192                               |
|                       | P218     | (ORT M gear)  |  | 1         | 40 times              |  |
|                       | P219     | (ORT L gear)  |  | 1         | 80 times              |  |
|                       | P220     | (ORT LL gear)   |  | 1         | 100 times             |  |
|                       | P221     | Completion range (Width) (After stoping)                    | 0 to 127 pulses  | 1         | 5 pulse               |  |
|                       | P222     |   |  | 1         | 0 pulse               |  |
|                       | P223     | Completion signale (ON-delay timer)                         | 0 to 1000ms  | 10        | 100ms                 |  |
|                       | P224     | (OFF-delay timer)   |  | 10        | 100ms                 |  |
|                       | P225     | Re-ORT mode (mode select)                                   | 0 : Quick APR<br>1 : After 1 revolution                        | 1         | 0                     |  |
|                       | P226     | ORT stoping mode (mode select))                             | 0 : With speed increase<br>1 : Without speed increase          | 1         | 1                     |  |
| Motor 2               | P227     | ORT rotation direction (mode select)                        | 0 : The nearest direction rotation<br>1 : Direction Indication | 1         | 1                     |  |
|                       | P228     | 2nd creeping speed change angle (MGORT)                     | 0 to 180°  | 1         | 45°                   |  |
|                       | P300     | Function block (P301 ~ P324) select <Motor 2>               | 0 : Non-indication<br>1 : Indication                           | 1         | 0                     |  |
|                       | P301     | Motor max. speed  | 100 to 20000r/min  | (Note1)   | 4500r/min             |  |
|                       | P302     | Acceleration time   | 0.1 to 120.0s  | 0.1       | 5.0s                  |  |
|                       | P303     | Deceleration time   | 0.1 to 120.0s  | 0.1       | 5.0s                  |  |
|                       | P304     | S-curve acc./dec. (Width) (Acc.)                            | 0 to 50%   | 1         | 10%                   |  |
|                       | P305     | (Dec.)  | 0 to 50%   | 1         | 10%                   |  |
|                       | P306     | Torque boost  | 0 : Automatic torque boost<br>1 to 150 : Manual                | 1         | 0                     |  |
|                       | P307     | Motor type (Type: Capacity)                                 | Individual capacity code                                       |           | Depending on capacity | Motor: MVE/MVS/V3/coil-switch/General-purpose  |
|                       | P308     | Base speed  | 100 to 20000r/min  | (Note1)   | Depending on capacity | Automatically rewritten by changing P307 'Motor code'<br>Fine adjustment is individually possible. |
|                       | P309     | Rated Voltage   | 120 to 230V (200V series)<br>240 to 460V (400V series)         | 1         | Depending on capacity |  |
|                       | P310     | Rated Current (Cont.)                                       | 0.1 to 500.0A  | 0.1       | Depending on capacity | (Specified max. motor speed corresponding to motor type)   |
|                       | P311     | Exciting current  | 0.1 to 500.0A  | 0.1       | Depending on capacity |  |
|                       | P312     | %R1   | 0.00 to 50.00%   | 0.01      | Depending on capacity |  |
|                       | P313     | %Lσ   | 0.00 to 50.00%   | 0.01      | Depending on capacity |  |
|                       | P314     | Motor max. speed  | 100 to 20000r/min  | (Note1)   | Depending on capacity |  |
|                       | P315     | Max output voltage  | 120 to 230V (200V series)<br>240 to 460V (400V series)         | 1         | Depending on capacity |  |
|                       | P316     | Slip frequency (Driving/Braking)                            | 0.00 to 5.00Hz   | 0.01      | Depending on capacity |  |
|                       | P317     | Coefficient 1   | 0000 to FFFF   | 1         | Depending on capacity |  |
|                       | P318     | 2   |  | 1         | Depending on capacity |  |
|                       | P319     | 3   |  | 1         | Depending on capacity |  |
|                       | P320     | Torque limit (Driving mode)                                 | 0 to 200%  | 1         | Depending on capacity | 100% value is 50% ED rated torque of the motor.  |
|                       | P321     | (Braking mode)  | 0 to 200%  | 1         | Depending on capacity | 100% value is 50% ED rated torque of the motor.  |
|                       | P322     | Magnetic flux level   | 10 to 100%   | 1         | 50%                   |  |
|                       | P323     | Speed meter gain  | 50 to 150%   | 1         | 100%                  |  |
|                       | P324     | Ammeter/load meter gain                                     | 50 to 200%   | 1         | 100%                  |  |
| Synchronous operation | P400     | Function block (P401 ~ P430) select <Synchronous operation> | 0 : Non-indication<br>1 : Indication                           | 1         | 0                     |  |
|                       | P401     | Acceleration time   | 0.1 to 120.0s  | 0.1       | 5.0s                  |  |
|                       | P402     | Deceleration time   | 0.1 to 120.0s  | 0.1       | 5.0s                  |  |
|                       | P403     | S-curve acc /dec (Width) (Acc.)                             | 0 to 50%   | 1         | 10%                   |  |
|                       | P404     | (Dec.)  | 0 to 50%   | 1         | 10%                   |  |
|                       | P405     | APR P -gain (H gear)  | 0.0 to 200 times   | 0.1       | 30.0times             |  |
|                       | P406     | (M gear)  | 0.0 to 200 times   | 0.1       | 30.0times             |  |
|                       | P407     | (L gear)  | 0.0 to 200 times   | 0.1       | 30.0times             |  |
|                       | P408     | (LL gear)   | 0.0 to 200 times   | 0.1       | 30.0times             |  |
|                       | P409     | APR Integration time (Hgear)                                | 0.0 to 3.00s   | 0.01      | 0.50s                 |  |
|                       | P410     | (M gear)  | 0.0 to 3.00s   | 0.01      | 0.50s                 |  |
|                       | P411     | (L gear)  | 0.0 to 3.00s   | 0.01      | 0.50s                 |  |
|                       | P412     | (LL gear)   | 0.0 to 3.00s   | 0.01      | 0.50s                 |  |



| groupe                | Function |  | Data range   | Increment | Factory writing       | Comment   |
|-----------------------|----------|--|--|-----------|-----------------------|---|
|                       | Code     | Name   |  |           |                       |   |
| Synchronous operation | P413     | Torque balance sequence selection                          | 0: by SETO signal<br>1: by CNC signal                  | 1         | 0(1)                  | This function is exclusive use for maker  |
|                       | P414     | APR output filter  | 0 to 1000ms  | 1         | 0ms                   |   |
|                       | P415     | Speed deflection of APR starting                           | 0 to 50%   | 1         | 0%                    |   |
|                       | P416     | Syn. spare 3   | 0000 to FFFF   | 1         | 0000                  |   |
|                       | P417     | Syn. spare 4   | 0 to 255   | 1         | 0                     |   |
|                       | P418     | Chuck-on timer   | 0 to 1000ms  | 10        | 100ms                 |   |
|                       | P419     | Completion range   | 0 to 100 pulses  | 1         | 10 pulses             | P203 data 0:1 pulse = 360°/4096<br>P203 data 1:1 pulse = 360°/8192                                |
|                       | P420     | Completion signal (ON-delay timer)                         | 0 to 1000ms  | 10        | 100ms                 |   |
|                       | P421     | (OFF-delay timer)  | 0 to 1000ms  | 10        | 100ms                 |   |
|                       | P422     | PE rotation direction (Mode select)                        | 0 In-phase<br>1 Anti-phase                             | 1         | 0                     |   |
|                       | P423     | Syn. ratio 1   | 1 to 99  | 1         | 1                     | Master axis (1) : Slave axis (n)  |
|                       | P424     | 2  | 1 to 99  | 1         | 2                     |   |
|                       | P425     | 3  | 1 to 99  | 1         | 3                     |   |
|                       | P426     | 4  | 1 to 99  | 1         | 4                     |   |
|                       | P427     | 5  | 1 to 99  | 1         | 5                     |   |
|                       | P428     | 6  | 1 to 99  | 1         | 6                     |   |
|                       | P429     | 7  | 1 to 99  | 1         | 7                     |   |
|                       | P430     | 8  | 1 to 99  | 1         | 8                     |   |
| Coil changeover       | P500     | Function block (P501 ~ P521) select<br>< Coil changeover > | 0 Non-indication<br>1 Indication                       | 1         | 0                     |   |
|                       | P501     | Coil changeover speed                                      | 0 to 20000r/min  | (Note1)   | Depending on capacity |   |
|                       | P502     | Hysteresis of coil changeover speed                        | 0 to 1000r/min   | 10        | 30r/min               |   |
| Y-coil                | P503     | Max speed  | 0 to 20000r/min  | (Note1)   | 1500r/min             |   |
|                       | P504     | Torque boost   | 0 Automatic torque boost<br>1 to 150 : Manual          | 1         | 0                     |   |
|                       | P505     | Base speed   | 0 to 20000r/min  | (Note1)   | Depending on capacity | Automatically rewritten by changing P307 'Motor code'<br>Fine adjustment is individually possible |
|                       | P506     | Rated voltage  | 120 to 230V (200V series)<br>240 to 460V (400V series) | 1         | Depending on capacity |   |
|                       | P507     | Rated current  | 0.1 to 500.0A  | 0.1       | Depending on capacity |   |
|                       | P508     | Rated torque current                                       | 0.1 to 500.0A  | 0.1       | Depending on capacity |   |
|                       | P509     | Exciting current   | 0.1 to 500.0A  | 0.1       | Depending on capacity |   |
|                       | P510     | %R1  | 0.00 to 50.00%   | 0.01      | Depending on capacity |   |
|                       | P511     | %L σ   | 0.00 to 50.00%   | 0.01      | Depending on capacity |   |
|                       | P512     | Motor max. speed   | 100 to 20000r/min                                      | (Note1)   | Depending on capacity | (Specified max. motor speed corresponding to motor type)  |
|                       | P513     | Max output voltage   | 120 to 230V (200V series)<br>240 to 460V (400V series) | 1         | Depending on capacity |   |
|                       | P514     | D operation constants                                      | 0000 to FFFF   | 1         | Depending on capacity |   |
|                       | P515     | Slip frequency (Driving)                                   | 0.00 to 5.00Hz   | 0.01      | Depending on capacity |   |
|                       | P516     | (Braking)  | 0.00 to 5.00Hz   | 0.01      | Depending on capacity |   |
|                       | P517     | Coefficient 1  | 0000 to FFFF   | 1         | Depending on capacity |   |
|                       | P518     | 2  |  | 1         | Depending on capacity |   |
|                       | P519     | 3  |  | 1         | Depending on capacity |   |
|                       | P520     | 4  |  | 1         | Depending on capacity |   |
|                       | P521     | 5  |  | 1         | Depending on capacity |   |
| Maker use only        | P800     | Function block (P801~ P810) select<br>< Maker use only >   | 0 Non-indication<br>1 Indication                       | 1         | 0                     | Don't change  |
|                       | P801     | Aux.function 1 (Maker use only)                            |  |           | Depending on capacity |   |
|                       | P802     | 2 (Maker use only)   |  |           | Depending on capacity |   |
|                       | P803     | Selection of current and voltage limit                     | 0000 to FFFF   | 1         | 0000                  |   |
|                       | P804     | Additional Torque boost at ORT                             | 0 to 150   |           | 0                     |   |
|                       | P805     | Sample times of speed detection                            | 0000 to FFFF   |           | 0000                  |   |
|                       | P806     | Digital speed reference / position reference change over   | 0 to 4   | 1         | 0                     |   |
|                       | P807     | PE original point signal select                            | 0 : not available<br>1 : available                     | 1         | 0                     |   |
|                       | P808     | Speed deviation over detection                             | 0 : not available<br>1 to 100%                         | 1         | 0                     |   |
|                       | P809     | Aux.function 9 (Maker use only)                            | 0 to 255   | 1         | Depending on capacity | Don't change  |
|                       | P810     | 10 (Maker use only)  |  |           | Depending on capacity |   |



| groupe               | Function |  | Data range  | Increment | Factory writing | Comment   |
|----------------------|----------|--|---|-----------|-----------------|---|
|                      | Code     | Name                                     |   |           |                 |   |
| Function             | P900     | Speed indication (Range select)          | 0 : 0 to 9999r/min<br>1 : 0 to 20000r/min                                 | 1         | 0               | note) Provided that resolution is 10.             |
|                      | P901     | Data Initializing                        | 0 : Manual setting value<br>1 : Initialized value (Factory setting value) | 1         | 0               | Initialized by writing 1.                         |
|                      | P902     | Alarm record clearing                    | 0 : Inactive<br>1 : Active  | 1         | 0               | Unavailable during alarm                          |
|                      | P903     | Total data setting                       | 0 : Inactive<br>1 : Total data setting                                    | 1         | 0               |   |
| Alarm (Monitor only) | F000     | Alarm (The latest)                       | Code indication   | —         | —               |   |
|                      | F001     | Alarm condition (Speed/speed detection)  | 0 to 20000r/min   | (Note1)   | —               |   |
|                      | F002     | (Speed reference)                        | 0 to 20000r/min   | (Note1)   | —               |   |
|                      | F003     | (Output current / Output torque current) | 0 to 255%   | 1         | —               |   |
|                      | F004     | Torque current reference                 | 0 to 255%   | 1         | —               |   |
|                      | F005     | Exciting current (Detection)             | 0 to 255%   | 1         | —               | Only V5 (Standard M5 has the same value as F003.) |
|                      | F006     | (Referece)                               | 0 to 255%   | 1         | —               |   |
|                      | F007     | Input signal status (Control)            | Corresponding LED indication  | —         | —               | Refer to p.85                                     |
|                      | F008     | (Option)                                 | Corresponding LED indication  | —         | —               |   |
|                      | F009     | Output signal status                     | Corresponding LED indication  | —         | —               |   |
|                      | F010     | Alarm record (The last)                  | Code indication   | —         | —               |   |
|                      | F011     | (The last but one)                       | Code indication   | —         | —               |   |
|                      | F012     | (The last but two)                       | Code indication   | —         | —               |   |

**(Note 1)** The set range of the speed setting parameter varies according to the value selected in P900 : Speed data set range. P900 : 0 → 0 to 9999 r/min, P900 : 1 → 0 to 20000 r/min  
(However, the number is indicated as multiplied by 1/10 and the decimal point is put on the minimum figure.) (Ex. the set value of 12000r/min is as 1200.)

**(Note 2)** Expression " \* \* \* Speed" indicated in the parameter name means the synchronous speed in M5 series (without PE vector control).

**(Note 3)** Factory writing data in ( ) are value of V5.

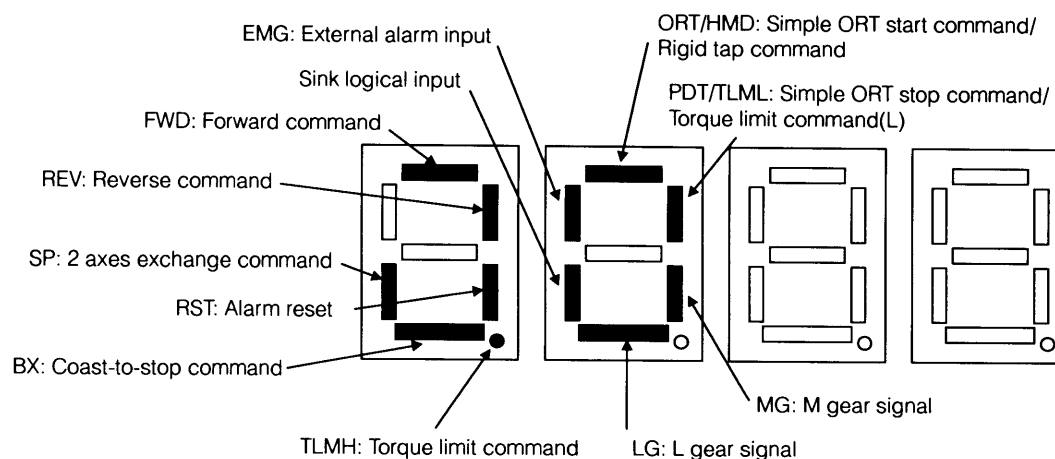


## Input and output signals check

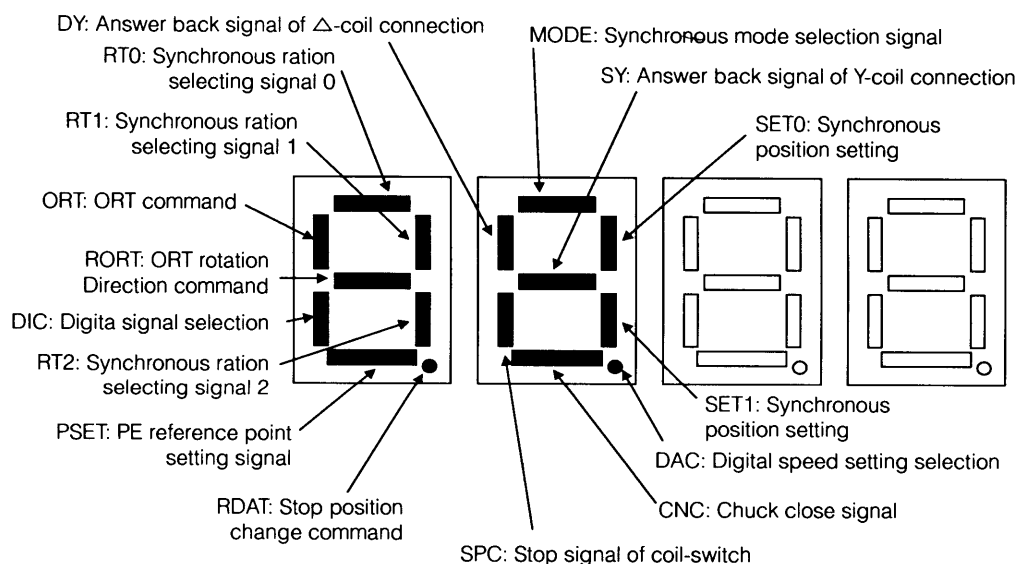
You can check the status of input and output signals on drive unit by digital indicator as follows.

Note: Black area shows indicator lights on.

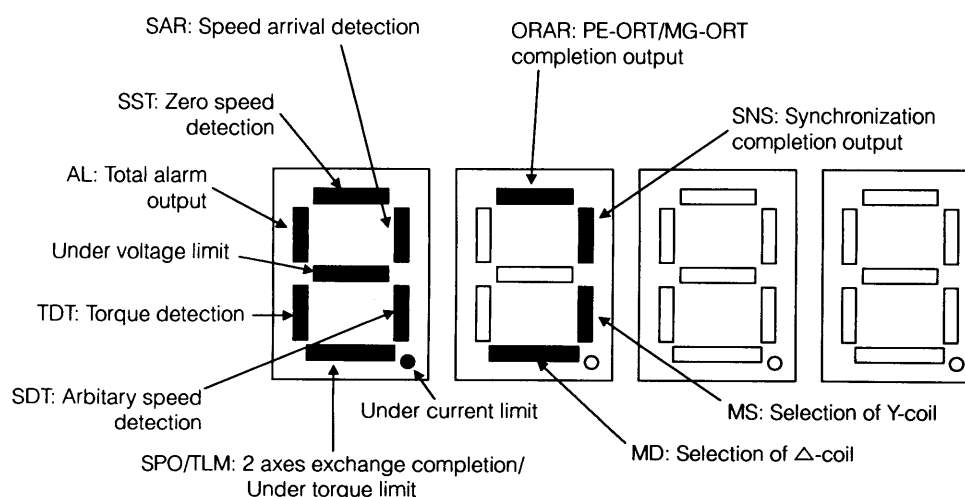
### C005 : Input signals (Control PCB)



### C006 : Input signals (Option PCB)



### C007 : Output signals





## Motor code (P053, P307)

0 0 0 1

| Series | Code | Type                       | Code   | Control     | Code | Motor cap. | Code | Motor cap. |
|--------|------|----------------------------|--------|-------------|------|------------|------|------------|
| 200V   | 0    | MVE(M5), M3                | 0      | Open-loop   | 01   | 1.1/0.75kW | 18   | 18.5/15kW  |
|        | 1    | MVS                        | 1      | Vector or   | 02   | 2.2/1.5kW  | 22   | 22/18.5kW  |
|        | 2    | V3                         | (Note) | PE feedback | 03   | 3.7/2.2kW  | 30   | 30/22kW    |
|        | 3    | General purpose (MLA, MLH) |        |             | 05   | 5.5/3.7kW  | 37   | 37/30kW    |
|        | 4    | Coil-switch (MVS)          |        |             | 07   | 7.5/5.5kW  | 45   | 45/37kW    |
|        | 5-7  | —                          |        |             | 11   | 11/7.5kW   | 55   | 55/45kW    |
| 400V   | 8    | MVE                        |        |             | 15   | 15/11kW    |      |            |
|        | 9    | MVS                        |        |             |      |            |      |            |
|        | A-B  | —                          |        |             |      |            |      |            |
|        | C    | CMVE                       |        |             |      |            |      |            |
|        | D    | General purpose (MLA, MLH) |        |             |      |            |      |            |
|        | E-F  | —                          |        |             |      |            |      |            |

**Note:** Please choose "vector", if you want to use PE-ORT or synchronous operation.

Please choose "Open-loop" for No.2 motor.

## Drive unit capacity(P076)

| 200V series                                   |      | 400V series                                   |      |
|---|------|---|------|
| Drive unit capacity(kW)<br>(Continuous/50%ED) | P076 | Drive unit capacity(kW)<br>(Continuous/50%ED) | P076 |
| 0.75/1.1                                      | 01   | —   | 401  |
| 1.5/2.2                                       | 02   | —   | 402  |
| 2.2/3.7                                       | 03   | 2.2/3.7                                       | 403  |
| 3.7/5.5                                       | 05   | 3.7/5.5                                       | 405  |
| 5.5/7.5                                       | 07   | 5.5/7.5                                       | 407  |
| 7.5/11  | 11   | 7.5/11  | 411  |
| 11/15   | 15   | 11/15   | 415  |
| 15/18.5                                       | 18   | 15/18.5                                       | 418  |
| 18.5/22                                       | 22   | —   | 422  |
| 22/30   | 30   | —   | 430  |
| 30/37   | 37   | —   | 437  |
| 37/45   | 45   | —   | 445  |
| 45/55   | 55   | —   | 455  |



## 4 Inspection and Maintenance

### WARNING

Being afraid of electric shock when power is applied or when charge indicator lit even after power off, do not remove the front cover. Failure to do so may result in death or serious injury.

When an abnormality occurs and is spreading, disabling to insure safety, causing or being afraid of causing a disaster such as fire, promptly switch OFF the circuit breaker on the power supply side.

Do not touch the electrical circuits or parts, or do not insert foreign bodies through the openings when applying power. It may result in electrical shock, burn by generated arc, and damage of the equipment.

When using instruments such as oscilloscope to work on live equipment, the oscilloscope's chassis should be grounded and a differential amplifier input should be used.

Care should be used in the selection of probes and leads and in the adjustment of the oscilloscope so that accurate readings may be made.

See instrument manufacture's instruction book for proper operation and adjustment to the instrument.

Before inspection and removing abnormality cause, disconnect and lock out power from the unit. Failure to disconnect power may result in death or serious injury.

A DC link circuit charge light provides visual indication that DC link voltage is present with the charged DC link capacitor; verify the DC link voltage level by measuring the voltage between power terminals P(+) and N(-) using an analog meter.

Do not attempt to service the unit until the charge indicator has extinguished and DC link voltage has discharged to zero volts.

### CAUTION

If the unit's Fault Alarm is activated, consult the Troubleshooting section of this instruction manual, and after correcting the problem, resume operation.

### CAUTION

Do not put foreign things such as dusts, oil mist, and metal pieces into the unit, or do not touch them to the cooling fins.

Disaster such as fire may be caused because of insulation fault or reduction or cooling ability.

The cooling fins of the unit are heated to a high temperature in operation and touching the fins may cause burn. Keep a sufficient time after stopping the unit when touching the fins.

a) Package drive unit and Drive unit

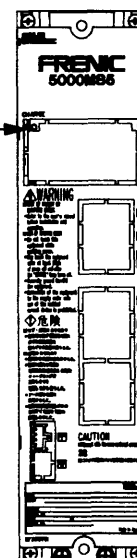


CHARGE light  
has gone out

b) Regenerating converter unit



c) Dynamic braking converter unit



CHARGE light  
has gone out

Fig. 4-1-1 CHARGE LAMP



In order to prevent potential problem from occurring and for the unit to be given long period of high-reliable operation, conduct inspection daily and periodically.

If any abnormality is found, remove the abnormal section or its cause, or replace and repair the abnormal parts or components.

**NOTE :**

- After inspection, record the inspected state. This record is useful for checking the history of drive system and as reference to the following inspection.
- When removing or attaching the cover, refer to "4-6 Front cover handling" (p.92).

## 4-1 Daily inspection

For daily inspection, it is not necessary to remove the cover of the unit during operating or supplying power.

Check visually the unit from the outside abnormal for the abnormal items in operating condition.

**NOTE :** If any abnormality found, check promptly for the location and degree of the abnormality. And investigate the necessity whether to continue or stop the operation.

## 4-2 Periodic inspection

For periodic inspections, switch the unit OFF and remove its front cover, and conduct mainly visual and finger inspection.

Refer to the items as the examples of periodic inspection items are shown in Table 4-2-1. Check the unit for unusual indication, howl, abnormal noise, and abnormal vibration during current conduction.

**NOTE :**

- Check should be carried out after ensuring the safety.
- Periodic inspection interval will vary per the unit environment, application, used year, and importance in the system. Pick an interval that best suits to the particular application (semi-annually, annually, etc.).

**Table 4-2-1 Inspection items chart**

| Item                |                    | Inspection criteria  | Corrective action  |
|---------------------|--------------------|--|--|
| Power supply unit   | Converter unit     | Within permissible limits (170V-235V AC) for 230V unit.                      | Adjust the power supply voltage  |
|                     | Drive unit         | Within permissible limits (229.5V-363V DC) for 330V unit.                    |  |
|                     | Package drive unit | Within permissible limits (170V-235V AC) for 230V unit.                      |  |
| Ambient temperature |                    | Within permissible limits (-10 to +55 °C) (Cooling fins : -10 to +40°C)      | Investigate cause and make corrections until environment is within permissible limits  |
| Ambient humidity    |                    | Within permissible limits (15 to 85% RH)*<br>No dew condensation or freezing | Investigate cause and make corrections until environment is within permissible limits. |
| Vibration           |                    | Within permissible limits 5.9m/s <sup>2</sup> {0.6G} or less.                | Investigate cause and make adjustments until within permissible limits                 |
| Noise               |                    | Abnormal audio noise from cooling fan, etc.                                  | Contact the supplier where the units was purchased                                     |
| Odor                |                    | Smell or burning   | Contact the supplier where the unit was purchased                                      |
| Dust                |                    | Dust accumulation on the cooling fins, fan or control board                  | Clean and blow out with compressed air   |

\* : 15 to 85% RH in operating condition, 5 to 95% RH in storing condition.

**NOTE :** Check internal connectors and screw only during periodic inspections or when cover is removed.



### 4-3 Parts replacement

The parts of the unit can not be permanently used, but have each period (life) determined with their kind. However, the life of the parts will vary according to the installation environment and application condition, and then it is difficult to set the life of the parts. Therefore, it is recommended for preventive maintenance policy that some parts should be replaced periodically or depended on the investigation in the periodic inspection.

An example of recommended years for parts replacement is given in Table 4-3-1. In this case, it is assumed that yearly ambient temperature is 30 °C, loading factor is less than 80%, and daily operation is 12 hours per day.

**Table 4-3-1**  
**Recommended years for parts replacement**

| Parts   | Recommended years for replacement | Replacement method                       |
|---|-----------------------------------|--|
| Cooling fan                                     | 3 years                           | New                                      |
| Smoothing capacitor                             | 5 years                           | New (Investigated)                       |
| Electrolytic capacitor on printed circuit board | 7 years                           | New printed circuit board (Investigated) |
| Fuse  | 10 years                          |  |
| Other   | —                                 | Investigated                             |

**NOTE :** When needing replacement of parts, contact the distributor where the unit was purchased or the Company's service center.



## 4-4 Electric quantity measurement of main circuit

Since the unit's input/output voltage and current contain higher harmonics components, selection of the measuring device could lead to gross difference of indications.

When using the measuring device for power frequency use, refer to the recommended measuring device as shown in Fig. 4-4-1.

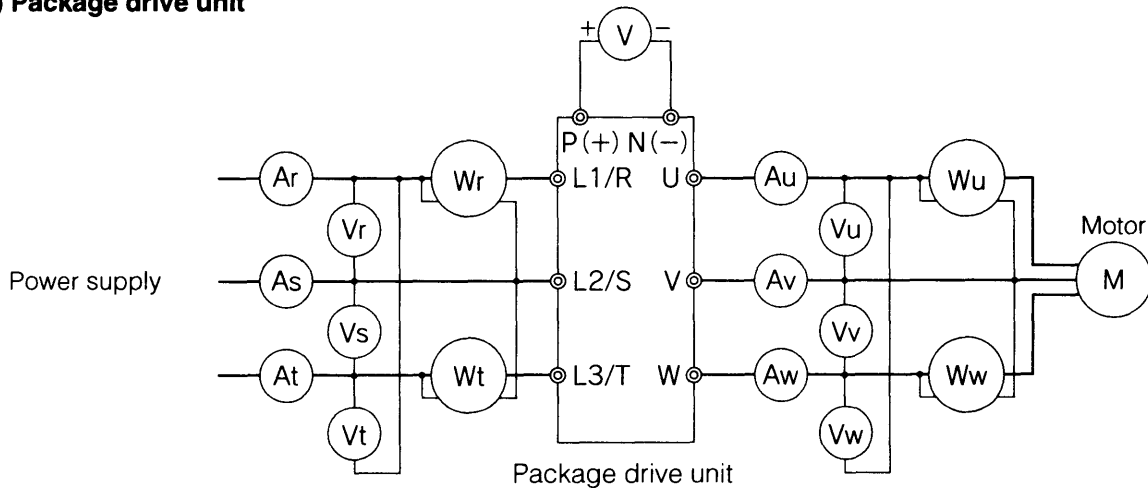
For power factor measurement, the market-available power factor meter measuring the phase difference

between voltage and current can not be used.

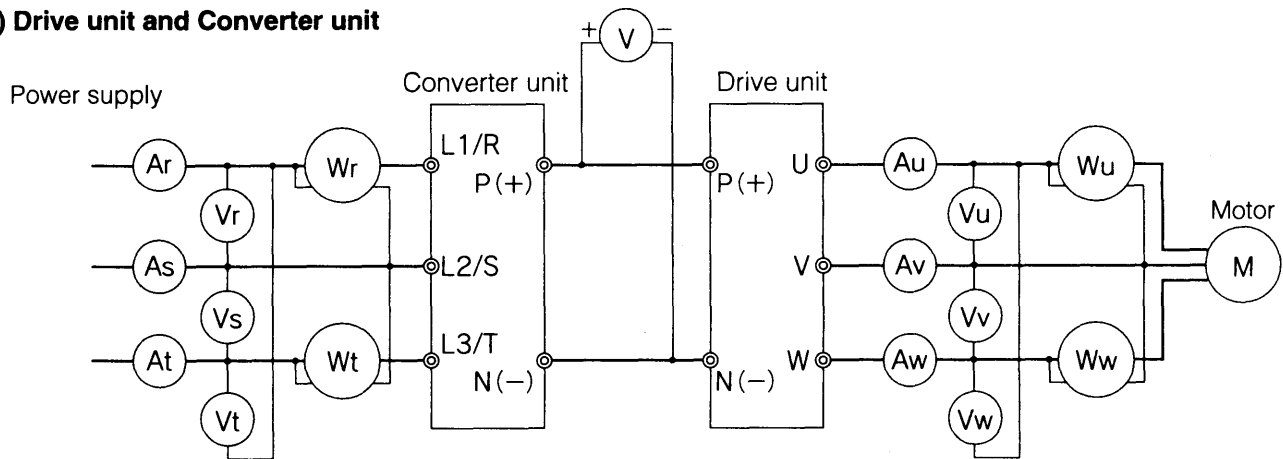
The power factor should be calculated from the measurement of power, voltage, and current on the input/output side as given below.

$$\text{Power factor} = \frac{\text{Power [kW]} \times 1000}{\sqrt{3} \text{ Voltage [V]} \times \text{Current [A]}} \times 100 [\%]$$

### a) Package drive unit



### b) Drive unit and Converter unit



| Item            | Simple measurement | Precision measurement             |
|-----------------|--------------------|-----------------------------------|
| Input voltage   | Tester             | Moving-iron type voltmeter        |
| Input current   | Clamp meter        | Moving-iron type voltmeter        |
| Input power     | —                  | Electrodynamometer type wattmeter |
| DC link voltage | Tester             | Moving-coil type voltmeter        |
| Output voltage  | Tester             | Rectifier type voltmeter          |
| Output current  | Clamp meter        | Moving-iron type ammeter          |
| Output power    | —                  | Electrodynamometer type wattmeter |

Fig. 4-4-1 Measurement and instrument for circuits

#### NOTE :

- When measuring exactly the AC output voltage, use a digital AC power meter.
- When the currents on the both input/output sides are largely unbalanced, use wattmeters with three-wattmeter method.



## 4-5 Insulation check

### CAUTION

**Do not perform a megger test between the unit terminals or on the control circuit terminals.**

Keep strictly the test procedure described below, otherwise the unit may be damaged.

#### a) Main circuit


Provide a 250 VDC megger.

**NOTE :** If the unit is tested with the 500 VDC megger, indications may be inaccurate due to the leakage current caused by the surge suppressor of the main power supply side.

Disconnect the wires connected to the main circuit terminals L1/R, L2/S, L3/T, P(+), DB, U, V, and W, and then connect them a common wire as shown in Fig. 4-5-1.

**NOTE :** If megger test is carried out under the condition that the external circuit wires are connected to the main circuit terminals, it leads to measuring the insulation resistance including the one of the external circuit and it is difficult to

measure correctly the insulation resistance of an unit itself.

Conduct a megger test between the unit terminals and the ground terminal .

The megger value 5 MΩ or more is normal.

#### b) Control circuit

Provide a tester set with a high resistance range.

Disconnect outside wiring at all unit terminals as of the main and control circuits.

Conduct the continuity test between the control circuits and the ground.

Measured value 1 MΩ or more is normal.

**NOTE :** Do not conduct the buzzer test to the control circuits. If this test is conducted, the circuit parts will be burnt or damaged.

#### a) Package drive unit

#### b) Drive unit

#### c) Regenerating converter unit

#### d) Dynamic braking converter unit

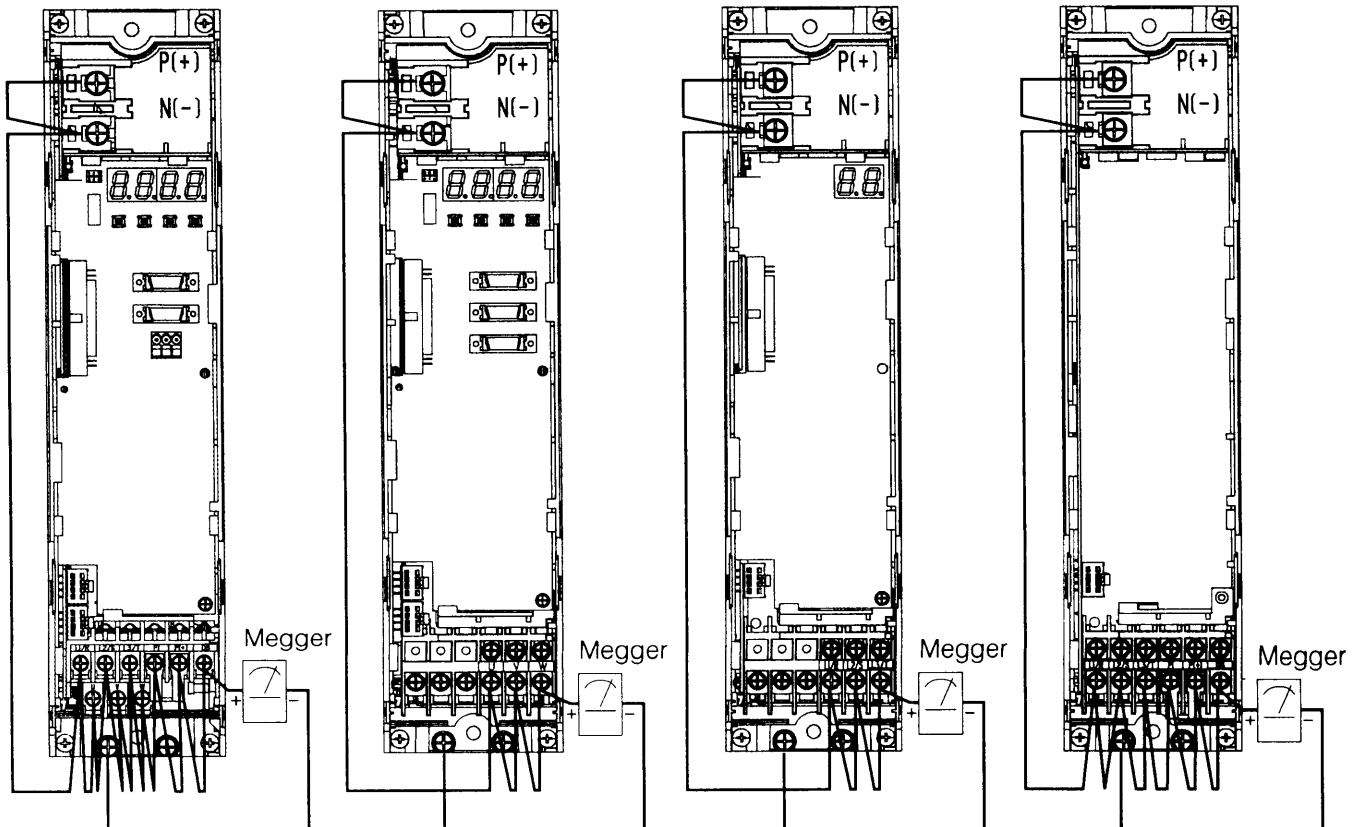


Fig. 4-5-1 Megger test of the main circuit



## 4-6 Front cover handling

### a) Removing

Remove all connectors on the front part of unit.

Pinch the top and bottom part of the front cover with fingers, and lift the bottom part upward fixing the top part.

When the inserts on the both parts have been pulled out, the cover can be removed.

### b) Mounting

Put the inserts on the upper part of the front cover into the grooves of the both side covers, and then put the inserts on the lower part into the grooves.

Press lightly the front cover wholly. If any gap is not present between the front cover and the side covers, the cover has been mounted.

Set the removed connectors, matching the connector Nos. to the corresponding Nos. on the front cover.

#### NOTE :

- When pulling out connector, hold the housing of the connector itself pressing the latch. If the wire is pulled, the core wires may be torn off or the connector may be damaged.
- When inserting connector, match the Nos. of the connector to avoid inserting into miss-location.
- Push slowly the connector holding the housing with the connector's latch pressed. If pushing with strong force, the printed circuit board may be damaged.

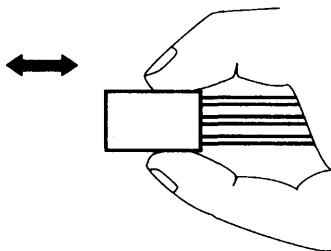


Fig. 4-6-2 Holding method of connector

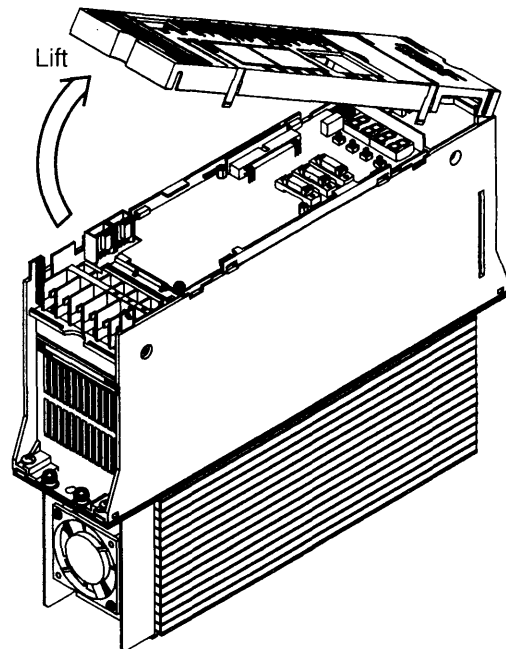
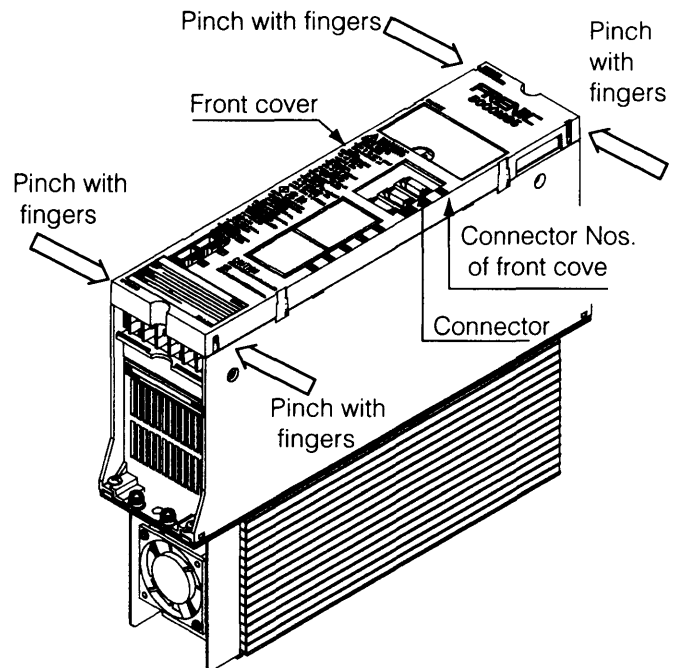


Fig. 4-6-1 Front cover handling



# 5 Troubleshooting

## ⚠ WARNING

Before inspection and removing abnormality cause, disconnect and lock out power from the unit. Failure to disconnect power may result in death or serious injury.

A DC link circuit charge light provides visual indication that DC link voltage is present with the charged DC link capacitor ; verify the DC link voltage level by measuring the voltage between power terminals P(+) and N(-) using an analog meter.

**Do not attempt to service the unit until the charge indicator has extinguished and DC link voltage has discharged to zero volts.**

## ⚠ WARNING

If the alarm reset is input when the operation command is ON (close) after removing the cause activating the protective function, the unit will go to starting.

**Being afraid of disaster such as injury, be sure that the operation command is OFF (open) and then reset the alarm.**

If the protection has tripped the unit, or any abnormalities have occurred, investigate the cause referring to the following descriptions and try to correct the cause.

If the problem is not relevant to the description, the unit is out of order, or some parts are damaged, it is recommended to consult the distributor where the unit was purchased or the Company's sales office nearby.

### 5-1 Unit protection

When the protection of drive unit is activated, the drive unit stops the output promptly, and indicates the alarm code on the indicator.

If the output is stopped, the motor goes to coast-to-stop running.

In the case where converter unit is used, the protection signal of the converter unit is transmitted to all drive units connected to the converter unit and activates the protection of the drive units.

After replacing the parts or removing the protection cause, input the reset command.

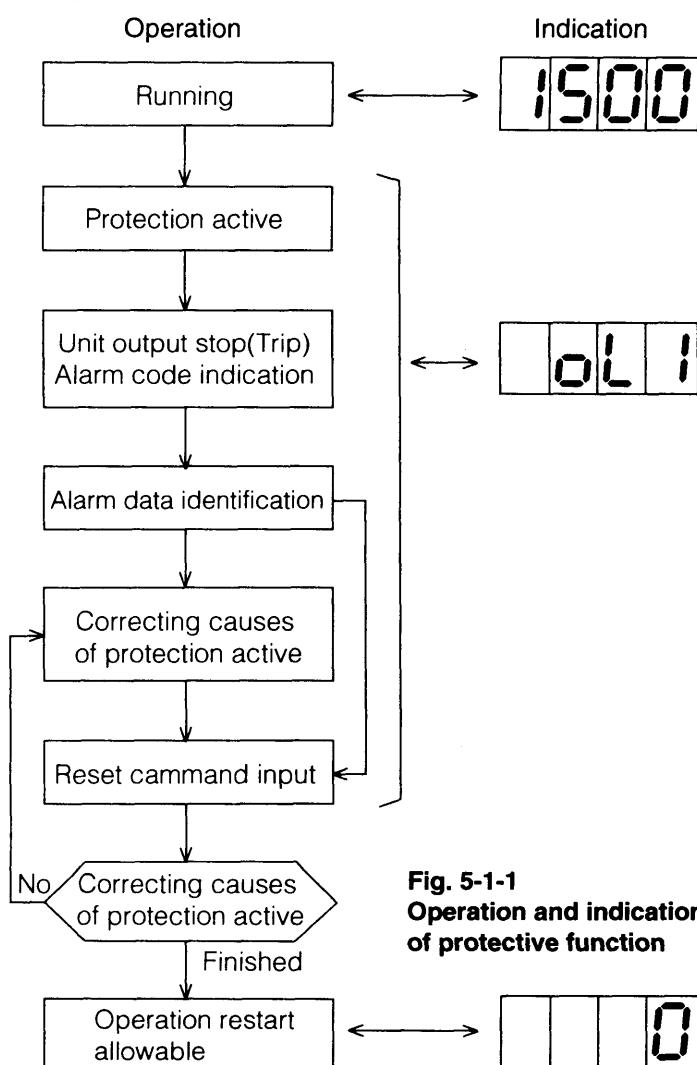
The active status of the protection is released and the operation of the unit can restart.

Even if the reset command is input without removing the protection cause, the active status can not be released.

**NOTE :** As for the operation method of the alarm mode, refer to "3-5 Alarm indication and operation"(p.77):

Indication example :

When the function "Unit overload" is active under monitoring "C000 Motor speed"  
(Motor speed : 1500 r/min).



**Fig. 5-1-1**  
Operation and indication  
of protective function

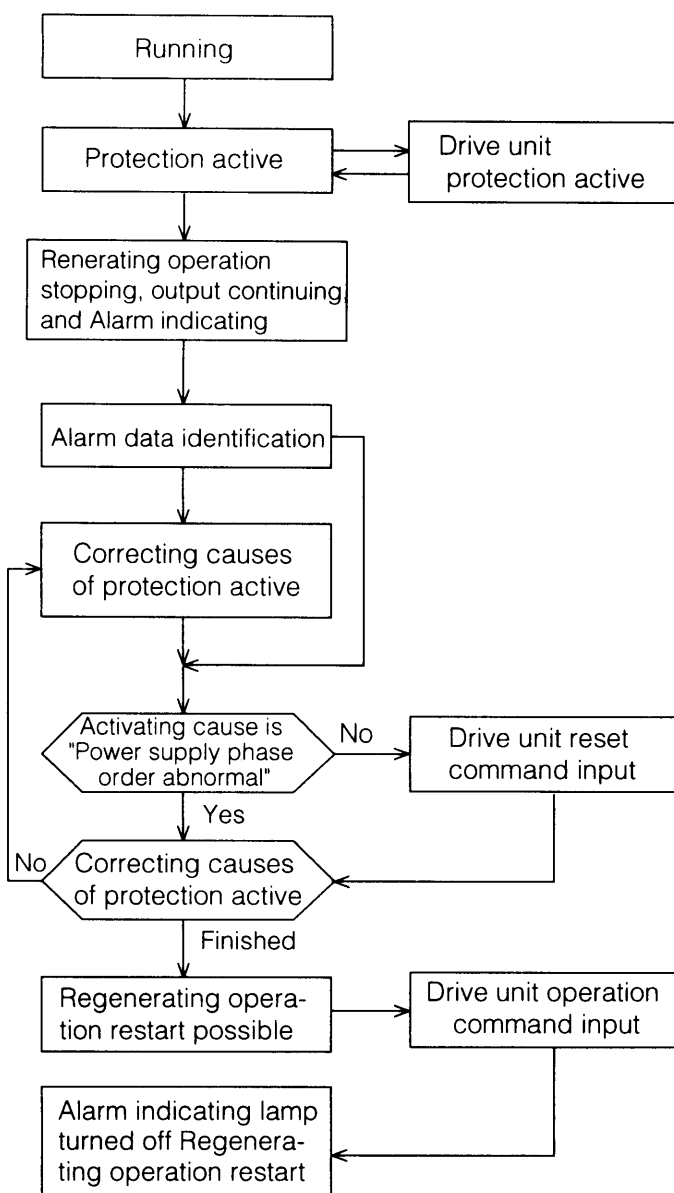


| Protective function  | Alarm code | Protective operation  |  |
|--|------------|---|--|
| Over current   | <b>OC</b>  | Operates when the unit output current momentarily exceeds the overcurrent detection level as in the case where the output circuit is shorted or grounded.   |  |
| Fuse blow-out  | <b>OCF</b> | Operates when a fuse blow on the DC link circuit of the unit is detected.   |  |
| Overvoltage  | <b>OU</b>  | Operates when the DC voltage in the DC link circuit exceeds the voltage detection level as in the case where the regenerating current is increased by braking operation (The regenerating energy exceeds the braking capacity).<br>However, this protection is not possible if excessive voltage (high voltage) is applied by error.<br>Overvoltage detection levels: 400V dc (200V series), 800V dc (400V series)  |  |
| Undervoltage   | <b>LU</b>  | Operates when the DC voltage in the DC link circuit becomes less than the undervoltage detection level as in the case of the power supply voltage drop.<br>Undervoltage detection levels: 186V dc (200V series), 372V dc (400V series)  |  |
| Drive unit overheat  | <b>OH1</b> | Operates when the air temperature inside of the unit or the temperature of the cooling fins rises as in the case of the cooling fan stop.   |  |
| External alarm input   | <b>OH2</b> | Operates according to the status of the contact when the alarm contact of external equipment such as a braking resistor or a thermal relay is connected to the terminals 4-5 of the connector CN3(OFF between the terminals 4-5)  |  |
| Drive unit overload  | <b>OL1</b> | Operates when the motor current exceeds the overload level of the inverse-time characteristic.<br>Overload level: 50%ED of rated output current × 120%, 1min.   |  |
| Motor overheat   | <b>OL2</b> | Operates when the temperature detected by the NTC thermistor, which is mounted in the motor for detecting the motor temperature, exceeds 150°C.   | Does not operate when 0 is input to the data of "P079 NTC thermistor selection". |
| Disconnection of the wiring of temperature detecting circuit | <b>rb</b>  | Operates when the wiring of the NTC thermistor circuit is disconnected, or the motor temperature becomes less than -20°C  |  |
| Over speed   | <b>OS</b>  | Operates in V5 series when the motor speed monitored in "C000 Motor speed" exceeds 120% of the value written in "P001 Motor max. speed."  |  |
| Speed deviation over   | <b>SF</b>  | <Delay of starting><br>· Operate in V5 series when torque limited and zero speed condition continuous more than 1s.<br>· Does not operate when the input data of "P077 Over speed deflection alarm" is 0.<br><Speed deviation over><br>· Operate in V5 series when the deviation of speed reference and speed detection becomes more than a fixed value (the proportion against "P001 Motor max. speed" set the "P808 Speed deflection alarm selection".)<br><br>Operates in M5 series as well as V5 series when the PE interface card is applied to the feedback control.<br>Does not operate when the PE interface card is not applied. |  |
| Current detecting circuit abnormal                           | <b>CF</b>  | Operates in the output stopping status when any abnormality is detected in the current detecting circuit of the control part.   |  |
| Converter unit abnormal                                      | <b>rf</b>  | Transmits the operation signal to the drive unit and-activates the protection of the drive unit when the protection of the converter unit is activated.   |  |
| Internal fan abnormal  | <b>FRL</b> | Operates when the internal fan stops.   |  |
| Memory error   | <b>Er1</b> | Operates when memory error occurs due to data writing error, etc.   |  |
| Loader communication error                                   | <b>Er2</b> | Operates when communication error with personal computers occurs.   |  |
| CPU error  | <b>Er3</b> | Operates when an error occurs in CPU.   |  |
| Synchronous communication error                              | <b>Er4</b> | Operates when an error occurs in the synchronous communication with the option card "Synchronous operation card(OPC II-MS5-SY)"   |  |
| Tunning error  | <b>Er5</b> | Operates when there is an open circuit or an excessively high impedance in the output circuit of the package drive unit and the drive unit.   |  |

**NOTE:** When the control power supply voltage drops to such a low voltage that the control circuit of the unit cannot be active, all the protective functions will be automatically reset.



## b) Regenerating converter unit



**Fig. 5-1-2 Operation of protective function**

When protection in a converter unit becomes active, the converter unit stops the regenerating operation to the power supply promptly and indicates the alarm code on the indicator.

The activating signal is also transmitted to the drive unit and activates the protection.

However, even though the protection is active, supplying power to the drive unit continues.

When the protection in the connected drive unit becomes active, the activating signal is transmitted and activated as in the following.

However, the alarm code is not indicated.

– In the case of one drive unit

The protection of the converter unit is active.

– In the case of two or more drive units

The protection of the converter unit is active when all of the drive unit protections are activated.

Input the reset command to the drive units after correcting the causes of protection active and replacing the faulty part.

When the protection activating condition is released in the converter unit and the drive unit, the operation can be restarted.

However, the alarm indication of the converter unit continues until the operation command is input to the drive unit.

Even if inputting the reset command without correcting the activating cause, the activating condition is not released.

When the cause of protection active is "Power supply phase order abnormal", switch OFF the power supply once and correct the connection. Therefore, it is not necessary to input the reset command.

**NOTE :** When AC power supply drops, protection is not active, but regenerating operation stops.

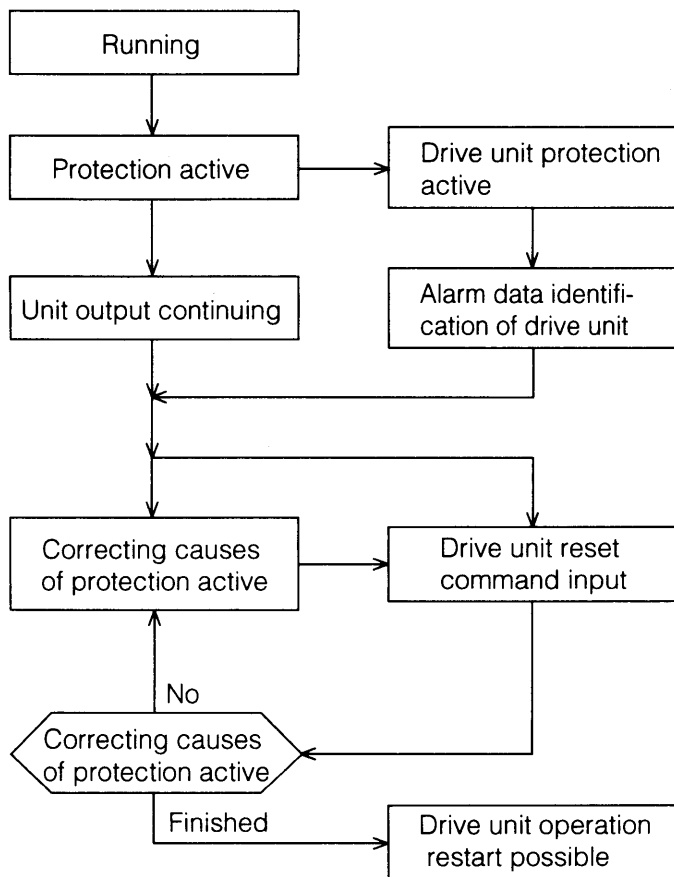
**Table 5-1-2 Protective function of regenerating converter unit**

| Protective function               | Indication | Protective operation  |
|-----------------------------------|------------|---|
| Power supply phase order abnormal | $\alpha P$ | Operates when the phase sequence at the AC power supply terminals of converter unit differs from the one of the power supply and the power is supplied. This alarm is released when the control power supply is turned off. |
| Regenerating over current         | $\alpha C$ | Operates when the instantaneous value of regenerating current to the power supply exceeds the over current level.   |
| Converter overheat                | $\alpha H$ | Operates when the ventilating fan stops and the temperature of cooling fins rises abnormally during running.  |

**NOTE :** When the control power supply voltage drops to such a low level that the unit control circuit is not still active, all the protection functions are automatically reset.



### c) Dynamic braking converter unit



**Fig. 5-1-3 Operation of protective function**

When protection in a converter unit becomes active, the converter unit transmits promptly the activating signal to the drive unit and activates the protection. The alarm code is indicated on the indicator of the drive unit.

Even though the protection is active, the converter unit continues the operation condition.

Even though the protection in the connected drive unit becomes active, the activating signal is not transmitted to the converter unit.

Therefore, the converter unit continues the operation.

Input the reset command to the drive units after correcting the causes of protection active and replacing the faulty part.

When the protection activating condition is released in the converter unit and the drive unit, the operation can be restarted.

Even if inputting the reset command without correcting the activating cause, the activating condition is not released.

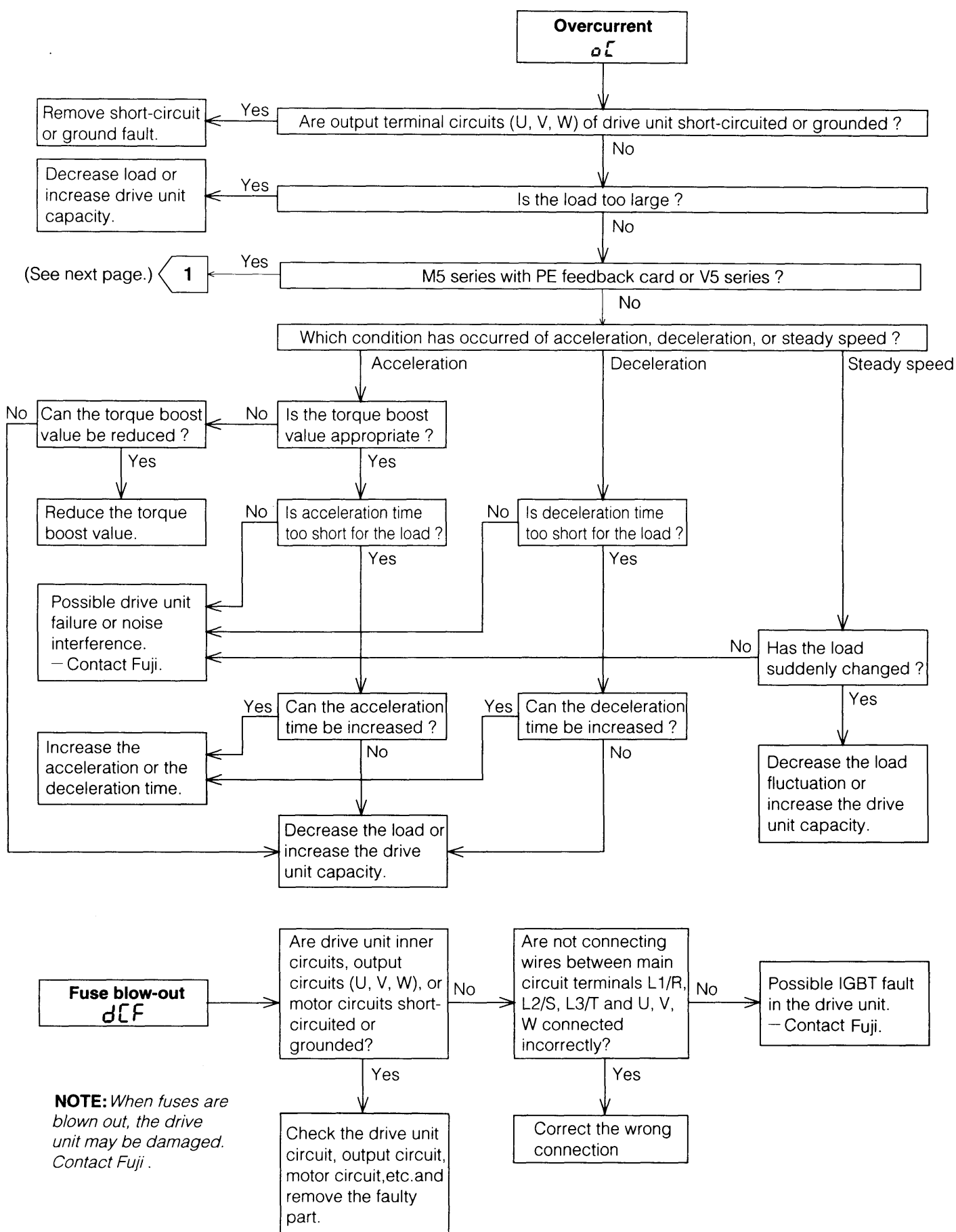
**Table 5-1-3 Protective function of dynamic braking converter unit**

| Protective function | Indication | Protective operation   |
|---------------------|------------|--|
| Converter overheat  | —          | Operates when the ventilating fan stops and the temperature of cooling fins rises abnormally during running. |

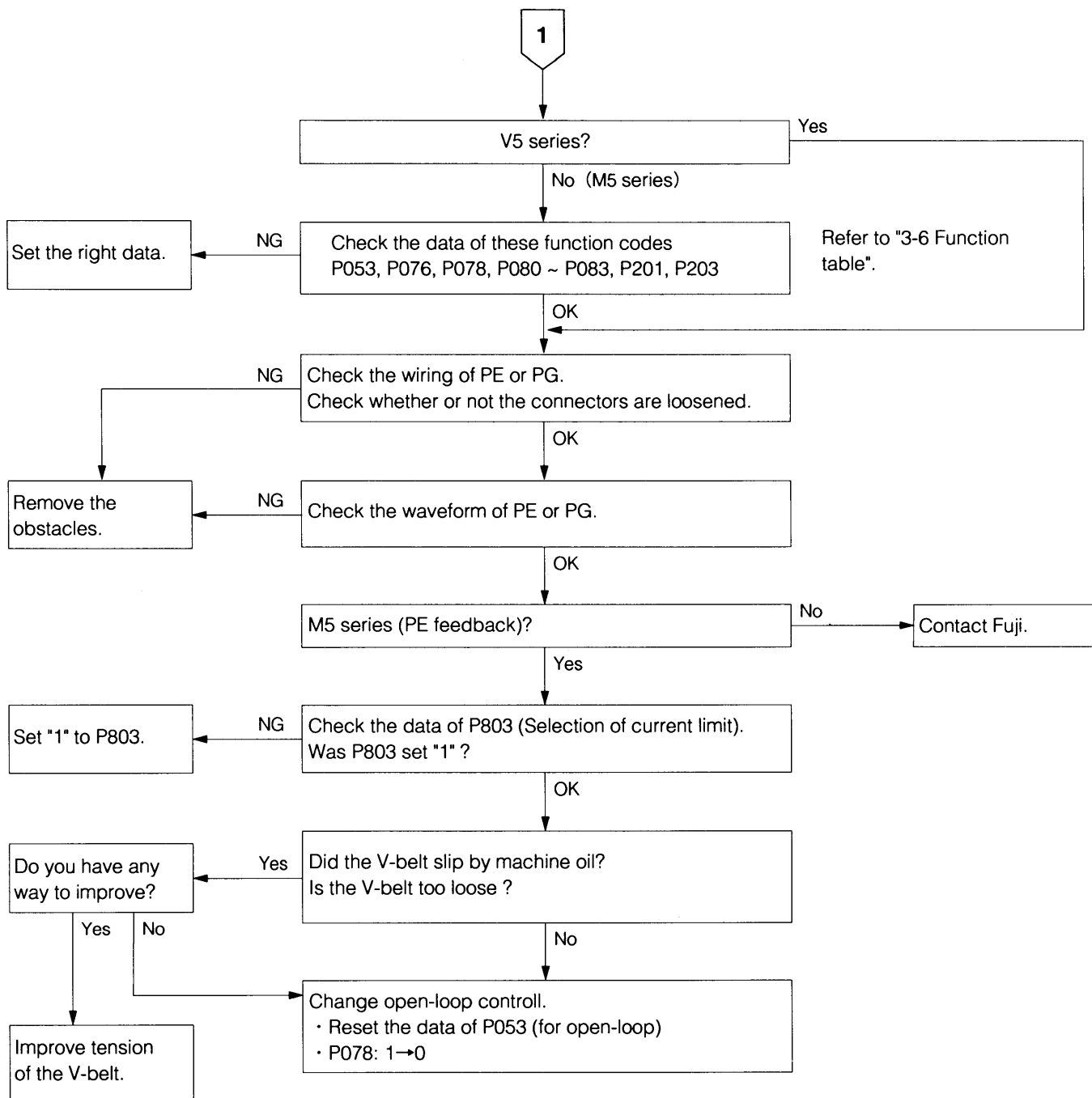
**NOTE :** When the control power supply voltage drops to such a low level that the unit control circuit is not still active, all the protection functions are automatically reset.



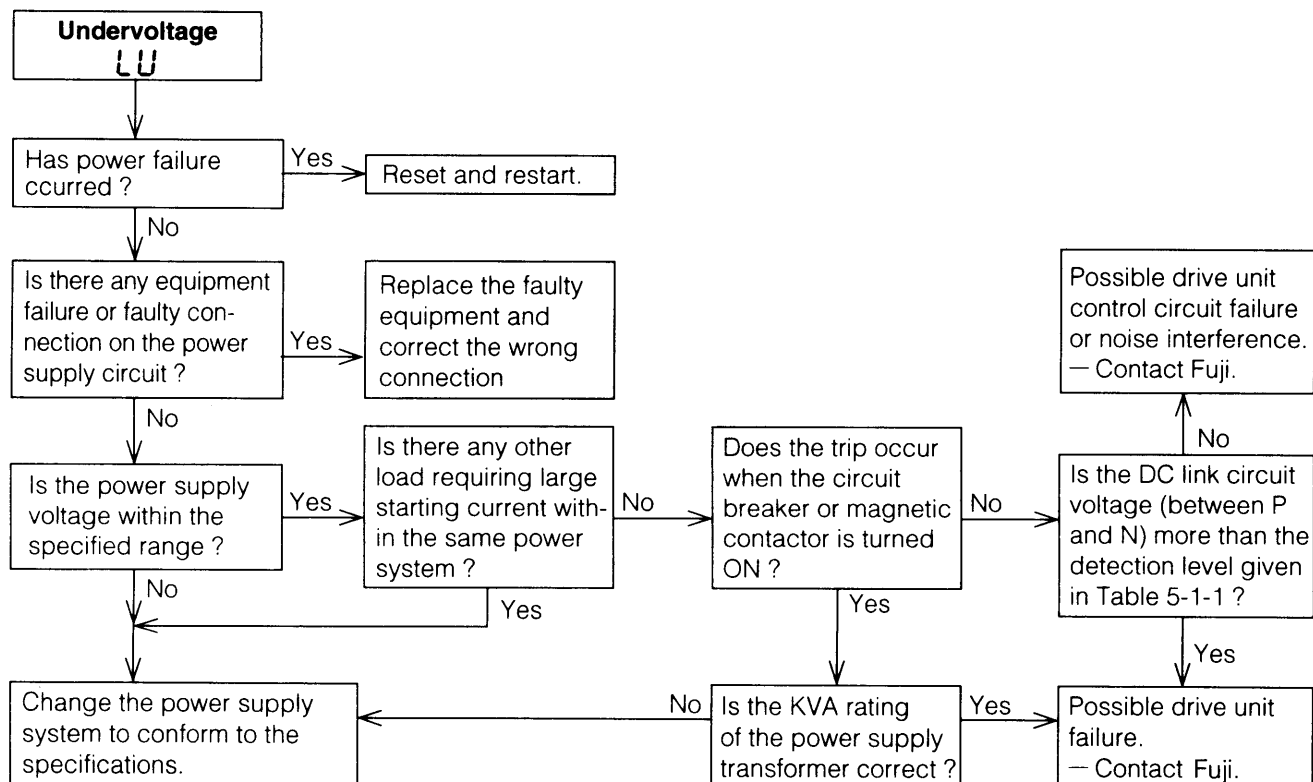
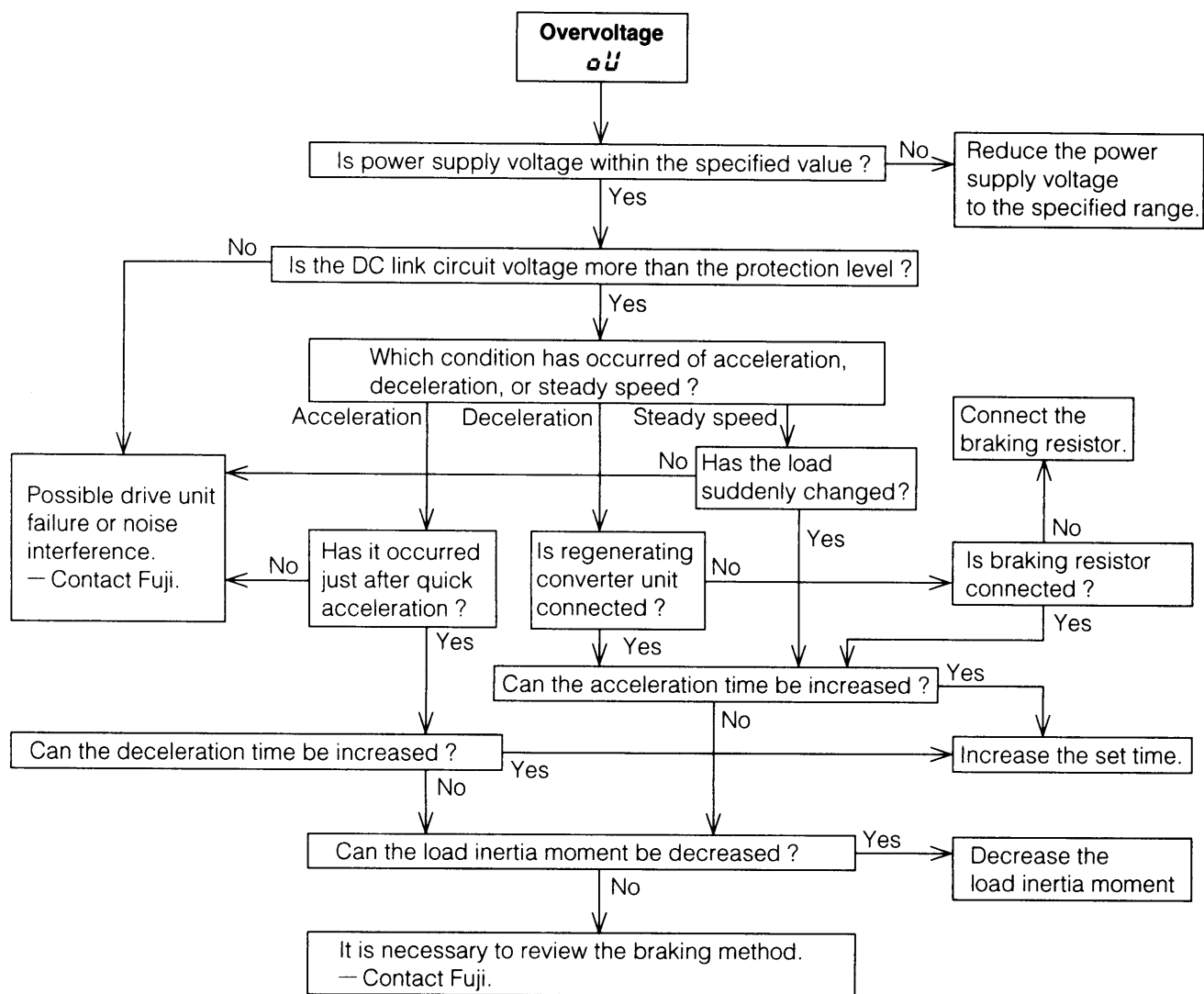
## 5-2 Diagnosis and remedy



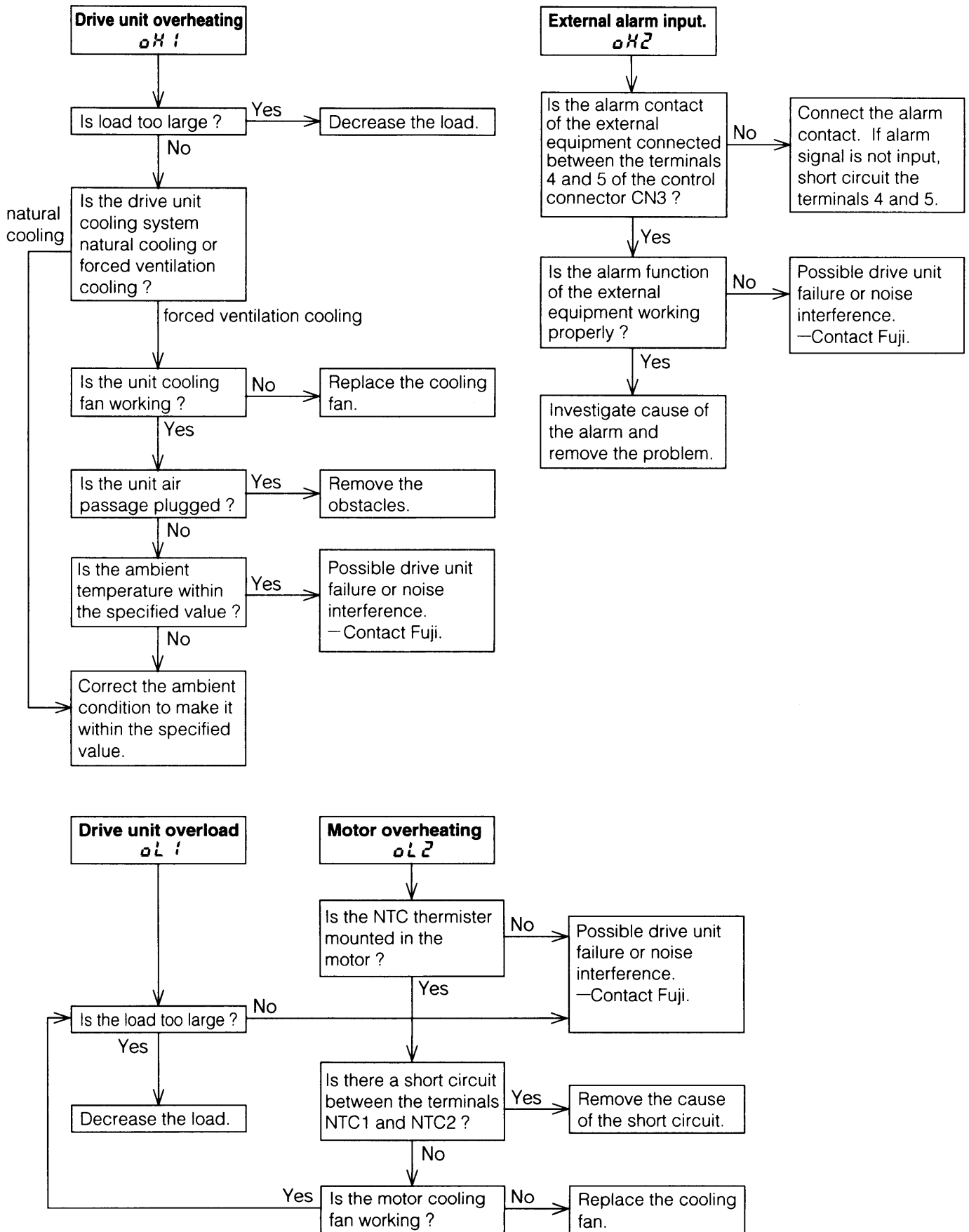




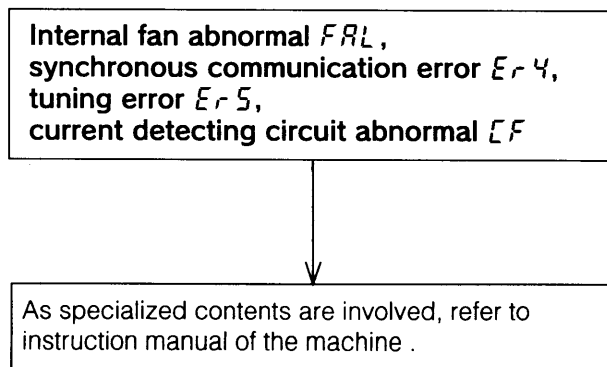
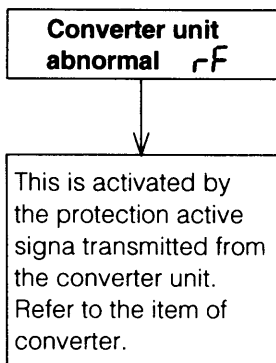
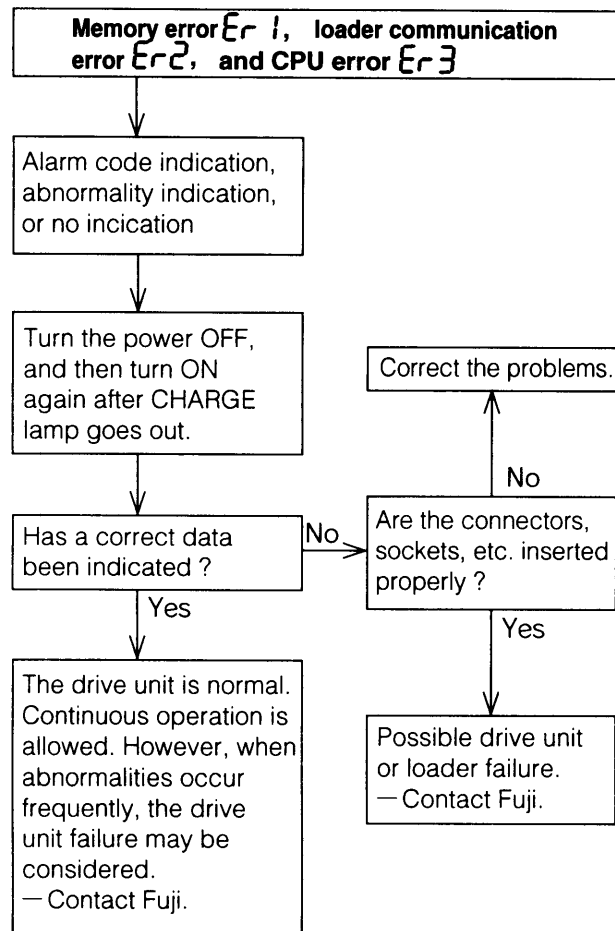
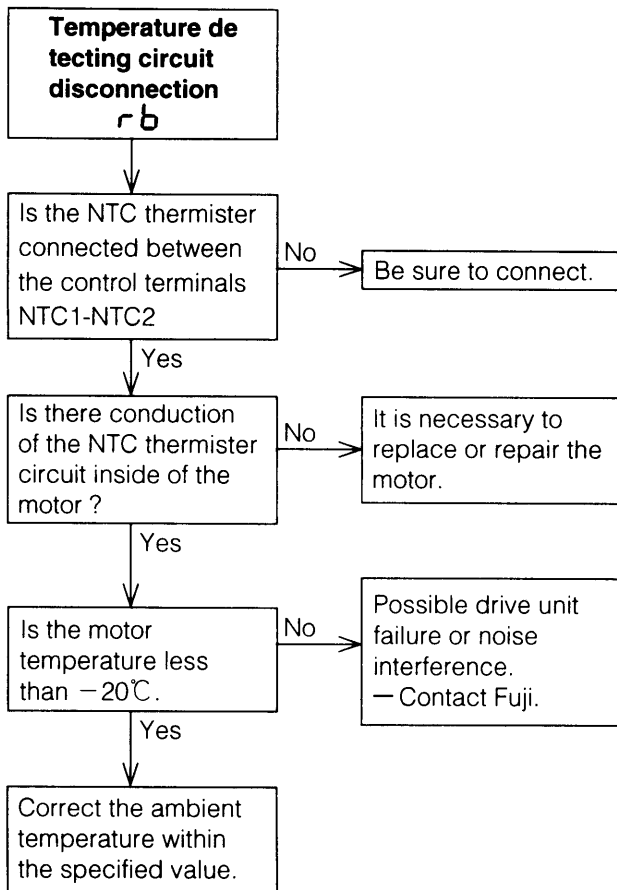




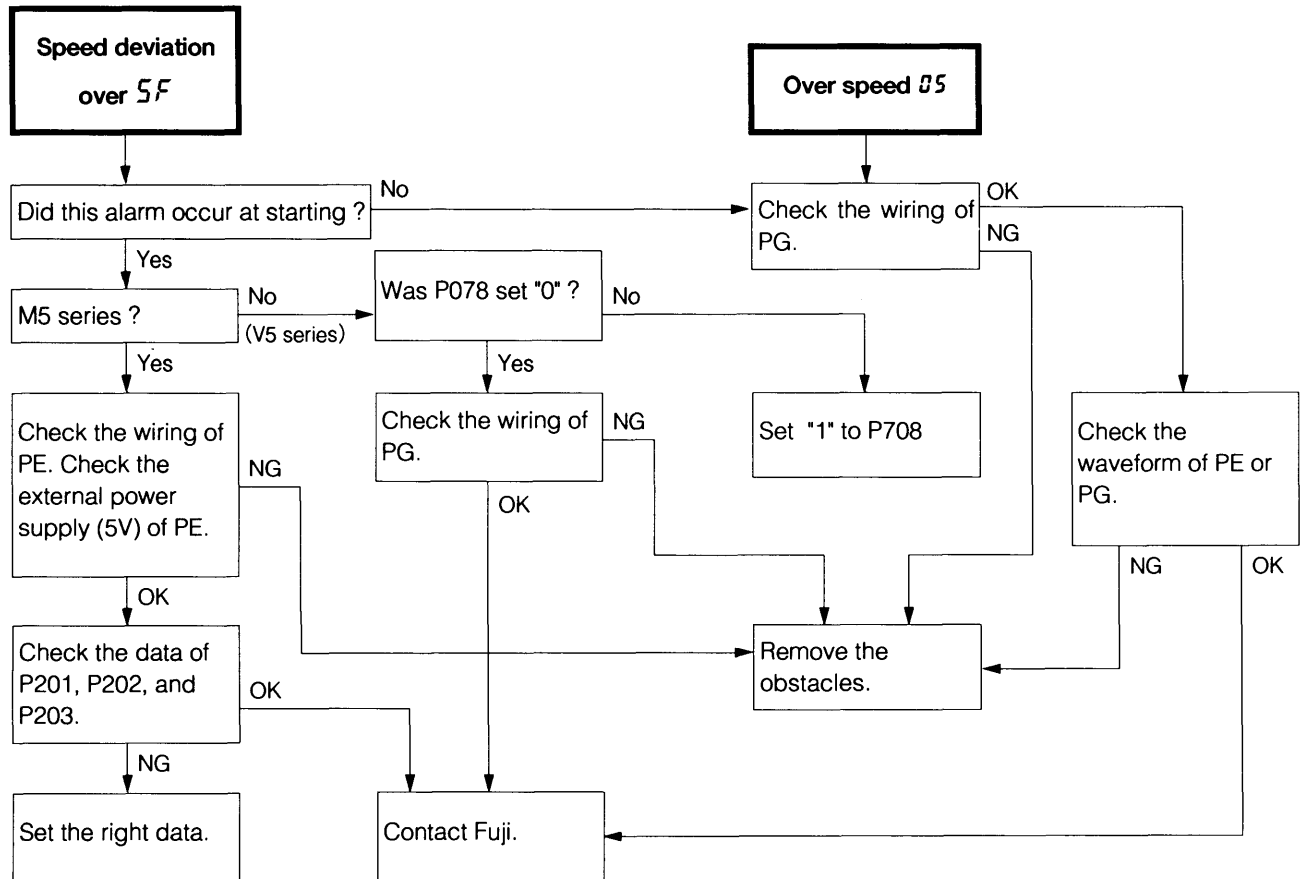






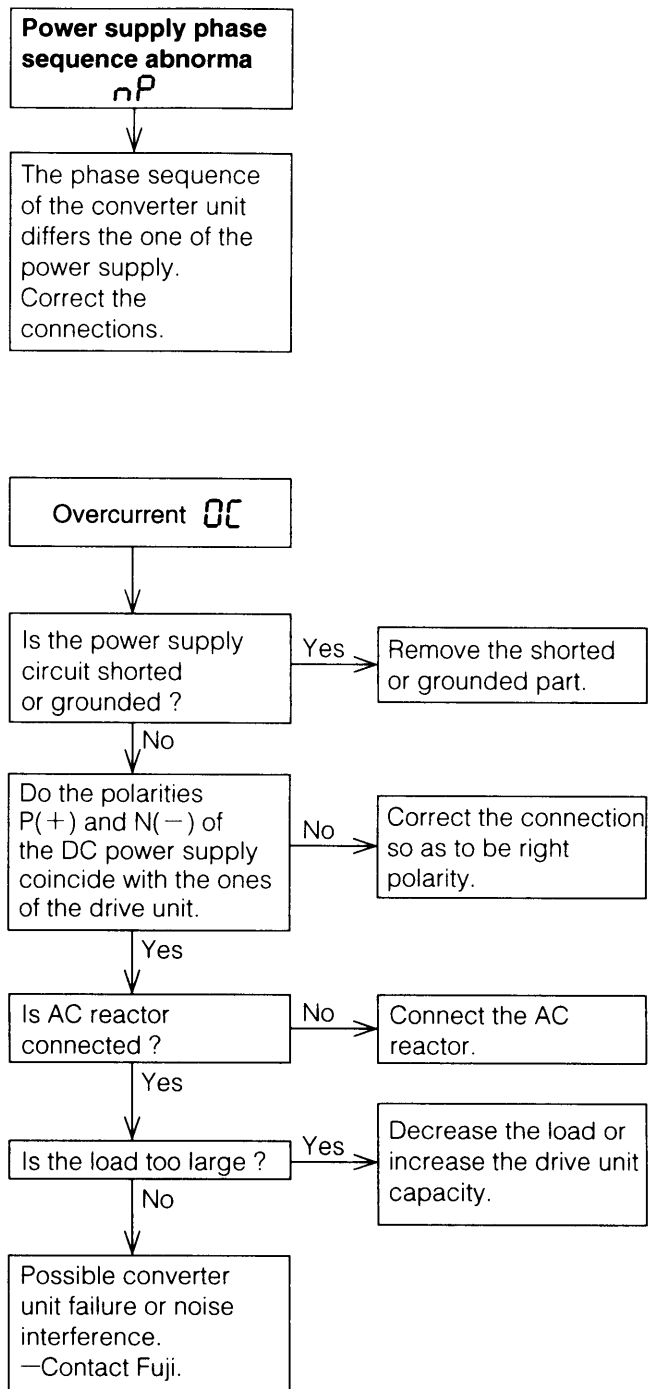




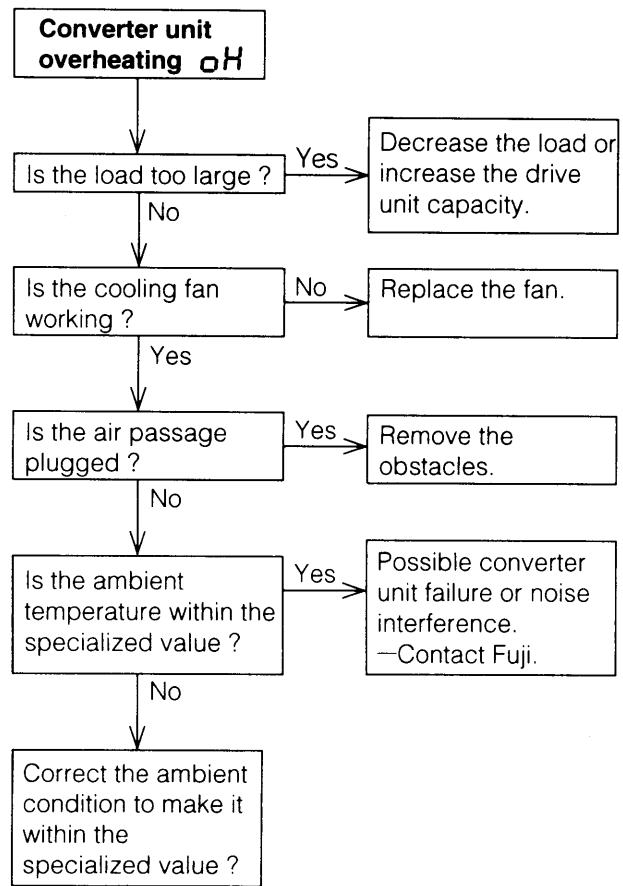




## b) Regenerating converter unit



## c) Regenerating converter unit and dynamic braking converter unit



**NOTE :** If current is conducted in the case where the polarities P(+) and N(-) of the DC power supply does not coincide with the ones of the drive unit, the drive unit may cause in damage.  
—Contact Fuji.



## 6 Terminals

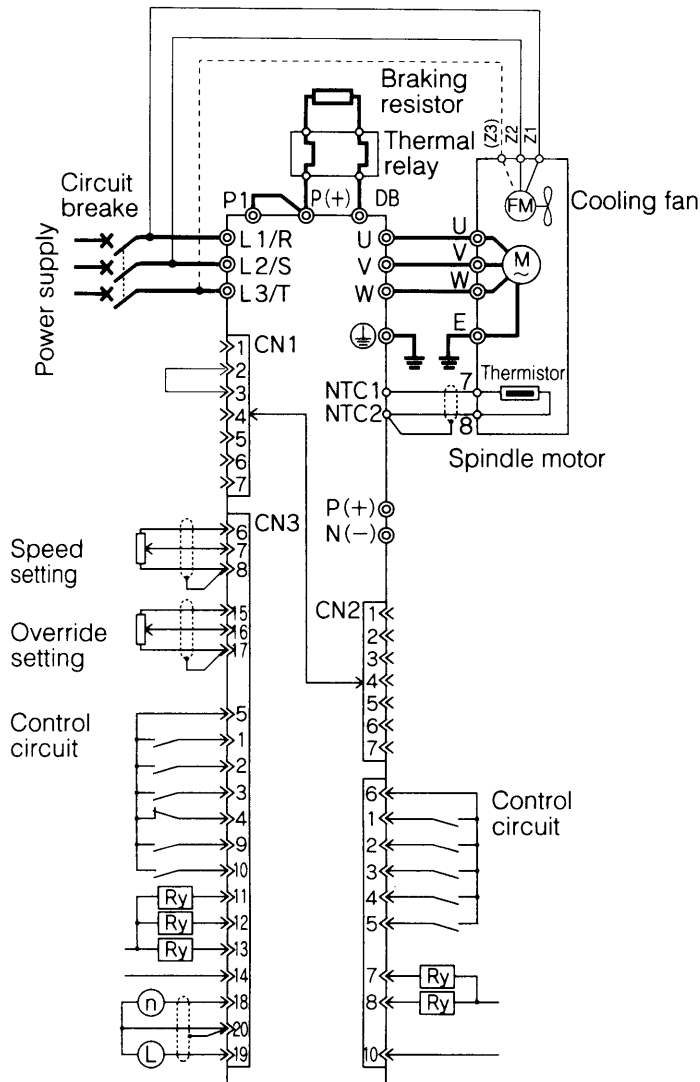


Fig. 6-1-1 M5 series package drive unit terminals

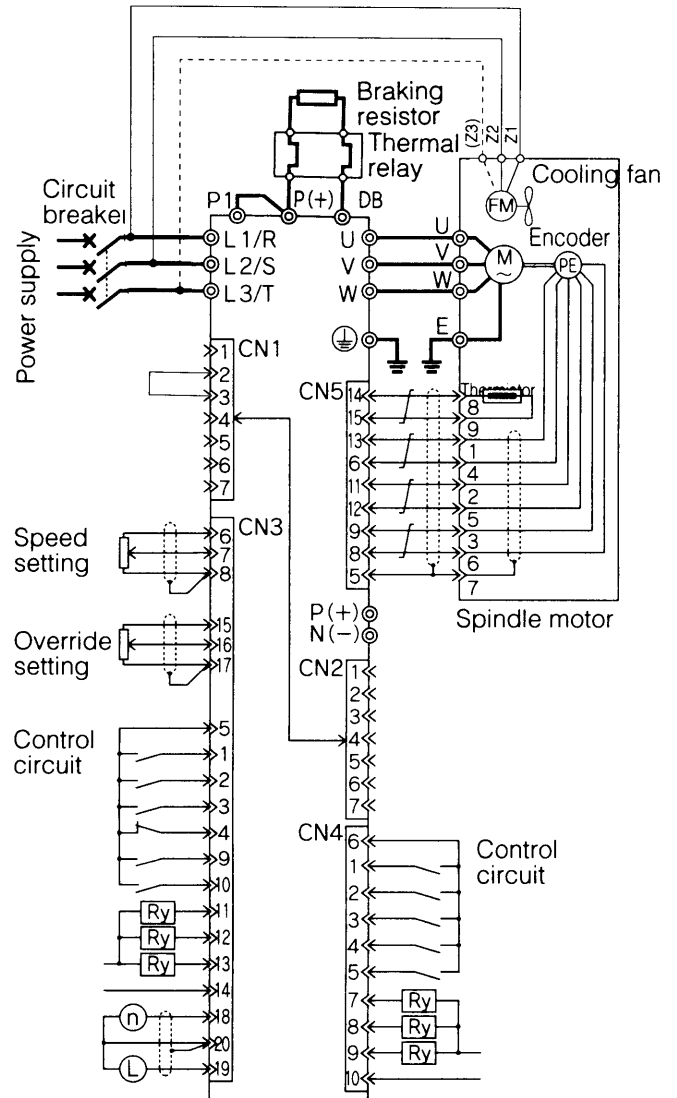


Fig. 6-1-2 V5 series package drive unit terminals

**NOTE :** Connection of the equipment to the supply under sole use of the residual current device is prohibited.

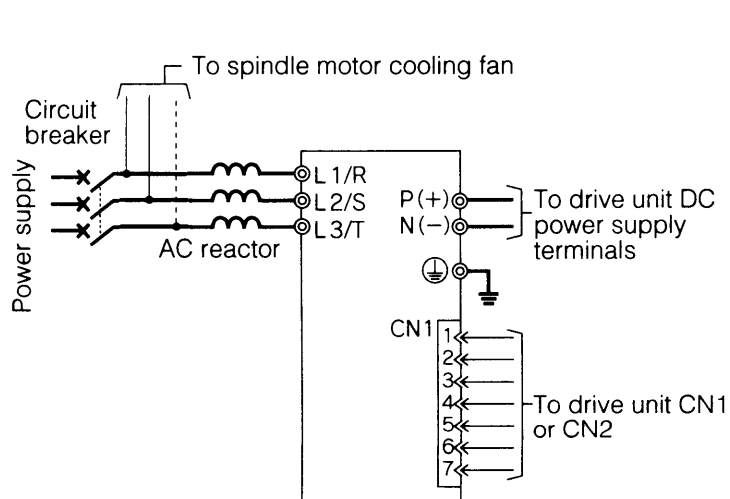


Fig. 6-1-3 Regenerating converter unit terminals

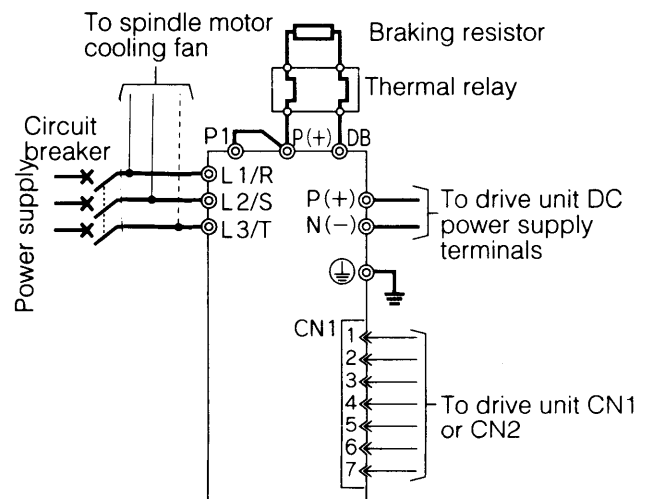


Fig. 6-1-4 Dynamic braking converter unit terminals

**NOTE :** The power supply phase number of the motor cooling fan is single phase (use Z1, Z2) for the motor with 7.5/5.5kW(MVE), 11/7.5kW(MVS) or less capacity and 3 phase (use Z1, Z2, Z3) for the motor with 7.5/5.5kW(MVE), 15/11kW(MVS) or more. For the 3 phase cooling fan, connect between L3/T phase line and the motor terminal Z3 as shown with the dotted line.



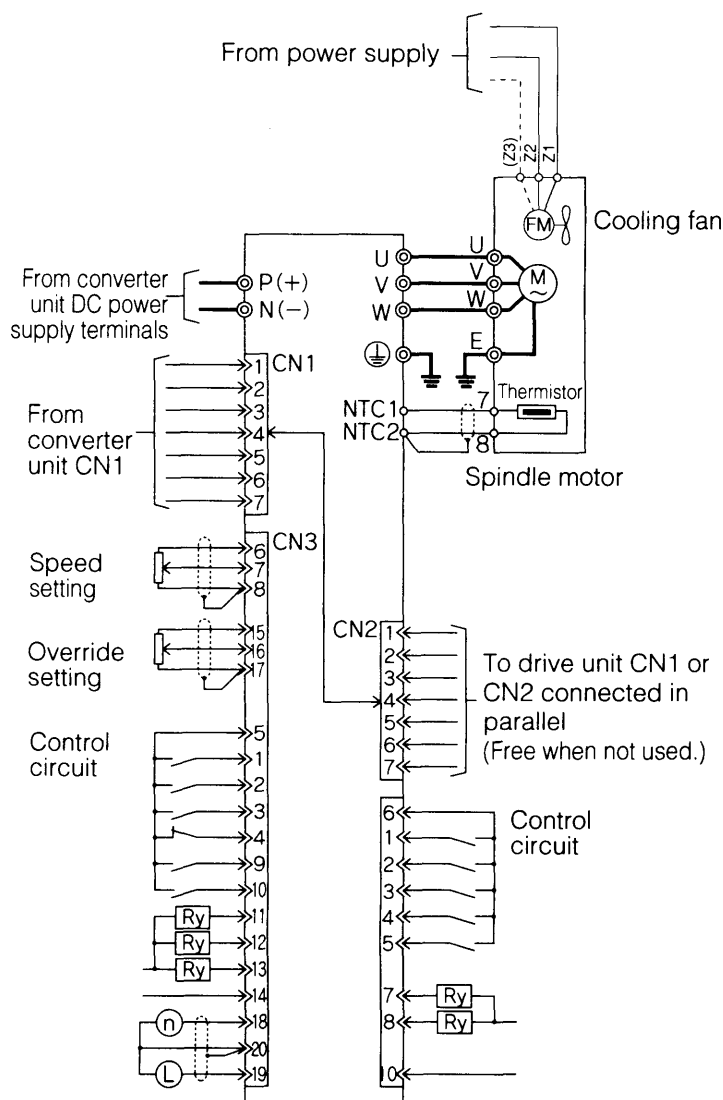


Fig. 6-1-5 M5 series drive unit terminals

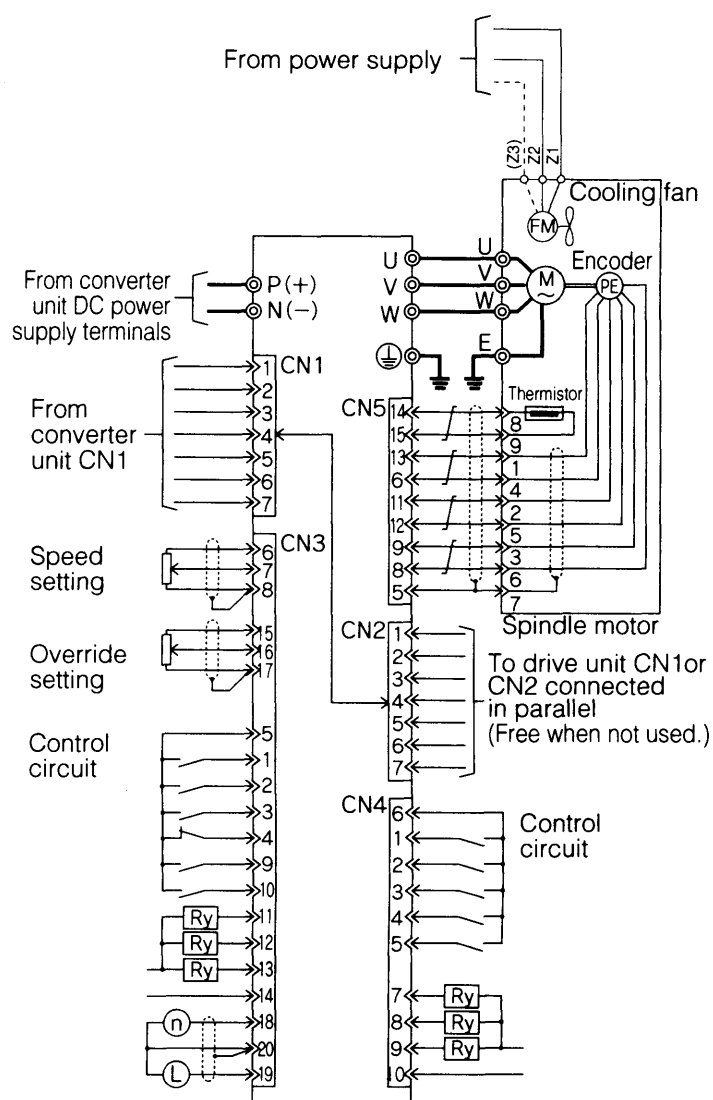


Fig. 6-1-6 V5 series drive unit terminals

## 6-1 Main circuit

### a) M5/V5 Series package drive unit terminals

| Terminal label   | Terminal name                   |
|------------------|---------------------------------|
| L1/R, L2/S, L3/T | AC power supply                 |
| U, V, W          | Drive unit output               |
| P1, P(+)         | Connection for DC reactor       |
| P(+), DB         | Connection for braking resistor |
| P(+), N(-)       | DC power supply                 |
| ⊕                | Ground terminal                 |

### b) Regenerating converter unit terminals

| Terminal label   | Terminal name   |
|------------------|-----------------|
| L1/R, L2/S, L3/T | AC power supply |
| P(+), N(-)       | DC power supply |
| ⊕                | Ground terminal |

### c) Dynamic braking converter unit terminals

| Terminal label   | Terminal name                   |
|------------------|---------------------------------|
| L1/R, L2/S, L3/T | AC power supply                 |
| P1, P(+)         | Connection for DC reactor       |
| P(+), DB         | Connection for braking resistor |
| P(+), N(-)       | DC power supply                 |
| ⊕                | Ground terminal                 |

### d) M5/V5 series drive unit terminals

| Terminal label | Terminal name     |
|----------------|-------------------|
| U, V, W        | Drive unit output |
| P(+), N(-)     | DC power supply   |
| ⊕              | Ground terminal   |



## 6-2 Control circuit

### a) M5 Series package drive unit and drive unit terminals

| Terminal label | Terminal name                               |
|----------------|---|
| NTC1, NTC2     | Connection for MVE motor and NTC thermistor |

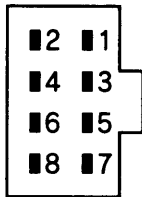
### b) Unit common connector CN1 and CN2

These are the connectors for the connection between M5/V5 series drive unit and converter unit.

The drive unit has CN1 and CN2 connected in parallel in the unit.

Either of them is for the connection between the units in the case of two or more drive units.

The converter unit has only CN1.



**Fig. 6-2-1**  
**CN1 and CN2 Terminal arrangement**

### c) M5/V5 series package drive unit and drive unit connector CN3

| Pin No. | Terminal name                    |
|---------|----------------------------------|
| 1       | Forward command                  |
| 2       | Reverse command                  |
| 3       | Alarm reset                      |
| 4       | External alarm input             |
| 5       | Control input common             |
| 6       | Power supply for speed setter    |
| 7       | Speed setting input              |
| 8       | Speed setting common             |
| 9       | M gear signal                    |
| 10      | L gear signal                    |
| 11      | Zero speed detection             |
| 12      | Speed arrival detection          |
| 13      | Total alarm output               |
| 14      | Transistor output common         |
| 15      | Power supply for override setter |
| 16      | Override setting input           |
| 17      | Override setting common          |
| 18      | Speedmeter                       |
| 19      | Load meter                       |
| 20      | Output common for meter          |

### d) M5 series package drive unit and drive unit connector CN4

| Pin No. | Terminal name              |
|---------|----------------------------|
| 1       | Coast-to-stop command      |
| 2       | Torque limit command       |
| 3       | 2 axes exchange command    |
| 4       | Simple ORT start command   |
| 5       | Simple ORT stop command    |
| 6       | Control input common       |
| 7       | Arbitrary speed detection  |
| 8       | 2 axes exchange completion |
| 9       | ————                       |
| 10      | Transistor output common   |
| 11      | ————                       |
| 12      | ————                       |
| 13      | ————                       |
| 14      | ————                       |
| 15      | ————                       |
| 16      | ————                       |
| 17      | ————                       |
| 18      | ————                       |
| 19      | ————                       |
| 20      | ————                       |

### e) V5 series package drive unit and drive unit connector CN4

| Pin No. | Terminal name             |
|---------|---------------------------|
| 1       | Coast-to-stop command     |
| 2       | Torque limit command (H)  |
| 3       | 2 axes exchange command   |
| 4       | Rigid tap command         |
| 5       | Torque limit command (L)  |
| 6       | Control input common      |
| 7       | Arbitrary speed detection |
| 8       | Under torque limit        |
| 9       | Torque detection          |
| 10      | Transistor output common  |
| 11      | ————                      |
| 12      | ————                      |
| 13      | ————                      |
| 14      | ————                      |
| 15      | ————                      |
| 16      | ————                      |
| 17      | ————                      |
| 18      | ————                      |
| 19      | ————                      |
| 20      | ————                      |



**f) V5 series package drive unit and driveunit connector CN5**

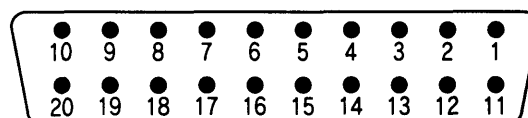
| Pin No. | Terminal name                         |
|---------|---------------------------------------|
| 1       | _____                                 |
| 2       | _____                                 |
| 3       | _____                                 |
| 4       | _____                                 |
| 5       | Connection for shield cover           |
| 6       | PE (Encoder) common                   |
| 7       | _____                                 |
| 8       | Reference B signal of PE              |
| 9       | B signal of PE                        |
| 10      | _____                                 |
| 11      | A signal of PE                        |
| 12      | Reference A signal of PE              |
| 13      | 5V power supply for PE                |
| 14      | Connection for NTC thermistor (motor) |
| 15      | Connection for NTC thermistor (motor) |
| 16      | _____                                 |
| 17      | _____                                 |
| 18      | _____                                 |
| 19      | _____                                 |
| 20      | _____                                 |

**g) M5/V5 series package drive unit and driveunit connector CN6 to CN10**

| Option card  | Connector                     |
|--------------|-------------------------------|
| OPCII-MS5-MG | CN-6                          |
| OPCII-MS5-PE | CN-6, CN-7, CN-8, CN-9        |
| OPCII-MS5-SY | CN-6, CN-7, CN-8, CN-9, CN-10 |

**Remarks :**

- These are the connectors for connecting the option cards mentioned above.  
As for the details, refer to instruction manual of the machine.
- When the option card is not used, these connectors can be seen from the outside because they are covered with the front cover.



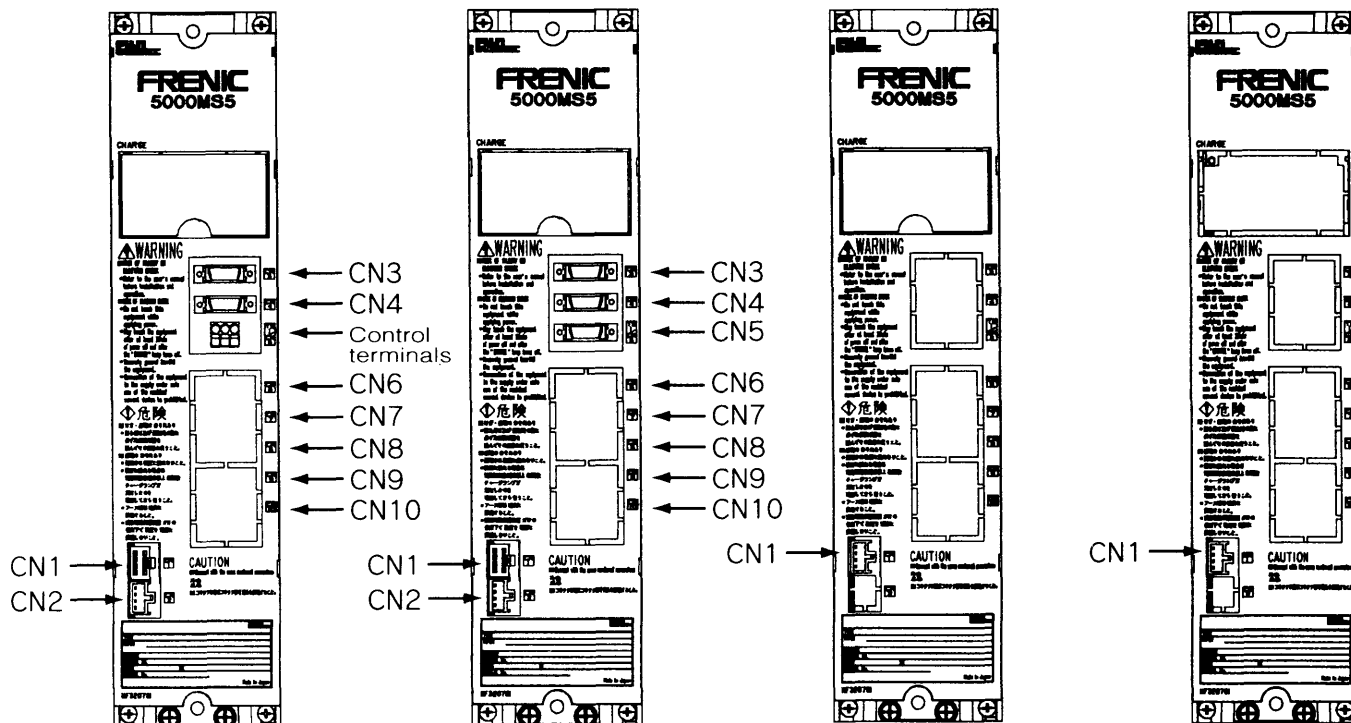
**Fig. 6-2-2**  
**CN3 to CN10 Terminal arrangement**

**a) M5 series package drive unit and drive unit**

**b) V5 series package drive unit and drive unit**

**c) Regenerating converter unit**

**d) Dynamic braking converter unit**



**Fig. 6-2-3 Control circuit terminal and connector position**



## 6-3 Terminal thread diameter and tightening torque

### a) Terminal thread diameter of M5/V5 series package drive unit

| Unit type     | AC power supply, DC reactor, braking resistor and unit output terminals<br>L1/R, L2/S, L3/T, P1, P(+), DB, U, V, W | DC power supply terminals<br>P(+), N(-) | Ground terminal<br>⊕ | Thermistor terminals<br>NTC1, NTC2 |
|---------------|--|---|----------------------|------------------------------------|
| FRN1.1M5-2    | M4   | M6                                      | M5                   | M2.5                               |
| FRN2.2M5/V5-2 |  |   |                      |                                    |
| FRN3.7M5/V5-2 |  |   |                      |                                    |
| FRN5.5M5/V5-2 |  |   |                      |                                    |
| FRN3.7M5-4    |  |   |                      |                                    |
| FRN5.5M5-4    |  |   |                      |                                    |

**NOTE :** The screws for the thermistor terminal NTC1 and NTC2 are attached only to M5 series.

### b) Terminal thread diameter of regenerating converter unit

| Unit type    | Unit output terminals<br>L1/R, L2/S, L3/T | DC power supply terminals<br>P(+), N(-) | Ground terminal<br>⊕ |
|--------------|---|---|----------------------|
| FRN5.5PR5-2  | M4  | M6                                      | M5                   |
| FRN7.5PR5-2  |   |   |                      |
| FRN11PR5-2   |   |   |                      |
| FRN15PR5-2   | M6  |   | M6                   |
| FRN18.5PR5-2 |   |   |                      |
| FRN22PR5-2   |   |   |                      |
| FRN30PR5-2   |   |   |                      |
| FRN37PR5-2   | M10                                       |   | M8                   |
| FRN45PR5-2   |   |   |                      |
| FRN55PR5-2   |   |   |                      |

### c) Terminal thread diameter of dynamic braking converter unit

| Unit type    | AC power supply, DC reactor and braking resistor terminals<br>L1/R, L2/S, L3/T, P1, P(+), DB | DC power supply terminals<br>P(+), N(-) | Ground terminal<br>⊕ |
|--------------|--|---|----------------------|
| FRN7.5PD5-2  | M4   | M6                                      | M5                   |
| FRN11PD5-2   |  |   |                      |
| FRN15PD5-2   | M6   |   | M6                   |
| FRN18.5PD5-2 |  |   |                      |
| FRN7.5PD5-4  | M4   | M6                                      | M5                   |
| FRN11PD5-4   |  |   |                      |
| FRN15PD5-4   | M6   |   | M6                   |
| FRN18.5PD5-4 |  |   |                      |

### d) Terminal thread diameter of M5/V5 series drive unit

| Unit type        | DC power supply terminals<br>P(+), N(-) | Unit output terminals<br>U, V, W | Ground terminal<br>⊕ | Thermistor terminals<br>NTC1, NTC2 |  |
|------------------|---|----------------------------------|----------------------|------------------------------------|--|
| FRN5.5MC5/VC5-2  | M6                                      | M4                               | M5                   | M2.5                               |  |
| FRN7.5MC5/VC5-2  |   |                                  |                      |                                    |  |
| FRN11MC5/VC5-2   |   |                                  |                      |                                    |  |
| FRN15MC5/VC5-2   |   | M6                               | M6                   |                                    |  |
| FRN18.5MC5/VC5-2 |   |                                  |                      |                                    |  |
| FRN22MC5/VC5-2   |   |                                  |                      |                                    |  |
| FRN30MC5/VC5-2   |   |                                  |                      |                                    |  |
| FRN37VC5-2       |   | M10                              | M8                   | _____                              |  |
| FRN45VC5-2       |   |                                  |                      |                                    |  |
| FRN55VC5-2       |   |                                  |                      |                                    |  |
| FRN7.5MC5-4      | M6                                      | M4                               | M5                   | M2.5                               |  |
| FRN11MC5-4       |   | M6                               | M6                   |                                    |  |
| FRN15MC5-4       |   |                                  |                      |                                    |  |
| FRN18.5MC5-4     |   |                                  |                      |                                    |  |

### e) Screw tightening torque

| Thread diameter | Tightening torque<br>[N·m] |
|-----------------|----------------------------|
| M2.5            | 0.5                        |
| M4              | 1.8                        |
| M5              | 3.5                        |
| M6              | 5.8                        |
| M8              | 13.5                       |
| M10             | 24                         |

**NOTE:** The screws for the thermistor terminal NTC1 and NTC2 are attached only to M5 series.



# 7 Standard Specifications

## 7-1 200V series

### a) M5 series package drive unit and drive unit individual specification

| Item                                 |                   |             | Specification  |                |                |   |                 |                |                |                  |                |                |  |
|--------------------------------------|-------------------|-------------|--|----------------|----------------|---|-----------------|----------------|----------------|------------------|----------------|----------------|--|
| Unit type                            |                   |             | FRN1.1<br>M5-2   | FRN2.2<br>M5-2 | FRN3.7<br>M5-2 | FRN5.5<br>M5/MC5-2                          | FRN7.5<br>MC5-2 | FRN11<br>MC5-2 | FRN15<br>MC5-2 | FRN18.5<br>MC5-2 | FRN22<br>MC5-2 | FRN30<br>MC5-2 |  |
| Output                               | 50%ED             | Output [kw] | 1.1  | 2.2            | 3.7            | 5.5   | 7.5             | 11             | 15             | 18.5             | 22             | 30             |  |
|                                      |                   | Current [A] | 7  | 14             | 24             | 28  | 41              | 57             | 74             | 88               | 101            | 136            |  |
|                                      | Continuous        | Output [kw] | 0.75   | 1.5            | 2.2            | 3.7   | 5.5             | 7.5            | 11             | 15               | 18.5           | 22             |  |
|                                      |                   | Current [A] | 5.3  | 11             | 17             | 22  | 33              | 45             | 54             | 75               | 88             | 105            |  |
|                                      | Overload capacity |             | 50%ED rated output ×120%, 1min   |                |                |   |                 |                |                |                  |                |                |  |
| Power loss [kw]                      |                   |             | 0.075  | 0.12           | 0.17           | 0.23/0.18                                   | 0.24            | 0.32           | 0.40           | 0.55             | 0.65           | 0.72           |  |
| Mass [kg]                            |                   |             | 5.5  |                |                | 6   |                 |                | 8              |                  | 9              |                |  |
| Construction/cooling system          |                   |             | External cooling/natural cooling   |                |                | External cooling/forced ventilation cooling |                 |                |                |                  |                |                |  |
| Control system                       |                   |             | Sine wave PWMcontrol and torque-vector control   |                |                |   |                 |                |                |                  |                |                |  |
| Acceleration and deceleration system |                   |             | Torque limit acc. and dec. Soft start and stop (Linear acc. and dec., S curve)   |                |                |   |                 |                |                |                  |                |                |  |
| Speed range [r/min]                  |                   |             | 30 to 6000   |                |                |   |                 |                |                |                  |                | 30 to 4500     |  |
| Base speed [r/min]                   |                   |             | 1500   |                |                |   |                 |                |                |                  |                |                |  |
| Input                                | Speed setting     |             | Analog signal : Speed setter, DC0 to 10V<br>Digital signal : Use option card.  |                |                |   |                 |                |                |                  |                |                |  |
|                                      | Override          |             | 0 to 50% (1%resolution) of speed setting value.  |                |                |   |                 |                |                |                  |                |                |  |
|                                      | Contact           |             | Forward command, Reverse command, Alarm reset, External alarm input, M gear signal, L gear signal, Coast-to-stop command, Torque limit signal, 2 axes exchange command, Simple ORT start/stop command. |                |                |   |                 |                |                |                  |                |                |  |
| Output                               | Analog signal     |             | Speed, load meter/DC0 to 10V   |                |                |   |                 |                |                |                  |                |                |  |
|                                      | Transistor        |             | Zero speed detect., Speed arrival detect., Total alarm output, Arbitrary speed detect., 2axes exchange completion  |                |                |   |                 |                |                |                  |                |                |  |

### b) V5 series package drive unit and drive unit individual specification

| Item                                 |                     |             | Specification   |                |   |                 |                |                |                  |                |                |                |                |                                |     |
|--------------------------------------|---------------------|-------------|---|----------------|---|-----------------|----------------|----------------|------------------|----------------|----------------|----------------|----------------|--------------------------------|-----|
| Unit type                            |                     |             | FRN2.2<br>V5-2  | FRN3.7<br>V5-2 | FRN5.5<br>V5/VC5-2                          | FRN7.5<br>VC5-2 | FRN11<br>VC5-2 | FRN15<br>VC5-2 | FRN18.5<br>VC5-2 | FRN22<br>VC5-2 | FRN30<br>VC5-2 | FRN37<br>VC5-2 | FRN45<br>VC5-2 | FRN55<br>VC5-2                 |     |
| Output                               | 50%ED               | Output [kw] | 2.2   | 3.7            | 5.5   | 7.5             | 11             | 15             | 18.5             | 22             | 30             | 37             | 45             | 55                             |     |
|                                      |                     | Current [A] | 14  | 24             | 28  | 41              | 57             | 74             | 88               | 101            | 136            | 166            | 195            | 238                            |     |
|                                      | Continuous          | Output [kw] | 1.5   | 2.2            | 3.7   | 5.5             | 7.5            | 11             | 15               | 18.5           | 22             | 30             | 37             | 45                             |     |
|                                      |                     | Current [A] | 11  | 17             | 22  | 33              | 45             | 54             | 75               | 88             | 105            | 137            | 167            | 205                            |     |
|                                      | 30min               | Output [kw] | —   |                |   |                 |                |                |                  |                |                |                |                | 45                             | 55  |
|                                      |                     | Current [A] | —   |                |   |                 |                |                |                  |                |                |                |                | 195                            | 238 |
|                                      | Overload capacity   |             | 50%ED rated output ×120%, 1min  |                |   |                 |                |                |                  |                |                |                |                | 30min rated output ×120%, 1min |     |
| Power loss [kw]                      |                     |             | 0.12  | 0.17           | 0.23/0.18                                   | 0.24            | 0.32           | 0.40           | 0.55             | 0.65           | 0.72           | 0.95           | 1.35           | 1.70                           |     |
| Mass [kg]                            |                     |             | 5.5   |                | 6   |                 | 8              |                |                  | 9              |                | 20             |                |                                |     |
| Construction/cooling system          |                     |             | External cooling/<br>natural cooling  |                | External cooling/forced ventilation cooling |                 |                |                |                  |                |                |                |                |                                |     |
| Control system                       |                     |             | Sine wave PWMcontrol and vector control and ASR control with ACR minor loop   |                |   |                 |                |                |                  |                |                |                |                |                                |     |
| Acceleration and deceleration system |                     |             | Torque limit acc. and dec. Soft start and stop (Linear acc. and dec., S curve)  |                |   |                 |                |                |                  |                |                |                |                |                                |     |
| Speed                                | Speed range [r/min] |             | 30 to 8000  |                |   |                 |                | 30 to 6000     |                  |                |                | 30 to 4500     |                | 30 to 4000                     |     |
|                                      | Base speed [r/min]  |             | 1500  |                |   |                 |                |                |                  |                |                | 1150           |                | 1000                           |     |
| Input                                | Speed setting       |             | Analog signal : Speed setter, DC0 to ±10V<br>Digital signal : Use option card.  |                |   |                 |                |                |                  |                |                |                |                |                                |     |
|                                      | Override            |             | 0 to 50% (1%resolution) of speed setting value.   |                |   |                 |                |                |                  |                |                |                |                |                                |     |
|                                      | Contact             |             | Forward command, Reverse command, Alarm reset, External alarm input, M gear signal, L gear signal, Coast-to-stop command, Torque limit command(H), Torque limit command(L), Rigid tap command, 2 axes exchange command. |                |   |                 |                |                |                  |                |                |                |                |                                |     |
| Output                               | Analog signal       |             | Speed, load meter/DC0 to 10V  |                |   |                 |                |                |                  |                |                |                |                |                                |     |
|                                      | Transistor          |             | Zero speed detect., Speed arrival detect., Total alarm output, Arbitrary speed detect., Under torque limit, Torque detect.  |                |   |                 |                |                |                  |                |                |                |                |                                |     |



### c) M5/V5 series package drive unit common specification

| Item                         |                                | Specification   |
|------------------------------|--------------------------------|---|
| Power supply                 | Voltage and frequency          | 3-phase 3-wire system, 200V/50Hz, 200 to 230V / 60Hz  |
|                              | Allowable deviation            | Voltage : + 10 to - 15%, Voltage imbalance ratio : 3% or less, Frequency : $\pm 5\%$  |
| Driving / Braking system     |                                | 4 quadrant driving / Dynamic braking (Resistance regenerative braking) : Braking resistance installed separately  |
| Braking torque and frequency |                                | 50 %ED rated torque $\times 120\%$ : 60 second, 10 %ED or 20 %ED  |
| Indication                   | Digital indication             | Function code of the function table and data  |
|                              | Lamp indication                | DC power supply voltage present   |
| Protective function          |                                | Overcurrent, Fuse blow-out, Overvoltage, Undervoltage, Drive unit overheating, External alarm input, Drive unit overload, Motor overheating, Temperature detecting circuit disconnected, Over speed, Speed deviation over, Current detecting circuit abnormal, Converter unit abnormal, Internal fan abnormal, Memory error, Loader communication error, CPU error, Synchronous communication abnormal, Tuning abnormal |
| Arising noise                |                                | less than 60dB (A)  |
| Applied standard             |                                | IEC 61800-2, IEC61800-3, EN50082-2, DIN VDE 0160  |
| Condition                    | Installation location          | Indoor, installation within panel (cooling fins installed outside panel possible), less than 1000m elevation (less than 3250m in transit.), not in contact with corrosive gas, flammable gas, dust, and direct sunlight   |
|                              | Ambient temperature / humidity | - 10 to + 55°C (cooling fins temperature - 10 to +40°C) / 15 to 85%RH, non-condensing   |
|                              | Vibration                      | 5.9m/s <sup>2</sup> {0.6G} or less  |
|                              | Storage temperature / humidity | - 25 to +55°C, 5 to 95%RH, non-condensing   |

**NOTE :** When the power supply voltage differs from the unit specification voltage, meet the voltage to the specified value by using a power supply transformer. And when the European Standard EN50178 is applied, use the Isolation Transformer.

**Remark :** Imbalance of the power supply voltage [%] =  $\frac{\text{Max. voltage [V]} - \text{Min. voltage [V]}}{\text{Average 3-phse voltage [V]}} \times 100$

### d) M5/V5 series drive unit common specification

| Item                |                                | Specification   |
|---------------------|--------------------------------|---|
| DC power supply     |                                | Regenerating and dynamic braking converter unit   |
| Indication          | Digital indication             | Function code of the function table and data  |
|                     | Lamp indication                | DC power supply voltage present   |
| Protective function |                                | Overcurrent, Fuse blow-out, Overvoltage, Undervoltage, Drive unit overheating, External alarm input, Drive unit overload, Motor overheating, Temperature detecting circuit disconnected, Over speed, Speed deviation over, Current detecting circuit abnormal, Converter unit abnormal, Internal fan abnormal, Memory error, Loader communication error, CPU error, Synchronous communication abnormal, Tuning abnormal |
| Arising noise       |                                | less than 60dB (A)  |
| Applied standard    |                                | IEC 61800-2, IEC 61800-3, EN50082-2, DIN VDE 0160   |
| Condition           | Installation location          | Indoor, installation within panel (cooling fins installed outside panel possible), less than 1000m elevation (less than 3250m in transit), not in contact with corrosive gas, flammable gas, dust, and direct sunlight  |
|                     | Ambient temperature / humidity | - 10 to +55°C (cooling fins temperature - 10 to + 40°C) / 15 to 85%RH, non-condensing   |
|                     | Vibration                      | 5.9m/s <sup>2</sup> {0.6G} or less  |
|                     | Storage temperature / humidity | - 25 to +55°C, 5 to 95%RH, non-condensing   |



#### e) Regenerating converter unit individual specification

| Item                    |                    | Specification  |                 |                |                |                  |                |                |                |                |                |
|-------------------------|--------------------|--|-----------------|----------------|----------------|------------------|----------------|----------------|----------------|----------------|----------------|
| Motor rated output [kW] | 50%ED              | 5.5  | 7.5             | 11             | 15             | 18.5             | 22             | 30             | 37             | 45             | 55             |
|                         | Continuous         | 3.7  | 5.5             | 7.5            | 11             | 15               | 18.5           | 22             | 30             | 37             | 45             |
| Unit type               |                    | FRN5.5<br>PR5-2  | FRN7.5<br>PR5-2 | FRN11<br>PR5-2 | FRN15<br>PR5-2 | FRN18.5<br>PR5-2 | FRN22<br>PR5-2 | FRN30<br>PR5-2 | FRN37<br>PR5-2 | FRN45<br>PR5-2 | FRN55<br>PR5-2 |
| Power loss [kW]         |                    | 0.11   | 0.14            | 0.18           | 0.27           | 0.33             | 0.40           | 0.48           | 0.55           | 0.75           | 0.90           |
| Mass [kg]               |                    | 6  |                 |                | 8              |                  | 9              |                | 20             |                |                |
| Driving/Braking system  |                    | Drive:Diode rectifying / Braking:Regenerative braking, 4 quadrant operation                                    |                 |                |                |                  |                |                |                |                |                |
| Indication              | Digital indication | Alarm code 3 points  |                 |                |                |                  |                |                |                |                |                |
|                         | Lamp indication    | DC power supply voltage present, during regenerating operation, and at control power supply voltage generation |                 |                |                |                  |                |                |                |                |                |
| Protective function     |                    | Power supply phase sequence abnormal, over regenerating current, converter overheating                         |                 |                |                |                  |                |                |                |                |                |

#### f) Dynamic braking converter unit individual specification

| Item                    |            | Specification   |                |                |                  |  |
|-------------------------|------------|---|----------------|----------------|------------------|--|
| Motor rated output [kW] | 50%ED      | 7.5   | 11             | 15             | 18.5             |  |
|                         | Continuous | 5.5   | 7.5            | 11             | 15               |  |
| Unit type               |            | FRN7.5<br>PD5-2   | FRN11<br>PD5-2 | FRN15<br>PD5-2 | FRN18.5<br>PD5-2 |  |
| Power loss [kW]         |            | 0.08  | 0.10           | 0.16           | 0.23             |  |
| Mass [kg]               |            | 5   |                | 6              |                  |  |
| Driving/Braking system  |            | Drive:Diode rectifying/Braking:Dynamic braking (Resistance regenerative braking, braking resistance seperately installed), 4 quadrant operation |                |                |                  |  |
| Protective function     |            | Converter overheating   |                |                |                  |  |

#### g) Regenerating and dynamic braking converter unit common specification

| Item                          |                              | Specification   |
|-------------------------------|------------------------------|---|
| Power supply                  | Voltage and frequency        | 3-phase 3-wire system, 200V/50Hz, 200to230V/60Hz  |
|                               | Allowable                    | Voltage : +10 to -15%, Voltage imbalance ratio : 3% or less, Frequency : ± 5%   |
| Construction / cooling system |                              | External cooling / forced ventilation cooling   |
| Arising noise                 |                              | less than 60dB (A)  |
| Applied standard              |                              | IEC 61800-2, IEC 61800-3, EN50082-2, DIN VDE 0160   |
| Condition                     | Installation location        | Indoor, installation within panel (cooling fins installed outside panel possible), less than 1000m elevation (less than 3250m in transit.), not in contact with corrosive gas, flammable gas, dust, and direct sunlight |
|                               | Ambient temperature/humidity | -10 to ±55°C (cooling fins temperature -10 to +40°C)/15 to 85%RH, non-condensing  |
|                               | Vibration                    | 5.9m/s <sup>2</sup> {0.6G} or less  |
|                               | Storage temperature/humidity | -25 to +55°C, 5 to 95%RH, non-condensing  |

**NOTE :** When the power supply voltage differs from the inverter specification voltage, meet the voltage to the specified value by using a power supply transformer. And when the European Standard EN50178 is applied, use the Isolation Transformer.

**Remark :** Imbalance of the power supply voltage [%] =  $\frac{\text{Max. voltage [V]} - \text{Min. voltage [V]}}{\text{Average 3-phse voltage [V]}} \times 100$

**NOTE :** The unit of the FRENIC5000MS5 series does not comply with the European Standard EN50081-2. When the unit needs to comply with the EMC Directive, the compliance with the European Standard EN50081-2 should be considered on the user side.



## h) Main circuit current value

### 1) M5/V5 series

Unit [A]

| Motor rated output [kW] | Package drive unit |  |                                  | Drive unit       |                         | Motor         |
|-------------------------|--------------------|--|----------------------------------|------------------|-------------------------|---------------|
|                         | Unit type          | AC power supply circuit<br>Without AC and DC reactor | Dynamic braking resistor circuit | Unit type        | DC power supply circuit | Rated current |
| 1.1/0.75                | FRN1.1M5-2         | 9.4/6.6  | 1.5                              |                  |                         | 5.3           |
| 2.2/1.5                 | FRN2.2M5/V5-2      | 15.9/11.1  | 2.8                              |                  |                         | 9 (11)        |
| 3.7/2.2                 | FRN3.7M5/V5-2      | 24.6/15.2  | 6.4                              |                  |                         | 13 (17)       |
| 5.5/3.7                 | FRN5.5M5/V5-2      | 33.5/23.3  | 8.0                              |                  |                         | 20 (22)       |
| 7.5/5.5                 |                    |  |                                  | FRN5.5MC5/VC5-2  | 26.7/18.9               | 29 (33)       |
| 11/7.5                  |                    |  |                                  | FRN7.5MC5/VC5-2  | 36.3(53.5)/28.2 (40.3)  | 40 (45)       |
| 15/11                   |                    |  |                                  | FRN11MC5/VC5-2   | 51.4(71.5)/37.4 (50.5)  | 53 (54)       |
| 18.5/15                 |                    |  |                                  | FRN15MC5/VC5-2   | 69.8(93.6)/53.7 (70.4)  | 72 (75)       |
| 22/18.5                 |                    |  |                                  | FRN18.5MC5/VC5-2 | 85.8(111)/73.6 (91.6)   | 86 (88)       |
| 30/22                   |                    |  |                                  | FRN22MC5/VC5-2   | 101/85.4                | 103 (105)     |
| 37/30                   |                    |  |                                  | FRN30MC5/VC5-2   | 138/103                 | (137)         |
| 45/37                   |                    |  |                                  | FRN37VC5-2       | 173/138                 | (167)         |
| 55/45                   |                    |  |                                  | FRN45VC5-2       | 207/174                 | (205)         |
|                         |                    |  |                                  | FRN55VC5-2       | 253/210                 |               |

#### NOTE :

- The values listed above are specified when the AC power supply is 200V/50Hz continuous rated output.
- The main circuit currents indicated as  $\boxed{A}$  /  $\boxed{B}$  are shown in  $\boxed{A}$  when the motor rated output is 50%ED and in  $\boxed{B}$  when it is continuous.
- The AC power supply circuit current values are shown in the total root-mean-square value.
- In the DC power supply circuit, the values outside ( ) show the current values in the case of the regenerating units connected and the ones inside ( ) show the current values in the case of the dynamic braking units connected.
- In the motor rated current, the values outside ( ) are for MVE series and the ones inside ( ) are for MVS series.
- As for the rated output current for the package drive unit and drive unit, refer to Table a) and b) in the page 105.
- When choosing the main circuit parts such as circuit breaker and magnetic contactor, refer to the current values in this table.

### 2) Converter series

Unit [A]

| Motor rated output [kW] | Regenerating unit |  |                         | Dynamic braking unit |  |                         |                         |
|-------------------------|-------------------|--|-------------------------|----------------------|--|-------------------------|-------------------------|
|                         | Unit type         | AC power supply circuit<br>With AC reactor | DC power supply circuit | Unit type            | AC power supply circuit<br>Without AC and DC | DC power supply circuit | Dynamic braking circuit |
| 5.5/3.7                 | FRN5.5PR5-2       | 21.8/15.4                                  | 26.7/18.9               |                      |  |                         |                         |
| 7.5/5.5                 | FRN7.5PR5-2       | 29.3/23.1                                  | 36.3/28.2               |                      |  |                         |                         |
| 11/7.5                  | FRN11PR5-2        | 42.0/30.5                                  | 51.4/37.4               |                      |  |                         |                         |
| 15/11                   | FRN15PR5-2        | 57.1/43.8                                  | 69.8/53.7               |                      |  |                         |                         |
| 18.5/15                 | FRN18.5PR5-2      | 70.0/60.1                                  | 85.8/73.6               |                      |  |                         |                         |
| 22/18.5                 | FRN22PR5-2        | 83.3/73.0                                  | 101/85.4                |                      |  |                         |                         |
| 30/22                   | FRN30PR5-2        | 113/87.6                                   | 138/103                 |                      |  |                         |                         |
| 37/30                   | FRN37PR5-2        | 143/118                                    | 173/138                 |                      |  |                         |                         |
| 45/37                   | FRN45PR5-2        | 180/154                                    | 207/174                 |                      |  |                         |                         |
| 55/45                   | FRN55PR5-2        | 213/180                                    | 253/210                 |                      |  |                         |                         |

#### NOTE :

- The values listed above are specified when the AC power supply is 200V/50Hz continuous rated output.
- The main circuit currents indicated as  $\boxed{A}$  /  $\boxed{B}$  are shown in  $\boxed{A}$  when the motor rated output is 50%ED and in  $\boxed{B}$  when it is continuous.
- The AC power supply circuit current values are shown in the total root-mean-square value.
- As for the DC power supply circuits, the current values in the regenerating unit are in the case of the AC reactors connected and the ones in the dynamic braking units are in the case where neither AC nor DC reactor is connected.
- When choosing the main circuit parts such as circuit breaker and magnetic contactor, refer to the current values in this table.



## 7-2 400V series

### a) M5 series package drive unit individual specification

| Item                        |                       |             | Specification   |            |
|-----------------------------|-----------------------|-------------|---|------------|
| Unit type                   |                       |             | FRN3.7M5-4  | FRN5.5M5-4 |
| Output                      | 50%ED                 | Output [kw] | 3.7   | 5.5        |
|                             |                       | Current [A] | 12  | 15         |
|                             | Continuous            | Output [kw] | 2.2   | 3.7        |
|                             |                       | Current [A] | 8.5   | 11         |
|                             | Overload capacity     |             | 50%ED rated output ×120%, 1min  |            |
| Power supply                | Voltage and frequency |             | 3-phase 3-wire system, 380 to 480V, 50/60Hz                               |            |
|                             | Allowable deviation   |             | Voltage: +10 to −15%, Voltage imbalance ratio: 3% or less, Frequency: ±5% |            |
| Power loss [kw]             |                       |             | 0.165   | 0.230      |
| Mass [kg]                   |                       |             | 6   |            |
| Construction/cooling system |                       |             | External cooling/foced ventilation cooling                                |            |

### b) M5 series drive unit individual specification

| Item                        |                   |             | Specification                              |            |            |              |
|-----------------------------|-------------------|-------------|--|------------|------------|--------------|
| Unit type                   |                   |             | FRN7.5MC5-4                                | FRN11MC5-4 | FRN15MC5-4 | FRN18.5MC5-4 |
| Output                      | 50%ED             | Output [kw] | 7.5  | 11         | 15         | 18.5         |
|                             |                   | Current [A] | 21   | 29         | 37         | 44           |
|                             | Continuous        | Output [kw] | 5.5  | 7.5        | 11         | 15           |
|                             |                   | Current [A] | 17   | 23         | 29         | 38           |
|                             | Overload capacity |             | 50%ED rated output ×120%, 1min             |            |            |              |
| DC power supply             |                   |             | Dynamic braking converter unit             |            |            |              |
| Power loss [kw]             |                   |             | 0.235                                      | 0.320      | 0.400      | 0.550        |
| Mass [kg]                   |                   |             | 6  | 8          |            | 9            |
| Construction/cooling system |                   |             | External cooling/foced ventilation cooling |            |            |              |



**c) M5 series package drive unit and drive unit common specification**

| Item                                 |                              | Specification   |
|--------------------------------------|------------------------------|---|
| Control system                       |                              | Sine wave PWM control and torque-vector control   |
| Acceleration and deceleration system |                              | Torque limit acc. and dec. Soft start and stop (Linear acc. and dec., S curve)  |
| Speed range [r/min]                  |                              | 30 to 6000  |
| Base speed [r/min]                   |                              | 1500  |
| Input                                | Speed setting                | Analog signal : Speed setter, DC0 to 10V<br>Digital signal : Use option card.   |
|                                      | Override                     | 0 to 50% (1% resolution) of speed setting value.  |
|                                      | Contact                      | Forward command, Reverse command, Alarm reset, External alarm input, M gear signal, L gear signal, Coast-to-stop command, Torque limit signal, 2 axes exchange command, Simple ORT start/stop command.  |
| Output                               | Analog signal                | Speed, load meter/DC0 to 10V  |
|                                      | Transistor                   | Zero speed detect., Speed arrival detect., Total alarm output, Arbitrary speed detect., 2axes exchange completion   |
| Driving/Braking system               |                              | 4 quadrant driving/ Dynamic braking (Resistance regenerative braking) : Braking resistance installed separately   |
| Braking torque and frequency         |                              | 50%ED rated torque × 120% : 60 second, 10%ED or 20%ED   |
| Indication                           | Digital indication           | Function code of the function table and data  |
|                                      | Lamp indication              | DC power supply voltage present   |
| Protective function                  |                              | Overcurrent, Fuse blow-out, Overvoltage, Undervoltage, Drive unit overheating, External alarm input, Drive unit overload, Motor overheating, Temperature detecting circuit disconnected, Over speed, Speed deviation over, Current detecting circuit abnormal, Converter unit abnormal, Internal fan abnormal, Memory error, Loader communication error, CPU error, Synchronous communication abnormal, Tuning abnormal |
| Arising noise                        |                              | less than 60dB (A)  |
| Applied standard                     |                              | IEC61800-2, IEC61800-3, EN50082-2, DIN VDE0160  |
| Condition                            | Installation location        | Indoor, installation within panel (cooling fins installed outside panel possible), less than 1000m elevation (less than 3250m in transit), not in contact with corrosive gas, flammable gas, dust, and direct sunlight.   |
|                                      | Ambient temperature/humidity | −10 to +55°C (cooling fins temperature −10 to +40°C) / 15 to 85%RH, non-condensing  |
|                                      | Vibration                    | 5.9m/s <sup>2</sup> {0.6G} or less  |
|                                      | Storage temperature/humidity | −25 to +55°C, 5 to 95%RH, non-condensing  |

**NOTE :** When the power supply voltage differs from the unit specification voltage, meet the voltage to the specified value by using a power supply transformer. And when the European Standard EN50178 is applied, use the Isolation Transformer.

Remark : Imbalance of the power supply voltage [%] = 
$$\frac{\text{Max. voltage [V]} - \text{Min. voltage [V]}}{\text{Average 3-phse voltage [V]}} \times 100$$



#### d) Dynamic braking converter unit individual specification

| Item                        |                              | Specification   |            |            |              |
|-----------------------------|------------------------------|---|------------|------------|--------------|
| Motor rated output [kW]     | 50%ED                        | 7.5   | 11         | 15         | 18.5         |
|                             | Continuous                   | 5.5   | 7.5        | 11         | 15           |
| Unit type                   |                              | FRN7.5PD5-4   | FRN11PD5-4 | FRN15PD5-4 | FRN18.5PD5-4 |
| Power supply                | Voltage and frequency        | 3-phase 3-wire system, 380 to 480V, 50/60Hz   |            |            |              |
|                             | Allowable deviation          | Voltage: +10 to -15%, Voltage imbalance ratio: 3% or less, Frequency: $\pm 5\%$   |            |            |              |
| Power loss [kw]             |                              | 0.080   | 0.100      | 0.160      | 0.230        |
| Mass [kg]                   |                              | 5   | 6          |            |              |
| Driving/Braking system      |                              | Drive: Diode rectifying/Braking: Dynamic braking (Resistance regenerative braking, braking resistance separately installed), 4 quadrant operation   |            |            |              |
| Protective function         |                              | Converter overheating   |            |            |              |
| Construction/cooling system |                              | External cooling/forced ventilation cooling   |            |            |              |
| Arising noise               |                              | less than 60dB (A)  |            |            |              |
| Applied standard            |                              | IEC61800-2, IEC61800-3, EN50082-2, DIN VDE0160  |            |            |              |
| Condition                   | Installation location        | Indoor, installation within panel (cooling fins installed outside panel possible), less than 1000m elevation (less than 3250m in transit), not in contact with corrosive gas, flammable gas, dust, and direct sunlight. |            |            |              |
|                             | Ambient temperature/humidity | -10 to +55°C (cooling fins temperature -10 to +40°C) / 15 to 85%RH, non-condensing  |            |            |              |
|                             | Vibration                    | 5.9m/s <sup>2</sup> {0.6G} or less  |            |            |              |
|                             | Storage temperature/humidity | -25 to +55°C, 5 to 95%RH, non-condensing  |            |            |              |

**NOTE :** When the power supply voltage differs from the inverter specification voltage, meet the voltage to the specified value by using a power supply transformer. And when the European Standard EN50178 is applied, use the Isolation Transformer.

Remark : Imbalance of the power supply voltage [%] = 
$$\frac{\text{Max. voltage [V]} - \text{Min. voltage [V]}}{\text{Average 3-phse voltage [V]}} \times 100$$

**NOTE :** The unit of the FRENIC5000MS5 series does not comply with the European Standard EN50081-2. When the unit the unit needs to comply with the EMC Directive, the compliance with the European Standard EN50081-2 should be considered on the user side.



## e) Main circuit current value

### 1) M5 series package drive unit and drive unit

Unit[A]

| Motor rated output [kW] | Package drive unit |                           |                                  | Drive unit   |                         |
|-------------------------|--------------------|---------------------------|----------------------------------|--------------|-------------------------|
|                         | Unit type          | AC power supply circuit   | Dynamic braking resistor circuit | Unit type    | DC power supply circuit |
|                         |                    | Without AC and DC reactor |                                  |              |                         |
| 3.7/2.2                 | FRN3.7M5-4         | 14.5/8.6                  | 2.0                              |              |                         |
| 5.5/3.7                 | FRN5.5M5-4         | 20.3/13.6                 | 3.0                              |              |                         |
| 7.5/5.5                 |                    |                           |                                  | FRN7.5MC5-4  | 31.2/22.9               |
| 11/7.5                  |                    |                           |                                  | FRN11MC5-4   | 42.6/29.1               |
| 15/11                   |                    |                           |                                  | FRN15MC5-4   | 54.4/39.9               |
| 18.5/15                 |                    |                           |                                  | FRN18.5MC5-4 | 63.1/51.2               |

#### NOTE :

- The values listed above are specified when the AC power supply is 400V/50Hz continuous rated output.
- The main circuit currents indicated as  $\boxed{A}$  /  $\boxed{B}$  are shown in  $\boxed{A}$  when the motor rated output is 50%ED and in  $\boxed{B}$  when it is continuous.
- The AC power supply circuit current values are shown in the total root-mean-square value.
- In the DC power supply circuit, the value in the case of the dynamic braking units connected.
- As for the rated output current for the package drive unit and drive unit, refer to Table a) and b) in the page 109.
- When choosing the main circuit parts such as circuit breaker and magnetic contactor, refer to the current values in this table.

### 2) Converter series

Unit[A]

| Motor rated output [kW] | Dynamic braking unit |                           |                         |                         |
|-------------------------|----------------------|---------------------------|-------------------------|-------------------------|
|                         | Unit type            | AC power supply circuit   | DC power supply circuit | Dynamic braking circuit |
|                         |                      | Without AC and DC reactor |                         |                         |
| 7.5/5.5                 | FRN7.5PD5-4          | 25.5/18.7                 | 31.2/22.9               | 4.1                     |
| 11/7.5                  | FRN11PD5-4           | 34.8/23.7                 | 42.6/29.1               | 6.1                     |
| 15/11                   | FRN15PD5-4           | 44.5/32.6                 | 54.4/39.9               | 8.2                     |
| 18.5/15                 | FRN18.5PD5-4         | 51.5/41.8                 | 63.1/51.2               | 10.0                    |

#### NOTE :

- The values listed above are specified when the AC power supply is 400V/50Hz continuous rated output.
- The main circuit currents indicated as  $\boxed{A}$  /  $\boxed{B}$  are shown in  $\boxed{A}$  when the motor rated output is 50%ED and in  $\boxed{B}$  when it is continuous.
- The AC power supply circuit current values are shown in the total root-mean-square value.
- As for the DC power supply circuits, the current values in the dynamic braking units are in the case where neither AC nor DC reactor is connected.
- When choosing the main circuit parts such as circuit breaker and magnetic contactor, refer to the current values in this table.



## Record of revisions

| Instruction manual number | Date of revision | Contents of revision  |
|---------------------------|------------------|---|
| INR-HF50888               | June 1997        | First edition   |
| INR-HF50888a-JE           | November 1997    | Supplement of contents concerning the regenerating converter unit, and partial supplement and revision of contents. Addition of the English edition.  |
| INR-HF50888b-JE           | November 1998    | Addition of the outer views of FRN37VC5-2 to FRN55VC5-2 and FRN37PR5-2 to FRN55PR5-2 to "2 Unit Outer View". Partial revision of the contents of "3-3 Handling of indicator window cover" with the addition of the outer view. Partial revision of "3-6 Function table". Partial revision of the terminal name and terminal label of "6 Terminals".<br>Changes of "frequency" to "speed" in a) M5 series package drive unit and drive unit individual specification of "7 Standard Specification". Supplement of the European standard number to the applied standard column of "7 Standard Specifications", revision of "NOTE" and supplement of "h) Main circuit current value. |
| INR-HF50888c-JE           | March 2000       | Addition of the method of changing the function data to "3 Data Indicating and Setting Part Handling".<br>Partial revision of the contents of "3-6 Function table" and "5 Trouble shooting". Partial revision of the circuit diagram of "6 Terminals". Addition of the rated output during 30 minutes.  |
| INR-HF50888d-JE           | September 2001   | Addition of contents concerning the M5 400V series.   |
|                           |                  |   |

**NOTE :** *Instruction manual number stated at the right top on the front cover.*



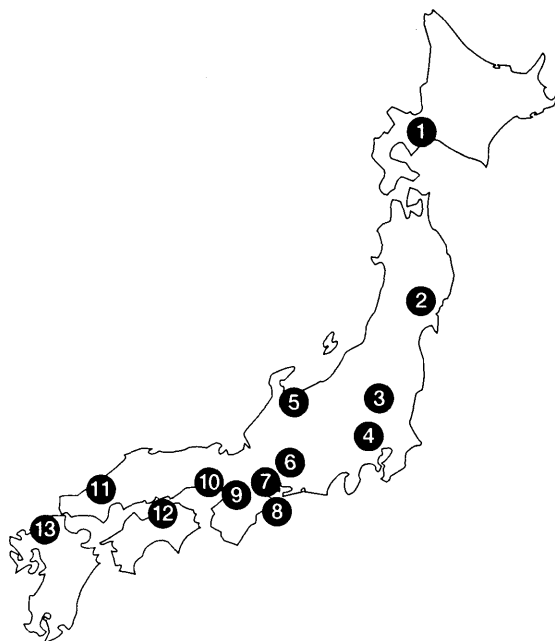
## *NOTES*

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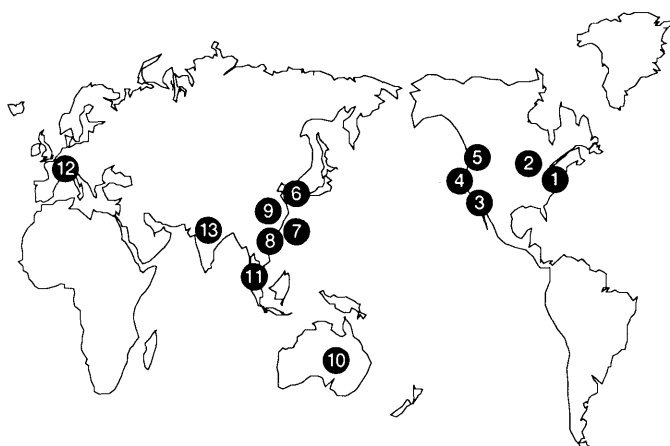
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