# Instruction Manual <br> HITACHI Inverter L300P Series - ... HFE 

Three phase input 200/400V class
NB601EX

## SAFETY

For the Best Results with L300P Series inverter, read this manual and all of the warning sign attached to the inverter carefully before installing and operating it, and follow the instructions exactly. Keep this manual handy for your quick reference.

## Definitions and Symbols

A safety instruction (message) is given with a hazard alert symbol and a signal word;
WARNING or CAUTION. Each signal word has the following meaning throughout this manual.


This symbol means hazardous high voltage. It used to call your attention to items or operations that could be dangerous to you or other persons operating this equipment.
Read these message and follow these instructions carefully.
This is the "Safety Alert Symbol" This symbol is used to call your attention to items or operations that could be dangerous to you or other persons operating this equipment.
Read these messages and follow these instructions carefully.


WARNING

## WARNING

Indicates a potentially hazardous situation which, if not avoided, can result in serious injury or death.

## CAUTION

## CAUTION

Indicates a potentially hazardous situation which, if not avoided, can result in minor to moderate injury, or serious damage of product.
The matters described under $\triangle$ CAUTION may, if not avoided, lead to serious results depending on the situation. Important matters are described
in CAUTION ( as well as WARNING ), so be sure to observe them.

## NOTE

## NOTE

Notes indicate an area or subject of special merit, emphasizing either the product's capabilities or common errors in operation or maintenance.


## HAZARDOUS HIGH VOLTAGE

Motor control equipment and electronic controllers are connected to hazardous line voltages. When servicing drives and electronic controllers, there might be exposed components with cases or protrusions at or above line potential. Extreme care should be taken to product against shock.

Stand on an insulating pad and make it a habit to use only one hand when checking components. Always work with another person in case an emergency occurs. Disconnect power before checking controllers or performing maintenance. Be sure equipment is properly grounded. Wear safety glasses whenever working on an electronic controllers or rotating electrical equipment.

## PRECAUTION

> $\lfloor$ WARNING : This is equipment should be installed, adjusted and serviced by qualified electrical maintenance personal familiar with the construction and operation of the equipment and the hazards involved. Failure to observe this precaution could results in bodily injury.

WARNING: The user is responsible for ensuring that all driven machinery, drive train mechanism not supplied by Hitachi, Ltd., and process line material are capable of safe operation at an applied frequency of $150 \%$ of the maximum selected frequency range to the AC motor. Failure to do so can result in destruction of equipment and injury to personnel should a single point failure occur.

WARNING : For protection, install an earth leakage breaker with a high frequency circuit capable of large currents to avoid an unnecessary operation. The ground faults protection circuit is not designed to protect personal injury.

## WARNING: HAZARD OF ELECTRICAL SHOCK. DISCONNECT INCOMING POWER

 BEFORE WORKING ON THIS CONTROL.WARNING: SEPARATE MOTOR OVERCURRENT, OVERLOAD AND OVERHEATING PROTECTION IS REQUIRED TO BE PROVIDED IN ACCORDANCE WITH THE SAFETY CODES REQUIRED BY JURISDICTIONAL AUTHORITIES.

CAUTION : These instructions should be read and clearly understood before working on L300P series equipment.
$\triangle$ CAUTION : Proper grounds, disconnecting devices and other safety devices and their location are the responsibility of the user and are not provided by Hitachi, Ltd.
$\triangle$ CAUTION : Be sure to connect a motor thermal switch or overload devices to the L300P series controller to assure that inverter will shut down in the event of an overload or an overheated motor.

CAUTION : DANGEROUS VOLTAGE EXISTS UNTIL CHARGE LAMP IS OFF.
$\triangle$ CAUTION : Rotating shafts and above ground electrical potentials can be hazardous. Therefore, it is strongly recommended that all electrical work conform to the National Electrical Codes and local regulations. Installation, alignment and maintenance should be performed only by qualified personnel. Factory recommended test procedures, included in the instruction manual, should be followed. Always disconnect electrical power before working on the unit.

## NOTE : POLLUTION DEGREE 2

The inverter must be used environment of the degree 2.
Typical constructions that reduce the possibility of conductive pollution are;

1) The use of an un-ventilated enclosure
2) The use of a filtered ventilated enclosure when the ventilation is fan forced that is, ventilation is accomplished by one or more blowers within the enclosure that provide a positive intake and exhaust.

## Cautions for EMC (Electromagnetic Compatibility)

You are required to safety the EMC directive (89/336/EEC) when using the L300P inverter in a European country. To safety the EMC directive and to comply with standard, follows the checklist below.

> 1. WARNING : This equipment should be installed, adjusted, and serviced by qualified personal familiar with construction and operation of the equipment and the hazards involved. Failure to observe this precaution could result in bodily injury.
1.The power supply to L300P inverter must meet these specifications:
a. Voltage fluctuation $+/-10 \%$ or less.
b. Voltage imbalance $+/-3 \%$ or less.
c. Frequency variation $+/-4 \%$ or less.
d. Voltage distortion THD $=10 \%$ or less.

## 2.Installation measure:

a. Use a filter designed for L300P inverter.
3.Wiring
a. Shielded wire (screened cable) is required for motor wiring, and the length must be less than 20 meters.
b. The carrier frequency setting must be less than 3 kHz to satisfy EMC requirements.
c. Separate the main circuit from the signal/process circuit wiring.
d. In case of remote operating with connector cable, the inverter does not conform to EMC.
4.Environmental conditions - when using a filter, follow these guidelines:
a. Ambient air temperature: $-10-+40^{\circ} \mathrm{C}$.
b. Humidity: 20 to $90 \%$ RH (non-condensing)
c. Vibration: $5.9 \mathrm{~m} / \mathrm{sec}^{2}(0.6 \mathrm{G}) 10-55 \mathrm{~Hz}$. (L300P-110-300LF/110-300HF)
$2.94 \mathrm{~m} / \mathrm{sec}^{2}(0.3 \mathrm{G}) 10-55 \mathrm{~Hz}$. (L300P-370-750LF/370-1320HF)
d. Location: 1000meters or less altitude, indoors (no corrosive gas or dust)

## Conformity to the Low Voltage Directive (LVD)

The protective enclosure must conform to the Low Voltage Directive.
The inverter can conform to the LVD by mounting into a cabinet or by adding covers as follows.

## 1.Cabinet and Cover

The inverter must be installed into a cabinet which has the protection degree of Type IP2X. In addition the top surfaces of cabinet that are easily accessible shall meet at least the requirements of the Protective Type IP4X, or which is constructed to prevent small objects from entering inverter.


IP4X cabinet


IP20 with louver

Fig. Inverter cabinet

## UL Warnings and Cautions Manual for L300P series

## This auxiliary instruction manual should be delivered to the end user.

## 1. Wiring Warnings for Electrical Practices and Wire Specifications

(1)

WARNING : "Use 60/75 ${ }^{\circ} \mathrm{C}$ CU wire only" or equivalent.
(2)


WARNING :
"Open Type Equipment." For models with L300P 900-1320H.
(3)


WARNING :
"Suitable for use on a circuit capable or delivering not more than 10,000 rms symmetrical amperes, 240 V maximum." For models with suffix L.
(4)WARNING : "Suitable for use on a circuit capable or delivering not more than 10,000 rms symmetrical amperes, 480 V maximum." For models with suffix H .

## 2.Tightening Torque and Wire Range

(1)

Tightening torque and wire range for field wiring terminals are marked adjacent to the terminal or on the wiring diagram.

| Model Name | Tightening Torque [Nom] | Wire Range (AWG) |
| :--- | :--- | :--- |
| L300P-110L | 4.9 | 4 |
| L300P-150L | 4.9 | 2 |
| L300P-185L | 4.9 | 1 |
| L300P-220L | 8.8 | $1 / 0$ |
| L300P-300L | 8.8 | $2 / 0$ |
| L300P-370L | 8.8 | $3 / 0$ or 2 parallel of 1 AWG |
| L300P-450L | 13.7 | 250 kcmil or 2 parallel of 1 AWG (75으) |
| L300P-550L | 13.7 | 350 kcmil or 2 parallel of $1 / 0$ AWG |
| L300P-750L | 13.7 | 350 kcmil or 2 parallel of $1 / 0 \mathrm{AWG}$ |
| L300P-110H | 4.9 | 8 |
| L300P-150H | 4.9 | 6 |
| L300P-185H | 4.9 | 6 |
| L300P-220H | 4.9 | 4 |
| L300P-300H | 4.9 | 3 |
| L300P-370H | 4.9 | 1 |


| L300P-450H | 8.8 | 1 |
| :--- | :--- | :--- |
| L300P-550H | 8.8 | $1 / 0$ |
| L300P- 750 H | 8.8 | 250 kcmil or 2 parallel of $1 \mathrm{AWG}\left(75^{\circ} \mathrm{C}\right)$ |
| L300P-900H | 13.7 | 250 kcmil or 2 parallel of $1 \mathrm{AWG}\left(75^{\circ} \mathrm{C}\right)$ |
| L300P-1100H | 13.7 | 350 kcmil or 2 parallel of $1 / 0 \mathrm{AWG}$ |
| L300P-1320H | 13.7 | 350 kcmil or 2 parallel of $1 / 0$ AWG |

## 3.Circuit Breaker / Fuse Size

(1) WARNING:

Distribution fuse/circuit breaker size marking is included in the manual to indicate that the unit shall be connected with an UL Listed inverse time circuit breaker, rated 600 V with the current ratings or an UL Listed fuse as shown in the table below.

| Model Name | Tightening Torque [Nom] | Wire Range (AWG) |
| :--- | :--- | :--- |
| L300P-110L | 60 | 60 |
| L300P-150L | 70 | 70 |
| L300P-185L | 90 | 90 |
| L300P-220L | 100 | 100 |
| L300P-300L | 150 | 150 |
| L300P-370L | 175 | 175 |
| L300P-450L | 200 | 200 |
| L300P-550L | 250 | 250 |
| L300P-750L | 300 | 300 |
| L300P-110H | 30 | 30 |
| L300P-150H | 35 | 35 |
| L300P-185H | 50 | 50 |
| L300P-220H | 50 | 50 |
| L300P-300H | 70 | 70 |
| L300P-370H | 80 | 80 |
| L300P-450H | 100 | 100 |
| L300P-550H | 125 | 125 |
| L300P-750H | 150 | 150 |
| L300P-900H | - | 200 |
| L300P-1100H | - | 225 |
| L300P-1320H | - | 300 |

## 4.Others

(1) WARNING : "Field wiring connection must be made by an UL Listed and CSA Certified closed-loop terminal connector sized for the wire gauge involved. Connector must be fixed using the crimp tool specified by the connector manufacturer.", or equivalent wording included in the manual.

## Revision History Table

| No. | Revision Contents | The Date <br> of Issue | Operation <br> Manual No. |
| :---: | :--- | :---: | :---: |
| 1 | Initial Release of Manual NB601AX | Sep. 1999 | NB601AX |
| 2 | The data 02 of the command b004 was added <br> The carrier frequency of the capacity 37kW and more was added. | Oct. 1999 | NB601BX |
| 3 | The specification of the capacity 75kW and more was added. | Jun. 2000 | NB601CX |
| 4 | A skipped number. |  | NB601DX |
| 5 | The specification of the capacity $90-132 \mathrm{~kW}$ and more was added | Feb. 2001 | NB601EX |
|  |  |  |  |

## 1.Installation

## CAUTION

- Be sure to install the unit on flame resistant material such as metal. .....  p.2-2 Otherwise, there is a danger of fire.- Be sure not to place anything inflammable in the vicinity.Otherwise, there is a danger of fire.p.2-2- Do not carry unit by top cover, always carry by supporting base of unit.There is a risk of falling and injury.p.2-2- Be sure not to let the foreign matter enter such as cut wire refuse, spatterfrom welding, iron refuse, wire, dust, etc.
Otherwise, there is a danger of fire.
- Be sure to install it in a place which can bear the weight according to the specifications in the text. (Chapter 6. Specifications)p.2-1Otherwise, it may fall and there is a danger of injury.
- Be sure to install the unit on a perpendicular wall which is not subject to vibrationp.2-3
Otherwise, it may fall and there is a danger of injury.
- Be sure not to install and operate an inverter which is damaged or parts of which are missing.p.2-2
Otherwise, there is a danger of injury.
- Be sure to install it in a room which is not exposed to direct sunlight and is well ventilated. Avoid environments which tend to be high in temperature, high in humidity or to have dew condensation, as well as places with dust, corrosive gas, explosive gas, inflammable gas, grinding-fluid mist, salt damage, etc.
Otherwise, there is a danger of fire.


## 2.Wiring

## WARNING

| - Be sure to ground the unit. <br> Otherwise, there is a danger of electric shock and/or fire. |  | p.2-9 |
| :---: | :---: | :---: |
| - Wiring work shall be carried out by electrical experts. Otherwise, there is a danger of electric shock and/or fire. |  | p.2-6 |
| - Implement wiring after checking that the power supply is off. It might incur electric shock and/or fire. |  | p.2-8 |
| - After installing the main body, carry out wiring. Otherwise, there is a danger of electric shock and/or injury. |  | p.2-5 |
| - Do not remove the rubber bush. (11 to 75 kW ) Due to the possibility that a wire may be damaged, shorted or may have a ground fault with the edge of the wiring cover. |  | p.2-4 |

## CAUTION

| Make sure that the input voltage is: <br> Three phase 200 to $240 \mathrm{~V} 50 / 60 \mathrm{~Hz}$ (for models with suffix L) Three phase 380 to $480 \mathrm{~V} 50 / 60 \mathrm{~Hz}$ (for models with suffix H) |  | p.2-6 |
| :---: | :---: | :---: |
| - Be sure not to input a single phase. Otherwise, there is a danger of fire. |  | p.2-8 |
| - Be sure not to connect AC power supply to the output terminals(U, V, W). Otherwise, there is a danger of injury and/or fire. |  | p.2-5 |
| - Be sure not to connect the resistor to DC terminals (PD,P and $N$ ) directly. Otherwise, there is a danger of fire. |  | p.2-5 |
| - Be sure to set the earth leakage breaker or the fuse(s) (the same phase as the main power supply) in the operation circuit. <br> Otherwise, there is a danger of fire. |  | p.2-12 |
| - As for motor leads, earth leakage breakers and electromagnetic contactors, be sure to use the equivalent ones with the specified capacity (rated). Otherwise, there is a danger of fire. |  | p.2-12 |
| - Do not stop operation by switching off the electromagnetic contactors on the primary or secondary sides of the inverter. <br> Otherwise, there is a danger of injury and/or machine breakage. |  | p.2-6 |
| - Fasten the screws with the specified fastening torque. Check so that there is no loosening of screws. <br> Otherwise, there is a danger of fire. |  | p.2-12 |

## 3.Control and operation

## WARNING

- While the inverter is energized, be sure not to touch the main terminal or to check the signal or put on/off wire and/or connector.

Otherwise, there is a danger of electric shock.

- Be sure to turn on the input power supply after closing the front case. While being energized, be sure not to open the front case.p.3-1

Otherwise, there is a danger of electric shock.

- Be sure not to operate the switches with wet hands.

Otherwise, there is a danger of electric shock.

- While the inverter is energized, be sure not to touch the inverter terminals even during stoppage.

Otherwise, there is a danger of electric shock.

- If the retry mode is selected, it may suddenly restart during the trip stop. Be sure not to approach the machine. (Be sure to design the machine so that personnel safety will be secured even if it restarts.)

Otherwise, there is a danger of injury.

- Be sure not to select retry mode for up and down equipment or traveling equipment, because there is output free-running mode in term of retry.

Otherwise, there is a danger of injury and/or machine breakage.

- Even if the power supply is cut for a short period of time, it may restart operation after the power supply is recovered if the operation command is given. If it may incur danger to personnel, be sure to make a circuit so that it will not restart after power recovery.

Otherwise, there is a danger of injury.

- The Stop Key is effective only when the function is set. Be sure to prepare the Key separately from the emergency stop.

Otherwise, there is a danger of injury.

- After the operation command is given, if the alarm reset is conducted, it will restart suddenly. Be sure to set the alarm reset after checking the operation command is off.p.3-1

Otherwise, there is a danger of injury.

- Be sure not to touch the inside of the energized inverter or to put a bar into it.

Otherwise, there is a danger of electric shock and/or fire.

## CAUTION

- Cooling fin will have high temperature. Be sure not to touch them. Otherwise, there is a danger of getting burned.
- Low to high speed operation of the inverter can be easily set. Be sure to operate it after checking the tolerance of the motor and machine.p.3-2

Otherwise, there is a danger of injury.

- Install external break system if needed.

Otherwise, there is a danger of injury.

- If a motor is operated at a frequency higher than standard setting value $(50 \mathrm{~Hz} / 60 \mathrm{~Hz})$,be sure to check the speeds of the motor and the machine with each manufacturer, and after getting their consent, operatep.3-2 them.

Otherwise, there is a danger of machine breakage.

- Check the following before and during the test run.

Otherwise, there is a danger of machine breakage.
Was the direction of the motor correct?
Was the inverter tripped during acceleration or deceleration?
Were the rpm and frequency meter correct?
Were there any abnormal motor vibrations or noise?

## 4.Maintenance, inspection and part replacement

## $\triangle$ WARNING

- After a lapse of more than 10 minutes after turning off the input power supply, perform the maintenance and inspection.
p.5-1

Otherwise, there is a danger of electric shock.

- Make sure that only qualified persons will perform maintenance, inspection and part replacement. (Before starting the work, remove metallic objects from your person (wristwatch, bracelet, etc.)

Otherwise, there is a danger of electric shock and/or injury.

## 5.Others

## $\triangle$ WARNING

## - Never modify the unit.

Otherwise, there is a danger of electric shock and/or injury.

## TABLE OF CONTENTS

Chapter 1 General Descriptions
1.1 Inspection upon Unpacking. ..... 1-1
1.1.1 Inspection of the unit ..... 1-1
1.1.2 Instruction manual ..... 1-1
1.2 Question and Warranty of the Unit ..... 1-2
1.2.1 Request upon asking ..... 1-2
1.2.2 Warranty for the unit. ..... 1-2
1.3 Appearance ..... 1-3
1.3.1 Appearance and Names of Parts ..... 1-3
Chapter 2 Installation and Wiring
2.1 Installation ..... 2-1
2.1.1 Installation ..... 2-2
2.1.2 Blind cover of wiring parts ..... 2-4
2.2 Wiring ..... 2-5
2.2.1 Terminal Connection Diagram ..... 2-6
2.2.2 Main circuit wiring ..... 2-8
2.2.3 Terminal Connection Diagram. ..... 2-13
2.2.4 Digital operator wiring ..... 2-15
Chapter 3 Operation
3.1 Operation ..... 3-3
3.2 Test Run. ..... 3-4
Chapter 4 Explanation of Function
4.1 About Digital Operator (OPE-SR) ..... 4-1
4.2 Code list ..... 4-5
4.3 Explanation of function ..... 4-10
4.3.1 Monitor mode
Output frequency monitor, Output current monitor, Operation direction monitor PID feedback monitor ..... 4-10
Intelligent input monitor, Intelligent output monitor ..... 4-11
Frequency conversion monitor, Output voltage monitor, Input electric power monitor. ..... 4-12
Accumulated time monitor on Run, Power ON time monitor, Trip time monitor, Trip monitor ..... 4-13
4.3.2 Function modeSetting of the output frequency, Operation direction, Selection with limits of operation direction,
Frequency command selection ..... 4-14
Operation command selection, Selection on stop, Selection of the stop key ..... 4-15
Adjustable time ..... 4-16
Base frequency ..... 4-17
Maximum frequency, Carrier frequency ..... 4-18
External analog input ..... 4-19
Input frequency Start/End ..... 4-20
Setting analog input filter, Output voltage gain ..... 4-21
Control system (V/f Characteristic) ..... 4-22
Torque boost ..... 4-24
Direct current braking (DB) ..... 4-25
Frequency limiter ..... 4-28
Frequency jump function, Acceleration stop function ..... 4-29
PID function ..... 4-30
Automatic energy-saving operation function ..... 4-31
Two-stage acceleration and deceleration function (2CH) ..... 4-32
Acceleration and deceleration pattern ..... 4-33
Instantaneous power failure / under-voltage ..... 4-34
Open phase protection function selection, Electronic thermal function ..... 4-36
Overload restriction / Overload advance notice ..... 4-38
Start frequency, Reduced voltage start selection ..... 4-40
BRD (dynamic braking) function, Cooling fan operating selection ..... 4-41
Intelligent input terminal setting, Input terminal $a / b(N O / N C)$ selection ..... 4-42
Multi-speed operation function ..... 4-43
Jogging operation (JG) ..... 4-44
Second control function (SET), Software lock mode selection (SFT) ..... 4-45
Free-run stop (FRS) ..... 4-46
Commercial power source switching (CS) ..... 4-47
Reset (RS) ..... 4-48
Unattended start protection (USP), UP / DOWN selection (UP/DWN). ..... 4-49
External trip (EXT), 3 Wire input function (STA, STP, F/R) ..... 4-50
Intelligent output terminal setting ..... 4-51
Intelligent output terminal $\mathrm{a} / \mathrm{b}(\mathrm{NO} / \mathrm{NC})$ selection ..... 4-52
Signal during run (RUN), Frequency arrival signal (FA1, FA2, FA3) ..... 4-53
RUN time/power ON time over (RNT/ONT), Force operation ope function ..... 4-55
FM terminal ..... 4-56
AM terminal, AMI terminal, External thermistor (TH) ..... 4-57
Initialization setting ..... 4-58
Display selection ..... 4-59
Stabilized factor, Operation selection on option error, Motor constant ..... 4-60
Communication function ..... 4-61
4.4 Protection function list ..... 4-75
4.4.1 Protection function ..... 4-75
4.4.2 Trip monitor display ..... 4-78
4.4.3 Warning Monitor display ..... 4-79
Chapter 5 Maintenance, Inspection
5.1 Precaution for Maintenance/Inspection ..... 5-1
5.1.1 Daily inspection ..... 5-1
5.1.2 Cleaning ..... 5-1
5.1.3 Regular inspection ..... 5-1
5.2 Daily inspection and regular inspection ..... 5-2
5.3 Megger test ..... 5-3
5.4 Withstand Voltage test ..... 5-3
5.5 The method to check Inverter, converter part ..... 5-4
5.6 Capacitor Life Curve ..... 5-5
Chapter 6 Specification
6.1 Standard specification list ..... 6-1
6.2 Dimension ..... 6-2

### 1.1 Inspection upon Unpacking

### 1.1.1 Inspection of the unit

Open the package and pick out the inverter, please check the following item.
If you discover any unknown parts or the unit is in bad condition, please contact your supplier or the local Hitachi Distributor.
(1) Make sure that there was no damage (injury, falling or dents in the body) during transportation of the unit.
(2) After unpacking the unit, make sure that the package contains one operation manual for the Inverter.
(3) Make sure that the product is the one you ordered by checking the specification label.


Picture 1-1 Position of specification label


Picture 1-2 Contents of specifications label

### 1.1.2 Instruction manual

This instruction manual is the manual for the HITACHI Inverter L300P Series.
Before operation of the Inverter, read the manual carefully. After Reading this manual, keep it to hand for future reference.
When using optional units for this inverter; please refer to the instruction manuals packed with the optional units.
This instruction manual should be delivered to the end user.

### 1.2 Question and Warranty of the Unit

### 1.2.1 Request upon asking

If you have any questions regarding damage to the unit, unknown parts or for general inquiries please contact your supplier or the local Hitachi Distributor with the following information.
(1) Inverter Model
(2) Production Number (MFG No.)
(3) Date of Purchase
(4) Reason for Calling

Damaged part and its condition etc.
Unknown parts and their contents etc.

### 1.2.2 Warranty for the unit

The warranty period of the unit is one year after the purchase date.
However within the warranty period, the warranty will be void if the fault is due to;
(1) Incorrect use as directed in this manual, or attempted repair by unauthorized personnel
(2) Any damage sustained, other than from transportation (Which should be reported immediately)
(3) Using the unit beyond the limits of the specification.
(4) Natural Disasters: Earthquakes, Lightning, etc

The warranty is for the inverter only, any damage caused to other equipment by malfunction of the inverter is not covered by the warranty.

Any examination or repair after the warranty period (one year) is not covered. And within the warranty period any repair and examination which results in information showing the fault was caused by any of the items mentioned above,. the repair and examination cost are not covered.
If you have any questions regarding the warranty please contact either your supplier or the local Hitachi Distributor.
Please refer to the back cover for a list of the local Hitachi Distributors.

### 1.3 Appearance

### 1.3.1 Appearance and Names of Parts


(Note)When you use cable for remote operation, please remove connector.

### 2.1 Installation

## $\triangle$ CAUTION

- Be sure to install the unit on flame resistant material such as metal.

Otherwise, there is a danger of fire.

- Be sure not to place anything inflammable in the vicinity. Otherwise, there is a danger of fire.
- Do not carry unit by top cover, always carry by supporting base of unit. There is a risk of falling and injury.
- Be sure not to let the foreign matter enter such as cut wire refuse, spatter from welding, iron refuse, wire, dust, etc.

Otherwise, there is a danger of fire.

- Be sure to install it in a place which can bear the weight according to the specifications in the text. (Chapter 6. Specifications)

Otherwise, it may fall and there is a danger of injury.

- Be sure to install the unit on a perpendicular wall which is not subject to vibration. Otherwise, it may fall and there is a danger of injury.
- Be sure not to install and operate an inverter which is damaged or parts of which are missing. Otherwise, there is a danger of injury.
- Be sure to install it in a room which is not exposed to direct sunlight and is well ventilated. Avoid environments which tend to be high in temperature, high in humidity or to have dew condensation, as well as places with dust, corrosive gas, explosive gas, inflammable gas, grinding-fluid mist, salt damage, etc.

Otherwise, there is a danger of fire.

### 2.1.1 Installation

## 1. Transportation

This inverter has plastic parts. So handle with care.
Do not over tighten the wall mounting fixings as the mountings may crack, causing is a risk of falling.
Do not install or operate the inverter if there appears to be damage or parts missing.
2. Surface for Mounting of Inverter

The temperature of the Inverter heatsink can become very high (the highest being about $150{ }^{\circ} \mathrm{C}$ ). The surface, which you are mounting the Inverter onto, must be made of a non-flammable material (i.e. steel) due to the possible risk of fire. Attention should also be made to the air gap surrounding the Inverter. Especially when there is a heat source such as a breaking resistor or a reactor.


## 3. Operating Environment - Ambient Temperature

The ambient temperature surrounding the Inverter should not exceed the allowable temperature range ( -10 to $40^{\circ} \mathrm{C}$ ). When using at $50^{\circ} \mathrm{C}$ of ambient air temperature, the rated output current will be reduced. (P.4-18)

The temperature should be measured in the air gap surrounding the Inverter, shown in the diagram above. If the temperature exceeds the allowable temperature, the component life will become shortened especially in the case of the Capacitors.

## 4.Operating Environment - Humidity

The humidity surrounding the Inverter should be within the limit of the allowable percentage range (20\% to $90 \%$ ). Under no circumstances should the Inverter be in an environment where there is the possibility of moisture entering the Inverter.

Also avoid having the Inverter mounted in a place that is exposed to the direct sunlight.

## 5. Operating Environment - Air

Install the Inverter avoiding any place that has dust, corrosive gas, explosive gas, combustible gas, mist of coolant and sea damage.
6. Mounting Position

Mount the Inverter in a vertical position using screws or bolts. The surface you mount onto should also be free from vibration and can easily hold the weight of the Inverter.

7. Ventilation within an Enclosure

If you are installing one or more Inverters in an enclosure a ventilation fan should be installed. Below is a guide to the positioning of the fan to take the airflow into consideration. The positioning of Inverter, cooling fans and air intake is very important. If these positions are wrong, airflow around the Inverter decreases and the temperature surrounding the Inverter will rise. So please make sure that the temperature around is within the limit of the allowable range.


## 8.External cooling of Inverter

It is possible to install the inverter so that the heatsink is out of the back of the enclosure. This method has two advantages, cooling of the inverter is greatly increased and the size of the enclosure will be smaller.

To install it with the heatsink out of the enclosure, a metal fitting option is required to ensure heat transfer.
Do not install in a place where water, oil mist, flour and dust etc can come in contact with the inverter as there are cooling fans fitted to the heatsink.
9. Approximate loss for each capacity

| Inverter capacity (kW) | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 | 90 | 110 | 132 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $70 \%$ of rated output (W) | 435 | 575 | 698 | 820 | 1100 | 1345 | 1625 | 1975 | 2675 | 3375 | 3900 | 4670 |
| $100 \%$ of rated output (W) | 600 | 800 | 975 | 1150 | 1550 | 1900 | 2300 | 2800 | 3800 | 4800 | 5550 | 6650 |
| $100 \%$ of rated efficiency(\%) | 94.8 | 94.9 | 95 | 95 | 95 | 95.1 | 95.1 | 95.1 | 95.2 | 95.2 | 95.2 | 95.2 |

### 2.1.2 Blind cover of wiring parts ( 11 to 75 kW )

(1) Cable entry through Rubber Bushes

The wiring should be done after making a cut in the rubber bushes with nippers or cutters.

(2) Cable entry through Conduit

After taking out the rubber bushes, connect the conduit.

(Note) Except for when connecting conduit, Do not take out the rubber bushes. It is possible that the wiring insulation is broken and a possible earth fault is caused.

### 2.2 Wiring

## $\triangle$ WARNING

- Be sure to ground the unit.

Otherwise, there is a danger of electric shock and/or fire.

- Wiring work shall be carried out by electrical experts.

Otherwise, there is a danger of electric shock and/or fire.

- Implement wiring after checking that the power supply is off. It might incur electric shock and/or fire.
- After installing the main body, carry out wiring.

Otherwise, there is a danger of electric shock and/or injury.

- Do not remove the rubber bush. (11 to 75 kW )

Due to the possibility that a wire may be damaged, shorted or may have a ground fault with the edge of the wiring cover.

## CAUTION

- Make sure that the input voltage is:

Three phase 200 to $240 \mathrm{~V} 50 / 60 \mathrm{~Hz}$ (for models with suffix L)
Three phase 380 to $480 \mathrm{~V} 50 / 60 \mathrm{~Hz}$ (for models with suffix H)

- Be sure not to input a single phase.

Otherwise, there is a danger of fire.

- Be sure not to connect AC power supply to the output terminals(U, V, W).

Otherwise, there is a danger of injury and/or fire.

- Be sure not to connect the resistor to DC terminals (PD,P and N) directly. Otherwise, there is a danger of fire.
- Be sure to set the earth leakage breaker or the fuse(s) (the same phase as the main power supply) in the operation circuit.

Otherwise, there is a danger of fire.

- As for motor leads, earth leakage breakers and electromagnetic contactors, be sure to use the equivalent ones with the specified capacity (rated).

Otherwise, there is a danger of fire.

- Do not stop operation by switching off the electromagnetic contactors on the primary or secondary sides of the inverter.

Otherwise, there is a danger of injury and/or machine breakage.

- Fasten the screws with the specified fastening torque. Check so that there is no loosening of screws. Otherwise, there is a danger of fire.


### 2.2.1 Terminal Connection Diagram (sink type)



### 2.2.1 Terminal Connection Diagram (source type)


(1) Explanation of main circuit terminals

| Symbol | Terminal Name | Explanation of contents |
| :---: | :--- | :--- |
| R, S, T <br> $(\mathrm{L} 1, \mathrm{~L} 2, \mathrm{~L} 3)$ | Main power | Connect alternating power supply. When using regenerative converter <br> and HS900 series, don't connect. |
| $\mathrm{U}, \mathrm{V}, \mathrm{W}$ <br> $(\mathrm{T} 1, \mathrm{~T} 2, \mathrm{T3})$ | Inverter output | Connect three-phase motor. |
| $\mathrm{PD}, \mathrm{P}$ <br> $(+1,+)$ | D.C.reactor | Remove the short bar between PD and P, connect optional Power factor <br> reactor (DCL-XX). |
| $\mathrm{P}, \mathrm{RB}$ <br> $(+, \mathrm{RB})$ | External braking resistor | Connect optional External braking resistor. <br> (Installed on 11kW and 15kW) |
| P, N <br> $(+,-)$ | External Regenerative unit | Connect optional Regenerative braking unit (BRD-XX). |
| G <br> E | Inverter earth terminals | It is earth terminals of inverter case. |

(2) Explanation of control circuit terminal

|  |  | Symbol | Terminal Name | Explanation of contents |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \stackrel{0}{3} \\ & \frac{0}{N} \\ & \frac{0}{\mathbb{N}} \end{aligned}$ |   <br>  $\pm$ <br> 0 0 <br> 0 $\vdots$ <br> 0 0 <br> 0 0 | L | Analogue power common | It is common terminal of frequency command signal ( $\mathrm{O}, \mathrm{O} 2, \mathrm{OI}$ ) and analogue output, AM, AMI. Don't earth. |  |
|  |  | H | Frequency power | It is the DC+10V power for terminals. | Allowable load current 20 mA |
|  |  | 0 | Frequency command power terminal (voltage) | When inputting DC $0-10 \mathrm{~V}$, it is maximum frequency on 10 V . When maximum frequency is expected to be on being less than 10V, set with A014. | Input Impedance 10k ohm Allowable maximum voltage 12 V |
|  |  | O2 | Frequency command support (voltage) | When inputting DC $0-+-10 \mathrm{~V}$, this signal is added to frequency command of O or Ol terminal. | Input Impedance 10k ohm Allowable maximum load voltage + -12V |
|  |  | OI | Frequency command Terminal (current) | When inputting DC $4-20 \mathrm{~mA}, 20 \mathrm{~mA}$ is maximum frequency. When only At terminal is ON, this input signal is effective. | Input Impedance 100 ohm Allowable maximum current 24 mA |
|  | $\begin{aligned} & \frac{\square}{3} \\ & \frac{1}{\overline{0}} \\ & \frac{1}{2} \end{aligned}$ | AM | Digital monitor (voltage) | Output one selected from monitor item output frequency, output current, LAD frequency output voltage, input electric power, and electric thermal rate. | Allowable maximum current 2 mA |
|  |  | AMI | Analogue monitor (current) |  | Allowable output less than Impedance 250 ohm |
|  |  | FM | Digital monitor (voltage) | Output the output frequency with digital besides above monitor. | ```Allowable maximum current 1.2mA Maximum frequency 3.6kHz``` |
|  |  | P24 | Interface power | It is DC24V power for connection input signal. When selecting source logic, it's for connection input common. | Allowable maximum output current 100 mA |
|  |  | CM1 | Interface power common | The common terminal is FW terminal, $1-5$ terminal, TH terminal, FM terminal, Don't earth. |  |
|  |  | PLC | Intelligent input common | Change sink type and source type by short bar on control terminals. P24-PLC: Sink type CM1-PLC: Source type |  |
|  |  | FW | Forward command | About FW signal, ON is Forward and OFF is stop command. | Allowable maximum voltage 27 V Input ON condition of terminal voltage Over 18V <br> Input OFF condition of terminal voltage Under 3V Input impedance 4.7 k ohm |
|  |  | $\begin{aligned} & 1 \\ & 2 \\ & 3 \\ & 4 \\ & 5 \end{aligned}$ | Intelligent input | Select 5 functions from 33 functions, and divide between 1 terminal and 5 terminals. |  |
|  |  | 11A | Intelligent output terminal 11 | Select output function and assign it output terminal 11 | Contact specification Maximum <br> AC250V,5A (R load) 1A (L load) DC30V,5A,(R load) <br> 1A (L load) minimum DC1V,1mA |
|  |  | 11C | Common terminal | It is common terminal of intelligent output terminal 11. |  |
|  |  | 12A | Intelligent output terminal 12 | Select output function and assign it output terminal 12 |  |
|  |  | 12C | Common terminal | It is common terminal of intelligent output terminal 12 |  |
|  |  | $\begin{aligned} & \text { AL1 } \\ & \text { AL2 } \end{aligned}$ | Alarm output terminal | Assign output function. Output is c contact. | Contact specification Maximum <br> AL1-ALO <br> AC250V,2A (R load) <br> 0.2 A (L load) <br> AL2-ALO <br> AC250V, 1A,(R load) <br> 0.2 A (L load) <br> minimum AC100V, 10 mA |
|  |  | ALO | Common terminal | It is common terminal of alarm output terminal. |  |
|  |  | TH | Thermistor input terminal | When a Thermistor signal is inputted to terminals TH and CM1, the Inverter checks for over-temperature and will cause trip event and turn off output motor | Allowable maximum resistance 10k ohm ,minimum power 100 mW |

### 2.2.2 Main circuit wiring

(1) Warning on wiring

When carrying out work on the Inverter wiring make sure to wait for at least ten minutes before you remove the cover. Making sure to check that the charge lamp is not illuminated. A final check should always be made with a voltage meter. After removing the power supply, there is a time delay before the capacitors will dissipate their charge.

1. Main power terminals( $R, S, T$ )

- Connect the main power terminals ( $\mathrm{R}, \mathrm{S}$, and T ) to the power supply through a electromagnetic contactor or an earth-leakage breaker.
-We recommend connecting the electromagnetic contactor to the main power terminals. Because when the protective function of inverter operates, it isolates the powers supply and prevent the spread of damages and accidents.
- This unit is for the three-phase power supply. It isn't for the single-phase power supply. If you require a single-phase power supply unit, please contact us.
- Don't operate with on/off of the switch set up in the converter side and the inverter side. Do an operation stop by the operation order (FW/RV) terminals
- This inverter becomes the following condition at the time of open phase because open phase protection is being made ineffective by the early data.

R phase or T phase, open phase condition: The power isn't turned on, and it doesn't operate.
S phase, open phase condition: It becomes single-phase operation condition. Trip operation such as a deficiency voltage or over current may be done.

Don't use it under open phase condition.

- A converter module may be damaged in the case shown below. Be careful.

When an unbalance of the power supply voltage is more than $3 \%$.
Power supply capacity, 10 times of the capacity of inverter and a case beyond 500kVA.
When a change in the rapid power supply voltage occur.
(Example) When inverter of the plural is installed with the common electric wire whose it is short by each other.
When there is insertion of the condenser or a removal.

- On/off of the power supply isn't to do it more than three times in one minute. It has the possibility that inverter is damaged.

2. Inverter output terminals ( $\mathrm{U}, \mathrm{V}$, and W )

- Wire with thicker wire than the applicable wire to control the voltage drop. Particularly when outputting low frequencies, the torque of the motor will reduce by the voltage drop of the wire.
- Do not install power factor correction capacitors or a surge absorber to the output. The inverter will trip or sustain damage to the capacitors or the surge absorber.
- In the case of the cable length being more than 20 meters, it is possible that a surge voltage will be generated and damage to the motor is caused by the floating capacity or the inductance in the wire ( 400 V especially). An EMC Mains Filter is available, please contact us.
- In the case of two or more motors, install a thermal relay to each motor.
- Make the RC value of the thermal relay the value of 1.1 times of motor rated electric current. Install output ACL when a life becomes short by the length of wiring.

3. Direct current reactor (DCL) connection terminals (PD, P)

- These are the terminals to connect the current reactor DCL (Option) to help improve the power factor.
- The short bar is connected to the terminals when shipped from the factory, if you are to connect a DCL you
will need to disconnect the short bar first.
- When you don't use a DCL, don't disconnect the short bar.

4. External braking resistor connection terminals ( $\mathrm{P}, \mathrm{RB}$ )

- The regenerative braking circuit (BRD) is built-in as standard up to the 15 kW Inverter. When braking is required, install an external-braking resistor to these terminals.
- The cable length should be less than 5 meters, and twist the two connecting wires to reduce inductance.
- Don't connect any other device other than the external braking resistor to these terminals.
- When installing an external braking resistor make sure that the resistance is correctly rated to limit the current drawn through the BRD.

5. Regenerative breaking unit connection terminals (P, N)

- The Inverters rated more than 18.5 kW don't contain a BRD circuit. If regenerative braking is required an external BRD circuit (Option) is required along with the resistor (Option).
- Connect external regenerative braking unit terminals ( $P, N$ ) to terminals ( $P, N$ ) on the inverter. The braking resistor is then wired into the External Braking unit and not directly to the Inverter.
- The cable length should be less than 5 meters, and twist the two connecting wires to reduce inductance.


## 6. Earth $(\mathrm{G} \rightleftharpoons)$ )

- Make sure that you securely ground the Inverter and motor for prevention of electric shock.
- The inverter and motor must be connected to an appropriate safety earth and follow the local standard. Failure to do so constitutes an electrical shock hazard.
(2) Wiring of main circuit terminals

The wiring of main circuit terminals for inverter is the following picture.


## Chapter 2 Installation and Wiring

(3) Wiring Equipment

(4) Common applicable tools

|  | Motor <br> Output <br> (kW) | Applicable Inverter model | Power lines R,S,T,U,V, W,P,PD,N |  | Earth line G |  |  | External resister between $P$ and RB |  | $\left\{\begin{array}{c} \text { Screw } \\ \text { size of } \\ \text { terminal } \end{array}\right.$ | Terminal | TightningTorquemax$(\mathrm{N} \cdot \mathrm{m})$ | Applicable tools |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | $\begin{gathered} \mathrm{mm}^{2} \\ \text { or } \\ \text { more } \end{gathered}$ | AWG or more | $\begin{gathered} \mathrm{mm}^{2} \\ \text { or } \\ \text { more } \end{gathered}$ | AWG or more | AWG or more (\#5) | $\mathrm{mm}^{2}$ | AWG |  |  |  | Leak breaker (ELB) | Circuit breaker or fuse | Electromagnetic controller (Mg) |
| $\begin{aligned} & 0 \\ & \text { N } \\ & \frac{\pi}{0} \\ & \text { D} \\ & \text { N} \end{aligned}$ | 11 | L300P-110LF | 14 | 4 | 14 | 4 | 10 | 5.5 | 8 | M6 | 14-6 | 4.9 | RX100(75A) | 60A | H50 |
|  | 15 | L300P-150LF | $\begin{gathered} 22 \\ (\text { Note 1) } \end{gathered}$ | 2 | 22 | 3 | 8 | 5.5 | 8 | M6 | 22-6 | 4.9 | RX100(100A) | 70A | H65 |
|  | 18.5 | L300P-185LF | 30 | 1 | 22 | 3 | 8 | - | - | M6 | 38-6 | 4.9 | RX100(100A) | 90A | H80 |
|  | 22 | L300P-220LF | 38 | 1/0 | 30 | 2 | 8 | - | - | M8 | 38-8 | 8.8 | RX225B(150A) | 100A | H100 |
|  | 30 | L300P-300LF | 60 (Note 1) | 2/0 | 30 | 2 | 6 | - | - | M8 | 60-8 | 8.8 | RX225B(200A) | 150A | H125 |
|  | 37 | L300P-370LF | 100 <br> $(38 \times 2)$ <br> (Note 1) | (\#1) | 50 | 1/0 | 6 | - | - | M8 | $\begin{aligned} & 100-8 \\ & (38-8) \end{aligned}$ | 8.8 | RX225B(225A) | 175A | H150 |
|  | 45 | L300P-450LF | $\begin{array}{\|c\|} \hline 100 \\ (38 \times 2) \\ \hline \end{array}$ | (\#2) | 80 | 3/0 | 6 | - | - | M10 | $\begin{array}{\|l\|} \hline 100-10 \\ (38-10) \\ \hline \end{array}$ | 13.7 | RX225B(225A) | 200A | H200 |
|  | 55 | L300P-550LF | 150 <br> $(60 \times 2)$ <br> (Note 1) | (\#3) | 80 | 3/0 | 4 | - | - | M10 | $\begin{aligned} & 150-10 \\ & (60-10) \end{aligned}$ | 13.7 | RX400B(350A) | 250A | H250 |
|  | 75 | L300P-750LF | 150 <br> $(60 \times 2)$ <br> (Note 1) | (\#3) | 100 | 4/0 | 4 | - | - | M10 | $\begin{aligned} & 150-10 \\ & (60-10) \end{aligned}$ | 13.7 | RX400B(350A) | 300A | H300 |
| $\begin{gathered} \infty \\ \frac{0}{0} \\ \frac{0}{0} \\ 2 \\ 0 \\ \hline \end{gathered}$ | 11 | L300P-110HF | 5.5 | 8 | 5.5 | 8 | 10 | 5.5 | 8 | M6 | 5.5-6 | 4.9 | EX50C(50A) | 30A | H25 |
|  | 15 | L300P-150HF | 8 | 6 | 8 | 8 | 10 | 5.5 | 8 | M6 | 8-6 | 4.9 | EX60B(60A) | 35A | H35 |
|  | 18.5 | L300P-185HF | 14 | 6 | 14 | 4 | 10 | - | - | M6 | 14-6 | 4.9 | EX60B(60A) | 50A | H50 |
|  | 22 | L300P-220HF | 14 | 4 | 14 | 4 | 10 | - | - | M6 | 14-6 | 4.9 | RX100(75A) | 50A | H50 |
|  | 30 | L300P-300HF | 22 | 3 | 22 | 3 | 10 | - | - | M6 | 22-6 | 4.9 | RX100(100A) | 70A | H65 |
|  | 37 | L300P-370HF | 38 | 1 | 22 | 3 | 8 | - | - | M6 | 38-6 | 4.9 | RX100(100A) | 80A | H80 |
|  | 45 | L300P-450HF | 38 | 1 | 22 | 1 | 8 | - | - | M8 | 38-8 | 8.8 | RX225B(150A) | 100A | H100 |
|  | 55 | L300P-550HF | 60 | 1/0 | 30 | 1 | 6 | - | - | M8 | 60-8 | 8.8 | RX225B(175A) | 125A | H125 |
|  | 75 | L300P-750HF | $\begin{gathered} 100 \\ (38 \times 2) \\ \hline \end{gathered}$ | (\#2) | 50 | 1/0 | 6 | - | - | M8 | $\begin{aligned} & \hline 100-8 \\ & (38-8) \\ & \hline \end{aligned}$ | 8.8 | RX225B(225A) | 150A | H150 |
|  | 90 | L300P-900HF | $38 \times 2$ | (\#2) | 50 | 3/0 | 6 | - | - | M10 | 38-10 | 13.7 | RX225B(225A) | 200A | H200 |
|  | 110 | $\begin{aligned} & \text { L300P- } \\ & 1100 \mathrm{HF} \end{aligned}$ | $60 \times 2$ | (\#3) | 80 | 3/0 | 4 | - | - | M10 | 60-10 | 13.7 | RX400B(350A) | 250A | H250 |
|  | 132 | $\begin{aligned} & \text { L300P- } \\ & 1320 \mathrm{HF} \end{aligned}$ | $80 \times 2$ | (\#3) | 100 | 4/0 | 4 | - | - | M10 | 80-10 | 13.7 | RX400B(350A) | 300A | H300 |

\#1 $3 / 0$ or 2 parallel of 1 AWG \#2 250 kcmil or 2 parallel of $1 \mathrm{AWG}\left(75^{\circ} \mathrm{C}\right)$ \#3 350 kcmil or 2 parallel of $1 / 0 \mathrm{AWG}$
\#4 Use suitable fuse with an UL-listed for UL. \#5 Conformity to the UL
(Note) Field wiring must be made by an UL-listed and CSA-certified closed-loop terminal connector sized for the wire gauge involved. Connector must be fixed by using the crimping tool specified by the connector manufacture or equivalent wording included in the manual.
(Note 1) If wires are shorter than 10 m and are located within an enclosure, it is possible to use following power lines.

| Inverter <br> Model | Power lines |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | mm <br> or <br> more | AWG <br> or <br> more | Heat <br> resistant |  |
| 150LF | 14 | 4 | $110^{\circ} \mathrm{C}$ | $14-6$ |
| 300LF | 38 | $1 / 0$ | $110^{\circ} \mathrm{C}$ | $38-8$ |
| 370LF | 60 | $2 / 0$ | $110^{\circ} \mathrm{C}$ | $60-8$ |
| 550LF,750LF | 100 | $(\# 2)$ | $110^{\circ} \mathrm{C}$ | $100-10$ |

## $\triangle$ WARNING

Use suitable circuit breaker or fuse listed in this manual for UL's listing purpose.
Otherwise, there is a danger of fire.
5) Connecting power to the control circuit, separating from main power

When the protection circuit of inverter is activated and the electromagnetic contactor on the input supply to the inverter isolates the power supply, the control circuit power supply from the inverter will also switch off and the alarm output signal will not be hold. The power terminals R0 and T0 are designed to allow a supply to go direct to the control circuit and therefore keep the alarm output signal on. In this case, please connect power terminals R0 and T0, to the primary side of the electromagnetic contactor. (inverter unit side of ACL, EMI filter, on using input ACL, EMI filter).

## (Connection)

[3] Connect power supply for control circuit to power terminals.

$$
\begin{aligned}
& \text { The specification of the receiving voltage } \\
& 200 \sim 240 \mathrm{~V} \pm 10 \%(50 / 60 \mathrm{~Hz} \pm 5 \%) \\
& \frac{(D C 282 \sim 339 \mathrm{~V})}{} \begin{array}{l}
380 \sim 480 \mathrm{~V} \pm 10 \%(50 / 60 \mathrm{~Hz} \pm 5 \%) \\
(\mathrm{DC} 537 \sim 678 \mathrm{~V})
\end{array}
\end{aligned}
$$



### 2.2.3 Terminal Connection Diagram

## (1) Wiring

1. Both the CM1 and $L$ terminal is insulated to both the common terminal of the input and output signals. Do not short or earth these common terminals.
2. Use twisted screened cable, for the input and output wires of the control circuit terminals. Connect the screen to the common terminal.
3. Limit connection wires to 20 m . When it is necessary to wire over 20 m , use a VX applied controller RCD-A (Remoter operation bar) or a CVD-E (Insulated signal transducer).
4. Separate the control circuit wiring from the main power and relay control wiring.
5. If control and power wires must cross make sure they cross at 90 degrees to each other.
6. When connecting a thermistor to the TH and CM1 terminal, twist the thermistor cables separate from the rests.

7. When using relays for the FW terminal or an intelligent input terminal uses a control relay as they are designed to work with 24 Vdc .
8. When the relay is used as an intelligent output, connect a diode for surge protection parallel to the coil.
9. Do not short the analogue voltage terminals H and L or the internal power terminals PV24 and CM1. There is risk of Inverter damage.
(2) Layout of control circuit terminals

| H | O2 | AM | FM | TH | FW | 5 | 4 | 3 | 2 | 1 | AL1 |  |
| :--- | :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| L | O | OI | AMI | P24 | PLC | CM1 | 12 C | 12 A | 11 C | 11 A | ALO | AL2 |

The terminal screw size; M3
(3)Change of input logic type

The logic type of intelligent input terminals is sink type (Factory Default). To change the input logic type into source type, take off the short bar between P24 and PLC on the control terminal and connect it between PLC and CM1.
(4) The connection to the input programmable logic controller (sequencer)


### 2.2.4 Digital operator wiring

For operating this inverter, it can use digital operator OPE-SR, OPE-SRE, OPE-S, SRW-0J and SRW-0EX. For remote operating, put off digital operator from inverter and use connector cable ICS-1(1m) or ICS3(3m).
(Note 1) When using connector cable, be sure to use less than 3 m length. Otherwise, there is a danger of malfunction.
(Note 2) In case of remote operating with connector cable, the inverter does not conform to EMC.

## \. WARNING

- Be sure not to touch the main terminal or to check the signal or put on/off wire and/or connector. Otherwise, there is a danger of electric shock.
- Be sure to turn on the input power supply after closing the front cover.

While being energized, be sure not to open the front cover.
Otherwise, there is a danger of electric shock.

- Be sure not to operate the switches with wet hands. Otherwise, there is a danger of electric shock.
- While the inverter is energized, be sure not to touch the inverter terminals even during stoppage. Otherwise, there is a danger of electric shock.
- If the retry mode is selected, it may suddenly restart during the trip stop. Be sure not to approach the machine. (Be sure to design the machine so that personnel safety will be secured even if it restarts.) Otherwise, there is a danger of injury.
- Be sure not to select retry mode for up and down equipment or traveling equipment, because there is output free-running mode in term of retry.

Otherwise, there is a danger of injury and/or machine breakage.

- Even if the power supply is cut for a short period of time, it may restart operation after the power supply is recovered if the operation command is given. If it may incur danger to personnel, be sure to make a circuit so that it will not restart after power recovery.

Otherwise, there is a danger of injury.

- The Stop Key is effective only when the function is set. Be sure to prepare the Key separately from the emergency stop.

Otherwise, there is a danger of injury.

- After the operation command is given, if the alarm reset is conducted, it will restart suddenly. Be sure to set the alarm reset after checking the operation command is off.

Otherwise, there is a danger of injury.

- Be sure not to touch the inside of the energized inverter or to put a bar into it. Otherwise, there is a danger of electric shock and/or fire.


## CAUTION

- Cooling fin will have high temperature. Be sure not to touch them.

Otherwise, there is a danger of getting burned.

- Low to high speed operation of the inverter can be easily set. Be sure to operate it after checking the tolerance of the motor and machine.

Otherwise, there is a danger of injury.

- Install external break system if needed.

Otherwise, there is a danger of injury.

- If a motor is operated at a frequency higher than standard setting value $(50 \mathrm{~Hz} / 60 \mathrm{~Hz})$, be sure to check the speeds of the motor and the machine with each manufacturer, and after getting their consent, operate them.

Otherwise, there is a danger of machine breakage.

- Check the following before and during the test run.

Otherwise, there is a danger of machine breakage.
Was the direction of the motor correct?
Was the inverter tripped during acceleration or deceleration?
Were the rpm and frequency meter correct?
Were there any abnormal motor vibrations or noise?

### 3.1 Operation

This inverter requires two different signals in order for the Inverter to operate correctly. The Inverter requires both an operation setting and a frequency setting.
The following indicates the details of each method of operation and the necessary instructions for operation.
(1) Operation setting and a frequency setting by the terminal control.

This is the method by connecting signals from the outside (the frequency setting, the starting switch etc.) with the control circuit terminals.

The operation is started when the operation setting (FW, RV) is turned ON while the input power is turned ON.
(Note) The methods of the setting frequency with terminal are the voltage setting and the electric setting. And they are selective by each system. The control circuit terminal list shows this in detail.
(Necessary things for operation)
[1] The operation setting: switch, relay etc.
[2] The frequency setting: signals from volume or external (DC0-10V, DC-10-10V, 4-20mA etc.)

(2) Operation setting and frequency setting with the digital operator.

This is the method for operation from the digital operator, which comes equipped with the inverter as standard, or the remote operator (SRW) keypad.
When the digital operator sets the operation, the terminals (FW, RV) don't need to be linked.
And it is possible to select frequency from the digital operator as a method of the frequency setting too.
(Necessary things for operation)
[1] Remote Operator (SRW) (It's unnecessary in case of digital operator operation)

(3) Operation setting and frequency setting from both digital operator and terminal operator This is the method of inverter operating from both of the above two operating methods It is possible that the operation setting and the frequency setting can be selected for both the digital operator and the terminal operator each separately.

### 3.2 Test Run

This is the common connection example. Please refer to 4.1 Digital Operator, for the detailed use of the digital operator (OPE-SR).
(1) To input the operation setting and the frequency setting from terminal control.

(Arrangements)
[1] Please make sure that the connections are correctly secure.
[2] Turn the ELB ON to supply power to the inverter.
(The red LED "POWER" on the digital operator should illuminate.)
[3] Set terminal with the frequency setting selection.
Set A001 as indication code, press the Fund key once. (Two figures are shown.)
Set 01 with the key or the key, press the key once to set the frequency setting for terminal. (Indication code turns back to A001.)
[4] Set terminal with the operation setting selection.
Set A002 as indication code, press the Fund key once. (Two figures are shown.)
Set 01 with the key or the key; press the key once to set the operation setting for terminal.
(Indication code turns back to A002.)
[5] Set monitor mode.
When monitoring the output frequency, set indication code to d001, and press the Or when monitoring the operating direction, set indication code to d003, press the
 key once. key once.
[6] Input starting operation setting.
Turn ON between [FW] and [CM1] of terminal.
Impress voltage between [ O ] and [ L ] of terminal to start operation.
[7] Input ending operation setting.
Turn OFF between [FW] and [CM1] to stop slowly down.
(2) Operation setting and the frequency setting from the digital operator (Remote Operator (SRW) is also same use.)

(Arrangements)
[1] Please make sure that there isn't matter about the connection.
[2] Turn the ELB on to supply power to the inverter.
(The red LED "POWER" on the digital operator should illuminate.)
[3] Set operator with the frequency setting selection.
Set A001 as indication code, press the fence key once.
(Two figures are shown.)
Set 02 with the key or the key, press the key once to set the frequency setting for the operator.
(Indication code turns back to A001.)
[4] Set operator with the operation setting selection.
Set A002 as indication code, press the

key once.
(Two figures are shown.)
Set 02 with thekey or the
 key, press the
 key once to set the operation setting for the operator. (Indication code turns back to A002.)
[5] Set the output frequency
Set F001 as indication code, as press the Fund key once.
(Indication code of four figures is shown.)
Set to the desired output frequency with the
(1) key or the 2 key, press the key once to store it.
(Indication code turns back to F001.)
[6] Set the operation direction.
Set F004 as indication code, press the
 key once. (00 or 01 is shown.)

Set operation direction to 00 in case of forward, or to 01 in case of reverse with the (4) key or the (2) key. Press the str key once to establish it. (Indication code turns back to F004.)
[7] Set monitor mode.
When monitoring the output frequency, set indication code to d001, and press the
Or when monitoring the operation direction, set indication code to d003, press the key once. (Indication code are forward,
[8] Press the kun key to start operating.
(The green LED "RUN" turns on a light, and the indication changes in response to the monitor mode set.)
[9] Press the
 key to decelerate to a stop.
(When the frequency turn back to 0 , the green LED "RUN" light will switch off.)

## $\triangle$ CAUTION

Make sure that the direction of the motor is correct. It is in danger of injury or machine damage. Make sure there is no abnormal noise and vibration. It is in danger of injury or machine damage.

Make sure that there is no tripping during the acceleration and deceleration and check that the revolution per minute and the frequency meter are correct.
When overcurrent tripping or overvoltage tripping occurs during the test run, increase the acceleration time or the deceleration time.

## Chapter 4 Explanation of function

### 4.1 About Digital Operator (OPE-SR)

Explanation of operating the digital operator (OPE-SR)
L300P series operates by using the digital operator, which is fitted as standard.

1. Name and contents of each part of the digital operator


| Name |  |
| :--- | :--- |
| Monitor | Display of frequency, output current and set value |
| Lamp on RUN <br> (Operation) | Light on when the inverter is running |
| Program lamp | Light on when displaying set value of each function in monitor section <br> Light will flash On and Off as a warning (when set value is incorrect) |
| POWER lamp | Power lamp of control circuit |
| ALARM lamp | Light on when the Inverter trips |
| Monitor lamp | Lamp display state of monitor section. <br> Hz : Frequency V $:$ Voltage A : Current $\quad$ kW : Electric power $\quad$ \% : Rate |
| Volume lamp | Light on when the frequency can be set by the volume for frequency setting |
| Operation command <br> Display lamp | Light on only when operating command (RUN/STOP) is set in operator |
| RUN key | Run command to start the motor. But this is only valid when operation command is <br> from the operator. (Be sure that the operation command display lamp is illuminated.) |
| STOP (STOP/RESET) key | This key is used to stop motor, or reset an alarm. |
| Volume for frequency <br> setting | This can be used to set the output frequency. But this is only valid when the frequency <br> command part is set in volume. |
| FUNC (Function) key | The key containing monitor mode, basic setting mode, extension functions mode. |
| STR (Store) key | The key to store the data set. (On changing set value, must be pushed or value is lost.) |
| UP/DOWN key | The keys to change extension function mode, function mode and set value. |

## 2. Operating method

(1) Method to display monitor mode, basic setting mode, extension function mode


When power is turned off while the basic setting mode or the extension setting mode is displayed.
(Display d001)


Monitor mode is displayed by pushing FUNC (Function) key once when display of Monitor mode No.
[5] Display monitor code No.
(Display d001)


Return to the state of [2].

The display will be different from the one above when the power is restored.

( 6 times)
key.
(6 times)
[4] Display extension function mode
(Display A - -)


Extension function mode
Display in the order of

$$
\mathrm{A} \leftrightarrow \mathrm{~b} \leftrightarrow \mathrm{C} \leftrightarrow \mathrm{H} \leftrightarrow \mathrm{P} \leftrightarrow \mathrm{U}
$$


[3] Display code No. of basic setting mode.
(Display F001)


Push the $\quad \begin{array}{r}\text { key. }\end{array}$
(Note) Refer to setting (3)method of function code.

## Chapter 4 Explanation of function

(2) Setting method of function

Change operation command part. (Operator $\longrightarrow$ Control terminal)
[1] Display extension
function mode


Make monitor display "A - - -" by referring to (1) displaying method.
Now operating command part is by the operator, so operating command display lamp should illuminate.

- Push the FUNO key.
[2] Display code No. of function mode.

(Display A002)


Push the Fung key.
[3] Display contents of function mode


Operation command part displays 02(operator).
Program (PRG) light on by displaying contents of function
mode

[5] Display extension function
mode (Display A ---)


It is possible to shift to other extension function modes, monitor modes and basic modes in this state.

[4] Display code No. of monitor mode. (Display A002)


The changed set value is confirmed by pushing the STR key.
Operation command display lamplight will switch off so that operation command is now changed to the control terminal.


Change operation command part to control terminal 01.

## Chapter 4 Explanation of function

(3) Setting method of function code

Code No. of monitor modes, basic setting modes and extension function codes can be set easily. Indicate the method to change code No.d001 of monitor mode to function code No. A029 simply.


[2] Change extension function mode

"d" blinks.

(Display A001)

"A" blinks.
The figure lighting is decided by pushing STR key.

[6] Finish setting function code No.


Finish setting A029
(Note) When you input code No. there isn't in the code list, "A" of left end blinks again. Confirm code No. and input it again.
[5] Change first figure of function code No.


First figure, "1" blinks.

(Display A021)


Second figures, "2" blinks.

[4] Change second figure of function code No.


Second figure, "0" blinks.

Third figure " 0 " blinks.
Don't change third figure and push the STR key and confirm 0.

### 4.2 Code list

Monitor code

| Display code | Function name | L300P monitor or data range (digital operator) | Initial data | Setting on running | Change mode during running | Page |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| d001 | Output frequency monitor | 0.00-99.99/100.0-400.0(Hz) | - | - | - | 4-10 |
| d002 | Output current monitor | 0.0-999.9(A) | - | - | - | 4-10 |
| d003 | Operation direction monitor | F(forward)/o(stop)/r(reverse) | - | - | - | 4-10 |
| d004 | PID feedback monitor | $\begin{aligned} & \hline 0.00-99.99 / 100.0-999.9 / 1000 .-9999 . / \\ & 1000-9999 / I^{-1} 100-1^{-} 999(10000-99900) \\ & \hline \end{aligned}$ | - | - | - | 4-10 |
| d005 | Intelligent input terminal monitor | (Example) FW, terminal2, and $1: \mathrm{ON}$ | - | - | - | 4-11 |
| d006 | Intelligent output terminal monitor |  | - | - | - | 4-11 |
| d007 | Frequency conversion monitor | $\begin{aligned} & \text { 0.00-99.99/100.0-999.9/1000.-9999./ } \\ & 1000-3996 \end{aligned}$ | - | - | - | 4-12 |
| d013 | Output voltage monitor | 0.0-600.0 V | - | - | - | 4-12 |
| d014 | Electric power monitor | 0.0-999.9 kW | - | - | - | 4-12 |
| d016 | Accumulated time monitor during RUN | 0.-9999./1000-9999/1-100-1-999 h | - | - | - | 4-13 |
| d017 | Power ON time monitor | 0.-9999./1000-9999/「-100-1-999 h | - | - | - | 4-13 |
| d080 | Number of trip time monitor | 0.-9999./1000-6553(10000-65530) (time) | - | - | - | 4-13 |
| d081 | Trip monitor 1 | Trip Code, frequency(Hz), current(A), voltage (V), RUN time(h) power ON time(h) | - | - | - | 4-13 |
| d082 | Trip monitor 2 | Trip Code, frequency $(\mathrm{Hz})$, current $(A)$, voltage (V), RUN time( h ) power ON time ( h ) | - | - | - | 4-13 |
| d083 | Trip monitor 3 | Trip Code, frequency (Hz), current(A), voltage $(\mathrm{V})$, RUN time $(\mathrm{h})$ power ON time ( h ) | - | - | - | 4-13 |
| d084 | Trip monitor 4 | Trip Code, frequency $(\mathrm{Hz})$, current $(A)$, voltage $(\mathrm{V})$, RUN time $(\mathrm{h})$ power ON time ( h ) | - | - | - | 4-13 |
| d085 | Trip monitor 5 | Trip Code, frequency $(\mathrm{Hz})$, current $(A)$, voltage $(\mathrm{V})$, RUN time $(\mathrm{h})$ power ON time ( h ) | - | - | - | 4-13 |
| d086 | Trip monitor 6 | Trip Code, frequency (Hz), current(A), voltage $(\mathrm{V})$, RUN time $(\mathrm{h})$ power ON time ( h ) | - | - | - | 4-13 |
| d090 | Warning monitor | Warning code | - | - | - | 4-78 |
| F001 | Output frequency setting | 0.0, starting frequency-Max. frequency <br> (2 ${ }^{\text {nd }}$ max. frequency) $(\mathrm{Hz})$ | 0.00 | $\checkmark$ | $\checkmark$ | 4-14 |
| F002 | $1^{\text {st }}$ acceleration time | 0.01-99.99/100.0-999.9/1000.-3600.(s) | 30.00 | $\checkmark$ | $\checkmark$ | 4-16 |
| F202 | $2^{\text {nd }}$ acceleration time | 0.01-99.99/100.0-999.9/1000.-3600. (s) | 30.00 | $\checkmark$ | $\checkmark$ | 4-16 |
| F003 | $1^{\text {st }}$ deceleration time | 0.01-99.99/100.0-999.9/1000.-3600. (s) | 30.00 | $\checkmark$ | $\checkmark$ | 4-16 |
| F203 | $2{ }^{\text {nd }}$ deceleration time | 0.01-99.99/100.0-999.9/1000.-3600. (s) | 30.00 | $\checkmark$ | $\checkmark$ | 4-16 |
| F004 | Operation direction selection | 00(forward)/01(reverse) | 00 |  |  | 4-15 |

(Note 1) Change mode during run by selection of b031 (software lock selection).
(Note) Do not forget to press "STR" key when you change the display.

Function Mode

| Code |  | Function name | Setting range | Initial data -FE/-FU/-FR | Setting on run | Change mode on run | Page |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \text { O } \\ & \underset{ \pm}{ \pm} \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | A001 | Frequency setting selection | 00(VR)/01 (terminal)/02(operator)/03(RS485)/ 04(option1)/05(option2) | 01/01/00 |  |  | 4-14 |
|  | A002 | Operation setting selection | 01(terminal)/02(operator)/03(RS485)/04(option1)/05(option2) | 01/01/02 |  |  | 4-15 |
|  | A003 | Base frequency | 30. - Maximum. frequency $(\mathrm{Hz})$ | 50./60./60. |  |  | 4-17 |
|  | A203 | Base frequency, 2nd motor | 30. $-2^{\text {nd }}$ Maximum. frequency ( Hz ) | 50./60./60. |  |  | 4-17 |
|  | A004 | Maximum frequency | 30.-400. (Hz) | 50./60./60. |  |  | 4-18 |
|  | A204 | Maximum frequency, 2nd motor | 30. - 400. (Hz) | 50./60./60. |  |  | 4-18 |
| 6u!! əəs łndu! 6oןeu甘 | A005 | AT terminal selection | 00 (Changing of O and OI with AT terminal)/01(Changing of O and O 2 with AT terminal) | 00 |  |  | 4-19 |
|  | A006 | 02 selection | 00 (single)/01(auxiliary speed of O, OI) [no reversible] /02(auxiliary speed of O, OI [reversible] | 00 |  |  | 4-19 |
|  | A011 | 0 start | $0.00-99.99 / 100.0-400.0(\mathrm{~Hz})$ | 0.00 | $\cdots$ | $\checkmark$ | 4-20 |
|  | A012 | 0 end | 0.00-99.99/100.0-400.0 (Hz) | 0.00 |  | $\checkmark$ | 4-20 |
|  | A013 | 0 start rate | 0.-100.0 (\%) | 0. |  | $\checkmark$ | 4-20 |
|  | A014 | 0 end rate | 0.-100.0(\%) | 100. |  | $\checkmark$ | 4-20 |
|  | A015 | 0 start selection | 00 (external starting frequency)/01(0Hz) | 01 |  | $\checkmark$ | 4-20 |
|  | A016 | O, OI, O2 sampling | 1.-30.(times) | 8. |  | $\checkmark$ | 4-21 |
| Multistage speed • jogging frequency setting | A019 | Multi-speed selection | 00 (binary : range is to 16 stage speed with 4 terminals)/01(bit : range is to 6 stage speed with 5 terminals) | 00 |  |  | 4-43 |
|  | A020 | Multi-speed 0 | 0.00 , starting frequency-maximum. frequency $(\mathrm{Hz})$ | 0.00 | $\checkmark$ | $\checkmark$ | 4-43 |
|  | A220 | Multi-speed 0, $2^{\text {nd }}$ motor | 0.00 , starting frequency- $2^{\text {nd }}$ maximum frequency $(\mathrm{Hz})$ | 0.00 | $\checkmark$ | $\checkmark$ | 4-43 |
|  | A021 | Multi-speed1 | 0.00 , starting frequency-maximum frequency $(\mathrm{Hz})$ | 0.00 | $\checkmark$ | $\checkmark$ | 4-43 |
|  | A022 | Multi-speed2 | 0.00 , starting frequency-maximum frequency $(\mathrm{Hz})$ | 0.00 | $\checkmark$ | $\checkmark$ | 4-43 |
|  | A023 | Multi-speed3 | 0.00 , starting frequency-maximum frequency $(\mathrm{Hz})$ | 0.00 | $\checkmark$ | $\checkmark$ | 4-43 |
|  | A024 | Multi-speed4 | 0.00 , starting frequency-maximum frequency $(\mathrm{Hz})$ | 0.00 | $\checkmark$ | $\checkmark$ | 4-43 |
|  | A025 | Multi-speed5 | 0.00 , starting frequency-maximum frequency $(\mathrm{Hz})$ | 0.00 | $\checkmark$ | $\checkmark$ | 4-43 |
|  | A026 | Multi-speed6 | 0.00 , starting frequency-maximum frequency $(\mathrm{Hz})$ | 0.00 | $\checkmark$ | $\checkmark$ | 4-43 |
|  | A027 | Multi-speed7 | 0.00 , starting frequency-maximum frequency $(\mathrm{Hz})$ | 0.00 | $\checkmark$ | $\checkmark$ | 4-43 |
|  | A028 | Multi-speed8 | 0.00 , starting frequency-maximum frequency $(\mathrm{Hz})$ | 0.00 | $\checkmark$ | $\checkmark$ | 4-43 |
|  | A029 | Multi-speed9 | 0.00 , starting frequency-maximum frequency $(\mathrm{Hz})$ | 0.00 | $\checkmark$ | $\checkmark$ | 4-43 |
|  | A030 | Multi-speed10 | 0.00 , starting frequency-maximum frequency $(\mathrm{Hz})$ | 0.00 | $\checkmark$ | $\checkmark$ | 4-43 |
|  | A031 | Multi-speed11 | 0.00 , starting frequency-maximum frequency $(\mathrm{Hz})$ | 0.00 | $\checkmark$ | $\checkmark$ | 4-43 |
|  | A032 | Multi-speed12 | 0.00 , starting frequency-maximum frequency $(\mathrm{Hz})$ | 0.00 | $\checkmark$ | $\checkmark$ | 4-43 |
|  | A033 | Multi-speed13 | 0.00 , starting frequency-maximum frequency $(\mathrm{Hz})$ | 0.00 | $\checkmark$ | $\checkmark$ | 4-43 |
|  | A034 | Multi-speed14 | 0.00 , starting frequency-maximum frequency $(\mathrm{Hz})$ | 0.00 | $\checkmark$ | $\checkmark$ | 4-43 |
|  | A035 | Multi-speed15 | 0.00 , starting frequency-maximum frequency $(\mathrm{Hz})$ | 0.00 | $\checkmark$ | $\checkmark$ | 4-43 |
|  | A038 | Jogging frequency | 0.00 , starting frequency $-9.99(\mathrm{~Hz})$ | 1.00 | $\checkmark$ | $\checkmark$ | 4-44 |
|  | A039 | Jogging selection | 00 (free-run on JG stop / invalid on running) / 01 (stop decelerating on JG stop / invalid on running) / 02(DC braking on JG stop/invalid on running) / 03(free-run on JG stop/valid on running[JG after stop decelerating]) / 04 (stop decelerating on JG stop/valid on running) / 05 (DC braking on JG stop/valid on operating) | 00 |  | $\checkmark$ | 4-44 |
|  | A041 | Torque boost selection | 00 (manual torque boost) / 01 (automatic torque boost) | 00 | 1 |  | 4-24 |
|  | A241 | Torque boost selection, $2^{\text {nd }}$ motor | 00 (manual torque boost) / 01 (automatic torque boost) | 00 |  |  | 4-24 |
|  | A042 | Manual torque boost | 0.0-20.0(\%) | 1.0 | $\checkmark$ | $\checkmark$ | 4-24 |
|  | A242 | Manual torque boost, $2^{\text {nd }}$ motor | 0.0-20.0(\%) | 1.0 | $\checkmark$ | $\checkmark$ | 4-24 |
|  | A043 | Manual torque boost point | 0.0-50.0(\%) | 5.0 | $\checkmark$ | $\checkmark$ | 4-24 |
|  | A243 | Manual torque boost point, $2^{\text {nd }}$ motor | 0.0-50.0(\%) | 5.0 | $\checkmark$ | $\checkmark$ | 4-24 |
|  | A044 | $1^{\text {st }}$ control | 00/(VC)/01(VP1.7power)/02(free V/f setting) | 00 |  |  | 4-22 |
|  | A244 | $2^{\text {nd }}$ control | 00/(VC)/01(VP1.7power)/02(free V/f setting) | 00 |  |  | 4-22 |
|  | A045 | Output voltage gain | 20.-100. (\%) | 100. | $\checkmark$ | $\checkmark$ | 4-21 |
|  | A051 | DC braking selection | 00 (invalid)/01(valid) | 00 |  | $\checkmark$ | 4-25 |
|  | A052 | DC braking frequency | $0.00-60.00(\mathrm{~Hz})$ | 0.50 |  | $\checkmark$ | 4-25 |
|  | A053 | DC braking wait time | 0.0-5.0(s) | 0.0 |  | $\checkmark$ | 4-25 |
|  | A054 | DC braking power | 0.-70. (\%) | 0. |  | $\checkmark$ | 4-25 |
|  | A055 | DC braking time | 0.0-60.0(s) | 0.0 |  | $\checkmark$ | 4-25 |
|  | A056 | DC braking edge/level selection | 00(edge action)/01(level action) | 01 |  | $\checkmark$ | 4-25 |
|  | A057 | DC braking power (starting time) | 0.-70. (\%) | 0. |  | $\checkmark$ | 4-25 |
|  | A058 | DC braking time (starting time) | 0.00-60.0(s) | 0.0 |  | $\checkmark$ | 4-25 |
|  | A059 | DC carrier frequency | $0.5-12(\mathrm{kHz})$ Derating $<0.5-8(\mathrm{kHz})>$ | 3.0 |  |  | 4-25 |

(Note) <>indicate the setting range of 90 to 132 kW

## Chapter 4 Explanation of function

Function Mode

| Code |  | Function name | Setting range | Initial data -FE/-FU/-FR | Setting on run | Change mode on run | Page |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | A061 | $1^{\text {st }}$ frequency upper limiter | $0.00,1^{\text {st }}$ frequency lower limiter-maximum frequency ( Hz ) | 0.00 |  | $\checkmark$ | 4-28 |
|  | A261 | $2^{\text {nd }}$ frequency upper limiter | $0.00,2^{\text {nd }}$ frequency lower limiter- $2^{\text {nd }}$ setting maximum frequency $(\mathrm{Hz})$ | 0.00 |  | $\checkmark$ | 4-28 |
|  | A062 | $1^{\text {st }}$ frequency lower limiter | 0.00 , start frequency- - $^{\text {st }}$ frequency maximum limiter( Hz ) | 0.00 |  | $\checkmark$ | 4-28 |
|  | A262 | $2^{\text {nd }}$ frequency lower limiter | 0.00 , start frequency-2 ${ }^{\text {nd }}$ frequency maximum limiter( Hz ) | 0.00 |  | $\checkmark$ | 4-28 |
|  | A063 | Jump frequency1 | 0.00-99.99/100.0-400.0(Hz) | 0.00 |  | $\checkmark$ | 4-29 |
|  | A064 | Jump frequency Width 1 | $0.00-10.00(\mathrm{~Hz})$ | 0.50 |  | $\checkmark$ | 4-29 |
|  | A065 | Jump frequency2 | 0.00-99.99/100.0-400.0(Hz) | 0.00 |  | $\checkmark$ | 4-29 |
|  | A066 | Jump frequency Width 2 | 0.00-10.00(Hz) | 0.50 |  | $\checkmark$ | 4-29 |
|  | A067 | Jump frequency3 | 0.00-99.99/100.0-400.0(Hz) | 0.00 |  | $\checkmark$ | 4-29 |
|  | A068 | Jump frequency Width 3 | 0.00-10.00(Hz) | 0.50 |  | $\checkmark$ | 4-29 |
|  | A069 | Acceleration stop frequency | 0.00-99.99/100.0-400.0(Hz) | 0.00 |  | $\checkmark$ | 4-29 |
|  | A070 | Acceleration stop time | 0.00-60.0(s) | 0.0 |  | $\checkmark$ | 4-29 |
| $\overline{0}$ | A071 | PID selection | 00 (invalid)/01(valid) | 00 |  | $\checkmark$ | 4-30 |
|  | A072 | PID-P gain | 0.2-5.0 | 1.0 | $\checkmark$ | $\checkmark$ | 4-30 |
|  | A073 | PID-I gain | 0.0-3600.(s) | 1.0 | $\checkmark$ | $\checkmark$ | 4-30 |
|  | A074 | PID-D gain | 0.00-100.0(s) | 0.00 | $\checkmark$ | $\checkmark$ | 4-30 |
|  | A075 | PID scale | 0.01-99.99 | 1.00 |  | $\checkmark$ | 4-30 |
|  | A076 | PID feedback selection | 00(feedback : OI)/01(feedback: 0) | 00 |  | $\checkmark$ | 4-30 |
| $\stackrel{\nwarrow}{\gtrless}$ | A081 | AVR selection | 00(ON always)/01(OFF always)/02(OFF on decelerating) | 00 |  |  | 4-17 |
|  | A082 | Motor voltage selection | 200/215/220/230/240, 380/400/415/440/460/480 | $\begin{aligned} & \hline(230 / 400) \\ & (230 / 460) \\ & (200 / 400) \\ & \hline \end{aligned}$ |  | - | 4-17 |
|  | A085 | Operation mode selection | 00(normal operation)/01(energy-saving operation) | 00 |  | - | 4-31 |
|  | A086 | Energy-saving responseaccuracy adjustment | 0.0-100.0 | 50.0 | $\checkmark$ | $\checkmark$ | 4-31 |
|  | A092 | Acceleration time2 | 0.01-99.99/100.0-999.9/1000.-3600.(s) | 15.00 | $\checkmark$ | $\checkmark$ | 4-32 |
|  | A292 | $2^{\text {nd }}$ acceleration time2 | 0.01-99.99/100.0-999.9/1000.-3600.(s) | 15.00 | $\checkmark$ | $\checkmark$ | 4-32 |
|  | A093 | Deceleration time2 | 0.01-99.99/100.0-999.9/1000.-3600.(s) | 15.00 | $\checkmark$ | $\checkmark$ | 4-32 |
|  | A293 | $2^{\text {nd }}$ deceleration time2 | 0.01-99.99/100.0-999.9/1000.-3600.(s) | 15.00 | $\checkmark$ | $\checkmark$ | 4-32 |
|  | A094 | $2^{\text {nd }}$ stage adjustable selection | 00 (change with 2CH terminal)/01(change with setting) | 00 |  | - | 4-32 |
|  | A294 | $\begin{aligned} & \hline 2^{\text {nd }} \text { stage adjustable } \\ & \text { selection( } \left.2^{\text {nd }} \text { motor }\right) \\ & \hline \end{aligned}$ | 00 (change with 2 CH terminal)/01(change with setting) | 00 |  | - | 4-32 |
|  | A095 | $2^{\text {nd }}$ acceleration frequency | 0.00-99.99/100.0-400.0(Hz) | 0.00 |  |  | 4-32 |
|  | A295 | $\begin{aligned} & 2^{\text {nd }} \text { acceleration } \\ & \text { frequency( } 2^{\text {nd }} \text { motor) } \end{aligned}$ | 0.00-99.99/100.0-400.0(Hz) | 0.00 |  | - | 4-32 |
|  | A096 | $2^{\text {nd }}$ deceleration frequency | 0.00-99.99/100.0-400.0(Hz) | 0.00 |  | - | 4-32 |
|  | A296 | $\begin{aligned} & 2^{\text {nd }} \text { deceleration frequency } \\ & \left(2^{\text {nd }}\right. \text { motor) } \end{aligned}$ | 0.00-99.99/100.0-400.0(Hz) | 0.00 |  | - | 4-32 |
|  | A097 | Acceleration pattern selection | 00(straight line)/01(S-curve)/02(U-curve)/03(reverse U-curve) | 00 |  | - | 4-33 |
|  | A098 | Deceleration pattern selection | 00(straight line)/01(S-curve)/02(U-curve)/03(reverse U-curve) | 00 |  | - | 4-33 |
|  | A101 | Ol start | 0.00-99.99/100.0-400.0(Hz) | 0.00 |  |  | 4-20 |
|  | A102 | Ol end | 0.00-99.99/100.0-400.0(Hz) | 0.00 |  | $\checkmark$ | 4-20 |
|  | A103 | Ol start rate | 0.-100. (\%) | 20. |  | $\checkmark$ | 4-20 |
|  | A104 | Ol end rate | 0.-100. (\%) | 100. |  | $\checkmark$ | 4-20 |
|  | A105 | Ol start selection | 00 (external start frequency)/01(0Hz) | 01 |  | $\checkmark$ | 4-20 |
|  | A111 | O2 start | -400.--100./-99.9-0.00-99.9/100.-400.(Hz) | 0.00 |  | $\checkmark$ | 4-20 |
|  | A112 | O2 end | -400.--100./-99.9-0.00-99.9/100.-400.(Hz) | 0.00 |  | $\checkmark$ | 4-20 |
|  | A113 | O2 start rate | -100.-100. (\%) | -100. |  | $\checkmark$ | 4-20 |
|  | A114 | O2 end rate | -100. - 100. (\%) | 100. |  | $\checkmark$ | 4-20 |
|  | A131 | Acceleration curve constant | 01(small swelling)-10(large swelling) | 02 |  | $\checkmark$ | 4-33 |
|  | A132 | Deceleration curve constant | 01 (small swelling-10(large swelling) | 02 |  | $\checkmark$ | 4-33 |
|  | b001 | Retry selection | 00 (trip)/01(0Hz start)/02(start after equal frequency)/ 03 (trip after equaling frequency and deceleration stop) | 00 |  | $\checkmark$ | 4-34 |
|  | b002 | Allowable under-voltage power failure time | 0.3-1.0(s) | 1.0 |  | $\checkmark$ | 4-34 |
|  | b003 | Retry wait time | 0.3-100.(s) | 1.0 |  | $\checkmark$ | 4-34 |
|  | b004 | Instantaneous power-failure/under-voltage trip during stop | 00 (invalid/01(valid)/ 02 (invalid during stop and deceleration by stop command) | 00 |  | $\checkmark$ | 4-34 |
|  | b005 | Instantaneous power-failure/under-voltage retry time selection | 00(16 times)/01(free) | 00 |  | $\checkmark$ | 4-34 |
|  | b006 | Open-phase selection | 00 (invalid)/01(valid) | 00 |  | $\checkmark$ | 4-36 |
|  | b007 | Frequency setting to match | 0.00-99.99/100.0-400.0(Hz) | 0.00 |  | $\checkmark$ | 4-34 |
|  | b012 | Electronic thermal level | $0.2^{*}$ constant current-1.20*constant current(A) | Rated Current of inverter |  | $\checkmark$ | 4-36 |
|  | b212 | Electronic thermal level (2 ${ }^{\text {nd }}$ motor) | $0.2^{*}$ constant current- $1.20^{*}$ constant current(A) | Rated Current of inverter |  | $\checkmark$ | 4-36 |
|  | b013 | Electronic thermal characteristic selection | 00/(reduced characteristic)01(constant torque characteristic)/ 02 (free setting) | 01/01/00 |  | $\checkmark$ | 4-36 |
|  | b213 | Electronic thermal characteristic selection (2 $2^{\text {nd }}$ motor) | 00/(reduced characteristic) 01 (constant torque characteristic)/ 02 (free setting) | 01/01/00 |  | $\checkmark$ | 4-36 |
|  | b015 | Free electronic thermal frequency 1 | 0.-400.(Hz) | 0. |  | $\checkmark$ | 4-37 |
|  | b016 | Free electronic thermal current 1 | 0.0-1000.(A) | 0.0 |  | $\checkmark$ | 4-37 |
|  | b017 | Free electronic thermal frequency 2 | 0.-400.(Hz) | 0. |  | $\checkmark$ | 4-37 |
|  | b018 | Free electronic thermal current 2 | 0.0-1000. (A) | 0.0 |  | $\checkmark$ | 4-37 |
|  | b019 | Free electronic thermal frequency 3 | 0.-400.(Hz) | 0. |  | $\checkmark$ | 4-37 |
|  | b020 | Free electronic thermal current 3 | 0.0-1000.(A) | 0.0 |  | $\checkmark$ | 4-37 |

## Chapter 4 Explanation of function

Function Mode

| Code |  | Function name | Setting range | Initial data $-\mathrm{FE} /-\mathrm{FU} /-\mathrm{FR}$ | Setting on run | Change mode on run | Page |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \stackrel{\rightharpoonup}{E} \\ & \underline{=} \\ & \text { O} \\ & \text { O} \\ & \frac{0}{0} \\ & 0 \end{aligned}$ | b021 | Overload restriction selection | 00 (invalid)/01(enabled on acceleration / constant speed)/02(enabled on constant speed) | 01 |  | $\checkmark$ | 4-38 |
|  | b022 | Overload restriction level | $0.50^{*}$ rated current-1.50* rated current(A) | Rated current of inverter x 1.20 |  | $\checkmark$ | 4-38 |
|  | b023 | Overload restriction limit constant | 0.10-30.00(s) | 1.00 |  | $\checkmark$ | 4-38 |
|  | b024 | Overload restriction 2 selection | 00 (invalid)/01(valid on acceleration / constant speed)/02(valid on constant speed) | 01 |  | $\checkmark$ | 4-38 |
|  | b025 | Overload restriction level 2 | $0.50{ }^{*}$ rated current-1.50*rated current(A) | Rated current of inverter x1.20 |  | $\checkmark$ | 4-38 |
|  | b026 | Overload restriction constant 2 | 0.10-30.00(s) | 1.00 |  | $\checkmark$ | 4-38 |
| 등 | b031 | Software lock mode selection | 00 (impossible to change the data except this item when SFT terminal is ON )/01(impossible to change the data except setting frequency item when SFT terminal is ON)/02(impossible to change the data except this item)/03(impossible to change the data except setting frequency item) $/ 10$ (possible to change data on operating) | 01 |  | $\checkmark$ | 4-45 |
|  | b100 | Free V/f frequency 1 | 0.- Free V/f frequency2(Hz) | 0. |  |  | 4-23 |
|  | b101 | Free V/f voltage 1 | 0.-800.0(V) | 0.0 |  |  | 4-23 |
|  | b102 | Free V/ff frequency 2 | 0.- Free V/f frequency3(Hz) | 0 |  |  | 4-23 |
|  | b103 | Free V/f voltage 2 | 0.-800.0(V) | 0.0 |  |  | 4-23 |
|  | b104 | Free V/f frequency 3 | 0.- Free V/f frequency $4(\mathrm{~Hz}$ ) | 0. |  |  | 4-23 |
|  | b105 | Free V/f voltage 3 | 0.-800.0(V) | 0.0 |  |  | 4-23 |
|  | b106 | Free V/f frequency 4 | 0.- Free V/f frequency5(Hz) | 0. |  |  | 4-23 |
|  | b107 | Free V/f voltage 4 | 0.800.0(V) | 0.0 |  |  | 4-23 |
|  | b108 | Free V/f frequency 5 | 0.- Free V/f frequency6(Hz) | 0. |  |  | 4-23 |
|  | b109 | Free V/f voltage 5 | 0.-800.0(V) | 0.0 |  |  | 4-23 |
|  | b110 | Free V/f frequency 6 | 0.- Free V/f frequency7(Hz) | 0. |  |  | 4-23 |
|  | b111 | Free V/f voltage 6 | 0.-800.0(V) | 0.0 |  |  | 4-23 |
|  | b112 | Free V/ff frequency 7 | 0.-400.(Hz) | 0. |  |  | 4-23 |
|  | b113 | Free V/f voltage 7 | 0.-800.0(V) | 0.0 |  |  | 4-23 |
|  | C001 | Intelligent input 1 setting | 01/(RV:Reverse is valid)/02(CF1:Multi-speed1)/ 03(CF2:Multi-speed2)/ <br> 04(CF3:Multi-speed3)/ 05(CF4:Multi-speed4)/ 06(JG:Jogging)/ <br> 07(DB:External DC braking)/08(SET:2 ${ }^{\text {nd }}$ control)/ <br> 09(2CH:two-stage adjustable speed)/11(FRS:Free-run)/ <br> 12(EXT:External trip)/13(USP:Unattended start protection)/ <br> 14(CS:commercial change)/15(SFT:software lock)/ <br> 16(AT:Analog input voltage/current select)/18(RS:Reset inverter)/ <br> 20(STA:3wire run)/ 21(STP:3wire keep)/22(F/R:3wire forward/reverse)/ <br> 23(PID:PID selection valid/invalid)/24(PIDC:PID integrating reset)/ <br> 27(UP:Remote control UP function)/ <br> 28(DWN:Remote control DOWN function)/ <br> 29(UDC:Remote control data clear)/31(OPE:Force operate ope)/ <br> 32(SF1:Multi-speed bit1)/ <br> 33(SF2:Multi-speed bit2)/34(SF3:Multi-speed bit3)/ <br> 35(SF4:Multi-speed bit4)/36(SF5:Multi speed bit5)/ <br> 37(SF6:Multi-speed bit6)/38(SF7:Multi-speed bit7)/ <br> 39(OLR:Overload restriction change)/no(NO:No assign) | 18 |  | $\checkmark$ | 4-42 |
|  | C002 | Intelligent input 2 setting |  | 16 |  | $\checkmark$ | 4-42 |
|  | C003 | Intelligent input 3 setting |  | 03/13/03 |  | $\checkmark$ | 4-42 |
|  | C004 | Intelligent input 4 setting |  | 02 |  | $\checkmark$ | 4-42 |
|  | C005 | Intelligent input 5 setting |  | 01 |  | $\checkmark$ | 4-42 |
|  | C011 | Intelligent input1 a/b ( $\mathrm{NO} / \mathrm{NC}$ ) selection | 00(NO)/01(NC) | 00 |  | $\checkmark$ | 4-42 |
|  | C012 | Intelligent input2 a/b (NO/NC) selection | 00 (NO)/01(NC) | 00 |  | $\checkmark$ | 4-42 |
|  | C013 | Intelligent input3 a/b (NO/NC) selection | 00(NO)/01(NC) | 00/01/00 |  | $\checkmark$ | 4-42 |
|  | C014 | Intelligent input4 a/b (NO/NC) selection | 00(NO)/01(NC) | 00 |  | $\checkmark$ | 4-42 |
|  | C015 | Intelligent input5 a/b ( $\mathrm{NO} / \mathrm{NC}$ ) selection | 00(NO)/01(NC) | 00 |  | $\checkmark$ | 4-42 |
|  | C019 | $\begin{aligned} & \text { Input FW a/b (NO/NC) } \\ & \text { Selection } \end{aligned}$ | 00(NO)/01(NC) | 00 |  | $\checkmark$ | 4-42 |
|  | C021 | Intelligent output 11 setting | 00(RUN:running)/01(FA1:Frequency arrivaltype 1 signal)/ 02(FA2:frequency arrival type2 signal)/03(OL:Overload advance notice signal)/04(OD:Output deviation for PID control)/05(AL:Alarm signal)/06(FA3:Only setting frequency)/08(IP:On instantaneous stop/ 09(UV:Under voltage)/11(RNT:RUN time over)/12(ONT:ON time over)/13(THM:thermal caution) | 01 |  | $\checkmark$ | 4-51 |
|  | C022 | Intelligent output 12 setting |  | 00 |  | $\checkmark$ | 4-51 |
|  | C026 | Alarm relay output |  | 05 |  | $\checkmark$ | 4-51 |
|  | C027 | FM selection | 00(Output frequency)/01(Output current) / <br> 03(Digital output frequency)/04(Output voltage)/ <br> 05(Input electric power)/06(thermal load rate)/07(LAD frequency) | 00 |  | $\checkmark$ | 4-56 |
|  | C028 | AM selection | 00 (Output frequency)/01(Output current)/04(Output voltage)/ 05(Input electric power)/06(thermal load rate)/07(LAD frequency) | 00 |  | $\checkmark$ | 4-57 |
|  | C029 | AMI selection | 00 (Output frequency)/01(Output current)/04(Output voltage)/ 05(Input electric power)/06(Thermal load rate)/07(LAD frequency) | 00 |  | $\checkmark$ | 4-57 |
|  | C031 | Intelligent output $11 \mathrm{a} / \mathrm{b}$ | $00(\mathrm{NO}) / 01(\mathrm{NC})$ | 00 |  | $\checkmark$ | 4-52 |
|  | C032 | Intelligent output $12 \mathrm{a} / \mathrm{b}$ | $00(\mathrm{NO}) / 01(\mathrm{NC})$ | 00 |  | $\checkmark$ | 4-52 |
|  | C036 | Alarm relay output a/b | 00( NO )/01 ( NC ) | 01 |  | $\checkmark$ | 4-52 |
|  | C040 | Overload advance notice signal output mode | 00 (On accel. And decel, constant speed)/01(Only constant speed) | 01 |  | $\checkmark$ | 4-39 |
|  | C041 | Overload advance notice level | 0.0-2.0*rated current(A) | Inverter rated current |  | $\checkmark$ | 4-38 |
|  | C042 | Frequency arrival setting for acceleration. | 0.00-99.99/100.0-400.0(Hz) | 0.00 |  | $\checkmark$ | 4-53 |
|  | C043 | Arrival frequency setting for deceleration. | 0.00-99.99/100.0-400.0(Hz) | 0.00 |  | $\checkmark$ | 4-53 |
|  | C044 | PID deviation setting level | 0.0-100.0(\%) | 3.0 |  | $\checkmark$ | 4-31 |

## Chapter 4 Explanation of function

Function Mode

(Note 1)<>indicate the setting range of 90 to 132 kW
(Note 2)<>indicate the setting range of 11 to 75 kW

### 4.3 Explanation of function

### 4.3.1 Monitor mode

## Output frequency monitor

Indication code d001 displays the frequency the inveter outputs.
The data is displayed as follows.
When d001 is displayed, the monitor lamp "Hz" is illuminated.
(Display)
0.00-99.99 : Display is in 0.01 Hz unit.
100.0-400.0 : Display is in 0.1 Hz unit.
(Note) When with digital operator, setting frequency output frequency is adjustable by changing this mode.

## Output current monitor

Indication code d002 displays the output current value.
The data is displayed as follows.
In case of displaying d002, the monitor lamp "A" is illuminated.
(Display)
0.0-999.9 : Display is in 0.1A unit.

## Operation direction monitor

Indication code d003 displays the direction that the Inverter output is rotating. Forward, reverse or stop.
On operating the inverter (in case of forward or reverse), the RUN lamp

Relation code
d003: Operation direction monitor will illuminate.
(Display)
F : Forward
o : Stop
r : Reverse

## PID feedback monitor

When you select PID function (01) in A071, the inverter displays the feedback value changed by A075 (PID scale).
" Display of monitor part " = " Feedback quantity " x " PID scale " (Frequency command value) (A075)

## Relation code

d004: PID feedback monitor
A071: PID selection
A075: PID scale
(Setting)
A071 : 0.1 (PID is effective)
A075 : 0.01-99.99(Display is $0.01-99.99$ (Set with the 0.01 unit)
(Display)
0.00 - 99.99 : Display is in 0.01 unit.
100.0 - 999.9 : Display is in 0.1 unit.

1000-9999 : Display is in 1 unit.
「100 - '-999 : Display is in 100 unit.

## Intelligent input monitor

The LED display will monitor the state of the intelligent inputs.

## Relation code

```
d005: Intelligent input monitor
```

(Example)
FW; input intelligent terminal 2,1:ON
Input intelligent terminal 5, 4, 3:OFF


Input intelligent
terminal


5


1

Display
(Black): Lights up
(White): Lights out

## Intelligent output monitor

The LED display will monitor the state of the intelligent outputs.

Relation code
d006: Intelligent output monitor

## (Example)

Output intelligent terminal 12, 11: ON
Output alarm AL: OFF


## Frequency conversion monitor

This inverter displays the value changed by the Inverter output frequency and the value set in b086 on the monitor part.
"Monitor part of display" = " output frequency(d001)" x " output frequency factor(b086)"
(Display) Display of d007

Relation code
d007: Frequency conversion monitor
b086: Frequency conversion factor
(Range of setting) The setting range of b086
0.1 - 99.9 :Set it with the 0.1 unit.
(Example)Output frequency (d001):50.00Hz
When the frequency conversion factor (b086) is 1.1,
the frequency conversion monitor (d007) displays " 55.00 " as " $50 \times 1.1=55.00$ ".
(Note)Output frequency of FM terminal becomes same as d007 at the time of setting up the digital output frequency to the FM terminal.

## Output voltage monitor

This inverter displays the output voltage of the inverter converted into the alternating Voltage.

Relation code
d013: Output voltage monitor

The monitor lamp "V" should illuminate while the contents of d013 are displayed.

## (Display)

0.0 - 600.0 :Display is in 0.1 V unit.

## Input electric power monitor

Display input electric power from inverter.
The monitor lamp "kW" ("V" and "A") should illuminate while the contents of d014 is displayed.

## (Display)

0.0 - 999.9 :Display is in 0.1 kW unit.

## Chapter 4 Explanation of function

## Accumulated time monitor on RUN

The operation time of inverter is accumulated and the value is displayed.
(Display)

## Relation code

d016: Accumulated time monitor on RUN

| 0. | -9999. |
| :--- | :--- |
| $1000-9999$ | : Display is in 1 hour units. |
| $r-100-1-999$ | : Display is in 10 hour units in 1000 hour units. |

## Power ON time monitor

This accumulates the time running to the inverter and displays the value. (Display)
0. - 9999. : Display is in 1 hour units.

1000-9999 : Display is in 10 hour units.
r-100 - r-999 : Display is in 1000 hour units.

## Trip time monitor

This displays the number of inverter trips.
(Display)

## Relation code

0.     - 9999. : Display is in 1 times unit. 1000-6553 : Display is in 10 times unit.

## Trip monitor 1-6

This displays the details for the last six protective trips.
The trip monitor 1 displayed the details of the last trip.
(Display contents)
[1] Trip Code (Display anything from E01 to E79.)(Note 1)
[2] Output frequency on tripping (Hz)
[3] Output current on tripping (A)
[4] The direct voltage (between P and N ) on tripping ( V )
Relation code
d017: Power ON time monitor
[5] The accumulated time inverter was operating until tripping (h)
[6] The accumulated time inverter was run until tripping (h)
(Note 1) Please refer to the pages 4.4 Protection function list (2) Trip monitor display.
The methods of trip monitor


## Chapter4 Explanation of function

### 4.3.2 Function mode

## Setting of the output frequency

Setting the output frequency of the motor.
The output frequency is set by F001, when the frequency command select (A001) is set to 02.
F001 $\quad$ Relation code
A001put frequency setting
A020/A220: $1^{\text {st }} / 2^{\text {nd }}$ multistage speed
zero

C001-C005: Intelligent input terminal

Please refer to the frequency command select (A001) about other methods of frequency setting.
When a frequency is set in F001, the same value is automatically set in both Multispeed 0 (A020) and the second set of motor data multispeed 0 (A220) when the SET terminal is ON.
In the case of using SET, you will need to assign 08(SET) to an intelligent input terminal.

| Set item | Function code | Data | Contents |
| :--- | :---: | :--- | :--- |
| Output frequency <br> setting | F001 | 0.0, start frequency-First/Second <br> maximum frequency | Unit : Hz <br> "F001" "A020" <br> Second control setting of "F001" $=$ <br> "A220" |
| Multistage speed <br> zero | A020/A220 |  |  |

## Operation direction

This is effective when the operating command is set by the digital operator.

## Relation code

F004: Operation direction select

| Function code | Data | Contents |
| :---: | :---: | :--- |
| F004 | 00 | Forward |
|  | 01 | Reverse |

Selection with limits of operation direction
The direction of the motor can be restricted.

| Function code | Data | Contents |
| :---: | :---: | :--- |
| b035 | 00 | Forward/reverse is effective. |
|  | 01 | Only forward |
|  | 02 | Only reverse |

## Frequency command selection

Select the method of frequency command.
When $0-10 \mathrm{Vdc}$ is inputted to the frequency command by 02-L terminal, operation direction of motor reverses.

Relation code
b035: Selection with limits of operation direction

On output frequency monitor d001, you can't get information about forward/reverse. So be sure with operation direction monitor d002.

| Function code | Data | Contents |
| :---: | :---: | :--- |
| A001 | 00 | Setting frequency with the potentiometer the digital operator has. |
|  | 01 | Setting frequency with control terminals (Terminals: O-L, OI-L, O2-L) |
|  | 02 | Setting frequency with digital operator(F001), remote operator. |
|  | 03 | Setting frequency with RS485 terminals for communication. |
|  | 04 | Setting frequency with option board 1. |
|  | 05 | Setting frequency with option board 2. |

## Chapter4 Explanation of function

## Operation command selection

Select the control of RUN/STOP commands.
Operation command from the control terminals (Terminal) tart/Stop by ON/OFF of control terminals.

Forward: FW-CM1 terminal
Reverse: RV-CM1 terminal

Relation code
A002
:Operation command selection
C001-C005: Input intelligent terminal
C019 :Inputting FW a/b (NO/NC) selection
F004 :Operation direction select

Put 01(RV) to an intelligent Input terminal.
When using the FW terminal, it is possible to change the contact from NO to NCby settin a or b (respectively) in C019.When operating from the digital operator, set operation direction in F004.Or operate Start/Stop with RUN key/STOP key on the digital operator.lt becomes stop command when proper forword command and reverse command are inputted at the same time.

| Set item | Function code | Data | Contents |
| :---: | :---: | :---: | :---: |
| Operation command selection | A002 | 01 | Start/Stop with control terminals(Terminal).(FW, RV) |
|  |  | 02 | Start/Stop with digital operator, remote operator. |
|  |  | 03 | Start/Stop with RS485 terminals for communications. |
|  |  | 04 | Start/Stop with option board 1. |
|  |  | 05 | Start/Stop with option board 2. |
| Input FW a/b (NO/NC) selection | $\begin{gathered} \mathrm{C} 019 \\ \mathrm{C} 011-\mathrm{C} 015 \end{gathered}$ | 00 | a contact (NO) |
|  |  | 01 | b contact (NC) |

## Selection on stop

When stop is commanded from the digital operator or the control terminals (Terminal), select the stop after slowing-down according to slowing-down time or the free run stop.

When the second cycle is started while in free run stop, the inverter follows the free-run stop selection b088 and restarts.
(Refer to the item of free-run stop.)

| Set item | Function <br> code | Data | Contents |
| :--- | :---: | :---: | :--- |
| Selection on Stop | b091 |  | Normal stop (Decelerated stop) |
|  |  | 01 | Free-run stop |
| Selection of free-run stop | b 088 | 00 | 0Hz start |
|  |  | 01 | Start frequency matching |
| Frequency setting to match | b 007 | $0.00-400.0$ | Unit : Hz |
| Waiting time for retrying | b 003 | $0.3-100$. | Unit : second |

## Selection of Stop key

Even though the control terminals are selected for the operation command, you can still set whether the stop key of operator (digital operator etc) is effective or not. Trip reset functions by the stop key follows this establishment,

## Relation code

b087: Selection of stop key too.

| Function code | Data | Contents |
| :---: | :---: | :--- |
| b087 | 00 | The stop key is effective. |
|  | 01 | The stop key is ineffective. |

## Chapter4 Explanation of function

## Adjustable time

The acceleration and deceleration time can be set.
Set a long time to accelerate or decelerate slowly or set a short time to accelerate or decelerate quickly.
The time setting is the time it takes to accelerate from zero to the

## Relation code

F002/F202: $1^{\text {st }} / 2^{\text {nd }}$ acceleration time F003/F203: $1^{\text {st }} / 2^{\text {nd }}$ deceleration time A004/A204: $1^{\text {st }} / 2^{\text {nd }}$ maximum frequency maximum frequency and to decelerate from the maximum frequency to zero.
Switching of the $1 \mathrm{st} / 2^{\text {nd }} / 3^{\text {nd }}$ acceleration time and the $1 \mathrm{st} / 2^{\text {nd }} / 3^{\text {nd }}$ deceleration time can be controlled with intelliginet input terminal assigned to 08 (SET)/17(SET3).

| Set item | Function code | Limit of setting | Contents |
| :---: | :---: | :---: | :--- |
| Acceleration <br> time | F002/F202 | $0.01-3600$. | Unit : second <br> Setting acceleration time from zero to maximum <br> frequency. |
| Deceleration <br> time | F003/F203 | $0.01-3600$. | Unit : second <br> Setting deceleration time from maximum <br> frequency to zero. |



However short you set the adjustable time, the adjustable time of the actual motor can't be shorter than the shortest adjustable time determined by the inertial Effect $J$ of the mechanical system and motor torque.
If you set the time shorter than the shortest adjustable time, a protection trip of OC or OV may occur.

Acceleration time ts

$$
\mathrm{t} s=\frac{(\mathrm{JL}+\mathrm{JM}) \times \mathrm{NM}}{9.55 \times(\mathrm{Ts}-\mathrm{TL})}
$$

Deceleration time tB
$t_{B}=\frac{(\mathrm{JL}+\mathrm{JM}) \times N \mathrm{~N}}{9.55 \times(\mathrm{TB}+\mathrm{TL})}$
$\mathrm{JL}: \mathrm{J}$ of the load converted into motor shaft $\left(\mathrm{kg} \cdot \mathrm{m}^{2}\right)$
$\mathrm{Jm}: \mathrm{J}$ of the motor $\left(\mathrm{kg} \cdot \mathrm{m}^{2}\right)$
Nм: Motor revolving (r/min)
Ts: The maximum motor acceleration torque on inverter driving ( $\mathrm{N} \cdot \mathrm{m}$ )
TB: The maximum motor deceleration torque on inverter driving ( $\mathrm{N} \cdot \mathrm{m}$ )
TL: Needed transit torque ( $\mathrm{N} \cdot \mathrm{m}$ )

## Base frequency

Base frequency and motor voltage
AVR function
(1) Base frequency and motor voltage

Relation code
A003/A203: $1^{\text {st }} / 2^{\text {nd }}$ base frequency
A081: AVR selection
A082: Motor voltage selection

On selection of base frequency and motor voltage, set the output of the inverter (frequency voltage) to the motor rating.


The Base frequency is the nominal frequency of the motor, this value can be found on the nameplate of the motor. It is important to match the Base frequency (A003) to this nominal value or there is risk of damage to the motor.
If a motor has a base frequency higher than 60 Hz , it is considered to be a special motor. In this situation, it is important to make sure the maximum output current of the inverter is higher than the FLC of the motor.
The Motor Voltage Selection is the nominal voltage of the motor, this value can be found on the nameplate of the motor. It is important to match the Motor Voltage (A082) to this nominal value or there is risk of damage to the motor.
When changing second base frequency (A203) an intelligent input terminal must be set to 08(SET) and switched on.

| Set item | Function code | Setting limit | Contents |
| :---: | :---: | :--- | :--- |
| Base frequency | A003/A203 | $30-1^{\text {st }} / 2^{\text {nd }}$ maximum <br> frequency | Unit:Hz |
| Motor voltage <br> selection | A082 | $200 / 215 / 220 / 230 / 240$ | Unit:V When inverter is 200V class, <br> selection is possible. |
|  |  | $380 / 400 / 415 / 440 / 460 / 480$ | Unit:V When inverter is 400V class, <br> selection is possible. |

(2) AVR function

Even if the incoming voltage changes, this function will keep the output voltage and a constant voltage level. The output voltage to the motor in this function references to the voltage selected on motor voltage selection. Select Yes/No of this function on A081 AVR selection.

| Function <br> code | Data | Contents | Description |
| :---: | :---: | :---: | :--- |
| A081 | 00 | Always ON | This function is effective on acceleration, constant speed, deceleration. |
|  | 01 | Always OFF | This function is ineffective on acceleration, constant speed, <br> deceleration. |
|  | 02 | On <br> decelerating <br> OFF | This increases a loss of motor and reduces the energy regenerated to <br> inverter on decelerating. |

## Chapter4 Explanation of function

## Maximum frequency

Set the maximum frequency value of the inverter.
This set value is the maximum frequncey that the inverter will achieve when It receives top speed reference from the control terminalsor the digital operator

To the change the $1^{\text {st }} / 2^{\text {nd }}$ maximum frequency, set an intelligent input terminal to 08(SET) and switch the input ON.
The Inverter output voltage from the base frequencey to the maximum frequency is the same level as the voltage selected on the motor voltage selection.

| Function code | Limit of setting | Contents |
| :---: | :---: | :---: |
| A004/A204 | $30 .-400$. | Unit : Hz |

## Carrier frequency



The carrier frequency of the PWM wave-form output from the inverter is adjustable by changing b083.

## Relation code <br> b083: Carrier frequency

If the carrier frequency is set higher, the audible noise from motor will be reduced but the RFI noise and the leakage current may be increased. This function may help to avoid the resonant frequency of the motor or the mechanical system.

| Function code | Limit of setting | Contents |
| :---: | :--- | :---: |
| b083 | $0.5-12.0$ (Note 1) | Unit: $\mathrm{kHz}(11$ to 75 kW$)$ |
|  | $0.5-8.0($ Note 1$)$ | Unit: $\mathrm{kHz}(90$ to 132 kW$)$ |

(Note 1) The maximum value of the carrier frequency in order to achieve full output current is different depending on the capacity. When raising the carrier frequency, the rated output current will be reduced.

| Voltage <br> class | 200V class |  | 400V class |  |
| :---: | :---: | :---: | :---: | :---: |
| Contents <br> $(\mathrm{kW})$ | Maximum carrier <br> frequency <br> $(\mathrm{kHz})$ | Derating on carrier <br> frequency $=12 \mathrm{kHz}$ | Maximum carrier <br> frequency <br> $(\mathrm{kHz})$ | Derating on carrier <br> frequency = 12kHz <br> $(8 \mathrm{kHz} 90 \mathrm{~kW}$ to 132kW) |
| 11 | 12 | $100 \%$ | 12 | $100 \%$ |
| 15 | 12 | $100 \%$ | 12 | $100 \%$ |
| 18.5 | 10 | $90 \%$ | 12 | $100 \%$ |
| 22 | 4 | $80 \%$ | 12 | $100 \%$ |
| 30 | 3 | $70 \%$ | 8 | $90 \%$ |
| 37 | 8 | $80 \%$ | 10 | $80 \%$ |
| 45 | 10 | $95 \%$ | 10 | $95 \%$ |
| 55 | 6 | $75 \%$ | 10 | $95 \%$ |
| 75 | 3 | $70 \%$ | 5 | $60 \%$ |
| 90 | - | - | 6 | $95 \%$ |
| 110 | - | - | 6 | $85 \%$ |
| 132 | - | - | 6 | $85 \%$ |

[^0]


## Chapter4 Explanation of function

## External analog input

This inverter has three kinds of external analog input terminals.
O-L terminal : 0-10Vdc OI-L termminal : 4-20mA
O2-L terminal : -10/0/+10V
Relation code
A005: AT terminal selection
A006: 02 Selection
C001-C005: Intelligent input terminal

The setting contents of this function is as follows.

| Set item | Function code | Data | Contents |
| :---: | :---: | :---: | :---: |
| AT terminal selection | A005 | 00 | $\begin{gathered} \text { Change of O/OI } \\ \text { with AT terminal } \end{gathered} \quad\left[\begin{array}{l} \text { AT terminal ON: OI-L valid } \\ \text { AT terminal OFF: O-L valid } \end{array}\right]$ |
|  |  | 01 | $\begin{gathered} \hline \text { Change of O/O2 } \\ \text { with AT terminal } \end{gathered}\left[\begin{array}{l} \text { AT terminal ON: O2-L valid } \\ \text { AT terminal OFF: O-L valid } \end{array}\right]$ |
| 02 selection | A006 | 00 | Single |
|  |  | 01 | Auxiliary frequency command of $\mathrm{O}, \mathrm{Ol}($ No reverse) |
|  |  | 02 | Auxiliary frequency command of $\mathrm{O}, \mathrm{Ol}($ Reverse) |

Assign 16(AT) to intelligent input terminal. The frequency setting is the values from terminals $\mathrm{O}, \mathrm{Ol}$ and O 2 when 16(AT) isn't assigned. The frequency set up when A006 is " 00 " becomes the value of O2. And, the frequency set up when A006 is " 01 " or " 02 " becomes the value which Ol and O 2 were added to. The following frequency command methods are available by combining A005, A006 with the intelligent input AT terminal. In the case that reverse and FW(forward) terminals are ON, the inverter operates reversely when (main frequency command + auxiliarly frequency command) $<0$.

|  | A006 | A005 | AT terminal | Main frequency command | Exlstence of Auxiliarly frequency command(02-L) | Existence <br> Of <br> Reverse |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Intelligent input terminal on assigning AT | 00 | 00 | OFF | O-L | No | No |
|  |  |  | ON | OI-L | No |  |
|  |  | 01 | OFF | O-L | No |  |
|  |  |  | ON | O2-L | No | Yes |
|  | 01 | 00 | OFF | O-L | Yes | No |
|  |  | (Example 1) | ON | OI-L | Yes |  |
|  |  | 01 | OFF | O-L | Yes |  |
|  |  |  | ON | O2-L | No | Yes |
|  | 02 | 00 | OFF | O-L | Yes |  |
|  |  | (Example 2) | ON | OI-L | Yes |  |
|  |  | 01 | OFF | O-L | Yes |  |
|  |  |  | ON | O2-L | No |  |
| Intelligent input Terminal when Don't assign AT | 00 | - | - | O2-L | No | Yes |
|  | 01 | - | - | Adding O-L and OI-L | Yes | No |
|  | 02 | - | - | Adding O-L and OI-L | Yes | Yes |



## Chapter4 Explanation of function

## Input frequency Start/End

External analog signal from the control terminals (frequency command)
O-L terminal : 0-10V
OI-L terminal : 4-20mA
O2-L terminal : -10/0/+10V
Set output frequency for one of the above
(1)Start, End of O-L terminal, OI-L terminal

| Relation code |  |
| :--- | :--- |
| A011: O start | A103: Ol start rate |
| A012: O end | A104: Ol end rate |
| A013: O start rate | A105: Ol start selection |
| A014: O end rate | A111: O2 start |
| A015: O start selection | A112: O2 end |
| A101: OI start | A113: O2 start rate |
| A102: Ol end | A114: O2 end rate |


| Set item | Function code | Data | Contents |
| :---: | :---: | :---: | :---: |
| O/Ol start | A011/A101 | 0.00-400.0 | Unit: Hz Set starting frequency |
| O/OI end | A012/A102 | 0.00-400.0 | Unit: Hz Set ending frequency |
| O/OI start rate | A013/A103 | 0.-100. | Unit : \% <br> Set start rate for external frequency command 0-10V, 4-20mA |
| O/OI end rate | A014/A104 | 0.-100. | Unit : \% <br> Set end rate for external frequency command $0-10 \mathrm{~V}, 4-20 \mathrm{~mA}$ |
| O/OI start Selection | A015/A105 | 00 | External start frequency <br> Output frequency from 0 to A013/A103 outputs the value of A011/A101 |
|  |  | 01 | OHz <br> Output frequency from 0 to A013/A103 outputs the value of 0Hz |

When the input is from 0 to 5 V with $\mathrm{O}-\mathrm{L}$ terminal, set A014 to $50 \%$.
(Example 1) A015/A105:00


(2) Start, End of O2-L terminal

| Set item | Function <br> code | Data | Contents | Notes |
| :---: | :---: | :---: | :--- | :---: |
| O2 start | A111 | $-400 .-400$. | Unit : Hz Set starting frequency |  |
| O2 end | A112 | $-400 .-400$. | Unit : Hz Set ending frequency |  |
| O2 start rate | A113 | $-100 .-100$. | Unit : \% Set starting rate for external frequency command <br> $-10-10 \mathrm{~V}$ (Note 1) | (Example 3) |
| O2 end rate | A114 | $-100 .-100$. | Unit : \% Set ending rate for external frequency command <br> $-10-10 \mathrm{~V}$ (Note 1) |  |

(Note 1) The rates of $-10 \mathrm{~V}-10 \mathrm{~V}$ is following.

$$
\begin{gathered}
-10 \mathrm{~V}-0 \mathrm{~V}:-100-0 \% \\
\text { 0V-10V:0-100\% }
\end{gathered}
$$

For example, in case of use with O2-L terminal, set -50\% to A113, 50\% to A114.


## Setting analog input filter

Set the internal filter of the frequency setting signal of voltage or current from the control terminals

Relation code
A016: O, OI, O2 filter

It is important to first remove the source of the noise to the system.
When stable operation can not be achieved due to the effect of electrcal noise, set a larger value.
The response will be slower by setting a larger value. The limit of setting is about $2 \mathrm{~ms}-60 \mathrm{~ms}$ ( set value : 130)

| Function code | Limit to set | Contents |
| :---: | :---: | :---: |
| A016 | $1 .-30$. | Can set with the 1 unit. |

## Output voltage gain

Regarding the voltage selected on A082 motor voltage selection as $100 \%$, set the rate of the voltage which the inverter outputs for the voltage selected.

## Relation code

A045: Output voltage gain
A082: Motor voltage selection

| Function code | Limit to set | Contents |
| :---: | :---: | :---: |
| A045 | $20 .-100$. | Unit:\% |



## Control system (V/f Characteristic)

Set V/f (output voltage/output frequency) characteristic.
To change $1^{\text {st }} / 2^{\text {nd }}$ control system (V/f characteristic), set 08(SET) to an intelligent input terminal and switch it ON.

Relation code
A044/A244:1 $1^{\text {st }} / 2^{\text {nd }}$ control system
b100/b102/b104/b106/b108/b110/b112
: Free setting V/f frequency $1 / 2 / 3 / 4 / 5 / 6 / 7$
b101/b103/b105/b107/b109/b111/b113
: Free setting V/f voltage 1/2/3/4/5/6/7

| Function code | Data | V/f characteristic |
| :---: | :---: | :--- |
| A044/A244 | 00 | Constant torque characteristic(VC) |
|  | 01 | Reduced torque characteristic(VP1.7power) |
|  | 02 | Free setting V/f characteristic |

(1) Constant torque characteristic (VC)

Output voltage outputs proportionally to the output frequency.
Output voltage outputs proportionally from 0 to the base frequency, but the output voltage from the base frequency to the maximum frequency is constant regardless of frequency.

(2) Reduced torque characteristic (VP1.7 power)

This characteristic can be used when a large starting torque isn't required.
At low speeds, it can cause improvement of efficiency, low noise and low vibration because of lowering the output voltage.
V/f characteristic is as follows.


(a) (b)
(C)

Period (a) :The limit from 0 to $10 \%$ of base frequency is the constant characteristic.
(Example) If the base frequency is 60 Hz , the limit from 0 to 6 Hz is constant characteristic.
Period (b) :The limit from $10 \%$ of base frequency to base frequency is reduced torque characteristic.
The voltage is output in the curve of 1.7 power for frequency.
Period (c):The voltage is constant from the base frequency to the maximum frequency.

## Chapter4 Explanation of function

(3) Free V/f setting

The free V/f setting sets optional V/f characteristics by setting the voltage and frequency in seven parts.(b100-b113)
The setting of free $\mathrm{V} / \mathrm{f}$ setting operates always to be $1 \leq 2 \leq 3 \leq 4 \leq 5 \leq 6 \leq 7$.
Please set first free V/f setting 7 because the initial value is all 0 Hz .
When the free V/f setting is valid, the function of torque boost(A041/A241), base frequency(A003/A203), maximum frequency(A004/A204) is invalid. (Free V/f frequency 7 is treated as maximum frequency.)

| Set item | Function code | Data | Contents |
| :---: | :---: | :---: | :---: |
| Free V/f frequency7 | b112 | 0.- 400. | Unit : Hz |
| Free V/f frequency6 | b110 | 0.- Free V/f frequency7 |  |
| Free V/f frequency5 | b108 | 0.- Free V/f frequency6 |  |
| Free V/f frequency4 | b106 | 0.- Free V/f frequency5 |  |
| Free V/f frequency3 | b104 | 0.- Free V/f frequency4 |  |
| Free V/f frequency2 | b102 | 0.- Free V/f frequency3 |  |
| Free V/f frequency1 | b100 | 0.- Free V/f frequency2 |  |
| Free V/f voltage7 | b113 | 0.0-800.0 | Unit : V <br> (Note 1) |
| Free V/f voltage6 | b111 |  |  |
| Free V/f voltage5 | b109 |  |  |
| Free V/f voltage4 | b107 |  |  |
| Free V/f voltage3 | b105 |  |  |
| Free V/f voltage2 | b103 |  |  |
| Free V/f voltage1 | b101 |  |  |

(Example)

(Note 1) Even if you set 800 V for free $\mathrm{V} / \mathrm{f}$ voltage1-7, output of inverter can't be more than the input voltage or the AVR setting voltage.


## Torque boost

A correctly installed motor and careful attention to voltage drop in the wiring will improve the motor torque at low speed. Setting of A041/A241 will select between manual torque boost and automatic torque boost, the level of torque boost corresponds to the set motor capacity selection (H003/H2O3) and the motor pole selection (H004/H2O4).

## Relation code

A041/A241: $1^{\text {st }} / 2^{\text {nd }}$ torque boost selection
A042/A242:1 $1^{\text {st }} / 2^{\text {nd }}$ manual operation torque boost A043/A243:1 $1^{\text {st }} / 2^{\text {nd }}$ manual operation torque boost break point
H003/H203: $1^{\text {st }} / 2^{\text {nd }}$ motor capacity selection
H004/H204:1s/ ${ }^{\text {st }}$ notor pole selection

| Set item | Function code | Data | Contents |
| :--- | :---: | :---: | :--- |
| Torque boost | A041/A241 | 00 | Manual torque boost |
|  | A04ual torque boost | A042/A242 | $0.0-20.0$ | | Automatic torque boost |
| :--- |
| Unit:\% |
| Level corresponding to output Voltage <br> $(100 \%)$ |
| Manual torque boost break point | A043/A243 $\quad 0.0-50.0 ~$| Unit:\% |
| :--- |
| Level corresponding to base frequency |

## (1) Manual torque boost

The values set up with A042/A242 and A043/A243 is outputted.
A042/A242 sets a percentage level where the base frequency voltage is $100 \%$.
The level set is the value of torque boost output voltage at 0 Hz .
When using the manual torque boost, it should be noted that overuse will cause saturation of the motor and may cause damage.
The manual torque boost break point is the frequency at which the voltage torque boost is switched off and normal operation resumes.
To change from A041and A042 to A241and A242 an intelligent input needs to be set to 08(SET) and switched on.

(2) Automatic torque boost

The output voltage is adjusted automatically by the condition of the load.
When using automatic torque boost it is important that the following two parameters are set correctly.

| Set item | Function code | Setting limit | Contents |
| :---: | :---: | :---: | :---: |
| Motor capacity selection | $\mathrm{H} 003 / \mathrm{H} 203$ | $0.20-75.0(11$ to 75 kW$)$ | Unit : kW |
|  |  | $0.20-160.0(90$ to 132 kW$)$ |  |
| Motor pole selection | $\mathrm{H} 004 / \mathrm{H} 204$ | $2 / 4 / 6 / 8$ | Unit : pole |

## Chapter4 Explanation of function

## Direct current braking(DB)

A dc voltage can be applied to the motor windings in order to lock the motor shaft and avoid overun at low speeds.
There are two methods of activating the dc braking,
Outside which is through the intelligent input terminals and Inside which is automatically started at a specific frequency.

Relation code
A051: DC braking selection
A052: DC braking frequency
A053: DC braking late time
A054: DC braking power
A055: DC braking time
A056: DC braking edge/level selection
A057: Starting DC braking power
A058: Starting DC braking time
A059: DC braking carrier frequency

| Set item | Functin code | Data | Contents |
| :---: | :---: | :---: | :---: |
| DC braking selection | A051 | 00 | Inside DC braking : invalid |
|  |  | 01 | Inside DC braking : valid |
| DC braking frequency | A052 | 0.00-60.00 | Unit: Hz <br> When the output reaches the set frequency and Inside DC braking is valid, DC braking is started. |
| DC braking late time | A053 | 0.0-5.0 | Unit : second <br> After DC braking time is reached, or DB terminal is ON , the late time is a delay before DC braking is started. |
| DC braking power/ Starting DC braking power | A054/A057 | 0.-70. | Unt: \% <br> Weak (Zero current) - <br> Strong (Inverter rating fairly 70\% the DC current) |
| DC braking time | A055 | 0.0-60.0 | Unit : second <br> The DC braking is stopped after this time delay has elapsed. The time is tarted when the late time has elapsed. |
| DC braking edge/level selection | A056 | 00 | Edge movement (Example 1-6-a) |
|  |  | 01 | Level movement (Example 1-6-b) |
| Starting DC braking time | A058 | 0.0-60.0 | Unit : second <br> It is valid for inside DC braking. <br> When operating command is ON, DC current is started. |
| DC braking carrier Frequency | A059 | 0.5-12 | Unit : kHz (11 to 75kW) |
|  |  | 0.5-8 | Unit : kHz (90 to 132kW) |

(1) DC braking carrier frequency

It is possible to alter the DC braking carrier frequency. However, if the DC braking carrier frequency is set higher than 3 kHz , the value of maximum braking power level is automatically reduced as follows.
Set DC braking carrier frequency with A059.


## Chapter4 Explanation of function

(2) Outside DC braking

Set 07(DB) to an intelligent input terminal.
DC braking is then switched by ON/OFF of DB terminal irrespective of DC braking selection A051.
Set strength of DC braking power with A054.
If DC braking late time A053 is set, the Inverter outpuit is cut off for this time period, the motor will be free running.

After the late time passes, DC braking is started.
Please set DC braking time A055 or DC braking time by DB terminal paying attention to the heat of the motor.
Please set each setting in accordance with the system, after level action or edge action are selected with A056.

| (a) Edge operation (A056:00) | (b) Level operation (A056:01) |
| :---: | :---: |
| (Example 1-a) $\qquad$ <br> FW $\qquad$ | (Example 1-b) |
| (Example 2-a) | (Example 2-b) |
| (Example 3-a) | (Example 3-b) |

## Chapter 4 Explanation of function

(3) Inside DC braking

When the inverter starts, and the DB terminal is not ON the inverter can operate dc braking.
When using inside DC braking, the DC braking selection A051 should be set 01.
Starting DC braking power is set with A057, DC braking time at starting is set with A058.
Braking power setting except starting time, set with A054.
If DC braking late time A053 is set and the dc braking frequency is reached, the operating command (FW) is switched OFF. The inverter cuts the output and for the set time of A053, free running of the motor will occur. After finishing the set time in A053, DC braking is started.
Set the frequency at which the DC braking will operate at with A052.
The operation of Edge/Level selection when using inside DC braking is different.
Edge action: Give priority to A055 DC braking action time, operate DC braking according to set time.
After turning operating command (FW) OFF, when output frequency reachs the set value of A052, during setting A055 DC braking is run. Even if operation command is turned ON, during setting time of A055, DC braking is run.(Example 5-a), (Example 6-a)

Level action: Give priority to operaing command, ignore DC braking time A055 and move to normal operation. When operation command is turned ON during DC braking, set time of A055 is ignored and normal operation is restored. (Example 5-b), (Example 6-b)
i) When starting (Example 4-a)

## Chapter 4 Explanation of function

## Frequency limiter

This function can set a maximum and minimum limit of the output frequency.
Even if a frequency command exceeds the maximum and minimum limiter the inverter will ignore this value and stop at the values set. Set first maximum limiter on setting.

## Relation code

A061/A261: $1 \mathrm{st} / 2^{\text {nd }}$ frequency maximum limiter

A062/A262: 1st/2 ${ }^{\text {nd }}$ frequency minimum limiter

Be sure that the maximum limiter (A061/A261) > minimum limiter (A062/A262).
The maximum and minimum limiter will not operate if 0 Hz is set.

| Set item | Function code | Setting limit | Contents |
| :--- | :--- | :--- | :--- |
| Frequency max. <br> limiter | A061/A261 | 0.00, <br> frequency min. limiter - max. <br> frequency | Unit $: \mathrm{Hz}$ <br> Setting max. of output <br> frequency |
| Frequency min. limiter | A062/A262 | 0.00, <br> starting frequency - max. <br> limiter frequency | Unit $: \mathrm{Hz}$ <br> Setting min. of output <br> frequency |

(1) In use O-L, Ol-L case


When frequency command is control terminal (Terminal), by setting Min. limiter, even if $O V$ is input, it is not possible to output less than the frequency set with Min. limiter.
(2) In use O2-L case


When using the minimum frequency limiter and $0 v$ is inputted into O 2 terminal, A062 applies to both forward and reverse directions.
(a) When operation command is control terminal (Terminal)(A002:01)

| Terminal | Revolution when O2 is 0V |
| :--- | :--- |
| FW(ON) | A062 on forward side |
| RV(ON) | A062 on reverse side |

(b) When operation command is operator (A002:02)

| F004 | Revolution when O2 is 0V |
| :---: | :--- |
| 00 | A062 on forward side |
| 01 | A062 on reverse side |

## Chapter 4 Explanation of function

## Frequency jump function

Frequency jump can be used to avoid resonance points on machinery.
Frequency jump is to jump the frquency command and avoid usual operation within the limit of the jump frequency.
Output frequency changes continuously according to adjustable time.
It is possible three different points are set for the jump frequency.
Relation code A063:Jump frequency1 A064:Jump frequency band1 A065:Jump frequency2 A066:Jump frequency band2

A067:Jump frequency 3
A068:Jump frequency band3

| Set item | Function code | Setting limit | Contents |
| :---: | :---: | :---: | :--- |
| Jump frequency $1 / 2 / 3$ | A063/A065/A067 | $0.00-400.0$ | Unit: Hz <br> Set the frequency fj of center to jump.(Note) |
| Jump frequency Width <br> $1 / 2 / 3$ | A064/A066/A068 | $0.00-10.00$ | Unit:Hz <br> Set $1 / 2$ value of frequency width to jump (Note) |

(Note) The frequency to jump is $\mathrm{fj}+2(\mathrm{~Hz})$.


## Acceleration stop function

When the inertial moment of a load is high, this is the function to wait until the slip of the motor on starting becomes smaller.
Use when the overcurrent trip occurs on starting.

Relation code
A069:Acceleration stop frequency A070:Acceleration stop time

| Set item | Function code | Data | Contents |
| :--- | :---: | :---: | :--- |
| Acceleration <br> stop frequency | A069 | $0.00-400.0$ | Unit: Hz <br> Set the frequency to be held. |
| Acceleration <br> stop time | A070 | $0.0-60.0$ | Unit: second <br> Set the time to hold the frequency. |



## Chapter 4 Explanation of function

## PID function

This integrated process control function can be used for controls such as constant flow and control for fan and pump applications.
When using this function set A071 to 01 and assign an intelligent input terminal to 23(PID terminal: (OFF)valid / (ON)invalid).

| Set item | Function code | Data | Contents |
| :--- | :---: | :---: | :---: |
| PID selection | A071 | 00 | Invalid |
|  | A072 | 01 | Valid |
| PID P gain | A073 | $0.0-3600$. | Integration Gain <br> Unit: seconds |
| PID I gain | A074 | $0.00-100.0$ | Derivative gain <br> Unit: seconds |
| PID D gain | A075 | $0.01-99.99$ | Unit :times |
| PID scale | A076 | 00 | OI-L:4-20mA |
| PID feedback <br> selection | 01 | O-L:0-10V |  |
| Maximum PID <br> Deviation level | C044 | $0.0-100.0$ | Unit :\% |


| A001 | :Frequency command |
| :--- | :--- |
| selection |  |
| A005 | :AT selection |
| A006 | :O2 selection |
| A071 | :PID selection |
| A072 | :PID P gain |
| A073 | :PID I gain |
| A074 | :PID D gain |
| A075 | :PID scale |
| A076 | :PID feedback selection |
| d004 | :PID feedback monitor |
| C001-C005:Intelligent input terminal |  |
| C021-C022:Intelligent output terminal |  |
| $C 044$ :PID deviation setting level |  |

(1) Feedback selection

Select which analogue input terminals will be the feedback reference (A076).
Set the set frequency command selection with A001. (It should not be the same as the terminals selected with A076). Or when the control terminal 01 is set with A001, the setting of AT selection A005 is invalid. The contents changes when O 2 is selected with A006.
(2) Basic operation of PID control

(3) Components of PID Kp:Proportional gain, Ti:Reset time, Td:Rate time, s:Operator, $\boldsymbol{E}$ :Deviation
[1] P action This is the action that the manipulated variable is in proportion to the command.

[2] I action This is the action that the manipulated variable increases with time in a straight line.

[3] D action This is the action that the manipulated variable is in proportion to the changing rate of command.


PI action combines above [1] and [2], PD action does [1] and [3], PID action does [1], [2] and [3].
(4) The adjustment of gain

Please adjust each gain according to the state as the following, when the response on the functional operation PID is not stable.

Inspite of changing command, the change of feedback signal is slow. $\longrightarrow$ Raise P gain.
The feedback signal changes instantly but is not stable. $\longrightarrow$ Lower P gain.
The command and feedback signal doesn't coincide instantly. $\longrightarrow$ Lower I gain.
The feedback signal oscillates and is not stable. $\longrightarrow$ Raise I gain.
In spite of raising of $P$ gain, the response is slow. $\longrightarrow$ Raise $D$ gain.
When $P$ gain is raised, the feedback signal oscillates and is not stable. $\longrightarrow$ Lower $D$ gain.
(5) The Maximum PID Deviation Level/Output

It is possible to establish the maximum deviation level C044 on PID control. When the PID deviation amount reaches the set level C044, it is possible to set an intelligent output.
C044 can be set from 0 to 100 and corresponds with the command; from 0 to maximum.
Assign 04 (OD) to intelligent output terminal 11, 12(C021, C022).
(6) Feedback monitor of PID

Feedback signal of PID can be monitored.
The monitor value can be displayed by the product of PID scale A075.
"Monitor display" = "Feedback (\%)" x "A075 setting"
(7) PID integral reset

This is the function to clear integral value of PID action.
Assign 24(PIDC) to intelligent input terminal.
It is cleared whenever PIDC is turned ON.
Don't turn absolutely ON PID terminal during PID action, because there is a possibility of overcurrent trip. Turn ON PIDC terminal after turning OFF PID action.

## Automatic energy-saving operation function

This function regulates the inverter output power automatically to a minimum while operating at constant speed.
This fits for the load of reduced torque characteristic of fans or pumps. In case of operating by this function, set A085 to "01". A086 can adjust the automatic operation, response time.

| Set item | Function code | Deta | Contents |
| :---: | :---: | :---: | :--- |
| Operation <br> mode selection | A085 | 00 | Normal operation |
|  |  | 01 | Energy-saving <br> operation |


| Set item | Function code | Deta | Response | Accuracy |
| :--- | :---: | :---: | :---: | :---: |
| Energy saving |  | 0 | Slow | High |
| response / accuracy | A086 | $\uparrow$ | $\uparrow$ | $\uparrow$ |
| adjustment |  | $\downarrow$ | $\downarrow$ | $\downarrow$ |

## Chapter 4 Explanation of function

## Two-stage acceleration and deceleration function (2CH)

By setting this function, it is possible to change the rate of acceleration and deceleration.
As methods to change the rate of acceleration and deceleration, you can select the method of changing by intelligent input terminal and the method of automatic changing by optional frequency. In case of changing by intelligent input terminal, assign 09(2CH) to an Intelligent input terminal.

## Relation code

F002/F202: $1^{\text {st }} / 2^{\text {nd }}$ acceleration 1
F003/F203: $1^{\text {st }} / 2^{\text {nd }}$ deceleration time 1
A092/A292: $1^{\text {st }} / 2^{\text {nd }}$ acceleration time 2
A093/A294: $1^{\text {st }} / 2^{\text {nd }}$ deceleration time 2
A094/A294: $1^{\text {st }} / 2^{\text {nd }}$ two-stage acceleration and deceleration selection
A095/A295:1 ${ }^{\text {st }} / 2^{\text {nd }}$ two-stage acceleration frequency
A096/A296: 1st /2 $2^{\text {nd }}$ two-stage deceleration frequency
C001-C005: Intelligent input terminal

| Set item | Function code | Data | Contents |
| :--- | :---: | :---: | :--- |
| Acceleration <br> time 2 | A092/A292 | $0.01-3600$. | Unit : second (Example 1,2) |
| Deceleration <br> time 2 | A093/A293 | $0.01-3600$. | Unit : second (Example 1,2) |
| Two-stage <br> acceleration <br> and <br> deceleration <br> selection | A094/A294 | 00 | Changing by intelligent input terminal 09 (2CH) (Example 1) |
| Two-stage <br> acceleration <br> frequency | A095/A295 | $0.00-400.0$ | Changing by two-stage acceleration and deceleration frequency <br> (A095/A295, A096/A296) (Example 2) |
| Two-stage <br> deceleration <br> selection (A094/A294) is 01. (Example 2) | A096/A296 | $0.00-400.0$ | Unit: Hz It is valid when two-stage acceleration and deceleration <br> selection (A094/A294) is 01. (Example 2) |

(Example 1) In to set A094/A294 to 00 case

(Example 2) In to set A094/A294 to 01 case


## Chapter4 Explanation of function

## Acceleration and deceleration pattern

(1) Selection of pattern

Pattern of acceleration and deceleration speed is possible to set up corresponding to each system.

## Relation code

A097: Acceleration pattern selection
A098: Deceleration pattern selection
A131: Acceleration curve constant
A132: Deceleration curve constant
Select the pattern of acceleration and deceleration with A097 and A098.

| Set value | 00 | 01 | 02 | 03 |
| :---: | :---: | :---: | :---: | :---: |
| Curve | Line | Sigmoid | U-shape | Reverse U-shape |
| A097 <br> ( Accel- <br> eration) |  |  |  |  |
| A098 <br> (Decel- <br> eration) |  |  |  |  |
| Contents | Accelerate and decelerate in line until output frequency set value. | Collapsing the cargo such as the going up and down machine, conveyor it uses it for prevention. | Cutting the tension con as the volume collect prevention. | rolled book such machine it uses it for |

It is possible to set the pattern of both acceleration, deceleration.
(2) The curve constant (the swelling degree)

It makes the rough sketch reference and please decide the swelling degree.


There is the range which the midway adjustable-speed time becomes fast in the S character pattern.

## Chapter 4 Explanation of function

## Instantaneous power failure / under-voltage

Instantaneous stop and start
(1) You can select whether the inverter trips or retries (restart) when an instantaneous power failure/under-voltage occurs. When retry function is selected with b001, and an instantaneous Stop/under-voltage trip occurs restart is tried 16 times and a trip will occur after 17 times.
And when retry function is selected, and an over-current or an over-voltage occurs, restart is tried 3 times and a trip will occur on the forth time.

When an instantaneous power failure/under-voltage occurs,

| b001 | :Relation code |
| :--- | :--- |
| b002 | :Allowable under-voltage power failure time |
| b003 | :Retry delay time |
| b004 | :Instantaneous power failure under-voltage |
|  | trip during stop |
| b005 | :Instantaneous power failure under-voltage |
| b007 | :fretry time time selection |
| C021-C022 :Intelligent output terminal |  |
| C026 | :Alarm relay output |

you can select execution of trip with b004.
To select a retry function with b001, set the following retry mode correspondent to each system.

| Set item | Function code | Data | Description |
| :---: | :---: | :---: | :---: |
| Retry selection | b001 | 00 | Trip. |
|  |  | 01 | Restart from 0 Hz on retry. |
|  |  | 02 | Start equaling frequency on retry. (Example 1) |
|  |  | 03 | Start f-equaling and stop decelerating on retry. After stop, start trip. (Note 1) |
| Allowable undervoltage power failure time | b002 | 0.3-1.0 | Units : second If the instantaneous power failure time is shorter than the set time, a restart will occur. (Example 1) If the instantaneous stop time is longer than set time, trip. (Example2) |
| Retry wait time | b003 | 0.3-100. | Units: second Delay before motor restart time. |
| Instantaneous power failure/under-voltage trip during stop (Note 2) | b004 | 00 | Invalid <br> Trip isn't caused and alarm isn't output. |
|  |  | 01 | Valid <br> Trip is cause and alarm is output. |
|  |  | 02 | Invalid <br> Trip isn't caused and alarm isn't output during stop and deceleration by stop command. |
| Instantaneous power failure/under-voltage retry time selection | b005 | 00 | Restart to 16 times on instantaneous stop under-voltage. |
|  |  | 01 | Restart freely on instantaneous stop under-voltage. |
| Frequency setting to match | b007 | $\begin{aligned} & 0.00- \\ & 400.0 \end{aligned}$ | Units: Hz <br> When the frequency of the motor during free-run is less than this set frequency, restart with 0 Hz is caused. (Example 3,4) |

(Note 1) When trip of the over voltage or over current etc. occurs in the deceleration midway an instantaneous power failure error (E16) is displayed and operates free-run. In this case make the deceleration time of long
(Note 2) When using control power supply terminal RO-TO and connecting DC voltage ( $\mathrm{P}-\mathrm{N}$ ) to $\mathrm{RO}-\mathrm{TO}$, an under-voltage may be detected at power off and give trip signal. If this may cause any problem to your system, set data in 00 or 02.
F-equaling start: The inverter reads the motor $\mathrm{r} / \mathrm{m}$ and direction and restarts the inverter to match these readings.

Retry function (b001: 02): The timing chart in case of selection is following.


After wait for t 2 seconds according to $\mathrm{t} 0<\mathrm{t} 1$, restart.
(Example 2)


Trip according to t0 $>\mathrm{t} 1$.
(Example 3) Motor frequency (revolution time) >b007 (Example 4) Motor frequency (revolution time) <b007

(2) Instantaneous power failure during stop alarm output during under-voltage

Select yes/no of alarm output when instantaneous power failure or under-voltage occurs with b004.
Alarm outputs while control power of inverter remains.

- Alarm output at an instantaneous power failure and under-voltage during standstill.

Standard (Example 5-7).
Alarm signal performance when connecting DC voltage (P-N) to R0-T0 terminal. (Example 8-10).

(3) It is possible to use an output by assigning the signal (IP: 08) during instantaneous stop, by setting (UV: 09) during under-voltage to an intelligent output terminal 11, 12(C021, C022) or alarm relay output terminal (C026).
(4) If the instantaneous power failure time is longer than 1 second, please refer to the pages $4-48$ Reset (RS).

## Open phase protection function selection

This is the function to warn when the inverter input supplies opens.

| Function <br> code | Data | Description |
| :---: | :---: | :--- |
| b006 | 00 | Invalid <br> Don't trip when the input supplies opens. |
|  | 01 | Valid <br> Trip when the input supplies opens. |

## Relation code

b006:Open phase selection

When an open phase occurs, there is a danger that the inverter could produce one of the following states;
(1) Ripple current of main capacitor increases, life of main capacitor shortens remarkably.
(2) In case of load, there is danger that the capacitors or thyristors inside the inverter could be damaged.
(3) There is a risk that the in-rush resistor to limit the current inside the inverter may burn out.

## Electrionic thermal function

Set the Inverter according to motor rated current to protectthe motor from overloading, overheating and damage.
A warning signal is outputted before tripping on electronic thermal protection.

## Relation code

b012/b212:1 $1^{\text {st }} / 2^{\text {nd }}$ electric thermal level
b013/b213:1 $1^{\text {st }} / 2^{\text {nd }}$ electric thermal characteristic selection
b015/b017/b019:free electric thermal frequency 1/2/3
b016/b018/b020:Free thermal current 1/2/3
C021-C022:Intelligent output terminal
C026:Alarm relay output terminal
C061:Thermal warning level
(1) Electronic thermal level

| Function code | Setting range | Description |
| :---: | :---: | :---: |
| b012/b212 | Rated Current $\times 0.2$ to <br> Rated Current $\times 1.2$ | Units:A |

(Example) L300P-110LFU
Motor current:44A
Setting range: 8.8 to 52.8 A
When electronic thermal level b012=44A, time limit characteristic is right diagram.
(2) Electronic thermal characteristic


Frequency characteristic is added up to set value of b012.

| Function <br> code | Deta | Electronic thermal <br> characteristic |
| :---: | :---: | :---: |
| b013/b213 | 00 | Reduced torque <br> characteristic |
|  | 01 | Constant torque <br> characteristic |
|  | 02 | Free setting |

When output frequency of general motor decreases, cooling function of self-cooled fan will fall.
Reduced torque characteristic is calculated according to heat of a HITACHI general motor.
(a) Reduced torque charcteristic

To add to the time limit characteristic set with the reduced time rate b012/b212 by each frequency.

(b) Constant torque characteristic

Set this in to use constant torque motor case.

(Example)b012 $=44(\mathrm{~A})$, when output frequency $=20 \mathrm{~Hz}$

(Example)b012 $=44(\mathrm{~A})$, when output frequency $=2.5 \mathrm{~Hz}$.

(3) Free/thermal characteristic

It is possible to set the electronic thermal characteristic freely according to the load in order to protect the motor and the Inverter.

Setting range is shown as follows;

| Set item | Function code | Set range | Description |
| :--- | :--- | :--- | :--- |
| Free electronic thermal frequency <br> $1 / 2 / 3$ | b015/b017/b019 | 0 to 400 | Units : Hz |
| Free electronic thermal current $1 / 2 / 3$ | b016/b018/b020 | 0.0 <br> 0.1 to 999.9 | disable <br> Units : A |



(Example) b012=44(A), output frequency=b017

(x):b018x116\%
(y):b018×120\%
(z):b018×150\%
(3) Thermal warning

A warning signal is outputted before overheat protection by the electronic thermal protection occurs.
Warning level is set with C061.
Assign 13(THM) to an intelligent output terminal (C021, C022) or the alarm relay output (C061).

| Function <br> code | Data | Description |
| :---: | :---: | :---: |
| C061 | 0. <br> $1 .-100$. | Thermal warning is noneffective <br> Units : \% |

## Overload restriction/Overload advance notice

(1) Overload restriction

The Inverter monitors the motor current on acceleration and constant speed,
When the inverter reaches the overload restriction level, the Inverter will reduce the output frequency automatically to restrict the overload.
This function prevents an over-current trip by inertia during acceleration or radical changes in load at constant speed.
Two kinds of overload restriction function are set with b021, b022, b023 and b024, b025, b026.
To change b021, b022, b023 and b024, b025, b026, assign 39(OLR) to an intelligent input terminal.
The current value this function operates at is set in overload restriction level.

## Relation code

```
b021:Overload restriction selection
b022:Overload restriction level
b023:Overload restriction constant
b024:Overload restriction 2 selection
b025:Overload restriction level2
b026:Overload restriction constant2
C001-C005:Intelligent input terminal
C021-C022:Intelligent output terminal
C026:Alarm relay output setting
C040:Overload advance notice signal
    output mode
C041: Overload notices level
```

The overload restriction constant is the time to decelerate to OHz from max. frequency. b021, b022, b023 and b024, b025, b026 is changed with OLR.
As this function operates, the acceleration time is longer than setting time.
If the overload restriction constant is set too short, in spite of accelerating, an over-voltage trip is caused with regenerative enegy from the motor on automatic deceleration by this function.
When this function operates in the midst of accelerating, the frequency will not reach the goal frequency, the Inverter will adjust in the following way.

Make acceleration time longer.
Raise torque boost.
Raise overload restriction level.

| Set item | Function code | Data | Description |
| :--- | :---: | :---: | :--- |
| Overload <br> restriction <br> Selection. | b021/b024 | 00 | Invalid |
|  | 01 | Acceleration/valid on constant speed. |  |
| Overload <br> restriction <br> Level. | b022/b025 | Rated current $\times 0.5$ to <br> Rated current $\times 1.5$ | Units $: A$ <br> Current value overload restriction operates. |
| Overload <br> restriction <br> Constant. | b023/b026 | 0.1 to 30.0 | Units $:$ second <br> Deceleration time when overload restriction <br> Operates. |


(2) Overload advance notice

When the load is high, it is possible to adjust the load again by outputting an overload advance notice.
It is used to prevent damage to the machine from too much load, i.e. baggage on a conveyor, the Inverter overload protection will operate.
Assign $03(\mathrm{OL})$ to an intelligent output terminal 11, 12 or the alarm relay output terminal.

| Set item | Function code | Data | Description |
| :---: | :---: | :---: | :---: |
| Overload advance notice signal output mode selection | C040 | 00 | On acceleration, constant speed, this is valid. |
|  |  | 01 | On constant speed only, this is valid. |
| Overload advance notice level |  | 0.0 | Overload advance notice is non-effective. |
|  | C041 | $\begin{gathered} 0.1 \text { to } \\ \text { Rated current } x \\ 2.0 \\ \hline \end{gathered}$ | Units: A <br> As load reaches overload advance notice level, OL signal is output. |



## Chapter 4 Explanation of function

## Start frequency

This frequency is the value the operator must set before the Inverter will give

Relation code an output.
Mainly used when an operator adjusts the start torque.
By setting the start frequency higher, direct starting is caused and the starting current increases. Therefore an overload is within the restriction range and the inverter has a tendency to trip on over-current protection.

| Function <br> code | Set range | Description |
| :---: | :---: | :---: |
| b082 | 0.10 to 9.99 | Units $: \mathrm{Hz}$ |

FW

## Reduced voltage start selection

This function is to raise the voltage slowly on motor starting.
The lower this value the more torque is available on starting.
However, by making this value lower, the inverter has a tendency of tripping on over-current protection, because of almost direct starting.

## Relation code

b036:Reduced voltage start selection
b082:Start frequency

| Function <br> code | Data | Time to take for reduced <br> voltage starting |
| :---: | :---: | :---: |
| b036 | 00 | No reduced voltage start |
|  | 01 | Short (about 6ms) |
|  | $\downarrow$ | $\uparrow$ |
|  | 06 | $\downarrow$ |



## Chapter 4 Explanation of function

## BRD (dynamic braking) function

This function only operates with the L300P - 15kW and lower, as they have the built-in BRD
This function is to consume regenerative energy from the motor as heat by the

Relation code
b090: BRD usage ratio b095: BRD selection b096: BRD On level use of an external resistor.
Regeneration occurs when the motor is decelerated to quickly and the motor turns into a generator and voltage flows back into the Inverter.
To use the BRD function, set following condition.

| Set item | Function code | Data | Description |
| :---: | :---: | :---: | :---: |
| BRD usage <br> Ratio | b090 | 0.0 | BRD don't operate. |
|  |  | 0.1-100.0 | The usage ratio of BRD is set by $0.1 \%$ unit. When inverter exceeds the usage ratio, trip. |
| Selection of BRD | b095 | 00 | BRD don't operate. |
|  |  | 01 | During run: valid (BRD operates.) <br> During stop: invalid (BRD doesn't operate.) |
|  |  | 02 | During run, stop, valid (BRD operates.) |
| BRD ON <br> Level | b096 | $\begin{gathered} (\text { Note 1) } \\ 330-380 \end{gathered}$ | Units: V In case of 200V class inverter, setting is valid. |
|  |  | $\begin{gathered} (\text { Note 1) } \\ 660-760 \end{gathered}$ | Units: V In case of 400V class inverter, setting is valid. |

(Note 1) BRD ON level is the voltage setting of the DC (direct current) voltage of the inverter.

## Cooling fan operating selection

You can select whether the fan operates continuously or operates only when the inverter is in the running operation.


| Function <br> code | Data | Description |
| :---: | :---: | :--- |
| b092 | 00 | Always run |
|  | 01 | Only during run <br> However, inverter operates for five minutes after <br> power ON, and for five minutes after inverter <br> operation stops. |

## Chapter 4 Explanation of function

## Intelligent input terminal setting

It is possible to operate functions by assigning those functions to the intelligent input terminals 1-5 (C001-C005).

Relation code
C001-C005: Intelligent input terminal

The intelligent input terminals 1-5 can be selected individually whether the contact input specification is either a NO or a NC contact.

Two or more intelligent input terminals can't be assigned to be the same function.
If an intelligent input is assigned a function which is already assigned to another terminal it will automatically be restored back to the setting before.

| Function Code | Data | Description | Reference item | Page |
| :---: | :---: | :---: | :---: | :---: |
| C001-C005 | 01 | RV:Reverse command | Operation run | 4-14 |
|  | 02 | CF1:Multi-speed 1 (binary operation) | Multi-speed operation function | 4-43 |
|  | 03 | CF2:Multi-speed 2 (binary operation |  |  |
|  | 04 | CF3:Multi-speed 3 (binary operation) |  |  |
|  | 05 | CF4:Multi-speed 4 (binary operation) |  |  |
|  | 06 | JG:Jogging | Jogging operation | 4-44 |
|  | 07 | DB:External DC braking | DC braking(external DC braking) | 4-26 |
|  | 08 | SET:2 ${ }^{\text {nd }}$ Set of Motor Data | $2^{\text {nd }}$ Set of Motor Data | 4-45 |
|  | 09 | 2CH:Two-stage adjustable-speed | Two-stage adjustable-speed function | 4-32 |
|  | 11 | FRS:Free-run stop | Free-run stop | 4-46 |
|  | 12 | EXT:External trip | External trip | 4-50 |
|  | 13 | USP:Unattended start protection | Unattended start protection function | 4-49 |
|  | 14 | CS:Commercial change | Commercial change | 4-47 |
|  | 15 | SFT:Software lock (control terminal) | Software lock | 4-45 |
|  | 16 | AT:analog input voltage/current select | Analog external input | 4-19 |
|  | 18 | RS:Reset inverter | Reset inverter | 4-48 |
|  | 20 | STA:3 wire start | 3 wire input function | 4-50 |
|  | 21 | STP:3 wire stop |  |  |
|  | 22 | F/R:3 wire direction |  |  |
|  | 23 | PID:PID selection (valid/invalid) | PID function | 4-30 |
|  | 24 | PIDC:PID integrating reset |  |  |
|  | 27 | UP:Remote control UP function | UP/DOWN function | 4-49 |
|  | 28 | DWN:Remote control DOWN function |  |  |
|  | 29 | UDC:Remote control data clear |  |  |
|  | 31 | OPE:force operation ope | force operation ope function | 4-55 |
|  | 32 | SF1:Multi-speed 1 (bit run) | Multi-speed operation function | 4-43 |
|  | 33 | SF2:Multi-speed 2 (bit run) |  |  |
|  | 34 | SF3:Multi-speed 3 (bit run) |  |  |
|  | 35 | SF4:Multi-speed 4 (bit run) |  |  |
|  | 36 | SF5:Multi-speed 5 (bit run) |  |  |
|  | 37 | SF6:Multi-speed 6 (bit run) |  |  |
|  | 38 | SF7:Multi-speed 7 (bit run) |  |  |
|  | 39 | OLR:Overload restriction change | Overload restriction | 4-38 |
|  | no | NO:No assign | - | - |

## Input terminal $\mathrm{a} / \mathrm{b}(\mathrm{NO} / \mathrm{NC})$ selection

It is possible to set a contact input or b contact input to intelligent input terminals 1-5 and FW terminals individually.

| Set item | Function code | Data | Description |
| :--- | :--- | :---: | :---: |
| Intelligent input 1-5 <br> a/b(NO/NC)selection | C011-C015 | 00 | $A \operatorname{contact}(N O)$ |
| Input FW <br> $\mathrm{a} / \mathrm{b}(\mathrm{NO} / \mathrm{NC}$ ) selection |  | 00 | $\mathrm{~B} \operatorname{contact(NC)}$ |
|  |  | 01 | $\mathrm{~B} \operatorname{contact}(\mathrm{NO})$ |

## Relation code

## C011-C015: Intelligent input a/b (NO/NC)

 selectionC019 :Input FW a/b (NO/NC) selection
a contact: "ON" with Close, "OFF" with Open b contact: "ON" with Open, "OFF" with Close RS terminal can set only a contact.

## Chapter 4 Explanation of function

## Multi-speed operation function

It is possible to set multiple operation speeds and switch between the speeds with the terminals.
Multi-speed operation can be selected by binary operation(max. 16 speeds) with 4 terminals or by bit operation (max. 6 speeds) with 5 terminals.

Relation code
A019: Multi-speed selection
A020/A220: 1st/2nd/multi-stage speed zero speed

A021-A035: Multi-speed 1-15
C001-C005: Intelligent input terminal

| Set item | Functin code | Set value | Description |
| :---: | :---: | :---: | :--- |
| Multi-speed <br> selection | A019 | 00 | Change to binary operation 16 speed. |
| Multi-speed <br> $0-15$ |  | 0.00, start frequency- <br> max. frequency | Units:Hz |

(1) Binary operation

It is possible to set multi-speed 0 to 15 by selecting 02 to 05 (CF1 to CF4) on the intelligent input terminals.
Set frequency setting for speed 1 to 15 with A021-A035.
Set 0 speed with A020/A220 or F001 when frequency command is operator.
Or when frequency command is control terminal (Terminal), set with O, OI, O2 terminal.

| Multi-speed | CF4 | CF3 | CF2 | CF1 |
| :---: | :---: | :---: | :---: | :---: |
| 0 speed | OFF | OFF | OFF | OFF |
| 1 speed | OFF | OFF | OFF | ON |
| 2 speed | OFF | OFF | ON | OFF |
| 3 speed | OFF | OFF | ON | ON |
| 4 speed | OFF | ON | OFF | OFF |
| 5 speed | OFF | ON | OFF | ON |
| 6 speed | OFF | ON | ON | OFF |
| 7 speed | OFF | ON | ON | ON |
| 8 speed | ON | OFF | OFF | OFF |
| 9 speed | ON | OFF | OFF | ON |
| 10 speed | ON | OFF | ON | OFF |
| 11 speed | ON | OFF | ON | ON |
| 12 speed | ON | ON | OFF | OFF |
| 13 speed | ON | ON | OFF | ON |
| 14 speed | ON | ON | ON | OFF |
| 15 speed | ON | ON | ON | ON |


(2) Bit operation

It is possible to set multi-speed 0 to 5 by assigning 32 to 38 (SF1-SF7) to the intelligent input terminals.

Set frequency SF1-SF7 to A021-A027.

| Multi-speed | SF7 | SF6 | SF5 | SF4 | SF3 | SF2 | SF1 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 speed | OFF | OFF | OFF | OFF | OFF | OFF | OFF |
| 1 speed | - | - | - | - | - | - | ON |
| 2 speed | - | - | - | - | - | ON | OFF |
| 3 speed | - | - | - | - | ON | OFF | OFF |
| 4 speed | - | - | - | ON | OFF | OFF | OFF |
| 5 speed | - | - | ON | OFF | OFF | OFF | OFF |
| 6 speed | - | ON | OFF | OFF | OFF | OFF | OFF |
| 7 speed | ON | OFF | OFF | OFF | OFF | OFF | OFF |

When each terminal turns ON simultaneously, the lower number has priority. In order for the inverter to operate both the frequency and the RUN operation (FW,RV) must be applied.

The L300P series can allocate it to 5 biggest terminals simultaneously.

## Chapter 4 Explanation of function

## Jogging operation(JG)

This function can be used to rotate the motor in small steps to allow fine-tuning.
Set an intelligent input terminal to 06(JG).

Relation code<br>A038 : Jogging frequency<br>A039 : Jogging selection<br>C001-C005 : Intelligent input setting

(1) Jogging frequency


The jogging operation does not use acceleration, therefore it would be advisable to set the jogging frequency to limit the starting current to a minimum or tripping may occur. Adjust A038 to the jogging frequency required.

| Function <br> code | Data | Description |
| :---: | :---: | :---: |
| A038 | 0.0, start frequency-9.99 | Units: Hz |

(2) Jogging operation selection

| Function <br> code | Data | Description | Jogging operation during run <br> Valid / Invalid |
| :---: | :---: | :--- | :---: |
| A039 <br> (Note 2) | 00 | Free-run on jogging stop | Invalid (Example 1) <br>  <br>  <br>  |
|  | 01 | Decelerating stop on jogging stop. | Direct braking on jogging stop. |

(Note 1) When using the jogging function, turn FW terminal or RV terminal ON after the JG terminal is turned ON. (It is the same when the operation command point is from the operator.)


When setting of A039 is 00,01 or 02 and FW signal is turned ON beforehand, the inverter doesn't operate jogging.
(Example 2)


When setting of A039 is 03,04 or 05 and FW terminal is turned ON beforehand, the inverter operates jogging. But jogging terminal is turned ON beforehand, the inverter output is cut off.
(Note 2) In the case that the setting of A039 is 02 or 05, data setting of DB is necessary. When DB data is not setting,the inverter operates Free-run.

## Second control function(SET)

This control function is used when the Inverter is connected to two different types of motors. By assigning 08(SET) to an intelligent input terminal and turning SET terminal ON/OFF you can switch between two different Inverter set-ups.
Select $2^{\text {nd }}$ control function while the Inverter is in the STOP condition.
The functions which can change with SET terminal
F002/F202 : $1^{\text {st }} / 2^{\text {nd }}$ acceleration time F003/F203: $1^{\text {st }} / 2^{\text {nd }}$ deceleration time
A003/A203:1 $1^{\text {st }} / 2^{\text {nd }}$ base frequency
A004/A204:1 $1^{\text {st }} / 2^{\text {nd }} \max$. frequency
A20/A220:1 $1^{\text {st }} / 2^{\text {nd }}$ multi-speed 0 setting
A041/A241:1 ${ }^{\text {st }} / 2^{\text {nd }}$ torque boost selection
A042/A242:1 $1^{\text {st }} / 2^{\text {nd }}$ manual torque boost
A043/A243:1 $1^{\text {st }} / 2^{\text {nd }}$ manual torque boost point
A044/A244:1 ${ }^{\text {st }} / 2^{\text {nd }}$ control system


A061/A261:1 $1^{\text {st }} / 2^{\text {nd }}$ frequency maxmum limiter
A062/A262:1 $1^{\text {st }} / 2^{\text {nd }}$ frequency minimum limiter
A092/A292:1 $1^{\text {st }} / 2^{\text {nd }}$ acceleration time 2
A093/A293:1 $1^{\text {st }} / 2^{\text {nd }}$ deceleration time 2
A094/A294:1 ${ }^{\text {st }} / 2^{\text {nd }}$ two-stage adjustable speed selection
A095/A295:1 $1^{\text {st }} / 2^{\text {nd }}$ two-stage acceleration frequency
A096/A296:1 $1^{\text {st }} / 2^{\text {nd }}$ two-stage deceleration frequency
b012/b212:1 $1^{\text {st }} / 2^{\text {nd }}$ electronic thermal level
b013/b213:1 ${ }^{\text {st }} / 2^{\text {nd }}$ electronic thermal characteristic selection
H003/H203:1 $1^{\text {st }} / 2^{\text {nd }}$ allowable motor selection
H004/H204:1 $1^{\text {st }} / 2^{\text {nd }}$ allowable motor pole selection
H006/H206:1 $1^{\text {st }} / 2^{\text {nd }}$ stabilized constant

Display during setting isn't differentiated between the $1^{\text {st }}$ control function or the $2^{\text {nd }}$ control function. So confirm it in the state of ON/OFF of termnal.
Even if $1^{\text {st }} / 2^{\text {nd }}$ control is changed during run, it will not be active until the inverter is stopped.

## Software lock mode selection(SFT)

This function is used to prevent changing data by mistake.
When you want to use an intellignent input terminal, assign 15(SFT).

## Relation code

b031 :Software lock mode selection C001-C005: Intelligent input setting

Below is the software lock code selection.

| Function code | Data | SFT <br> terminal | Description |
| :---: | :---: | :---: | :---: |
| b031 | 00 | ON/OFF | Write disable except for b031/write enable |
|  | 01 | ON/OFF | Write disable except for b031,F001,A020,A220, <br> A021~A035,A038 / write enable |
|  | 02 | - | Write disable except for b031 |
|  | 03 | - | Write disable except for b031,F001,A020,A220, <br> A021~A035,A038 |
|  | 10 | - | Write disable except for change mode during running (code <br> list reference) |

## Chapter 4 Explanation of function

## Free-run stop (FRS)

By operating the free-run stop (FRS) function, the inverter output is cut off.
The motors will free wheel under its own momentum.
This function is used when the motor is to be stopped by the use of a brake, like an electromagnetic brake.

If you stop the motor with a machine brake while the inverter is still

## Relation code

```
b088 : Free-run stop selection
003 : Retry wait time
b007 : frequency setting to match
b091 : Stop mode selection
C001-C005 : intelligent input terminal
```

Outputting to the motor an over-current trip may occur.
Assign 11(FRS) to an intelligent input terminal.
This free-run stop function will operate when the FRS terminal is ON.
If you turn FRS terminal OFF the inverter will restart after the retry wait time b003 passes.
However when the operation command selection A002 is set to control terminal (01), the inverter restarts during free-running.

This function will only operate when the FW terminal is ON.
On restart it is possible to select 0 Hz start or matching frequency start as output methods with the free-run stop selection b088. (Example 1, 2)
When you set the frequency setting b007 to match and the frequency detected is under this setting when the free-run stop is released, the inverter is restarted from 0 Hz .
The setting of this function is valid for selection b091 on stopping.

| Set item | Function <br> code | Data | Description |
| :--- | :---: | :---: | :--- |
| Free-run stop Selection | b088 | 00 | $0 H z$ start (Example 1) |
|  | b003 | $0.3-100$. | Equaling frequency start (Example 2) <br> Retry wait time <br> Frequency setting to match <br> Time until restart after FRS terminal is OFF. <br> (This is also used for Instantaneous restart.) |
| b007 | $0.00-400.0$ | Units : Hz (instantaneous stop, reference to item <br> of insufficiency) <br> This sets the level to match frequency. <br> (Refer to item of instantaneous stop and restart.) |  |

(Example 1) 0Hz start


Start 0 Hz regardless of the motor speed.
On OHz start, the retry wait time is disregarded. When 0 Hz start is used and the motor speed is still high there is the possibility of over-current trips.
(Example 2) Equaling start
$\qquad$


After FRS terminal is switched OFF, the Inverter reads the frequency of the motor and when it reaches the value in b007 the Inverter will begin to RUN again.
On frequency matching start if an over-current trip occurs, try extending the retry time.

## Chapter 4 Explanation of function

## Commercial power source switching(CS)

This function is used for systems with an excessive amount of starting torque requirements. The motor would be started direct-on-line and then when the motor had started the inverter would take over. This function

Relation code
b003 : retry waiting time
b007 : frequency setting to match
C001-C005 : Intelligent input terminal is comonly used to reduce the costing of the inverter. For example, a system may require 55 kW to start but only 15 kW to run at constant speed. Therefore, a 15 kW rated inverter would be sufficient when using the commerical power source switching. Assign 14(CS) to an intelligent input terminal. Using the example below. When the motor has been started direct-on-line, Mg2 is switched OFF and Mg3 is switched on. With the Forward command to the inverter already on the CS terminal is switched on and Mg1 is closed. The Inverter will then read the motor RPM and when the CS terminal is switched OFF the retry wait time (b003) is started.

Once the wait time has elapsed the inverter will then start and match the frequency which is set (b007).
When the Earth Leakage Breaker (ELB) trips on ground fault, the commercial circuit will not operate. When a backup is required, take the supply from the commercial circuit ELBC.
For FWY, RVY, CSY, use control relays. The sequence above is reference to the circuit and timing diagram below.

If an over-current trip occurs when frequency matching, extend the retry wait time (b003).
When the power is supplied to the inverter, also it is possible to activate retry operation too. In this case, follwing CS terminal is out of necessary. For more information, refer to Reset(RS).

## Connection figure example and timing on commercial power source switching



## Chapter 4 Explanation of function

## Reset (RS)

This function resets the inverter when a protective trip has occurred. The method of reset is to either push the STOP/RESET key on the digital operator or to switch the RS terminal ON.
To reset the inverter with the control terminal, assign 18(RS) to an intelligent input terminal.

## Relation code

b003 : Retry waiting time
b007 : Frequency setting to match
C102: Reset selection
C103: Reset frequency matching
selection

Reset frequency matching selection C 103 selects whether the inverter restarts
at OHz or the inverter matches the output frequency after the reset operation is complete.
Reset selection C102 selects when the alarm signal is cancelled and whether it is valid or invalid in normal operation.
The RS terminal is valid only when the contact is set to NO.

| Set item | Function code | Data | Description |
| :---: | :---: | :---: | :---: |
| Retry waiting time | b003 | 0.3-100. | Units: seconds <br> (Reference to items of instantaneous power failure or under-voltage) <br> After reset, time until restart is tried. |
| Frequency setting to match | b007 | 0.00-400.0 | Units: Hz <br> (Reference to items of instantaneous stop/undervoltage) |
| Reset selection | C102 | 00 | On ON signal, trip cancel (Example 1) On normal, this is valid (output cuts off). |
|  |  | 01 | On OFF signal, trip cancel (Example 2) On normal, valid (output cuts off) |
|  |  | 02 | On ON signal, trip cancel (Example 1) On normal, this is invalid. (only trip cancel) |
| Reset frequency matching selection | C103 | 00 | 0Hz start |
|  |  | 01 | Frequency matching start. (Example 3) |

(Example 1)

(Example 2)

(Example 3) When 01 (frequency matching) is selected with reset frequency matching selection C103, it is also possible to operate frequency start on power ON again. And retry waiting time is disregarded at the time of the setting C103:00 ( 0 Hz start).


## Chapter 4 Explanation of function

## Unattended start protection (USP)

The USP function is designed as a fail safe to prevent

Relation code
C001-C005: Intelligent input terminal accidental starting of the Inverter if the RUN signal is ON when
the power is restored to the Inverter. When this function worked E13 is displayed. Either resetting the Inverter or turning the RUN signal OFF can clear the trip

This function is able to disarm when the operation command is turned off. (Example 1)
If the trip is cancelled while the RUN signal is still ON then the inverter will restart automatically.(Example 2) When the operation command is turned on after the power supply input, the inverter drives normal. (Example 3) Assign 13(USP) to an intelligent input terminal. Unattended start protection is shown as follows;

(Example 2)

(Example 3)


## UP/DOWN selection(UP/DWN)

The Inverter output frequency can be changed with the UP and DWN intelligent input terminals.

Relation code
C101 :UP/DOWN memory selection C001-C005: Intelligent input terminal

Assign 27(UP) and 28(DWN) to two of the intelligent input terminals 1-5
This function is valid only when the frequency command selection A001 is set to 01 or 02 . However, when 01 (control terminal) is set, this can only be used for multi-speed operation.
This function will not operate when the external analog frequency command or the jogging operation is used. Acceleration time operates according to F002, F003/F202, F203 when UP/DWN terminal is ON. To change $1^{\text {st }} / 2^{\text {nd }}$ control, assign $08(S E T)$ to an intelligent input terminal, change with SET terminal. It is possible for the Inverter to retain the frequency setting value from the UP/DWN terminals. Parameter C101 switches the memory On or OFF. It is also possible to clear the memory and return to the original set frequency. Assign 29(UDC) to an intelligent input terminal and switch it on to clear the memory.

| Function <br> code | Data | Description |
| :---: | :---: | :--- |
| C101 | 00 | This will not memorize the frequency command adjusted with UP/DWN. <br> When power is turned ON again, set value is returned to the value before it <br> was adjusted with UP/DWN. |
|  | 01 | This memorizes the frequency command adjusted with UP/DWN. <br> When power is turned ON again, set value is kept the value after it was <br> adjusted with UP/DWN. |



## Chapter 4 Explanation of function

## External trip (EXT)

This function can be used to force the Inverter into a trip situation which

## Relation code

C001-C005: Intelligent input terminal is switched by an external input, i.e. PLC or relay contact.
When the EXT terminal is switched ON, the inverter trips on an E12 error and the outputis switched OFF.
Assign 12(EXT) to an intelligent input terminal.
The trip will not be canceled when the terminal is turned OFF.
To cancel the trip, the reset signal must be applied or the Inverter switched OFF and ON again at the supply.


## 3 Wire input function(STA, STP, F/R)

This function is used when a momentary push start/stop control is required.

Relation code
C001-C005: Intelligent input terminal

Set the operation command selection A002 to control terminal (01).
Assign 20 (STA), 21 (STP) and 22 (F/R) to three of the intelligent input terminals, and the operation becomes possible as follows. When the terminal is assigned STP terminal, FW terminal and also RV terminal become invalid. If all three inputs are not assigned this function will not operate.
The FW terminal and RV terminal become redundant when the 3 wire control is assigned to the intelligent input terminals. Output from the 3 wire control terminal is as follows;


## Chapter 4 Explanation of function

## Intelligent output terminal setting

Any of the following functions can be assigned to the intelligent Output terminals (11 or 12) or the alarm relay.
Both intelligent output terminals 11 and 12 and the alarm relay

## Relation code

C021-C022 : Intelligent output terminal
C026 : Alarm relay output terminal setting are all relay outputs.
All three output relays can be selected to be either NO or NC (a or b).

| Data | Description | Reference item | Page |
| :---: | :--- | :--- | :---: |
| 00 | RUN:Signal during run | Signal during run | $4-53$ |
| 01 | FA1:Frequency arrival signal at the time of <br> constant speed |  |  |
| 02 | FA2:Frequency arrival signal at the time of <br> over setting frequency | Frequency arrival signal | $4-53$ |
| 03 | OL:Overload advance notice signal | Overload advance notice signal | $4-38$ |
| 04 | OD:output deviation for PID control | PID function | $4-30$ |
| 05 | AL:Alarm signal | Protection function | - |
| 06 | FA3:Arrival signal for only setting frequency | Frequency arrival signal | $4-53$ |
| 08 | IP:Instantaneous stop signal | Instantaneous stop/under-voltage | $4-34$ |
| 09 | UV:Under voltage signal | RUN time over | $4-55$ |
| 11 | RNT:RUN time over | Power ON time over | $4-55$ |
| 12 | ONT:ON time over | Electric thermal function | $4-38$ |
| 13 | THM:Thermal caution |  |  |

## Chapter 4 Explanation of function

## Intelligent output terminal $\mathrm{a} / \mathrm{b}$ (NO/NC) selection

This sets the intelligent output terminal 11,12 and alarm relay output terminal contact condition to either NO or NC,
(a or b).

## Relation code

C031-C032: Intelligent output 11,12a/b (NO/NC) selection

C036 : Alarm relay output a/b (NO/NC) selection
Each output is changeable individually.
Both intelligent output terminals 11 and 12 and the alarm relay are all relay outputs.

| Set item | Function code | Data | Description |  |
| :--- | :---: | :---: | :--- | :--- |
| Intelligent output 11,12 <br> A/b(NO/NC) selection | C031-C032 | 00 | A contact(NO) | Contact specification |
|  |  | 01 | B contact(NC) | AC 250V 5Amax |
| Alarm relay output <br> A/b(NO/NC) selection | C036 | 00 | A contact(NO) | Contact specification |
|  |  | 01 | B contact(NC) | AL1-ALO:AC 250V 5Amax |
| AL2-ALO:AC 250V 2Amax |  |  |  |

a contact: Close with $\{O N\}$, open with $\{O F F\}$.
b contact: Open with $\{O N\}$, close with $\{O F F\}$.
(1) Specification of the intelligent output terminals 11 and 12

Specification of the intelligent output terminals 11 and 12 is as follows;


Contact Specification

| C031, <br> C032 <br> Set value | Power supply | Output description | State of output <br> terminal 11 <br> or 12 terminal |
| :---: | :---: | :---: | :---: |
| 0 <br> 00 <br> (a contact) | On | ON | Close |
|  | Off | OFF | Open |
| 01 <br> (b contact) | On | - | Open |
|  | Off | ON | Open |


| Maximum | Resistor <br> load | Inductor <br> load |
| :--- | :--- | :--- |
|  | AC250V, 5A | AC250V, 1A |
|  | DC30V, 5A | DC30V, 1A |
|  | DC1V 1mA |  |

(2) Specification of the alarm relay output terminal

The specifications of the alarm relay output terminal is a changeover contact. Action is as follows.


| C036 <br> Set value | Power <br> source | State of <br> inverter | State of output <br> terminal |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  | On abnormal | Close | Open |
|  | Off | On normal | Open | Close |
| 01 <br> (b contact) | On | On abnormal | Open | Close |
|  | Off | On normal | Close | Open |
|  | - | Open | Close |  |


| Contact Specification |  | Resistor load | Inductor load |
| :--- | :--- | :--- | :--- |
| AL1-AL0 | Maximum | AC250V, 2A <br> DC30V, 8A | AC250V, 0.2A <br> DC30V, 0.6A |
|  | Minimum | AC100V, 10mA <br> DC5V, 100mA |  |
|  | Maximum | AC250V, 1A <br> DC30V, 1A | AC250V, 0.2A <br> DC30V, 0.2A |
|  | Minimum | AC100V, 10mA <br> DC5V, 100mA |  |

## Chapter 4 Explanation of function

## Signal during run (RUN)

This function is to provide an output signal when the Inverter is in a running condition.
Assign 00 (RUN: signal during run) to an intelligent output terminal 11,12 or the alarm relay output terminal.

Relation code
C001-C005: Intelligent input terminal
C021,C022: Intelligent output terminal
C026: Alarm relay output

The signal is still outputted when the dc braking operates.
The signal is not outputted when the output frequency is 0 Hz , and when the status of the inverter is retry. Operation is as follows;


## Frequency arrival signal (FA1, FA2, FA3)

When the output frequency arrives at the set frequency, an arrival signal is outputted.
Assign 01(FA1:constant speed arrival signal), 02(FA2:over setting frequency) or 06(FA3: only setting frequency) to an intelligent output

Relation code

C021,C022: Intelligent output terminal
C026 : Alarm relay output
C042 :Acceleration arrival frequency
C043 :Deceleration arrival frequency terminal 11, 12 or the alarm relay output terminal.
Hysteresis frequency arrival signal is the following.
When ON: ON with ( $1 \%$ of setting frequency - maximum frequency) $(\mathrm{Hz}$ )
When OFF: OFF with ( $2 \%$ of setting frequency - maximum frequency) $(\mathrm{Hz}$ )
However in to set 06(FA3) case when inverter accelerate.
When ON :(1\% of setting frequency - maximum frequency) $(\mathrm{Hz})$
When OFF: ( $2 \%$ of setting frequency + maximum frequency) $(\mathrm{Hz})$
When inverter decelerates
When ON : ( $1 \%$ of setting frequency + maximum frequency $)(\mathrm{Hz})$
When OFF: ( $2 \%$ of setting frequency - maximum frequency) $(\mathrm{Hz})$

| Set item | Function code | Data $(\mathrm{Hz})$ | Description |
| :--- | :---: | :---: | :--- |
| Acceleration <br> arrival frequency | C 042 | 0.0 | Arrival signal at acceleration is OFF. |
|  |  | $0.01-400.0$ | Arrival signal at acceleration is ON. |
|  |  | 0.0 | Arrival signal at deceleration is OFF. |
|  |  | $0.01-400.0$ | Arrival signal at deceleration is ON. |

## Chapter 4 Explanation of function

(1) Output on constant speed arrival (01:FA1)

When the inverter arrives at the set frequency with frequency setting (F001, A020,A220) or multi-speed (A021-A035),
the output relay is switched.


Setting frequency $\left\{\begin{array}{l}F_{\text {on }}: 1 \% \text { of maximum frequency } \\ F_{\text {off }}: 2 \% \text { of maximum frequency }\end{array}\right.$
(Example) max. frequency f $\max =120(\mathrm{~Hz})$
setting frequency $f$ set $=60(\mathrm{~Hz})$
$\mathrm{f}_{\text {on }}=120 \times 0.01=1.2(\mathrm{~Hz})$
$\mathrm{f}_{\text {off }}=120 \times 0.02=2.4(\mathrm{~Hz})$
On acceleration: ON with $60-1.2=58.8(\mathrm{~Hz})$
On deceleration: OFF with $60-2.4=57.6(\mathrm{~Hz})$
(2) Output over setting frequency (02:FA2)

When the output is over the arrival frequency set in C042, C043 on adjustable speed time, the output relay is switched.

(3) Output setting frequency (06:FA3)

The signal is switched only when the output frequency matches the arrival frequency set in C042, C043 on adjustable speed time.

$f_{o n}: 1 \%$ of max. frequency
$\mathrm{f}_{\text {off }}: 2 \%$ of max. frequency

## RUN time / power ON time over (RNT/ONT)

When the accumulated operation time reaches or is over the Setting time in b034, RUN time/power ON time over (RNT/ONT) output is switched.

## Relation code

b034 : Warning time level
C021,C022: Intelligent output terminal
C026 : Alarm relay output terminal
d016 :Accumulation time monitor during RUN
d017
:Power ON time monitor

| Function <br> code | Data | Description |
| :---: | :---: | :--- |
| b034 | 0. <br> $1 .-9999$. <br> $1000-6553$ | Don't operate. <br> Set by 10-hour unit. <br> Set by 100 hours unit. (10000-65530 hours) |

(1) Run time over (RNT)

Assign 11 (RNT) to an intelligent output terminal 11, 12 (C021, C022) or the alarm relay output terminal (C026).
Set ON time level with b034.
(2) Power ON time over (ONT)

Assign 12(ONT) to an intelligent output terminal 11, 12 (C021, C022) or the alarm output terminal, (C026). Set ON time level with b034.

## Force operation ope function

This function is used to operate from the operator forcibly by on/off of an intelligent terminal when frequency and operation command A001: Frequency setting selection
A002: Operation command selection
C001-C005: Intelligent input terminal is selected other than the operator.
Becoming the operation from the frequency and operation command that was selected by A001 and A002 if the signal is off, and becoming the frequency and operation command from an operator forcibly if the signal is on when the compulsion operation function is selected by an intelligent input selection.
When changed the operation command while driving, operation command is canceled and become stoppage at first.
Operation command from each command input the operation command once again as the stoppage at first for driving once again.

| Setting item | Function cord | Setting value | Contents |
| :---: | :---: | :---: | :---: |
| Frequency command selection | A001 | $\begin{aligned} & 00 \\ & 01 \\ & 02 \\ & 03 \\ & 04 \\ & 05 \\ & \hline \end{aligned}$ | Potentiometer the digital operator has Terminal <br> Operator <br> RS485 <br> Option 1 <br> Option 2 |
| Operation command selection | A002 | $\begin{aligned} & 01 \\ & 02 \\ & 03 \\ & 04 \\ & 05 \\ & \hline \end{aligned}$ | Terminal Operator RS485 <br> Option 1 Option 2 |
| Intelligent input selection | C001-C005 | 31 | OPE : Compulsion operation |

## FM terminal

The FM control terminal can monitor the output frequency and output current. FM terminal is a PWM (Pulse Width Modulation) output.

Relation code
C027: FM selection b081: FM adjustment

## (1) FM selection

Select a signal to output from the following options.
When 03(digital frequency) is set a digital frequency counter meter is required.
Use an analog meter for all other output signals.

| Function <br> code | Data | Description | Full scale value |
| :---: | :---: | :--- | :---: |
| C027 | 00 | Output frequency (Example 1) | 0-Max. frequency(Hz) |
|  | 01 | Output current (Example 1) | $0-200 \%$ |
|  | 03 | Digital output frequency <br> (Example 2) | 0 -Max. frequency(Hz) |
|  | 04 | Output voltage (Example 1) | $0-100 \%$ |
|  | 05 | Input electric power (Example 1) | $0-200 \%$ |
|  | 06 | Thermal load ratio (Example 1) | $0-100 \%$ |
|  | 07 | LAD frequency (Example 1) | $0-\mathrm{Max}$. frequency $(\mathrm{Hz})$ |

(Example 1) Set value:00, 01, 04, 05, 06, 07


Period T: constant (6.4m) Duty $\mathrm{t} / \mathrm{T}$ : change
(Example 2) Set value: 03


Period T: change
Duty t/T : 50\%fixed
(2) FM adjustment

This function is used to calibrate a meter connected to the FM terminal.

| Function code | Set range | Description |
| :---: | :---: | :---: |
| b081 | $0 .-255$. | Change one by one. |

(Calibration methods)
(1) Connect meter to FM-CM1.
(2) Adjust b081 so that the meter is reading the same as the output frequency on your scale.
(Example) When output frequency is 60 Hz , change value of b 081 so that meter is 60 Hz .

## AM terminal, AMI terminal

The AM terminal and the AMI terminal can monitor the output frequency or the output current.
The AM terminal has an analog output of $0-10 \mathrm{~V}$.
The AMI terminal has an analog output of $4-20 \mathrm{~mA}$.
(1) AM, AMI selection

Relation code
b080 : AM adjustment
C028: AM selection
C029: AMI selection
C086: AM offset adjustment
C087: AMI adjustment
C088: AMI offset adjustment

Select a signal to output from the following options;

| Set item | Function code | Data | Contents | Full scale value |
| :---: | :---: | :---: | :---: | :---: |
| AM selection/ AMI selection | C028/C029 | 00 | Output frequency | 0-Max. frequency (Hz) |
|  |  | 01 | Output current | 0-200\% |
|  |  | 04 | Output voltage | 0-100\% |
|  |  | 05 | Input electric power | 0-200\% |
|  |  | 06 | Thermal load ratio | 0-100\% |
|  |  | 07 | LAD frequency | $0-\mathrm{Max}$. frequency $(\mathrm{Hz})$ |

(2) AM adjustment, AMI adjustment

This function is used to calibrate a meter connected to the AM and AMI terminal.

| Set item | Function <br> code | Data | Description |
| :--- | :---: | :---: | :--- |
| AM adjustment | b080 | $0 .-255$. | After offset adjustment with C086, adjust according to <br> memory. |
| AM offset <br> Adjustment | C086 | $0.0-10.0$ | Units : V |
| AMI adjustment | C087 | $0 .-255$. | After offset adjustment with C088, adjust according to <br> memory. |
| AMI offset <br> adjustment | C088 | $0.0-20.0$ | Units : mA |

## External thermistor(TH)

Temperature protection of the external machine is possible by the use of a Thermistor fitted to your motor.
Wire the thermistor between control terminals TH and CM1.
Set the following function according to the thermistor specification.


| Set item | Function <br> code | Set value | Contents |
| :--- | :---: | :---: | :--- |
| Thermistor selection | b098 | 00 | Invalid <br> (No temperature protection by external thermistor) |
|  |  | 01 | Valid normal temperature/factor resistance element <br> (For PTC) |
|  | b099 | $0 .-9999$. | Valid (For NTC) |
| Units : OHM |  |  |  |
| Set the resistance value of temperature for trip |  |  |  |
| according to thermistor methods. |  |  |  |

## Chapter 4 Explanation of function

## Initialization setting

It is possible at any time to reinitialize the Inverter parameters back to there factory default. The trip history can also be cleared at any time, however, if problems occur it will be difficult to fault find without the trip history for reference.

Relation code b084: Initialization selection b085: Initial data selection

Initialization details are as follows;

| Set item | Function <br> mode | Data | Description |
| :--- | :---: | :---: | :--- |
| Initialization <br> selection | b084 | 00 | This clears only trip history. |
|  |  | This only initializes setting value. <br> Setting value becomes the state on factory <br> forwarding. |  |
|  |  | This clears trip history and initializes setting. |  |
|  | b085 | 00 | Initializing setting for Japan. |
|  |  | 02 | Initializing setting for Europe |

(Initialization methods)
After setting the above parameters, initialize as follows;

(1) Hold down the FUNC, UP and DOWN key and then press the STR key. When the display starts to flash and rotate release all the keys.

(2) During initializing

Above display is for Japan.
Other displays are below.

(3) When "d001" is displayed in the monitor, initialization is complete.


## Chapter 4 Explanation of function

## Display selection

This function can be used to limit what the digital operator can display.

Relation code
b037 :Display selection
U001-U012 : User selection

| Set item | Function code | Data | Description |
| :---: | :---: | :---: | :--- |
|  |  | 00 | All display |
| Display <br> selection | b037 | 01 | Function individual display (Display, no display by item <br> set)(Example 1) |
|  |  | User setting and b037 <br> Only item set by user selection of U001-U012 is displayed. <br> (Set U001-U012 first.) |  |
| User <br> selection | U001-U012 | no | No assignment. |
|  | d001-P031 | Select the code to display. (All code is an object.) |  |

(Example 1) When the Display selection (b037) is set to 02, only the programmed parameters are displayed. To set which parameters are displayed insert code groups in parameter U001-U012.

The table below shows which parameter groups can be displayed and what code is used in U001-U012.

| No | Function to restrict display | Data | Code to be restricted display | Note |
| :---: | :---: | :---: | :---: | :---: |
| 1 | A001 | 01 | A005,A006,A011-A016,A101-A105, A111-A114,C081-C083,C121-C123 | O,OI,O2 terminal function |
| 2 | A002 | 01,03,04, 05 | b087 | Stop key function |
| 3 | A019 | 00 | A028-A035 (Note) | Multi-speed function |
|  | C001-C005 | 02,03,04,05 |  |  |
| 4 | A044,A244 | 02 | b100-b113 | Control methods |
| 5 | A051 | 01 | A052-A059 | DC control |
| 6 | A071 | 01 | A072-A076,C044 | PID function |
| 7 | A094 | 01 | A095-A096 | 2 stage adjustable frequency |
| 8 | b013,b213 | 02 | b015-b020 | Electric thermal characteristic |
| 9 | b021 | 01,02 | b022,b023 | Overload restriction |
| 10 | b024 | 01,02 | b025,b026 | Overload restriction2 |
| 11 | b095 | 01,02 | b090,b096 | BRD function |
| 12 | C001-C005 | 08 | A203,A204,A220,A241-A244,A261,A262 A292,A293,A294-A296, b212,b213,H203 H204,H206 | $2^{\text {nd }}$ control |
| 13 |  | 11 | b088 | Free-run stop |
| 14 | C021,C022,C026 | 02,06 | C042~C043 | Frequency arrival signal |
| 15 | A094 | 01 | A095,A096 | $2^{\text {nd }}$ two adjustable |
| 16 | A294 | 01 | A295,A296 | frequency |
| 17 | b098 | 01,02 | b099,C085 | Thermistor function |
| 18 | C001-C005 | 06 | A038,A039 | jogging function |
| 19 | A097 | 01,02,03 | A131 | Acceleration curve constant |
| 20 | A098 | 01,02,03 | A132 | Deceleration curve constant |
| 21 | C001-C005 | 27,28,29 | C101 | UP/DWN selection |
| 22 |  | 18 | C102 | Reset selection |

(Note) If attach all the spite individually data, of A019, C001-C005 and do not do the setting A028-A035 is not displayed.

## Chapter 4 Explanation of function

## Stabilized factor

When the motor is hunting or unstable, this function can be adjusted to help stabilize the motor.
When the motor is unstable, check the allowable motor selection ( $\mathrm{H} 003 / \mathrm{H} 203$ ) and motor pole selection (H004/H204) with your motor. If their code data is different from your motor specification, set the right data. When R1 of usage motor is less than R1 of regular motor, raise the set value of $\mathrm{H} 006 / \mathrm{H} 206$ gradually. When you operate greater motor than rated capacity of inverter, lower the set value of H006/H206.
The following two functions can also assist to reduce hunting or rattling of a motor.
(1) Lower the carrier frequency (b083).
(2) Lower the output voltage gain (A045).

| Set item | Function <br> code | Data | Description |
| :--- | :---: | :---: | :--- |
| Output gain | A045 | $20 .-100$. | Units :\% <br> Lower this when hunting occurs. |
| Carrier <br> frequency | b083 | $0.5-12.0$ <br> $(11$ to 75 kW$)$ | Units :kHz |
|  | $0.5-8.0$ <br> $(90$ to 132 kW$)$ | Lower this when hunting occurs. |  |
| Stabilized <br> factor | H006/H206 | $0 .-255$. | Raise or lower when hunting occurs. |

## Operation selection on option error

When an add-in option is the cause of a protective trip this function can be used to switch the trip facility off and allow the Inverter to carry on in it's operation.

## Relation code

P001: Option1 operation selection on error P002: Option 2 operation selection on error

| Set item | Function <br> code | Data | Description |
| :---: | :---: | :---: | :--- |
| Operation selection <br> on optional error | P001/P002 | 00 | TRP: inverter trip and output alarm when option error occurs. |
|  | 01 | RUN: inverter ignores this and continues operation when <br> option error occurs. |  |

## Motor constant

Set each constant according to the motor you use.
In case of using several motors in parallel, set the constant

## Relation code

H003/H203: $1^{\text {st }} / 2^{\text {nd }}$ allowable motor selection H004/H204: $1^{\text {st }} / 2^{\text {nd }}$ motor pole selection
values that are closest to the total capacity of the belonging motor.
Reduced torque or instability may occur while using auto torque boost function if these settings are incorrect.

## Chapter 4 Explanation of function

## Communication function

Serial communication is possible from the Inverter to any external equipment using RS485 protocol. This function is built-in as standard and is controlled by the TM2 control terminals.

## Relation code

A001: Frequency selection
A002: Operation command selection
C070: Data command
C071: Communication transmission speed
C072: Communication code
C073: Communication bit
C074: Communication parity
C075: Communication stop bit
C078: Communication waiting time

## (1) Communication specification

| Item | Specification | Notes |
| :--- | :--- | :--- |
| Transmission speed | $2400 / 4800 / 9600 / 19200$ bps | Selection with <br> operator |
| Communication methods | Half duplex communication methods <br> Direct current transmission |  |
| Synchronizing methods <br> Transmission code | ASCII code <br> Transmission methods <br> Communication interface <br> Data bit | RSansmission from lower bit <br> $7 / 8$ bit |
| Parity | No parity/even/odd | Selection with <br> Operator |
| Stop bit | $1 / 2$ bit | Selection with <br> Operator <br> Selection with |
| Start methods | One-way start form by command of host side | Operator |
| Waiting time | $0-1000[m s]$ | Setting with <br> operator |
| Connect form | $1: N$ (N = Maximum 32) | Station number is <br> selected with <br> operator. |
| Error check | Overrun / Fleming / BCC / Vertical / Horizontal parity |  |

<RS485 port specification and connection>
Use TM2 of controls terminal PCB for RS485 communication function.


Connect each inverter in parallel as shown below. It is necessary to short terminals RP and SN on the last inverter in the link (even if communication is to only one inverter the link should still be made).
By shorting between RP and SN, the terminal resistance is increased and controls the reflection of the signal.

(2) Setting

The following settings are required to operate RS485 communication.

| Set item | Function code | Set value | Description |
| :---: | :---: | :---: | :---: |
| Data command | C070 | 02 | Operator |
|  |  | 03 | RS485 |
|  |  | 04 | Option 1 |
|  |  | 05 | Option 2 |
| Communicating transmission speed | C071 | 02 | Loop-back test |
|  |  | 03 | 2400 bps |
|  |  | 04 | 4800 bps |
|  |  | 05 | 9600 bps |
|  |  | 06 | 19200 bps |
| Communication code | C072 | 1 to32 | This assigns the station number of the inverter. This is used when you control more than one simultaneously. |
| Communication bit | C073 | 7 | 7 bit |
|  |  | 8 | 8 bit |
| Communication parity | C074 | 00 | No parity |
|  |  | 01 | Even parity |
|  |  | 02 | Odd parity |
| Communication bit | C075 | 1 | 1 bit |
|  |  | 2 | 2 bit |
| Communication waiting time | C078 | 0 to 1000 | Units :ms <br> (3) Communication procedure reference |

(3) Communication protocol

The method of the communication protocol is shown below in the time diagram.


The following is indicated.
(1): Frame transmitted from external control machines to the inverter
(2): Frame replied from inverter to the external control machines

Frame (2) from the inverter is a reply to frame (1) from the external control machine, the active output is not operated.
The commands are shown below;

Command list

| Command | Command description | Advisability <br> of all code | Notes |
| :---: | :--- | :---: | :---: |
| 00 | Forward / backward / stop command | $\checkmark$ |  |
| 01 | Setting of frequency command | $\checkmark$ |  |
| 02 | Setting of intelligent terminal state | - |  |
| 03 | Collective reading of monitor data | - |  |
| 04 | Reading of inverter state | - |  |
| 05 | Reading of trip history |  |  |
| 06 | Reading of 1 setting item |  | This doesn't operate unless b084 is <br> 07 |
| Setting of 1 set item |  |  |  |
| 08 | Returning of each set value to initial |  |  |
| origin) or 02). (Clear of the trip |  |  |  |

Explanation of each command is the following.
(i) 00 command : This controls the forward, backward and stop command. (Set up A002 in 03 in the case that this command is used.)

- Transmission frame

Frame format

| STX | Code | Command | Data | BCC | CR |
| :---: | :---: | :---: | :---: | :---: | :---: |


|  | Explanation | Data size | Value |
| :--- | :--- | :--- | :--- |
| STX | Control code (Start of TeXt) | 1 byte | STX (0x02) |
| Code | Station number of inverter | 2 byte | $01-32$, and FF(broadcast) |
| Command | Transmission command | 2 byte | 00 |
| Data | Transmission data | 1 byte | (Note 1) Reference |
| BCC | Bloc check code | 2 byte | Exclusive OR of Code, Command and Data |
| CR | Control code <br> (Carriage Return) | 1 byte | CR (0x0D) |

(Note 1)

| Data | Description | Note |
| :---: | :---: | :---: |
| 0 | Stop command |  |
| 1 | Forward command |  |
| 2 | Reverse command |  |

(Example) When you transmit forward command to code 01
$(\mathrm{STX})|01| 00|1|(\mathrm{BCC}) \mid(\mathrm{CR}) \xrightarrow[\text { ASCIIconverter }]{\longrightarrow} 02|3031| 3030|31| 3330 \mid 0 \mathrm{D}$
Reply frame
On normal reply : (4) - (i) reference
On abnormal reply : (4) - (ii) reference
(ii) 01 command: This is to set frequency command. (Set up A001 in 03 in the case that this command is used.)

- Transmission frame

Frame format

| STX | Code | Command | Data | BCC | CR |
| :---: | :---: | :---: | :---: | :---: | :---: |


|  | Explanation | Data size | Value |
| :--- | :--- | :--- | :--- |
| STX | Control code (Start of TeXt) | 1 byte | STX (0x02) |
| Code | Station number of inverter | 2 byte | $01-32$, and FF (broadcast) |
| Command | Transmission command | 2 byte | 01 |
| Data | Transmission data <br> (tenth ASCII code) | 6 byte | (Note 2) Reference |
| BCC | Block check code | 2 byte | Exclusive OR of Code, Command and Data |
| CR | Control code <br> (Carriage Return) | 1 byte | CR (0x0D) |

(Note 2) When you set code 01 for 5 Hz
(STX)|01|01|000500|(BCC)|(CR)
$\xrightarrow{\text { ASCII conversion }} 02|3031| 3031|303030353030| 3035 \mid 0 D$
(Note) The data is 100 times as big as set value.

$$
\text { (Example) } 5(\mathrm{~Hz}) \rightarrow 500 \rightarrow 000500 \longrightarrow 303030353030
$$

Reply frame
On normal reply: (4) - (i) Reference
On abnormal reply : (4) - (ii) reference
(iii) 02 command: This sets the state of the intelligent terminals.

- Transmission frame

Frame format

| STX | Code | Command | Data | BCC | CR |
| :---: | :---: | :---: | :---: | :---: | :---: |


|  | Explanation | Data size | Value |
| :---: | :--- | :---: | :--- |
| STX | Control code (Start of TeXt) | 1 byte | STX (0x02) |
| Code | Station number of inverter | 2 byte | $01-32$, and FF (broadcast) |
| Command | Transmission command | 2 byte | 02 |
| Data | Transmission data | 16 byte | (Note 3) reference |
| BCC | Block check code | 2 byte | Exclusive OR of Code, Command and <br> Data (5) Reference |
| CR | Control code <br> (Carriage Return) | 1 byte | CR (0x0D) |

(Note 3) Data (sixteenth) of intelligent terminal and contents
(The details refer to intelligent input terminal function.)

| Data (sixteenth) | Description | Data (sixteenth) | Description |
| :---: | :---: | :---: | :---: |
| 0000000000000001 | FW: forward command | 0000000000100000 | STA: 3 wire start |
| 0000000000000002 | RV: reverse command | 0000000000200000 | STP: 3 wire stop |
| 0000000000000004 | CF1: multi-speed1 (binary operation) | 0000000000400000 | F/R: 3 wire direction |
| 0000000000000008 | CF2: multi-speed2(binary operation) | 0000000000800000 | PID:PID selection (valid/invalid) |
| 0000000000000010 | CF3: multi-speed3(binary operation) | 0000000001000000 | PIDC: PID integral reset |
| 0000000000000020 | CF4: multi-speed4(binary operation) | 0000000002000000 |  |
| 0000000000000040 | JG: jogging(inching operation) | 0000000004000000 |  |
| 0000000000000080 | DB: external DC control | 0000000008000000 | UP: remote operation Accelerating speed |
| 0000000000000100 | SET: 2 | 0000000010000000 | DWN: remote operation Decelerate speed |
| 0000000000000200 | 2CH: two stage adjustable speed | 0000000020000000 | UDC: remote operation data clear |
| 0000000000000400 |  | 0000000040000000 |  |
| 0000000000000800 | FRS: free-run stop | 0000000080000000 | OPE:Force operation ope |
| 0000000000001000 | EXP: external trip | 0000000100000000 | SF1: multi-speed(bit run) |
| 0000000000002000 | USP: unattended start protection | 0000000200000000 | SF2: multi-speed(bit run) |
| 0000000000004000 | CS: commercial change | 0000000400000000 | SF3: multi-speed(bit run) |
| 0000000000008000 | SFT: software lock (control terminal) | 0000000800000000 | SF4: multi-speed(bit run) |
| 0000000000010000 | AT: analog input voltage/current | 0000001000000000 | SF5: multi-speed(bit run) |
| 0000000000020000 |  | 0000002000000000 | SF6: multi-speed(bit run) |
| 0000000000040000 | RS: reset | 0000004000000000 | SF7: multi-speed(bit run) |
| 0000000000080000 | - | 0000008000000000 | OLR: overload restriction setting |

(Example) When you make (forward), (multi-speed1) and (multi-speed2) active on inverter setting of code 01, the calculation of data is
$0 \times 0000000000000001+0 \times 0000000000000004+0 \times 0000000000000008=0 \times 000000000000000 \mathrm{D}$
so transmission frame is
(STX)|01|02|000000000000000D|(BCC)|(CR)
Reply frame
On normal reply: Refer to (4) - (i)
On abnormal reply: Refer to (4) - (ii)
(iv) 03 command: This reads monitor data collectively.

- Transmission frame

Frame format


Replay frame

|  | Explanation | Data size | Value |
| :--- | :--- | :--- | :--- |
| STX | Control code(Start of TeXt) | 1 byte | STX (0x02) |
| Code | Station number of inverter | 2 byte | $01-32$ |
| Command | Transmission command | 2 byte | 03 |
| BCC | Block check code | 2 byte | Exclusive OR of Code, Command and <br> Data(5) Reference |
| CR | Control code <br> (Carriage Return) | 1 byte | CR (0x0D) |

Frame format

| STX | Code | Data | BCC | CR |
| :--- | :--- | :--- | :--- | :--- |


|  | Explanation | Data size | Value |
| :--- | :--- | :--- | :--- |
| STX | Control code (Start of TeXt) | 1 byte | STX (0x02) |
| Code | Station number of inverter | 2 byte | $01-32$ |
| Data | Data | 104 byte | (Note 4) reference |
| BCC | Block check code | 2 byte | Exclusive OR of Code, Command and <br> Data (5) Reference |
| CR | Control code <br> (Carriage Return) | 1 byte | CR (0x0D) |

(Note 4) Each monitor value

| Monitor item | Units | $\begin{gathered} \text { Compe } \\ \text {-titive } \\ \text { rate } \\ \hline \end{gathered}$ | Data size | Explanation |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Output frequency | Hz | $\times 100$ | 8 byte | Tenth ASCII code |  |
| Output current | A | $\times 10$ | 8 byte | Tenth ASCII code | 듬 |
| Revolution direction | - | - | 8 byte | 0: stop, 1: forward, 2:backward | ¢ |
| PID feedback monitor | \% | $\times 100$ | 8 byte | Tenth ASCII code | $\stackrel{\square}{\square}$ |
| Intelligent input monitor | - | - | 8 byte | (Note 5) reference | $\stackrel{\rightharpoonup}{+}$ |
| Intelligent output monitor | - | - | 8 byte | (Note 6) reference |  |
| Frequency converting monitor | - | $\times 100$ | 8 byte | Tenth ASCII code |  |
|  |  | - | 8 byte | (00000000) padding data |  |
| Output voltage monitor | V | $\times 10$ | 8 byte | Tenth ASCII code | $\stackrel{1}{0}$ |
| Electric power monitor | kW | $\times 10$ | 8 byte | Tenth ASCII code | $\sum_{0}$ |
| - | - | - | 8 byte | (00000000) padding data | - |
| RUN time monitor | h | x 1 | 8 byte | Tenth ASCII code | $\stackrel{\text { ¢ }}{\stackrel{\circ}{\text { ® }}}$ |
| ON time monitor | h | x1 | 8 byte | Tenth ASCII code |  |

(Note 5) Intelligent input terminal monitor

| Item | Data |
| :--- | :---: |
| FW (Forward terminal $)$ | 00000001 |
| $1\left(1^{\text {st }}\right.$ terminal $)$ | 00000002 |
| $2\left(2^{\text {nd }}\right.$ terminal $)$ | 00000004 |
| $3\left(3^{\text {rd }}\right.$ terminal $)$ | 00000008 |
| $4\left(4^{\text {th }}\right.$ terminal $)$ | 00000010 |
| $5\left(5^{\text {th }}\right.$ terminal $)$ | 00000020 |

(Note 6) Intelligent output terminal monitor

| Item | Data |
| :--- | :---: |
| AL (Alarm terminal $)$ | 00000001 |
| $11\left(11^{\text {th }}\right.$ terminal $)$ | 00000002 |
| $12\left(12^{\text {th }}\right.$ terminal $)$ | 00000004 |

## Chapter 4 Explanation of function

(v) 04 command: This reads the state of the inverter.

- Transmission frame

Frame format

| STX | Code | Command | BCC | CR |
| :--- | :--- | :--- | :--- | :--- |


|  | Explanation | Data size | Value |
| :--- | :--- | :--- | :--- |
| STX | Control code(Start of TeXt) | 1 byte | STX (0x02) |
| Code | Station number of inverter | 2 byte | $01-32$ |
| Command | Transmission command | 2 byte | 04 |
| BCC | Block check code | 2 byte | Exclusive OR of Code, Command and <br> Data (5) Reference |
| CR | Control code(Carriage Return) | 1 byte | CR (0x0D) |

Replay frame
Frame format

| STX | Code | Data | BCC | CR |
| :---: | :---: | :---: | :---: | :---: |


|  | Explanation | Data size | Value |
| :--- | :--- | :--- | :--- |
| STX | Control code(Start of TeXt) | 1 byte | STX (0x02) |
| Code | Station number of inverter | 2 byte | $01-32$ |
| Data | Data on trip | 8 byte | (Note 7) reference |
| BCC | Block check code | 2 byte | Exclusive OR of Code, Command and <br> Data (5) Reference |
| CR | Control code(Carriage Return) | 1 byte | CR (0x0D) |

(Note 7)The data to indicate status contents of inverter is constructed from the following three factors [A), B), C)].

Data | Status A | Status B | Status C | 00 (reservation) |
| :--- | :--- | :--- | :--- |
|  |  |  |  |

## Inverter status A)

| Code | Status |
| :--- | :--- |
| 00 | Initial status |
| 01 | Vdc on waiting settlement |
| 02 | On stopping |
| 03 | On running |
| 04 | On FRS |
| 05 | On JG |
| 06 | On DB |
| 07 | On reading frequency |
| 08 | On retrying |
| 09 | On UV |
| 10 | On TRIP |
| 11 | On waiting reset |

Inverter status B)

| Code | Status |
| :--- | :--- |
| 00 | On stopping |
| 01 | On running |
| 02 | On tripping |

Inverter status C)

| Code | Status |
| :--- | :--- |
| 00 | -- |
| 01 | Stop |
| 02 | Deceleration speed |
| 03 | Constant speed |
| 04 | Acceleration speed |
| 05 | Forward |
| 06 | Reverse |
| 07 | Reverse from forward |
| 08 | Forward from reverse |
| 09 | Forward start |
| 10 | Reverse start |

(vi) 05 command: This reads trip history data.

- Transmission frame

Frame format


|  | Explanation | Data size | Value |
| :--- | :--- | :--- | :--- |
| STX | Control code(Start of TeXt) | 1 byte | STX (0x02) |
| Cord | Station number of inverter | 2 byte | $01-32$ |
| Command | Transmission command | 2 byte | 05 |
| BCC | Block check code | 2 byte | Exclusive OR of Code, Command and <br> Data (5) Reference |
| CR | Control code(Carriage Return) | 1 byte | CR (0x0D) |

Replay frame
Frame format:

| STX | Code | Data | BCC | CR |
| :--- | :--- | :--- | :--- | :--- |


|  | Explanation | Data size | Value |
| :--- | :--- | :--- | :--- |
| STX | Control code(Start of TeXt) | 1 byte | STX (0x02) |
| Code | Station number of inverter | 2 byte | $01-32$ |
| Data | Each monitor data on trip | 440 byte | (Note 8) reference |
| BCC | Block check code | 2 byte | Exclusive OR of Code, Command and Data <br> (5) Reference |
| CR | Control code(Carriage Return) | 1 byte | CR (0x0D) |

Note 8) The monitor data (trip history) on trip memorizes the last six errors with an accumulated count number (8byte).

| Accumulated <br> count number | Trip history 1 | --- |
| :--- | :--- | :--- |


| Monitor item | Units | Magnifi cation | $\begin{aligned} & \hline \text { Data } \\ & \text { size } \\ & \hline \end{aligned}$ | Notes |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Trip factor |  | - | 8byte | Cord display |  |
| Inverter status A) | - | - | 8byte | 04 command | 뭉 |
| Inverter status B) |  | - | 8byte | Note 7 reference | $\stackrel{\square}{\square}$ |
| Inverter status C) |  | - | 8byte |  |  |
| Output frequency | Hz | $\times 10$ | 8byte | Tenth ASCII code |  |
| Output current | A | $\times 10$ | 8byte | Tenth ASCII code | $\Gamma$ |
| Current voltage | V | $\times 10$ | 8byte | Tenth ASCII code | 을 |
| Accumulated RUN time | hour | $\times 1$ | 8byte | Tenth ASCII code | $\underset{\sim}{\text { ® }}$ |
| Power source ON time | hour | x1 | 8byte | Tenth ASCII code |  |

(vii) 06 command: This reads 1 set item.

- Transmission frame

Frame format

| STX | Code | Command | Parameter | BCC | CR |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Explanation |  | Data size |  | Value |
| STX |  | Control code(Start of TeXt) |  | 1 byte |  | STX (0x02) |
| Code |  | Station number of inverter |  | 2 byte |  | 01-32 |
| Command |  | Transmission command |  | 2 byte |  | 06 |
| Parameter |  | Parameter number of data |  | 4 byte |  | (Note 9) |
| BCC |  | Block check code |  | 2 byte |  | Exclusive O Data (5) Ref |
| CR |  | Control code(Carriage Return) |  | 1 byte |  | CR (0x0D) |

(Note 9) The range of parameter to get,

$$
\text { F002-, A001-, b001-, C001-, H003-, P001- (F001 uses } 01 \text { command.) }
$$

Replay frame
Frame format
On normal reply : (4) - (i) Reference


|  | Explanation | Data size | Value |
| :--- | :--- | :--- | :--- |
| STX | Control code(Start of TeXt) | 1 byte | STX (0x02) |
| Code | Station number of inverter | 2 byte | $01-32$ |
| ACK | Control code(ACKnowledge) | 1 byte | ACK (0x06) |
| Data | Data (tenth ASCII code) | 8 byte | (Note 10) |
| BCC | Block check code | 2 byte | Exclusive OR of Code, Command and <br> Data (5) Reference |
| CR | Control code(Carriage Return) | 1 byte | CR (0x0D) |

(Note 10) When data is the selected item, this transmits and receives corresponding to station number.
On abnormal reply: (4) - (ii) reference
(viii) 07 command: This sets 1 set item.

- Transmission frame

Frame format

| STX | Code | Command | Parameter | Data | BCC | CR |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |


|  | Explanation | Data size |  |
| :--- | :--- | :--- | :--- |
| STX | Control code(Start of TeXt) | 1 byte | STX (0x02) |
| Code | Station number of inverter | 2 byte | $01-32$, FF(broadcast) |
| Command | Transmission command | 2 byte | 07 |
| Parameter | Parameter number of data | 4 byte | (Note 9) |
| Data | Data of parameter <br> (Tenth ASCII code) | 8 byte | (Note 10) |
| BCC | Block check code | 2 byte | Exclusive OR of Code, Command and <br> Data (5) Reference |
| CR | Control code(Carriage Return) | 1 byte | CR (0x0D) |

## Reply frame

On normal reply : (4) - (i) Reference
On abnormal reply : (4) - (ii) Reference
(ix) 08 command: This returns each set value to initial value.

This works in conjunction with initial selection (b084). If b084 is 00, the trip history is cleared.

- Transmission frame

Frame format

| STX | Code | Command | BCC | CR |
| :---: | :--- | :--- | :--- | :--- |


|  | Explanation | Data size | Value |
| :--- | :--- | :--- | :--- |
| STX | Control code(Start of TeXt) | 1 byte | STX (0x02) |
| Cord | Station number of inverter | 2 byte | $01-32$, FF(broadcast) |
| Command | Transmission command | 2 byte | 08 |
| BCC | Block check code | 2 byte | Exclusive OR of Code, Command and <br> Data (5) Reference |
| CR | Control code(Carriage Return) | 1 byte | CR (0x0D) |

Replay frame
On normal reply : (4) - (i) Reference
On abnormal reply : (4) - (ii) Reference
(x) 09 command: This checks whether it is possible to store set value to EEPROM or not.

- Transmission frame

Frame format

| STX | Code | Command | BCC | CR |
| :---: | :---: | :---: | :---: | :---: |


|  | Explanation | Data size | Value |
| :--- | :--- | :--- | :--- |
| STX | Control code(Start of TeXt) | 1 byte | STX (0x02) |
| Code | Station number of inverter | 2 byte | $01-32$ |
| Command | Transmission command | 2 byte | 09 |
| BCC | Block check code | 2 byte | Exclusive OR of Code, Command and <br> Data (5) Reference |
| CR | Control code(Carriage Return) | 1 byte | CR (0x0D) |

- Transmission frame

Frame format

| STX | Code | ACK | Data | BCC | CR |
| :--- | :--- | :--- | :--- | :--- | :--- |


|  | Explanation | Data size | Value |
| :--- | :--- | :--- | :--- |
| STX | Control code(Start of TeXt) | 1 byte | STX (0x02) |
| Code | Station number of inverter | 2 byte | $01-32$ |
| ACK | Control code(ACKnowledge) | 1 byte | ACK (0x06) |
| Data | Data | 2 byte | Allowance with 01 00: Prohibition |
| BCC | Block check code | 2 byte | Exclusive OR of Code, Command and <br> Data (5) Reference |
| CR | Control code(Carriage Return) | 1 byte | CR (0x0D) |

On normal reply : (4) - (i) Reference
(xi) OA command: This stores the set value to the EEPROM.

- Transmission frame

Frame format

| STX | Code | Command | BCC | CR |
| :--- | :--- | :--- | :--- | :--- |


|  | Explanation | Data <br> size | Value |
| :--- | :--- | :--- | :--- |
| STX | Control code(Start of TeXt) | 1 byte | STX (0x02) |
| Code | Station number of inverter | 2 byte | $01-32$ |
| Command | Transmission command | 2 byte | 0 OA |
| BCC | Block check code | 2 byte | Exclusive OR of Code, Command and <br> Data (5) Reference |
| CR | Control code(Carriage Return) | 1 byte | CR (0x0D) |

Replay frame
On normal reply: (4) - (i) Reference
On abnormal reply: (4) - (ii) Reference
(xii) OB command: This recalculates the internal motor constants.

This function is required when base frequency and parameter of $\mathrm{H}_{* u}$ is changed by RS485 communication.

- Transmission frame

Frame format

| STX | Code | Command | BCC | CR |
| :---: | :---: | :---: | :---: | :---: |


|  | Explanation | Data <br> size | Value |
| :--- | :--- | :--- | :--- |
| STX | Control code(Start of TeXt) | 1 byte | STX (0x02) |
| Code | Station number of inverter | 2 byte | $01-32$ |
| Command | Transmission command | 2 byte | $0 B$ |
| BCC | Block check code | 2 byte | Exclusive OR of Code, Command and <br> Data (5) Reference |
| CR | Control code(Carriage Return) | 1 byte | CR (0x0D) |

Reply frame
On normal reply : (4) - (i) Reference
On abnormal reply : (4) - (ii) Reference
(4) Acknowledge / Negative acknowledge response
(i) Acknowledge response

Reply frame
Frame format

| STX | Code | ACK | BCC | CR |
| :---: | :---: | :---: | :---: | :---: |


|  | Explanation | Data <br> size | Value |
| :--- | :--- | :--- | :--- |
| STX | Control code(Start of TeXt) | 1 byte | STX (0x02) |
| Code | Station number of inverter | 2 byte | $01-32$ |
| ACK | Control code(ACKnowledge) | 1 byte | ACK(0x06) |
| BCC | Block check code | 2 byte | Exclusive OR of Code, Command and <br> Data (5) Reference |
| CR | Control code(Carriage Return) | 1 byte | CR (0x0D) |

(ii) Negative acknowledge response

Reply frame
Frame format

| STX | Code | NAK | Error code | BCC | CR |
| :--- | :--- | :--- | :--- | :--- | :--- |


|  | Explanation | Data <br> size | Value |
| :--- | :--- | :--- | :--- |
| STX | Control code(Start of TeXt) | 1 byte | STX (0x02) |
| Code | Station number of inverter | 2 byte | $01-32$ |
| NAK | Control code <br> (Negative ACKnowledge) | 1 byte | NCK(0x06) |
| Error code | Error contents of <br> Communication | 2 byte | (Note 11) |
| BCC | Block check code | 2 byte | Exclusive OR of Code, Command and <br> Data (5) Reference |
| CR | Control code <br> (Carriage Return) | 1 byte | CR (0x0D) |

(Note 11) Error code list

| Error code | Contents |
| :---: | :--- |
| 01 H | Parity error |
| 02 H | Sum check error |
| 03 H | Framing error |
| 04 H | Overrun error |
| 05 H | Protocol error |
| 06 H | ASCII code error |
| 07 H | Reception buffer overrun error |
| 08 H | Reception time out error |
| - | - |
| - | - |
| 11 H | Error for abnormal command |
| 12 H | - |
| 13 H | Practice disapproval error |
| 14 H | - |
| 15 H | - |
| 16 H | Parameter abnormal error |
| 17 H | - |

Inverter doesn't reply on all code communication.
(5) About the calculation method of BCC (the Block Check Code)
(Example) 5 Hz is set up by using 01 commands (the setting of the frequency command). (when the code of the inverter of the object is " 01 ")

Constitution of the transmission


BCC is the result that transforms the Code~Data into ASCII Code and took an EXCLUSIVE OR (Xor) every 1 byte. In the case of the above transmission frame, BCC calculates it as follows.

(Appendix) ASCII code transformation table

| Character data | ASCII code |
| :---: | :---: |
| STX | 02 |
| ACK | 06 |
| CR | 0 D |
| NCK | 15 |
| 0 | 30 |
| 1 | 31 |
| 2 | 32 |
| 3 | 33 |
| 4 | 35 |
| 5 | 36 |
| 6 | 38 |
| 7 | 39 |
| 8 |  |


| Character data | ASCII code |
| :---: | :---: |
| A | 41 |
| B | 42 |
| C | 43 |
| D | 44 |
| E | 45 |
| F | 46 |
| H | 48 |
| P | 50 |

(6) Communication test mode

The communication test mode checks the communication line of RS485.
(The communication test mode procedure)
(i) Please remove the wiring of terminal unit TM2 of the control terminal unit foundation, to do the loop back check.
(ii) Please set up the following with the operator of the inverter.

Please set up C071 (Communication transmission speed selection) to 02 (Loop Back Test).
(iii) Shut the power supply of the inverter at first and please turn on the power supply once again. The check is started.
(iv) When the check ends the display is as follows.

Normal :


Abnormal :

(v) Please push the reset button of the digital operator or copy unit. And, the setting of C071 is returned to the setting of an original request.

### 4.4 Protection function list

### 4.4.1 Protection function

| Name | Description |  | Display of digital panell digital operator | Display of remote operator/ Copy unit ERR1*** |
| :---: | :---: | :---: | :---: | :---: |
| Over-current protection | Motor is restricted and decelerates rapidly, excessive current is drawn through the inverter and there is a risk of damage. Current protection circuit operates and the inverter output is switched off. | At constant Speed | E 4 | OC. Drive |
|  |  | On deceleration speed | \% | OC. Decel |
|  |  | On acceleration speed | ET 2 | OC. Acce |
|  |  | Other | EGH | Over. C |
| Overload protection (note 1) | When the Inverter detects an overload in the motor, the internal electronic thermal overload operates and the inverter output is switched off. |  |  | Over. L |
| Braking resistor overload Protection | When BRD exceeds the usage ratio of the regenerative <br> braking resistor, the over-voltage circuit operates and the inverter output is switched off. |  | $E E 5$ | OL. BRD |
| Over-voltage protection | When regenerative energy from the motor exceeds the maximum level, the over-voltage circuit operates and the inverter output is switched off. |  | 7 | Over. V |
| EEPROM error (note 2) | When EEPROM in the inverter is subject to radiated noise or unusual temperature rises, the inverter output is switched off. |  |  | EEPROM |
| Under-voltage | When the incoming voltage of inverter is low, the control <br> circuit can't operate correctly. The under-voltage circuit operates and the inverter output is switched off. |  | $E$ | Under. V |
| CT error | When an abnormality occurs to a CT (current detector) in the inverter, the inverter output is switched off. |  | 1\% | CT |
| CPU error | When a mistaken action causes an error to the builtin CPU, the inverter output is switched off. |  | E i i | CPU |
| External trip | When a signal is given to the EXT intelligent input terminal, the inverter output is switched off. (on external trip function select) |  | 6 E | EXTERNAL |
| USP error | This is the error displayed when the inverter power is restored while still in the RUN mode. <br> (Valid when the USP function is selected) |  | -19 | USP |
| Ground fault protection | When power is turned ON, this detects ground faults between the inverter output and the motor. |  | $E 10$ | GND. FIt |
| Incoming over-voltage protection | When the incoming voltage is higher than the specification value, this detects it for 100 seconds then the over-voltage circuit operates and the inverter output is switched off. |  |  | OV. SRC |
| Temporary power loss protection | When an instantaneous power failure occurs for more than 15 ms , the inverter output is switched off. Once the instantaneous power failure wait time has elapsed and the power has not been restored it is regarded as a normal power failure. <br> However, when the operation command is still ON with restart selection the inverter will restart. So please be careful of this. |  |  | Inst. P-F |
| Abnormal temperature | When main circuit temperature raises by stopping of cooling fan, the inverter output is switched off. |  | $E] 1$ | OH. FIN |
| Gate Array error | Communication error between CPU and gate array indicate |  |  | GA |
| Open-phase protection | When an open-phase on the input supply occurs the inverter output is switched off. |  |  | PH. Fail |
| IGBT error | When an instantaneous over-current is detected on the output the inverter output is switched off to protect the main devices. |  | $E 36$ | IGBT |


| Name | Description | Display of <br> digital panel <br> digital <br> operator | Display of remote <br> operator/ <br> Copy unit |
| :--- | :--- | :--- | :--- |
| ERR1 |  |  |  |

(Note 1) After a trip occurs and 10 second pass, restart with reset operation.
(Note 2) When EEPROM error E $\boldsymbol{E}$ occurs, confirm the setting data again.
(Note 3) Protection function list of optional board.
(1)Digital-input option board (SJ-DG)

| Item | Contents | Display of <br> digital panel. | Display of remote <br> operator ERR1*** |
| :--- | :--- | :--- | :--- |
| SJ-DG Error | Detect abnormal connection between the inverter main <br> bady and SJ-DG | E60.: | E70.: |

(2)DeviceNet option board (SJ-DN)

| Item | Contents | Display of digital panel. | Display of remote operatorERR1*** |
| :---: | :---: | :---: | :---: |
| DeviceNet communication error | This error is displayed, disconnection occurs when BusOff or timeout is occurred, while the inverter is operating with DeviceNet. (Trip is caused by P045 and P048 setting) |  | OP1-0 OP2-0 |
| Duplicate MACID | This error indicates that component have the same MACID, which exist on the same network | E61.: E71.: | OP1-1 OP2-1 |
| External trip | This error is displayed, when Fault / Trip is set to 1 toward control supervisor object data: Instance 1, Attribute 17. | E62. 672.1 | OP1-2 OP2-2 |
| Inverter communication error | This error is displayed, when communication timeout occurs between the inverter and the option board. | E69], E79. | OP1-9 OP2-9 |

## Chapter 4 Explanation of function

(Note 4)If the inverter doesn't run normally or the inverter trips, check the dip switch and/or rotary switch setting on optional board.
(1)Digital-input option board (SJ-DG)

| Dip | witch | Rotary switch | Setting frequency |  |  |  | Acceleration and deceleration time setting |  |  | Torque limit setting | Position setting |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | PE | CODE | Setting resolution |  |  |  |  |  |  |  |  |
| Swit | h No. | Setting code | 0.01 Hz | 0.1 Hz | 1 Hz | Rate | 0.01 sec | 0.1 sec | 1 sec | 1\% | 1pulse |
| 1 | 2 |  |  |  |  |  |  |  |  |  |  |
| BIN <br> (Binary input at OFF) BCD (BCD input at ON) | PAC <br> (One time input mode at OFF) | 0 | $\bigcirc$ |  |  |  |  |  |  |  |  |
|  |  | 1 |  | $\bigcirc$ |  |  |  |  |  |  |  |
|  |  | 2 |  |  | $\bigcirc$ |  |  |  |  |  |  |
|  |  | 3 |  |  |  | $\bigcirc$ |  |  |  |  |  |
|  |  | 4 |  |  |  |  |  |  |  | $\bigcirc$ |  |
|  |  | 5 |  |  |  |  |  |  |  |  |  |
|  |  | 6 |  |  |  |  |  |  |  |  | $\bigcirc$ |
|  | DIV (Dividing input mode at ON ) | 0 | $\bigcirc$ |  |  |  | $\bigcirc$ |  |  | $\bigcirc$ | $\bigcirc$ |
|  |  | 1 |  |  |  |  |  | $\bigcirc$ |  |  |  |
|  |  | 2 |  |  |  |  |  |  | $\bigcirc$ |  |  |
|  |  | 3 |  | $\bigcirc$ |  |  | $\bigcirc$ |  |  |  |  |
|  |  | 4 |  |  |  |  |  | $\bigcirc$ |  |  |  |
|  |  | 5 |  |  |  |  |  |  | $\bigcirc$ |  |  |
|  |  | 6 |  |  | $\bigcirc$ |  | $\bigcirc$ |  |  |  |  |
|  |  | 7 |  |  |  |  |  | $\bigcirc$ |  |  |  |
|  |  | 8 |  |  |  |  |  |  | $\bigcirc$ |  |  |
|  |  | 9 |  |  |  | $\bigcirc$ | $\bigcirc$ |  |  |  |  |
|  |  | A |  |  |  |  |  | $\bigcirc$ |  |  |  |
|  |  | B |  |  |  |  |  |  | $\bigcirc$ |  |  |

(2)DeviceNet option board (SJ-DN)

The table below is the setting method of Baud rate (Front view of the option board.).
( $\downarrow, \mathbf{A}^{\text {indicate }}$ direction for switch of Dip switch )

| Baud rate | 125 kbps | 250kbps | 500kbps |
| :---: | :---: | :---: | :---: |
| Dip switch Setting |  |  |  |

(Note) Do not switch on DR1 and DR0 at the same time.
The table below is the setting method of MAC ID (Front view of the option board)

| MAC ID | Dip switch setting |
| :---: | :---: |
| C | Figure left describes the direction of Dip switches. See below. Bottom: 0 Upper: 1 |
| $\begin{array}{ll} 1 \\ 0 & \square \\ \square \end{array} \square \square$ | Bit increases from right to left switches. <br> Therefore, figure left becomes formula below. $1 \cdot 2^{5}+\underline{0} \cdot 2^{4}+1 \cdot 2^{3}+\underline{0} \cdot 2^{2}+\underline{0} \cdot 2^{1}+1 \cdot 2^{0}=29(\mathrm{Hex})=41(\mathrm{dec})$ |
| NA32 NA16 NA8 NA4 NA2 NA1 | NA32 NA16 NA8 NA4 NA2 NA1 |

### 4.4.2 Trip monitor display

(1) Factor of trip, explanation of display

E 1919


(2) Output frequency on trip. (Hz)

Display trip factor.
Please refer to 4. 4. 1.

Display the state of inverter on tripping.
Id : During reset.
$i$ : During stop.
D During deceleration.
む : During constant speed.
1): During acceleration.
: The state operation command is set with frequency command.
: During start.

8
: During overload restriction.
(5) Accumulated time that the inverter has been running. (h)

(6) Accumulated time that the inverter has been powered up. (h)


## Chapter 4 Explanation of function

## 4．4．3 Warning Monitor display

Warning messages will appear when the data set is contradicting to others．
Program lamp（PRG）turns ON during the warning（until the data is changed）．

Relation code
d090 ：Warning Monitor

Below is the description of the warnings．

| Warning | Codes | ＜，＞ | Basic code |
| :---: | :---: | :---: | :---: |
| －1001／｜－！201 | frequency upper limiter A061／A261 | $>$ | Maximum frequencyA004/A204 |
| にا002／－－202 | frequency lower limiter A062／A262 | $>$ |  |
| －－004／－－204 | Base frequency A003／A203（Note 1） | $>$ |  |
| ｜－i005／｜＝¢ 205 | Output frequency F001，Multi stage speed 0 A020／A220 | $>$ |  |
| ミーシ006／－206 | Multi stage speed 1～15 A021～A035 | ＞ |  |
| ミ012／－－212 | frequency upper limiter A062／A262 | ＞ | frequency upper limiterA061/A261 |
| に，－ $015 /$ にし215 | Output frequency F001，Multi stage speed 0 A020／A220 | $>$ |  |
| に－1016／｜＝1216 | Multi stage speed 1～15 A021～A035 | ＞ |  |
| に， | frequency upper limiter A061／A261 | ＜ | frequency lower limiter A062／A262 |
| に025／－－225 | Output frequency F001，Multi stage speed 0 A020／A220 | ＜ |  |
| に，031／－¢ 231 | frequency upper limiter A061／A261 | $<$ | Starting frequency b082 |
| に032／－2332 | frequency lower limiter A062／A262 | ＜ |  |
| に1035／！－235 | Output frequency F001，Multi stage speed 0 A020／A220 | ＜ |  |
| İl036 | Multi stage speed 1～15 A021～A035 | ＜ |  |
| 1－1：037 | Jogging frequency A038 | ＜ |  |
|  | Output frequency F001，Multi stage speed 0 A020／A220 | ＜＞ | Jump frequency 1／2／3 <br> ＋－Jump width <br> A063＋－A064 <br> A065＋－A066 <br> A067＋－A068（Note 2） |
| 1－1086 | Multi stage speed 1～15 A021～A035 | ＜＞ |  |
| ミ－1091／ミこ291 | frequency upper limiter A061／A261 | $>$ | Free v／f frequency 7 b112 |
| ミーシ092／ミこ292 | frequency lower limiter A062／A262 | ＞ |  |
| ミーシ095／ミへ295 | Output frequency F001，Multi stage speed 0 A020／A220 | $>$ |  |
| 1－1096 | Multi stage speed 1～15 A021～A035 | ＞ |  |
| 代110 | Free v／f frequency 1～6 b100，b102，b104，b106，b108，b110 | $>$ |  |
|  | Free v／f frequency 2～6 b102，b104，b106，b108，b110 | ＜ | Free v／f frequency 1 b100 |
|  | Free v／f frequency 1 b100 | ＞ | Free v／f frequency 2 b102 |
|  | Free v／f frequency 3～6 b104，b106，b108，b110 | $<$ |  |
|  | Free v／f frequency 1， 2 b100，b102 | $>$ | Free v／f frequency 3 b104 |
|  | Free v／f frequency 4～6 b106，b108，b110 | $<$ |  |
|  | Free v／f frequency 1～3 b100，b102，b104 | $>$ | Free v／f frequency 4 b106 |
|  | Free v／f frequency 5， 6 b108～b110 | ＜ |  |
|  | Free v／f frequency 1～4 b100，b102，b104，b106 | $>$ | Free v／f frequency 5 b108 |
|  | Free v／f frequency 6 b110 | ＜ |  |
|  | Free v／f frequency 1～5 b100，b102，b104，b106，b108 | ＞ | Free v／f frequency 6 b110 |
| －1120 | Free electronic thermal frequency 2， 3 b017，b019 | ＜ | Free electronic thermal frequency 1 b015 |
|  | Free electronic thermal frequency 1 b015 | $>$ | Free electronic thermal frequency 2 b017 |
|  | Free electronic thermal frequency 3 b019 | ＜ |  |
|  | Free electronic thermal frequency 1， 2 b015，b017 | ＞ | Free electronic thermal frequency 3 b019 |

Warning is cleared when the setting fulfils the above condition．
Data will be changed automatically to the basic code．
（Note 1）In case of this，the Base frequency will be changed to Maximum frequency．Because it has the possibility that the motor is damaged according to the value，please set the correct data when the IZ 004／IZ 204 will appear．
（Note 2）The jump frequency will be automatically re－written to the lowest jump frequency（＝Jump frequency －jump width）

## WARNING

- After a lapse of more than 10 minutes after turning off the input power supply, perform the maintenance and inspection.

Otherwise, there is a danger of electric shock.

- Make sure that only qualified persons will perform maintenance, inspection and part replacement. (Before starting the work, remove metallic objects from your person (wristwatch, bracelet, etc.)
(Be sure to use tools protected with insulation.)
Otherwise, there is a danger of electric shock and/or injury.


### 5.1 Precautions for Maintenance/Inspection

### 5.1.1 Daily inspection

Every day before operation check the following;
[1] Does the motor operate according to the settings?
[2] Is there any trouble with the surroundings of the installation?
[3] Is there any trouble with the cooling or ventilation system?
[4] Is there any abnormal vibration or sound?
[5] Are their any signs of over-current or discoloration?
[6] Is their any unusual odour present?

Check the input voltage to the inverter by using a meter during running
[1] Is the supply voltage constant?
[2] Are all the phases of the supply balanced?

### 5.1.2 Cleaning

Make sure that the inverter is not dirty when operating.
Wipe clean with a soft cloth and synthetic detergent or ethanol.
(Note) Don't use solvents containing any of the following, acetone, benzene, toluene, alcohol etc. as they can cause melting of the inverter surface, peeling of paint. Never clean the display part of the digital operator with detergent or alcohol.

### 5.1.3 Regular inspection

Inspections should be regularly carried out on the parts that can't be inspected while the inverter is running.
[1] Is there any trouble with the cooling system? - - Cleaning of air filter etc.
[2] Check that all screw terminals and fixings are tight as they may loosen due to vibration or temperature change etc.
[3] Is there any corrosion, damage to insulators?
[4] Measurement of insulation resistance.
[5] Check of cooling fan, smoothing capacitor, relay and exchange if necessary.

## Chapter 5 Maintenance, Inspection

### 5.2 Daily inspection and regular inspection

| Inspection parts | Inspection item | Inspection item | Inspection cycle |  |  | Inspection methods | Decision standard | Meter |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | $\begin{array}{\|l\|} \hline \text { 交 } \\ \text { ón } \\ \hline \end{array}$ | Regular |  |  |  |  |
|  |  |  |  | 1 year | 2 year |  |  |  |
| Whole | Surroundings | Check temperature of surrounding, humidity, dust. | $\bigcirc$ |  |  | Refer to 2.1 Installing. | Temperature range is between -10 and 40 degrees. No dew present and humidity is below $90 \%$. | Thermometer, hygrometer, recorder |
|  | Whole equipment | Is there abnormal vibration, abnormal sound? | $\bigcirc$ |  |  | By watching, hearing. | No trouble. |  |
|  | Power voltage | Is main circuit voltage normal? | $\bigcirc$ |  |  | Measurement of inverter terminal R, S, T phase voltage | Within alternating voltage allowable change. | Tester, digital multimeter |
| Main circuit | Whole | (1)Megger check $\left(\begin{array}{l}\text { Between circuit } \\ \text { terminal and earth } \\ \text { terminal }\end{array}\right)$ <br> (2)Are all screws terminals tight? <br> (3)Is there any sign of over-voltage? <br> (4)cleaning |  | $\begin{aligned} & \bigcirc \\ & \bigcirc \\ & 0 \end{aligned}$ | $\bigcirc$ | (1)After you remove connector J61 from inside the inverter take out the wiring of input/output of inverter main circuit terminal and control terminal, measure beween parts shortened terminal <br> R,S,T,U, V,W,P,PD,N,RB and earth terminal with megger. <br> (2)Incremental clamping. <br> (3) Watch. | (1) To be over 5M ohm. <br> (2)(3) No abnormality . | $\begin{aligned} & \text { DC500V } \\ & \text { class megger } \end{aligned}$ |
|  | Connection conductor/ electric line | (1)Is there warp in conductor? <br> (2) Is there any damage of coating of wires? |  | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ |  | (1)(2) By watching | (1)(2) No abnormality |  |
|  | Terminals | Is there any damage? |  | $\bigcirc$ |  | By watching. | No abnormality. |  |
|  | Inverter parts Converter parts | Resistance check between each terminal. |  |  | $\bigcirc$ | Take out connect of inverter, measure terminal between R,S,T and P,N, between $\mathrm{U}, \mathrm{V}, \mathrm{W}$ and $\mathrm{P}, \mathrm{N}$ with tester x 1 Ohm range. | Refer to check method of 5.5 inverter, converter parts. | Analog form tester |
|  | Smoothing capacitor | (1)Is there any liquid? <br> (2)Does relief valve come out? Is there any swell? <br> (3)Measure of allowable static-electricity. | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ |  | $\bigcirc$ | (1),(2) By watching. <br> (3)Measure with capacity measure. | (1),(2) No abnormality <br> (3) Over $80 \%$ of rated capacity. | Capacity meter |
|  | Relay | (1)Is there abnormal sound in operation? <br> (2)Is there damage to the contacts? |  | $\begin{aligned} & \bigcirc \\ & \bigcirc \end{aligned}$ |  | (1)By hearing (2) By watching | (1),(2) No abnormality |  |
|  | Resistor | (1)Is there any crack, discoloration of resistance insulator. <br> (2)Confirm existance of breaking of wire. |  | $\begin{aligned} & \bigcirc \\ & \bigcirc \end{aligned}$ |  | (1)By watching.cementing resistance. Curl type resistance. <br> (2)Take out connection to other side, measure it with tester. | (1)No abnormality Error to be within $10 \%$ of Display resistance. | Tester, Digital multimeter |
| Control circuit, Protection circuit | Operation check | (1)Confirm balance of each output phase voltage with inverter single operation. <br> (2)Operate sequence protection moving test. And no abnormality. |  | $\bigcirc$ $\bigcirc$ |  | (1)Measure inverter output terminal U,V,W phase voltage. <br> (2)Short or open protection circuit output of inverter. | (1)Phase voltage balance $200 \mathrm{~V} / 400 \mathrm{~V}$ class is within $4 \mathrm{~V} / 8 \mathrm{~V}$. <br> (2)On sequence, to operate abnormality. | ```Digital multi- meter, rectification type voltmeter``` |
| Cooling system | Cooling fan | (1)Is there abnormal vibration, abnormal sound? <br> (2)Is there loosening of connecting parts? | $\bigcirc$ |  |  | (1)Revolve by hands in the state of tone-on idle. <br> (2) By watching. | (1) Revolving smooth. <br> (2) No abnormality. |  |
| Display | Display | (1)Is the LED lamp illuninated? <br> (2) Cleaning. | $\bigcirc$ | $\bigcirc$ |  | (1)Lamp indicates lamp on operator. <br> (2) Cleaning with cloth. | (1)Confirm light. |  |
|  | Meter | Is direction value normal? | $\bigcirc$ | $\bigcirc$ |  | Confirm indication value of board meter. | Satisfy normal value, control value. | Voltage meter, current meter |
| Motor | Whole | (1)Is there abnormal signal, abnormal sound? <br> (2)Is there any abnormal odour? | $\begin{aligned} & \bigcirc \\ & \bigcirc \end{aligned}$ |  |  | (1)By hearing, feeling, watching. <br> (2)Abnormal odour from overheat, damage etc. confirmation. | (1)(2) No abnormality. |  |
|  | Inslated resistance | (1)Megger check (terminal collection earth terminal) |  |  | $\bigcirc$ | Remove connection to U,V and W and disconnect motor wiring. | (1) To be over 5M ohm. | DC500V class megger |

(Note) Life time of the capacitors depends on the ambient temperature.

### 5.3 Megger test

When executing a megger test on the inverter remove all wires to R, S, T, PD, P, N, RB, U, V and W. Do not use a megger or buzzer on the control circuit only use a digital multi-meter.
(Megger Voltage 500V DC)
Execute megger test of main circuit after the J61 connector has been removed. Short terminals of R, S, T, PD, P, N, RB, U, V and W.
After the megger test is complete, reconnect the J61 connector as before.


### 5.4 Withstand Voltage test

Never perform withstand voltage test on the inverter.
The inverter main circuit uses semiconductors. Semiconductors can deteriorate when a withstand voltage test is performed.

### 5.5 The method to check Inverter, converter part

A test is possible to check quality.

## (Preparation)

[1] Take out the power lines ( $R, S$ and $T$ ) connected to the inverter, the motor connection lines ( $U, V$ and $W$ ) and the regenerative control resistance ( $P$ and $R B$ ).
[2] Prepare tester. (Using range of 1 ohm resistance measure range.)
(How to check)
It is possible to check the quality of the charging state of the terminals $R, S, T, U, V, W, R B, P$ and $N$ of the inverter and the pole of the tester by measuring the charging state.
(Note 1) Before you measure the voltage between $P$ and $N$ with DC current range, confirm that the smoothing capacitor is discharged fully, execute checks.
(Note 2) Almost infinite value is indicated on no conducting.
With the effect of the smoothing capacitor, the inverter conducts instantly and an infinite value isn't indicated. Ohm-number 10 ohms is indicated on conducting.
The values indicated will not be exactly the same for each terminal, however they will be very close together. If there is a significant difference a problem may exist.

|  |  | Pole of tester |  | Measure value |
| :---: | :---: | :---: | :---: | :---: |
|  |  | $\oplus$ <br> (Red) | $\ominus$ (Black) |  |
| $\begin{aligned} & \stackrel{\rightharpoonup}{0} \\ & \stackrel{\rightharpoonup}{0} \\ & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | D1 | R | PD | No-conduct |
|  |  | PD | R | Conduct |
|  | D2 | S | PD | No-conduct |
|  |  | PD | S | Conduct |
|  | D3 | T | PD | No-conduct |
|  |  | PD | T | Conduct |
|  | D4 | R | N | Conduct |
|  |  | N | R | No-conduct |
|  | D5 | S | N | Conduct |
|  |  | N | S | No-conduct |
|  | D6 | T | N | Conduct |
|  |  | N | T | No-conduct |
|  | TR1 | U | P | No-conduct |
|  |  | P | U | Conduct |
|  | TR2 | V | P | No-conduct |
|  |  | P | V | Conduct |
|  | TR3 | W | P | No-conduct |
|  |  | P | W | Conduct |
|  | TR4 | U | N | Conduct |
|  |  | N | U | No-conduct |
|  | TR5 | V | N | Conduct |
|  |  | N | V | No-conduct |
|  | TR6 | W | N | Conduct |
|  |  | N | W | No-conduct |
| $\begin{gathered} \stackrel{\rightharpoonup}{\tilde{\omega}} \\ \underset{\sim}{\infty} \\ \underset{\sim}{c} \end{gathered}$ | TR7 | RB | P | No-conduct |
|  |  | P | RB | Conduct |
|  |  | RB | N | No-conduct |
|  |  | N | RB | No-conduct |



## Chapter 5 Maintenance, Inspection

### 5.6 Capacitor Life Curve


(Note 1)
Ambient air temperature means the surrounding temperature of the inverter. In case the inverter is installed in a cabinet, ambient air temperature is the temperature of the internal air of the cabinet.
(Note 2)
DC bus capacitors are recommended to be replacing every 5 years. And if the inverter is used in a worse condition, this recommended replacing period is reduced.

### 6.1Standard specification list

| Inverter Model |  |  | 200 V class |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | $\begin{aligned} & \hline \text { L300P } \\ & \text { 110LF } \end{aligned}$ | $\begin{aligned} & \hline \text { L300P } \\ & \text { 150LF } \end{aligned}$ | $\begin{aligned} & \hline \text { L300P } \\ & \text { 185LF } \end{aligned}$ | $\begin{aligned} & \hline \text { L300P } \\ & \text { 220LF } \end{aligned}$ | $\begin{aligned} & \hline \text { L300P } \\ & \text { 300LF } \end{aligned}$ | $\begin{aligned} & \hline \text { L300P } \\ & \text { 370LF } \end{aligned}$ | $\begin{aligned} & \hline \text { L300P } \\ & \text { 450LF } \end{aligned}$ | $\begin{aligned} & \hline \text { L300P } \\ & \text { 550LF } \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline \text { L300P } \\ & 750 \mathrm{LF} \end{aligned}$ |
| Enclosure <br> (Note 1) <br> Max. Applicadie Motor 4P <br> (kW) (Note 2) |  |  | IP20(NEMA1) |  |  |  |  |  |  |  |  |
|  |  |  | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 |
| Rated input Alternating voltage(kVA) |  | 200 V | 15.2 | 20.0 | 25.2 | 29.4 | 39.1 | 48.4 | 58.5 | 72.7 | 93.5 |
|  |  | 240 V | 18.2 | 24.1 | 30.3 | 35.3 | 46.9 | 58.1 | 70.2 | 87.2 | 112.2 |
| Rated input alternating voltage |  |  | Three-phase $200-240 \mathrm{~V}$ ( $\pm 10 \%$ ) $50 \mathrm{~Hz} / 60 \mathrm{~Hz}$ |  |  |  |  |  |  |  |  |
| Rated output voltage (Note 3) |  |  | Three-phase 200-240V (This corresponds to receiving voltage.) |  |  |  |  |  |  |  |  |
| Rated output current (A) |  |  | 44 | 58 | 73 | 85 | 113 | 140 | 169 | 210 | 270 |
| Control system Output frequency range (Note 4) |  |  | Sine-wave modulation PWM system. |  |  |  |  |  |  |  |  |
|  |  |  | $0.1-400 \mathrm{~Hz}$ |  |  |  |  |  |  |  |  |
| Frequency accuracy |  |  |  |  |  |  |  |  |  |  |  |
| Frequency resolving power |  |  | Digital setting: 0.01 Hz , analog setting:Max. frequency $/ 4000$ |  |  |  |  |  |  |  |  |
| Voltage/frequency characteristic |  |  | V/f option variable, V/f control, (constant torque, reduced torque) <br> $120 \%$ for 60 seconds, $150 \%$ for 0.5second |  |  |  |  |  |  |  |  |
| Overload current rate |  |  |  |  |  |  |  |  |  |  |  |
| Acceleration/ deceleration time |  |  | $0.01-3,600$ seconds (straight or S-Curve on acceleration, deceleration is optional setting individually), $2^{\text {nd }}$ adjustable setting is possible. |  |  |  |  |  |  |  |  |
|  | Regenerative Control (short duration) (Note 5) |  | BRD circuit built-in <br> (Discharge resis-tance is required.) |  | Regenerative unit is required. |  |  |  |  |  |  |
|  | DC Braking |  | On starting and decelerating by stop command, inverter operates under operation setting frequency. Or inverter operates with external input (Breaking power, time, frequency can be set.) |  |  |  |  |  |  |  |  |
|  | Frequency | Operator | Setting by 4 , 2 keys |  |  |  |  |  |  |  |  |
|  |  | Volume | Setting with potentiometer on the digital operator (Built-in as standard) (Analog setting) |  |  |  |  |  |  |  |  |
|  |  | Extemal Signal | DC 0 to 10V, -10 to +10 V (input impedance 10k ohm), 4 to 20 mA (input impedance 100 ohm ) |  |  |  |  |  |  |  |  |
|  |  | Extemal port | Setting with RS485 communication |  |  |  |  |  |  |  |  |
|  | Run/ Stop | Operator | Run/Stop (forward changes with code) |  |  |  |  |  |  |  |  |
|  |  | Extemal signal | Forward Run/Stop (1a connect), reverse command is impossible on assigning of terminal (selection of 1a, 1b is possible), input of 3 wires is possible. |  |  |  |  |  |  |  |  |
|  |  | Extemal port | Setting with RS485. |  |  |  |  |  |  |  |  |
|  | Intelligent input terminal |  | Use by selecting terminals from; Reverse command (RV), mult-speed1-4 (CF1-CF4), jogging (JG), external dc braking (DB), $2^{\text {nd }}$ control (SET), $2^{\text {nd }}$ acceleration (2CH), free-run stop (FRS), external trip (EXT), USP function (USP), commercial change (CS),software lock (SFT), analog input voltage / current / select (AT), reset inverter (RS), 3 wire run (STA), 3 wire keep (STP), 3 wire direction selection (F/R), PID selection valid/invalid (PID), PID integrating reset (PIDC), remote control, up function (UP), remote control down function (DWN), remote control data clear (UDC), multi-speed bit 1-7(SF1-SF7),overload ristriction change (OLR), no assign (NO) |  |  |  |  |  |  |  |  |
|  | Thermistor input terminal |  | 1 terminal |  |  |  |  |  |  |  |  |
| $\begin{aligned} & \text { 흠 } \\ & \frac{2}{5} \\ & 0 \end{aligned}$ | Intelligent output terminal |  | 2 relay outputs (1a contact), relay(1c contact), output relay selection as follows; (selection from during running, on arrival with constant speed, over setting frequency, PID over-deviation) |  |  |  |  |  |  |  |  |
|  | Intelligent monitor output terminal |  | Analog voltage output, analog current output, pulse line output |  |  |  |  |  |  |  |  |
| Display monitor |  |  | Output frequency, output current, frequency conversion value, trip history, input output terminal state, input electric power, output voltage. |  |  |  |  |  |  |  |  |
| Other function |  |  | V/f free setting (5 points), Upper / lower frequency limitter, Frequency jump, Curve adjustable speed, Manual torque boost level / Braking point,Analog meter adjustment, Starting frequency, Carrier frequency adjustment, Electronic thermal free setting, External start/end (frequency/rate),Analog input selection, Trip retry, Reduced voltage start, Overload restriction |  |  |  |  |  |  |  |  |
| Carrier frequency range |  |  | $0.5-12 \mathrm{kHz}$ |  |  |  |  |  |  |  |  |
| Protection function |  |  | Over-current, over-voltage, under-voltage, electronic thermal level, abnormal trouble, ground fault current on starting, instantaneous stop, USP error, open-phase error, control resistor overload, CT error, external trip, communication error |  |  |  |  |  |  |  |  |
|  | Frequency <br> temperature <br> /Preservation <br> temperature <br> (Note 6)/humidty <br>  |  | -10 to $40^{\circ} \mathrm{C}$ (Note 10) /-20 to $65^{\circ} \mathrm{C} / 20$ to $90 \%$ RH (installed with no dew condensation) |  |  |  |  |  |  |  |  |
|  | Vibration (Note 7) |  | $5.9 \mathrm{~m}^{2} / \mathrm{S}(0.6 \mathrm{G}), 10-55 \mathrm{~Hz}$ |  |  |  |  | $2.94 \mathrm{~m}^{2} / \mathrm{S}(0.3 \mathrm{G}), 10-55 \mathrm{~Hz}$ |  |  |  |
|  | Using place |  | Under 1,000m above sea level, indoors (installed away from corrosive gasses, dust)(Note 8) |  |  |  |  |  |  |  |  |
| Paint color |  |  | Blue (D.I.C14 version No.436) |  |  |  |  | Gray(MUNSELL 8.5YR6.2/0.2) |  |  |  |
| Options |  |  | Operator with copy function, cable for operator, braking resistor, regenerative control unit, alternating reactor, D.C. reactor, EMC Mains filter, higher harmonic control unit, LCR filter, applied control installation |  |  |  |  |  |  |  |  |
| Remote operator |  |  | OPE-SR, cable for remote operation ICS-1(1m), ICS3(3m) (Note 9) |  |  |  |  |  |  |  |  |
| Schematic mass (kg) |  |  |  |  |  |  |  |  |  |  |  |

(Note 1) Protective system bases on JME1030.
(Note 2) Applicable motor indicates HITACHI three-phase motor. When you use other motor, set so that the motor current doesn't exceed the rated current of the inverter.
(Note 3) Output voltage will reduce when the power voltage is reduced. (Except when AVR function is selected.)
(Note 4) When you operate motor over $50 / 60 \mathrm{~Hz}$, inquire about the allowable max.revolution time of motor etc. from motor manufacturer.
(Note 5) Braking resistance isn't installed in the inverter. When the inverter requires a high regenerative torque, use optional braking resistance and regenerative braking unit.
(Note 6) Protective temperature is temperature during transportation.
(Note 7) This bases on the test methods of JIS C0911(1984).
(Note 8) When the inverter is used in a place with dust, we recommend the optional varnish coating specification. Before itis required.
(Note 9) When you use cable for remote operation, please remove connector. Please refer to 1.3 Appearance.
(Note 10) When using at $50^{\circ} \mathrm{C}$ of ambient air temperature, the rated output current will be reduced. (P.4-18)
(Note) Insulation distance is based on UL, CE standard.

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## Chapter 6 Specification

## 6. 2 Dimension

L300P-110, 150LF/HF


L300P-185-300LF/HF


## Chapter 6 Specification

L300P-370LF/HF


L300P-450, 550LF/HF, 750HF


## Chapter 6 Specification

L300P-750LF


L300P-900H, 1100H




[^0]:    A CAUTION : Be sure to keep the above-mentioned table.
    Otherwise, there is a danger of inverter unit breakage.
    When using at $50^{\circ} \mathrm{C}$ of ambient air temperature, the rated output current will be reduced as below (Fig.reference).

