

# 800 Model Energy-saving, Highly efficient Owner's Manual

High-performance Flux/Current Vector Control AC Drive



Version No. 2.31  
No. 2.32

200V Series 0.4KW~110KW (0.5HP~150HP)  
400V Series 0.75KW~450KW (1HP~600HP)

## Summary of relevant differences LS800 No. 2.31 and No. 2.32

The LS800 inverter has been installed the software No. 2.31 or No. 2.32 version per customer's demand at ex-factory. Please refer to the following summary list for the relevant differences between these two versions:

### LS800 No. 2.31 Version

#### ※ FM AO: Pulse/Analogy Output

- (0) PWM(Pulse Width Modulation) output – To output DC voltage to (FM1 or FM2) terminal through PWM at a maximum range: DC 0V~10V/1mA.
- (1) Pulse frequency output – To output the pulse frequency in a multiple ratio (F132 or F137) to (FM1 or FM2) terminal.

#### ※ Please refer to P5-34~P5-35 for the description of parametric functions in details.

R	Parameters	Descriptions	Range	Unit	Ex-factory value
×	F131	FM1 Analog output mode	0~1		0
○	F132	Multiple ratio of pulse frequency 1	1~36		1
○	F133	FM1 Multifunctional output setup	0~21		1
○	F134	FM1 Analog output gain/10V	0.50~8.00	Pu	1.00
×	F135	FM1 Analog polarity setup	0~1		0
×	F136	FM2 Analog output mode	0~1		0
○	F137	Multiple ratio of pulse frequency 2	1~36		1
○	F138	FM2 Multifunctional output setup	0~21		10
○	F139	FM2 Analog output gain/10V	0.50~8.00	Pu	1.00
×	F140	FM2 Analog polarity setup	0~1		0
×	F202	Longest outage duration allowable	0~5000	ms	0

### LS800 No. 2.32 Version

#### ※ FM AO : Analog Output – (FM1or FM2) Output mode

- (0) 0~10V output – Corresponding value of (FM1 or FM2) output:0~10V.
- (1) ±10V output – Corresponding value of (FM1or FM2) output: ±10V.
- (2) 4~20mA output – Corresponding value of (FM1or FM2) output:4~20mA.

#### ※ Please refer to P5-36 ~ P5-37 for the description of parametric function in details.

R	Parameters	Descriptions	Range	Unit	Ex-factory value
×	F131	Longest outage duration allowable	0~5000	ms	20
○	F132	Terminal-actuating setup for failure reset and after power restoration	0~1		0
○	F133	FM1 Output mode	0~2		0
○	F134	FM1 Multifunctional output setup	0~21		1
×	F135	0V/4mA Bias gain	0.0~700.0	%	0.0
×	F136	10V/20mA Gain	0.0~700.0	%	100
○	F137	FM2 Output mode	0~2		0
○	F138	FM2 Multifunctional output setup	0~21		10
○	F139	0V/4mA Bias gain	0.0~700.0	%	0.0
×	F140	10V/20mA Gain	0.0~700.0	%	100.0
×	F202	Reserved			

Appended please find the introduction of difference relevant to the parameter settings between LS800 Series No. 2.31 and LS800 Series No. 2.32. When mentioned 800 Series or LS800 Series in this manual, it refers that applies to LS800 Series No. 2.31 and LS800 Series No. 2.32; a separate introduction will be prepared for their inconsistent contents, if any.

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## PREFACE

More and more applications of ac drive are commercially used today as automated process operation becomes popular. Based on our professional commitments by focusing on modern technologies and pushing for the latest industry standards, we attach this manual of our high performance ac drive. This manual contains detailed instructions on installation (including operation, maintenance, inspection, and repair), peripheral wiring, specifications, and parameter setup process, and gives you complete description of types and technical operation of the product.,(diagnosis and troubleshooting of abnormalities, and cautions relevant to the routine maintenance of ac drive. In order to ensure a correct installation and operation of ac drive, please peruse this product instruction and appropriately keep the operation manual.)

To help you complete the installation setup in a systematic and efficient way, a summary process flow chart is given in the title "Commissioning" for you to skip over otherwise complicated setup procedures while saving your time in working out the proper installation.

Thank you for having our LS800 Series (No. 2.31 and No. 2.32) Flux Current Vector Control AC Drive (Sensorless & Close Loop), one that has incorporated the advanced IGBT Module mute design and decades of our expertise to yield the optimal economic benefits for your from your production facilities.

※ All the products are constantly modified thereof specifications to improve the perfection; for downloading the latest version of specifications, please visit Long Shenq website <http://www.acinverter.com.tw>

The company reserves the right to modify the models and specifications without notice. Copyright and all rights are reserved. No part of this publication may be reproduced in any form.



- ◆ Read this manual before installation, wiring, operation, maintenance, inspection, and repair, and follow the appropriate instructions. For any doubt, consult with us, or local dealer.
- ◆ To prevent any personal injury or property loss due to accident, strictly comply with warning, notice, and danger marks and prompts following those marks.
- ◆ Place this manual in locations where permits easy access is allowed for the operators to refer to.



CAUTION

### CAUTION

To warn that any act of omission to the instructions following this mark may cause personal injury.



WARNING

### WARNING

To warn that any act of omission to the instructions following this mark may cause personal injury and property loss.



INHIBIT

### RESTRICTED

To warn that any act of omission or violation against the instructions following this mark may cause personal injury and property loss.

- ◆ This product has survived strict QC, and provided with reinforced packing materials before leaving our factory to ensure free of any unexpected impact or damage during the shipment.
- ◆ Operators referred in this manual include qualified technicians of service and installation, those who are familiar with technologies involved, and operating employees.



- ◆ Each unit of ac drive has been ex-factory set, never modify the setup of internal parameters at own discretion unless absolutely necessary. Please confirm first the safety allowance to the motor or the mechanical system before operation or in case that the output frequency must be set at 60 Hz or higher.

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- ◆ Only qualified technician is allowed to operate this ac drive. The qualified technician to this purpose is referred to one who is familiar with the internal construction, installation procedure, operating method, and service steps of the ac drive; and who also knows how to practise safety measures to prevent any hazard and/or accident.
  - ◆ Before installing the ac drive, check the environment of the installation site to see if it is proper for the installation. If yes, firmly secure the ac drive to a flat and smooth cement or metal plate wall, properly guarded from impact by foreign object that may damage the ac drive.
  - ◆ Addition of blowing fans is a must to ensure that the temperature of the incoming air will not rise to such an extent that may affect the operation of multiple ac drives installed in the same control panel.
  - ◆ Check all the wires connected to each terminal block are firmly secured, and all grounding terminals on ac drive and on motor are properly earthed.
  - ◆ Before operating, always confirm if the voltage from the power source complies with the rated voltage of the ac drive; and check for correct wiring to any brake controller or brake resistance, if provided.
  - ◆ Whereas, VDC of the primary loop in the ac drive is as high as 650 VDC (400V Class)/325 VDC (200V Class), never use your hand to direct touch any loop in the ac drive to avoid electric shock. Do not remove the protection lid when the loop is conducted. Make sure to kill the source, wait for the CHARGE indicator to go off, and verify using a multi-meter the absence of VDC between ⊕P、⊖N terminals before performing any service or inspection job.
  - ◆ Terminals inside the ac drive when not in operating status may carry dangerous voltage. Never touch the terminal block of the ac drive with bare hands. To perform any wiring inspection and service routines, always wait for five minutes or longer after the power source is turned off and after the CHARGE indicator goes off.
  - ◆ If the ac drive is expected not to use for a longer period, make sure that the power supply to the ac drive is cut off, and measures offending off dust and humidity are in place to avoid unnecessary replacement of parts in future use.
  - ◆ When the ac drive is going to shut down for an extended period of time, please perform the charging/discharging work for the capacitor once every two months; that is, turn on the power supply for one minute, and then turn off the power supply and wait for the “CHARGE” indicating lamp to go out, re-turn on the power supply, repeatedly perform this cyclic action for more than 10 times in order to prolong the life of ac drive.
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# I -Installation-

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## Installation

### First-time Use

Thank you for purchasing our 800 model AC Drive. To protect your right and interests, please confirm the following receiving inspection prior to the installation and use of AC Drive.

### If description and specification of the Product received are the same as that you have ordered ?

Check upon the nameplate found on the side of the product if the specification complies with that you have ordered.

### Any damage ?

Check the appearance for any damage to the product, such as ingress of water, damaged package or dents on the machine during transportation.

### Is there any loosening lid/screw ?

Confirm the torque using a screw driver if required.



WARNING

Upon receiving Series 800 AC Drive, check for correct voltage, specification, and capacity. Any mistake in the voltage class may lead to burnt-out of the drive, and personal injury or fire hazard in serious case.

## Installation Site Setup & Control

### Installation Site



INHIBIT

The installation site shall be far away from the following location :

- Inflammable materials, e.g., wood.
- Dust, metal powder, and oil stain.
- Radioactive substance, and EMI.
- Corrosive gases, liquids, and are prone to water leakage, and high humidity.
- Vibration, such as having the ac drive installed at where attached to any machine vulnerable to vibration.
- Where exposed to direct sunshine, or at an ambient temperature lower than  $-10^{\circ}\text{C}$  or higher than  $45^{\circ}\text{C}$ ; and
- Any location at a sea level of 1000m or higher.



WARNING

Avoid installation or placement of the ac drive in any of those locations described above since severe environment will subject the ac drive to failure, damage, deterioration, or even fire hazard.

### Temperature & Humidity

Type of Installation	Ambient	Ambient Humidity
Closed Wall Mounting	$-10 \sim +45^{\circ}\text{C}$	Below 95%RH (non-condensation)
In Panel Mounting	$-10 \sim +50^{\circ}\text{C}$	Below 95%RH (non-condensation)
Storage Temperate	$-20 \sim +60^{\circ}\text{C}$	Below 95%RH (non-condensation)

※ For reference only in environment impact assessment of the installation!

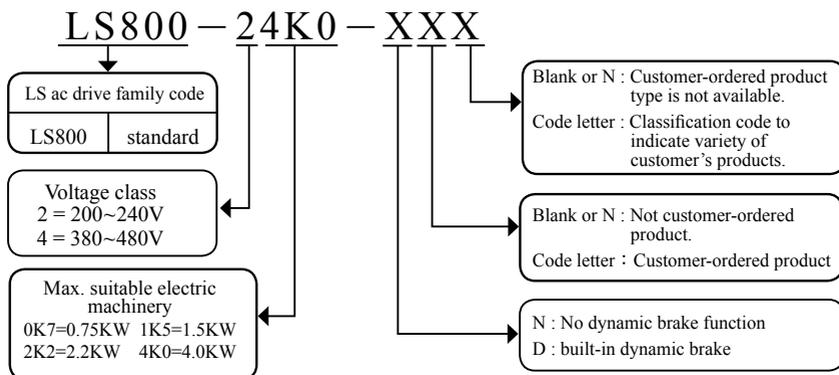
# I -Installation-

## Description of Nameplate

Found on one side of the ac drive, the nameplate bears model, specification, protection class and other information as described below.

Model No.	→	MODEL	: LS800-24K0-XXX(VER 2.31)
Input Spec.	→	INPUT	: AC 3PH 200~240V 50/60Hz
Output Spec.	→	OUTPUT	: AC 3PH 0~240V 4.2KVA 16.0A cont 24.0A int 4.0KW 5HP
Output frequency	→	Freq.Range	: 0.0~400.0 Hz
Protection Class	→	PANEL.	: IP20 NEMA 1
Manufacturing Series No.	→	S/NO	:

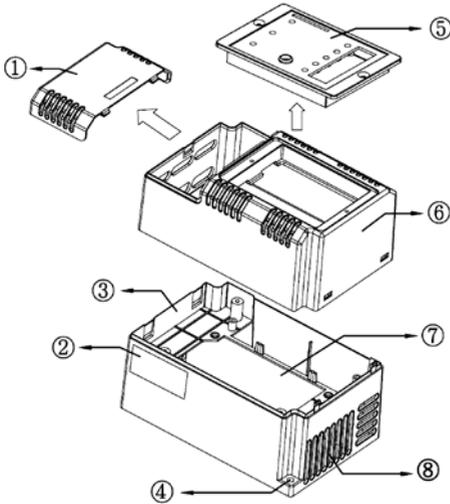
## Description of Model on the Nameplate of the Drive: (MODEL)



### ◆ Model No. and power of ac drive

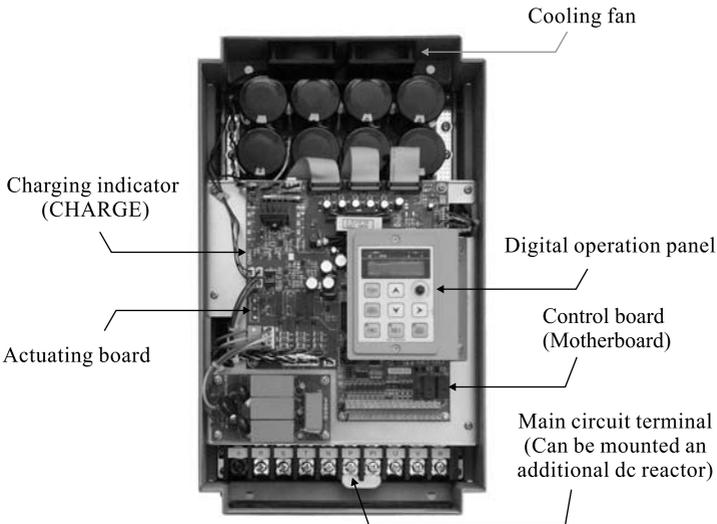
Model No.	Power	Model No.	Power	Model No.	Power
0K4	0.4KW	018	18.5KW	132	132KW
0K7	0.75KW	022	22KW	160	160KW
1K5	1.5KW	030	30KW	185	185KW
2K2	2.2KW	037	37KW	220	220KW
4K0	4.0KW	045	45KW	300	300KW
5K5	5.5KW	055	55KW	375	375KW
7K5	7.5KW	075	75KW	450	450KW
011	11KW	090	90KW		
015	15KW	110	110KW		

### Designations of Parts



- ① Terminal Block Lid
- ② Specification Nameplate
- ③ AC Drive Base
- ④ Setscrew Hole
- ⑤ Keyboard Panel
- ⑥ AC Drive Lid
- ⑦ Heat Sink Location
- ⑧ Heat Sink Vent

### High Horsepower Control Box Layout



# I -Installation-

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## Removing the AC Drive Lid

0.5HP~5.0HP

Step 1: Have one thumb to slightly push in the locking buckle



Step 2: Push to lift the lid and remove the terminal lid



Step 3: To remove the lid for service, have both thumbs press LH & RH locking buckles to unbuckle the lid.



step 4: Hold and pull upward to remove the entire lid



7.5HP~30HP



Step 1 : Take and hold the PULL UP and push the panel up



Step 2 : Remove the panel

40HP~300HP



Step 1 : Unscrew to remove four screws first



Step 2 : Carefully remove the panel



Step 3 : Finish the removal of panel

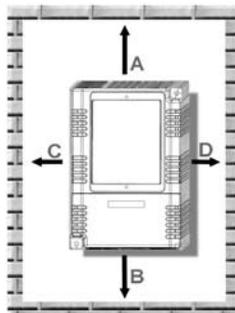
# I -Installation-

## Installation Direction & Space

To maintain good cooling air circulation, the ac drive must be secured in vertical position with sufficient clearance left to its surroundings, abutted components and baffles. Whereas cooling fans are mounted at the base of the ac drive, sufficient space shall be maintained to facilitate the air ventilation.

### Cautionary points for installations:

- (1) For application at an ambient temperature of 40 or higher, install the ac drive at a well ventilated place or enhance the cooling device for external environment.
- (2) Instant generation of high temperature may take place if an additional brake resistor is equipped to the ac drive; please select carefully the installation site for the brake resistor, or mount additional fans to help heat dissipation.
- (3) Installation site should be well ventilated and kept far away from inflammables.
- (4) Determine the minimum clearance between the body of the ac drive and the wall according to the model of the ac drive and the number of horsepower.



After removing the power source, wait for five minutes or longer to allow the internal capacitor to complete discharging before opening up the lid.

### Minimum In-panel Installation Clearance (Refer to Chart and Table)

Direction & Safe distance LS800 Capacity	A	B	C	D
≤ 2.2kw	≥ 100 mm	≥ 100 mm	≥ 50 mm	≥ 50 mm
4.0kw ~ 11kw	≥ 120 mm	≥ 120 mm	≥ 50 mm	≥ 50 mm
15kw ~ 22kw	≥ 150 mm	≥ 150 mm	≥ 100 mm	≥ 100 mm
30kw ~ 37kw	≥ 200 mm	≥ 200 mm	≥ 150 mm	≥ 150 mm
45kw ~ 75kw	≥ 300 mm	≥ 300 mm	≥ 200 mm	≥ 200 mm
90kw ~ 220kw	≥ 400 mm	≥ 400 mm	≥ 250 mm	≥ 250 mm
300kw ~ 375kw	≥ 500 mm	≥ 500 mm	≥ 300 mm	≥ 300 mm

### **Functions and maintenance of cooling fan**

- ◆ There is cooling fan mounted inside the ac drive and will be triggered its running when temperature of ac drive reaches up to 40°C after operation. Temperature rise to reach 85°C ( ±5°C ) due to a heavy & full load or a too-high environment temperature will trip an over temperature protection ( Err5 ).
- ◆ Regular cleaning and maintenance is necessary to ensure the heat sink function of cooling fan when mounted at a place with worse environmental conditions, such as power, dust, oil sludge and cotton fibers etc .



# II Wiring

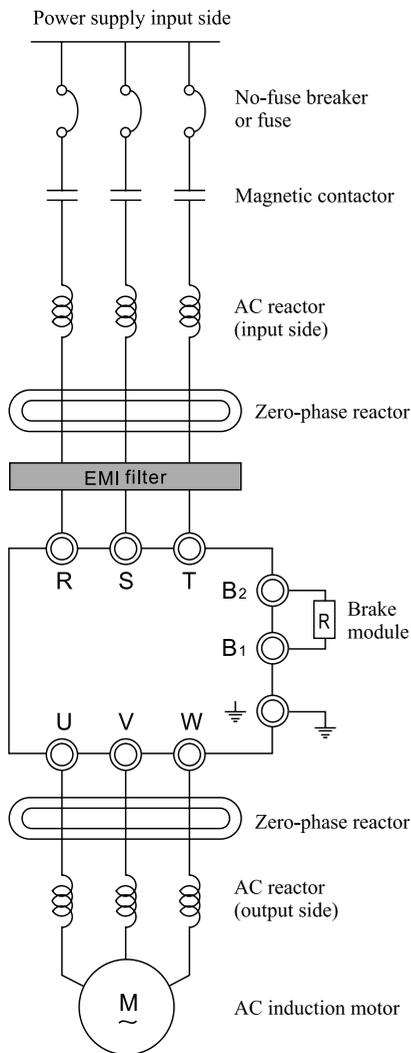
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## II -Wiring-

### Schematic View of Peripheral Configuration

#### 3 Phase 200V/400V Series

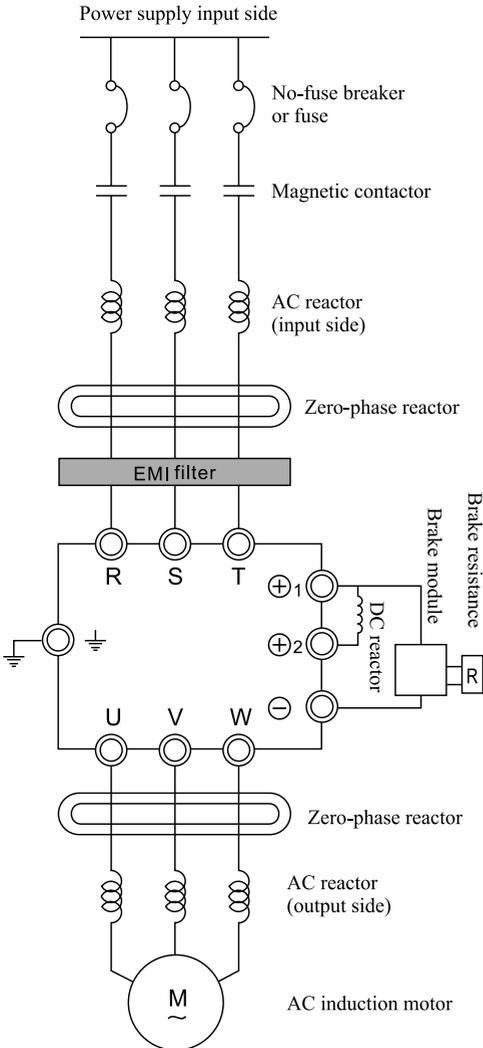
System wiring diagram for model below 15HP(including) (For peripheral machines, please select them according to the need)



<b>Power supply input side</b>	Please follow the rated power supply specifications from the operation instruction manual to install the power supply (Please see Appendix A P9-1).
<b>No-fuse breaker or fuse</b>	There may be a higher input current when turning on the power supply. Please select an appropriate No-Fuse Breaker or Fuse.
<b>Magnetic contactor</b>	When mounted a magnetic contactor (MC) at the power supply side, please do not use this MC to make a frequent ON and OFF operations to avoid failing the ac drive. The number of time to switch ON/OFF MC shall be one time in 30 minutes the utmost.
<b>AC reactor (input side)</b>	When connected to a power supply transformer with a higher capacity (above 600KVA) or switching over to phase capacitance may be desired, a current higher than the peak value will inrush into the input power supply circuit and damage the AC drive; therefore, additional mounting of AC reactor is recommended to improve the power while the wiring distance shall be within 10m.
<b>Zero-phase reactor</b>	Fitted to attenuate the low-frequency interference; especially for the locale with audio frequency device together with interference from the input & output sides reduced as well. The effective range is AM frequency channel 10MHz.
<b>EMI filter</b>	Can be applied to weaken the interference from electromagnetic waves.
<b>Brake resistance</b>	Mounted to shorten the deceleration time for motor. Please see the details in Chapter 8.(Optional)
<b>AC reactor (output side)</b>	When wired from the output side to motor, the wiring length of motor will affect the magnitude of voltage back wave. An additional mounting of AC reactor is recommended when the wiring length of motor is longer than 20 meters (the closer the wiring length to the AC drive side, the better the effect will be).

### 3 Phase 200V/400V Series

System wiring diagram for model above 20HP(including) (For peripheral machines, please select them according to the need)



<b>Power supply input side</b>	Please follow the rated power supply specifications from the operation instruction manual to install the power supply (Please see Appendix A P9-1).
<b>No-fuse breaker or fuse</b>	There may be a higher input current when turning on the power supply. Please select an appropriate no-fuse breaker or fuse.
<b>Magnetic contactor</b>	When mounted a magnetic contactor (MC) at the power supply side, please do not use this MC to make a frequent ON and OFF operations to avoid failing the ac drive. The number of time to switch ON/OFF MC shall be one time in 30 minutes the utmost.
<b>AC reactor (input side)</b>	When connected to a power supply transformer with a higher capacity (above 600KVA) or switching over to phase capacitance may be desired, a current higher than the peak value will inrush into the input power supply circuit and damage the ac drive; therefore, additional mounting of AC reactor is recommended to improve the power while the wiring distance shall be within 10m.
<b>Zero-phase reactor</b>	Fitted to attenuate the low-frequency interference; especially for the locale with audio frequency device together with interference from the input & output sides reduced as well. The effective range is AM frequency channel 10MHz.
<b>EMI filter</b>	Can be applied to weaken the interference from electromagnetic waves.
<b>Brake resistance/ Brake module</b>	Mounted to shorten the deceleration time for motor. Please see the details in Chapter 8.(Optional)
<b>AC reactor (output side)</b>	When wired from the output side to motor, the wiring length of motor will affect the magnitude of voltage back wave. An additional mounting of AC reactor is recommended when the wiring length of motor is longer than 20 meters (the closer the wiring length to the AC drive side, the better the effect will be).(Optional)

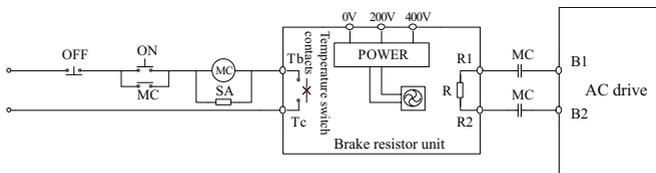
# II -Wiring-

## Mounting the brake control circuits

### Mounting the brake resistor for overheating protection

To mount the brake resistor (Accessory Model No.: LSDR, please refer to P8-3 for the specifications of resistance unit) onto AC drive for overheating protection.

#### 0.4KW~11KW AC Drive(200V class /400V class)



#### 15KW~375KW AC Drive (200V class/400V class)

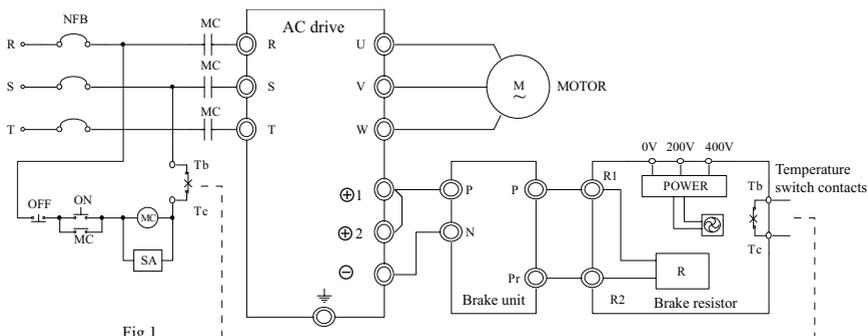


Fig 1

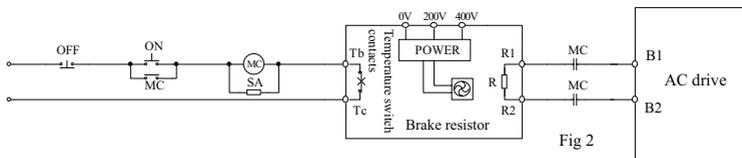


Fig 2

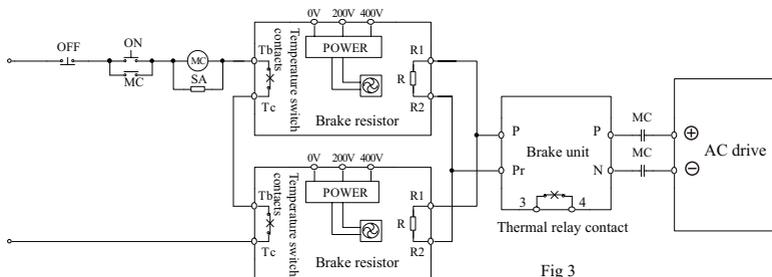


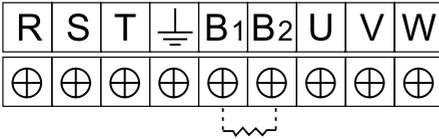
Fig 3

## Primary Loop Terminal Block

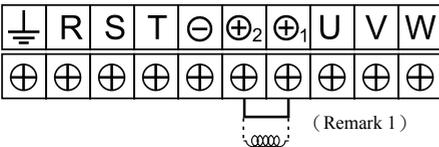
Synopsis of new-old notes main-circuit terminal blocks

Old terminal note	New terminal note	Descriptions
R/L1, S/L2, T/L3	R/L1, S/L2, T/L3	Power supply input terminal (single/three phases)
U, V, W	U, V, W	AC drive output, connecting the 3-phase induction motor
P, P1	⊕ 1, ⊕ 2	Power correction DC reactor connecting terminal; remove the short-circuit tab for installation
P, B	B1/⊕ 1, B2	Brake resistance connecting terminal; please purchase the optional item according to the selection table. (see to page 8-1)
P, N	⊕ 1, ⊖	Brake unit connecting terminal (LSBR Series)
⊥	⊥	Grounding terminal, please follow the 200 V series third-type grounding and 400V series particular grounding from Electrical Code to ground the terminal.

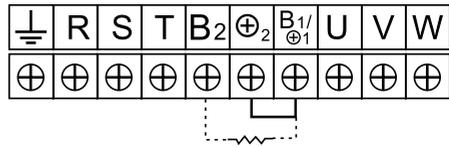
◆ 0.4KW~11KW (200V / 400V Series)



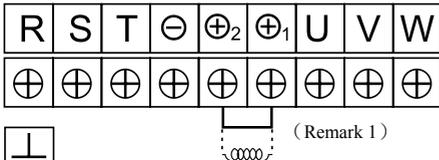
◆ 15KW~30KW(200V Series)  
15KW~37KW(400V Series)



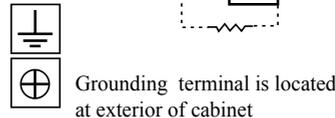
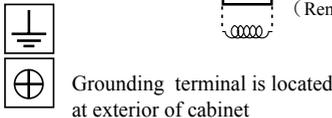
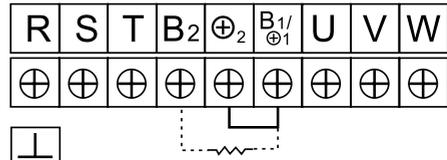
◆ 15KW~30KW(200V family with BRAKE)  
15KW~37KW(400V family with BRAKE)



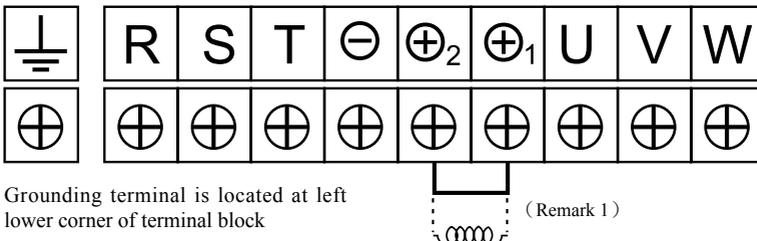
◆ 37KW~55KW(200V Series)  
45KW~75KW(400V Series)



◆ 37KW~55KW (200V family with BRAKE)  
45KW~75KW (400V family with BRAKE)



◆ 75KW~110KW(200V Series)  
90KW~375KW(400V Series)



Remark 1: When additionally mounted the reactor, please remove the shorting-strip.

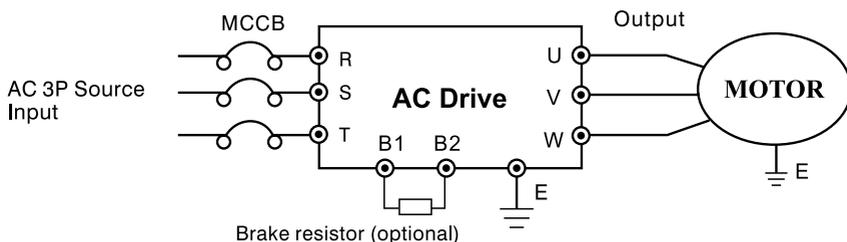
# II -Wiring-

## Wiring Methodology

### 3-Phase Primary Loop Wiring Diagram -1

(LS800-20K4、LS800-20K7、LS800-21K5、LS800-22K2、LS800-24K0、LS800-25K5、LS800-27K5、LS800-2011)

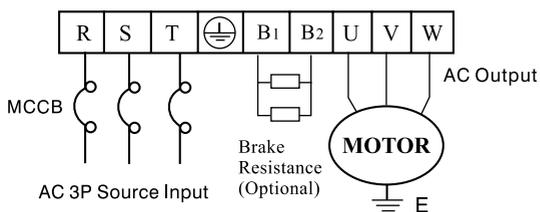
(LS800-40K7、LS800-41K5、LS800-42K2、LS800-44K0、LS800-45K5、LS800-47K5、LS800-4011)



CAUTION

- (1) Units in 3-phase 200V and 400V series with a horsepower up to 15HP are fitted a brake circuit. Please see P8-3 for selecting the correct resistance and the watt number.
- (2) Each frequency ac drive and motor casing must be properly grounded to prevent lightning and electric shock.

### 3 Phase Source Terminal Block (0.4KW/0.5HP~11KW/15HP)

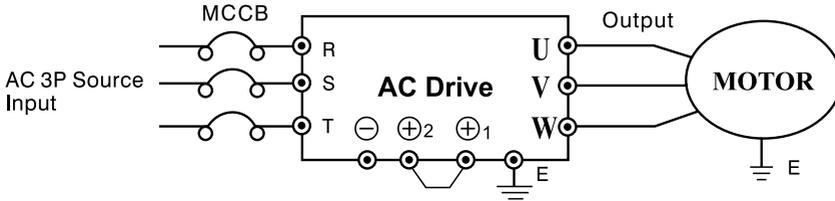


Symbol	Description
R.S.T	Connected to 3-phase power supply input
B1.B2	Can be connected to brake resistor; circuit has been embedded, additional mounting of brake unit is unnecessary.
U.V.W	To be connected to 3-phase motor output terminals
⊕ or ⊖	Grounding terminal

### 3-Phase Primary Loop Wiring Diagram -2

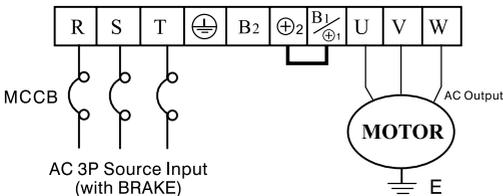
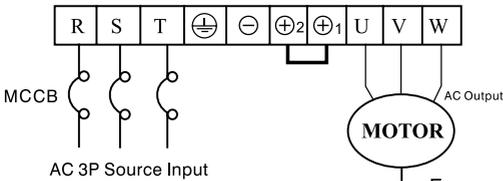
(LS800-2015、LS800-2018、LS800-2022、LS800-2030、LS800-2037、LS800-2045、LS800-2055、LS800-2075、LS800-2090、LS800-2110)

(LS800-4015、LS800-4018、LS800-4022、LS800-4030、LS800-4037、LS800-4045、LS800-4055、LS800-4075、LS800-4090、LS800-4110、LS800-4132、LS800-4160、LS800-4185、LS800-4220、LS800-4300、LS800-4375)



- (1) A brake circuit is provided up to 20HP for 3P Series 200V and 400V. Refer to P8-1 for selecting correct resistance and wattage.
- (2) The brake circuit of 20HP~100HP can be customized and fabricated inside the ac drive.
- (3) Each ac drive must be properly grounded to prevent lightning and electric shock.

### 3P Source Terminal Block (Please see P2-4 for detailed descriptions)



Symbol	Description
R, S, T	Connecting the AC 3-phase power supply input.
⊕1, ⊖ (⊕1, ⊕2=P ⊖=N)	⊕1, ⊖ terminal may be connected to external brake unit, but direct connection to brake resistance is not acceptable.
⊕1, ⊕2	To be connected to DC reactor.
B2, B1/⊕1	Can be connected to brake resistance; no external brake unit which is built in.
⊖ or ⊕	Grounding terminal
U, V, W	Output to connect 3-phase motor terminals

## II -Wiring-

### Notices to Wiring

#### (1) Primary Loop Wiring

1. Make sure that the connections of power supply for input terminals R.S.T, and output terminals U.V.W (to be connected to the motor) are correct; any wrong connection will lead to a serious damage of the AC drive.
2. Never connect any power factor capacitor, or LC, RC noise filter to the output end of the ac drive.
3. Keep the wirings of main circuit to the ac drive far away from signal cable of the control systems (e.g., PLC, electronic signal system) to avoid interference.
4. Please firmly fasten the screws on main circuit terminals to avoid any production of sparkling due to vibration-loosened screws.
5. The specifications for the distance between the power supply input and output in AC drive are described in the table below.

	Standard wiring length	Limit of wiring length
Distance from power supply system →to power supply side of ac drive	Within 2~30 meters	Within 30~300 meters
Output side of ac drive →Junction side of AC Motor terminal	Within 2~25 meters	Within 25~200 meters
Solution to solve the too-long wiring problem is shown in the right.	Additional mounting of input & output reactors is recommended.	Additional mounting of input & output reactors is a must.



WARNING

If the power line is too long, a parasitic capacitance will be produced from the electric machinery and power lines to the ground (lower potential side) that lead to a generation of high-voltage surge to destroy the voltage-withstanding insulation of AC drive and motor.

#### (2) Ground wire

1. For the purpose of safety and reducing the noise, please apply the third grounding type  $\oplus$  to 200V series and special grounding type  $\ominus$  to 400V series. (grounding impedance below 10 $\Omega$ ).
2. Avoid sharing the grounding electrodes and ground wire with other power facilities including the welding machine and dynamo-machines. Keep the ground wire far away from the power cable of large capacity equipment as applicable.

#### (3) Circuit breaker for wiring the main circuit – Electromagnetic contactor

To protect the loop, NFB, or an additional EM contact must be provided between the primary loop AC source and LS800 input terminals R.S.T. on the power side.

##### \* Use of Leakage Breaker :

1. When an exclusive leakage breaker switch for the ac drive is used, please select to set an induced current of 30mA or greater for each ac drive.
2. If a general leakage breaker switch is used, please select to set an induced current of 200mA or greater and a time duration of more than 0.1s for each ac drive.

#### (4) Surge Absorber

Any windings for the peripheral devices of ac drive, e.g., electromagnetic contactor, relay, solenoid valve, etc., must be connected in parallel with the surge absorber to prevent the noise interference. Please refer to the table below for selecting the surge absorber:

Voltage	Where Needed	Spec. of Surge Absorber
200V	Windings of large capacity other than relay	AC250V 0.5uf 200Ω
	Control relay	AC250V 0.1uf 100Ω
400V	Ditto	AC500V 0.5uf 220Ω

### Primary Loop & Control Loop Routings Comparison Chart.



CAUTION

- ⊙ Before wiring, confirm that the source voltage must comply with the rated input voltage of the ac drive.
- ⊙ Please follow the regulations set forth in Electric Codes to select the specification of terminal screws and the size of wire diameter and firmly fasten them.
- ⊙ The wiring on the side of the source input terminals (3Ø/R.S.T) will not affect the phase sequence; However, phase sequence exists when any two terminals of U.V.W. on the output side are changed and that will affect the revolving direction of the motor.



WARNING

- ⊙ The wiring operation for the ac drive must be done only after the power source is cut off for operation safety.
- ⊙ Please mount a no-fuse MCCB (Molded Case Breaker) at the power supply input side to turn on/off the power supply and protect the input end of the ac drive.
- ⊙ Properly connect the ground wire to avoid possible electric shock or fire disaster.

#### Form (1) 200V Series

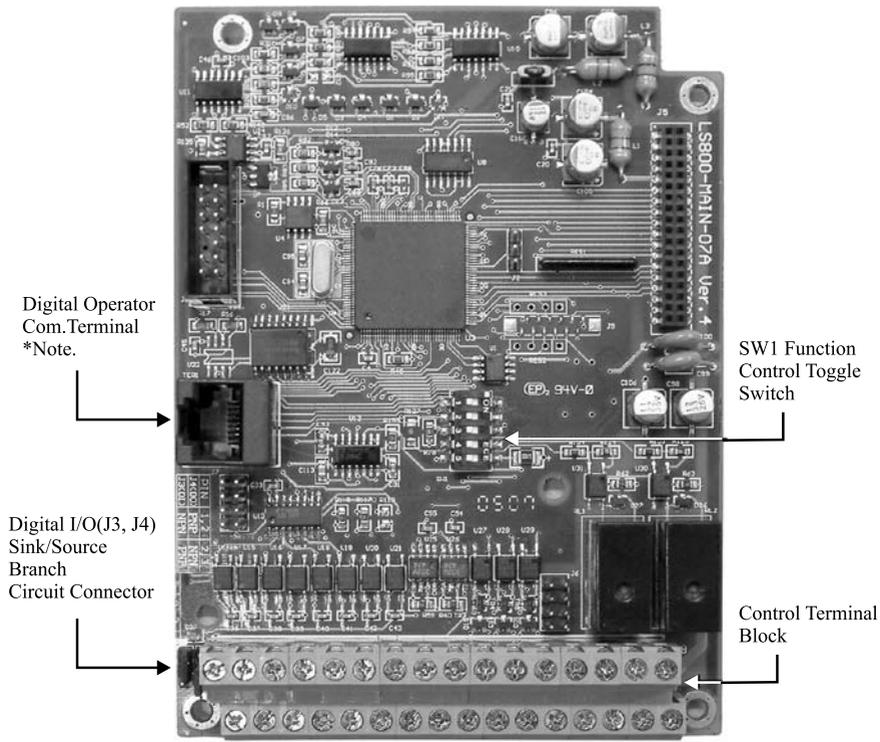
Description \ Spec.	Spec.																	
	20K4	20K7	21K5	22K2	24K0	25K5	27K5	2011	2015	2018	2022	2030	2037	2045	2055	2075	2090	2110
Capacity KW/HP	0.4 / 0.5	0.75 / 1	1.5 / 2	2.2 / 3	4.0 / 5	5.5 / 7.5	7.5 / 10	11 / 15	15 / 20	18.5 / 25	22 / 30	30 / 40	37 / 50	45 / 60	55 / 75	75 / 100	90 / 125	110 / 150
3-Phase MCCB Rated Current (A)	5	10	15	30	40	50	60	100	125	150	175	225	250	300	400	450	500	550
Power wire gage (mm2)	2.0			3.5		5.5	8.0	14	30			50	60	80	100		150	
Primary loop screw	M4						M5		M6	M8			M10		M12			
Control loop wire gage (mm2)	0.5 mm <sup>2</sup> ~ 1.25 mm <sup>2</sup>																	

#### Form (2) 400V Series

Description \ Spec.	Spec.																							
	40K7	41K5	42K2	44K0	45K5	47K5	4011	4015	4018	4022	4030	4037	4045	4055	4075	4090	4110	4132	4160	4185	4220	4300	4375	
Capacity KW/HP	0.75 / 1	1.5 / 2	2.2 / 3	4.0 / 5	5.5 / 7.5	7.5 / 10	11 / 15	15 / 20	18.5 / 25	22 / 30	30 / 40	37 / 50	45 / 60	55 / 75	75 / 100	90 / 125	110 / 150	132 / 175	160 / 200	185 / 250	220 / 300	300 / 400	220 / 500	
3p MCCB Rated Current (A)	5	10	15	20	30	40	50	60	75	100	125	150	175	200	225	250	275	300	350	400	450			
Power wire gage (mm2)	2.0		3.5		5.5		8.0		14	22	38		50	60	100			120						
Primary loop screw	M4						M5		M6		M8			M10		M12								
Control loop wire gage (mm2)	0.5 mm <sup>2</sup> ~ 1.25 mm <sup>2</sup>																							

## Control Terminal block Location Reference Chart

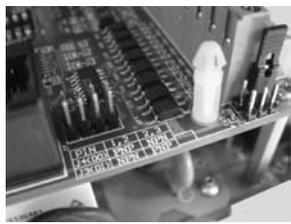
### LS800 Control board (Motherboard)



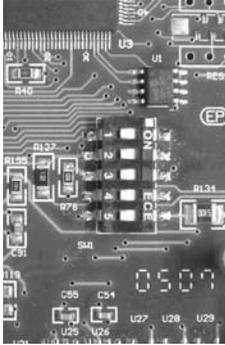
(Note 1) Only a single unit of loop is allowed to start for use since the digital operator related to an internal communication mode and the external communication mode for SG-, SG+ are of different active and passive communication modes, thus are prevented from being connected for use at the same time.

### ◆ J3、J4 Sink/Source Branch Circuit Connector

1. After completing the adjustment with J3 and J4, the logic of the I/O terminals may be switched into Sink Mode and Source Mode.
2. A detailed equivalent schematic view is given on P2-18、P2-19.



◆ **SW1 Function Toggle SW**



Description of SW1 Functions (RS485 Modbus set for internal and external uses).

NO.	Function	Toggle SW ON	Ex-factory Setup
1	SG-	External signal output to terminal block SG- (N.1)	OFF
2	SG+	External signal output to terminal block SG+ (N.2)	OFF
3	485 SW	OFF – internal digital operator in RS485 communication format (N.2) ON – external digital operator in RS485 Modbus communication format.	OFF
4	120Ω Terminal R	Terminal R for internal and external RS485	ON
5	To set up V or A input mode to be inputted by AI terminal	OFF	ON
		V Mode 0~10V	

Note 1: External signals are for RS485 Modbus signal with SG- and SG+ input to the terminal block for external monitor with sources from PLC, or computer.

Note 2: The internal digital operator relates to the operation and control carried out by panel pushbuttons.

◆ **LS800 Digital Operator Communication Connector Spec.**

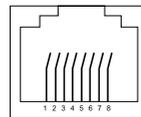


1. RJ45: a short connector as illustrated to the left, instead of the universal one generally available in the market.

◆ **LS800 RS485 Communication Connector Spec.**



DB9	
Pin	
1	B(-)
2	A(+)
3	A(+)
4	X
5	⏏
6	+5V
7	B(-)
8	⏏
9	+5V



RJ45	
Pin	
1	+5V
2	⏏
3	B(-)
4	A(+)
5	B(-)
6	A(+)
7	⏏
8	+5V

## II -Wiring-

### ◆ LS800 control terminals – wiring addresses and sequence are shown follows

NO.2.31

Di1	Di2	Di3	Di4	Di5	Di6	Di7	Di8	FM1	FM2	Do1	Do2	Do3	Ta1	Tb1	Tc1
SG-	SG+	AV1	AV2	AI	+10V	AVG	-10V	24V	COM	COM	COM	E	Ta2	Tb2	Tc2

### ◆ LS800 control terminals – wiring addresses and sequence are shown follows (Attached a PG-AB2 card)

NO.2.32

A	$\bar{A}$	B	$\bar{B}$	AO	BO	AO1	BO1	A1	B1	E	5V	0V	12V		
Di1	Di2	Di3	Di4	Di5	Di6	Di7	Di8	FM1	FM2	Do1	Do2	Do3	Ta1	Tb1	Tc1
SG-	SG+	AV1	AV2	AI	+10V	AVG	-10V	AVG	COM	COM	DCM	E	Ta2	Tb2	Tc2

1. Please use slender type "-" or "+" (#101 screwdriver) screwdriver to unscrew the terminal screws on the terminal block, then route the wire from the wiring opening below the terminal block to connect respective terminal and firmly fasten the terminal screws. (Please refer to P2-11 for cautionary points when wiring the terminal block is desired)
2. Please see P2-14、P2-16 and P2-21 in this Section for the tabulated descriptions of functions relevant to the variety of terminals in control terminal blocks and PG-AB2.

## Wiring Connection of Control Circuit Terminals

### Notices to Control Circuit Wiring



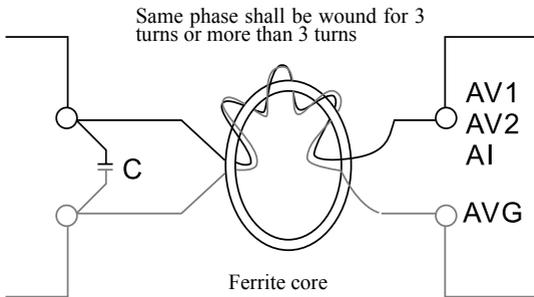
WARNING

Separation mesh connection must be provided between the control loop wiring and the terminal block and earthed. Improper wiring will cause serious interference and abnormal operation resulting in accident, personal injury and property loss.

- ☑ For safety concerns, select suitable specifications of wire gages for wiring connection in accordance with the Electric Code.
- ☑ For customers, please follow the national regulations relevant to power wiring connection locally.
- ☑ Control circuit wiring: Wire to connect the control circuit wirings after separating the main circuit wiring from other power cable electricity wires; if interlacing the wiring connection is necessary, please make it in a cross connection of 90 degrees.
- ☑ Communication cables for all I/O control signals or remote digital operation setup unit must be separated far away from large current power cables (source, motor, brake) as applicable, and shall never be provided in the same cable conduit.
- ☑ As long as the indicating lamp of digital operation panel is on never attempt to connect or remove any cable.

## Analog input terminals (AV1, AV2, AI, AVG)

- ☑ Connecting to a weak analog signal is easily interfered by external noise, therefore, the wiring length for connection shall not be too long (less than 20m is recommended), and a shielding wire shall be used. Moreover, the peripheral meshed wires to the shield wires shall be well grounded; for a bigger induced noise, connection to AVG terminal can access a better effect.
- ☑ When connecting the external analog signal output is desired, an error action may taken place due to the interference produced from the analog signal output and the AC motor actuator; when encountered such a situation, connecting the external analog output side to a capacitor and a ferrite core can inhibit the noise. Such a connection is shown in the right figure. :



## Digital input terminals (Di1 ~ Di8, COM)

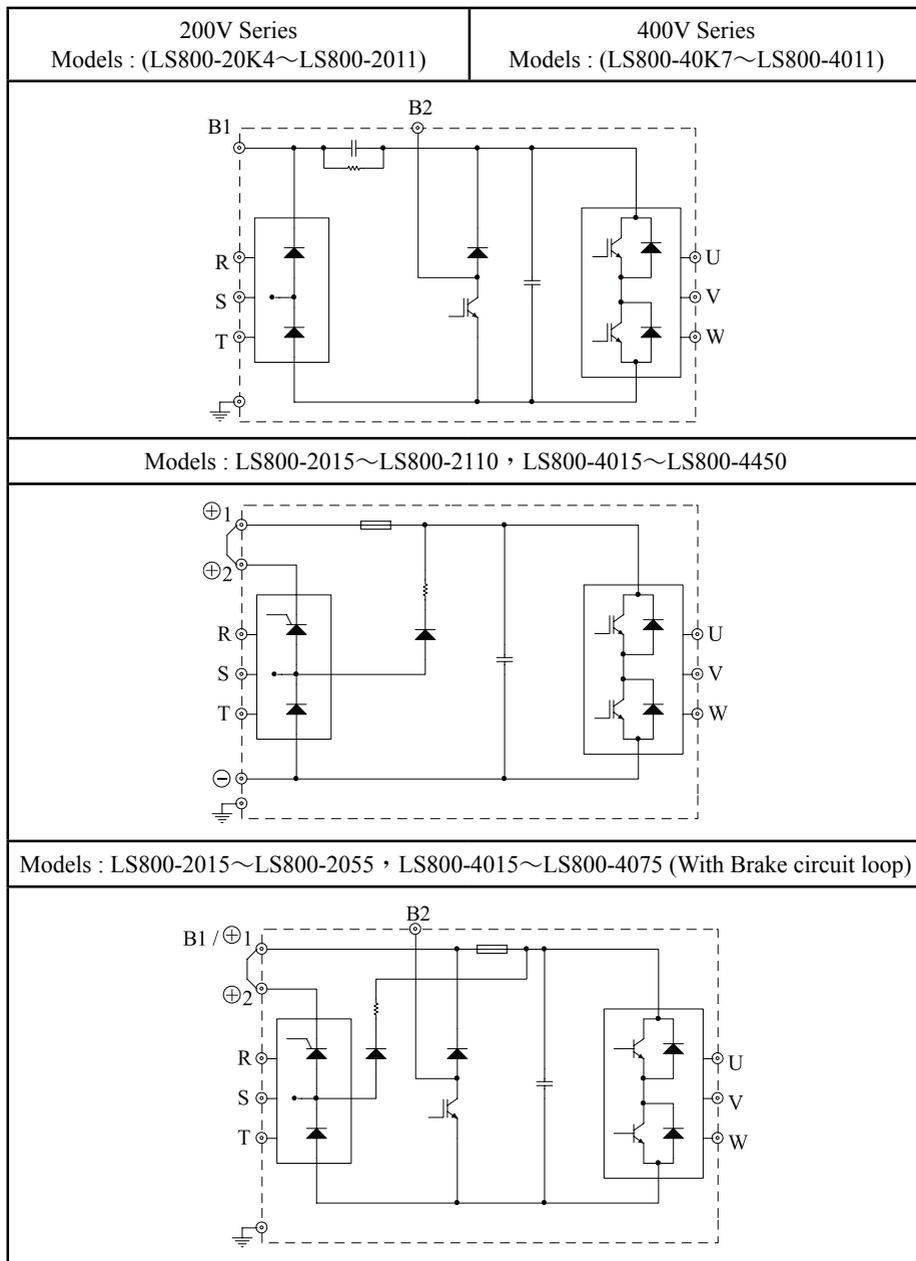
- ☑ Multifunctional input terminals are characterized as dry contacts that cannot be input any signal source with voltage; when a contact is to be enabled for input control, in order to avoid any occurrence of bad contact, a contact with high reliability to contact the weak signals should be used.

## Do output (Do1, Do2, Do3, DCM)

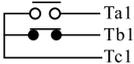
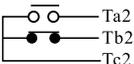
- ☑ When enabling the control relay is desired, a surge absorber or a flywheel diode shall be connected in parallel to both ends of exciting coil while attention shall be made to the correctness of polarity for connection.

# II -Wiring-

## Main power source circuit diagram



## Schedule of Control Terminal Function (No. 2.31)

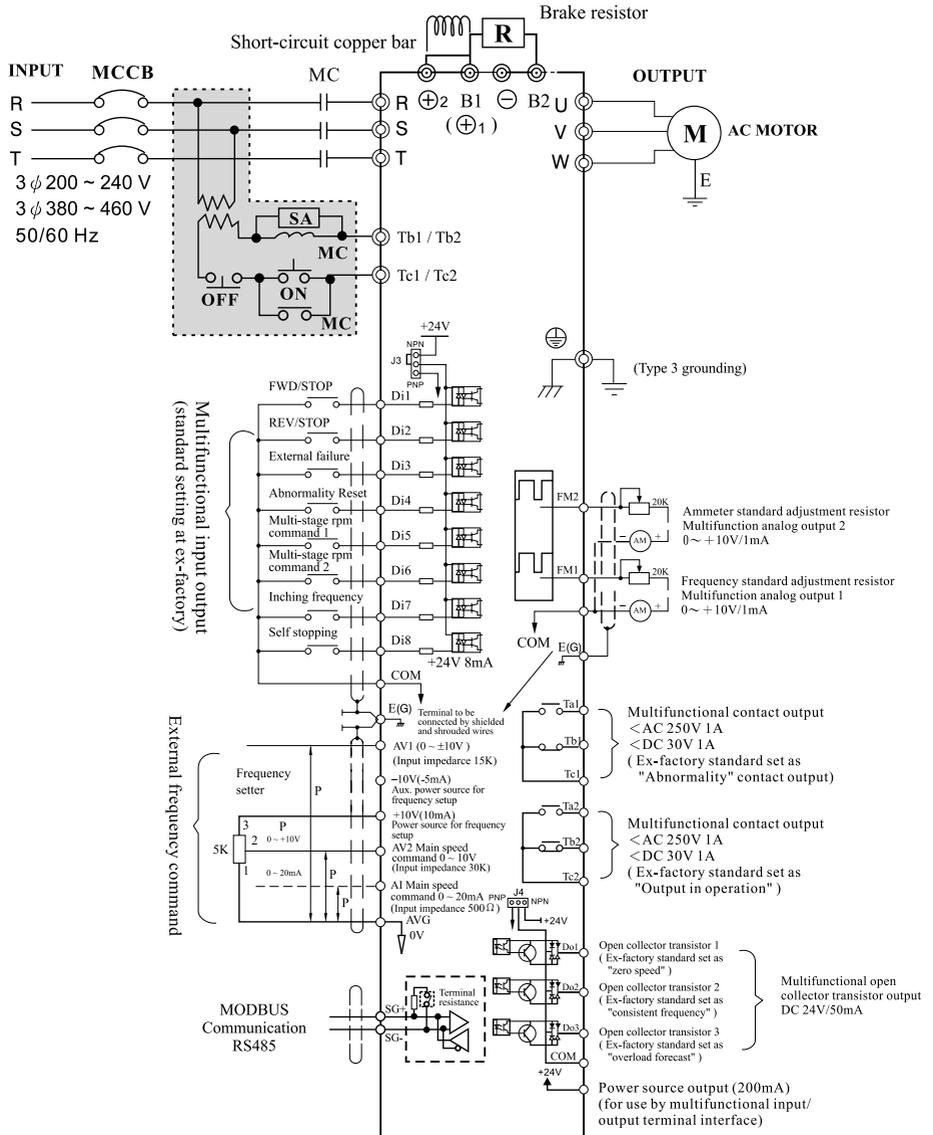
Terminal Mark	Terminal Designation	Description	Remarks	
Multi-function Input Terminals	Di1	Forward rotation command	Forward revolution when Di1-COM is ON; and stop, OFF	Control
	Di2	Reverse rotation command	Reversal revolution when Di2-COM is ON; and stop, OFF	Control
	Di3	Input in case of external Abnormality(NC)	AC Drive trips off to stop when external abnormality signal is ON. (Err 29)	Control
	Di4	Abnormality reset	Di4 ON releases the status imposed and maintained by the circuit protection action against failure.	Control
	Di5	Multi-section command 1	To execute four-section speed control with binary 2Bit.	Control
	Di6	Multi-section command 2		
	Di7	Jog inching frequency	To execute the inching frequency operation when enabled ON.	Control
	Di8	Free-run	When activated (ON), the drive immediately stops outputting.	Control
	COM	Digital Input common terminal	The multi-function input terminals of the common terminal	Common point
Analog frequency setup	+10V	Source for F setup	Source output DC +10V for frequency setup (maximal 10mA allowed)	Source
	-10V	Negative source for F setup	Auxiliary negative source output DC -10V for F setup (maximal -5mA allowed)	Source
	AVG	Common terminals for F setup	Common reference potential terminal for F setup input signals (terminal AV1.AV2.AI)	Common point
	AV1	Analog voltage F command	With input voltage at DC 0~±10V (or DC 0~+10V), the input impedance is 15kΩ	Signal source
	AV2	Analog voltage F command	With input voltage at DC 0~+10V, the input impedance is 30kΩ	Signal source
	AI	Analogy current F command	With input current at DC 0~20mA, the input impedance is 500kΩ (or DC 0~+10V, 30kΩ)	Signal source
Multi-function Output Terminals	DO1	Zero-Speed detected	ON in stop status or below zero-speed level	Control
	DO2	Consistent F	ON when the output F at any setting is over the detected F.	Control
	DO3	Overload forecast	On when the drive detection output is over the OL level	Control
	COM	Digital output common terminal	The multi-function output terminals (FM analog output) of the common terminal	Common point
	24V	Auxiliary source for terminal	Auxiliary source 24V/200mA MAX. for I/O terminals	Source
	Ta1	Output in normality (NC)	1a and 1b contacts function to output when the abnormality protection mechanism of the drive is activated.	Control
	Tb1		*Ta1-Tc1 is ON in case of abnormality Contact	Contact Capacity: AC 250V 1A DC 30V 1A
	Tc1		*Tb1-Tc1 is OFF in case of abnormality Contact	
	Ta2		In Operation	
	Tb2		*Ta2-Tc2 is ON during operation Contact	Contact Capacity: AC 250V 1A DC 30V 1A
	Tc2		*Tb2-Tc2 is OFF during operation Contact	
	FM1	Analog output, FM	Multi-function analog monitor 1, DC 0~+10V/100% FM meter head	Signal
FM2	Analog output, amperage monitor	Multi-function analog monitor 2, DC 0~+10V/100% ac drive rated A.	Signal	
COM.	SG+	RS-485 series com. interface	RS-485 series com. jack, positive end input	COM.
	SG-	RS-485 series com. interface	RS-485 series com. jack, negative end input	COM.
	E	Earth cable terminal	Exclusively for the shielded cable to connect the selected earth shielded cable use.	Earth



Whereas the control block is characterized by empty contact, no signal source carrying voltage should be inputted; otherwise, the AC drive will be damage.

# II -Wiring-

## LS800 Control Circuit Terminal Block Wiring Diagram(No. 2.31)



## Schedule of Control Terminal Function (No. 2.32)

Terminal Mark	Terminal Designation	Description	Remarks	
Multi-function Input Terminals	Di1	Forward rotation command	Forward revolution when Di1-COM is ON; and stop, OFF	Control
	Di2	Reverse rotation command	Reversal revolution when Di2-COM is ON; and stop, OFF	Control
	Di3	Input in case of external Abnormality(NC)	AC Drive trips off to stop when external abnormality signal is ON.	Control
	Di4	Abnormality reset	Di4 ON releases the status imposed and maintained by the circuit protection action against failure.	Control
	Di5	Multi-section command 1	To execute four-section speed control with binary 2Bit.	Control
	Di6	Multi-section command 2		
	Di7	Jog inching frequency	To execute the inching frequency operation when enabled ON.	Control
	Di8	Free-run	When activated (ON), the drive immediately stops outputting.	Control
COM	Digital Input common terminal	The multi-function input terminals of the common terminal	Common point	
Analog frequency setup	+10V	Source for F setup	Source output DC +10V for frequency setup (maximal 10mA allowed)	Source
	-10V	Negative source for F setup	Auxiliary negative source output DC -10V for F setup (maximal -5mA allowed)	Source
	AVG	Common terminals for F setup	Common reference potential terminal for F setup input signals (terminal AV1, AV2, AI)	Common point
	AV1	Analog voltage F command	With input voltage at DC 0~±10V (or DC 0~+10V), the input impedance is 15kΩ	Signal source
	AV2	Analog voltage F command	With input voltage at DC 0~+10V, the input impedance is 30kΩ	Signal source
	AI	Analogy current F command	With input current at DC 4~20mA, the input impedance is 500kΩ (or DC 0~+10V, 30KΩ)	Signal source
Multi-function Output Terminals	DO1	Zero-Speed detected	ON in stop status or below zero-speed level	Control
	DO2	Consistent F	ON when the output F at any setting is over the detected F.	Control
	DO3	Overload forecast	On when the drive detection output is over the OL level	Control
	DCM	Digital output common terminal	The multi-function output terminals of the common terminal	Common point
	Ta1	Output in normality (NC)	1a and 1b contacts function to output when the abnormality protection mechanism of the drive is activated.	Control
	Tb1		*Ta1-Tc1 is ON in case of abnormality Contact	Contact Capacity: AC 250V 1A DC 30V 1A
	Tc1		*Tb1-Tc1 is OFF in case of abnormality Contact	
	Ta2		In Operation	
	Tb2		*Ta2-Tc2 is ON during operation Contact	Contact Capacity: AC 250V 1A DC 30V 1A
	Tc2		*Tb2-Tc2 is OFF during operation Contact	
	FM1	Analog output, FM	Multi-function analog monitor 1, DC 0~+10V/ (or 4~20mA)/100% FM meter head	Signal
	FM2	Analog output, amperage monitor	Multi-function analog monitor 2, DC 0~+10V(or 4~20mA)/100% ac drive rated A.	Signal
	AVG	Analog output common terminal	The pulse frequency (FM) terminal of the common termina	Common point
COM.	SG+	RS-485 series com. interface	RS-485 series com. jack, positive end input	COM.
	SG-	RS-485 series com. interface	RS-485 series com. jack, negative end input	COM.
	E	Earth cable terminal	Exclusively for the shielded cable to connect the selected earth shielded cable use.	Earth



CAUTION

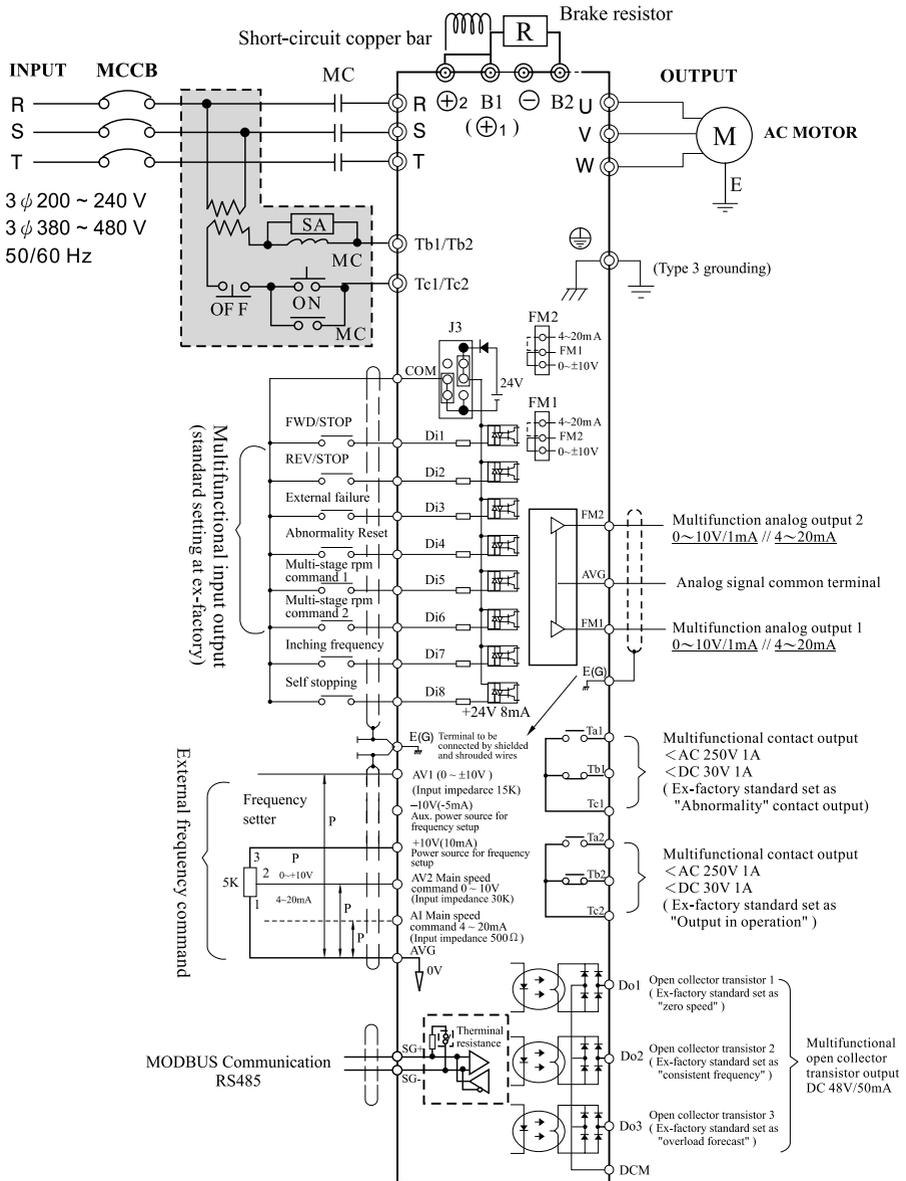


INHIBIT

Whereas the control block is characterized by empty contact, no signal source carrying voltage should be inputted; otherwise, the AC drive will be damage.

# II -Wiring-

## LS800 Control Circuit Terminal Block Wiring Diagram(No. 2.32)



### Coping with Sink Mode/Source Mode

- ◎ With the use of J3 (branch circuit connector), the logic of the input (Di1~Di8) terminals may be switched to Sink Mode or Source Mode
- ◎ With the use of J4 (branch circuit connector), the logic of the input (Do1~Do3) terminals may be switched to Sink Mode or Source Mode.

**Table: Sink Mode, Source Mode and Signal Input ( No. 2.31 )**

	Digital Input (D – in) Mode	Digital Output (D – out) Mode
Sink Mode		
Source Mode		

※ The external power supply for Sink mode、Source mode and the signal input, please refer to the scripts of P2-19.

## II -Wiring-

### Internal / external wire for input mode power supply coping with Sink / Source mode

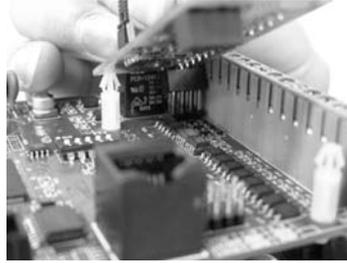
⊙ After the use of J3 (circuit jumper), it can switch the logic of the input terminal over to SINK mode (0V common)/SOURCE mode (+24V common). Furthermore, in order to increase the degree of freedom for the signal-inputting method, it is adaptable to external +24V as well.

**Table: Sink Mode, Source Mode and Signal Input (No. 2.32)**

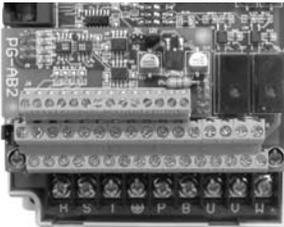
	Adaptive to internal power supply	Adaptive to external power supply
Sink Mode	<p>J3 (NPN setup)</p> <p>J3</p> <p>Circuit-shunting position</p> <p>COM</p> <p>(24V)</p> <p>Di1</p> <p>Di2</p>	<p>J3 (EXT setup)</p> <p>J3</p> <p>Circuit-shunting position</p> <p>External +24V</p> <p>COM</p> <p>(24V)</p> <p>Di1</p> <p>Di2</p>
Source Mode	<p>J3 (PNP setup)</p> <p>J3</p> <p>COM</p> <p>(24V)</p> <p>Di1</p> <p>Di2</p>	<p>J3 (EXT setup)</p> <p>J3</p> <p>External +24V</p> <p>COM</p> <p>(24V)</p> <p>Di1</p> <p>Di2</p>

## PG-AB2 Installing and Wiring

### Installing Procedure:



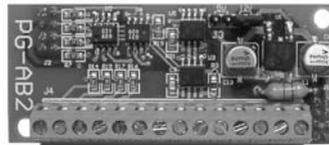
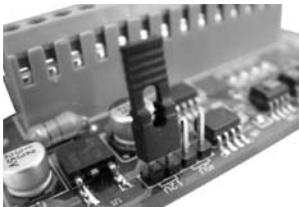
1. Before installing the option card, confirm the power indicator (CHARGE) inside the component of the ac drive is OFF, then remove the digital operator and the lid to facilitate installation.
2. Never exercise excessive force during installation. Firmly press in the direction as illustrated ( from top to bottom) to place the golden fingers, which to be engaged and laterally pressed to secure.
3. Check for any missing parts upon completing the installation before restoring the lid to subject to feeding test.



WARNING

**Before feeding, make sure that terminal block screws and wiring are firmly secured. In case of any problem found with any mechanical part, do not try to repair at own efforts; instead, you should contact the genuine maker or its authorized dealer to solve the problem.**

### PG-AB2(Optional) :



The J3 control signal source adjustment Jump used for the second unit encoder (Terminals A1, B1) is essentially for the determination for the pulse generator of having +5V or +12V at the jump in the right upper corner as the input. External wiring diagram and PG-AB2 terminals and specification are given detailed description and notes in P2-21~P2-25.

## PG Speed Control Card(option card)

### PG-AB2 Terminals & Specification

Terminal Mark	Description	Specification
E	Shielded cable connection ground terminal	-----
A	Phase A pulse input (+)	※ Adaptable to Line Driver, Encoder with 5V or 12V source of complementary and open collector transistor, A, B. Phase signal output. ※ Maximal response frequency 300 KHz. ※ If open collector transistor type of input is used, connect Phase A and Phase B terminals to source terminals of 12V encoder.
$\bar{A}$	Phase A pulse input (-)	
B	Phase B pulse input (+)	
$\bar{B}$	Phase B pulse input (-)	
AO	Phase A pulse monitor output	※ The maximal for Phase A and Phase B open collector transistor output is DC 5V/30mA. ※ Maximal response frequency 300 KHz
BO	Phase B pulse monitor output	
5V	Pulse generator dedicated source	DC +5V ( $\pm 5\%$ ), 200mA (max.)
12V		DC +12V ( $\pm 5\%$ ), 200mA (max.)
0V		DC 0V (+5V and +12V share the common grounding terminal)
A1	Phase A pulse frequency command input	For Phase A and Phase B, the input is done by open collector transistor type (0~300 KHz). (Select J3 according to the specification.
B1	Phase B pulse frequency	
AO1	Phase A pulse frequency command monitor output	※ Phase A and Phase B open collector transistor output, DC 5V/30mA (max.) ※ Maximal response frequency 300 KHz
BO1	Phase B pulse frequency command monitor output	



WARNING

**While installing PG-AB2 Speed Control Card, confirm that the CHARGE indicator in the ac drive is OFF.**

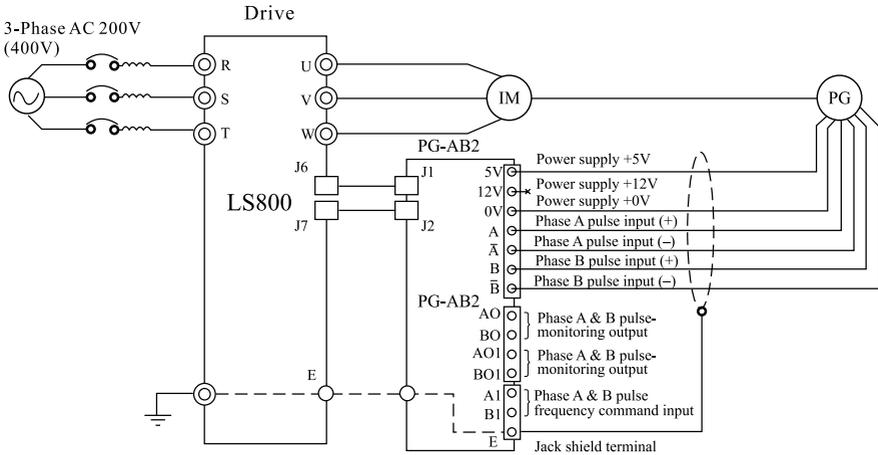
- ⊙ 1 : Refer to the table given on PG-AB2, and the voltage specification of the encoder installed while exercising the PG speed control.
- ⊙ 2 : A set of "speed feedback control input" is provided on PG-AB2 card to accept the complementary type input from Line Diver, or open collector transistor type input; a "frequency command input, allowing control of speed command ratio by taking advantage of the multiplication setup frequency ratio F155; and two sets of "pulse monitor output", for exercising synchronous operation speed command source and monitor.
- ⊙ 3 : Always use the shielded wire on the signal line.
- ⊙ 4 : Do not use the PG source for any purpose other than PG, or error may present due to noise.
- ⊙ 5 : Maintain the PG wiring not greater than 100M, and keep it far away from the power cable as applicable.
- ⊙ 6 : Determine the revolving direction for PG according to F150 (to set up the direction for the encoder PG). The initial setting relates to Phase A taking the lead when the motor is revolving clockwise.



CAUTION

To avoid accident due to interference, proper shielded wire must be secured for signal wiring adapted to elevator or only remote control; negligence in this caution will result in personal injury and property loss.

## PG-AB2 Wiring Diagram



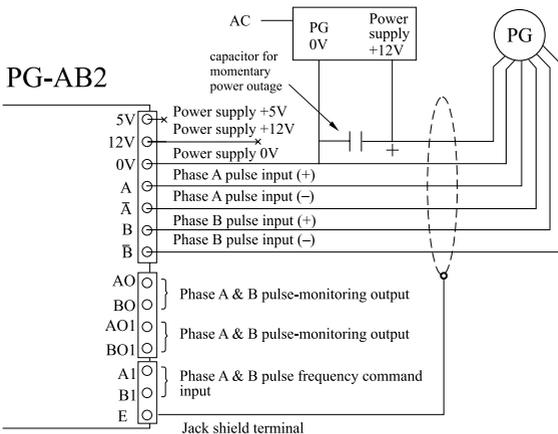
There are two types, 5V and 12V, of internal source for PG-AB2, confirm PG source specification before wiring.

- ◎ The PG output pulse detected is 300kHz max.
- ◎ The PG output frequency (FPG) may be solved by the following formula:

$$\text{FPG(Hz)} = \frac{\text{Motor revolving speed at the highest frequency output}}{60} \times \text{PG Constant(p/rev)}$$

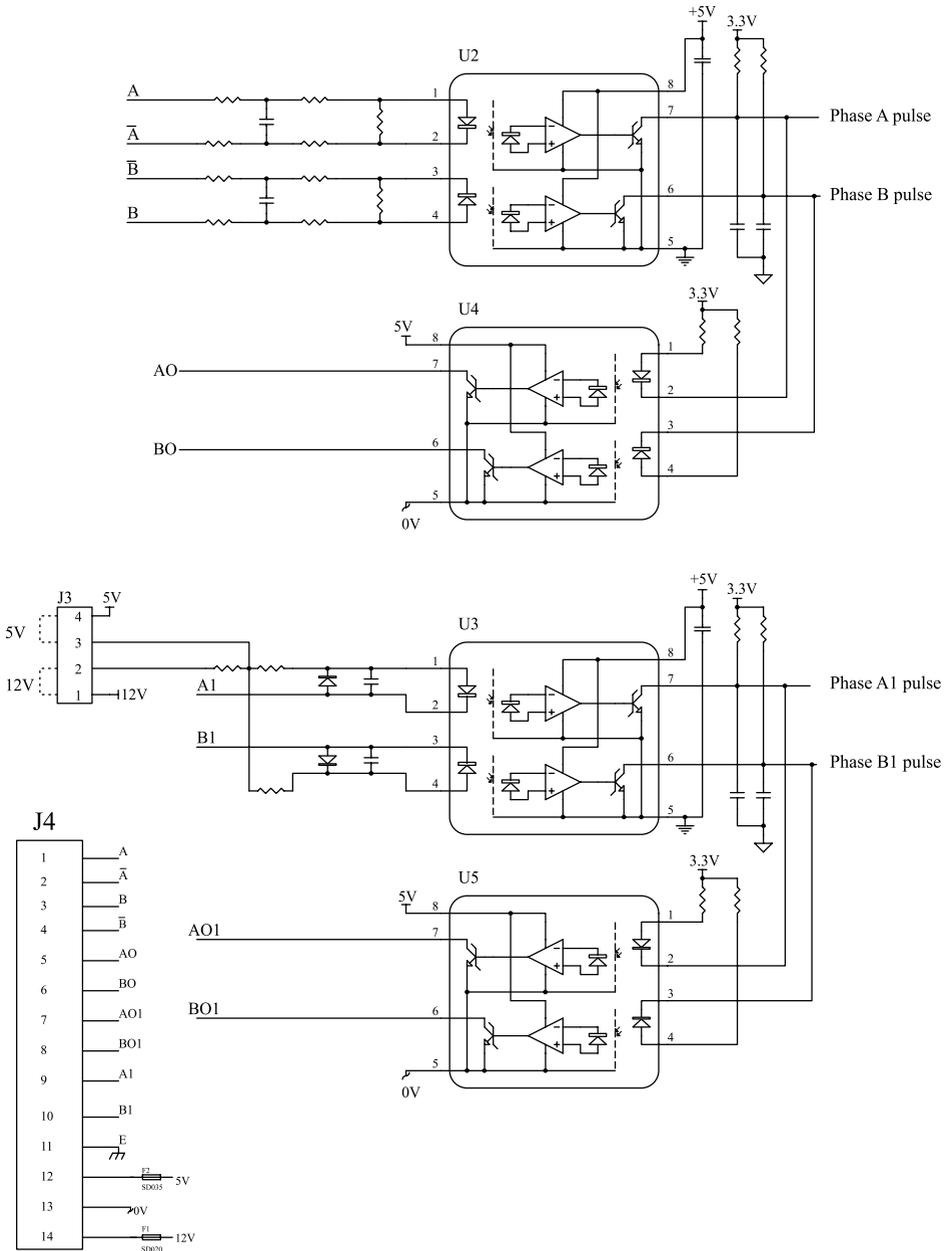
Make available other sources if the PG source capacity is 200mA or above.

Installation of additional capacitor at the source end or the similar measure is needed if the exercise of transient power interruption process is a must.

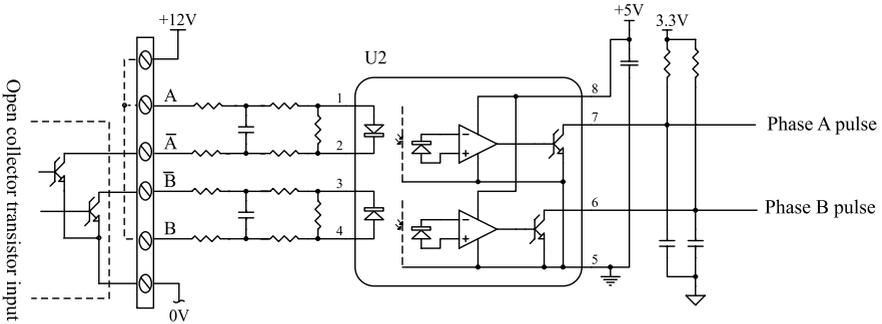


# II -Wiring-

## PG-AB2 I/O Circuits Construction Chart



## Open collector transistor input wiring diagram

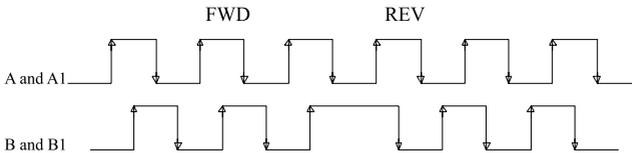


### PG-AB2 Input mode setup

#### PG-AB2 input mode setup

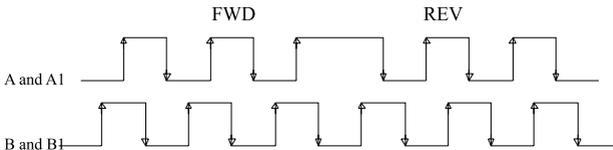
##### ◆ F150 Encoder (PG) input direction = 1 : A leads B

- Phase A, B pulse trains, Phase A leads Phase B by 90 degrees for FWD (Positive/negative edge trigger) (fourfold frequency multiplication)
- A1, B1 are pulse trains input by frequency speed command



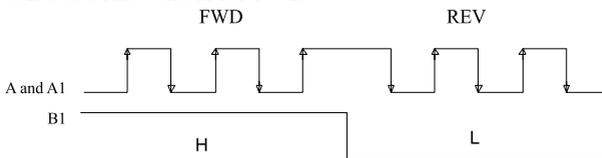
##### ◆ F150 Encoder (PG) input direction = -1 : B leads A

- Phase A, B pulse trains, Phase B leads Phase A by 90 degrees for REV (Positive/negative edge trigger) (fourfold frequency multiplication)
- A1, B1 are pulse trains input by frequency speed command



##### ◆ F150 Encoder (PG) input direction = 0 : one-way feedback/command

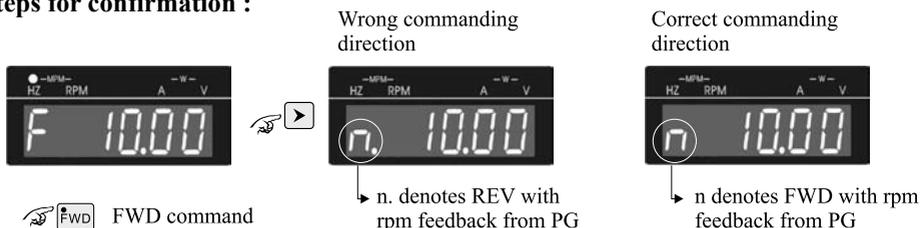
- Phase A is a pulse train
- A1 is a pulse train input by frequency speed command, phase B1 is for direction while symbol L is for REV and H for FWD.



### # PG feedback for operation & test confirmation:

- (1) Please mount the PG feedback card before energizing the power supply; also please pay attention to the Encoder-needed voltage is 5V or 12V; enable the power supply after the completion of wiring connection. (※Caution: Wrong input of power source and polarity to the encoder will burn the Encoder and the PG feedback card)
- (2) Firstly establish the motor parameters in nameplate F141~F146, and perform F147 = 2: open-loop scalar control so that the FWD command at 10Hz can be taken to start the motor running.
- (3) During the operation, please check if the rotating direction of motor is correct; switch over any two phase lines amid the wires (U.V.W.) of motor if the direction is wrong.
- (4) Set up the constant rpm feedback F148 = 1: Encoder (PG), F149- Number of pulse of Encoder (PG), F150- Direction of Encoder (PG); and perform F147 = 2: Open-loop scalar control to take the forward rotation command at 10Hz to actuate the motor's running; and during the operation, press  to check if the Encoder direction, frequency of Encoder (PG) are identical to the direction of forward rotation command; if the direction of Encoder (PG) is different from the direction given from the frequency command, please perform the following steps for confirmation:

#### Steps for confirmation :



### # Troubleshooting:

- Problem 1: No display of rpm feedback from PG.

Solution: Please check if the voltage and polarity of power supply, and Encoder wire A &  $\bar{A}$  and B &  $\bar{B}$  is correct.

- Problem 2: An speed Error between the frequency command and the rpm feedback from PG.

Solution: There will be a load and a slip frequency generated from the motor operation that leads to a little error between the frequency command and the rpm feedback from PG; the error range should be  $\pm 0.5\text{Hz}$  or so; if there is a big error range, please examine if the number of pulse set to F149 Encoder (PG) is correct and if the net grounding wire is at good condition.

- (5) Perform F147 = 0: Electric parameter detection (Pr\_RL) after the completion the foregoing steps and follow a success detection to set F147 = 5: Close-loop vector control for servo actuation and torque control; high-precision control and speed response is obtainable.

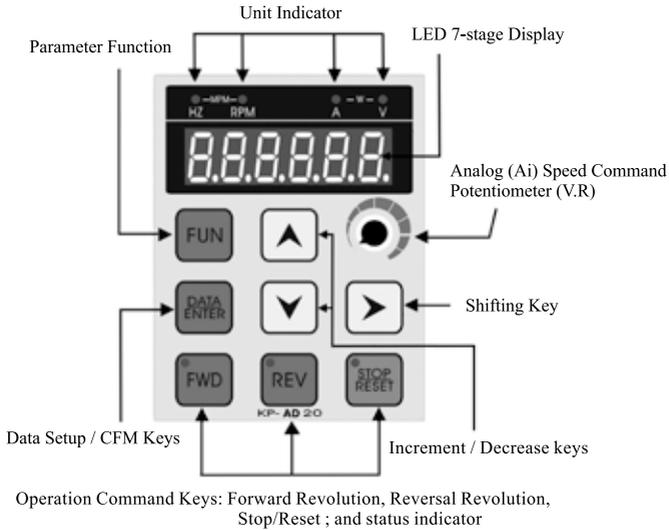
※ **For the steps of electric parameter detection(Auto-tuning), please see P4-2 for the description of auto-tuning.**

# III Digital Operator Panel

- ◆ Location&Designation of Digital Operator.....3-1
- ◆ Function description of keys.....3-2
- ◆ Parameter Setup Mode.....3-3
- ◆ Operator Control Mode.....3-4
- ◆ Multi-function Digital I/O Terminals  
Status Display Inspection.....3-5

# III -Digital Operator-

## Location & Designation of Digital Operator



### Functions of Digital Operator Panel

The operation panel is able to perform the functions of running, shutdown, and frequency setup, monitoring the running status, parameter setup and failure display, etc.

### Storing Parameters

Save each and all parameter settings that have been confirmed and complied with the purposes as demanded in the commissioning into EEPROM of DSP (F209 = 1).

### Duplicating Parameters

- SAVE(1)** Save the ac drive parameters into the digital operator by selecting Parameter F209 : Copy & Save the Parameter in Digital Operation panel = 1: Save in Digital Operator panel.
- RECALL(2)** Power off to remove the digital operation panel and install it to another AC drive; recall the duplicated parameter to the RAM in the DSP by selecting Parameter F208: Recall Parameter (source) = 2: Parameter of Digital. Operator before selecting saves to EEPROM in DSP to complete parameter duplication for another unit of AC drive.



WARNING

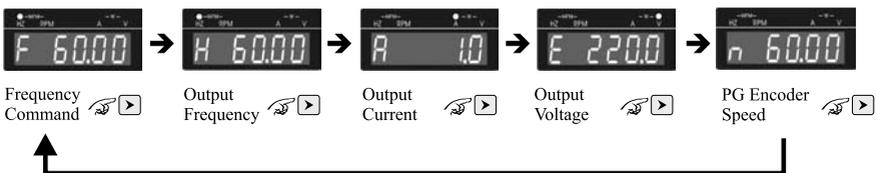
When the vector control mode is selected to duplicate any parameter of F147 = 5, 6 for example, make sure that the electric machinery features must be consistent; otherwise, perform once the Auto-tuning of electric and mechanical parameters.

**Function description of keys :**

Classification	Key	Brief Description of Function
Parameters / Data Key		Enter into Parameter Function Mode key.
		To read, and write parameter settings. To confirm and enter data, and save the data at DSP (interior of EEPROM) automatically.
Shift/ Increase, Decrease Keys		To move the position of flashing cursor rightward to select the place for data entry. <b>* Each depress of right-shift key will enable a cyclic display during the operation.</b> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">                     ┌ F: Frequency Comm. → H: Output frequency → A: Output current                      └────────── n : PG Encoder Speed ←────────── E : Output voltage ←──────────┘                 </div>
		To execute numeric increase for parameter encoding and setting. To perform the frequency setting under operation control mode by setting the F5: Frequency command source = 0 to the digital operation panel.
		To execute numeric decrease for parameter encoding and setting. To enter into F0 to monitor variety of displays under the operation control mode.
Operation Command Key		To execute the operation command in forward resolution, and turn on the LED indicator. To serve as a function key to execute the stop running command ,when setting the revolving direction is not limited to the FWD command
		To execute the operation command in reversal resolution, and turn on the LED indicator. To serve as a function key to execute the stop running command ,when setting the revolving direction is not limited to the REV command
		To execute the stop running command. To execute reset in case of abnormality; and return to the original setting in parameter setup mode.
Revolution Speed Command		Speed control for operation panel AV(V.R.) when F5 = frequency command source = 1

**Quick & cyclic display functions during operation**

Each press of  key from digital operation panel is able to cyclically display the functions in the following order: Frequency Command→Output frequency→Output current→Output voltage→PG Encoder Speed.

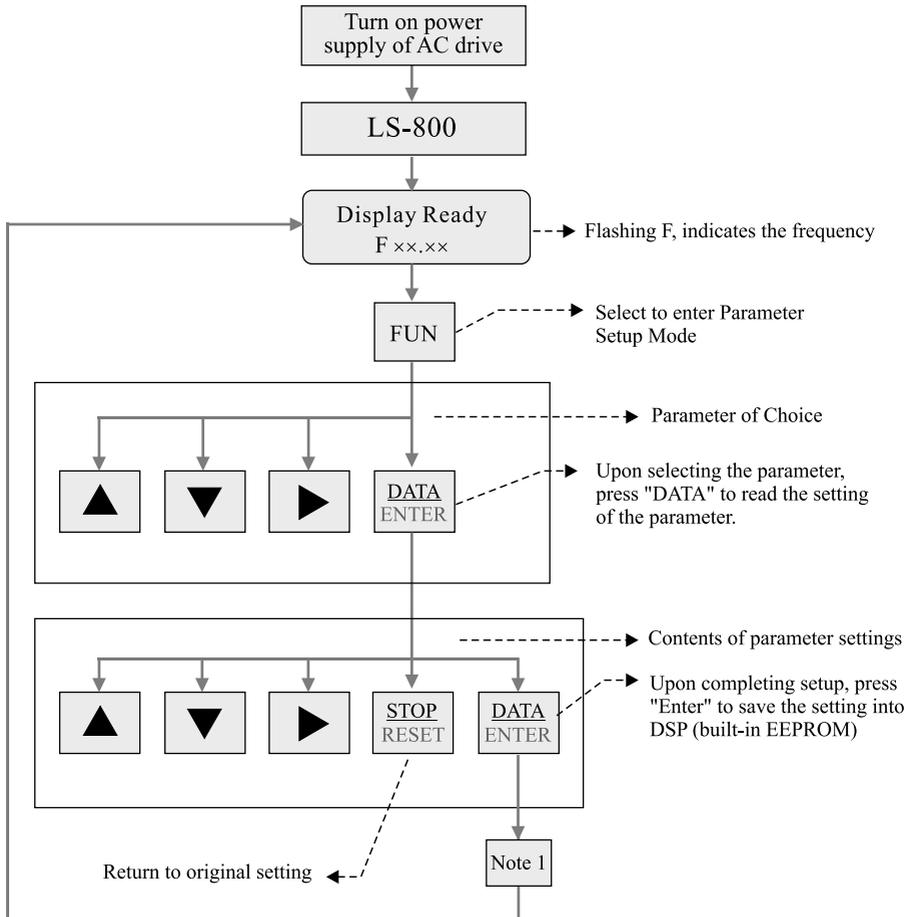


# III -Digital Operator-

## Parameter Setup Mode

This mode is for changing the set values of internal parameters. Please use the increment, decrement, and shift keys to change the parameter settings, and press the ENTER/DATA key to save the changed data in DSP (interior EEPROM) automatically and exit the setup mode. For more details of parameters, please see the "Summary of parameter setting" in the Appendix C.

### Parameter Setup Mode Flow Chart

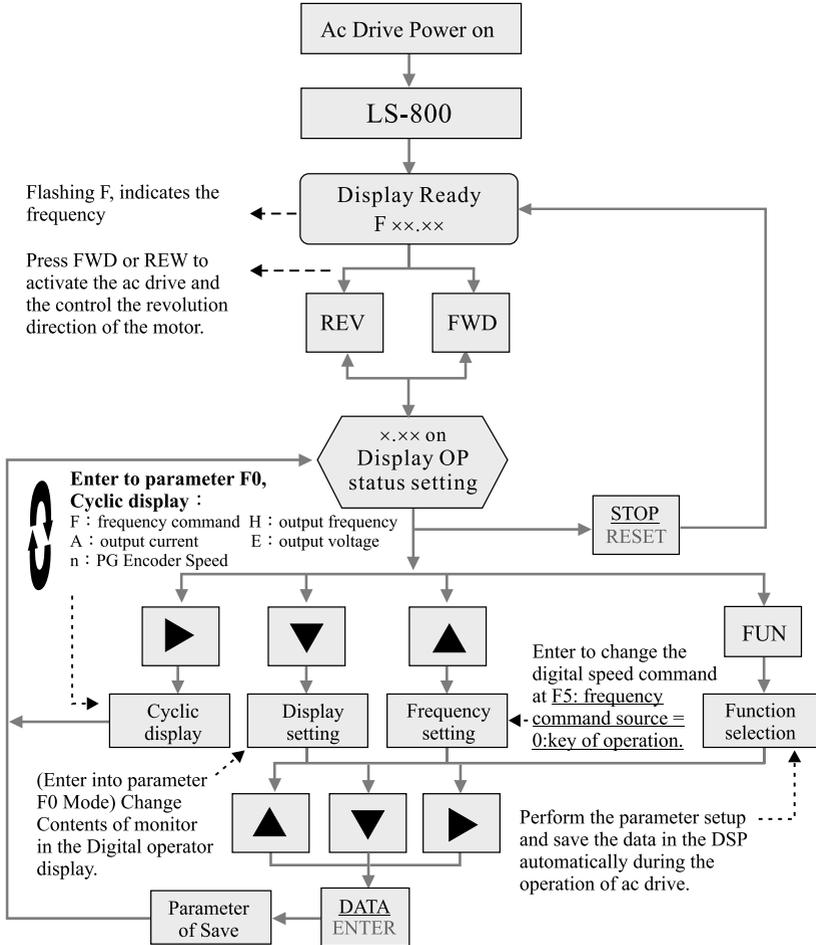


◎Note 1 : Make sure to save each and all parameter setting that have been confirmed and complied with the purpose as demanded in the commissioning into the DSP(built-in EEPROM), if copying the parameters is desired, please save the parameters of ac drive into the Digital Operation Panel; or select parameter F209: Copy & Save the parameter in digital operation panel = 1: save in Digital Operation Panel.

## Operator Control Mode

The flow chart of the operator control mode is given below. This mode is for monitor display in the control of control operation and frequency display commands, output frequency, output amperage and output voltage, as well as the display of abnormality nature and records. For details of parameters, refer to Appendix C “Schedule of Parameter Settings”.

### Operator Control Mode flow



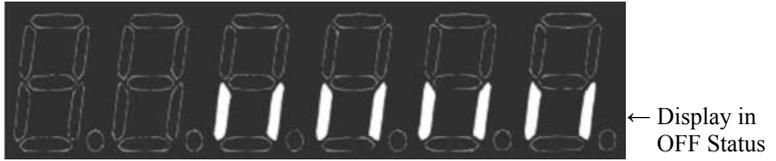
Note 1 : If the speed signal source dose not fall on F5 (frequency command source) = 0 : Digital Operation panel mode the Digital speed command input is ineffective.

# III -Digital Operator-

## Multi-function Digital I/O Terminals Status Display Inspection

F0 : Display Status Setting = 22 (Multi-function digital input terminal status)

Multi-function Parameter → F74 F73 F72 F71 F70 F69 F68 F68



Multi-function Terminal → Di8 Di7 Di6 Di5 Di4 Di3 Di2 Di1

Multi-function Parameter → F74 F73 F72 F71 F70 F69 F68 F68



Multi-function Terminal → Di8 Di7 Di6 Di5 Di4 Di3 Di2 Di1

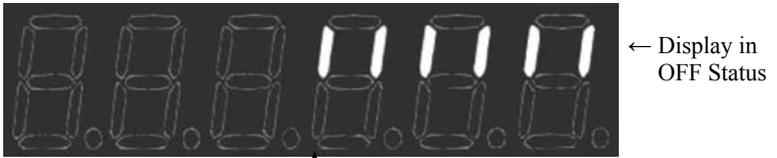
F0 : Display Status Setting = 23 (Multi-function digital input terminal status)

Multi-function Parameter → F75 F79 F78 F77 F76



Multi-function Terminal → RL1 RL2 Do3 Do2 Do1  
Brake acting function

Multi-function Parameter → F75 F79 F78 F77 F76



Multi-function Terminal → RL1 RL2 Do3 Do2 Do1  
Brake acting function

# IV Test Run

- ◆ Commissioning Operation.....4-1
- ◆ Auto-tuning Function.....4-2
- ◆ Auto-tuning Function Process Flow Chart.....4-4
- ◆ Basic Parameter Setup.....4-5
- ◆ Quick operation parameter setup block diagram.....4-6

## Commissioning Operation

### # Inspection before operation:

- ⊙ After the completion of wirings and before supplying the power for test run, please go through the following checkups:
  1. Check if wirings are correct. 「 input terminals R.S.T shall be wired to power supply while output terminals U.V.W shall be connected to 3-phase induction motor 」 . Phase reversal at input/output terminals is not allowed.
  2. Look around the interior and all the wiring terminal blocks inside the ac drive to see if there are any wire chips of leads; make sure to remove them thoroughly.
  3. Check if terminals and screws, etc. components are firmly and tightly fastened.
  4. Check if there is short-circuit or grounding among the terminals.
  5. Check if the voltage of the input power supply is the same as the rated voltage of the ac drive.

**200V class : Single / 3-phase AC 200~240V 50/60Hz**

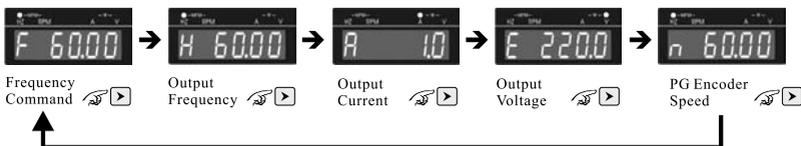
**400V class : 3-phase AC 380~480V 50/60Hz**

### # Commissioning:

- ⊙ The AC drive has been ex-factory set at F147 = 2, i.e., the Open loop V/F Control Mode, or select the operation mode according to F147 as detailed in P5-38~P5-39 , F4 = 0 i.e., the operation control method is PB Operator, and F5 = 1, the command source is the potentiometer (V. R) control. Before feeding for commissioning, turn the potentiometer (V.R) knob counter-clockwise before inputting the power. Carry out the commissioning according to the steps given below:
  1. Power ON.
  2. Confirm the display status is shown the target frequency. (F ××.××) °
  3. Enter into operation control mode (Press keypad [FWD] to enter forward operation control.)
  4. Enter speed command (Turn the potentiometer knob found on the operator slowly clockwise to run the commissioning at a frequency within 10Hz).
  5. Press keypad [STOP] to slow down and stop the motor.

### # Operation Checklist:

- ⊙ If the revolving direction of the motor is correct (Interchange any two of the phase lines to change the motor's direction of rotation.)
- ⊙ Check if motor runs smoothly.
- ⊙ Check if motor vibrates abnormally.
- ⊙ Check if acceleration and deceleration are smooth.
- ⊙ Check if output load current is normal ( Press the ▼ key to access parameter F0 = 2 : output current, or ► right-shift cyclic key to monitor the output load currents.)



## Auto-tuning Function

### # Auto-tuning Elements

- ⊙ If F147 = 5: Closed Loop Vector Control, 6: Sensorless Vector Control is selected as the control mode, auto tuning must be performed prior to the drive operation.
- ⊙ Before executing the auto tuning function of parameters, it is necessary to establish the following parameters in accordance with the capacity data specified in the nameplate of motor: F141 : Rated Voltage, F142 : Rated Current, F143 : Rated Frequency, F144 : Rated speed (rpm), F145 : Rated HP, and F146 : Number of Polarity of Motor(P).
- ⊙ Select F4 (Operation Control Signal Source) = 0 : Digital Operation panel before performing the auto-tuning.

**Note: Dynamic parameter tuning: After executing the forward rotation command to run the motor at 2/3 speed (40Hz) of the rated frequency for about one minute, the detection and measurement of motor parameters at no-load or below 50% load is available.**



When performing the Auto-tune, the motor must be separated from the machine if motor's running will generate an unsecure status or uncertain factor.

### # Parameter Auto-tune

- ◆ Parametric tuning (F147) at -1: Static electric parameter detection: This function is designed for those machinery equipments coupled with heavy duty that fails the detection of dynamic parameters; however, it shall be used in association with the setup of parameter F160 (motor's no-load current %) so that the motor's electric parameter group (F156~F159) can be detected in full while the accuracy in this regard is lower than the 0: Electric parameter detection.
- ◆ Parametric tuning (F147) at 0: Electric parameter detection: To execute an automatic tuning for static and dynamic parameters.
- ◆ Upon performing electric parameter auto-tuning, the ac drive will continue to perform functions of static parameter auto-tuning and dynamic parameter auto-tuning. It is feasible to automatically detect those electric characteristics of the motor and automatically set up the motor electric parameter group in the software. Perform the auto-tuning according to the following steps:
  1. Set up the control mode (F147) at 0: Electric Parameter Detection to perform the parameter auto-tuning.
  2. Press keypad "FWD or REV" for the ac drive to display Pr-RL to start outputting DC current to the motor for providing Stage 1 static mode parameter auto-tuning in advance, and Stage 2 dynamic parameter auto-tuning for the revolution type of the motor.
  3. If the auto-tuning has been successfully executed, the ac drive will automatically set up the electric characteristics of the motor and save them into corresponding parameters F156~F160.
  4. If F147 = 5(Closed Loop Vector Control) Mode is required, perform the F147 = 1 (Machinery Parameter Detection) auto-tune. The setting of the parameter modulation will affect the response of the vector speed (PI) control. During the auto-tune, the ac drive displays Pr-Jm; the dynamic parameter modulation of the revolution type of the motor will

## IV –Test Run–

---

be performed, and the modulation setting will be saved into Parameter F161. (Refer to Prompt 2.)

5. Modify the control mode (F147) = 5: Closed Loop Vector Control, and 6: Sensorless Vector Control.

### **PROMPT:**

1. With the speed precision highlighted within the high speed area (approximately 100% or greater of the rated speed , Please set F121 to be ranging 0.90~0.95.
2. When Parameter F147 is set at 1 for performing auto-tuning of mechanical parameter, PG feedback device must be provided each to the AC drive and the motor before carrying out machine parameter test and detection.

# Auto-tuning Function Process Flow Chart

