

# 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: Analog Output

- (0) PWM(Pulse Width Modulation) output— To output DC voltage to (FM1 or FM2) terminal through PWM at a maximum range: DCV 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	FFM2 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.

---

## 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](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.

- 
- ◆ 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.
-



# TABLE OF CONTENTS

---

## Summary Differences Between LS800 V.2.31 and LS800 V.2.32

Preface .....1

Description of Safety & Symbols & Warnings .....2

### I. Installation

- ◆ Installation .....1-1
- ◆ Installation Site Setup & Control .....1-2
- ◆ Description of Nameplate.....1-3
- ◆ Designations of Part.....1-4
- ◆ High Horsepower Control Box Layout.....1-4
- ◆ Removing the AC Drive Lid.....1-5
- ◆ Installation Direction & Space.....1-7
- ◆ Functions and Maintenance of Cooling Fan.....1-8

### II. Wiring

- ◆ Schematic View of Peripheral Configuration.....2-1
  - ◆ Mounting the Brake Control Circuits.....2-3
  - ◆ Primary Loop Terminal Block.....2-4
  - ◆ Wiring Methodology.....2-5
    - 3-Phase Primary Loop Wiring Diagram-1(200~240V).....2-5
    - 3-Phase Primary Loop Wiring Diagram-2(380~480V).....2-6
  - ◆ Notices to Wiring.....2-7
  - ◆ Primary Loop & Control Loop Routings Comparison Chart.....2-8
  - ◆ Control Terminal Block Location Reference Chart .....2-9
  - ◆ Wiring connection of control circuit terminals.....2-11
    - Notices to Control Circuit Wiring.....2-11
    - Analog input Terminals (AV1,AV2,AI,AVG).....2-12
    - Digital input Terminals (Di1 ~ Di8,COM) .....2-12
    - Do Output(Do1,Do2,Do3,DCM) .....2-12
  - ◆ Function description of cointrol circuit terminals(No.2.31).....2-13
  - ◆ Wiring diagram of control circuit terminal (NO.2.31).....2-14
  - ◆ Function description of cointrol circuit terminals (No.2.32).....2-15
  - ◆ Wiring diagram of control circuit terminal (NO.2.32).....2-16
    - Coping with Sink Mode / Source Mode(No.2.31).....2-17
    - Internal / external wire for input mode power supply coping with Sink /  
Source mode (No.2.32).....2-18
  - ◆ PG-AB2 Installing.....2-19
-

# TABLE OF CONTENTS

---

○ PG Speed Control Card (Option Card).....	2-20
○ PG-AB2 Wiring Diagram.....	2-22
○ PG-AB2 I/O Circuits Construction Chart.....	2-23
○ Main power source circuit diagram.....	2-25

## 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

## IV. Test Run

◆ Commissioning Operation.....	4-1
○ Inspection before Operation.....	4-1
○ Commissioning.....	4-1
○ Operation Checklist.....	4-1
◆ Auto-tuning Function.....	4-2
○ Prerequisites for Auto-tuning.....	4-2
○ Parameter Auto-tune.....	4-2
◆ Auto-tuning Tuning Process Flow Chart.....	4-4
◆ Basic Parameter Setup.....	4-5
◆ Quick Operation Parameter Setup Block Diagram.....	4-6
○ Fast Operation Control Mode.....	4-6
○ Five control modes for selection.....	4-7
○ Torque Current Limit, Torque Current Comm.....	4-9
○ Position tracking of pulse-wave command.....	4-9

## V. Description of Parameter Function

◆ Operator Display Setting.....	5-1
◆ Operation Control Parameters.....	5-3
◆ Speed Limit.....	5-7
◆ Multi-stage Speed command setup.....	5-9
◆ Acceleration/Deceleration Time.....	5-10
◆ Analog input .....	5-12
◆ Digital (Di) input.....	5-18
◆ Digital (Do) output.....	5-22

---

# 目 錄

---

◆ Jumping Frequency.....	5-25
◆ Motor protection setup.....	5-25
◆ Automatic Operation Function.....	5-29
◆ Magnetic Flux Setup.....	5-31
◆ FM 1 AO Waveform Output(No.2.31 Special-Purpose) .....	5-34
◆ FM 2 AO Waveform Output(No.2.31 Special-Purpose).....	5-34
◆ AC Drive Parameters(No.2.32 Special-Purpose).....	5-36
◆ FM1 AO analogy output (No.2.32 Special-Purpose).....	5-36
◆ FM 2 AO analogy output (No.2.32 Special-Purpose).....	5-37
◆ Motor Nameplate.....	5-37
◆ Control Mode.....	5-38
◆ Encoder Setup.....	5-40
◆ Motor Electric Parameters.....	5-43
◆ Flux Estimation Tester.....	5-44
◆ Speed PI Controller.....	5-45
◆ Zero-Speed positioning.....	5-48
◆ Abnormality Record.....	5-49
◆ External PID.....	5-51
◆ Special parameter settings.....	5-55
◆ Communication setup.....	5-56
◆ MODBUS Communication.....	5-58
◆ Recalling Parameters.....	5-65

## VI. Protection & Troubleshooting

◆ Abnormality Diagnosis.....	6-1
◆ Most Frequently Used Troubleshooting.....	6-5

## VII. Test, Inspection, & Maintenance.....7-1

## VIII. Selection of brake resistance and brake unit

◆ Selecting Brake Unit.....	8-1
◆ Selecting Brake Resistance.....	8-3
◆ Braking resistor-watt and resistance values of the calculation.....	8-5

## IX. Appendix

◆ A Standard specifications.....	9-1
◆ B Ex-factory set values.....	10-1
◆ C Parameter Setup Schedule.....	11-1
◆ D Err Display .....	12-1
◆ E Dimensional Drawings of Mechanism.....	13-1

---



# **I Installation**

- ◆ **Installation.....1-1**
- ◆ **Installation Site Setup & Control.....1-2**
- ◆ **Description of Nameplate.....1-3**
- ◆ **Designations of Part.....1-4**
- ◆ **High Horsepower Control Box Layout.....1-4**
- ◆ **Removing the AC Drive Lid.....1-5**
- ◆ **Installation Direction & Space.....1-7**
- ◆ **Functions and Maintenance of Cooling Fan.....1-8**

# I -Installation-

---

## 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!

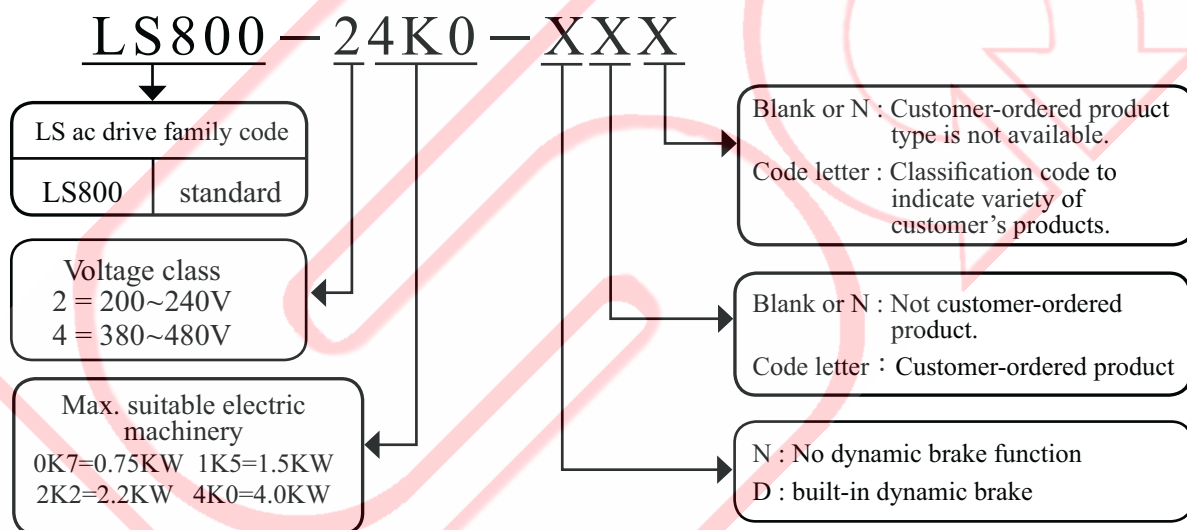
# I -Installation-

## 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	:

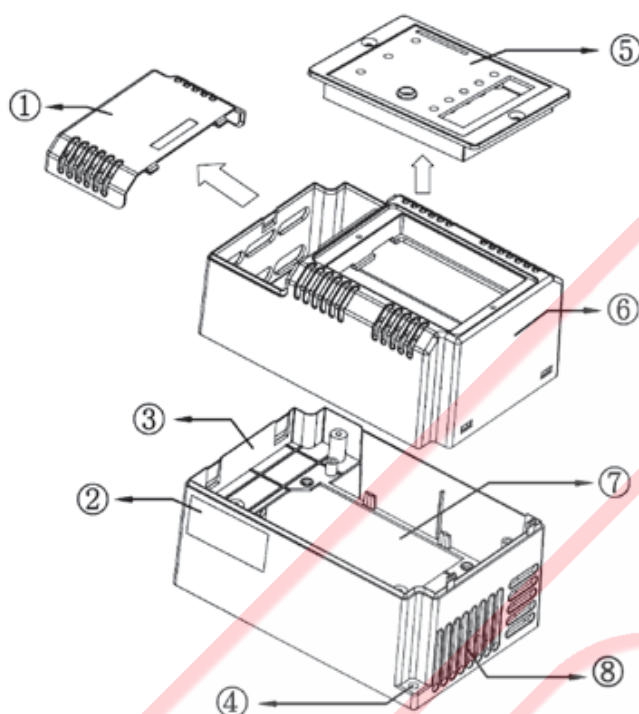
## Description of Model on the Nameplate of the Drive: (MODEL)



### ◆ Model No. and power of ac drive

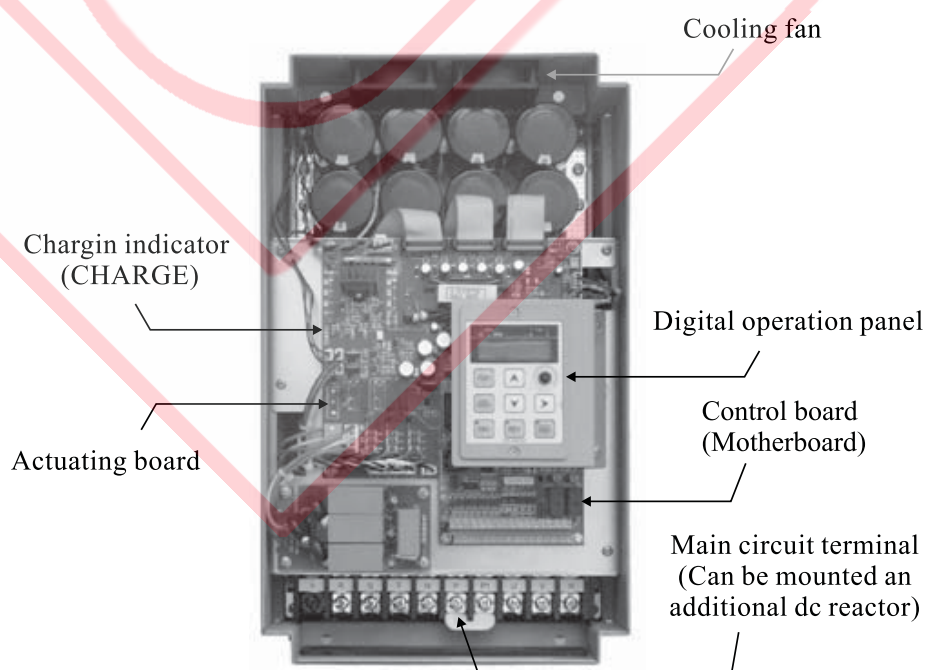
Model No.	Power	Model No.	Power	Model No.	Power
0K4	0.4KW	018	18.5KW	132	132KW
0K7	0.75KW	022	22KW	160	160KW
1K5	1.5KW	030	30KW	185	185KW
2K2	2.2KW	037	37KW	220	220KW
4K0	4.0KW	045	45KW	300	300KW
5K5	5.5KW	055	55KW	375	375KW
7K5	7.5KW	075	75KW	450	450KW
011	11KW	090	90KW		
015	15KW	110	110KW		

## 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-

---

## 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

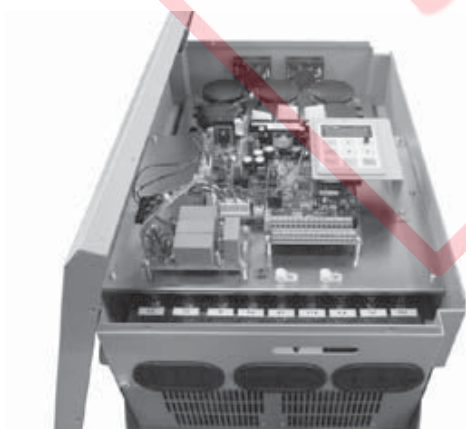
40HP~300HP



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

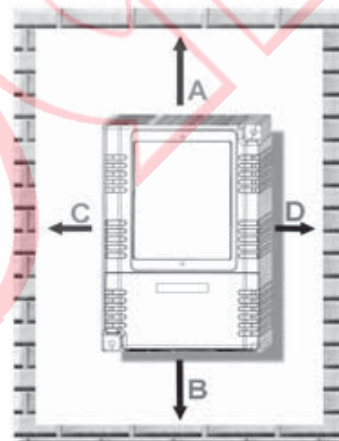
To maintain good cooling air circulation, the ac drive must be secured in vertical position with sufficient clearance left to its surroundings, abutted components and baffles. Whereas cooling fans are mounted at the base of the ac drive, sufficient space shall be maintained to facilitate the air ventilation.

### 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 (  $\pm 5^{\circ}\text{C}$  ) 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

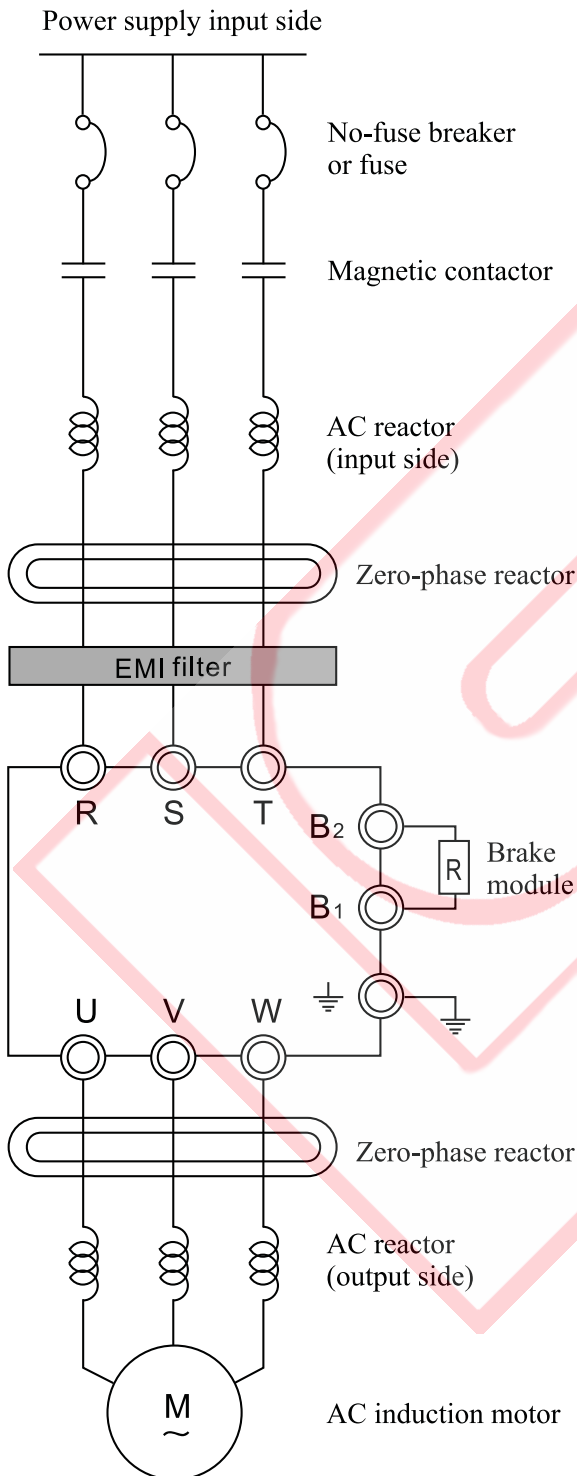
◆ Schematic View of Peripheral Configuration.....	2-1
◆ Mounting the brake control circuit.....	2-3
◆ Primary Loop Terminal Block.....	2-4
◆ Wiring Methodolog.....	2-5
◆ Notices to Wiring.....	2-7
◆ Primary Loop & Control Loop Routings Comparison Chart.....	2-8
◆ Control Terminal Block Location Reference Chart.....	2-9
◆ Wiring connection of control circuit terminals.	2-11
◆ Schedule of Control Terminal Function (NO.2.31).....	2-13
◆ Control Circuit Terminal Block Wiring Diagram(NO.2.31).....	2-14
◆ Schedule of Control Terminal Function (NO.2.32).....	2-15
◆ Control Circuit Terminal Block Wiring Diagram (NO.2.32).....	2-15
◆ PG-AB2 Installing and Wiring.....	2-18

## 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)

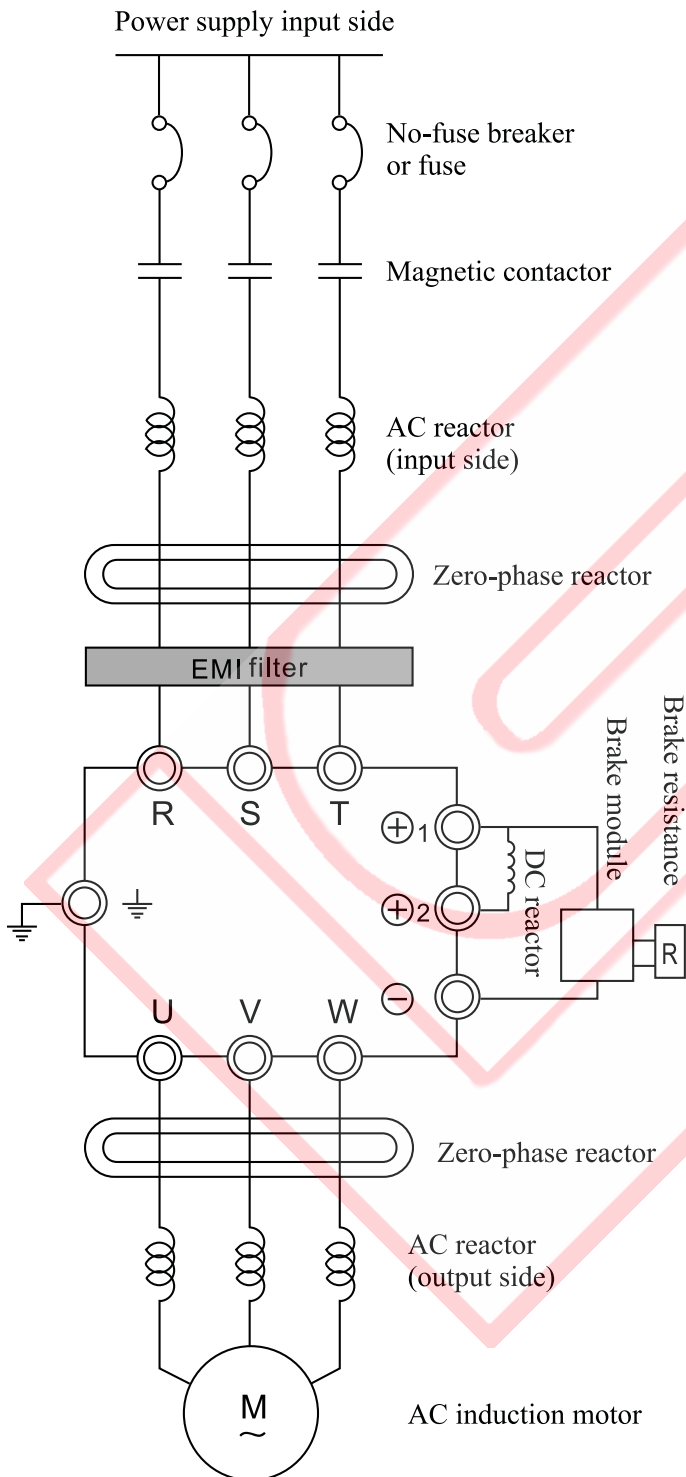


<b>Power supply input side</b>	Please follow the rated power supply specifications from the operation instruction manual to install the power supply (Please see Appendix A P9-1).
<b>No-fuse breaker or fuse</b>	There may be a higher input current when turning on the power supply. Please select an appropriate 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 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).



### 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 intrush 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)

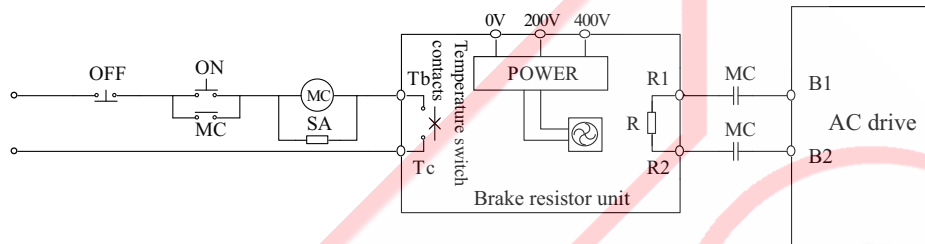
## II -Wiring-

### Mounting the brake control circuits

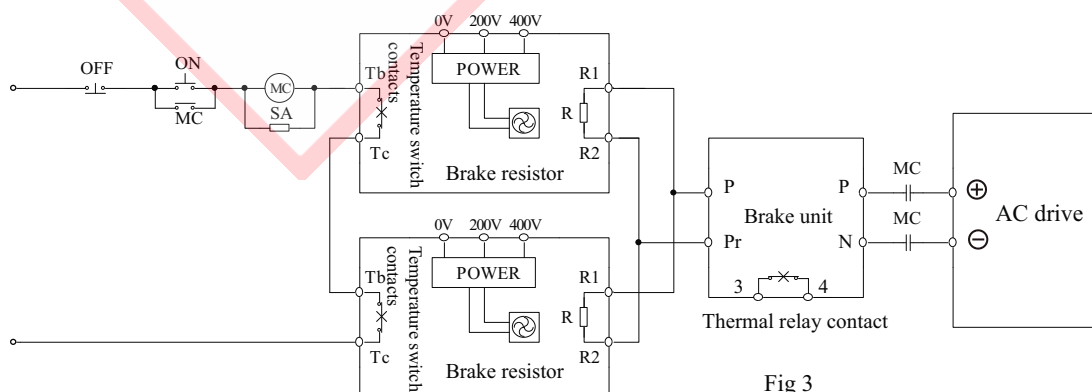
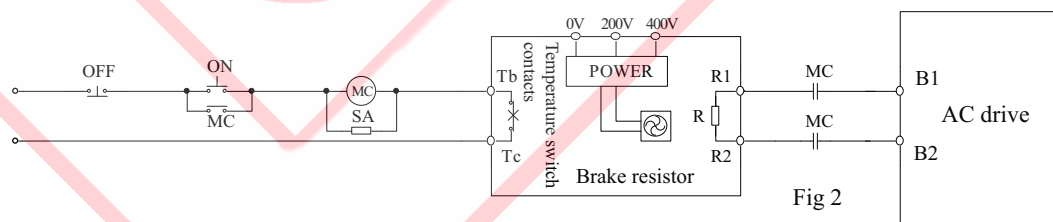
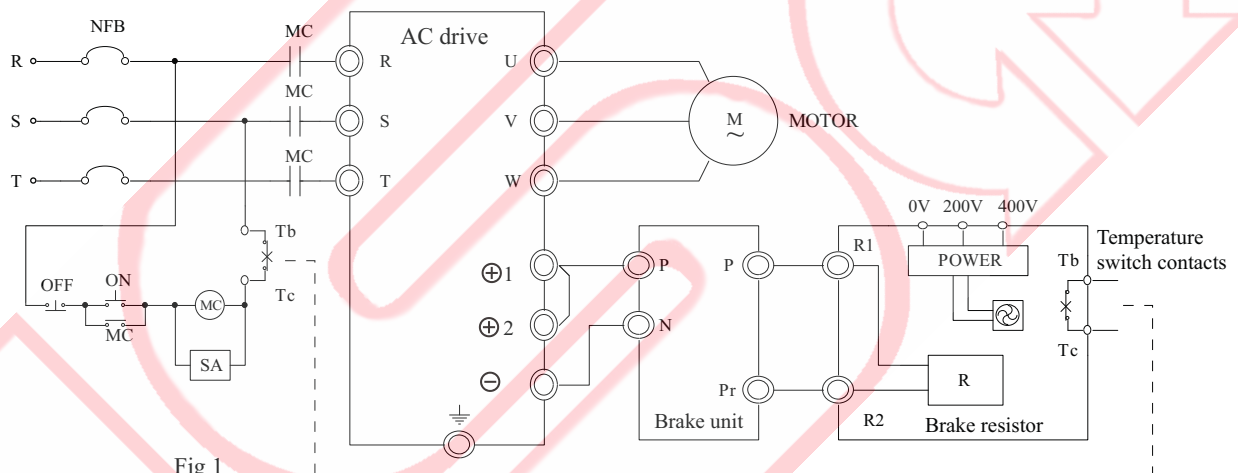
#### Mounting the brake resistor for overheating protection

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)

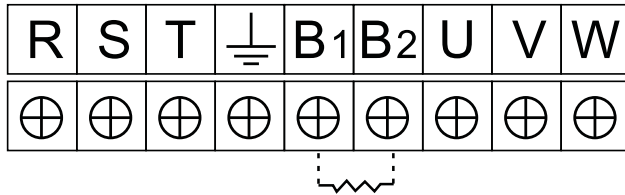


##### 15KW~375KW AC Drive (200V class/400V class)

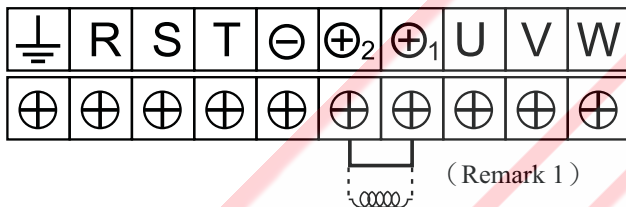


## Primary Loop Terminal Block

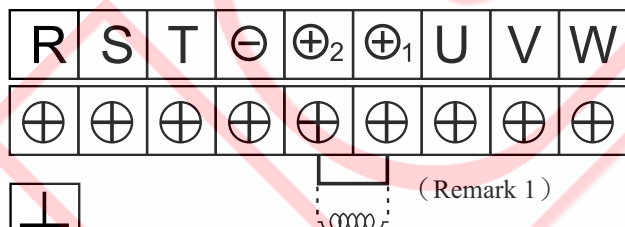
### ◆ 0.4KW~11KW (200V / 400V Series)



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



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

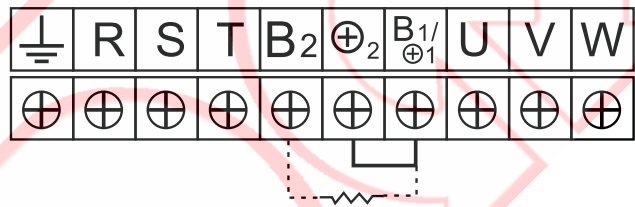


Grounding terminal is located at exterior of cabinet

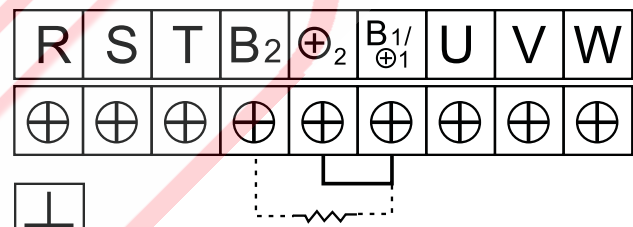
## Synopsis of new-old notes main-circuit terminal blocks

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 motor actuator 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.
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.

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

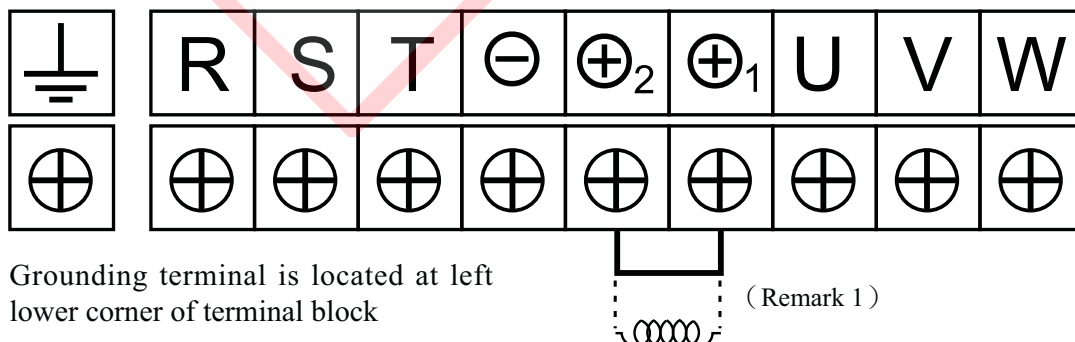


### ◆ 37KW~55KW (200V family with BRAKE) 45KW~75KW (400V family with BRAKE)



Grounding terminal is located at exterior of cabinet

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



Grounding terminal is located at left lower corner of terminal block

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

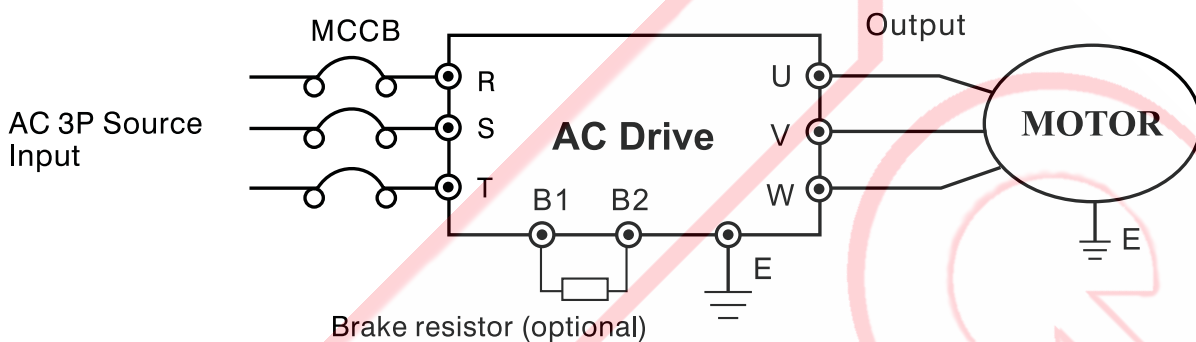
## II -Wiring-

### 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)

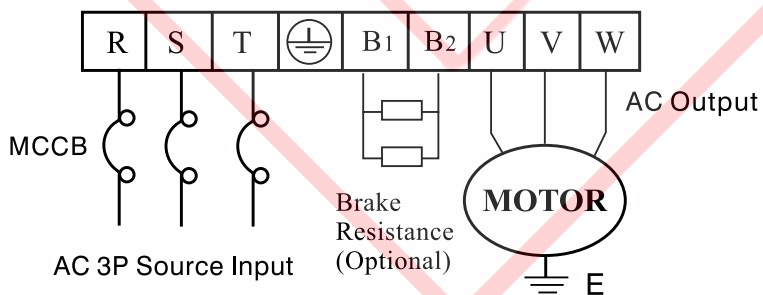
(LS800-40K7、LS800-41K5、LS800-42K2、LS800-44K0、LS800-45K5、LS800-47K5、LS800-4011)





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)

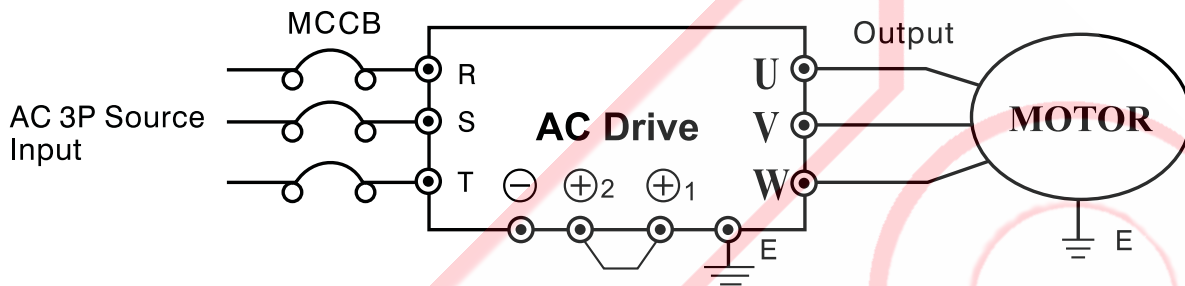


Symbol	Description
R.S.T	Connected to 3-phase power supply input
B1.B2	Can be connected to brake resistor; circuit has been embedded, additional mounting of brake unit is unnecessary.
U.V.W	To be connected to 3-phase motor output terminals
 or 	Grounding terminal

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

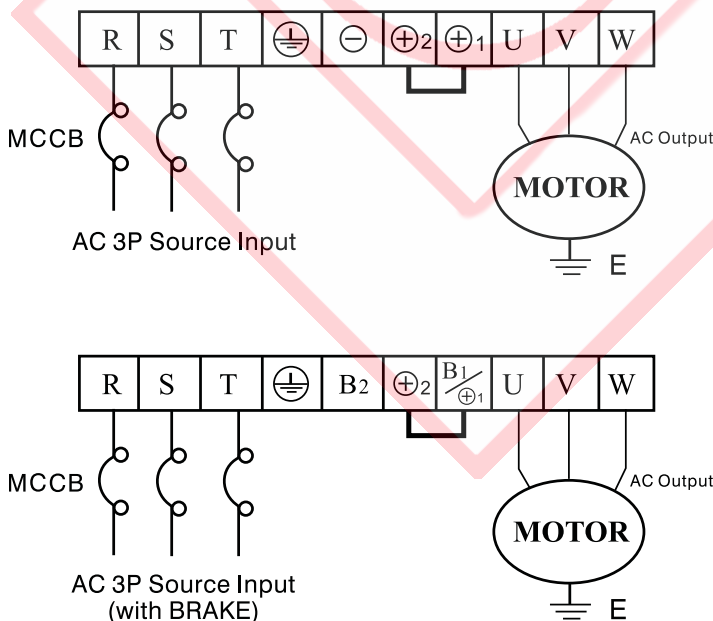
(LS800-2015、LS800-2018、LS800-2022、LS800-2030、LS800-2037、LS800-2045、LS800-2055、LS800-2075、LS800-2090、LS800-2110)

(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 lightening 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.
$\oplus, \ominus$	P(+), N(-) terminal may be connected to external brake unit, but direct connection to brake resistance is not acceptable.
$\oplus 1, \oplus 2$	To be connected to DC reactor.
B <sub>2</sub> , B <sub>1</sub> / $\oplus 1$	Can be connected to brake resistance; no external brake unit which is built in.
$\ominus$ or $\oplus$	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 sparking 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 form 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 electric machinery	Within 2~25 meters	Within 25~200meters
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  $\oplus$  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 crews and the size of wire diameter and firmly fasten them.
- ⊙ The wiring on the side of the source input terminals (3ψ/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

Spec. Description	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>																	

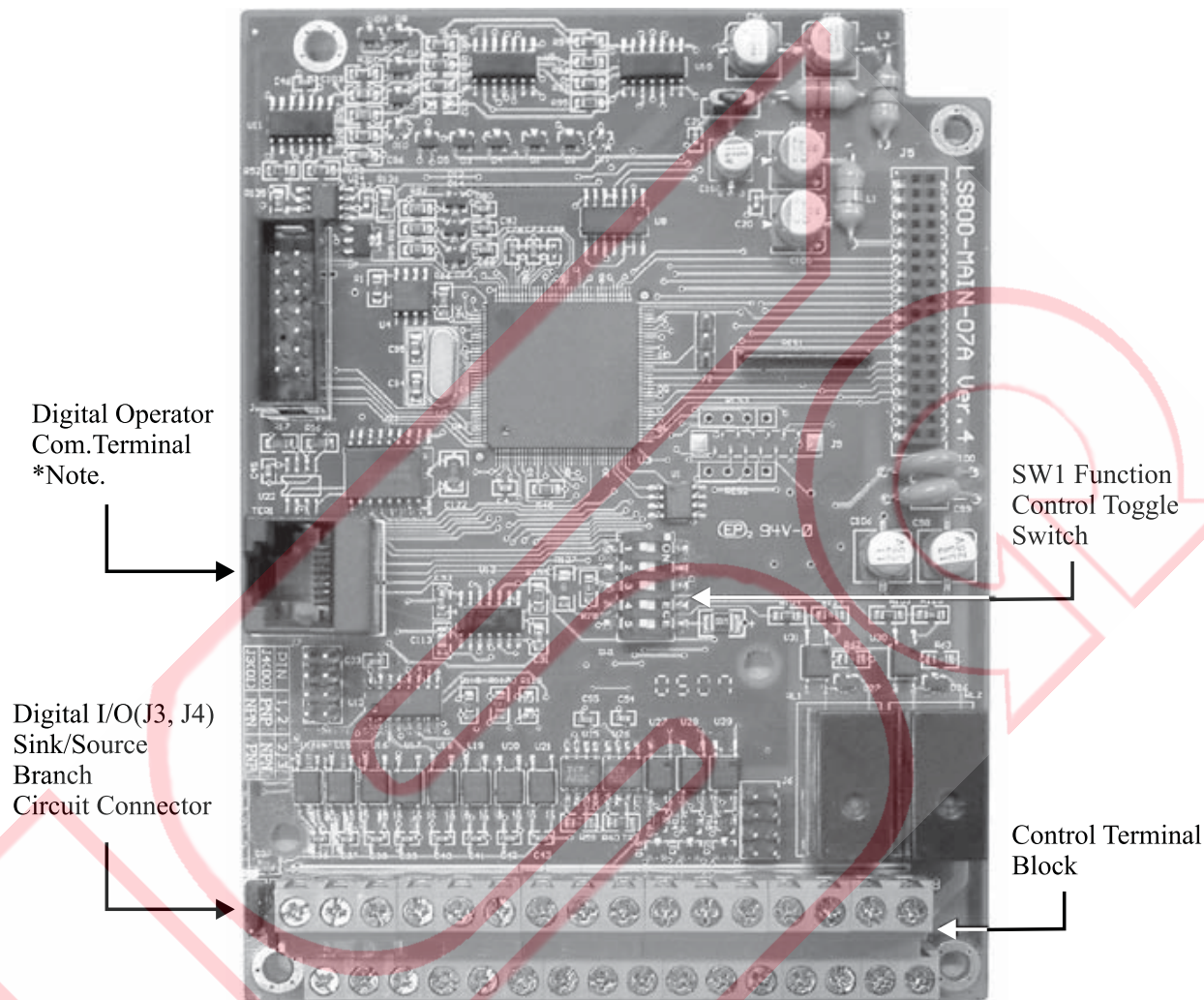
#### Form (2) 400V Series

Spec.	40K7	41K5	42K2	44K0	45K5	47K5	4011	4015	4018	4022	4030	4037	4045	4055	4075	4090	4110	4132	4160	4185	4220	4300	4375
Description																							
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>																						

## II -Wiring-

### Control Terminal block Location Reference Chart

#### LS800 Control board (Motherboard)

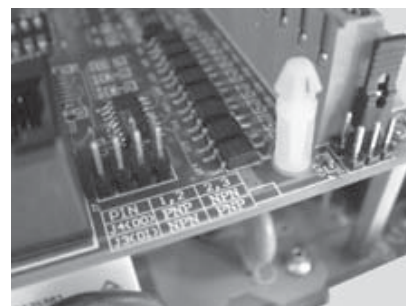


WARNING

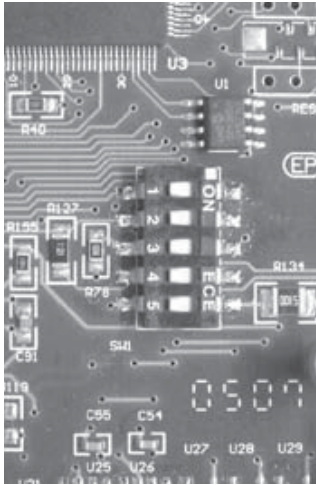
(Note 1) Only a single unit of loop is allowed to start for use since the digital operator related to an internal communication mode and the external communication mode for SG-, SG+ are of different active and passive communication modes, thus are prevented from being connected for use at the same time.

#### ◆ 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 P2-17 、 P2-18.



## ◆ SW1Function 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- (N1)	OFF
2	SG+	External signal output to terminal block SG+ (N1)	OFF
3	485 SW	OFF – internal digital operator in RS485 communication format (N2) 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	
		ON	
		A Mode 0~20mA	

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.

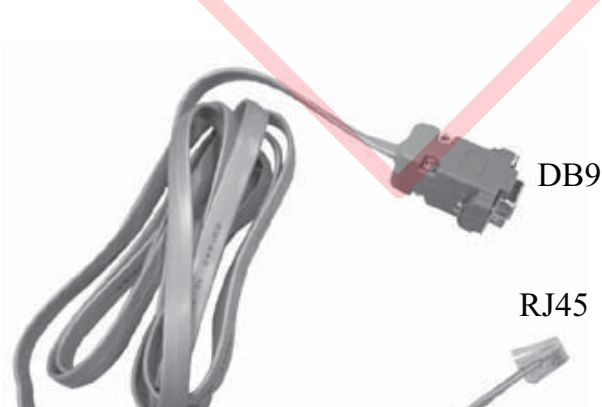
Note 2: The internal digital operator relates to the operation and control carried out by panel pushbuttons.

## ◆ LS800 Digital Operator Comm. Connector Spec.

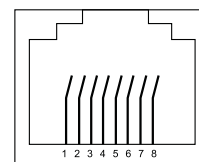


1. RJ45: a short connector as illustrated to the left, instead of the universal one generally available in the market.

## ◆ LS800 RS485 Comm. 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

														NO.2.32		
A	$\overline{A}$	B	$\overline{B}$	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 P2-13、P2-15 and P2-20 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

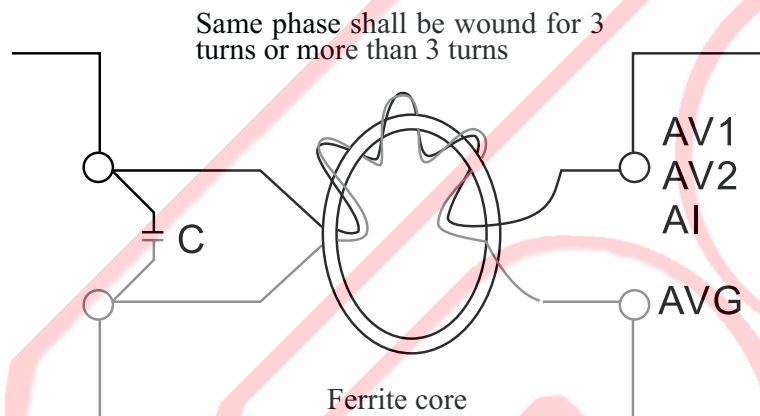
Separation mesh connection must be provided between the control loop wiring and the terminal block and earthed. Improper wiring will cause serious interference and abnormal operation resulting in accident, personal injury and property loss.

- ☑ 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. :



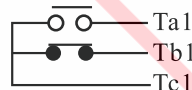

### Digital input terminals (Di1 ~ Di8, COM)

- ☑ 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.

## 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 DC0~±10V (or DC0~+10V), the input impedance is 15kΩ		Signal source
	AV2	Analog voltage F command	With input voltage at DC0~+10V, the input impedance is 30kΩ		Signal source
	AI	Analogy current F command	With input current at DC4~20mA, the input impedance is500kΩ (or DC0~+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.		Contact
	Tb1		*Ta1-Tc1 is ON in case of abnormality Contact	Contact Capacity: AC250V 1A DC30V 1A	Contact
	Tc1		*Tb1-Tc1 is OFF in case of abnormality Contact		Contact
	Ta2	In Operation	1a and 1b contacts function to output when the F to activate the output of ac drive is above the value as preset.		Contact
	Tb2		*Ta2-Tc2 is ON during operation Contact	Contact Capacity: AC250V 1A DC30V 1A	Contact
	Tc2		*Tb2-Tc2 is OFF during operation Contact		Contact
	FM1	Analog output, FM	Multi-function analog monitor 1, DC0~10V/100% FM meter head		Signal
FM2	Analog output, amperage monitor	Multi-function analog monitor 2, DC+~+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



CAUTION

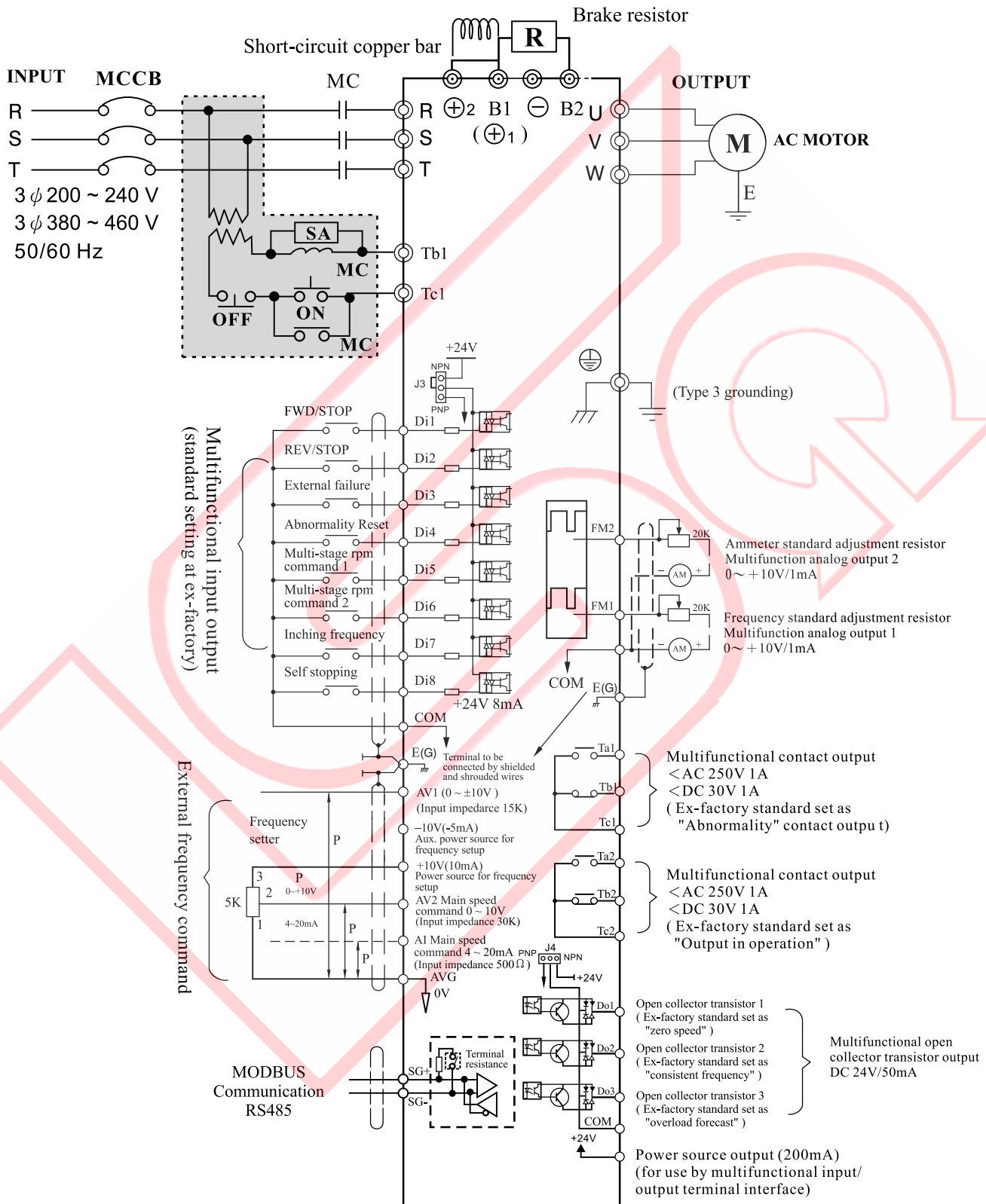


INHIBIT

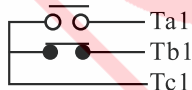
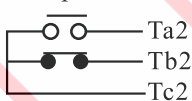
Whereas the control block is characterized by empty contact, no signal source carrying voltage should be inputted; otherwise, the AC drive will be damage.



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



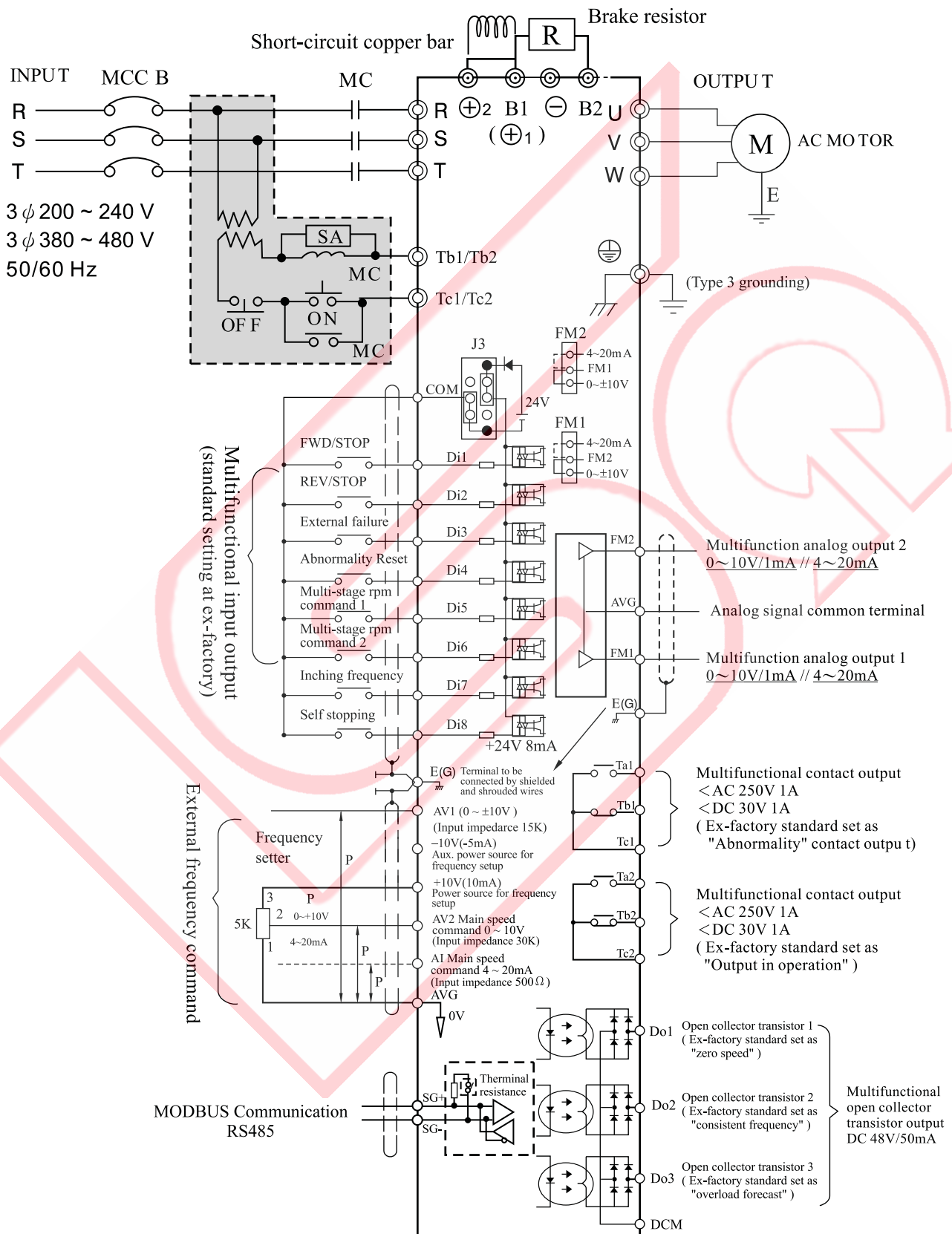
## Schedule of Control Terminal Function (NO.2.32)

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. (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 DC0~±10V (or DC0~+10V), the input impedance is 15kΩ		Signal source	
	AV2	Analog voltage F command	With input voltage at DC0~+10V, the input impedance is 30kΩ		Signal source	
	AI	Analogy current F command	With input current at DC4~20mA, the input impedance is500kΩ (or DC0~+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.		Contact	
	Tb1		*Ta1-Tc1 is ON in case of abnormality Contact		Contact Capacity: AC250V 1A DC30V 1A	Contact
	Tc1		*Tb1-Tc1 is OFF in case of abnormality Contact			Contact
	Ta2		In Operation	1a and 1b contacts function to output when the F to activate the output of ac drive is above the value as preset.		Contact
	Tb2		*Ta2-Tc2 is ON during operation Contact		Contact Capacity: AC250V 1A DC30V 1A	Contact
	Tc2		*Tb2-Tc2 is OFF during operation Contact			Contact
	FM1		Analog output, FM	Multi-function analog monitor 1, DC0~10V/100% FM meter head		Signal
	FM2	Analog output, amperage monitor	Multi-function analog monitor 2, DC+~+10V(or 4~20mA) /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.

# 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 P2-18.

## 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)**

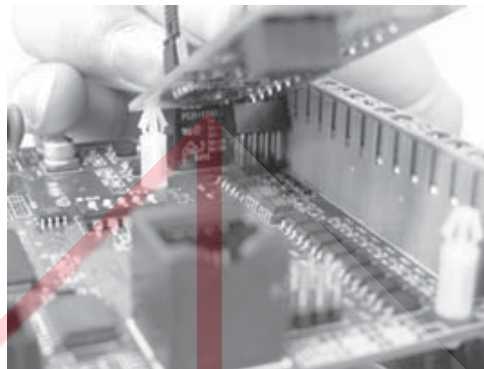
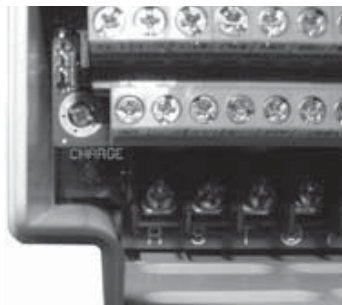
	Adaptive to internal power supply	Adaptive to external power supply
Sink Mode	<p>J3 (NPN setup)</p>	<p>J3 (EXT setup)</p>
Source Mode	<p>J3 (NPN setup)</p>	<p>J3 (EXT setup)</p>



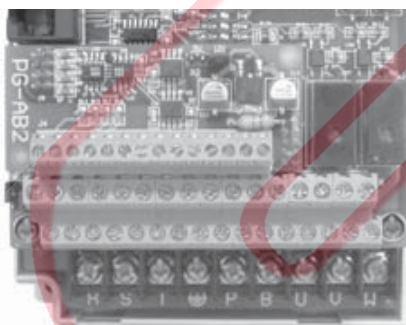
## II -Wiring-

### PG-AB2 Installing and Wiring

#### Installing Procedure:



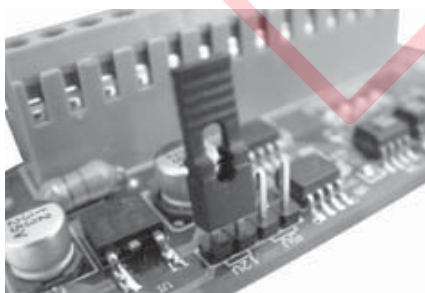
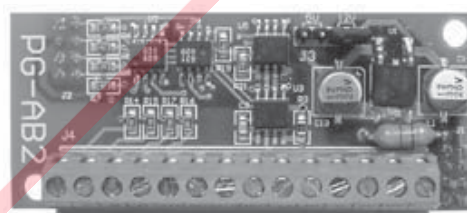
1. Before installing the option card, confirm the power indicator (CHARGE) inside the component of the ac drive is OFF, then remove the digital operator and the lid to facilitate installation.
2. Never exercise excessive force during installation. Firmly press in the direction as illustrated ( from top 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 P2-20~P2-24.



## 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 A 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.

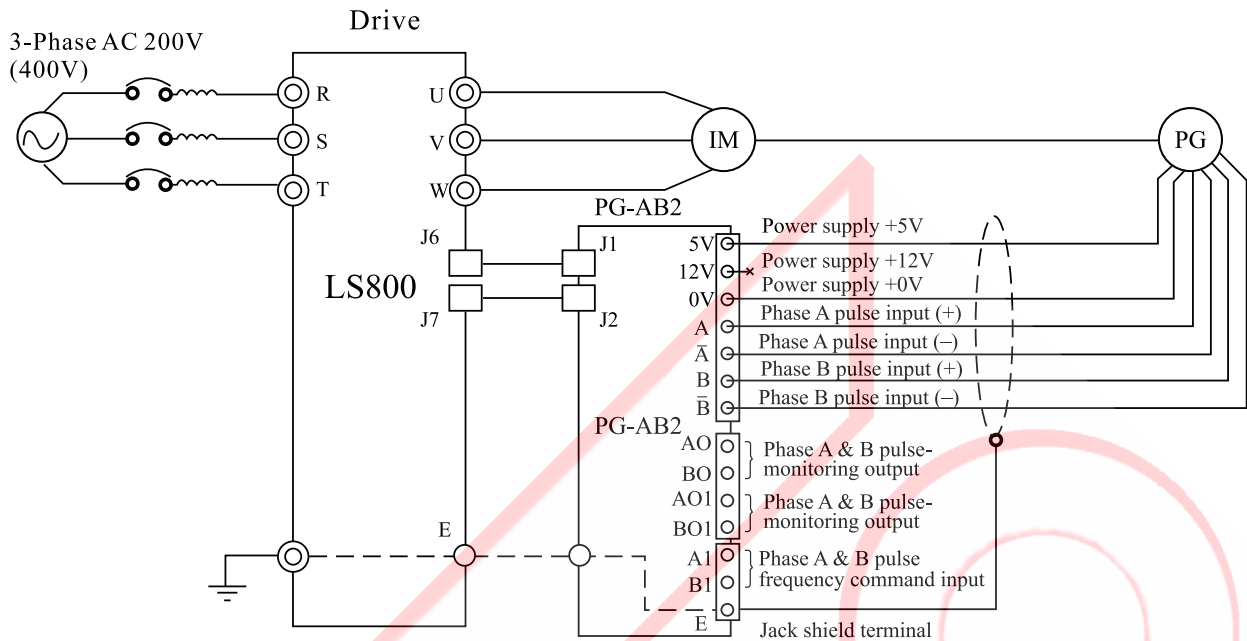


#### CAUTION

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.

## II -Wiring-

### PG-AB2 Wiring Diagram



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

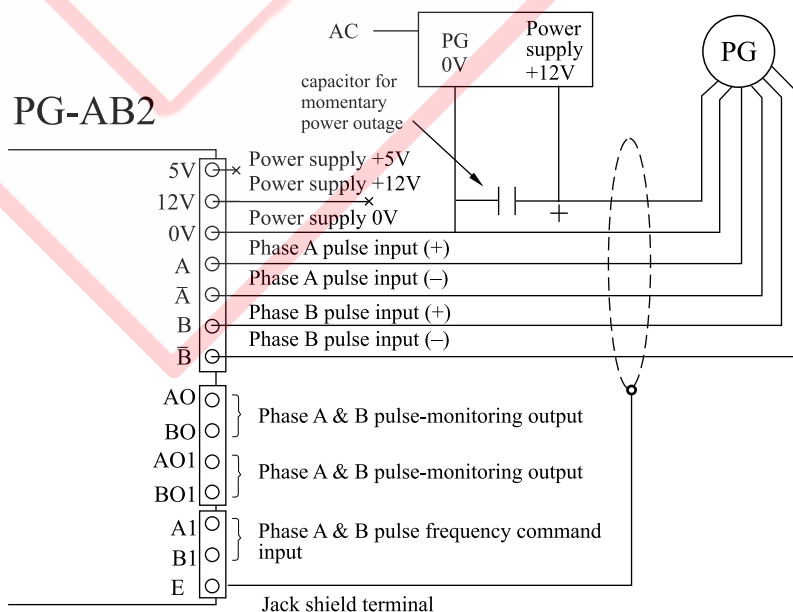
◎ The PG output pulse detected is 300kHz max.

◎ The PG output frequency (FPG) may be solved by the following formula:

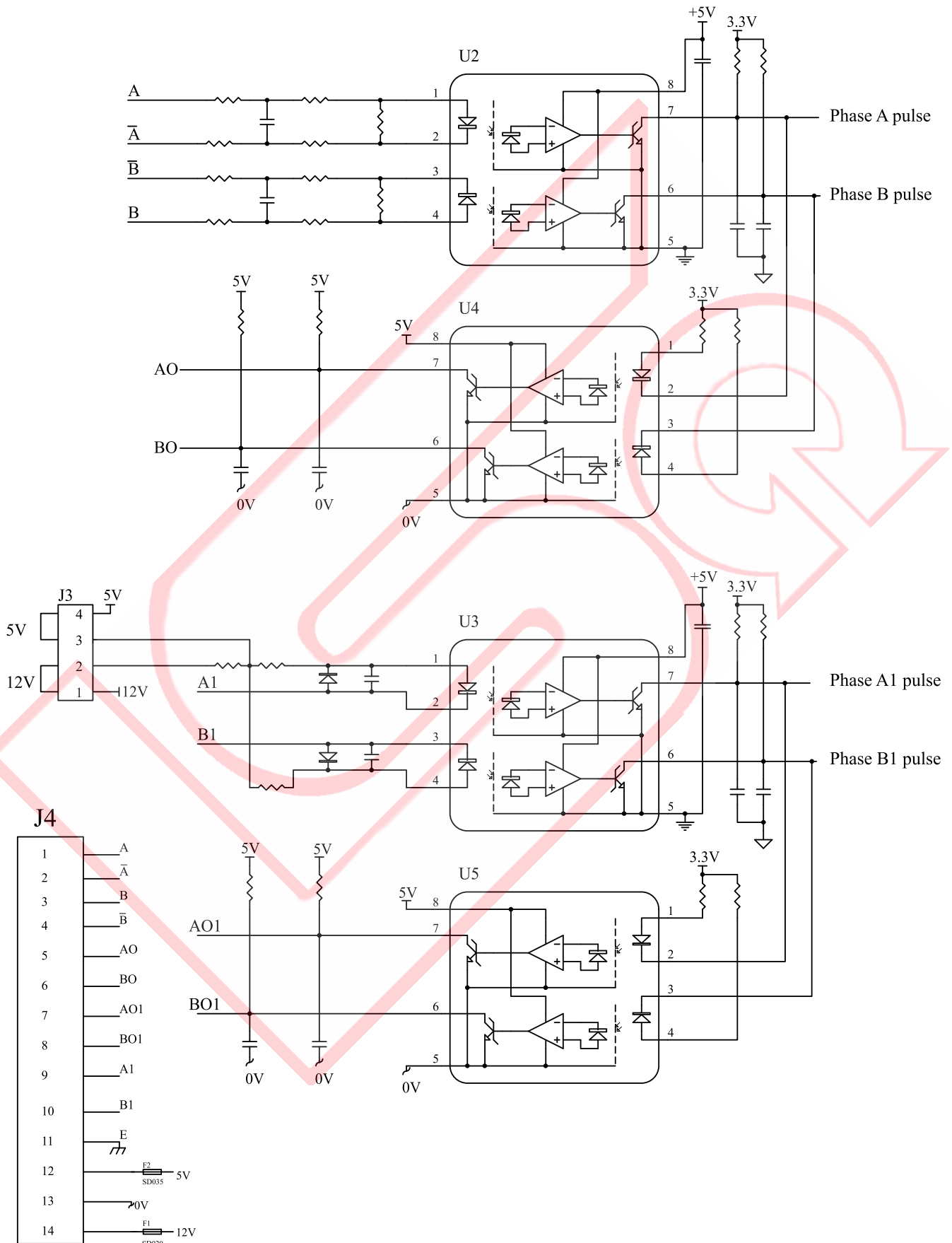
$$\text{FPG(Hz)} = \frac{\text{Motor revolving speed at the highest frequency output}}{60} \times \text{PG Constant(p/rev)}$$

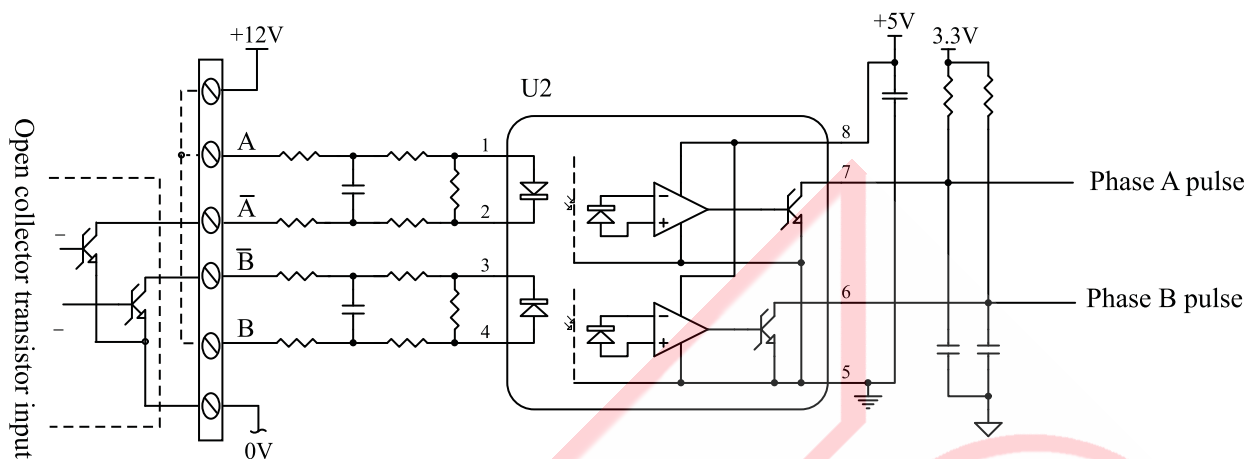
Make available other sources if the PG source capacity is 200mA or above.

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.



## PG-AB2 I/O Circuits Construction Chart



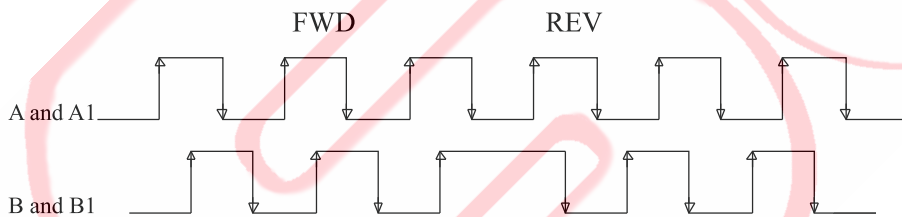


## PG-AB2 Input mode setup

## PG-AB2 input mode setup

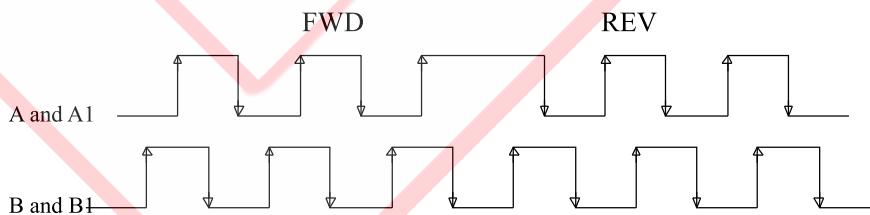
◆ **F150 Programmer (PG) input direction = 1:A leads B**

- 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



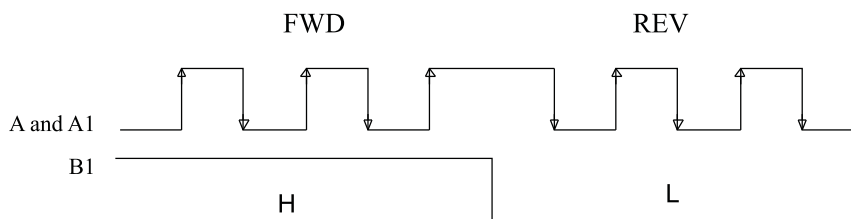
◆ **F150 Programmer (PG) input direction = -1:B leads A**

- 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 Programmer (PG) input direction = 0:one-way feedback/command**

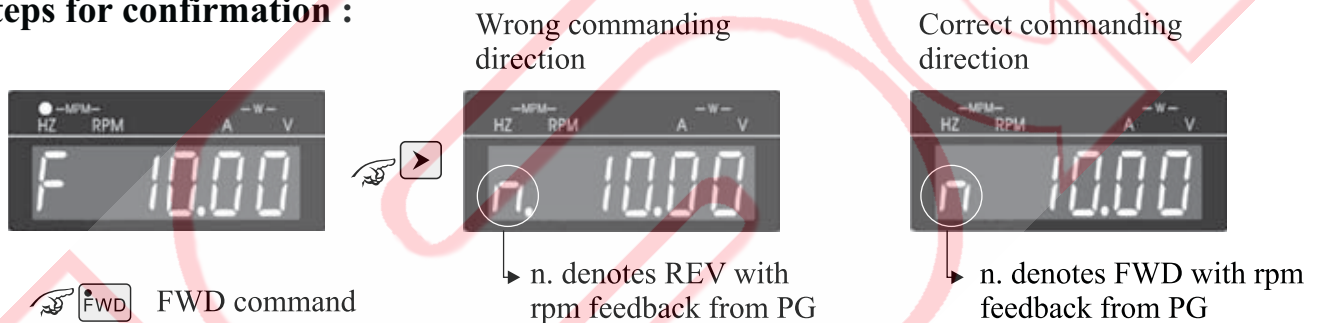
- Phase A is a pulse train
- A1 is a pulse train input by frequency speed command, phase B1 is for direction while symbol L is for REV and H for REV.



## # 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: Programmer (PG), F149- Number of pulse of Programmer (PG), F150- Direction of Programmer (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 direction, frequency of Programmer (PG) are identical to the direction of forward rotation command; if the direction of Programmer (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 phase sequence and polarity of power supply, A &  $\bar{A}$  and B &  $\bar{B}$  is correct.

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

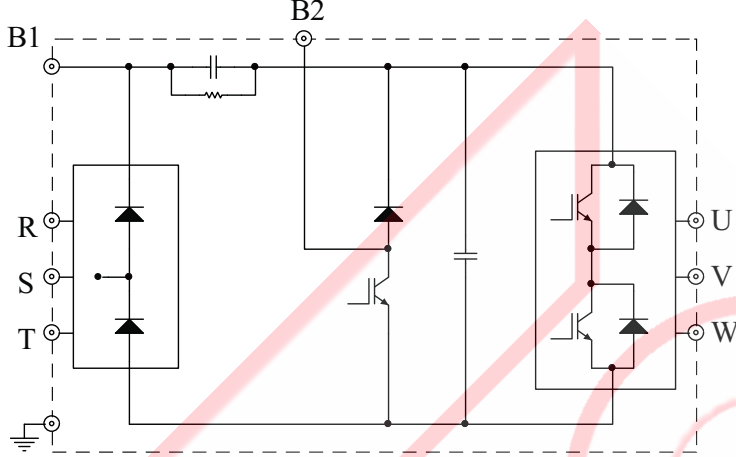
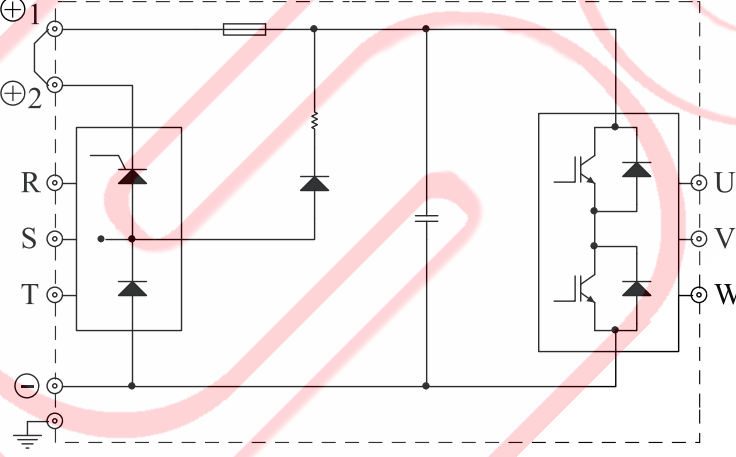
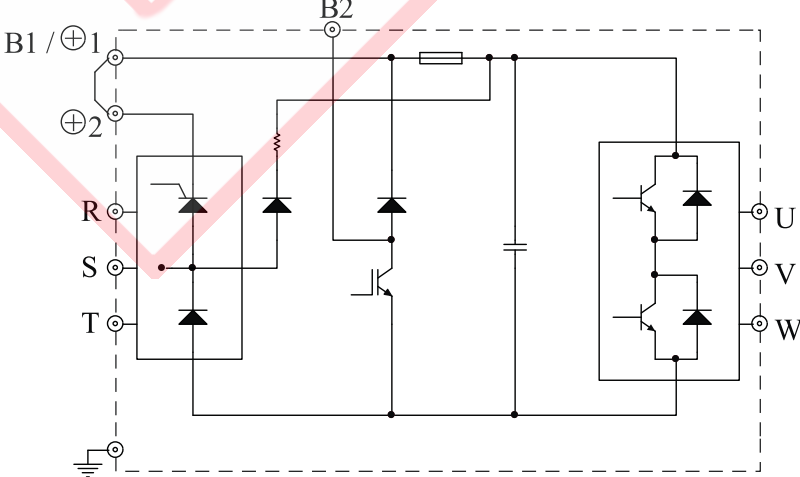
Solution: There will be a load and a slip frequency generated from the motor operation that leads to a little error between the frequency command and the rpm feedback from PG; the error range should be  $\pm 0.5\text{Hz}$  or so; if there is a big error range, please examine if the number of pulse set to F149 Programmer (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, please see P4-2 for the description of auto-tuning.

## II -Wiring-

### Main power source circuit diagram

200V Series Models : (LS800-20K4~LS800-2011)	400V Series Models : (LS800-40K7~LS800-4011)
	
Models : LS800-2015~LS800-2110 , LS800-4015~LS800-4450	
	
Models : LS800-2015~LS800-2055 , LS800-4015~LS800-4075 (With Brake circuit loop)	
	

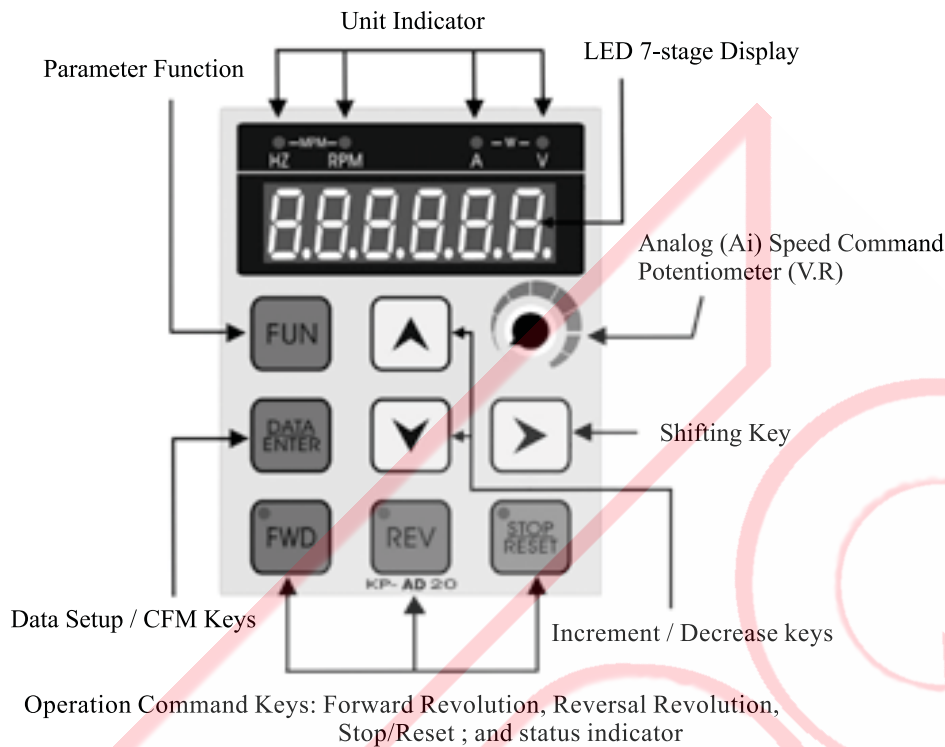


# **III Digital Operator Panel**

- ◆ **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 : Save Present Parameters – 1: Save to Digital Operator.











**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

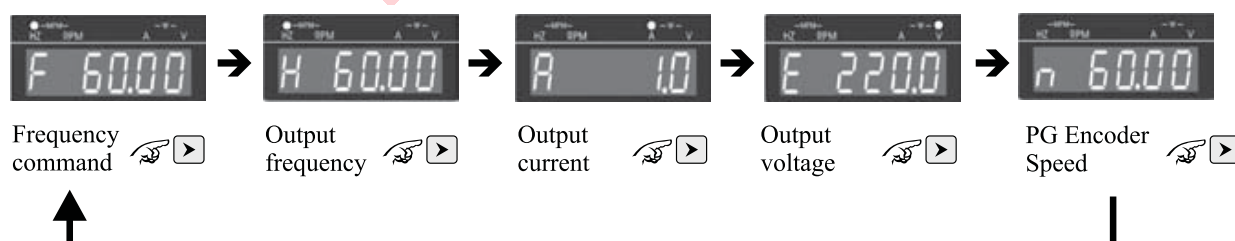
When the vector control mode is selected to duplicate any parameter of F147=5,6 for example, make sure that the electric machinery features must be consistent; otherwise, perform once the Auto-tuning of electric and mechanical parameters.

### Funcution description of keys :

Classification	Key	Brief Description of Function
Control/ Parameter 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> 
		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.

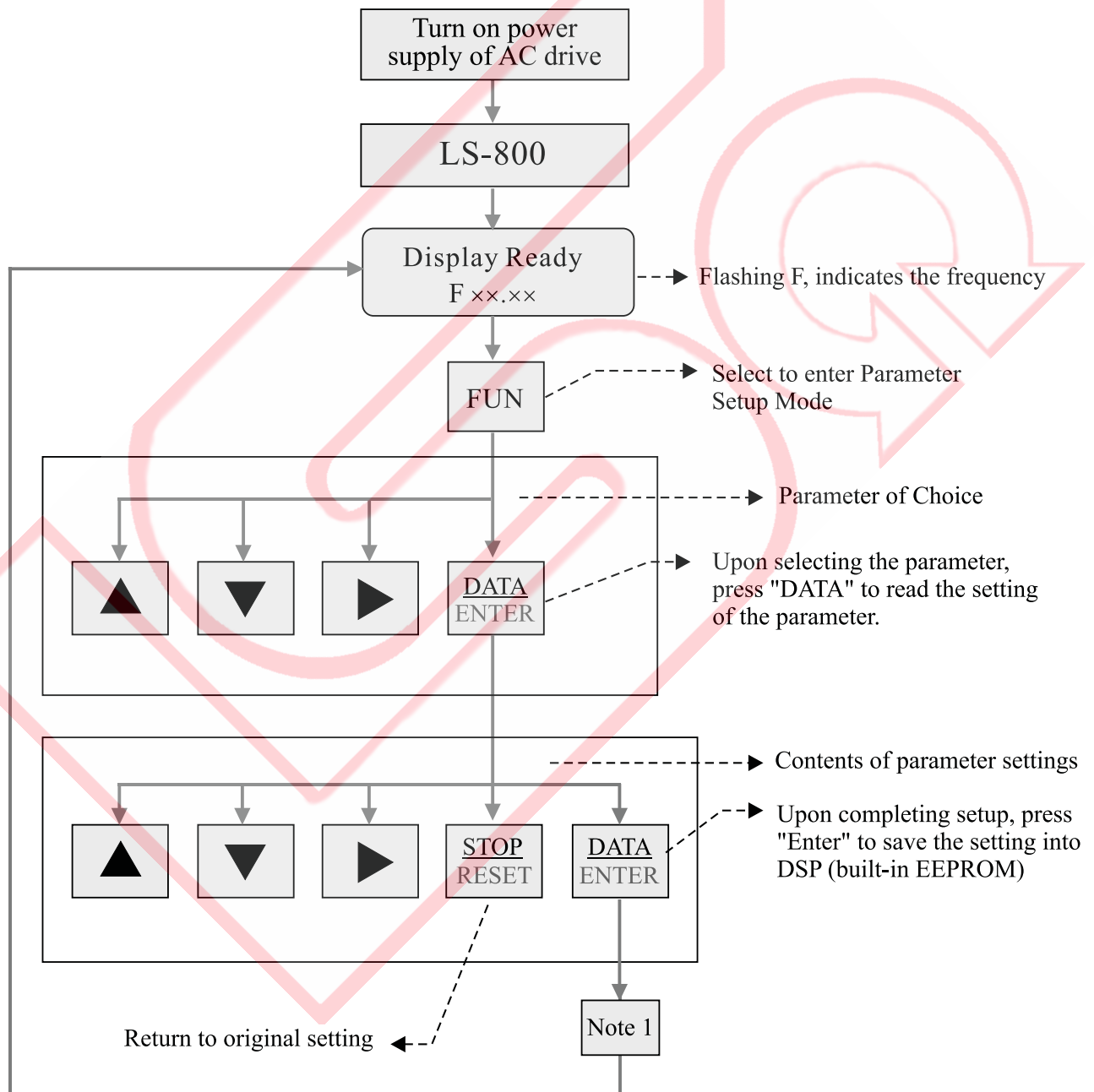


# III –Digital Operator–

## 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

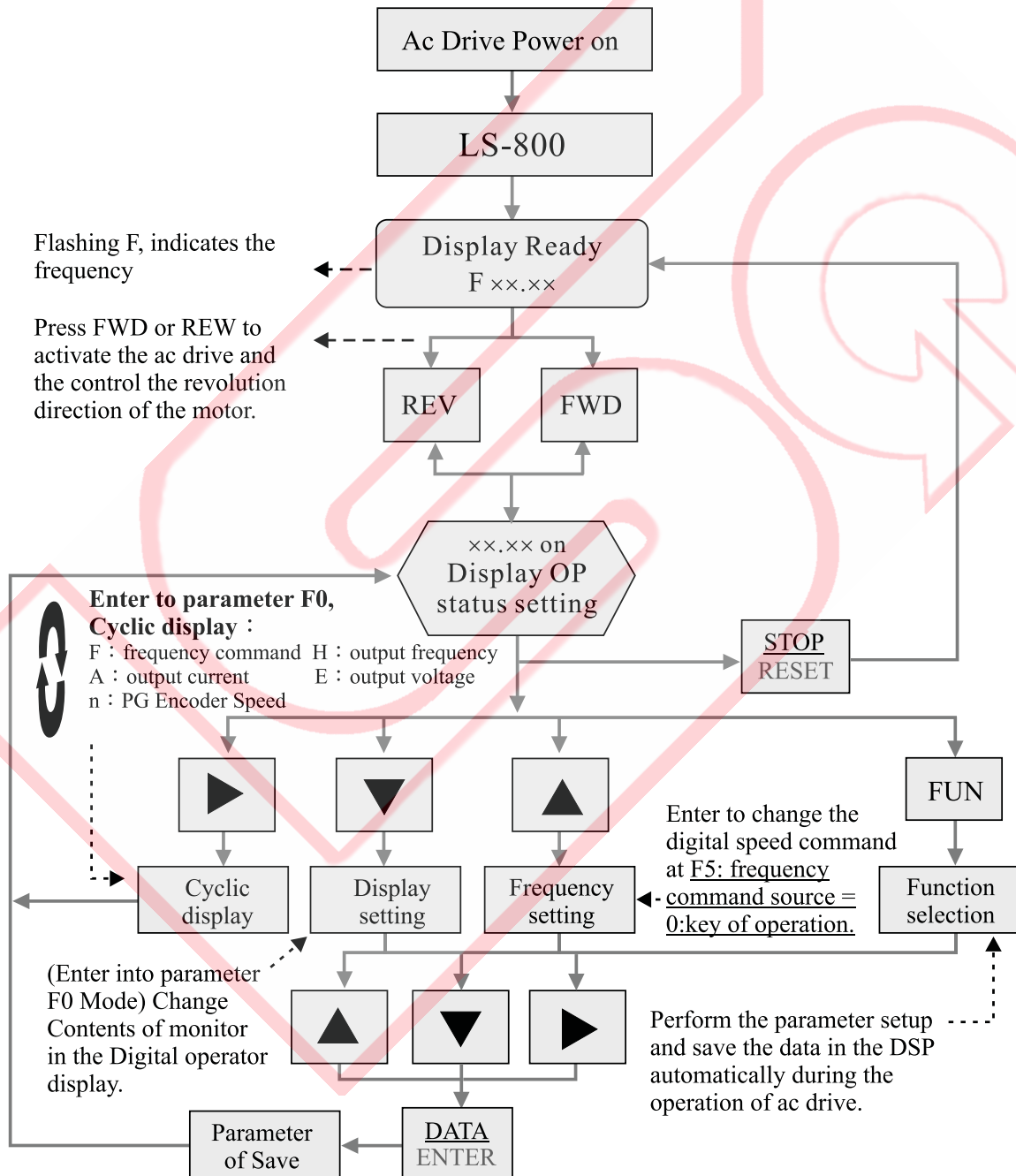


©Note 1 : Make sure to save each and all parameter setting that have been confirmed and complied with the purpose as demanded in the commissioning into the DSP(built-in EEPROM), if copying the parameters is desired, please save the parameters of ac drive into the Digital Operation Panel; or select parameter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



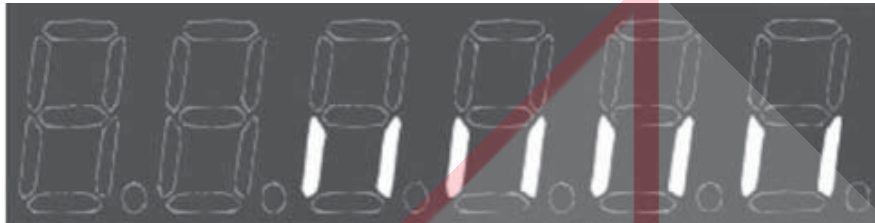
Note 1 : If the speed signal source dose not fall on F5 (frequency command source) = 0 : Digital Operation panel mode the Digital speed command input is ineffective.

### 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



← Display in  
OFF Status

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

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



← Display in  
ON Status

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



← Display in  
ON Status

Multi-function Terminal → RL1 RL2 Do3 Do2 Do1

Brake acting function

Multi-function Parameter → F75 F79 F78 F77 F76



← Display in  
OFF Status

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 Tuning Process Flow Chart.....4-4
- ◆ Basic Parameter Setup.....4-5
- ◆ Quick operation parameter setup block diagram.....4-6

## IV -Test Run-

### 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 AC200~240V 50/60Hz**

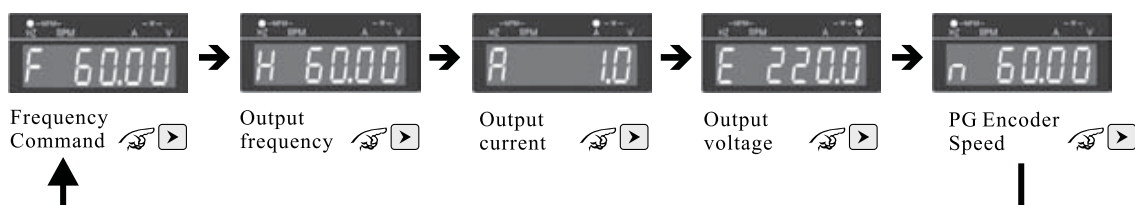
**400V class : 3-phase AC380~480V 50/60Hz**

#### # 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 Poles 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.**



CAUTION

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) -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) -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 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–

---

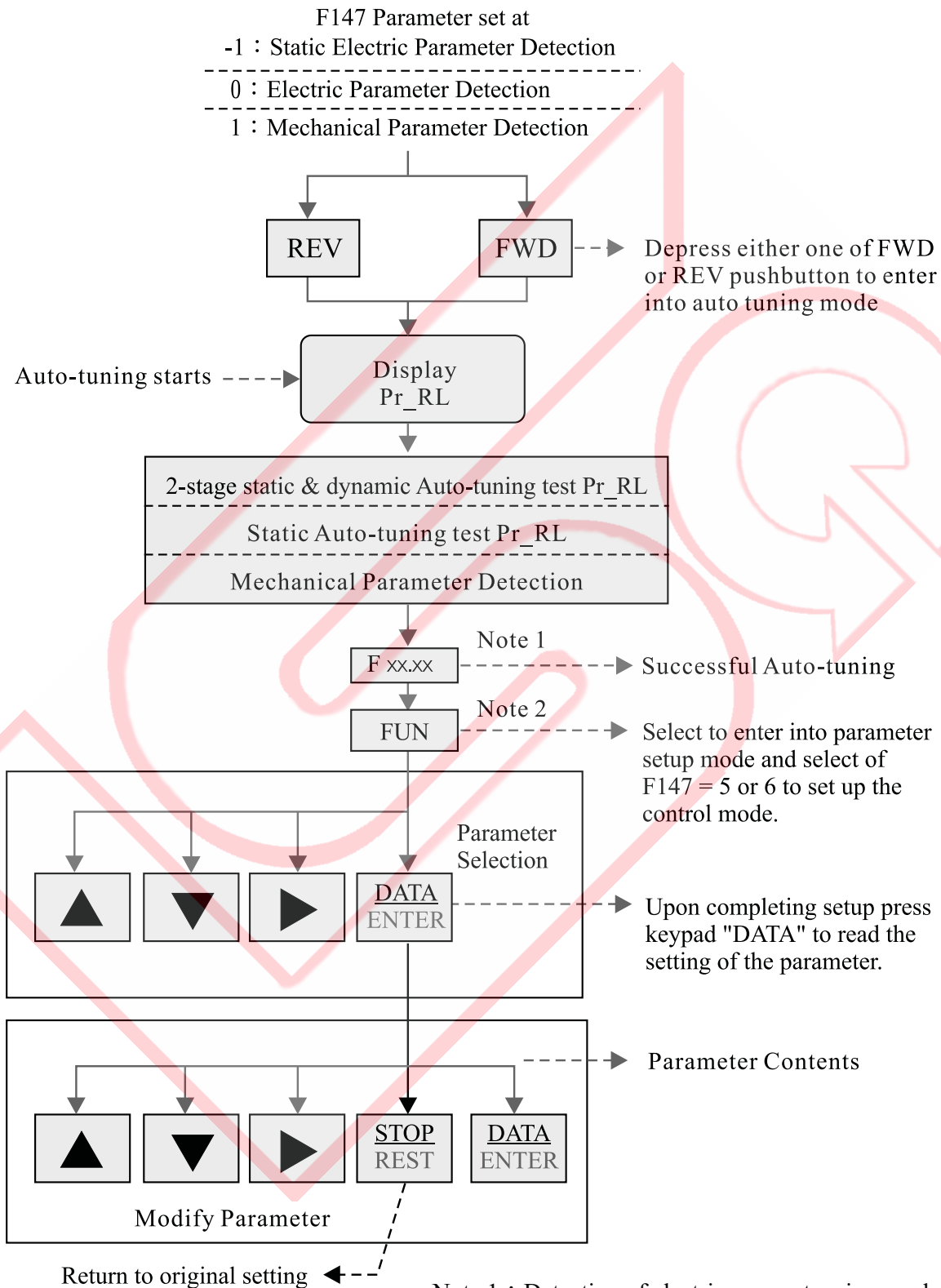
be performed, and the modulation setting will be saved into Parameter F161. (Refer to Prompt 2.)

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 Funing Process Flow Chart



Note 1 : Detection of electric parameters is completed.

Note 2 : Set up F147 back to the corresponding operation control mode.

# IV -Test Run-

## Basic Parameter Setup

Note1: N = Setup varies depending on the ac drive and motor capacity.

Parameter Code	Description	Setup Range	Unit	Ex-factory Setting	Page No.	
F4	Operation control source	0~1		0	P5-3	
0 : Digital Operation panel      1 : Digital input terminal						
F5	Frequency command source	0~8		1	P5-3	
0 : Digital Operation panel (F17)      3 : AV2 Input (+10V)      6 : Pulse Frequency Command 1 : Operation panel AV Input (V.R)      4 : AI Input (20mA or +10V)      7 : External PID 2 : AV1 Input (±10V)      5 : AV2+AI      8 : External PID or AV2						
F6	Activation Mode	0~2		0	P5-5	
0 : Started by activation frequency      1 : Flying Re-start activation      2 : DC brake before starting by activation frequency						
F7	Stop Mode	0~2		1	P5-6	
0 : Coast to Stop      1 : Dynamic stop      2 : DC brake						
F13	Rotation Direction Control	0~3		1	P5-7	
0 : Either FWD or REV      1 : FWD Only      2 : REV only      3 : REV only with negative baize						
F14	Lower limit frequency (※F14≤F15)	0.0~400.0	Hz	0.0	P5-8	
F15	Upper limit frequency(※F14≤F15)	0.0~400.0	Hz	60.0		
F35	Mast speed, stage4, stage8, stage12, acceleration time 0	0.0~30000	sec	10.0	P5-10	
F36	Mast speed, stage4, stage8, stage12, deceleration time 0	0.0~30000	sec	10.0		
F68	Di1、Di2 Setup	0~1		0	P5-18	
0 : Di1(FWD/STOP)・Di2(REV/STOP)      1 : Di1(RUN/STOP)・Di2(FWD/REV)						
F92	Stall protection setup	0~31		3	P5-23	
bit4 : Automatic Voltage Regulation (AVR)      bit 3 : Inhibit inertia at motor start      bit2 : Protection function F96 bit1 : Protection function F94      bit 0 : Protection function F93						
F93	Stalling Voltage Setup for Deceleration	1.00~1.25		1.20	P5-27	
F94	Stalling Current Setup for Acceleration	0.50~2.50	Pu	1.50		
F95	Start Thermal relays the current setting of position	0.80~1.30	Pu	1.00		
F96	Current level for electronic thermal relay	1.00~2.50	Pu	1.50		
F97	Acting time for electronic thermal relay	0.1~120.0	sec	60.0		
F98	V/F output current limit	0.20~1.45		1.30	P5-28	
F99	Leaking current,3-phase current, and abnormal level setup	0.001~0.500	Pu	0.250		
F102	Brake discharging level	1.12~1.40		1.20	P5-29	
F128	PWM switch frequency	1000~16000	Hz	5000	P5-34	
F129	RST Input Voltage(rms)	150~500	V	N (Note 1)		
(※F129 setting must satisfy : F129 ≤ 1.5 × F141)						
F141	Motor Nameplate Information	Rated voltage (rms)	150~500	V	N (Note 1)	P5-37
F142		Rated current(rms)	1.0~1000.0	A	N (Note 1)	
F143		Rated frequency	10.0~150.0	Hz	N (Note 1)	
F144		Rated speed	0~9000	rpm	N (Note 1)	
F145		HP	0.5~600.0	Hp	N (Note 1)	P5-38
F146		No. of Pole	2~32	Pole	N (Note 1)	
F147	Control mode setup	-1~6		2		
-1 : Static Electric Parameter Detection      3 : Closed Loop Scalar Control (V/F + Feedback) 0 : Electric Parameter Detection      4 : Sensorless Scalar Control (V/F Sensorless Vector Control) 1 : Mechanical Parameter Detection      5 : Close Loop Vector Control (Flux Vector+Feedback) 2 : Open Loop Scalar Control (V/F)      6 : Sensorless Vector Control (Sensorless Flux/Vector Contor)						
F148	Speed feedback	0~1	1	0	P5-40	
0 : No feedback      1 : Encoder (PG)						
F149	Encoder (PG)Pulse	600~2500	P/rev	1024	P5-40	
F150	Encoder (PG) Direction	-1~1		1		
-1 : B leads A      0 : single phase feed back      1 : A leads B						



## Quick operation parameters setup block diagram

### # Fast operation control mode

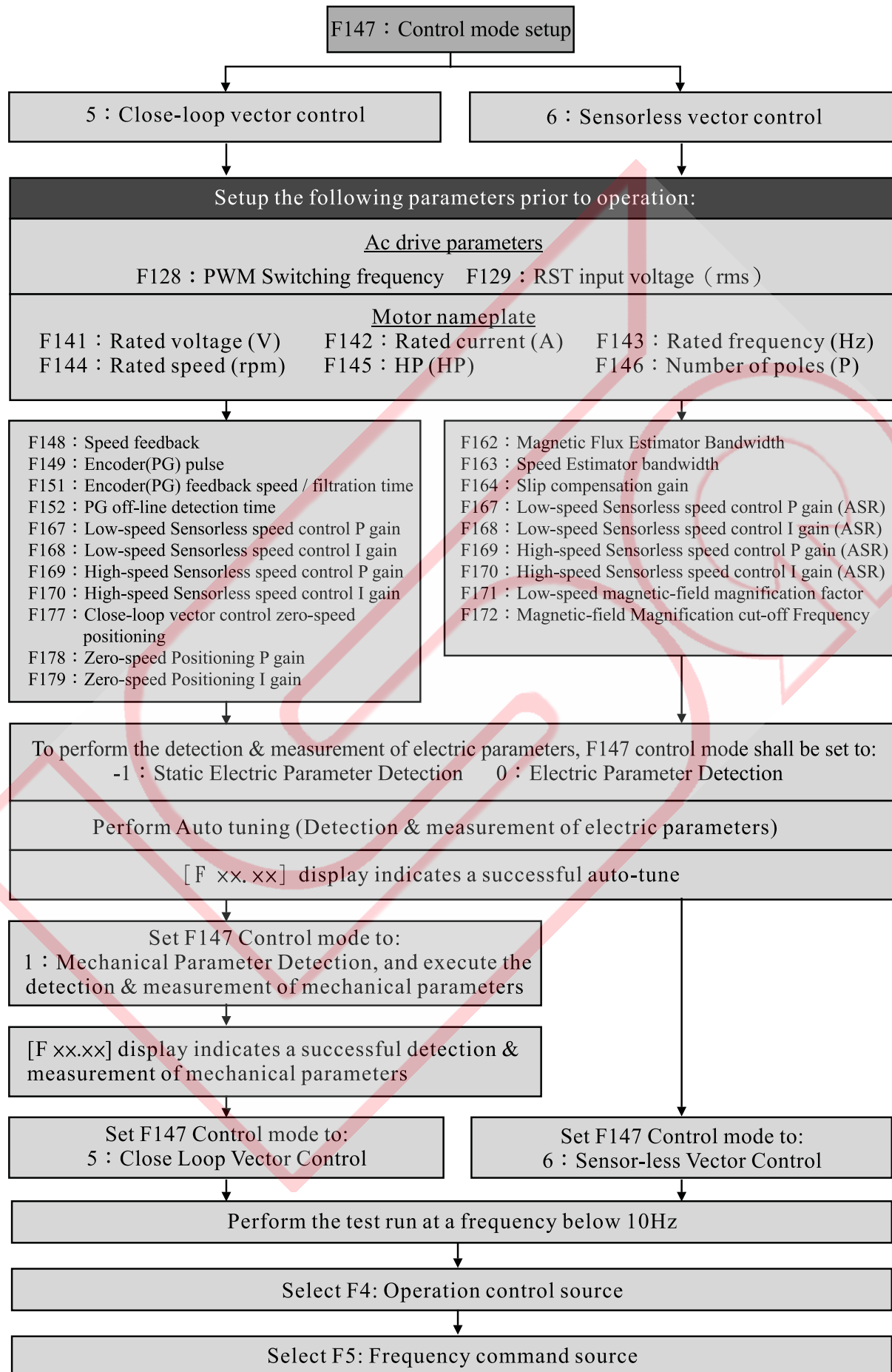
- ◎ There are several operation control methods applicable to the ac drive for thereof startup operator. You can use the following operation methods to simply and quickly start the ac drive.
- ◎ There are two primary operation control parameters to start the operation of ac drive:  
The first one is F4: Operation Control Source and the other one is F5: Frequency command source. Please see the table below for description of operation.

Parameter functions	Description of operating procedures	Ex-factory setting	Page No.
<b>F4 : Operation control source</b>			
0 : Digital operation panel	Press <b>FWD</b> key after the display of F xx.xx ↓ Enter into the FWD operation mode  ※Please pay attention to the forward & backward rotating direction of motor when performing the test run.※	0	P5-3
1 : Digital input terminal	Terminal Di1 /ON → FWD ( Indicator ON) operation →OFF/Stop.		P5-3 P5-19
<b>F5 : Frequency command source</b>			
0 : Digital operation panel	Frequency changing mode is accessible by pressing the <b>▲</b> key during the operating state.		P5-3
1 : Operation panel AV input (V.R)	To perform the rpm control from the Variable Resistor (V.R) from the operation panel.		
2 : AV1 input (±10V)	To perform the rpm control by inputting 0~+10V to analogy AV1 terminal.		
3 : AV2 input (+10V)	To perform the rpm control by inputting 0~+10V to analogy AV2 terminal.		
4 : AI input (20mA)	To perform the rpm control by inputting 4~20mA to analogy AI terminal.		
5 : AV2+AI	With analogy AV2 and AI terminals, addition and subtraction operation can be provided for both analogy signals at the same time to perform rpm control.		
6 : Pulse Frequency Command	Additional mounting of PG-AB2 is required that relays the pulse signals to A1, B1 terminals for rpm control.		
7 : External PID	To execute the external analog signals for PID feedback control.		
8 : External PID or AV2	General control mode is to take the analog signal AV2 as the speed command source, and PID control mode will be automatically enabled when feedback value of PID analog signal reaches above the pressure command value.		
		1	P5-4          P5-5

### # Five control modes for selection

- ◆ LS800 provides five control modes – 2: Open-loop scalar control (V/F), 3: Close-loop scalar control (V/F + PG), 4: Sensor-less scalar control (V/F sensor-less vector control), 5: Close-loop vector control (Flux vector + PG), 6: Sensor-less vector control (Sensor-less flux vector control). The user can base on his own application requirements and use the digital operation panel to select the control mode.
- ◆ The AC drive has been set to V/F control mode at ex-factory; please set up the control modes and relevant parameters according to the following flow processes.

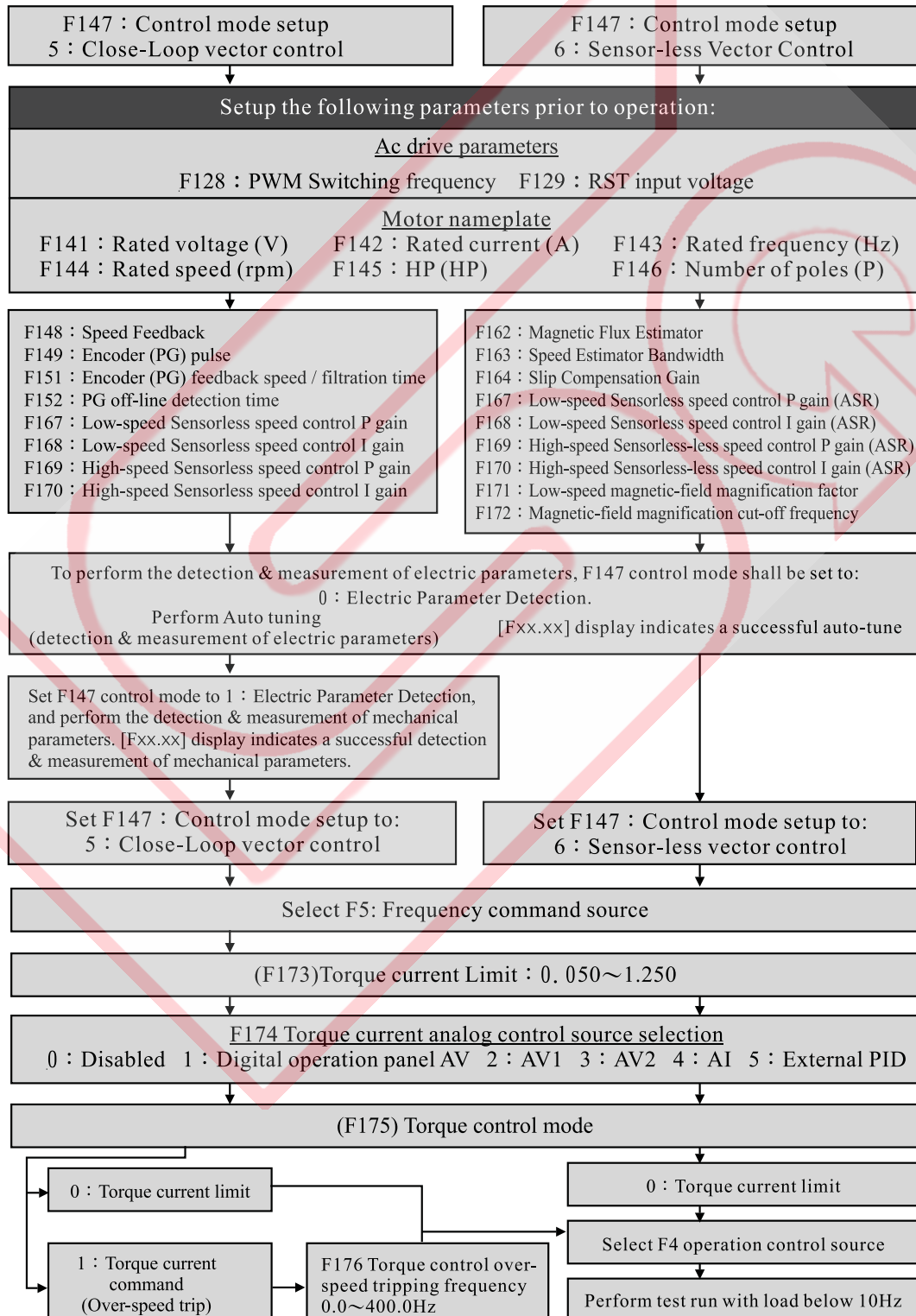




## IV -Test Run-

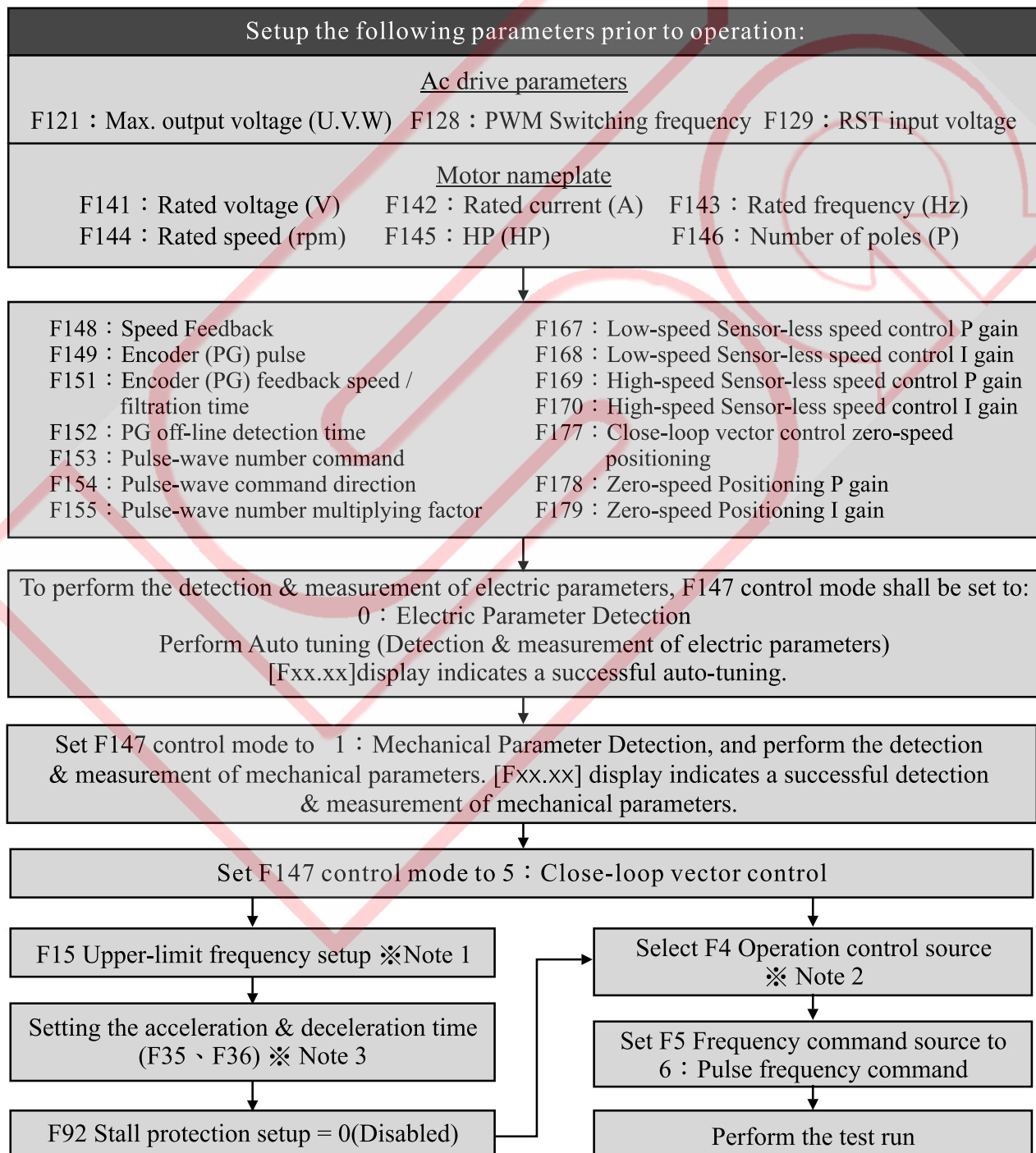
### # Torque current limit, torque current command

- ◆ Torque current limit is provided only for setting the operation of two control modes:  
F147=5: Close-loop vector control (flux vector + PG), 6: Sensor-less vector control (sensor-less flux vector control); torque control function for other control modes is not available.
- ◆ Max. torque current = Rated current of AC drive x (F173) torque current command level x 2.
- ◆ Torque current( rms) = (Rated current of AC drive × (F173) torque current command level × 2) / 1.414



## # Position tracking of pulse-wave command

- ◆ Additional mounting of PG feedback card (optional) is needed for performing the position tracking of pulse-wave command; please refer to P2-19 in this regard; and the pulse-wave frequency command shall be input from A1, B1.
- ◆ Note 1: The set value to F15 for the upper limit of frequency shall be higher than the upper limit of pulse-wave frequency command to be controlled by more than 15%.
- ◆ Note 2: When set F4 operation control source= 1: Digital input (Di1, Di2) terminal, it shall be enabled prior to the signal from the pulse-wave frequency command so as to protect the pulse-wave number command from loss.
- ◆ Note 3: The speed rate of acceleration/deceleration can be the speed rate of pulse-wave frequency command or the speed rate set to F35, F36.







# V Description of Parameter Functions

- ◆ Operator Display Setting...5-1
- ◆ Operation Control Parameters.....5-3
- ◆ Speed limit.....5-7
- ◆ Multi-stage speed Command Setup.....5-9
- ◆ Acceleration/Deceleration time.....5-10
- ◆ Analog Input.....5-12
- ◆ Digital(Di) Input.....5-18
- ◆ Input (Do)Output.....5-22
- ◆ Jumping Frequency.....5-25
- ◆ Motor Protection Setup....5-25
- ◆ Automatic Operation Function.....5-29
- ◆ Magnetic Flux Setup.....5-31
- ◆ FM1 AO waveform output.... (No.2.31 Special-Purpose).....5-34
- ◆ FM2 AO waveform output.... (No.2.31 Special-Purpose).....5-34
- ◆ AC Drive Parameter (No.2.32 Special Purpose).....5-36
- ◆ FM1 AO analogy output (No.2.32 Special-Purpose).....5-36
- ◆ FM2 AO analogy output (No.2.32 Special-Purpose).....5-37
- ◆ Motor nameplate.....5-37
- ◆ Control Mode.....5-38
- ◆ Encoder Setup.....5-40
- ◆ Motor Electric Parameters.....5-43
- ◆ Flux Estimation Tester.....5-44
- ◆ Speed PI Controller (ASR)5-45
- ◆ Zero-speed positioning.....5-48
- ◆ Abnormality Records.....5-49
- ◆ External PID.....5-51
- ◆ Special parameter setup....5-55
- ◆ Communication Setup.....5-56
- ◆ MODBUS Communication.....5-58
- ◆ Recalling Parameters.....5-65

## Operator Display Setting

R	Parameter	Description	Range	Unit	Ex-factory Setting
○	F0	Operator display selections	0~40		1

※ Seven digits display and LED indicators on the operator panel may be applied to monitor a total of 37 operation status or settings of the AC drive.

Setting	Function	Description of Function	Related Parameter
0	frequency Command (F)	Display the command setting	F5
1	Output frequency (H)	Display the output motor speed value.	-
2	Output Current (A)	Display the drive motor load current from output of AC drive (U.V.W)	-
3	Output Voltage (E)	Display the output (U.V.W) voltage (rms) of the ac drive.	
4	PG Feedback Speed rpm (n)	Display the actual speed of the motor feedback to Encoder.	F148、F149
5	Pulse Frequency Command	Displayed pulse frequency command × F155 multiplying power.	F153、F155
6	Vector Estimated RPM	Display the calculated sensorless vector control output speed.	F147=6
7	Output Power Supply Frequency	Display the compensated output frequency of the closed loop scalar or vector control	F147=3,4,5,6
8	Unitless	Display the linear speed, feeding speed of the process (with maximum display value at 3276.7).	F3
9	Slipping Frequency	Display the slip Frequency due to load when the motor is on load.	F147=3,4,5,6
10	Vdc(V)	Display DC voltage on the DC bus capacitor	—
11	Excitation Voltage	Display the excitation voltage in vector control mode.	
12	Torque Voltage	Display the torque voltage in vector control mode	
13	Excitation Current Command	Display the command value of excitation current in vector control mode	
14	Torque Current Command	Display the command value of torque current in vector control mode	
15	Excitation Current	Display the actual excitation current	
16	Torque Current	Display the actual torque current	
17	Output Power	Display the total output apparent power $P=IV$	
18	True Power (rms)	Display the total true power $P=VI \cos\psi$	
19	Virtual Power %	Display the total reactive power $P=VI \sin\psi$	

### Description of power display:

#### Example: Motor with the following specifications:

Number of Poles	HP	Voltage (rms)	Current (rms)	Frequency	Speed (rpm)
4	5 Hp	220/380(V)	14/8.1(A)	60Hz	1700

Input the rated apparent power :  $S_N = \sqrt{3} \times 220 \times 14 = \sqrt{3} \times 380 \times 8.1 = 5334.7$

Rated output shaft power :  $P_{out,N} = 5 \times 746 = 3730W = T_N \times \omega_N$

Rated speed :  $\omega_N = 1700 \times (2 \cdot \pi / 60) = 178.023 (rad / s)$

Rated torque:  $T_N = P_{out} / \omega_N = 20.95 (N - m)$

R : Parameter is changeable  
during operation (○)

## –Description of parameter functions– V

Input true power = (Stator wire loss + core loss + rotor wire loss + bearing rotation loss) + rotating shaft's output mechanical power  $P_{in} = \sqrt{3} \times V_{LL} \times I_{\phi} \times \cos \theta_{VI} = P_{out} + P_{loss}$

Input virtual power  $Q_{in} = \sqrt{3} \times V_{LL} \times I_{\phi} \times \sin \theta_{VI}$

Input apparent power  $S_{in} = \sqrt{3} \times V_{LL} \times I_{\phi} = \sqrt{P_{in}^2 + Q_{in}^2}$

Where,  $V_{LL}$  is the rms of line voltage;  $I_{\phi}$  is the rms of phase-current or line-current;  $\theta_{VI}$  is the power factor angle. If the motor at present has  $V_{LL} = 120 \text{ volt}$  ,  $I_{\phi} = 10 \text{ A}$  ,  $\theta_{VI} = 60^\circ$  , then

$$P_{in} = \sqrt{3} \times 120 \times 10 \times \cos 60^\circ = 1039.2$$

$$Q_{in} = \sqrt{3} \times 120 \times 10 \times \sin 60^\circ = 1800$$

$$S_{in} = \sqrt{3} \times 120 \times 10 = \sqrt{1039.2^2 + 1800^2} = 2078.5$$

And the display of ac drive is to take  $S_N$  as 100.00%; therefore, the indicating values shall be as follows respectively:

$$P_{in}(\%) = \frac{1039.2}{5334.7} \times 100.00 = 19.48\%$$

$$Q_{in}(\%) = \frac{1800}{5334.7} \times 100.00 = 33.74\%$$

$$S_{in}(\%) = \frac{2078.5}{5334.7} \times 100.00 = 38.96\%$$

Setting	Function	Description of Function	Related Parameter
20	Temperature (°C)	Display the temperature of internal heat sink.	F100、101
21	Count value	Built in a simple counter unit to display the count number.	F84、F85
22	Digital input status	Able to monitor and access a real-time ON/OFF status display from digital input terminals and digital output terminals (Please see P3-5 for status monitoring).	F68~F74
23	Digital output status		F75~F79
24	Digital operation panel AV(%)	<ul style="list-style-type: none"> <li>• Able to display the percentage of analog input voltage %.</li> <li>• Able to monitor the noise voltage generated from the wiring and use this voltage to set up the bias voltage to avoid unnecessary noise interference.</li> </ul>	F5=1
25	AV1(V)		F5=2
26	AV2(V)		F5=3
27	AI(mA)		F5=4
28	Vdc_0	The initial DC voltage of DC bus on capacitor when POWER is ON.	-
29	Cycles & Multiple Stages	Able to display the stroke by number of cycle and number of speed stage established by the auto-operation mode. <ul style="list-style-type: none"> <li>• No. of cycle and speed stage is displayed in decimal system (0~9).</li> <li>• Display will be : (No. of cycle) × × × . × × (No. of speed stage)</li> </ul>	F103~F120
30	K_Vdc		
31	Phase U current (rms)	Display the drive motor load amperage of Phase U output of the AC drive.	
32	Phase V current (rms)	Display the drive motor load amperage of Phase V output of the AC drive.	
33	Phase W current (rms)	Display the drive motor load amperage of Phase W output of the AC drive.	
34	PID (%)	Display the PID control output in %.	F186
35	Reserved	Reserved	
36	Software version	To display the version number of software.	
37	Position-tracking error	Display the position and track the error value.	F177 = 2

## V -Description of parameter functions-

R : Parameter is changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory Setting
○	F1	LPF filtration time display	0~15		6

- ◎ Able to filter out the fluctuation of low-bit display value in order to read the numerical value of indicated status.
- ◎ Do not set up a long time constant, otherwise it will affect the response speed against the display of numerical value.

○	F2	Speed display unit	0~1		0
---	----	--------------------	-----	--	---

- ◎ Frequency (Hz) or speed (rpm) can be displayed for the output operation speed of the ac drive to be set by this parameter while displaying any function selected for the status displayed by F0 operation panel

■ **0 : Frequency(Hz)**

■ **1 : Revolution per minute(rpm)**

○	F3	Unitless display of fold of multiplication	0.001~10.000		1.000
---	----	--	--------------	--	-------

- ◎ This function may be applied to set up a multiplying power to display linear speed, feeding speed or the output of the final mechanical real rpm after reduction ratio.
- ◎ Unit-less display value = output rpm × F3 multiplying power.  
(Max multiplying display value = 3276.7).

### Operation control Parameter

×	F4	Operation Control Source	0~1		0
---	----	--------------------------	-----	--	---

**Before operating the AC drive, operation control command must first be given. User may select the operation control input as Digital Operation Panel or Digital Input Terminal.**

■ **0 : Digital operation panel** — AC driver to start, forward direction, reverse direction and stop operation of the ac drive are all controlled by the Digital operation panel.

■ **1 : Digital Input Terminal** — AC driver to start, forward direction reverse direction, and stop operation of the ac drive are all controlled by the digital input terminals.

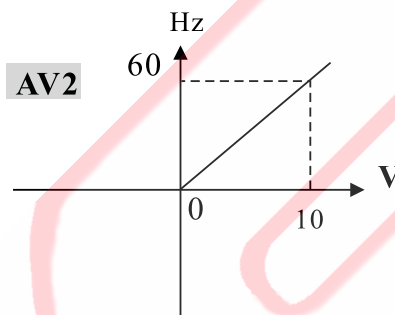
○	F5	Frequency Command Source	0~8		1
---	----	--------------------------	-----	--	---

- ※ This parameter relates to the Frequency command of the ac drive. The following nine options of Frequency commands are available for selection, depending on required configuration of the control system.
- ※ Once the inching command function setup becomes effective, it has the highest control priority is over the other nine speed commands and permits adaptation of any other type of speed command for alternative control.
- **0 : Digital operation panel (F17)** — Control is set up by keypad [Increase] and [Decrease] from the Digital Operation panel, or by functions 12: Master Speed Increase, and 13: Master Speed Decrease Control of the multi-function programmable digital input terminals.

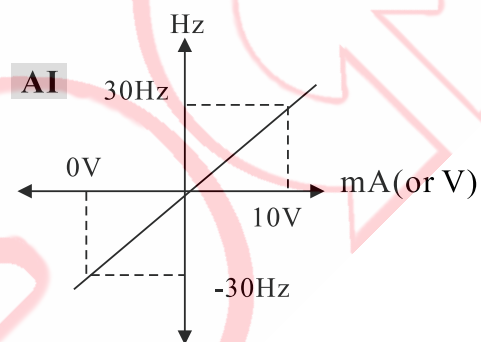
- **1 : Operation panel AV Input (V.R)** — Control by potentiometer (V.R) signals DC0~5V from the operation panel.
- **2 : AV1 Input ( $\pm 10V$ )** — Control by analog voltage signal DC0~ $\pm 10V$  from analog input terminal AV1.
- **3 : AV2 Input (+10V)** — Control by analog voltage signal DC0~+10V from analog input terminal AV2.
- **4 : AI Input (20mA)** — Control by analog current signal DC4~20mA (or DC0~+10V to be selected from SW1~5) from analog input terminal AI.
- **5 : AV2+AI** — Control by addition of two input values of the analog voltage and analog current (or voltage) signals from both analog input terminals AV2 and AI; or addition and subtraction control being done by an ideal negative bias set up by the parameter while performing synchronous linking analog compensation control for multiple units.

※ For example: (1) Parameter F15 = 60Hz(Upper Limit Frequency), AV2 of F58 = 10V(Gain Ratio 100%), F57 = 0V(bias Ratio 0%). (see Fig.1 for the curve of Hz vs.V).

※ For example: (2) AI of F63 = 10V(Gain Ratio 50%), F62 = 0V(bias Ratio -50%), (See Fig. 2 for the curve of Hz vs. mA (or V)).

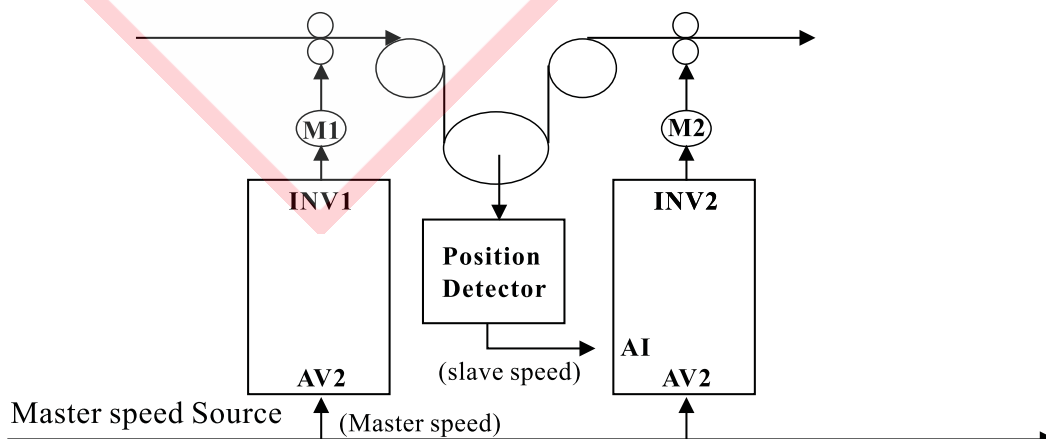


Performing Calculation of Addition and Subtraction (Note 1)



**Note 1:** Figs. 1 and 2 are schematic view showing the executed addition and subtraction calculation signals.

※ For example 3: AV2 of INV2 is the master speed input to exercise addition/subtraction operation on AI signals with AI as compensating input. The sum of both values is not be greater than the upper limit of F15 frequency and if the difference between both is less than 0Hz, the ac drive stops. Refer to the setup method illustrated in Figs. 1 and 2 for the setting of the parameter.





- **6 : Pulse frequency Command** — Relates to the control interface for the speed command of the pulse signal type. An additional encoder speed feedback card must be installed to provide follow-up operation control with the master ac drive (synchronous operation control by ratio).

※ **Note : The set value of F15: Upper Limit Frequency must be higher than the upper limit of needed pulse frequency command by more than 15%.**

(Refer to encoder setup parameter group F148~F155 for related application.)

- **7 : External PID** — To perform external analog signals for PID feedback control. [Select parameter setup PID set point value and PID feedback value for its input control terminals, and PID parameter group F186~F200]

- **8 : AV2 + External PID** — General control mode is to take the analog signal AV2 as the speed command source, and PID control mode will be automatically enabled when feedback value of PID analog signal reaches above the pressure command value. (Conditions of control mode are described below)

- (1) Unless otherwise the pressure mode at minimum pressure is enabled at PID command value < Parameter F201, and AV2 < 0.5 %, it is under general control mode.
- (2) Under the general control mode :
  - (A) If PID command value < Parameter F201, and AV2 ≥ 0.5 %, then it is in general control mode.
  - (B) When PID command value ≥ Parameter F201 :
    - (a) Under general control mode :
      - If PID feedback value < PID command value, then it stays at general control mode.
      - If PID feedback value ≥ PID command value, then it enters into PID control mode.
    - (b) Under PID control mode :
      - If PID command value ≥ Parameter F201, then it stays at PID control mode.
      - If PID command value < Parameter F201, then it ends the PID control mode.

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F6	Strat Mode	0~2		0

- **0 : Started by Activation Frequency** — The AC drive input frequency of the ac drive. (Refer to F16).

- **1 : Flying Re-start activation** — The motor frequency is first detected from the running motor by the AC drive, and the detected frequency point is entered for the speed operation (Catch the flying motor speed ). so as to reduce the severe impact from the regenerated current of the motor upon starting.

- **2 : DC brake before Starting by Activation Frequency** — The AC drive upon receiving the start command signal, will first perform the DC brake to make sure that the motor is stopped properly before start-up by activation frequency. Refer to F8 and F9 for the parameter setup of the DC brake before activation. °



**Caution :** To use the function of flying re-start, select 3: Closed Loop V/F vector Control in F147 control mode. To do this, a PG device for Phases A and B signals must be made available to precisely detect the running frequency and revolving direction, this operation is preferred for a load with greater inertia. When selected open loop V/F vector control and sensorless V/F vector control, the error of the estimated idling frequency is greater when the electric signals transmitted by the idling motor are used to estimate the idling frequency and direction; meanwhile, impacts from regenerated current inputted to operation is greater, thus is more preferred for the load with smaller inertia.



INHIBIT

Use of this function of flying re-start is not allowed for Closed Loop Flux Vector Control and Sensorless Flux Vector Control in F147 control mode.

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F7	Stop Mode	0~2		1

◎ To select the stop mode of the ac drive as required by the machine after the input of the proper stop signal.

■ **0 : Coast to Stop** — With the stop signal, the ac drive immediately turns off its drive signal for the power circuit between the ac drive and the motor to become OFF. Accordingly, the motor coasts to stop due to the system friction.

■ **1 : Dynamic Stop** — the motor reduces its speed and stops according to the rate of the deceleration time.

■ **2 : Dynamic DC Brake** — DC brake is enabled when the output frequency reduces according to the deceleration rate to stopping. This enables the motor to stop soonest. Refer to those related parameters of F10~F12.

×	F8	Brake Time before Activation	0.0~120.0	Sec	5.0
---	----	------------------------------	-----------	-----	-----

◎ With this parameter set to activate the ac drive upon the expiry of the duration of the enabled DC brake. If the time is set at its minimum value, i.e., "0", it is deemed as a cancellation of the function of brake before activation.

×	F9	Current of brake before activation	0.00~1.00	Pu	0.20
---	----	------------------------------------	-----------	----	------

◎ This parameter is to set up the magnifying factor of output dc brake current prior to the operation of ac drive. A minimum set value of brake current "0" will leave the output of brake energy ineffective, and will be regarded as a control to trigger a time-delay for operation. The set value of F8 shall govern the length of time delay.

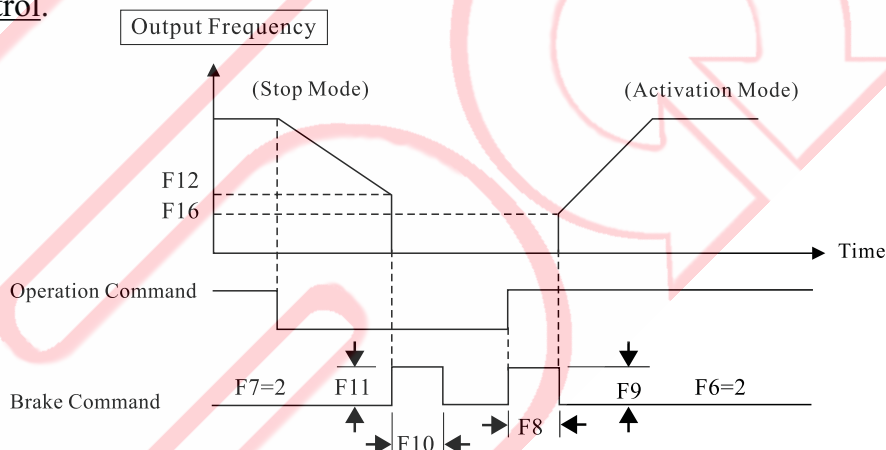
Note : The brake current 100% is to take the set value to the F142 motor-rated current as the standard.

## V -Description of parameter functions-

R : Parameter is changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F10	Stop brake time	0.0~120.0	Sec	5.0
×	F11	Stop brake current	0.00~1.00	Pu	0.20
×	F12	(V/F) Stop Brake Beginning Frequency	0.0~60.0	Hz	0.0

- ◎ This parameter group sets the frequency to begin the DC brake, brake current and brake time when the motor stops, thus to provide load holding after the motor stops. Do not set Stop Brake Time and Stop Brake current at the minimum, i.e., "0" since there is no time or brake energy is available for operation.
- ◆ This parameter is to establish the function of frequency for initiating the dynamic dc brake to stop; the following setup shall be made first: F7 Stop mode=2: Dynamic DC Brake, F10:Stop Brake time and F11: Stop Brake current.
- ◆ F12 function is F147 = Open Loop scalar Control, 3 : Close Loop scalar Control or 4 : Sensorless scalar control.



### Speed Limit

×	F13	Rotating Direction Control	0~3		1
---	-----	----------------------------	-----	--	---

- ◎ If for safety concerns for the operation of the machine that the motor can only be set for forward or reverse direction, apply this set of functions to select the restricted rotating direction for the motor.

■ **0 : Either FWD or REV**

■ **1 : FWD only**

■ **2 : REV only**

■ **3 : REV only with negative bias**

- ◎ If 3: REV only with negative bias is selected, there are five types of analog input signal in the parameter F5: Speed Command that provide the settings of the negative bias frequency. When the analog input signal setting works within the negative bias frequency region, the motor runs in reverse direction; in positive frequency region, in forward direction. [For details of analog signal bias setup, refer to each analog signal bias parameter group (F50, F52, F57, and F62)].

- ◎ Select 3: REV only with negative bias, F5 = 5 : AV2 + AI to control the operation of addition& subtraction, and F5 = 7 : PID(%) to perform the negative PID % control.



WARNING

**The rotating direction set for the AC drive is not necessarily the same as that of the motor. The polarity of motor differs on the each make. Attention must be made to the danger caused by reverse motor rotation.**

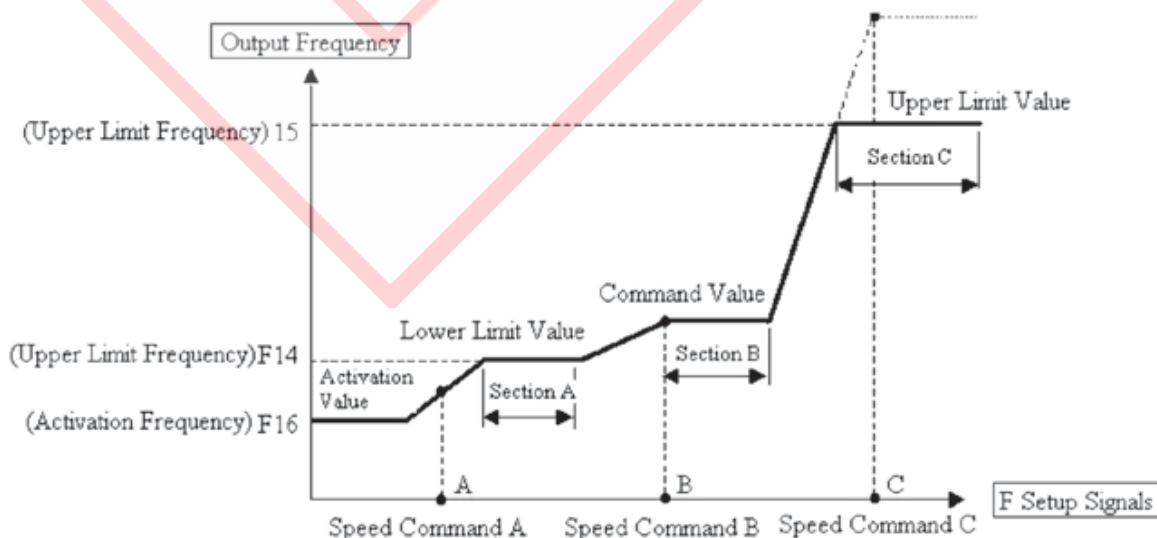
R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F14	Lower Limit Frequency	0.0~400.0	Hz	0.0
×	F15	Upper Limit Frequency	0.0~400.0	Hz	60.0

※ **Proper upper and lower frequency limit settings could help protect the mechanical system. Any wrong speed command given by the operator shall not cause damage to the system due to machine idling or operation in dangerously high speed.**

※ **Set value of Upper /Lower Limit Frequency must satisfy the condition:  $F15 \geq F14$ .**

×	F16	Activation Frequency	0.0~30.0	Hz	0.0
---	-----	----------------------	----------	----	-----

- ◎ The function of lower limit frequency is disabled once it is smaller than the activation frequency.
- ◎ If the speed command setting is greater than that of F16 activation frequency the latter is inputted into operation up to the former. The system is in ready status if the speed command setting is smaller than that of the activation frequency.
- ◎ When the F14 lower limit frequency setting is greater than that of the F16 activation frequency and the speed command setting A is greater than F16 activation frequency setting (the speed command A as illustrated), the activation frequency value is inputted into operation until it reaches the lower frequency setting (Section a as illustrated). If the speed command setting is greater than the lower limit setting (i.e., the speed command B as illustrated), then the operation continues to reach the speed command setting (i.e., Section b as illustrated).
- ◎ When the speed command setting is higher than the upper limit frequency (i.e., the speed command C), the output frequency will be limited to operate at the upper limit frequency setting (i.e., Section C as illustrated).



## Multi-Stage Speed Command Setup

Terminal Command →	Multi-stage Command 4	Multi-stage Command 3	Multi-stage Command 2	Multi-stage Command 1	Setup Range	Unit	Ex-factory Setting
○ F17 Master Speed	OFF	OFF	OFF	OFF	0.0~400.0Hz	Hz	5.0
○ F18 Stage 1 speed	OFF	OFF	OFF	ON	0.0~400.0Hz	Hz	5.0
○ F19 Stage 2 speed	OFF	OFF	ON	OFF	0.0~400.0Hz	Hz	10.0
○ F20 Stage 3 speed	OFF	OFF	ON	ON	0.0~400.0Hz	Hz	15.0
○ F21 Stage 4 speed	OFF	ON	OFF	OFF	0.0~400.0Hz	Hz	20.0
○ F22 Stage 5 speed	OFF	ON	OFF	ON	0.0~400.0Hz	Hz	30.0
○ F23 Stage 6 speed	OFF	ON	ON	OFF	0.0~400.0Hz	Hz	40.0
○ F24 Stage 7 speed	OFF	ON	ON	ON	0.0~400.0Hz	Hz	50.0
○ F25 Stage 8 speed	ON	OFF	OFF	OFF	0.0~400.0Hz	Hz	0.0
○ F26 Stage 9 speed	ON	OFF	OFF	ON	0.0~400.0Hz	Hz	0.0
○ F27 Stage 10 speed	ON	OFF	ON	OFF	0.0~400.0Hz	Hz	0.0
○ F28 Stage 11 speed	ON	OFF	ON	ON	0.0~400.0Hz	Hz	0.0
○ F29 Stage 12 speed	ON	ON	OFF	OFF	0.0~400.0Hz	Hz	0.0
○ F30 Stage 13 speed	ON	ON	OFF	ON	0.0~400.0Hz	Hz	0.0
○ F31 Stage 14 speed	ON	ON	ON	OFF	0.0~400.0Hz	Hz	0.0
○ F32 Stage 15 speed	ON	ON	ON	ON	0.0~400.0Hz	Hz	0.0

- ◎ ON and OFF indicate those commands of closed and open circuit given by external terminals.
- ◎ In the multi-stage operation mode, stage speed operation may be selected (up to 16 stage speeds) in the form of binary 4bit and must be done through those multi-function input terminals (F69~F74).( please see the table above)
- ◎ Parameters F103~F120 may be selected for the programmable automatic operation to execute those sixteen stages of preset frequency. Control is done by multi-function input terminals 14: Automatic Operation and 15: Automatic Operation Control suspended, and the operation display status operation F0=29 allows display of cycle counts and the stage number of the speed executed. For related operation on time and rotation direction of the motor, refer to Parameters F105~F120.

R	Parameter	Description	Range	Unit	Ex-factory Setting
○	F33	Inching Speed	0.0~400.0	Hz	5.0



WARNING

※ **ATTENTION - The inching operation has the top priority over any speed from the master through Stage 15 speed, it is impossible to select any other speed for operation whenever the inching operation is executed. The inching operation relates to a one and only command that is put on top priority to execute under any source of operation command.**

## Acceleration/Deceleration Time

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F34	Acceleration/deceleration time unit	0~2		1

■ **0 : 0.01 Second** — The acceleration/deceleration time of F35~F44 shall be 0.00~300.00 seconds.(Ex-factory set value: 10.00 seconds)

■ **1 : 0.1 Second** — The acceleration/deceleration time of F35~F44 shall be 0.0~3000.0 seconds.( Ex-factory set value: 10.0 seconds)

■ **2 : 1 Second** — The acceleration/deceleration time of F35~F44 shall be 0~30000 seconds.( Ex-factory set value:100 seconds)

○	F35	Master Speed,Stage 4,Stage 8,Stage 12, Acceleration time 0	0.0~30000	Sec	10.0
○	F36	Master Speed,Stage 4,Stage 8,Stage 12, Deceleration time 0	0.0~30000	Sec	10.0
○	F37	Stage 1,Stage 5,Stage 9,Stage 13 , Acceleration time 1	0.0~30000	Sec	10.0
○	F38	Stage 1,Stage 5,Stage 9,Stage 13 , Deceleration time 1	0.0~30000	Sec	10.0
○	F39	Stage 2,Stage 6,Stage 10,Stage 14 , Acceleration time 2	0.0~30000	Sec	10.0
○	F40	Stage 2,Stage 6,Stage 10,Stage 14 , Deceleration time 2	0.0~30000	Sec	10.0
○	F41	Stage 3,Stage 7,Stage 11,Stage 15 , Acceleration time 3	0.0~30000	Sec	10.0
○	F42	Stage 3,Stage 7,Stage 11,Stage 15 , Deceleration time 3	0.0~30000	Sec	10.0
○	F43	Inching Acceleration Time	0.0~30000	Sec	5.0
○	F44	Inching Deceleration Time	0.0~30000	Sec	5.0

◎ The time duration set for acceleration or deceleration determines the increasing or decreasing speed of output frequency F143: rated frequency is the reference frequency for the acceleration or deceleration of time.

◎ There are four sets of independent acceleration/deceleration time settings available for the allotment of internal acceleration/deceleration time (as shown in the table given above) either by Parameter F45 or through those multi-function input terminals (F69~F74 functions 10 : Acceleration/Deceleration Time 1, and 11: Acceleration/Deceleration Time 2).

◎ Inching acceleration/deceleration time settings are only available for the operation at inching speed.



CAUTION

**Shorter acceleration/deceleration time may cause danger of transient overload current or overload voltage; improper adjustment will cause the ac drive to trip, damaged or burnt out.**



# V -Description of parameter functions-

R : Parameter is changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F45	Multi-stage acceleration/deceleration time allotment	0~2		0

◎ Four independent sets of acceleration/deceleration time are available to allow combined application through three types of internal and external allotment

■ **0 : All Internal Allotment** — Acceleration/deceleration time is assigned for the use by stages 16 preset of speed through the existing allotment mode already fixed. (Refer to F35~F44 table or Table 1 given below.)

■ **1: Half Internal Allotment and another Half External Terminals** — Master Speed, Stage 1 through Stage 3 speed, and Stage 8 through Stage 11 speed are respectively allotted internally based on the individual acceleration/deceleration time; and stage 4 speed through stage 7 speed, stage 12 speed through stage 15 speed are freely used and controlled through external multi-function input terminals to be set by binary 2bit. (Refer to Table 1 or Table 2.)

■ **2: All External Terminals** — Acceleration/deceleration time of 16 stages of speed are all controlled by multi-function input terminals to be edited by binary 2bit. (Refer to Table 2.)

(Table 1)

Multi-stage Speed Acceleration / Deceleration Time	Master	Stage1	Stage2	Stage3	Stage4	Stage5	Stage6	Stage7
	Stage8	Stage9	Stage10	Stage11	Stage12	Stage13	Stage14	Stage15
0 : Internal Allotment	0	1	2	3	0	1	2	3
1 : Internal/External Allotment	0	1	2	3	External (Multi-function digital input) terminals			

(Table 2)

Digital Terminal Acceleration / Deceleration Time	DIn	DIn
	2	1
Acceleration/Deceleration 0	OFF	OFF
Acceleration/Deceleration 1	OFF	ON
Acceleration/Deceleration 2	ON	OFF
Acceleration/Deceleration 3	ON	ON

×	F46	S-curve time when starting the accelerate	0.00~3.00	Sec	0.00
×	F47	S-curve time when finishing the accelerate	0.00~3.00	Sec	0.00
×	F48	S-curve time when starting the deceleration	0.00~3.00	Sec	0.00
×	F49	S-curve time when finishing the deceleration	0.00~3.00	Sec	0.00



◎ S-curve can be used to perform an impact-free operation by soft start and soft deceleration.

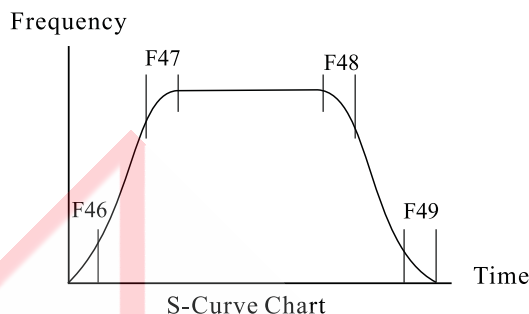
◎ After setting the S-curve time, the acceleration/  
deceleration time will be extended as follows:

Actual acceleration time =

Selected acceleration time + (F46 + F47) / 2

Actual deceleration time =

Selected deceleration time + (F48 + F49) / 2



## Analog Input

R	Parameter	Description	Range	Unit	Ex-factory Setting
○	F50	AV : 0V Input bias %	-300.00~300.00	%	0.00
○	F51	AV : 5V Input Gain %	-300.00~300.00	%	100.00

◎ Parameters F50 and F51 are used to define the knob (VR)/AV analog signal command setting of the operator. The bias ratio corresponding to Parameter F50/0V may be set up a set of negative bias to avoid noise interference at 0V, or for the application by other control; Parameter F51/5V is related to gain frequency and will be subject to F15 upper limit frequency at the optimal output. (Refer to those examples of seven basic curves given below.)

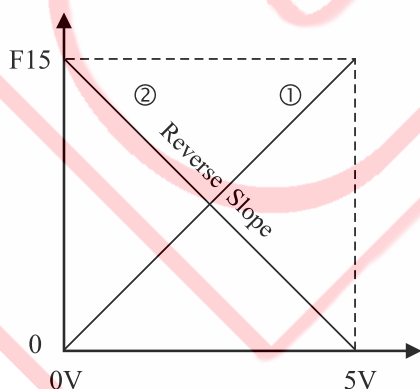


Fig 1

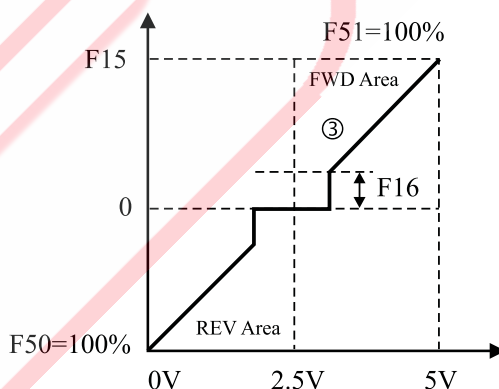


Fig 2

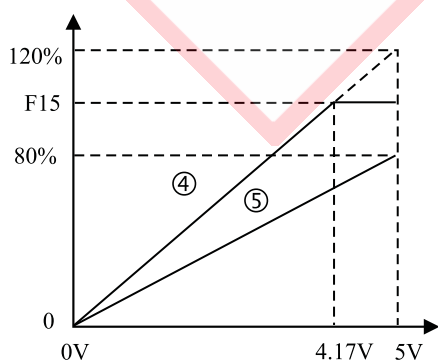


Fig 3

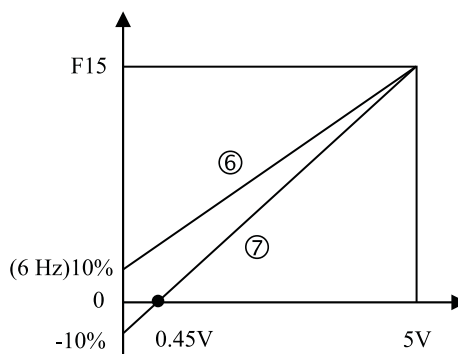


Fig 4

# V –Description of parameter functions–

R : Parameter is changeable during operation (○)

※ Refer to the Description Given Below According to the Chart Given Above  
Fig. 1, 2,3,4

	Curve①	Curve②	Curve③	Curve④	Curve⑤	Curve⑥	Curve⑦
F5 Frequency Command Source	1: AV/5V	1: AV/5V	1: AV/5V	1: AV/5V	1: AV/5V	1: AV/5V	1: AV/5V
F13 Rotation Direction Control	1: FWD only	1 : FWD only	3 : REV with negative bias	1 : FWD only	1 : FWD only	1 : FWD only	1 : FWD only
F15 Upper Limit Frequency	60HZ	60HZ	60HZ	60HZ	60HZ	60HZ	60HZ
F16 Activation Frequency	0HZ	0HZ	3HZ	0HZ	0HZ	0HZ	0HZ
F50 Operator AV:0V Bias Ratio	0.00%	100.00%	-100.00%	0.00%	0.00%	10.00%	-10.00%
F51 Operator AV:5V Gain Ratio	100.00%	0.00%	100.00%	120.00%	80.00%	100.00%	80.00%

- ◆ Maximum AV Operator F = (F15) upper limit frequency × (F51) Gain ratio
- ◆ Frequency-positive bias voltage = (F15) upper limit frequency × (F50) bias Gain ratio  
Example: Curve ⑥ = 60Hz × 10% = 6Hz
- ◆ Negative bias voltage = [ 5V(AV ÷ (F50 bias Gain ratio + F51 Gain ratio) ) ] × F50  
Negative bias voltage

Example: Curve ⑦ = [5V ÷ (10% + 100%)] × 10% = 0.45V **(Plus and minus symbols will not be enabled for operation)**

- ◆ Operator Voltage (V) 
$$\frac{\text{Maximum Voltage} \times \text{Maximum Operator F}}{\text{upper limit frequency} \times \text{bias Gain ratio}}$$

Example : Curve ④ =  $\frac{5V \times 60Hz}{60Hz \times 120\%} = 4.16V$  Example : Curve ⑤ =  $\frac{5V \times 48Hz}{60Hz \times 80\%} = 5V$

- ◆ Gain ratio = 
$$\frac{\text{Maximum Voltage} \times \text{Maximum Operator F}}{\text{upper limit frequency} \times \text{Operator Gain ratio}}$$

Example : Curve ④ =  $\frac{5V \times 60Hz}{60Hz \times 4.16V} = 120\%$  Example : Curve ⑤ =  $\frac{5V \times 48Hz}{60Hz \times 5V} = 80\%$

R	Parameter	Description	Range	Unit	Ex-factory Setting
○	F52	AV1 : -10V Input bias %	-300.00~300.00	%	-100.00
○	F53	AV1 : 10V Input Gain %	-300.00~300.00	%	100.00
○	F54	AV1 : Dead Band Voltage (Dead Band)	0.00~85.00	%	0.00
○	F55	AV1 : Zero-point Output Gain	0.00~50.00	%	0.00
○	F56	AV1 : Maximal Output Limit	10.00~100.00	%	100.00

- ◆ Parameters F52~F56 relate to the applied parameter group for analog input terminals AV1(0~±10V) , and the Parameter F13 is set at = 3 : REV with negative bias to be available for speed control and FWD/REV direction control.

- ◆ F54 set for dead band voltage allows effective prevention from noise interference when operating at 0V since such interference may cause the ac drive from precise stop of its operation resulting in the operation of the motor to swing between FWD and REV.
- ◆ Parameters F55 and F56 relate to AV1 analog input signals to allow the zero-point output and maximum output settings through A/D converter controlled parameter module output.
- ◆ Dead Band voltage =  $\pm 10\text{Vdc} * (\text{F54})10\% \div [(\text{F53})\% - (\text{F52})\%] \div 2$
- ◆ Zero-point output frequency =  $(\text{F15})$  upper limit frequency  $* (\text{F55})\%$
- ◆ Maximum output frequency =  $(\text{F15})$  upper limit frequency  $* (\text{F56})\%$

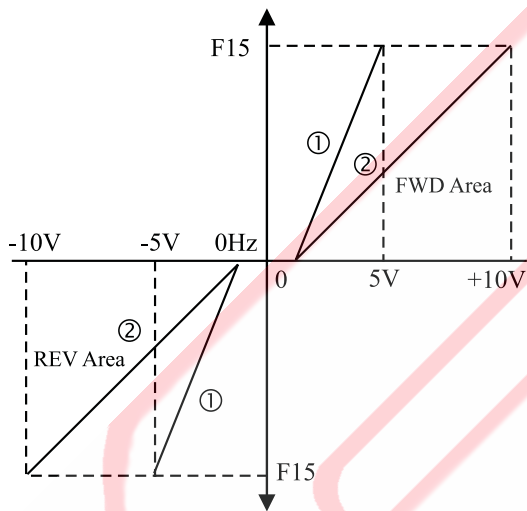


Fig 1

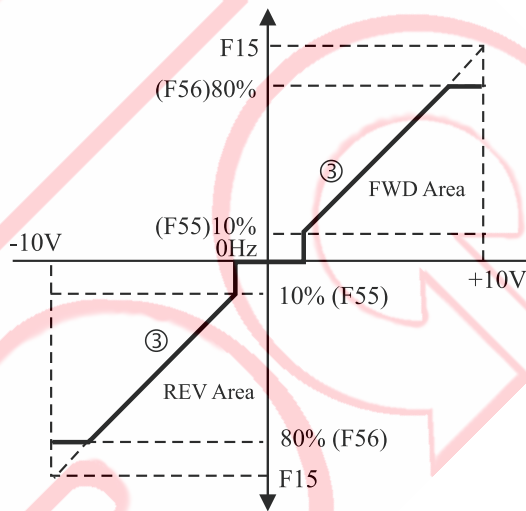


Fig 2

※ Please refer to the following tables for the description of parameters corresponding to the parameters shown in Figure 1 and Figure 2.

	Curve ① Fig.1	Curve ② Fig.1	Curve ③ Fig.2
F5 Frequency Command Source	2 : AV1/10V	2 : AV1/±10V	2 : AV1/±10V
F13 Rotating Direction Limit	3 : REV with negative bias	3 : REV with negative bias	3 : REV with negative bias
F15 Upper Limit Frequency	60Hz	60Hz	60Hz
F52 -10V:Negative Gain Ratio	-200%	-100%	-100%
F53 10V: Gain Ratio	200%	100%	100%
F54 Dead Band Voltage	10%	10%	10%
F55 Zero-point Output Gain	0.0%	0.0%	10%
F56 Maximal Output Limit	100%	100%	80%

# V -Description of parameter functions-

R : Parameter is changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory Setting
○	F57	AV2 : 0V Input bias %	-300.00~300.00	%	0.00
○	F58	AV2 : 10V Input Gain %	-300.00~300.00	%	100.00
○	F59	AV2 : Dead Band Voltage (Dead Band)	0.00~85.00	%	0.00
○	F60	AV2 : Zero-point Output Gain	0.00~50.00	%	0.00
○	F61	AV2 : Maximal Output Limit	10.00~100.00	%	100.00
○	F62	AI : 4mA / 0V Input bias %	-300.00~300.00	%	0.00
○	F63	AI : 20mA / 10V Input Gain %	-300.00~300.00	%	100.00
○	F64	AI : Dead Band Voltage (Dead Band)	0.00~85.00	%	0.00

- ◆ Voltage signals of Analog input terminals AV2(0~10V) and current (or voltage) signals of AI (4~20mA or 0~10V) are two individual sets of analog signal parameter groups of the same operation.
- ◆ Inputs of analog signal made through parameters of Input Bias Ratio (F57, F62) , Gain Ratio (F58, F63) , and Dead Band Voltage (F59, F64) are sufficient to cope with different control requirements for parameter setup; and may set up the zero-point output F60 and maximum output limit F61 through parameters under the control of A/D converter. (Refer to examples of 12 types of basic curves.)

○	F65	AI : Signal Input mode	0~1		0
---	-----	------------------------	-----	--	---

- **0 : 4~20mA** — AI input terminal, able to receive 4~20mA analog signal and enable the function for F66 parameter to detect the signal interruption.
- **1 : 0~10V** — AI input terminal, able to receive 0~10V analog signal, but unable to enable the function for detection of signal interruption.

○	F66	AI : Signal Interrupts detection	0~3		0
---	-----	----------------------------------	-----	--	---

- **0 : Not detected** — Disabled the function for detecting the AI signal interruption.
- **1 : Slow down to zero Hz after stopping** — When interrupted the AI signal, frequency (Hz) will be reduced Progressively to 0Hz, a display of Err22 will appear.
- **2 : Free run stopping** — When interrupted the AI signal, the frequency inverter will disconnect the output signal immediately to enable an open-circuit state between the frequency inverter and the motor; and then the motor will follow to come to stop after free run, a display of Err22 will appear.
- **3 : Maintain the frequency of operation before break** — The frequency inverter will still stay at running state after the signal interruption for external AI detection.

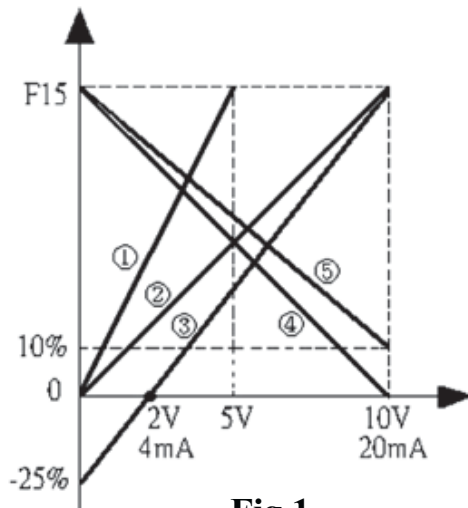


Fig 1

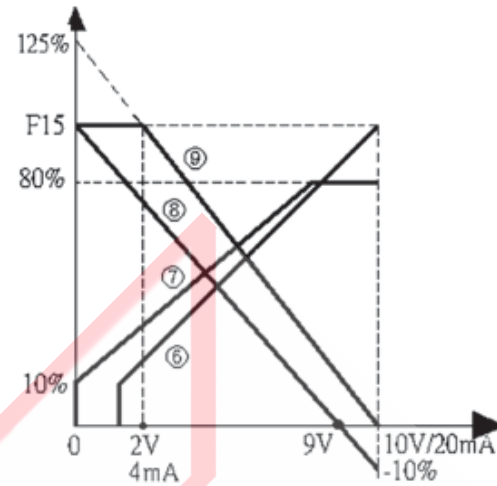


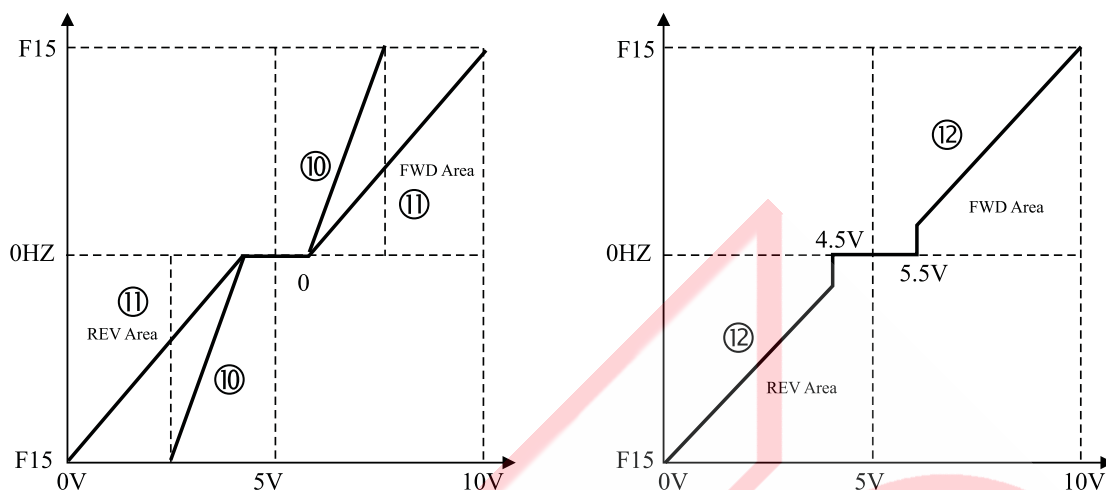
Fig 2

※ Refer to the Description Given Below According to the Chart Given Above  
Fig. 1

	Curve ①	Curve ②	Curve ③	Curve ④	Curve ⑤
F5 Frequency Command Source	3:AV2/10V	3:AV2/10V	3:AV2/10V	3:AV2/10V	3:AV2/10V
F15 Upper Limit Frequency	60Hz	60Hz	60Hz	60Hz	60Hz
F57、F62 0V(0mA) Bias Ratio	0.0%	0.0%	0.0%	100%	100%
F58、F63 10V(20mA) Gain Ratio	200%	100%	100%	0.0%	10%
F59、F64 Dead Band Voltage	0.0%	0.0%	0.0%	0.0%	0.0%
F60 Zero-point Output Gain	0.0%	0.0%	0.0%	0.0%	0.0%
F61 Maximum Output Limit	100%	100%	100%	100%	100%

※ Refer to the Description Given Below According to the Chart Given Above  
Fig. 2:

	Curve ⑥	Curve ⑦	Curve ⑧	Curve ⑨
F5 Frequency Command Source	3:AV2/10V	3:AV2/10V	3:AV2/10V	3:AV2/10V
F15 Upper Limit Frequency	60Hz	60Hz	60Hz	60Hz
F57、F62 0V(0mA) Bias Ratio	0.0%	0.0%	100%	100%
F58、F63 10V(20mA) Gain Ratio	100%	100%	-10%	0.0%
F59、F64 Dead Band Voltage	10%	0.0%	0.0%	0.0%
F60 Zero-point Output Gain	10%	10%	0.0%	0.0%
F61 Maximum Output Limit	100%	80%	100%	100%



※ Refer to the Description Given Below According to the Chart Given Above :

	Curve ⑩	Curve ⑪	Curve ⑫
F5 Speed Command Source	3 : AV2/10V	3 : AV2/10V	3 : AV2/10V
F13 Rotating Direction Limit	3 : REV with negative bias	3 : REV with negative bias	3 : REV with negative bias
F15 Upper Limit Frequency	60Hz	60Hz	60Hz
F57 、 F62 0V(0mA) Bias Ratio	-200.0%	-100.0%	-100.0%
F58 、 F63 10V(20mA) Gain Ratio	200.0%	100.0%	100.0%
F59 、 F64 Dead Band Voltage	10.0%	10.0%	10.0%
F60 Zero-point Output Gain	0.0%	0.0%	0.0%
F61 Maximum Output Limit	100.0%	100.0%	100.0%