

# 800 AC DRIVE

Application Manual

## Model

## Sensorless & Closed Loop



SUITABLE MODEL : THREE PHASE 200V~240V/380V~460V CLASS



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# **PREFACE**

**More and more applications of ac drive are commercially used today as automated process operation becomes popular. Based on our professional commitments by focusing on modern technologies and pushing for the latest industry standards, we attach this manual of our high performance ac drive. This manual contains detailed instructions on installation (including operation, maintenance, inspection, and repair), peripheral wiring, specifications, and parameter setup process, and gives you complete description of types and technical operation of the product.**

**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 current flux vector drive, one that has incorporated the advanced IGBT Module mute design and decades of our expertise to yield the optimal economic benefits for you from your production facilities.**

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



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



**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 N · P 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.
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# **I Installation**

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# I -Installation-

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## Installation

### First-time Use

Thank you for selecting our Series 800 ac drive. Please confirm the following matters before installation.

#### **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  $40^{\circ}\text{C}$ ; 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 nstallation	Ambient	Ambient Humidity
<b>Closed Wall Mounting</b>	$-10 \sim +40^{\circ}\text{C}$	95% RH or less (non-condensation)
<b>In Panel Mounting</b>	$-10 \sim +45^{\circ}\text{C}$	95% RH or less (non-condensation)

**\* For reference only in environment impact assessment of the installation!**

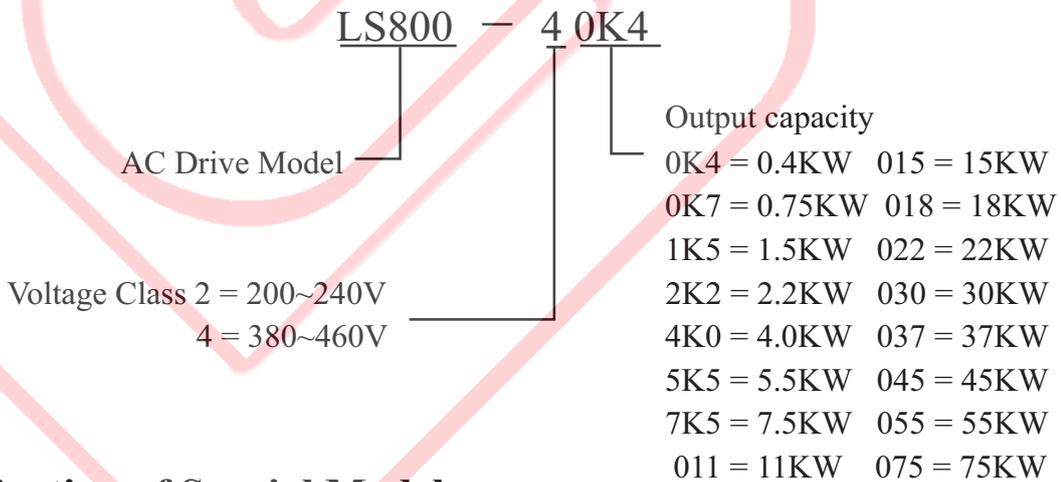
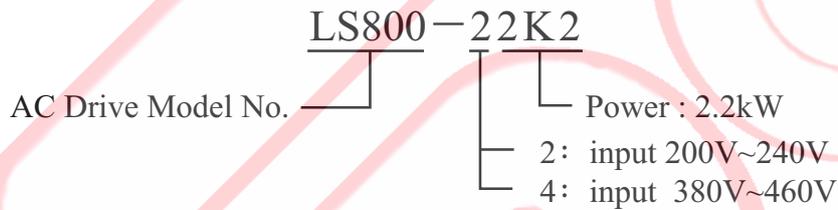
# I -Installation-

## Description of Nameplate :

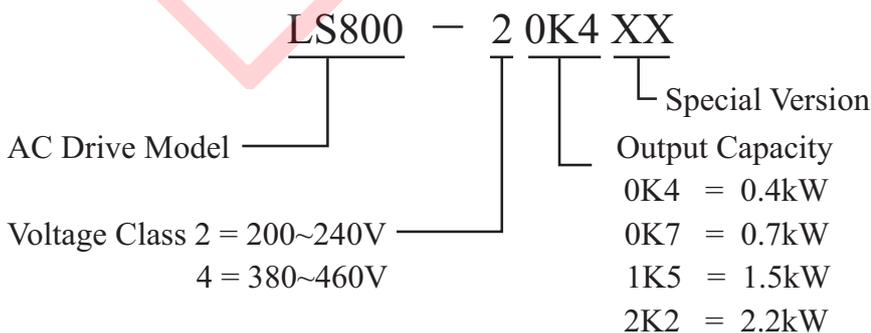
Found on one side of the ac drive, the nameplate bears model, specification, protection class and other information as described below.

<b>Model No.</b>	→	MODEL : LS800-22K2
<b>Input Spec.</b>	→	INPUT : AC 3Ph 200~240V 50/60Hz
<b>Output Spec.</b>	→	OUTPUT : AC 3Ph 0~240V 4.2KVA 11.0A cont 17.0A int 2.2kW 3Hp
<b>Protection Class</b>	→	PANEL. : IP20 NEMA 1
<b>Manufacturing Series No.</b>	→	S/NO : 0410A00001

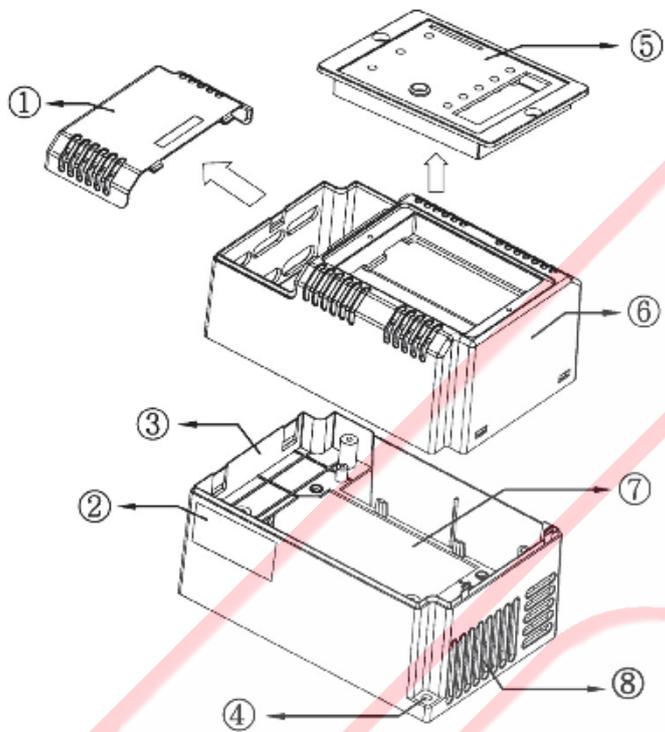
### Description of Model on the Nameplate of the Drive: ( MODEL )



### Identification of Special Model:

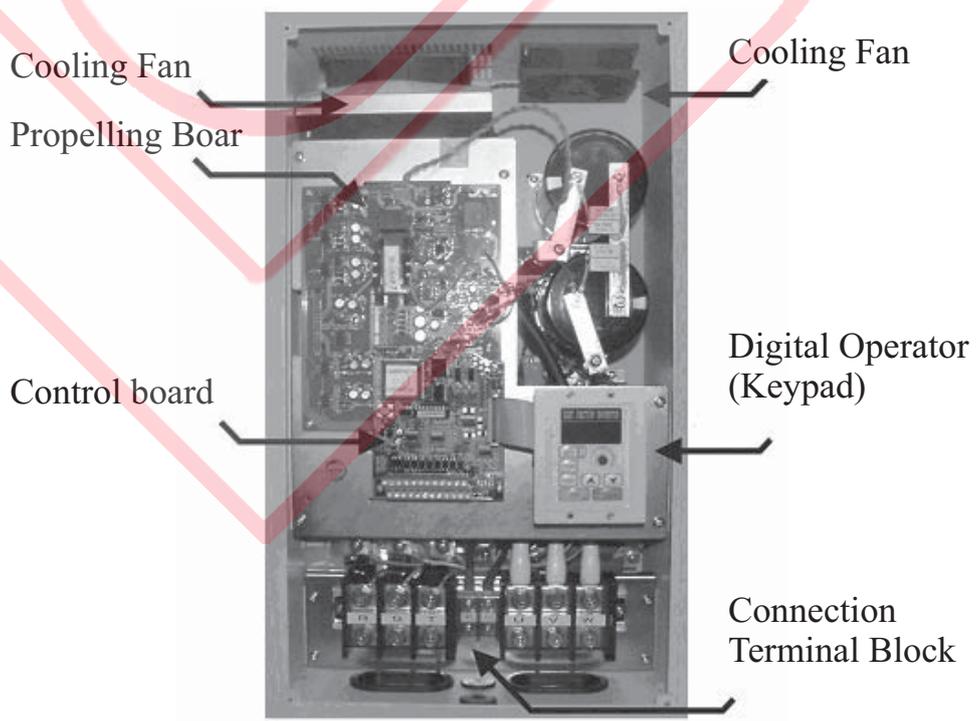


**Designations of Parts**



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

**High HP Box**

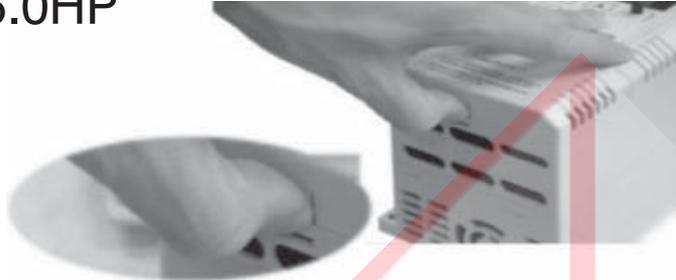


# I -Installation-

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## Removing the AC Drive Lid

0.5HP~5.0HP



**Step 1: Have one thumb to slightly push in the locking button.**



**Step 2: Lift the lid to remove the terminal.**



**Step 3: To remove the lid for service, have both thumbs to press and push up both (LH & RH) locking rings.**

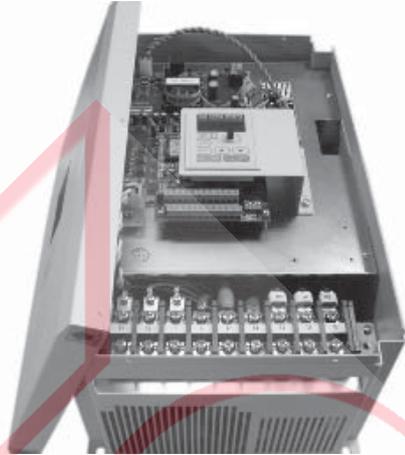


**Step 4: Hold and lift to remove the entire lid**

5.5HP ~ 50HP



**Step 1 : Push up the panel**

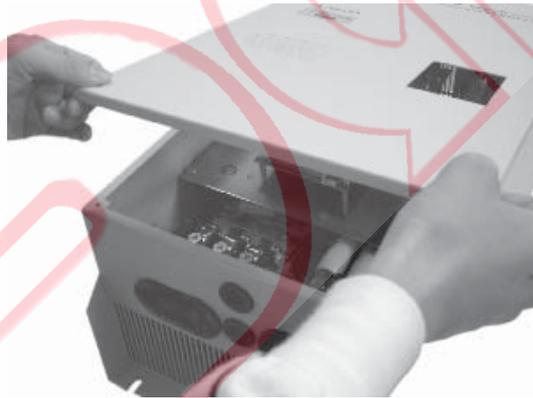


**Step 2 : Lid is removed**

60HP ~ 100HP



**Step 1 : Remove first the screws(X4)**



**Step 2 : Carefully remove the panel**



**Step 3 : Lid is removed**

# I -Installation-

## Installation Direction & Space

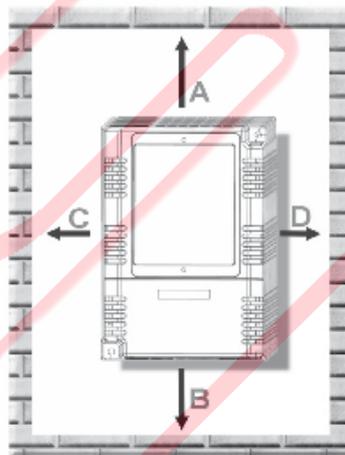
To maintain good cooling air circulation, the ac drive must be secured in vertical position leaving sufficient clearance between the ac drive and its surrounding, and abutted components and guards. Whereas cooling fans are mounted at the base of the ac drive, sufficient space shall be maintained to facilitate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

### Notices to Installation

- (1) If the ambient temperature maintains at 40°C or higher, install the ac drive at Where well ventilated or improve external cooling system.
- (2) Whereas transient temperature rise may take place if additional brake resistance is installed, select carefully the installation site for the brake resistance, or additional fans are provided 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)

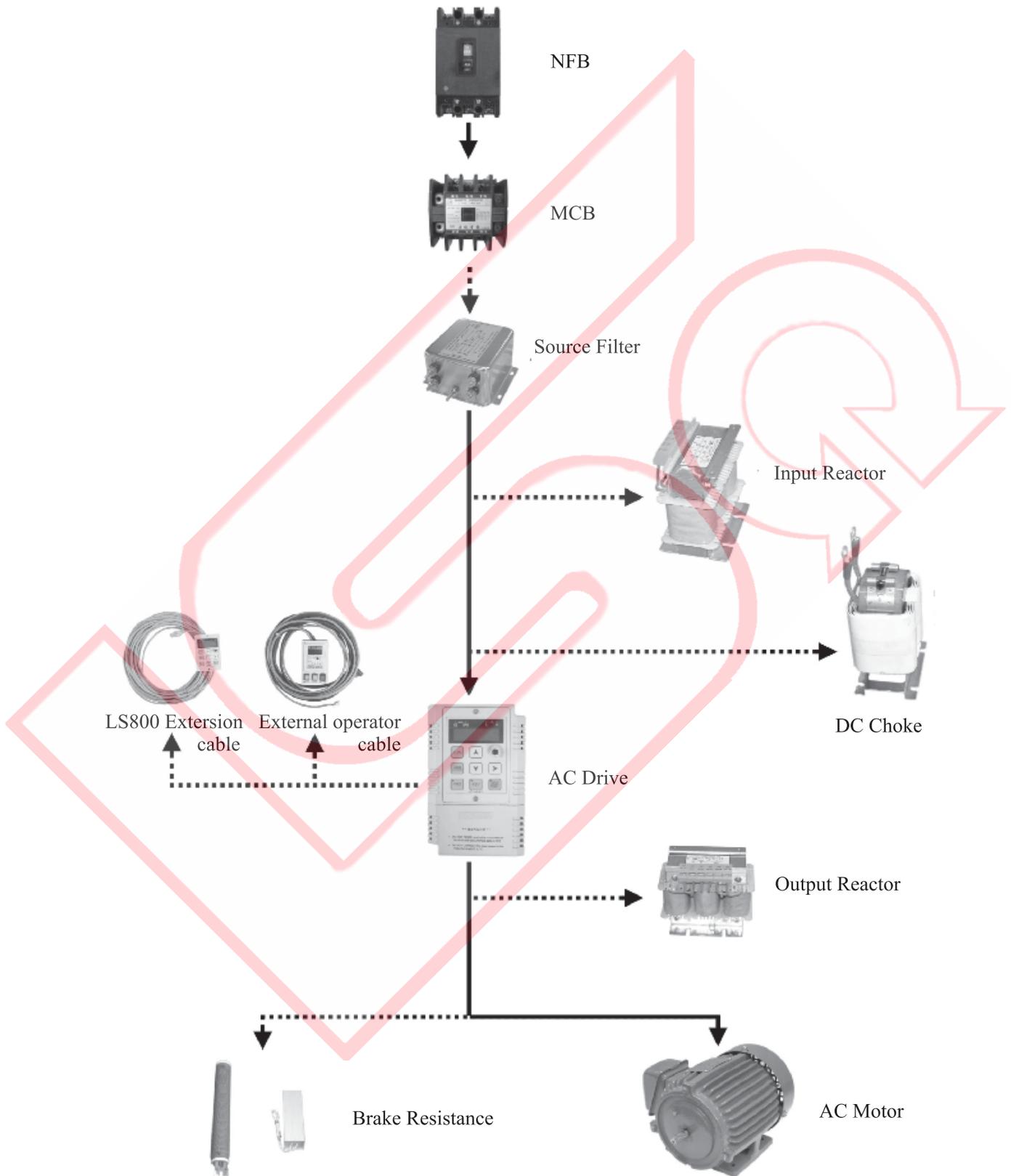
Direction & Safety Clearance LS800 Capacity	A	B	C	D
≤ 2.2kw	≥ 100 mm	≥ 100 mm	≥ 50 mm	≥ 50 mm
4.0kw ~ 11kw	≥ 120 mm	≥ 120 mm	≥ 50 mm	≥ 50 mm
15kw ~ 22kw	≥ 150 mm	≥ 150 mm	≥ 100 mm	≥ 100 mm
30kw ~ 37kw	≥ 200 mm	≥ 200 mm	≥ 150 mm	≥ 150 mm
45kw ~ 75kw	≥ 300 mm	≥ 300 mm	≥ 200 mm	≥ 200 mm

# II Wiring

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# II - WIRING -

## Schematic View of Peripheral Configuration

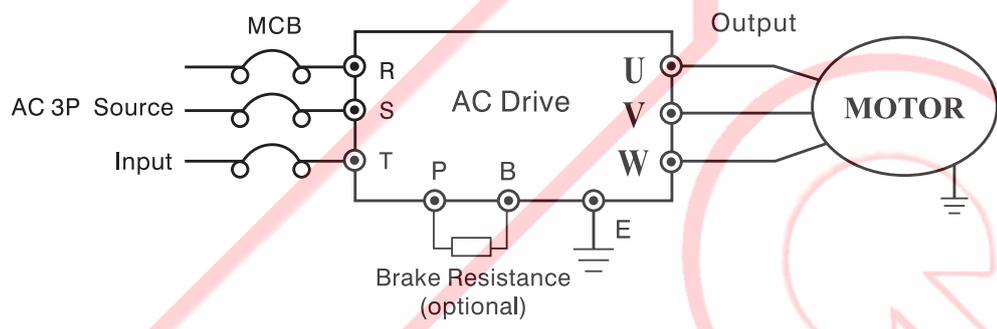


### Connection to Peripherals

**Wiring Methodology**

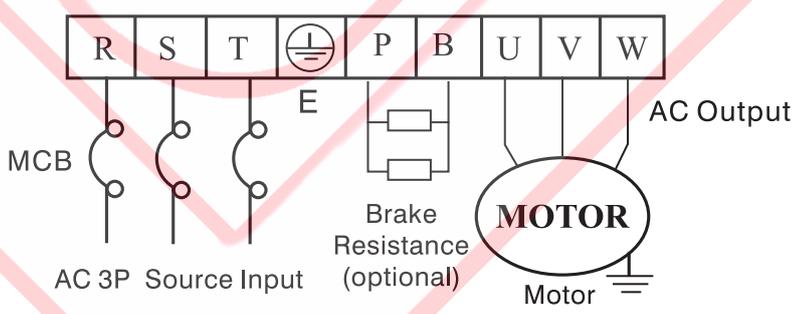
**3-Phase Primary Loop Wiring Diagram**

( LS800-20K5 、 LS800-20K7 、 LS800-21K5 、 LS800-22K2 、  
 LS800-24K0 、 LS800-25K5 、 LS800-27K5 、 LS800-40K7 、  
 LS800-41K5 、 LS800-42K2 、 LS800-43K7 、 LS800-45K5 、  
 LS800-47K5 )



- (1) A brake circuit is provided up to 10HP for 3p Series 200V and 400V. Refer to P. 8-1 for selecting correct resistance and wattage.
- (2) Each frequency ac drive and motor casing must be properly grounded to prevent lightning and electric shock.

**3 Phase Source Terminal Block**

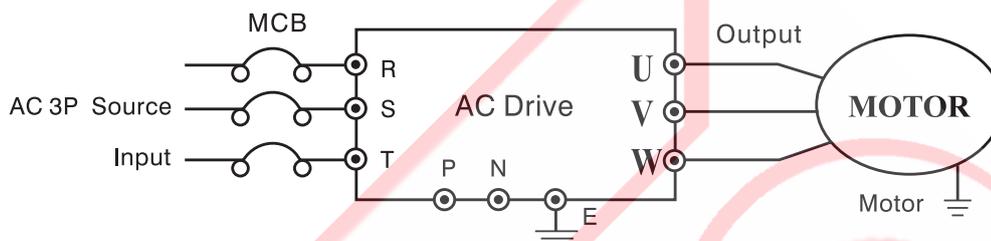


Symbol	Description
R.S.T	Connecting 3p source input
P.B	May be connected to brake resistance; no external brake unit is required for less than 10HP, which is built in.
U.V.W	Output to connect 3p motor terminal
⊕	Grounding terminal

## II -WIRING-

### 3-Phase Primary Loop Wiring Diagram

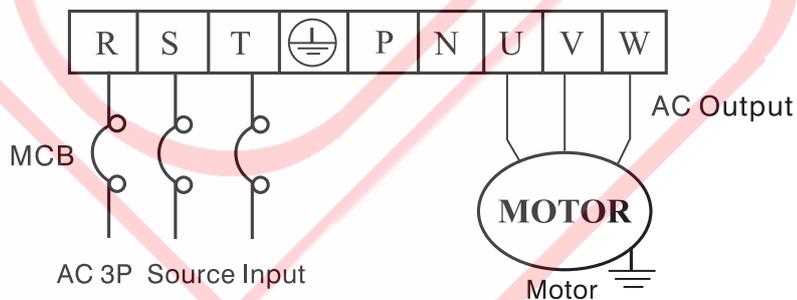
(LS800-2011、LS800-2015、LS800-2018、LS800-2022、LS800-2030、LS800-2037、LS800-2045、LS800-2055、LS800-4011、LS800-4015、LS800-4018、LS800-4022、LS800-4030、LS800-4037、LS800-4045、LS800-4055、LS800-4075)



CAUTION

- (1) A brake circuit is not provided for 3p Series 200V and 400V of 15HP or greater. Refer to P. 8-1 for selecting correct braking unit resistance and wattage.
- (2) Each ac drive must be properly grounded to prevent lightening and electric shock.

### R-3p Source Terminal Block



Symbol	Description
R.S.T	Connecting 3p source input
P.N	P(+), N(-) terminals may be connected to external brake unit, but direct connection to brake resistance is not acceptable.
U.V.W	Output to connect 3p motor terminal
⊕	Grounding terminal

## Notices to Wiring

### (1) Primary Loop Wiring

1. Make sure that the connections for source input terminals R.S.T, and output terminals U.V. W (to be connected to the motor) are correct; any mistake in the connection would lead to serious damage to 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 primary loop wiring of the ac drive far away from signal cable of any other control system (e.g., PLC, tiny signal system) to avoid interference.

### (2) Ground wire

1. Connect the ground terminal  $\oplus$  in the third type grounding method ( $\leq 10\Omega$ ).
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) EM Contact – Breaker Used in Primary Loop Wiring

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 a leakage breaker switch dedicated for the ac drive is used, select the one with an induced current of 30mA or greater for each unit of ac drive.
2. If a general leakage breaker switch is used, select the one with an induced current of 200mA or greater for each unit of ac drive, and the time of action shall not be shorter than 0.1 s.

### (4) Surge Absorber

Any windings of the peripheral, e.g., EM contact, relay, solenoid to the ac drive must be connected in parallel with the surge absorber to prevent noise interference. Select the surge absorber by referring to the list given below :

Voltage	Where Needed	Spec. of Surge Absorber
220V	Large capacity windings other than relay	AC250V 0.5uf 200 $\Omega$
	Control relay	AC250V 0.1uf 100 $\Omega$
380V	Large capacity windings other than relay	AC500V 0.5uf 220 $\Omega$
	Control relay	AC500V 0.1uf 100 $\Omega$

## II - WIRING-

### Primary Loop & Control Loop Routings Comparison List



CAUTION



WARNING

- ⊙ Before wiring, confirm that the source voltage must comply with the rated input voltage of the ac drive.
- ⊙ Select the proper specification of the terminal screw and the size of the wire as provided in Electrician Code, and firmly tighten up the screw.
- ⊙ The wiring on the side of the source input terminals (3p/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.
- ⊙ The wiring operation for the ac drive must be done only after the power source is cut off for operation safety.
- ⊙ Install a no-fuse switch MCB to the source input side for power on/off operation and protecting the input end of the ac drive.
- ⊙ Properly connect the ground wire to avoid possible electric shock or fire disaster.

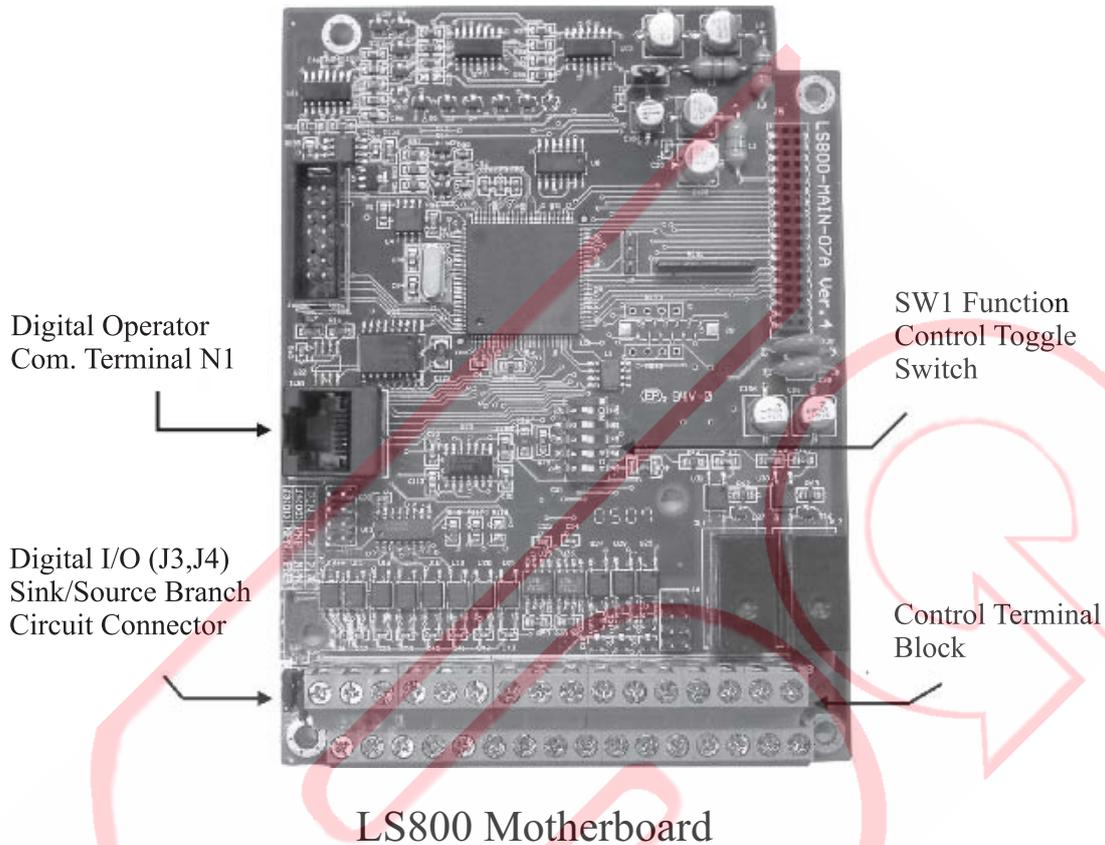
#### Form (1) 200V ~ 240V

Spec.	20K4	20K7	21K5	22K2	24K0	25K5	27K5	2011	2015	2018	2022	2030	2037	2045	2055
<b>Description</b>															
<b>Capacity kw/HP-200V</b>	0.4 / 0.5	0.75 / 1	1.5 / 2	2.2 / 3	3.7 / 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
<b>3p MCB Rated Current (A)</b>	5	10	15	20	30	50	60	75	125	150	175	225	250	300	400
<b>Power wire gage (mm<sup>2</sup>)</b>	2.0			3.5		5.5	8.0	14	22	30	38	50	60	80	100
<b>Primary loop screw</b>	M4				M5		M6			M8		M10			
<b>Control loop wire gage (mm<sup>2</sup>)</b>	1.25mm <sup>2</sup>														

#### Form (2) 380V ~ 460V

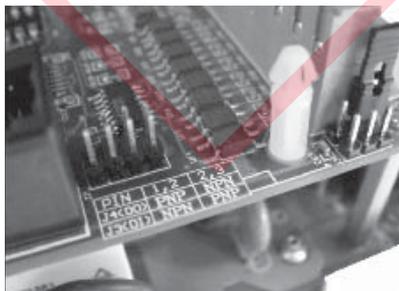
Spec.	40K7	41K5	42K2	44K0	45K5	47K5	4011	4015	4018	4022	4030	4037	4045	4055
<b>Description</b>														
<b>Capacity kw/HP-400V</b>	0.75 / 1	1.5 / 2	2.2 / 3	3.7 / 5	5.5 / 7.5	7.5 / 10	11 / 15	15 / 20	18.5 / 25	22 / 30	30 / 40	37 / 50	45 / 60	55 / 75
<b>3p MCB Rated Current (A)</b>	5	10	15	20	30		50	60	100		125	150	175	200
<b>Power wire gage (mm<sup>2</sup>)</b>	2.0			3.5	5.5	8.0		14		22	38		50	
<b>Primary loop screw</b>	M4			M5		M6			M8		M10			
<b>Control loop wire gage (mm<sup>2</sup>)</b>	1.25mm <sup>2</sup>													

## Control Terminal Block Location Reference Chart



**Caution: (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.**

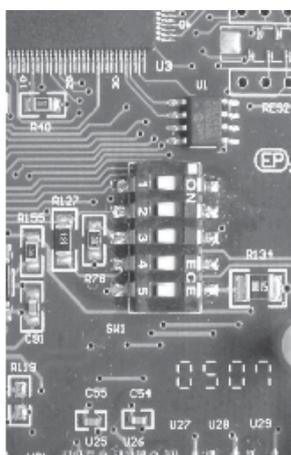
### ◆ J3, J4 Sink/Source Branch Circuit Connector



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 P. 2-11.

## II - WIRING-

### ◆ SW1 Function Toggle SW



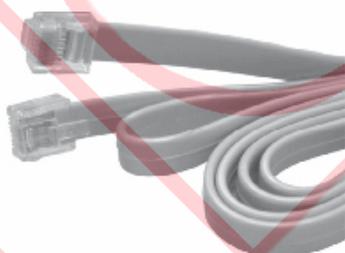
Description of SW1 Functions (RS485 Modbus set for internal and external uses).

NO.	Function	Toggle SW ON		Ex-factory Setup
1	SG-	External signal output to terminal block SG- (N1)		OFF
2	SG+	External signal output to terminal block SG+ (N1)		OFF
3	485 SW	<b>OFF</b> – internal digital operator in RS485 communication format (N2) <b>ON</b> – external digital operator in RS485 Modbus communication format.		OFF
4	120 Ω 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	ON
		V Mode 0~10V	A Mode 0~20mA	

**Note:** 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.

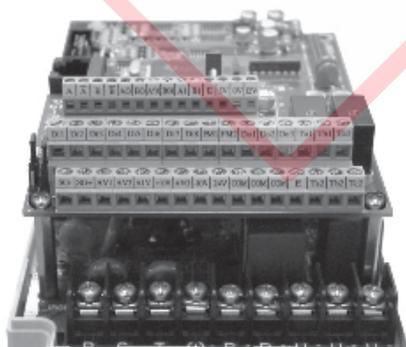
**Note:** The internal digital operator relates to the operation and control carried out by panel pushbuttons .

### ◆ 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.

### ◆ Control Terminal Block



1. Use type "–" or "+" (#101 screwdriver) to loosen up the terminal screw on the terminal block. Insert the wire from where below the terminal block and tighten up the screw (Refer to P2-8 in wiring on the terminal block).
2. Functions of the control terminal block and PG-AB2 terminals are respectively given in P2-9, and P2–13.

## Connecting 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 the proper wire gage according to Electrician Code.
- ☑ For overseas client, provide the wiring according to the applicable electric wiring regulations of the native country.
- ☑ Control circuit wiring: Provide the control circuit wiring only after the primary circuit wiring is separated from other power or electricity cable. Make it a 90-degree crossover at where alternative connection warrants.
- ☑ 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 trunking.
- ☑ As long as the digital operator indicator is on, never attempt to connect or disconnect any cable.
- ☑ Make sure that the screws to the primary loop terminals are properly tightened up to prevent sparks generated by loosening screw due to vibration.
- ☑ Please refer to the list given below for the clearance between the source input and output wirings of the ac drive.

	Wiring Standard Length	Wiring Length Limit
Source system→ Source end of the ac drive	Within 2~30M	Within 20~300M
Output end of the ac drive → AC electric machinery connection end	Within 2~25M	Within 25~200M
In case of excessive wiring	Recommended installation of I/O reactor	Mandatory installation of I/O reactor

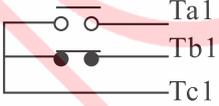
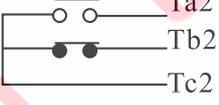


WARNING

Excessive length of power cable will cause parasitic capacitance created at the electric machinery and power cable to the ground, resulting high voltage surge to directly damage the ac drive.

# II - WIRING -

## Schedule of Control Terminal Function

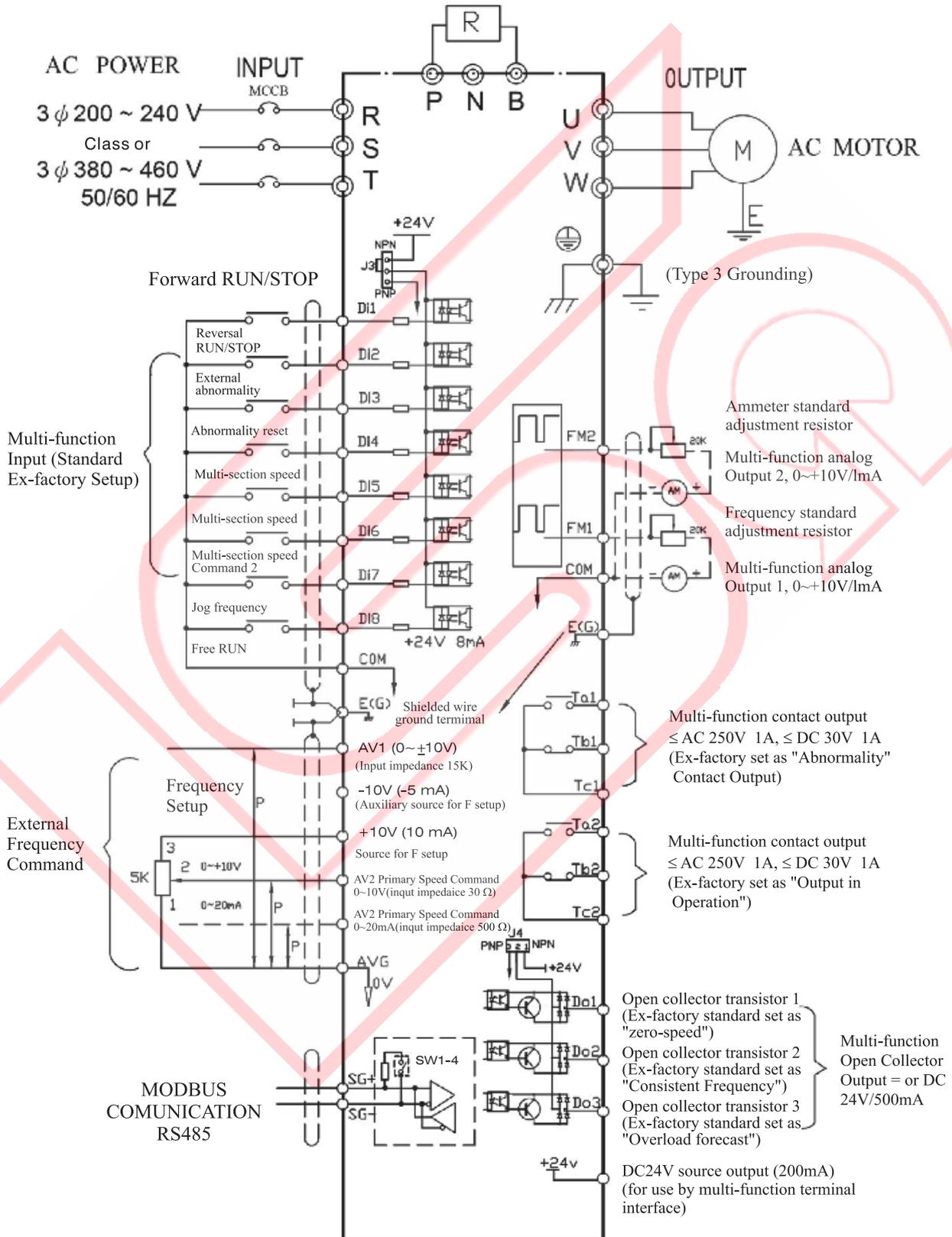
Terminal Mark	Terminal Designation	Description	Remarks		
Multi-function Input Terminals	Di1	Forward revolution command	Forward revolution when Di1-COM is ON; and stop, OFF	Control	
	Di2	Reversal revolution command	Reversal revolution when Di2-COM is ON; and stop, OFF	Control	
	Di3	Input in case of external abnormality (NC)	AC Drive trips off to stop when external abnormality signal is ON. (Err 29)	Control	
	Di4	Abnormality reset	The status retained when reset to ON to release failure in order to protect loop	Control	
	Di5	Multi-section command 1	To execute four-section speed control with binary 2Bit.	Control	
	Di6	Multi-section command 2		Control	
	Di7	Jog inching frequency	To execute inching frequency when ON	Control	
	Di8	Free-run	When activated (ON), the drive immediately stops outputting.	Control	
	COM	I/O Common terminal	Terminal common by multi-function I/O terminals and pulse FM terminals	Common Point	
Analog F Setting	+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 DC0~20mA, the input impedance is 500kΩ (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	I/O Common terminal	Terminal shared by multi-function I/O terminals and pulse FM terminals	Common Point	
	24V	Auxiliary source for terminal	Auxiliary source 24V/200mA MAX. for I/O terminals	Source	
	Ta1	Output in normality (NC)	1a and 1b contacts function to output when the abnormality protection mechanism of the drive is activated.	Control	
	Tb1		* Ta1-Tc1 is ON in case of abnormality Contact	Contact Capacity: AC250V 1A DC30V 1A	Contact
	Tc1		* Tb1-Tc1 is OFF in case of abnormality 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.	Control	
	Tb2		* Ta2-Tc2 is ON during operation Contact	Contact Capacity: AC250V 1A DC30V 1A	Contact
	Tc2		* Tb2-Tc2 is OFF during operation 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-483 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.

# Control Circuit Wiring Diagram

## AC Drive Control Circuit Terminal Wiring



# II - WIRING -

## Coping with Sink Mode/Source Mode

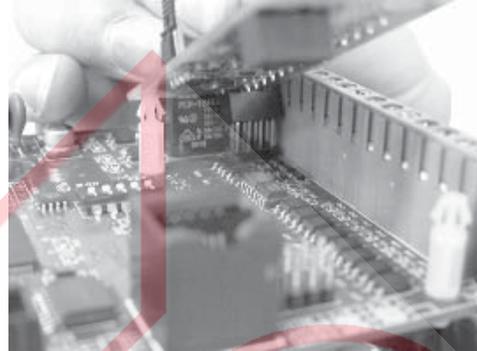
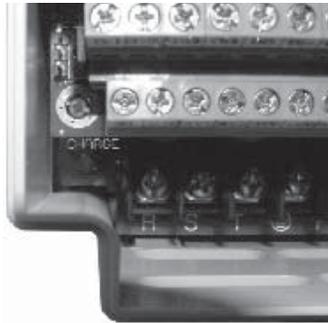
- ⊙ With the use of J3 (branch circuit connector), the logic of the input (Di1~Di8) terminals may be switched to Sink Mode or Source Mode
- ⊙ With the use of J4 (branch circuit connector), the logic of the output (Do1~Do3) terminals may be switched to Sink Mode or Source Mode.

**Table: Sink Mode, Source Mode and Signal Input**

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

## Installing Option Card and Wiring

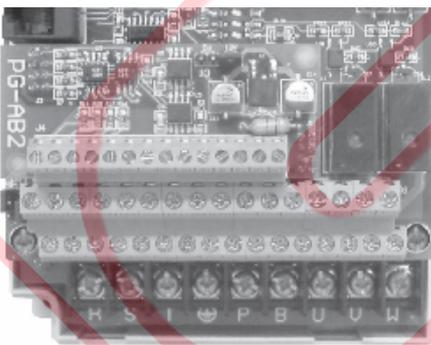
### Installing Procedure:



**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.

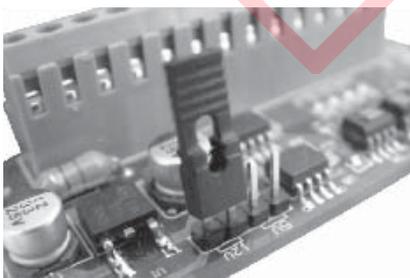
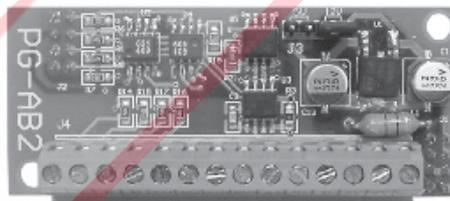
**3.** Check for any missing parts upon completing the installation before restoring the lid to subject to feeding test.



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 P2-13~P2-15.

## II - WIRING-

### 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.
$\bar{A}$	Phase A pulse input (-)	
B	Phase B pulse input (+)	* 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.
$\bar{B}$	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.
BO	Phase B pulse monitor output	* Maximal response frequency 300 KHz
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. Refer to page 2-12 to selection a correct signal voltage.)
B1	Phase B pulse frequency command input	
AO1	Phase A pulse frequency command monitor output	* Phase A and Phase B open collector transistor output, DC5V/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.**

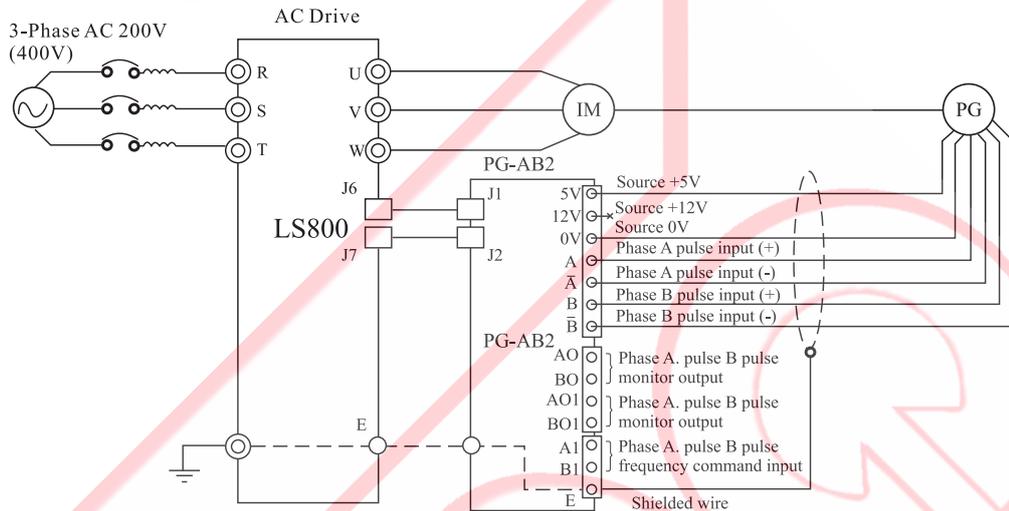
- ① 1. Refer to the table given on PG-AB2, and the voltage specification of the encoder installed while exercising the PG speed control.
- ② 2. A set of "speed feedback control input" is provided on PG-AB2 card to accept the complementary type input from Line Driver, or open collector transistor type input; a "frequency command input, allowing control of speed command ratio by taking advantage of the multiplication setup frequency ratio of F132; and two sets of "pulse monitor output", for exercising synchronous operation speed command source and monitor.
- ③ 3. Always use the shielded wire on the signal line.
- ④ 4. Do not use the PG source for any purpose other than PG, or error may present due to noise.
- ⑤ 5. Maintain the PG wiring not greater than 100M, and keep it far away from the power cable as applicable.
- ⑥ 6. Determine the revolving direction for PG according to F129 (to set up the direction for the encoder 1). 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 any remote control; negligence in this caution will result in personal injury and property loss.**

## PG-AB2 Wiring Diagram



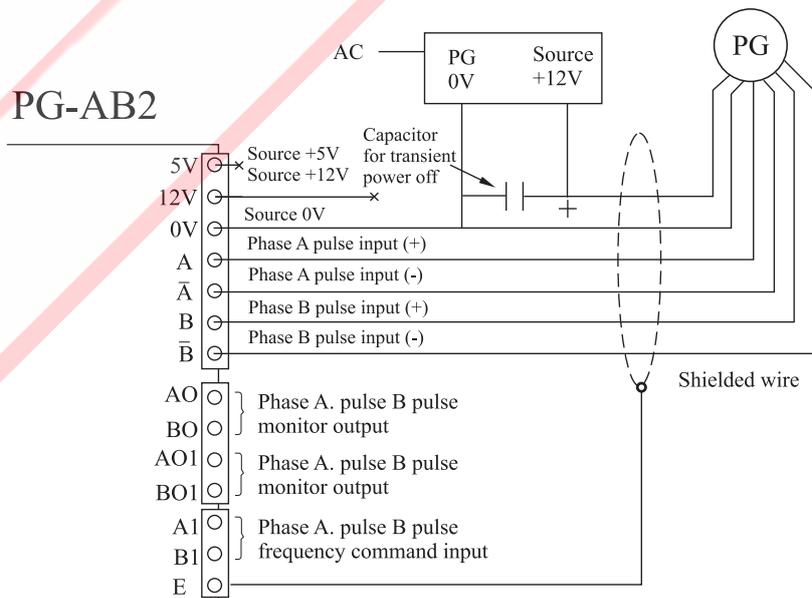
There are two types, 5V and 12V, of internal source for PG-AB2, confirm PG source specification before wiring.

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

### Motor revolving speed at the highest frequency output

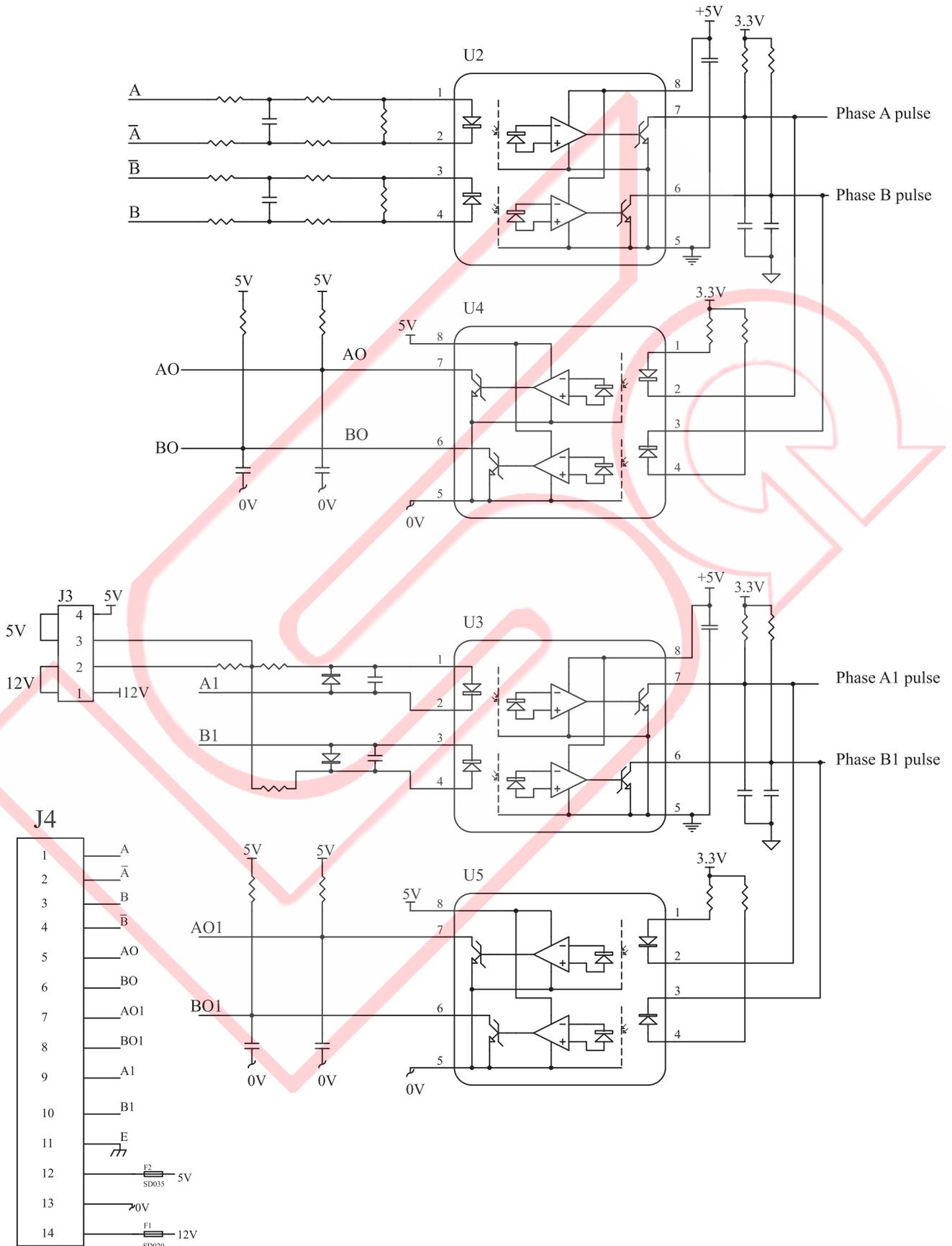
$$FPG(\text{Hz}) = \frac{60}{\text{X PG Constant}(\text{p/rev})}$$

Make available other sources if the PG source capacity is 200mA or above. Installation of additional capacitor at the source end or the similar measure is needed if the exercise of transient power interruption process is a must.



# II - WIRING -

## PG-AB2 I/O Circuits Construction Chart

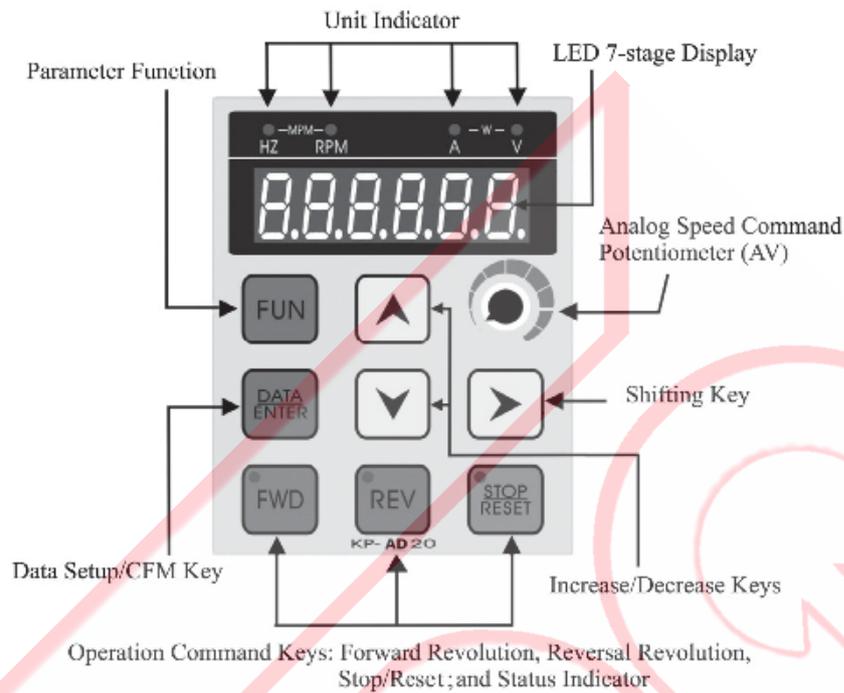


# III Digital Operator

◆ Location & Designation of Digital Operator...	3-1
➤ Functions of digital Operator .....	3-1
➤ Storing Parameters .....	3-1
➤ Duplicating Parameters .....	3-1
◆ Operation Keys Overview.....	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

The operator functions include operation, frequency setup, operation status monitor, parameter setup, abnormality display, parameter storage, and parameter duplication.



WARNING

When the vector control mode is selected to duplicate any parameter of F126=4,5,6 for example, make sure that the electric machinery features must be consistent; otherwise, perform once the Auto-tuning of electric and mechanical parameters.

### # Storing Parameters

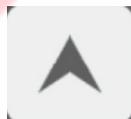
Save each and all parameter settings that have been confirmed and complied with the purposes as demanded in the commissioning into EEPROM of DSP (F207=1); and save the back-up into EEPROM of the digital operator (F207=2) to perform parameters duplication for multiple units of ac drive or function as the storage area for the second set of parameter group.

### # Duplicating Parameters

**SAVE** (1) Save the ac drive parameters into the digital operator by selecting Parameter F207: Save Present Parameters – 2: Save to Digital Operator.

**RECALL** (2) Power off to remove the digital operator and install it to another ac drive; recall the duplicated parameter to the RAM in the DSP by selecting Parameter F206: Recall Parameter (source)=3: Parameter of Digital Operator before selecting F207=1: Save to EEPROM in DSP to complete parameter duplication for another unit of ac drive.

**Operation Keys Overview:**

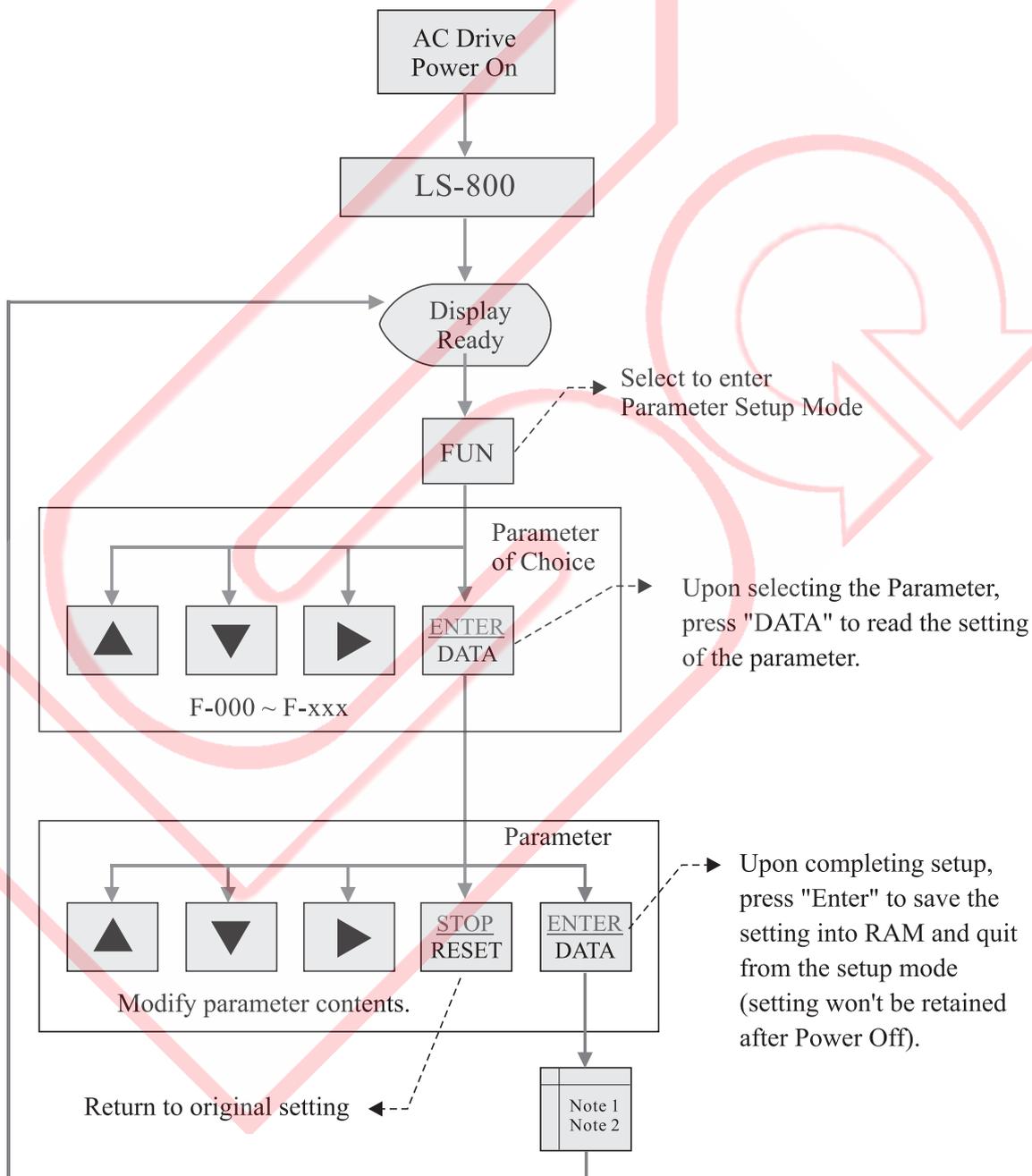
Classification	Key	Brief Description of Function
Control/ Parameter Key		Enter into Parameter Function Mode key.
		In the operation control mode, with <u>F5: Revolution Speed Command Source</u> set at 0 for the frequency setup under PB_ <u>operator</u> .
		To read, and write parameter settings.
		To enter data confirmation and enter into control mode.
Shift/ Increase, Decrease Keys		Remove the flaring cursor to the right to select the number of digital place of the setting to be entered.
		To execute numeric increase for parameter encoding and setting.
		To execute numeric decrease for parameter encoding and setting.
Operation Command Key		To execute the command of forward resolution, and turn on the LED indicator.
		The functional key to stop operation if the direction shift does not execute the command of forward revolution,
		To execute the command of reversal resolution, and turn on the LED indicator.
		The functional key to stop operation if the direction shift does not execute the command of reversal revolution,
		To execute the command of stop operation.
Revolution Speed Command		To execute reset in case of abnormality; and return to the original setting in parameter setup mode.
		F5: Revolution speed command source setting at 2 as the revolution speed control for the operator AV (DC 5V as inherited)

# III – DIGITAL OPERATOR –

## Parameter Setup Mode

This mode is used for changing internal parameter setting. Use Increase/Decrease Key and Step-up Key to complete the change. Upon completing the change, press ENTER/DATA Key to save the data into RAM and quit the Setup Mode.

Parameter Setup Mode Flow Chart

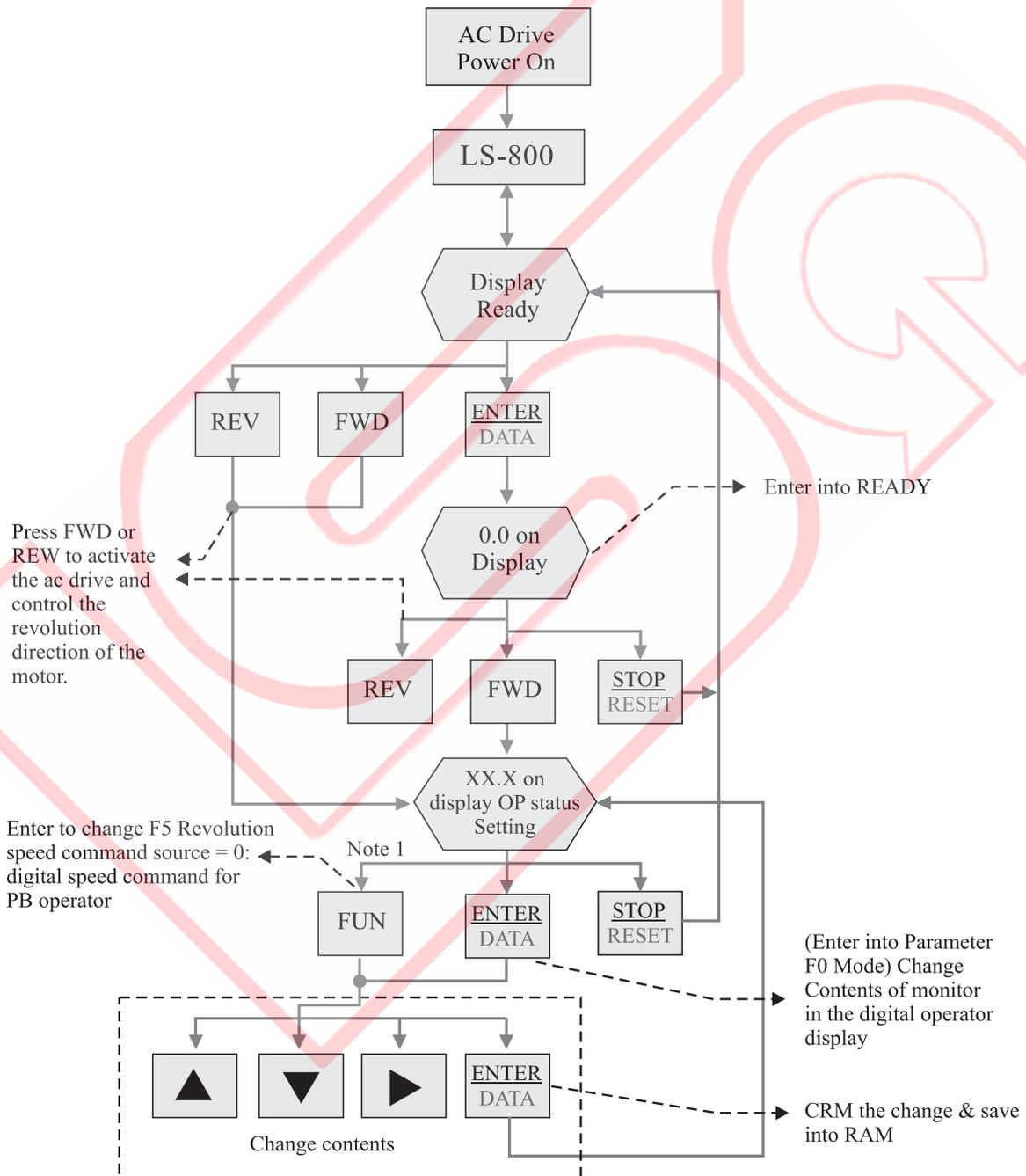


- Note 1: Make sure to save each and all parameter setting that have been confirmed and complied with the purpose as demanded in the commissioning into the built-in EEPROM by selecting F207 (save current parameter)= 1: Save to DSP (built-in EEPROM) to prevent loss of the parameter setting.
- Note 2: F207 (save current parameter)= 0: Not Save ; 1 : Save to DSP ; and 2 : Save to Digital Operator.

## 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 Schedule of Parameter Settings.

Operator Control Mode Flow



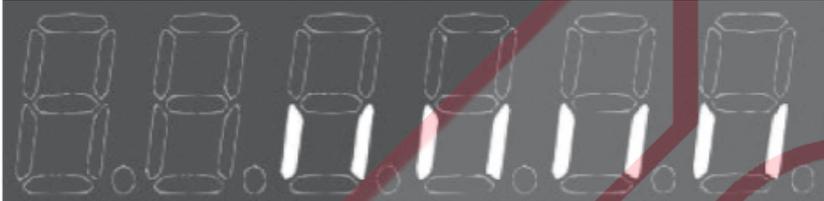
Note 1: If the speed signal source dose not fall on F5(revolution speed command source) = 0: PB Operator Mode. the digital speed command input is ineffective.

### 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 → F65 F64 F63 F62 F61 F60 F59 F59



← Display in OFF Status

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

Multi-function Parameter → F65 F64 F63 F62 F61 F60 F59 F59



← Display in ON Status

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

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

Multi-function Parameter → F66 F70 F69 F68 F67



← Display in ON Status

Multi-function Terminal → ↑ RL1 RL2 Do3 Do2 Do1

Ineffective

Multi-function Parameter → F66 F70 F69 F68 F67



← Display in OFF Status

Multi-function Parameter → ↑ RL1 RL2 Do3 Do2 Do1

Ineffective

# IV Commissioning

◆ Commissioning Operation.....	4-1
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## IV – COMMISSIONING –

---

### Commissioning Operation

#### # Inspection before Operation:

- ⊙ Upon completing the wiring and before feeding for commissioning, check to confirm that:
  1. If wiring is correct? "Input terminals R. S. T. shall be connected to the power source; and output terminals U. V. W., to the 3-phase induction motor." Never confuse the input and output connections.
  2. If any residual conductor cuttings left inside the ac drive and where around the area of the wiring terminal block? If any, clean it up.
  3. If all terminals and screws are firmly secured?
  4. If there is any short-circuit or grounding found between terminals?
  5. If the input source voltage is of the same grade of the rated voltage of the ac drive.

#### # Commissioning :

- ⊙ The ac drive has been ex-factory set at F126=2, i.e., the Open loop V/F Control Mode, or select the operation mode according to F126 as detailed in P5-28, and 29. F4=0, i.e., the operation control method is PB Operator; and F5=2, the speed 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 "ready".
  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 motor runs normally?
- ⊙ If the revolving direction of the motor is correct (switch any two phases among U.V.W. cables found on the output side of the ac drive to change the revolving direction of the motor.)
- ⊙ If there is any abnormal vibration observed from the motor?
- ⊙ If smooth acceleration and deceleration are available?
- ⊙ If any abnormality observed on the 3-phase load current? (Press keypad ENTER/DATA to enter parameter F0=31, 32, 33: i.e., the output current to monitor the U.V.W. output load amperage.)

## # Fast Operation Control Mode

- ◎ Many operation control methods may be applied for the ac drive to activate it to operate. Here is a summary operation method to activate the ac drive.
- ◎ Two primary operation control parameters involved in the activation of the ac drive; one is F4: Operation Control Source; and the other is F5: Speed Command Source. Refer to the table given below for the operation.

Parameter Function	Operation Procedure	Ex-factory Setting	Page No.
<b>F4 : Operation Control Source</b>			
0 : PB Operator	Press keypad <b>FWD</b> once Ready displays ↓ <b>Enter into Forward Operation Mode</b>	0	P5-2
	* During commissioning, watch for the revolving direction of the motor. *		
1 : Digital Input Terminal	Terminal Di1 /ON → FWD (indicator ON) operation, Dil/OFF→Stop		P5-2 P5-18
<b>F5 : Speed Command Source</b>			
0 : PB Operator	Enter into frequency to change mode by pressing keypad <b>FUN</b> while in operation status.	2	P5-3
1 : Digital Input Terminal	Edit from the multi-function input terminal the 8-stage preset frequency to execute operation.		P5-3
2 : Operator AV Input (5V)	To perform speed control from the potentiometer (V.R.) on the operator.		P5-3
3 : AV1 Input (±10V)	To perform speed control by entering 0 ~ ±10V from analog AV1 terminal.		P5-3
4 : AV2 Input (+10V)	To perform speed control by entering 0 ~ +10V from analog AV2 terminal.		P5-3
5 : AI Input (20mA)	To perform speed control by entering 0 ~ 20mA from analog AI terminal.		P5-3
6 : AV2+AI	With analog AV2 and AI terminals, addition and subtraction operation can be provided for both analog signals at the same time to perform revolving speed control.		P5-3
7 : Encoder 2	Additional PG-AB2 speed control card must be installed to connect to terminals A1 and B1 with digital pulse signals to perform revolving speed control.		P5-4

## Auto-tuning Function

### # Auto-tuning Elements

- ◎ If F126=4: Sensorless V/F vector Control, 5: Closed Loop Flux Vector Control, or 6: Sensorless Flux Vector Control is selected for the control mode; auto-tuning must be performed before operation.
- ◎ When F126=6 Sensorless Flux Vector Control is applied, select the motor with a rated voltage 20V (40V in case of 400 Grade) higher than the input source voltage of the ac drive where speed precision is a must within the high speed range (approximate 90% or greater of the rated speed). If the rated voltage of the motor is equal to that of the input source of the ac drive, then proper and correct motor characteristics may not be available if the output voltage of the ac drive is less than sufficient. (Refer to Prompt 1.)
- ◎ Before performing the function of parameter auto-tuning, the specification capacity on the nameplate of motor must be set to Parameter F120: Rated Voltage, F121: Rated Amperage, F122: Rated Frequency, F123: Rated speed, F124: Rated HP, and F125: Number of Polarity of Motor.
- ◎ Select F4 (Operation Control Signal Source) = 0: PB Operator Operation before performing the auto-tuning.



Upon performing the auto-tuning, the motor must be separated from the machine, and confirm that there is no exposure to danger even the motor is running.

### # Parameter Auto-tune

- ◎ 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 before setting up F126=1 for machinery parameter detection. Perform the auto-tuning according to the following steps:
  1. Set up the control mode (F126) at 0: Electric Parameter Detection to perform the parameter auto-tuning.
  2. Press keypad [ENTER] 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 F133~F137.

4. If F126=5 (Closed Loop Flux Vector Control) Mode is required, perform the F126=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 be performed, and the modulation setting will be saved into Parameter F138. (Refer to Prompt 2.)
5. Modify the control mode (F126) to 4: Sensorless V/F vector Control, 5: Closed Loop Flux Vector Control, or 6: Sensorless Flux Vector Control.
6. Save electric parameters into F207-1: Save to DSP (EEPROM) to avoid losing the electric parameters after power off.

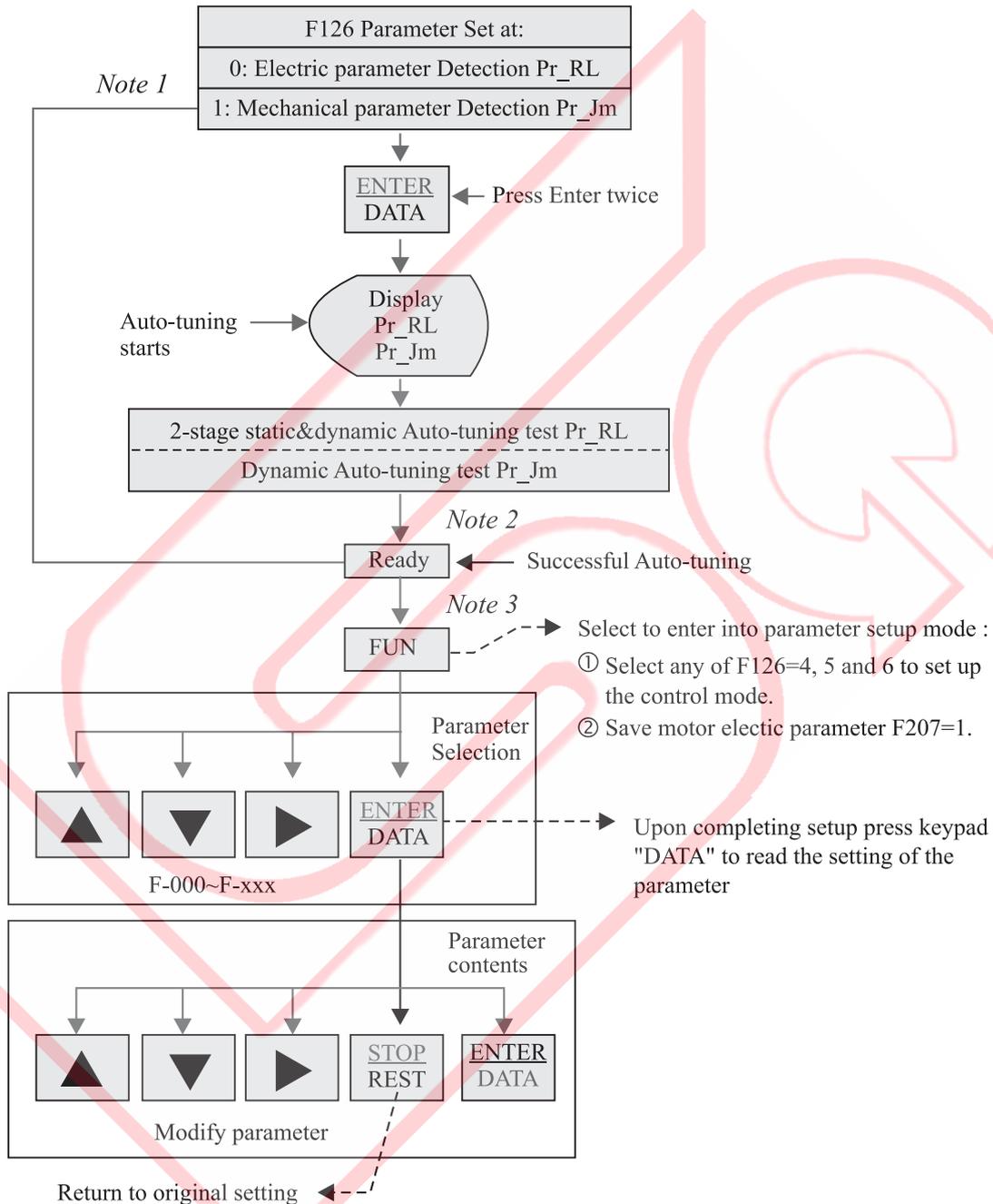
Note: If auto-tuning continues to fail, adjust for higher rated current of the motor at an increment of 10% until the auto-tuning modulation is successfully done. In case of further failure, replace with an electric machine provided with better characteristics, or input by manual electric parameters to F133~F137.

**PROMPT:**

1. With the speed precision highlighted within the high speed area (approximately 90% or greater of the rated speed, set F120 (Motor Rated Voltage) at 90% of F109 (Input Voltage) \* 1.1.
2. When Parameter F126 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.

# IV – COMMISSIONING –

## Auto-tuning Function Process Flow Chart



Note 1 : Run the Mechanical Parameter Detection right after the completion of electric parameter detection .

Note 2 : Motor electric characteristics are automatically set to corresponding parameter F133~F138.

Note 3 : ① Set up F126 back to the corresponding operation control mode; and

② Set up F207=1 save parameter.

# - COMMISSIONING - IV

## 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	1	0	P5-2	
0 : PB Operator      1 : Digital input terminal						
F5	Speed command source	0 ~ 8	1	2	P5-3	
0 : PB Operator      3 : AV1 Input (±10V)      6 : AV2+AI 1 : Digital input terminal      4 : AV2 input (+10V)      7 : Encoder 2 2 : Operator AV input (5V)      5 : AI Input (20mA or+10V)      8 : External PID						
F6	Activation Mode	0-2	1	0	P5-5	
0 : Started by activation F      1 : Flying Re-start activation      2 : DC brake & started by activation F						
F7	Stop Mode	0-2	1	1	P5-5	
0 : Free-run      1 : Dynamic stop      2 : Dynamic DC brake						
F13	Revolution limit	0-3	1	1	P5-7	
0 : FWD & REV      1 : FWD Only      2 : REV only      3 : REV only with negative baize						
F14	F lower limit(* F14 ≤ F15)	0~400.0	0.1Hz	0	P5-7	
F15	F upper limit(* F15 ≥ F14)	0~400.0	0.1Hz	60.0	P5-7	
F26	Acceleration Time 1	.1~1200.0	0.1 sec	10.0	P5-9	
F27	Deceleration Time 1	.1~1200.0	0.1sec	10.0	P5-9	
F59	DI1、DI2 Setup	0, 1	1	0	P5-18	
0 : DI1(FWD/STOP) · DI2(REV/STOP)      1 : DI1(RUN/STOP) · DI2(FWD/REV)						
F81	Stall Prevention	0, 1	1	0	P5-24	
0 : Not Activated      1 : Activated						
F82	Stall voltage setup	1.00~1.25	0.01	1.10	P5-24	
F83	Stall amperage setup	0.50~2.50	0.01Pu	1.50	P5-24	
F84	OL amperage level	1.00~2.50	0.01Pu	1.50	P5-25	
F85	OL time allowance	0.1~120.0	0.1 sec	60.0	P5-25	
F86	Leakage current outputted or unbalanced 3-phase output current	0.001~0.500	0.001Pu	0.100	P5-25	
F90	Discharge brake loop activated	0, 1	1	0	P5-26	
0 : Not Activated      1 : Activated						
F108	PWM switch frequency	2000~16000	1Hz	5000	P5-30	
F109	RST input voltage(rms)	180~500	1VAC	N (Note1)	P5-31	
(* F109 setting must satisfy : F109 ≤ 1.2×F120)						
F120	Motor Nameplate Information	Rated voltage (rms)	180~500	1V	N (Note1)	P5-32
F121		Rated amperage (rms)	1.5~130.0	0.1A	N (Note1)	P5-32
F122		Rated frequency	50.0~70.0	0.1Hz	N (Note1)	P5-32
F123		Rated speed	0~4200	1rpm	N (Note1)	P5-33
F124		HP	.5~50.0	0.1Hp	N (Note1)	P5-33
F125		No.of Pole	2~12	2 pole	N (Note1)	P5-33
F126	Control mode setup	0-6	1	2	P5-33	
0 : Electric parameter detection      3 : Closed loop V/F vector control      5 : Closed loop flux vector control 1 : Mechanical parameter Detection      (V/F + Feedback)      (Flux vector control+ feedback) 2 : Open loop V/F vector control      4 : Sensorless V/F vector control      6 : Sensorless flux vector control						
F127	Speed feedback	0, 1	1	0	P5-34	
0 : no feedback      1 : Encoder1						
F128	Encoder 1 Slot No./Revolution	600~2500	1P/rev	1024	P5-34	
F129	Encoder 1 Direction	-1~1	1	1	P5-34	
-1 : B leads A      0 : single phase feed back      1 : A leads B						

IV – COMMISSIONING –

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# V Description of Parameter Functions

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# V – DESCRIPTION OF PARAMETER FUNCTIONS –

## Operation Status Monitor Setup

Parameter	Description	Range	Unit	Ex-factory Setting
F0	Operator display variables selections	0~36	1	1

◎ Seven digits display and LED indicators on the operator panel may be applied to monitor a total of 35 operation status or settings of the ac drive.

Setting	Function	Description of Function	Related Parameter
0	Speed Command	Display the command setting	F5
1	Output Motor Speed	Display the output motor speed value.	—
2	Feedback Speed 1	Display the actual speed of the motor feedback to Encoder 1.	F128
3	Feedback Speed 2	Display the product of Encoder 2 feedback speed and F132 multiplying factor.	F130、F132
4	Sensorless Vector Output Speed	Display the calculated sensorless vector control output speed.	F126=6
5	Output Frequency	Display the compensated output frequency of the closed loop scalar or vector control.	F126=3.4.5.6
6	Output Process Speed	Display the linear speed, feeding speed of the process (with maximum display value at 3276.7).	F2.F123
7	Slip Frequency	Display the slip Frequency due to load when the motor is on load	F126=3.4.5.6
8	Vdc (V)	Display DC voltage on the DC bus capacitor	—
9	Output Voltage (rms)	Display the output (U.V.W) voltage (rms) of the ac drive.	
10	Excitation Voltage	Display the excitation voltage in vector control mode	
11	Torque Voltage	Display the torque voltage in vector control mode	
12	Output Current (rms)	Display the total drive motor load current from output of ac drive (U.V.W)	—
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 Apparent Power	Display the total output apparent power $P=IV$	
18	Output True Power (rms)	Display the total true power $P=VI \cos\varphi$	
19	Output Reactive Power	Display the total reactive power $P=VI \sin\varphi$	
20	Temperature	Display the temperature reading of the internal heat sink	F87
21	Counts	Display the counter value of the built-in summary counter.	F75
22	Digital Input Status	Display the digital input and output terminals control status for real-time display of ON or OFF status (for status monitor, refer to P3-5).	F59~F65
23	Digital Output Status		F66~F70
24	Digital Operator AV (%)	<ul style="list-style-type: none"> <li>• Display the analog input voltage as displayed</li> <li>• Display the noise voltage generated by the wiring; the voltage may be used to set up the bias voltage for avoiding unnecessary noise interference.</li> </ul>	F5=2
25	AV1 (%)		F5=3
26	AV2 (%)		F5=4
27	AI (%)		F5=5

# - DESCRIPTION OF PARAMETER FUNCTIONS - V

## Operation control parameters

Setting	Function	Description of Function	Related Parameter
28	Vdc_0	Display the initial Vdc of the DC bus when powered on capacitor	—
29	Cycles & Multiple Stages	Display the cycles of automatic operation, and the number of operation stages currently executed	F92~F100
30	Reserved	Reserved	
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 %	
36	LS800 Version	The version of LS800 Software.	

F1	Speed display unit	0~1	1	0
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◎ Frequency (Hz) or revolution per minute (rpm) can be displayed for the output operation speed of the ac drive to be set by this parameter while displaying any function selected from the status displayed by F0 operator.

- **0 : Frequency(HZ)**
- **1 : Revolution per minute(rpm)**

F2	Display Multiplying Factor for process speed display	0.001~10.000	0.001	1.000
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- ◎ This function may be applied to set up a multiplying factor to display linear speed, feeding speed or the output of the final mechanical real rpm after reduction ratio.
- ◎ The display value of the 7-digits display = output rpm × F2 multiplying power (with the maximum display value at 3276.7).

F3	Operator Display Update constant LPF time	0~15	1	2
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- ◎ This function filters the variation of low byte display value in order to read the display status number.
- ◎ Long constant setting is not recommended as it will affect the response speed of the displayed number.
- ◎ This function relates to the built-in low pass filter.

F4	Operation Control Source	0~1	1	0
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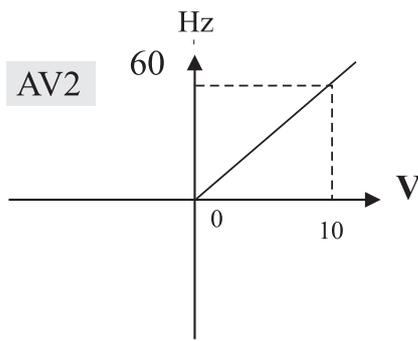
- \* **Before operating the ac drive, operation control command must first be given. User may select the operation control input between PB Operator or Digital Input Terminal.**
  - **0 : PB Operator** — Activation to start, forward direction, reverse direction and stop operation of the ac drive are all controlled by the PB operator.
  - **1 : Digital Input Terminal** — Activation to start, forward direction, reverse direction, and stop operation of the ac drive are all controlled by the digital input terminals.

## V – DESCRIPTION OF PARAMETER FUNCTIONS –

Parameter	Description	Range	Unit	Ex-factory Setting
F5	Speed Command Source	0~8	1	2

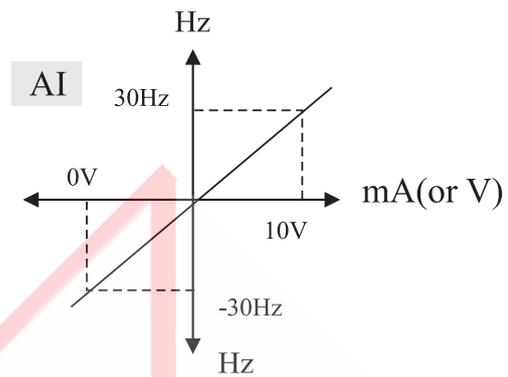
- \* **This parameter relates to the speed command of the ac drive. The following nine options of speed commands are available for selection, depending on required configuration of the control system.**
- \* **Once the inching speed function setup becomes effective, it has the highest control priority is over the other nine speed commands and permits adaptation of any other type of speed command for alternative control.**
- **0 : PB Operator** – Control is set up by keypad [Increase] and [Decrease] from the PB Operator, or by functions 11: Master Speed Increase, and 12: Master Speed Decrease Control of the multi-function programmable digital input terminals.
  - **1 : Digital Input Terminal** – 8-stage preset frequency comprises of 5: Multi-stage speed 1, 6: Multi-stage Speed 2, and 7: Multi-stage Speed 3, 8: Multi-stage Speed 4, and 9: Inching Operation Control by multi-function programmable digital input terminals total 16 preset speeds.
  - **2: (Operator) AV input (5V)** – Control by potentiometer (V.R) signals DC0~5V from the operator.
  - **3 : AV1 Input ( $\pm 10V$ )** – Control by analog voltage signal DC0~ $\pm 10V$  from analog input terminal AV1.
  - **4 : AV2 Input (+10V)** – Control by analog voltage signal DC0~+10V from analog input terminal AV2.
  - **5 : AI Input (20mA)** – Control by analog current signal DC0~20mA (or DC0~+10V to be selected from SW1~5) from analog input terminal AI.
  - **6 : 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), AV2 of F49=100% F48=0V(with a bias of 0%) (see Fig.1 for the curve of Hz vs.V).**
- (2) AI of F54=50%. F53= -50%(with a bias of 50%). (See Fig. 2 for the curve of Hz vs. mA (or V).**

# - DESCRIPTION OF PARAMETER FUNCTIONS - V



(Fig 1)

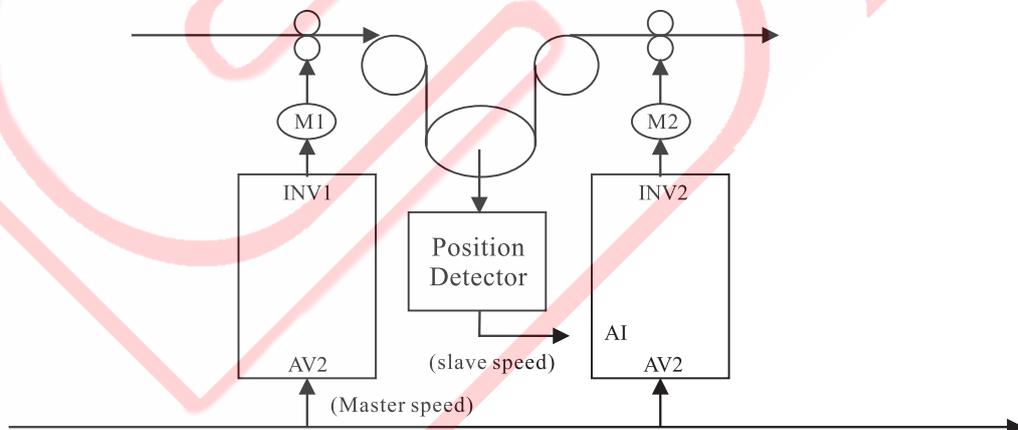
Performing Calculation of Addition and Subtraction (Note 1)



(Fig 2)

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

**\* For example: 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.**



(Fig 3)

- **7 : Encoder 2** — Relates to the control interface for the speed command of the digital 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).

(Refer to encoder setup parameter group F127~F132 for related application.)

- **8 : External PID** — To perform external analog signals for PID feedback control. [Select parameter setup PID setpoint value and PID feedback value for its input control terminals, and PID parameter group F157~F171.]

## V – DESCRIPTION OF PARAMETER FUNCTIONS –

Parameter	Description	Range	Unit	Ex-factory Setting
F6	Activation Method	0~2	1	0

- **0 : Started by Activation Frequency** — The activation 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.



WARNING

To use the function of flying re-start, select 3: Closed Loop v/f vector Control in F126 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 F126 control mode.

F 7	Stop Mode	0~2	1	1
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- 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 : DC Brake Stop** — DC brake is enabled when the output frequency reduces according to the deceleration rate to the value to start the brake for stopping. This enables the motor to stop soonest. Refer to those related parameters of F10~F12.

## - DESCRIPTION OF PARAMETER FUNCTIONS - V

Parameter	Description	Range	Unit	Ex-factory Setting
F8	Brake Time before Activation	0~30.0 Sec	0.1 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.

**\* Parameter F6=2 must be set up when DC brake function before activation must be used, and the frequency operation is activated once again immediately following the brake time expiry.**

F9	Voltage of Brake before Activation	0~.200	0.001Pu	.050
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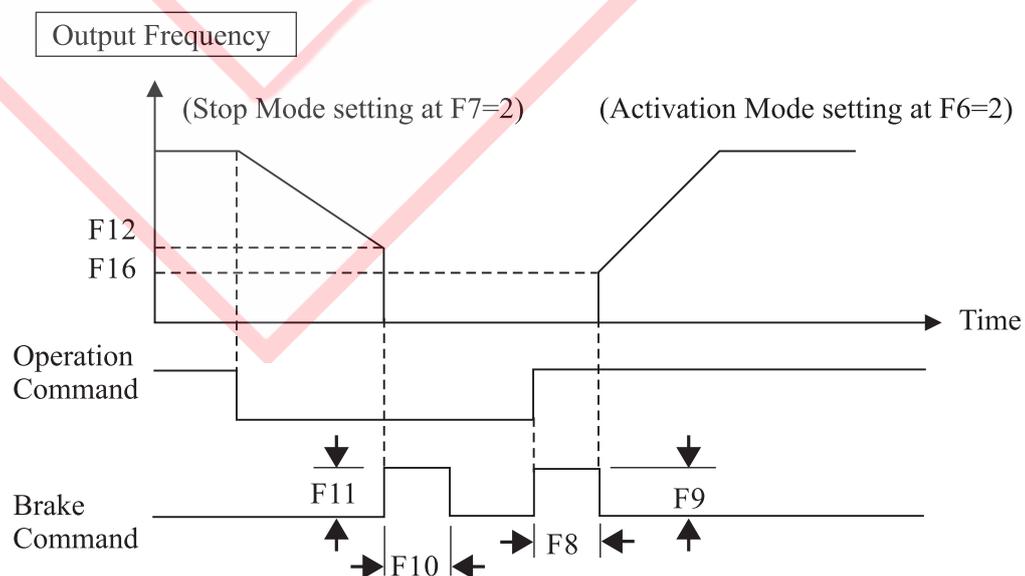
- ◎ This parameter sets up the percentage of the output DC brake voltage before the operation of the ac drive. If it is set at its minimum, i.e., "0", the output brake energy is void, and will be deemed as a control for the deferred time operation of the drive activation. The length for the time deferred is the setting of F8.

F10	Stop Brake Time	0~30.0 Sec	0.1 Sec	5.0 Sec
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F11	Stop Brake Voltage	0~.200	0.001Pu	.050
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F12	Stop Brake Beginning Frequency	0~20.0HZ	0.1HZ	0HZ
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- ◎ This parameter group sets the frequency to begin the DC brake voltage 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 Voltage at the minimum, i.e., "0" since there is no time or brake energy is available for operation.



# V – DESCRIPTION OF PARAMETER FUNCTIONS –

## Speed Limit

Parameter	Description	Range	Unit	Ex-factory Setting
F13	Rotating Direction Control	0~3	1	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 (F41, F42, F48, and F53)]

◎ When executing functions of external PID control and setting negative bias, the motor will be in REV operation driven by ac drive while PID Loop output value within -(%) and will be in FWD operation while PID Loop output value within +(%).



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.

F14	Lower Limit Frequency	0~400.0HZ	0.1HZ	0
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◎ The conditional:  $F14 \leq F15$ .

F15	Upper Limit Frequency	0~400.0HZ	0.1HZ	60.0
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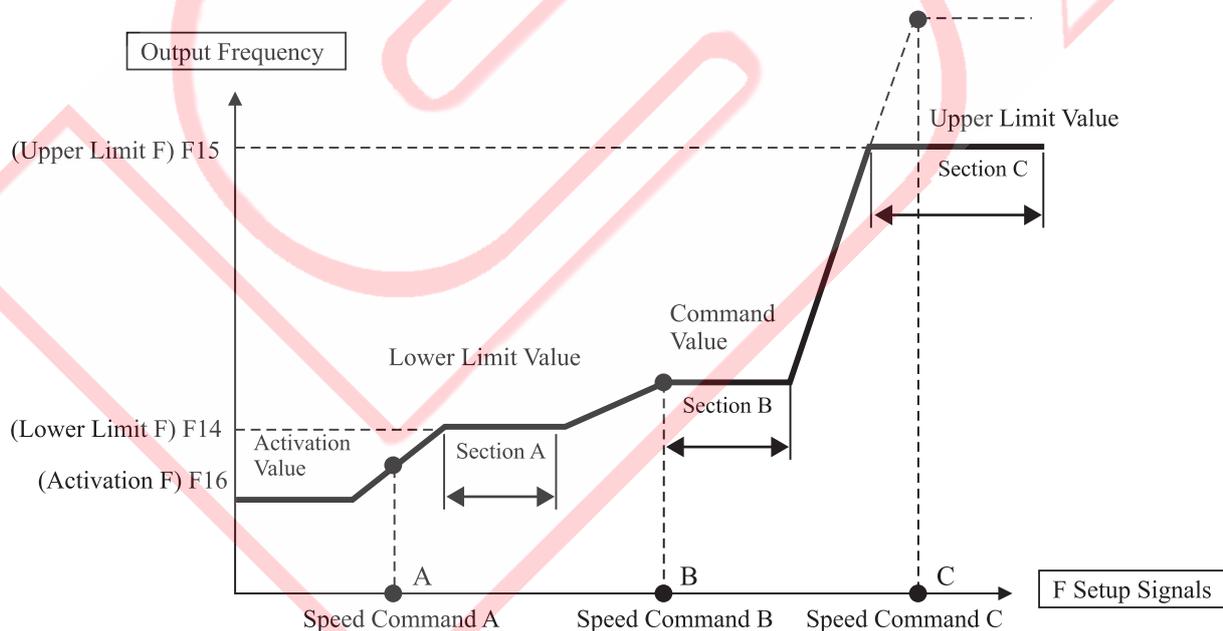
**\* Proper upper and lower frequency limit settings could help protect the mechanical system. Any wrong speed command given by the operator shall not cause damage to the system due to machine idling or operation in dangerously high speed.**

**\* The conditional:  $F15 \geq F14$ .**

## - DESCRIPTION OF PARAMETER FUNCTIONS - V

Parameter	Description	Range	Unit	Ex-factory Setting
F16	Activation Frequency	0~30.0HZ	0.1HZ	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).



## V – DESCRIPTION OF PARAMETER FUNCTIONS –

### Multi-stage Speed Command Setup

Terminal Command →	Inching Command	Multi-stage Command3	Multi-stage Command2	Multi-stage Command1	Setup Range	Unit	Ex-factory Setting	
F17	Master	OFF	OFF	OFF	0~400.0HZ	0.1HZ	60.0HZ	
F18	Stage 1	OFF	OFF	ON	0~400.0HZ	0.1HZ	5.0HZ	
F19	Stage 2	OFF	OFF	ON	OFF	0~400.0HZ	0.1HZ	10.0 HZ
F20	Stage 3	OFF	OFF	ON	ON	0~400.0HZ	0.1HZ	15.0 HZ
F21	Stage 4	OFF	ON	OFF	OFF	0~400.0HZ	0.1HZ	20.0 HZ
F22	Stage 5	OFF	ON	OFF	ON	0~400.0HZ	0.1HZ	30.0 HZ
F23	Stage 6	OFF	ON	ON	OFF	0~400.0HZ	0.1HZ	40.0 HZ
F24	Stage 7	OFF	ON	ON	ON	0~400.0HZ	0.1HZ	50.0 HZ
F25	Inching	ON	×	×	×	0~400.0HZ	0.1HZ	5.0 HZ

**ATTENTION - The inching operation has the top priority over any speed from the master through Stage 7 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.**

- ◎ 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 9 stage speeds) in the form of binary 3bit and must be done through those multi-function input terminals (F60~F65).
- ◎ Parameters F91~F100 may be selected for the programmable automatic operation to execute those eight stages of preset frequency. Control is done by multi-function input terminals 13: Automatic Operation and 14: Automatic Operation Control suspended, and the operation display status operation 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 F93~F100.

	Internal Time Allotment	Multi-stage Speed				
F26	Acceleration time 1	Master /Stage 8 Speed	Stage 4 / 12 Speed	0.1~1200.0	0.1 Sec	10.0 Sec
F27	Deceleration time 1			0.1~1200.0	0.1 Sec	10.0 Sec
F28	Acceleration time 2	Stage 1 / 9 Speed	Stage 5 / 13 Speed	0.1~1200.0	0.1 Sec	10.0 Sec
F29	Deceleration time 2			0.1~1200.0	0.1 Sec	10.0 Sec
F30	Acceleration time 3	Stage 2 /10 Speed	Stage 6 /14 Speed	0.1~1200.0	0.1 Sec	10.0 Sec
F31	Deceleration time 3			0.1~1200.0	0.1 Sec	10.0 Sec
F32	Acceleration time 4	Stage 3 / 11 Speed	Stage 7 / 15 Speed	0.1~1200.0	0.1 Sec	10.0 Sec
F33	Deceleration time 4			0.1~1200.0	0.1 Sec	10.0 Sec
F34	Inching Acceleration Time			0.1~1200.0	0.1 Sec	5.0 Sec
F35	Inching Deleceleration Time			0.1~1200.0	0.1 Sec	5.0 Sec

# - DESCRIPTION OF PARAMETER FUNCTIONS - V

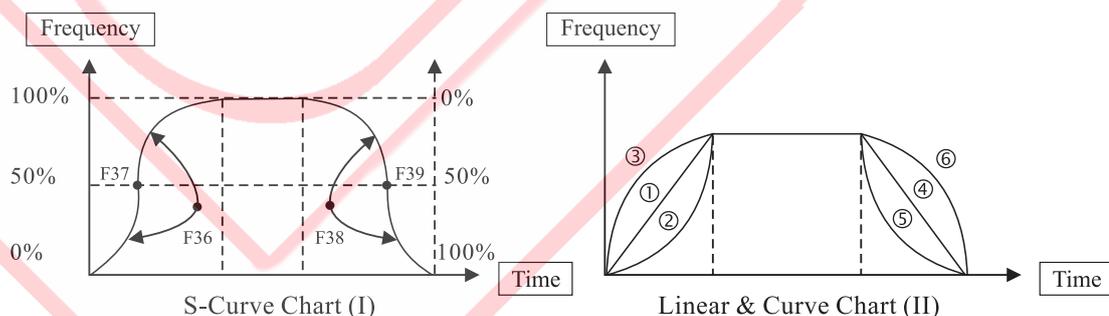
- ⊙ The time duration set for acceleration or deceleration determines the increasing or decreasing speed of output frequency. F122: rated frequency is the reference frequency for the acceleration or deceleration of time.
- ⊙ There are four sets of independent acceleration/deceleration time settings available for the allotment of internal acceleration/deceleration time (as shown in the table given above) either by Parameter F40 or through those multi-function input terminals (F60~F65 functions 9: Acceleration/Deceleration Time 1, and 10: Acceleration/Deceleration Time 2).
- ⊙ Inching acceleration/deceleration time settings are only available for the operation at inching speed.



**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.**

F36	Acceleration curvature	0~100%	1%	0%
F37	Acceleration curves intersection point	0~100%	1%	50%
F38	Deceleration curvature	0~100%	1%	0%
F39	Deceleration curves intersection point	0~100%	1%	50%

- ⊙ Settings for acceleration/deceleration linear, curve and S curve changes can be adjusted by applying acceleration/deceleration curvatures and acceleration/deceleration curves intersection point depending on the requirements of the machine to effectively reduce the impacts on the system when the ac drive starts or stops.



- ⊙ Amplitudes of acceleration/deceleration and the curves intersection point can be respectively set through F36~F39.

**Example 1 :** F36(curvature)=1 ~ 100%  
 (Curvature features protrusion at top and recess at bottom)  
 F37 (intersection point)= 50%  
 (Adjusting upper and lower intersection points)  
 F38 (curvature)= 1 ~ 100%  
 (curvature features protrusion at top and recess at bottom)  
 F39 (intersection point) = 50%

**Example 2 :** When ① F36=0%,  
 ④ F38=0% the curve relates to a linear one, and F37 and F39 are disabled.  
 ② F36=1 ~ 100% , F37=100%  
 ⑤ F38=1 ~ 100% , F39=0%  
 ③ F36=1 ~ 100% , F37=0%  
 ⑥ F38=1 ~ 100% , F39=100%

## V – DESCRIPTION OF PARAMETER FUNCTIONS –

Parameter	Description	Range	Unit	Ex-factory Setting
F40	Multi-stage acceleration/ deceleration time allotment	0~2	1	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 F26~F33 table or Table 1 given below.)
- **1: Half Internal Allotment and another Half External Terminals** – Master speed through Stage 3 speed are respectively allotted internally based on the individual acceleration/deceleration time; and stage 4 speed through stage 7 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: External Terminals** – Acceleration/deceleration time of eight 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	Master	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7
	Stage 8	Stage 9	Stage 10	Stage 11	Stage 12	Stage 13	Stage 14	Stage 15
0 : Internal Allotment	1	2	3	4	1	2	3	4
1 : Internal/External Allotment	1	2	3	4	External (Multi-function digital input) terminals			

(Table 2)

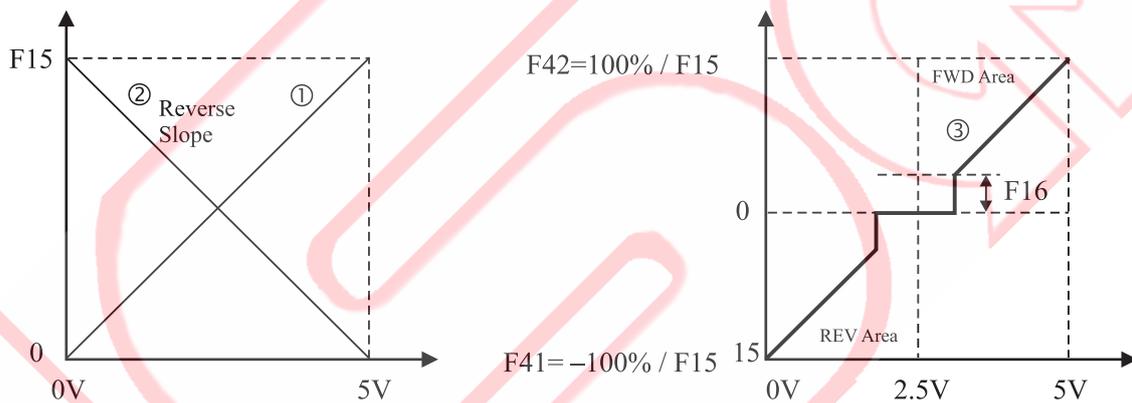
Digital Terminal Acceleration/ Deceleration Time	DIn	DIn
	2	1
Acceleration/Deceleration 1	OFF	OFF
Acceleration/Deceleration 2	OFF	ON
Acceleration/Deceleration 3	ON	OFF
Acceleration/Deceleration 4	ON	ON

# - DESCRIPTION OF PARAMETER FUNCTIONS - V

## Analog Frequency Commands

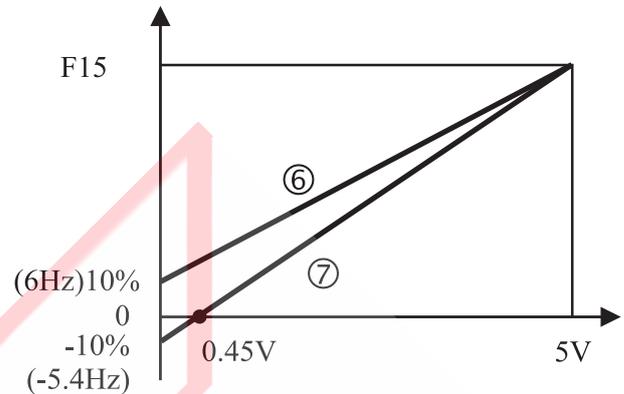
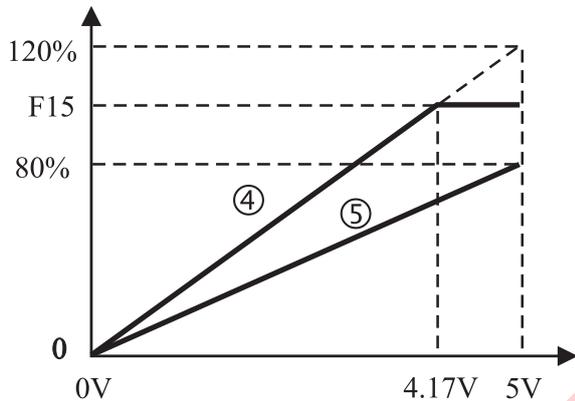
Parameter	Description	Range	Unit	Ex-factory Setting
F41	Operator Analog AV : 0V bias Ratio	-300.00~300.00	%	0.00%
F42	Operator Analog AV : 5V Gain Ratio	-300.00~300.00	%	100.00%

◎ Parameters F41 and F42 are used to define the knob (VR)/AV analog signal command setting of the operator. The bias ratio corresponding to Parameter F41/0V may be set up a set of negative bias to avoid noise interference at 0V, or for the application by other control; Parameter F42/5V is related to gain frequency and will be subject to F15 upper limit frequency at the optimal output. (Refer to those examples of five basic curves given below.)



	Curve ①	Curve ②	Curve ③
F5 Speed Command Source	2 : AV/5V	2 : AV/5V	2 : AV/5V
F13 Rotation Direction	1 : FWD only	1 : FWD only	3 : REV with negative bias
F15 Upper Limit Frequency	60HZ	60HZ	60HZ
F16 Activation Frequency	0HZ	0HZ	3HZ
F41 Operator AV:0V Bias Ratio	0.0%	100%	-100%
F42 Operator AV:5V Gain Ratio	100%	0.0%	100%

# V – DESCRIPTION OF PARAMETER FUNCTIONS –



- \* 1. Maximum AV output  $F = (F15)$  upper limit frequency  $\times (F42)$  Gain ratio
- 2. If the maximum AV output frequency is greater than the setting for  $(F15)$  upper limit frequency, the latter will govern the maximum output (e.g., Curve ④).

- \* 1. Bias Frequency =  $(F15)$  upper limit frequency  $\times (F41)$  bias Gain ratio (e.g., Curve ⑥)
- 2. Negative bias voltage =  $(AV) 5V / [(F41) \times 10\% + (F42) \times 100\%] \times (F41) \times 10\%$  (e.g., Curve ⑦).

	Curve ④	Curve ⑤	Curve ⑥	Curve ⑦
F5 Speed Command Source	2 : AV/5V	2 : AV/5V	2 : AV/5V	2 : AV/5V
F15 Upper Limit Frequency	60HZ	60HZ	60HZ	60HZ
F41 Operator AV:0V bias Ratio	0.0%	0.0%	10%	-10%
F42 Operator AV:5V Gain Ratio	120%	80%	100%	100%

F43	Analog Voltage AV1: -10 Gain Ratio	-300.00~300.00	%	-100.00%
F44	Analog Voltage AV1:10V Gain Ratio	-300.00~300.00	%	100.00%
F45	Analog Voltage AV1 Dead Band Voltage	0.00~50.00	%	0.00%
F46	Analog Voltage AV1 Zero-point Output Gain	0.00~50.00	%	0.00%
F47	Analog Voltage AV1 Maximal Output Limit	10.00~100.00	%	100.00%

## - DESCRIPTION OF PARAMETER FUNCTIONS - V

- ① 1. Parameters F43~F47 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.
- ② 2. F45 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.
- ③ 3. Parameters F46 and F47 relate to AV1 analog input signals to allow the zero-point output and maximum output settings through A/D converter controlled parameter module output.
- ④ 4. Dead Band voltage =  $\pm 10 \text{ Vdc} * (\text{F45}) * 10\% \div [(\text{F44})\% - (\text{F43})\%] \div 2$
- ⑤ 5. Zero-point output frequency =  $(\text{F15}) \text{ upper limit frequency} * (\text{F46})\%$
- ⑥ 6. Maximum output frequency =  $(\text{F15}) \text{ upper limit frequency} * (\text{F47})\%$

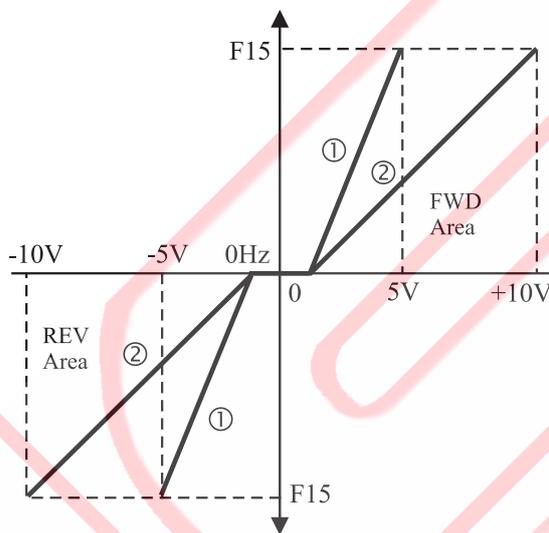


Fig. 1

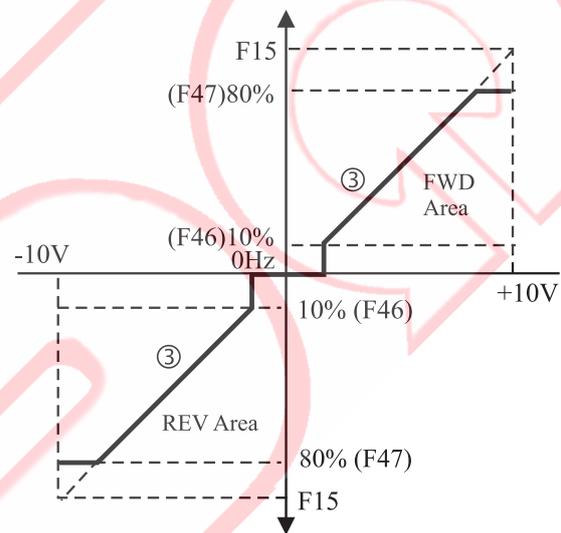


Fig. 2

**\* Refer to the Description Given Below According to the Chart Given Above :**

	Curve ① Fig. 1	Curve ② Fig. 1	Curve ③ Fig. 2
F5 Speed Command Source	3 : AV1/±10V	3 : AV1/±10V	3 : 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
F43 -10V:Negative Gain Ratio	-200%	-100%	-100%
F44 10V: Gain Ratio	200%	100%	100%
F45 Dead Band Voltage	10%	10%	10%
F46 Zero-point Output Gain	0.0%	0.0%	10%
F47 Maximal Output Limit	100%	100%	80%

## V – DESCRIPTION OF PARAMETER FUNCTIONS –

Parameter	Description	Range	Unit	Ex-factory Setting
F48	Analog Voltage AV2 : 0 Bias Ratio	-300.00~300.00	%	0.00%
F49	Analog Voltage AV2:10V Gain Ratio	-300.00~300.00	%	100.00%
F50	Analog Voltage AV2: Dead Band Voltage	0.00~50.00	%	0.00%
F51	Analog Voltage AV2 Zero-point Output Gain	0.00~50.00	%	0.00%
F52	Analog Voltage AV2 Maximal Output Limit	10.00~100.00	%	100.00%
F53	AI : 0mA(or 0V) Bias Ratio	-300.00~300.00	%	0.00%
F54	AI : 20mA(or 0V) Gain Ratio	-300.00~300.00	%	100.00%
F55	AI Dead Band Voltage	0.00~50.00	%	0.00%
F56	AI Zero-point Output Gain	0.00~50.00	%	0.00%
F57	Analog current AI, Maximal Output Limit	10.00~100.00	%	100.00%

- ◎ Voltage signals of Analog input terminals AV2 (0~10V) and current (or voltage) signals of AI (0~20mA 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 (F48, F53), Gain Ratio (F49, F54), and Dead Band Voltage (F50, F55) are sufficient to cope with different control requirements for parameter setup; and may set up the zero-point output (F51, F56) and maximum output limit (F52, F57) through parameters under the control of A/D converter.  
(Refer to examples of 11 types of basic curves.)

# - DESCRIPTION OF PARAMETER FUNCTIONS - V

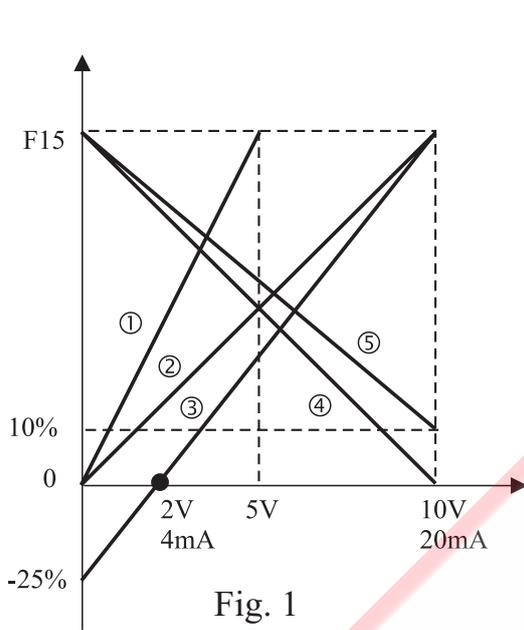


Fig. 1

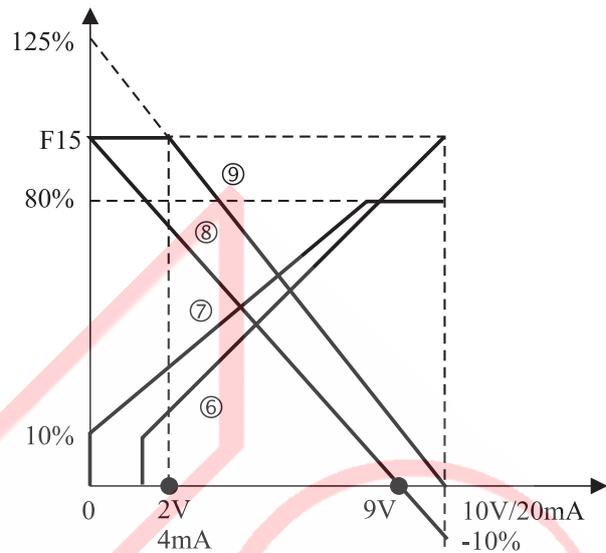


Fig. 2

**\* 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 Speed Command Source	4:AV2/10V	4:AV2/10V	4:AV2/10V	4:AV2/10V	4:AV2/10V
F15 Upper Limit Frequency	60HZ	60HZ	60HZ	60HZ	60HZ
F48、F53 0V(0mA) Bias Ratio	0.0%	0.0%	-25%	100%	100%
F49、F54 10V(20mA) Gain Ratio	200%	100%	100%	0.0%	10%
F50、F55 Dead Band Voltage	0.0%	0.0%	0.0%	0.0%	0.0%
F51、F56 Zero-point Output Gain	0.0%	0.0%	0.0%	0.0%	0.0%
F52、F57 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 Speed Command Source	4:AV2/10V	4:AV2/10V	4:AV2/10V	4:AV2/10V
F15 Upper Limit Frequency	60HZ	60HZ	60HZ	60HZ
F48、F53 0V(0mA) Bias Ratio	0.0%	0.0%	100%	125%
F49、F54 10V(20mA) Gain Ratio	100%	100%	-10%	0.0%
F50、F55 Dead Band Voltage	10%	0.0%	0.0%	0.0%
F51、F56 Zero-point Output Gain	10%	10%	0.0%	0.0%
F52、F57 Maximum Output Limit	100%	80%	100%	100%

# V – DESCRIPTION OF PARAMETER FUNCTIONS –

## Multi-Function Input Terminal

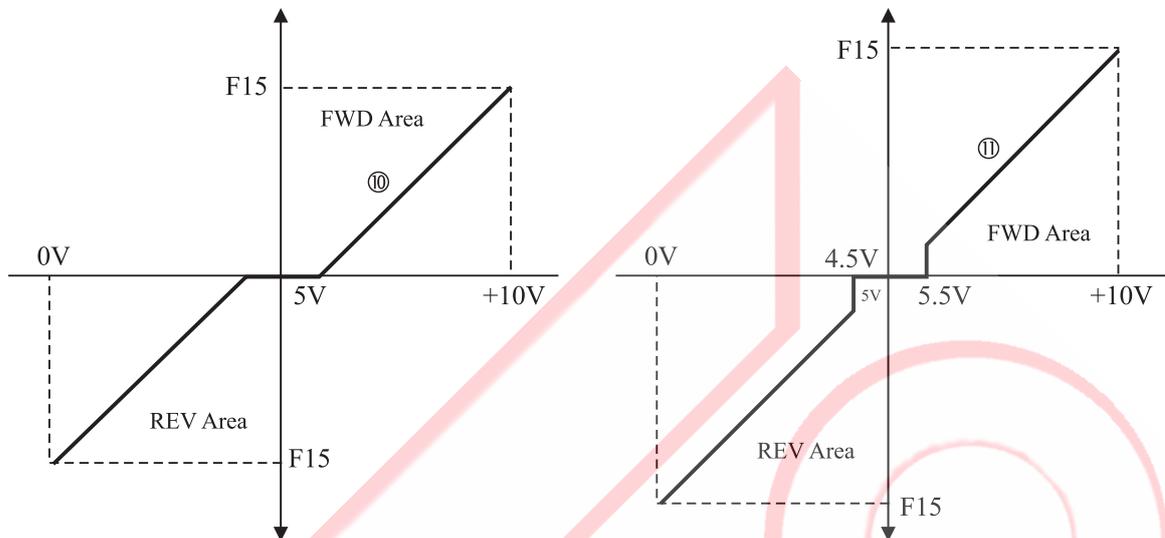


Fig. 3

\* Refer to the Description Given Below According to the Chart Given Above Fig. 3 :

	Curve ⑩	Curve ⑪
F5 Speed Command Source	4:AV2/10V	4:AV2/10V
F13 Rotation Direction Limit	3:REV with negative bias	3:REV with negative bias
F15 Upper Limit Frequency	60HZ	60HZ
F48 、 F53 0V(0mA)Bias Ratio	-100%	-100%
F49 、 F54 10V(20mA) Gain Ratio	100%	100%
F50 、 F55 Dead Band Voltage	10%	10%
F51 、 F56 Zero-point Output Gain	0.0%	10%
F52 、 F57 Maximum Output Limit	100%	100%

F58	Digital Terminal Scan Cycle	1~5000	1 = 0.2ms	10×0.2ms=2ms
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- ◎ This function filters the multi-function input terminals to prevent CUP malfunction due to noise interference or switching ejection.
- ◎ The scan cycle of this function will affect the response time of the multi-function input terminal. The user is advised to make proper adjusting of the setting as applicable.
- ◎ Scan time = setting × 0.2 ms (1 ms = 10<sup>-3</sup> s)

# - DESCRIPTION OF PARAMETER FUNCTIONS - V

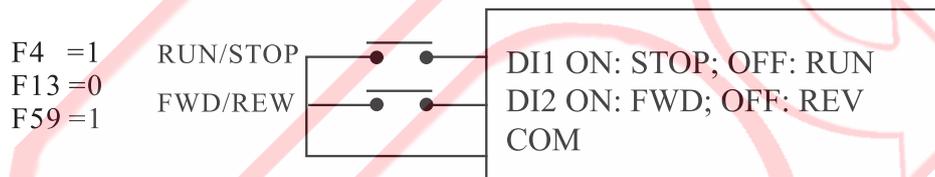
Parameter	Description	Range	Unit	Ex-factory Setting
F59	DI1, DI2, Setup	0.1	Non	0

⊙ This function sets up only terminals DI1 and DI 2, and only corresponding to 2-way operation controls and adaptation to the multi-function 1: 3-way Operation (DI3) control. All other functions do not fall with the operation scope of DI1 and DI2.

■ **F59=0 : 2-Way Control- DI1(FWD/STOP), DI2(REV/STOP).**



■ **F59=1 : 2-Way Control- DI1(RUN/STOP), DI2(FWD/REV).**



■ **F60=1 : 3-Way Control Operation (DI3)**, (Any input terminals from DI3~DI8 may define this function in conjunction with DI1, DI2 terminals of F59.)



Parameter	Designation	Description	Range	Unit	Ex-factory Setting
F60	DI3 Setup	⊙ Multi-function input terminals may be set up for particular use as desired. To apply such function Refer to description of function.	0	1	2
F61	DI4 Setup				4
F62	DI5 Setup				5
F63	DI6 Setup	⊙ No specific sequence is specified for the function of these six terminals; however, the setting should never be repeated with the exception of the setting of 0: Disabled.	21	1	6
F64	DI7 Setup				9
F65	DI8 Setup				18

# V – DESCRIPTION OF PARAMETER FUNCTIONS –

- **0: Disabled** – This function allows the function input terminal function to be in the states of being disabled, thus to prevent any malfunction for cause not identified.
- **1:3-Way Control** – (Refer to 3-way control wiring diagram). RUN terminal relates to internally latched contact-a terminal; STOP terminal, contact-b terminal to release RUN from its latched status. FWD and REV may be switched between each other as desired.
- **2:Input in Case of External Abnormality (NO)** – relates to Contact-b in case of external normal status; and Contact-a in case of abnormality, the ac drive trips to stop outputting.
- **3:Input in Case of External Abnormality (NC)** – relates to Contact-a in case of external normal status; and Contact-b in case of abnormality, the ac drive trips to stop outputting.
- **4:RESET** – When the ac drive trips due to abnormality, RESET command is used to release the abnormality status.



INHIBIT

Never operate the RESET command in a constantly closed (ON) status.

■ <b>5 : Multi-stage command 1</b>	Multi-stage commands 1, 2, 3 and 4 may be in the format of binary 4-bit edited into 16-stage speed for operation control. (Refer to Table 1, P5-20.)
■ <b>6 : Multi-stage command 2</b>	
■ <b>7 : Multi-stage command 3</b>	
■ <b>8 : Multi-stage command 4</b>	

- **9: Inching Operation** – Once executed, the inching command has priority over any other speed command; therefore, it is impossible to select any other type of speed operation while the inching operation is being executed.

■ <b>10 : Acceleration/Deceleration Time Command 1</b>
■ <b>11: Acceleration/Deceleration Time Command 2</b>

- If different acceleration/deceleration gradient changes are required in the process of acceleration or deceleration for any frequency; the terminal function may be applied for required control. (Refer to Table 2, P5-20), or
- Alternatively in any process of acceleration or deceleration for a frequency at any stage of speed, the terminal function may be applied to exercise various changes of gradient within four sets.

# - DESCRIPTION OF PARAMETER FUNCTIONS - V

Multi-stage command Terminal (N1) 16-Stage Preset Speeds	DIn Multi-Stage Command 4 $2^3 = 8$	DIn Multi-Stage Command 3 $2^2 = 4$	DIn Multi-Stage Command 2 $2^1 = 2$	DIn Multi-Stage Command 1 $2^0 = 1$
Master Speed	OFF	OFF	OFF	OFF
Stage 1 Speed	OFF	OFF	OFF	ON
Stage 2 Speed	OFF	OFF	ON	OFF
Stage 3 Speed	OFF	OFF	ON	ON
Stage 4 Speed	OFF	ON	OFF	OFF
Stage 5 Speed	OFF	ON	OFF	ON
Stage 6 Speed	OFF	ON	ON	OFF
Stage 7 Speed	OFF	ON	ON	ON
Stage 8 Speed	ON	OFF	OFF	OFF
Stage 9 Speed	ON	OFF	OFF	ON
Stage 10 Speed	ON	OFF	ON	OFF
Stage 11 Speed	ON	OFF	ON	ON
Stage 12 Speed	ON	ON	OFF	OFF
Stage 13 Speed	ON	ON	OFF	ON
Stage 14 Speed	ON	ON	ON	OFF
Stage 15 Speed	ON	ON	ON	ON

Binary Function Terminal 2 Acceleration /Deceleration Tim	2 DIn	1 DIn
Acceleration / Deceleration 1	OFF	OFF
Acceleration / Deceleration 2	OFF	ON
Acceleration / Deceleration 3	ON	OFF
Acceleration / Deceleration 4	ON	ON

(Table 2)

**Note 1:**  
**Din represents the definition given to any digital terminal input DI1~DI8.**

(Table 1)

- **12: Master Speed Increase** – The master speed frequency increase signal is entered from the multi-function terminal and its rate to be determined by F26 and F58.
- **13: Master Speed Decrease** – The master speed frequency decrease signal is entered from the multi-function terminal its rate to be determined by F27 and F58.
- ⊙ These two functions may be set by function terminal to provide external control over the frequency of the master speed. They permit two-way operation with the function [increase (▲) and decrease (▼)] from the operator; however, the control priority for F5 Speed Command must be set at 0; Operator.
- **14: Automatic Operation** – when automatic operation is effectively set, its priority is next higher to the inching command.
- **15: Auto Operation Suspended**
- ⊙ When the programmable automatic operation function is selected and the function terminal is activated, the ac drive starts to execute the sequential operation according to the preset 8-stage speed frequency. The operation may be suspended by using the function of Suspension Terminal and resumed when the suspension is over. If the operation is resumed by turning off the Automatic Operation Terminal, the operation procedure starts to execute from the original point.
- **16: Counter Signal Input** – The width of the trigger-off signal shall not be less than 2ms while paying attention to the setting of the related Parameter F58.
- **17: Counter Zero-in**
- ⊙ External trigger-off signal may be applied with this function terminal, such as an access switch. The signals from photo-sensor detector are inputted into Counting Terminal for the ac drive to count. If the counts must be cleared off and zeroed in, Zero-in Terminal is applied to achieve the purpose.

## V – DESCRIPTION OF PARAMETER FUNCTIONS –

### Multi-function Output Terminal

- **18: Free Run Stop** – When the function terminal signal is inputted, the ac drive immediately turns off its output for the motor to coast to stop due to the system friction .
- **19: Save Energy Operation** – When the function terminal signal is inputted, the ac drive starts to perform internal operation to control the operation at an optimal efficiency setting. (For details, refer to F104.)
- **20: Second Unit PID** – to activate the internal 2<sup>nd</sup> PID parameter control mode (F168~F171).
- **21: Enabling PID** – PID control module is activated by the input from the multi-function terminal. (For details, refer to F157).

Parameter	Designation	Description	Range	Unit	Ex-factory Setting
F66	Relay1 Setup	◎ No specific setup sequence is specified for the function of these six output terminals. Upon selecting the function, read first the description and related requirements of the function.	0   11	1	1
F67	DO1 Setup				11
F68	DO2 Setup				6
F69	DO3 Setup				7
F70	Relay 2 Setup				3

- **0: Disabled** – This function allows the output terminal function to be in the states of being disabled.
- **1: Output in Case of Abnormality (NO)** – In case of any abnormality detected by the ac drive, the contact is in closed status.
- **2: Output in Case of Abnormality (NC)** – If any abnormality is detected by the ac drive, or CPU is losing POWER, this contact turns into open status. The normal output is closed status.
- **3: In Operation** – When the ac drive enters into standby mode or is in operation, this contact is in closed status.
- **4: Frequency Attained 1** – When the output frequency of the ac drive reaches Specified Frequency 1 (F72), this contact is in closed status.
- **5: Frequency Attained 2** – When the output frequency of the ac drive reaches Specified Frequency 2 (F73), this contact is in closed status.
- **6: Consistent Frequency** – When the output frequency of the ac drive is consistent with the setting for the Master Speed through Stage 7 frequency, the range to judge the consistent frequency is set by (F71), and this contact within that range is in closed status. (Unsuitable application On the Analog signal speed command)

## - DESCRIPTION OF PARAMETER FUNCTIONS - V

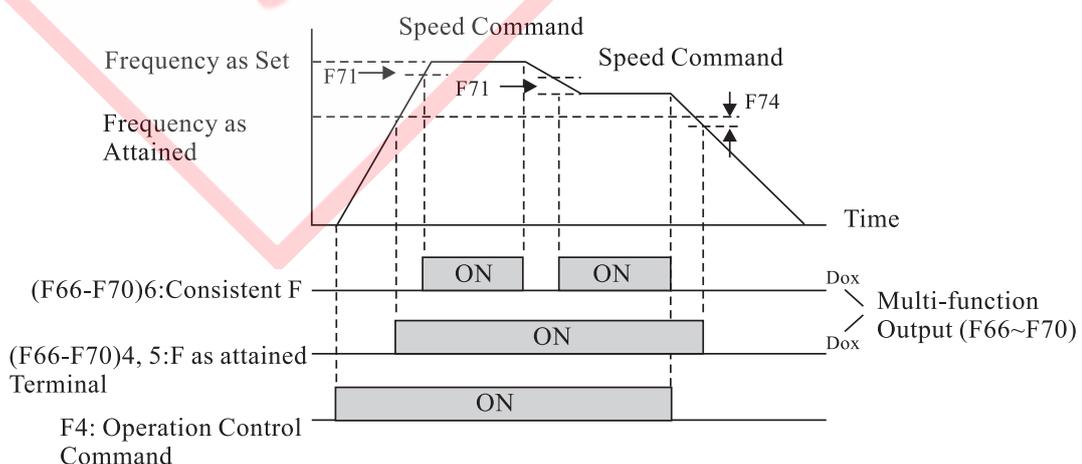
- **7: Overload Alarm** – When the ac drive detects output overload, this contact is in closed status. The OL value = (F121) Rated current of the Motor × (F84) OL Current Gains.
- **8: OL Timing Forecast** – When the multiplication value of electronic thermal sensor built in the ac drive has reached 80% of the time of trip-off level, this contact is in closed status. The OL level is set with (F84); and the multiplication time, with (F85).
- **9: Counter Cycle is Up** – When the ac drive is performing external count and the numeric value of the counting is equal to the setting of F75, this contact is in closed status, and then clear the numeric value to restart counting.
- **10: Comparator Counting is Up** – When the ac drive is performing external count and the numeric value of the counting is equal to the setting of F76, this contact is in closed status, and then clear the numeric value to restart counting.
- **11: Zero-Speed Detected** – When the ac drive is in downtime or the frequency set is smaller than the setting of the minimum activation frequency, this Contact is in closed status.

F71	Frequency Attained 1	0~10.0HZ	0.1HZ	1.0
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- ◎ When the output frequency falls between the frequency setup range of ±F71 the output multi-function terminal remains at ON status.

F72	Frequency Attained 1	0~400.0HZ	0.1HZ	60.0
F73	Frequency Attained 2	0~400.0HZ	0.1HZ	60.0
F74	Magnetic Stagnation Width Attained	0~10.0HZ	0.1HZ	1.0

- ◎ When the output frequency is higher than the setting of the Frequency Attained, the multi-function output terminal set will remain in ON status; when the output frequency drops to the Magnetic Stagnation width below the Frequency Attained, the multi-function output terminal is in OFF status



# V – DESCRIPTION OF PARAMETER FUNCTIONS –

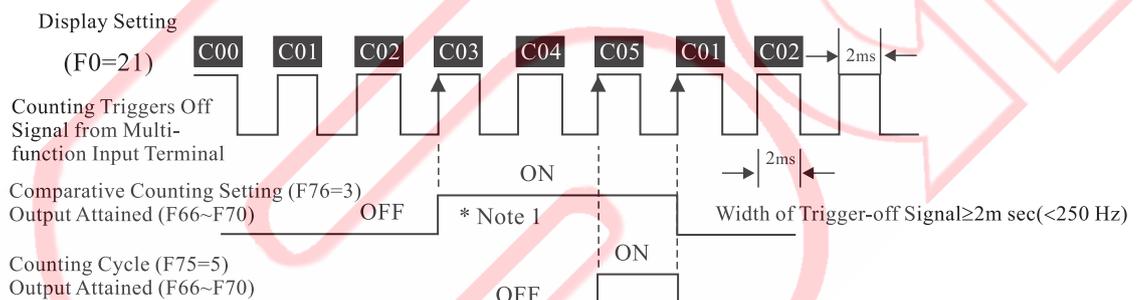
## Jumping Frequency

Parameter	Description	Range	Unit	Ex-factory Setting
F75	Counting Cycle	0~30000	1P	1000

- ⊙ This parameter is applied to set up the counting cycle of the built-in counter. Once the counting reaches the preset value of the counting cycle, any multi- function output terminal may be selected to trigger the terminal output (Fig.1).

F76	Comparative Counting	0~30000	1P	500
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- ⊙ This parameter is applied to set up the comparison value of the built-in counter. Once the counting reaches the preset value of the counting cycle, any multi- function output terminal may be selected to trigger the terminal output to enter into ON status, and then enter into OFF status until the F75 counting cycle setting is up (Fig. 1).



(Fig.1)

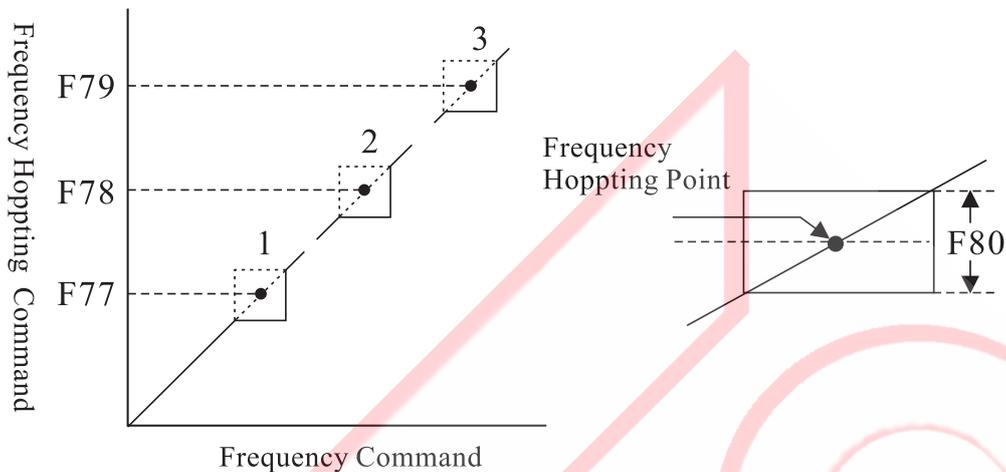
\* Note 1: Attention to description and setting of Parameter F58 is urged.

F77	Frequency Skip 1	0~400.0HZ	0.1HZ	0.0
F78	Frequency Skip 2	0~400.0HZ	0.1HZ	0.0
F79	Frequency Skip 3	0~400.0HZ	0.1HZ	0.0
F80	Frequency Skip Width	0~10.0HZ	0.1HZ	0

- ⊙ Functions of Frequency Skip and Frequency Skip Width are exclusively provided to avoid resonance to the mechanical system under certain frequency, where it is unavoidable to pass through during acceleration or deceleration, and operation under such frequency is strictly prohibited.
- ⊙ If the frequency skip width is set at 0Hz, all the frequency-skip points are void.
- ⊙ Frequency skip conditions must satisfy  $F77 \leq F78 \leq F79$ , and the operation must be provided in sequence as set. Skip frequencies respectively at Points 1, 2, 3 may be partially or entirely overlapped to increase the operation of bandwidth from different segments, and to serve as the frequency skip area for one point or two points.

# - DESCRIPTION OF PARAMETER FUNCTIONS - V

## Protection Setup



F81	Stall Prevention	0,1	1	0
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- **0 : Not Activated** –Function to prevent of stall due to over voltage and over current is disabled.
- **1 : Activation** – Function to prevent of stall due to over voltage and over current is activated.

F82	Stalling voltage Setup	1.00~1.25	0.01	1.10
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- ⊙ In performing deceleration, the ac drive will stop decelerating (output frequency suspended from decreasing) due to rising DC bus voltage when the motor regenerates energy into the ac drive due to the high motor load inertia; The ac drive will continue to perform deceleration only when the dc bus voltage falls below the setting.
- ⊙ Stalling Voltage Level = (F109) Mains input voltage × 1.414 × (F82) Stalling Voltage %.

**[Example]:** Stalling Voltage Level = 220VAC × 1.414 × 110% = 342VDC

F83	Stalling Current Setup	0.50~2.50Pu	0.01Pu	1.50
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- ⊙ In performing acceleration, the ac drive will stop the acceleration (output frequency is suspended from increasing) when the output current increase from the ac drive is over the setting of the stalling current level due to fast acceleration or overload of motor; and the ac drive continues to accelerate only when the current falls below the setting.

## V – DESCRIPTION OF PARAMETER FUNCTIONS –

- ◎ Stalling current level = (F121) Motor Rated Current × (F83) Stalling Current Gain.

**[Example]: Stalling Current Level** = 4A × 150% = 6.0A



The upper limit of stalling current should never be two-fold higher than the rating of the ac drive.

F84	Overload Current Level	1.00~2.50Pu	0.01Pu	1.50
F85	Overload time	0.1~120.0 Sec	0.1 Sec	60.0

- ◎ When rated capacity of ac drive is higher than motor's capacity, please has to input exact rated capacity of motor into parameter F120-F125 to avoid motor be burned out by higher capacity of ac drive leads to higher current.
- ◎ This parameter provides electronic thermal overload protection to protect the motor from overheating while taking the protection for insufficient cooling ability of the motor operated at lower speed into consideration.
- ◎ The ac drive output load maintains the current, and Overload Time allowance timer is immediately activated when the current becomes greater than the setting of the overload current level.
- ◎ Overload Current Level = (F121) Motor Rated Current × (F84) OL Current Gain Level.

F86	Leakage current outputted or unbalanced 3-phase output current	0.001~0.500Pu	0.0 1Pu	0.100
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- ◎ This function is provided to prevent poor wiring or poor motor insulation on the output side of the ac drive. When the sum of the 3-phase current on the output side (U.V.W) of the ac drive becomes greater than the abnormality level setting, abnormal earth leakage is judged.

F87	Over Temp. Protection Setup	60.0~95.0°C	0.01°C	85.00
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- ◎ This function is provided to detect the temperature protection level of the built-in heat sink. Once the setting is challenged, the ac drive trips to protect from overheating

F88	Fans Activating Temp. Setup	30.0~45.0°C	0.01°C	40.00
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- ◎ Upon Power ON, the fans automatically run for one (1) minute and then reverts to the control by the fans activation temperature setting.
- ◎ The fans are forced to operate once the temperature of the built-in heat sink becomes greater than the temperature setting to activate the fans.

F89	Automatic Voltage Regulation (AVR)	0,1	1	0
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- **0: Disabled** - AVR is disabled while the output (U.V.W) voltage varies depending on the source voltage level inputted.

# - DESCRIPTION OF PARAMETER FUNCTIONS - V

## Automatic Operation Function

■ **1: Activation** – AVR is activated for the output voltage.

- ◎ When the the main input power is higher than (F101) Maximun Output Voltage (U.V.W), the voltage regulator automatically maintains the voltage under the setting given in F101 for the motor to provide stable torque output while preventing drastic increase of torque due to temperature rise. However, once the input source is lower than the F101 setting, the output voltage varies depending on the level of the input voltage.



INHIBIT

Never activate AVR for the setting **5: Closed Loop Flux Vector Control** or the setting **6: Sensorless Flux Vector Control** in (F126) Control Mode.

F90	Dynamic Braking Activated	0, 1	1	0
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■ **0: Disabled** – Dynamic Braking is disabled.

■ **1: Activation** – With the ac drive operating, and BUS voltage (Vdc) greater than 120%, the built-in dynamic braking is activated.

**[Example]** : (F109)Mains input voltage  $220\text{Vac} \times 1.414 \times 120\% = 373\text{ Vdc}$  discharge level.



WARNING

**Built-in Dynamic Braking has been provided for the ac drive of 7.5 KW or less. External braking unit must be provided for ac drive of other Hp spec.**

F91	Automatic Operation	0~4	1	0
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■ **0: Disabled** – Automatic operation is disabled.

■ **1: Reciprocal Fashion** – to perform reciprocal automatic operation from Master Speed through Stage 7 Speed.

- ◎ Reciprocal Fashion Performed – Master Speed → Stage 1 Speed ... Stage 7 Speed → Stage 6 Speed ... Master Speed → Master Speed ... etc, and then the operation is continued in reverse order to complete a cycle of a total of 16 speeds. The number of cycle times is set by F92 and displayed with the stage speed monitor. The ac drive automatically stops once the setting of cycle times is up.

■ **2: Cyclic Fashion** – to perform automatic operation clockwise from Master Speed through Stage 7 Speed.

- ◎ Cyclic Fashion Performed – The automatic operation is performed clockwise from Master Speed ... Stage 1 Speed ... Stage 7 Speed → Master Speed → Stage 1 Speed ... etc. It is repeated clockwise with the number of cycles to be set by F92 and displayed on the stage speed monitor together with the number of cycles and stage speed. The ac speed automatically stops when the setting of cycle times is up.

# V – DESCRIPTION OF PARAMETER FUNCTIONS –

## Magnetic Flux Setup

- **3: Master Speed after Reciprocation** – this function is performed same as that described in the setting of 1: Reciprocal fashion with the exception that the master speed frequency operates upon the expiry of the number of cycles.
- **4: Master Speed after Circulation** – this function is performed same as that described in the setting of 2: Cyclic fashion with the exception that the master speed frequency operates upon the expiry of the number of cycles.



WARNING

Once Automatic Operation setup is done , the execution is subjected to the programmed mode of the multi-function input terminals **13: Automatic Operation** and **14: Automatic Operation Suspended**. The automatic operation control is second in priority to the inching function while the **Operation Control** and **speed Command** fails to execute operation control (settings 1~4 enable activation of automatic operation).

F92	Number of Cycles	1~2000	1	1
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◎ This function defines the number of operation cycles needed in automatic operation.

F93	Stage 1 Time & Direction	-30000~30000 Sec.	1 Sec.	10
F94	Stage 2 Time & Direction	-30000~30000 Sec.	1 Sec.	10
F95	Stage 3 Time & Direction	-30000~30000 Sec.	1 Sec.	10
F96	Stage 4 Time & Direction	-30000~30000 Sec.	1 Sec.	10
F97	Stage 5 Time & Direction	-30000~30000 Sec.	1 Sec.	10
F98	Stage 6 Time & Direction	-30000~30000 Sec.	1 Sec.	10
F99	Stage 7 Time & Direction	-30000~30000 Sec.	1 Sec.	10
F100	Stage 8 Time & Direction	-30000~30000 Sec.	1 Sec.	10

- ◎ To set the operation time and direction by the stage speed enabled. The setting of negative value is for operation in reverse direction and operation time counts; and the setting of positive value is for forward direction and operation time counts. Refer to the setting given in F13 if FWD and REV operation control is required.
- ◎ Frequency of any stage of speed may be set at 0Hz in the course of performing the stage speed in automatic operation to provide the function of stop by timer; and the frequency of any stage speed may be set to be disabled by setting the automatic operation time at 0 sec to skip to the frequency of the next stage speed.

F101	Maximum Output Voltage (U.V. W)	.50~1.00X	0.01Pu	0.90
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- ◎ The range of the input voltage to the ac drive may be of AC180V~240V or 380V~480V. The maximum output voltage may be set by this parameter function for the maximum rms voltage to compensate for the rated voltage of the motor. Maximum output voltage = (F109) input voltage x F101(0.90pu) setting value.

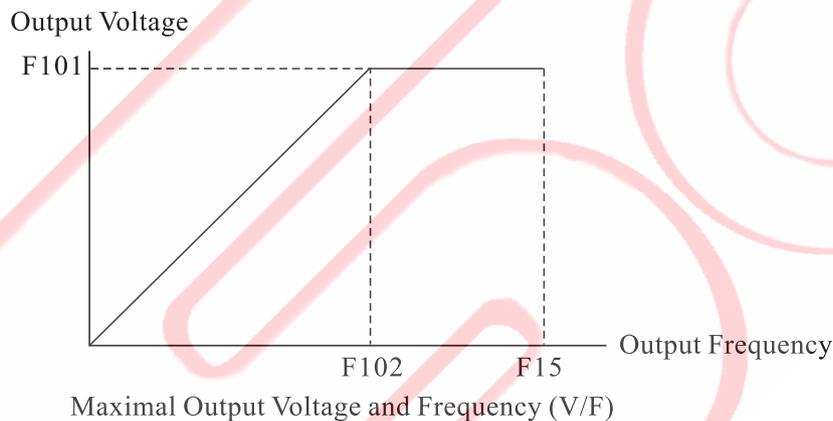
## - DESCRIPTION OF PARAMETER FUNCTIONS - V

\* The setting for F101 maximum output voltage at 1.00 is optimum when (F126) control mode is selected at **2: Open Loop V/F vector Control**, **3: Closed Loop V/F vector Control**, or **4: Sensorless V/F vector Control**.

\* **ATTENTION!** The maximum output voltage should not be greater than 90% and the internal must be done with adjustment of magnetic filed control function if **5: Closed Loop Flux Vector Control** or **6: Sensorless Flux Vector Control** is selected from (F126) control mode. Any setting greater than 90% will be made at the cost of voltage compensation efficiency, and even resulting in tripping. The optimum setting is 0.9 (90%).

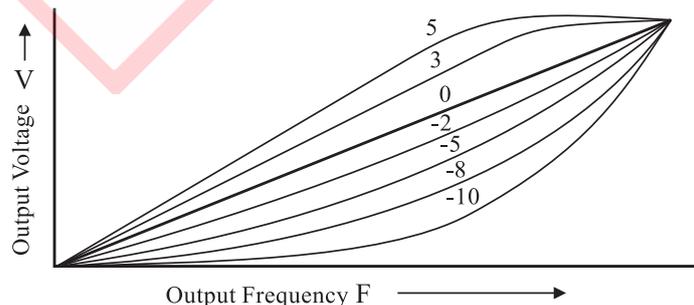
F102	V/F Maximum Voltage Frequency	0.50~2.00	0.01Pu	1.00
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- ⊙ The setting of output voltage, frequency of ac drive has to be comply with motor's normal rated. [Max. voltage frequency (1.0) will be based on F122 : rated frequency].



F103	V/F Curve Select	-10~50	1	0
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- ⊙ The relation between output voltage and output frequency is defined in terms of square decrease, linear or square increase changes as illustrated below.
- ⊙ With the setting of 0, it relates to a linear V/F curve applicable to the load of a constant torque.
- ⊙ With the setting selected from the range of -1 ~ -10, it relates to square decrease V/F curve, applicable to blower and pump.
- ⊙ With the setting elected from the range of 1 ~ 5, it relates to square increase V/F curve.



## V – DESCRIPTION OF PARAMETER FUNCTIONS –

Parameter	Description	Range	Unit	Ex-factory Setting
F104	Save Energy Control Mode	0~2	1	0

◎ Upon activating the function of save energy control and the operation is at full voltage during acceleration/deceleration; the optimum output power will be automatically controlled by the load power during the operation at constant speed while the output speed is under monitor without stalling.

\* **Recommendation:** In selecting the save energy control function from (F126) control mode, **5: Closed Loop Flux Vector Control** and **3: Closed Loop V/F vector Control** are preferred; followed by **4: Sensorless V/F vector Control** and **6: Sensorless Flux Vector Control**; while **2: Open Loop V/F vector Control** fails to perform economy control.

\* **ATTENTION!** This function is not applicable to any system with sudden and frequent load changes, or load already approaching the full load (rated) operation during the operation.

- **0: Normal Mode** – motor operation controlled in normal mode without activating economy control.
- **1: Save Energy Control Mode** – economy control command to be controlled by internal calculation.
- **2: External Terminal Control** – economy control command to be controlled by external terminal input signals.

F105	V/F Torque Compensation Mode	0~2	1	1
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■ **0: Disabled** – no torque compensation is provided.

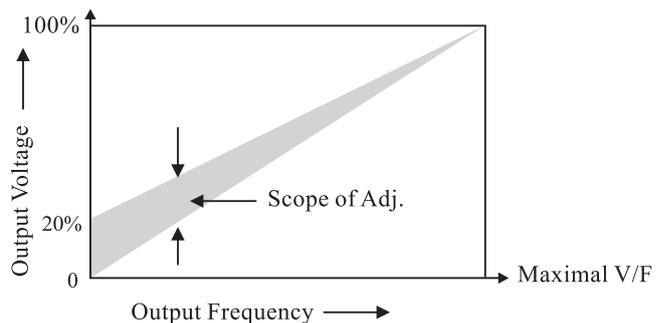
■ **1: Setup Compensation Activated** – compensation activated with the amount to be set up by (F106).

■ **2: Automatic Torque Compensation** – Upon detecting the resistance and feedback current signals from the motor, the ac drive performs automatic torque compensation control.

◎ The torque compensation mode is only applicable to 2: Open Loop V/F vector Control, 3: Closed Loop V/F vector Control, and 4: Sensorless V/F vector Control in (F126) Control Mode.

F106	V/F Torque Compensation Setting	0~.200Pu	0.001Pu	0.020
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◎ This function provides the means for proper adjustment of the corresponding output voltage at 0Hz so as to improve the torque performance of the motor as demonstrated in the lower speed area.



# - DESCRIPTION OF PARAMETER FUNCTIONS - V

## AC Drive parameters

- ⊙ Excessive adjustment will cause high motor current resulting in overload, and further leading to the activation of functions (F83~F85) of output limiting current. Therefore, confirm the output current value displayed under F0=12 before making the adjustment of F106 for the optimum setting.
- ⊙ Unless otherwise specified, 3Hz is sufficient to activate the motor to run in the V/F control mode.

F107	PWM Modulation Method	1~2	1	1
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■ **1: 3-Phase Modulation** – Use of 3-phase modulation driven motor obtains the smoothest current output and comparatively quiet operation.

■ **2: 2-Phase Modulation** – 2-phase modulation technology allows the time reduction of the IGBT On/Off operation, thus reducing the switching loss.

- ⊙ Excessively long wiring for the motor is prone to reflective voltage feedback (tidal effects) from the motor, and this acts as additional load to the ac drive (power loss). In such case, the use of 2-phase modulation driven motor and lower setting of F108 carrier frequency would help to reduce the reflective motor voltage, harmonics, and EMI problem.

\* **ATTENTION!** If the wiring length has to be made not less than 50M, AC Drive grade motor with higher voltage rating capability of its insulation is strongly recommended since excessive long cables will create greater parasitic induction, and higher multiple voltage loops. These can easily damage the motor insulation and the ac drive.

\* **RECOMMENDATION** – An output reactor should be installed whenever the wiring on the output side of the ac drive is 25M or longer (refer to P2-8).

F108	PWM Switching Frequency	2000~16000Hz	1HZ	5000
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- ⊙ This parameter sets up the carrier frequency in PWM output.
- ⊙ The setting level of the carrier frequency will affect the EM noise of the motor, switching loss of the IGBT and the heat dissipation due to switching loss as stated in the table given below:

Carrier F	Motor Noise	Switching Loss	Heat Dissipation	Torque	Harmonics
2KHz	High	Low	Low	High	Low
↑↓	↑↓	↑↓	↑↓	↑↓	↑↓
16KHZ	Low	High	High	Low	High

# V – DESCRIPTION OF PARAMETER FUNCTIONS –

## METER 1 Waveform Output

Parameter	Description	Range	Unit	Ex-factory Setting
F109	Mains Input Voltage (rms)	180Vac~500Vac	1V	200/400V

- ⊙ This parameter defines the standard input power supply voltage to the ac drive. The ac drive would determine all related voltage working levels and voltage protection levels according to this parameter.

Low Voltage Level = AC in  $\times$  1.414  $\times$  70%

Over Voltage Level = AC in  $\times$  1.414  $\times$  130%

Brake Level = AC in  $\times$  1.414  $\times$  120%

- ⊙ The setting value of F109 needs to be lower or equal to F120  $\times$  1.2;  
Namely F109=220V, F120=184V to be as min. rated voltage of motor.

F110	METER 1 Output	0, 1	1	0
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- **0: PWM Pulse Output** – DC voltage is output to the FM1 terminal with the maximum range of DC0~10V/1mA.

- **1: Pulse Frequency Output** – Pulse frequency output equivalent to the output frequency  $\times$  multiplying factor (F111) is output to the FM1 terminal.

F111	Meter 1 Pulse Frequency Multiplying Factor	1~36X	1	1
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- ⊙ Pulse frequency = output frequency  $\times$  multiplying factor of pulse (with the maximum output of the pulse frequency at 1.25 KHz).

F112	PWM1 Output Mode Options	0~17	1	1
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- ⊙ An analog DC voltage DC0~10V/1mA signal output by means of PWM pulse can be used to monitor the following 17 operation status settings of the ac drive. (providing the same functions as that by F0: Operator Display Status).

Setting	Function (100% Implication)	Setting	Function (100% Implication)
0	No output	9	Torque Voltage
1	Motor Output Speed	10	Output Current
2	Feedback Speed 1	11	Excitation Current Command
3	Feedback Speed 2	12	Torque Current Command
4	Sensorless Vector Output Speed	13	Excitation Current
5	Source Frequency	14	Torque Current
6	Slip Frequency	15	True Power
7	Output Voltage	16	Reactive Power
8	Excitation Voltage	17	PID% Output

# - DESCRIPTION OF PARAMETER FUNCTIONS - V

## METER 2 Waveform Output

Parameter	Description	Range	Unit	Ex-factory Setting
F113	PWM1 Display Variable Multiplying Factor/10V	.50~8.00	0.01Pu	1.00

- ⊙ This function is applied to adjust the multiplying factor of the analog output of full voltage (Output Voltage (Vdc) = 10V ÷ F113 Variable Multiplying Factor).

F114	PWM1 Display Variable Polarity Setup	0, 1	1	0
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- ⊙ Polarity setup is essentially done with DC5V as the potential point at "0". Accordingly, any voltage greater than DC5V relates to FWD speed signal; and smaller than DC5V relates to REV speed signal. This function is applicable only to the display of output frequency or speed; therefore, any other function given with the polarity setup is of no significance.

- **0: Without Polarity** –with 0V as the reference point, and with no capability to identify FWD and REV.
- **1: With Polarity** – with 5V as the reference point, and with the capability to identify FWD and REV.

F115	METER2 Output Format	0, 1	1	0
F116	Meter 2 Pulse Frequency Multiplying Factor 2	1~36	1	1
F117	PWM2 Output Mode Options	0~17	1	10
F118	PWM2 Display Variable Multiplying Factor/10V	.50~8.00	0.01Pu	1.00
F119	PWM2 Display Variable Polarity Setup	0,1		0

- ⊙ Refer to Meter1 parameter functions as Meter2 parameter functions given in F115 ~ F119 above are the same as that provided by METER1.

F120	Rated Voltage (rms)	180Vac~500/Vac	1V	N(Note 1)
F121	Rated Current (rms)	1.5A~130.0A	0.1A	N(Note 1)
F122	Rated Frequency	50.0HZ~70.0HZ	0.1HZ	N(Note 1)

- ⊙ Rated voltage, rated current and rated frequency set as above for the type of the motor are related to parameter functions of the ac drive driven motor.  
(N1: N=ex-factory setting varies according to the respective ac drive used)

\* **F120~F125 related to the parameter group are to set up the nameplate of the motor; settings must be defined according to those rated settings on the motor nameplate.**

\* **Motor parameters must be known for application in vector control mode. Correct parameter settings give the better motor speed response and torque characteristics curves.**

\* **When the capacity of drive is bigger than the motor, the setting of F121 has to be bigger than rated current of drive divided 9. (F121>the drive rated current ÷9)**

## V – DESCRIPTION OF PARAMETER FUNCTIONS –

### Control Mode

Parameter	Description	Range	Unit	Ex-factory Setting
F123	Rated Speed	0~4200rpm	1rpm	N(N1)

- ⊙ This parameter is related to the rated speed of the motor.
- ⊙ In vector control, the ac drive uses this parameter setting as reference to calculate the compensation for the slip speed. The running speed will not drop due to excessively large load on the motor, as automatic speed regulation control is provided to maintain constant speed.

F124	HP	0.5~50.0HP	0.1HP	N(N1)
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- ⊙ This parameter is related to the output rated power of the motor.

F125	Number of Poles	2,4,6,8,10,12 Pole	2 Pole	N(N1)
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- ⊙ Setting is defined with the number of poles of the motor.
- ⊙ With v/f control, synchronous speed of the motor is achieved to correctly display the speed.
- ⊙ With vector control, the ac drive uses the setting of this parameter as reference to perform the speed vector control calculation.

F126	Control Mode Setup	0~6	1	2
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- **0: Electric Motor Parameter Auto-tuning** – the electric characteristics of the motor can be automatically calibrated through the auto-tuning of the static and dynamic parameters built in this parameter at F133~F137.
- **1: Mechanical Motor Parameter Auto-tuning** – The mechanical inertia constant of the motor can be automatically calibrated by automatically setting up the mechanical constant value (F138) through the auto-tuning function of dynamic parameters built in parameter F138.
- **2: Open Loop V/F vector Control** – the ac drive outputs SVPWM waveform to the motor.
- **3: Closed Loop V/F vector Control** – The encoder mounted on the motor performs speed feedback for slip compensation so that the speed of the motor follows the speed command closely in high precision speed control.
- **4: Sensorless V/F vector Control** – relates to the voltage type sensorless controller, whereby the voltage command and feedback current signal are applied to estimate the stator magnetic flux and determines the slip for making the frequency compensation.
- **5: Closed Loop Flux Vector Control** – relates to a current type closed loop (attached with PG) vector controller, to provide similar servo drive control with high precision speed response and torque control.