

ADLEEPOWER®

INSTRUCTION MANUAL

VARITORQUE INVERTER



THANK YOU VERY MUCH FOR YOUR PURCHASE
OF ADLEE INVERTER APxG5 SERIES.
PLEASE READ THIS INSTRUCTION MANUAL
BEFORE INSTALL THE INVERTER.

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1. PREFACE

Thank you for purchasing ADLEEPOWER Varitorque Inverter APXG5 . Please read this manual thoroughly before install and operate APXG5 .

This manual should be stored by the user of the APXG5 for reference of maintenance and inspection.




Indicated a potentially hazardous situation which, if not avoided, could result in death or serious personnel injury.



Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate personnel injury and damage to equipment.

Danger


- Only commence wiring after verifying that the power supply is turned OFF.
- Wiring should be performed only by qualified personnel.
- Make sure to connect the ground terminal.  Ground resistance 0.1 Ω or less.
- Do not measure any element signal during operation. Failure to observe this caution can result in personal injury.
- Perform maintenance or inspection only after verifying that the CHARGE LED goes OFF and after the main circuit power source is turned OFF.
- Never modify the product. Failure to observe this warning can result in an electrical shock or personal injury and will invalidate the guarantee.

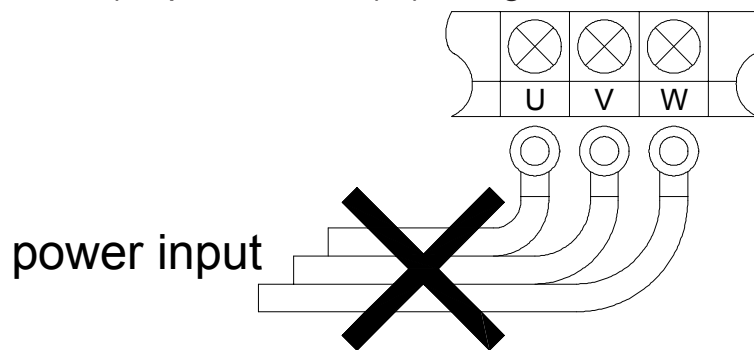
Caution

- Mount the inverter on nonflammable material.(i.e. metal)
- When mounting units in an enclosure, install a fan or other cooling device to keep the intake air temperature below 45 °C .
- Overheating may cause a fire or damage to the unit.

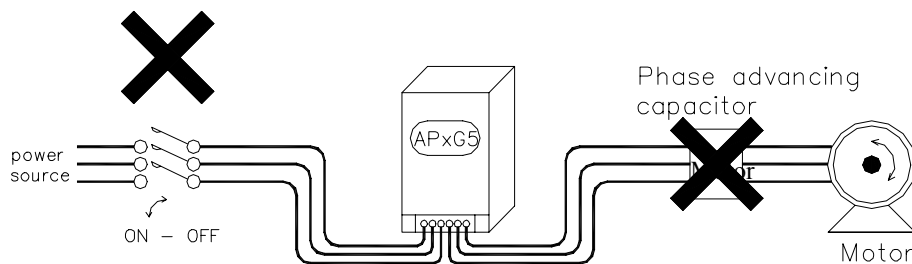


Caution

- Please confirm power source voltage to inverter input rated voltage.
- Please make sure the wiring is correct when inverter adds a braking resistor.
- Do not put the advance phase capacitor between the inverter and motor.
-  is grounding symbols. Be sure ground both the inverter and motor.
- Check the power connector is locked on the terminal of inverter.
(※ Do not loosen, otherwise, connector will be oxidized and over heat.)
- Check that the input power source voltage is $220\text{Vac} \pm 10\%$ or $380/440\text{Vac} \pm 10\%$.
- Be sure to connect the power source to R,S,T(input terminals) and the motor to U,V,W.(output terminals). (Wrong connection will damage the inverter.)



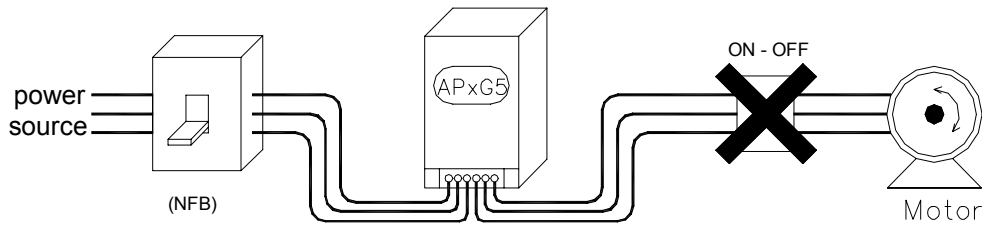
- Do not make any replacement for electronic parts when troubles are occurred.
- Do not perform a withstand voltage test of the inverter. It may cause semiconductor parts or power switches to be damage.
- Do not install relay between power source and inverter for operating start and stop.





Caution

- For operating motor "start" and "stop" should use keypad or terminal to control these functions.



- Do not install phase advancing capacitor between inverter and motor for operating motor.

1-1 Acceptance Inspection and Precautions

During product manufacturing, packaging, and shipment have been standardised. If any problems are discovered, please contact your dealer or producer immediately.

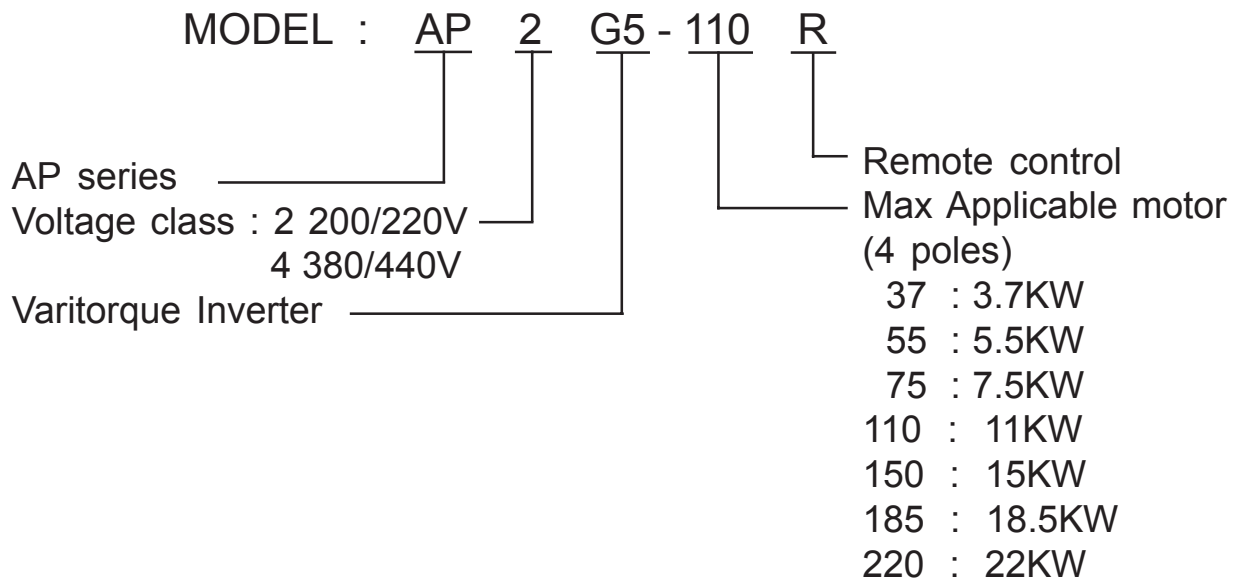
- . Any damage with each product after shipping.
- . The instruction manual is contained in the package.
- . The product as same as an order (check the nameplate, voltage and frequency).
- . All of terminals are locked and unusual substance.
- . The keyboard of remote control must be corrected.
- . Check the additional accessories.

1-2 Nameplate of rating details





ADLEEPOWER ®
<i>Varitorque Inverter</i>
MODEL AP2G5-110 VER V01 INPUT AC3 ϕ 200/220V 50/60 Hz OUTPUT CURRENT 46A FUSE AMP 75A CAPACITY 17.6KVA (11KW/15HP) ADLEE POWERTRONIC CO., LTD.



ADLEEPOWER ®	
VARITORGUE INVERTER	
MODEL	AP4G5-337
VER	V01
SOURCE	AC3 ϕ 380/440/460V
HZ	50/60
CAPACITY	6.5KVA(3.7KW/5HP)
FUSE AMP	15 A
OUTPUT CURRENT	9 A



2. SPECIFICATION

Model	AP2G5							AP4G5						
Voltage	3 ϕ 220V \pm 10%							3 ϕ 380/440V \pm 10%						
Model No	37	55	75	110	150	185	220	37	55	75	110	150	185	220
Input Frequency	50/60HZ \pm 5%													
Output Voltage	3 ϕ 220V							3 ϕ 380V~440V						
Output Frequency	0.5HZ ~ 400HZ													
Ourput Rated current(A)	17	24	33	46	61	76	90	8.5	12	16.5	23	31	38	42
Capacity(KVA)	6.5	9.2	12.6	17.6	23.3	29	34	6.5	9.2	12.6	17.5	23.6	29	32.8
Appropriate motor (KW)	3.7	5.5	7.5	11	15	18.5	22	3.7	5.5	7.5	11	15	18.5	22
Control	SVPWM													
Braking	Regenerative discharge braking													
Current capacity	150% of rated current (one minute)													
Acceleration time	0.2 ~ 1200 Sec													
Deceleration time	0.2 ~ 1200 Sec													
Frequency Setting	Digital	Use keyboard    for setting and confirm by 												
	Analog	0~5VDC,0~10VDC,4~20mA analog signal												
Display type	Digital display or analog signal (terminal)													
Dimension	Fig1			Fig2				Fig1			Fig2			
Colling Method	Air-cooled													
Weight (NW KG)	5.6	5.8	6.2	14.5	14.5	16	16	5.6	5.8	6.2	6.2	14.5	15.2	16

3. DIMENSION

Fig 1

Unit : mm

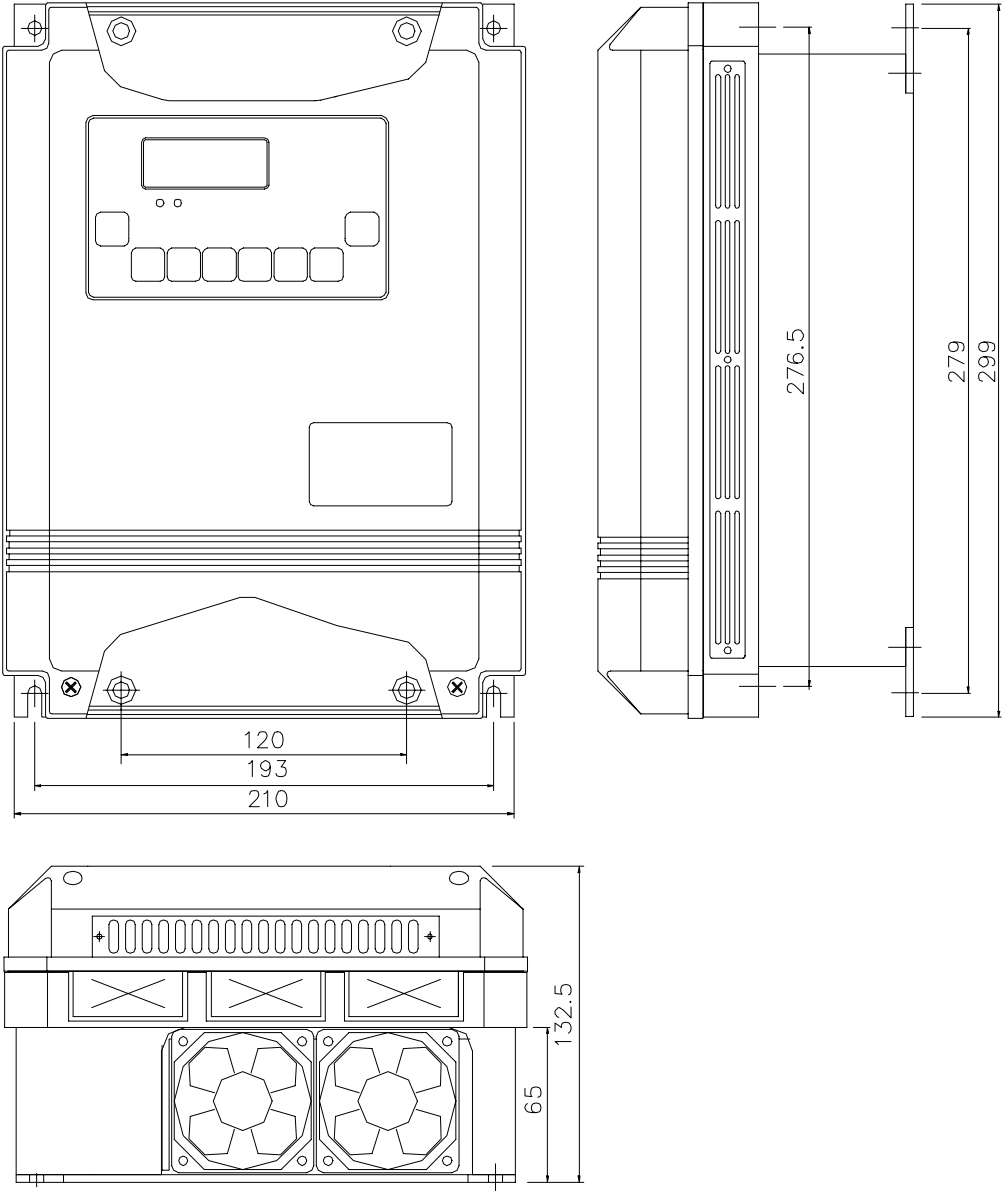
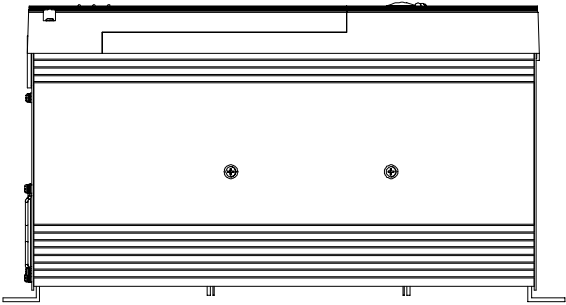
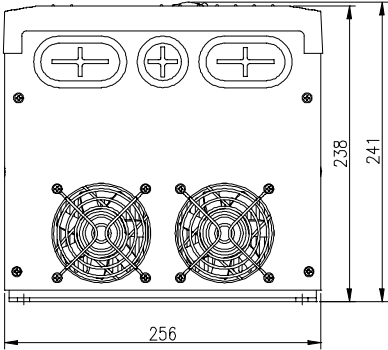
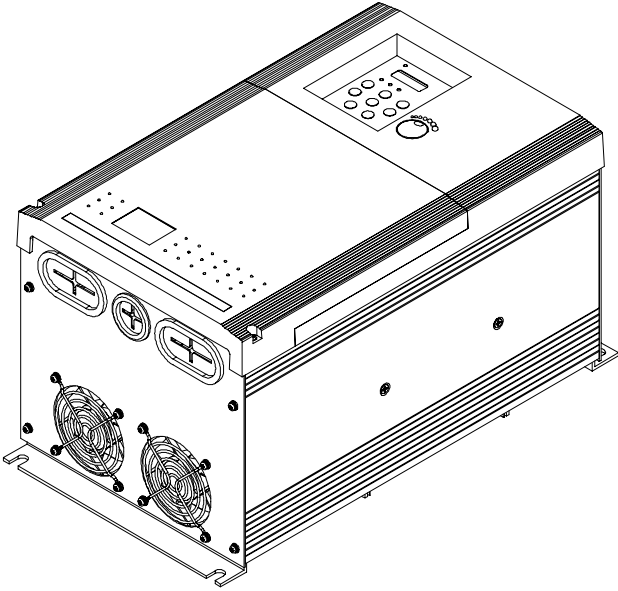
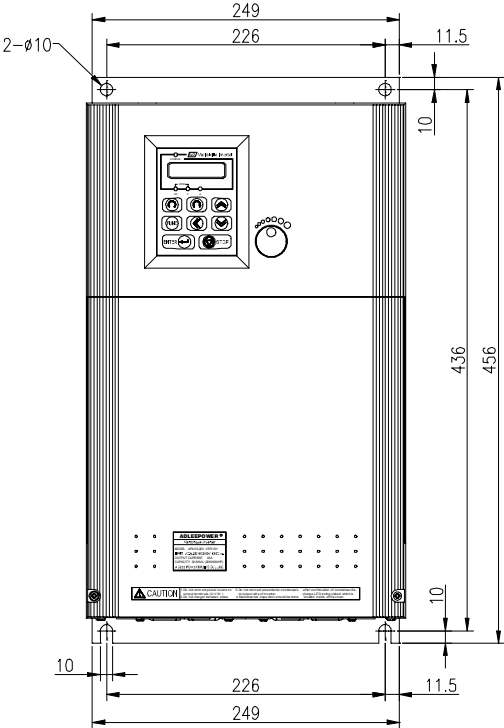


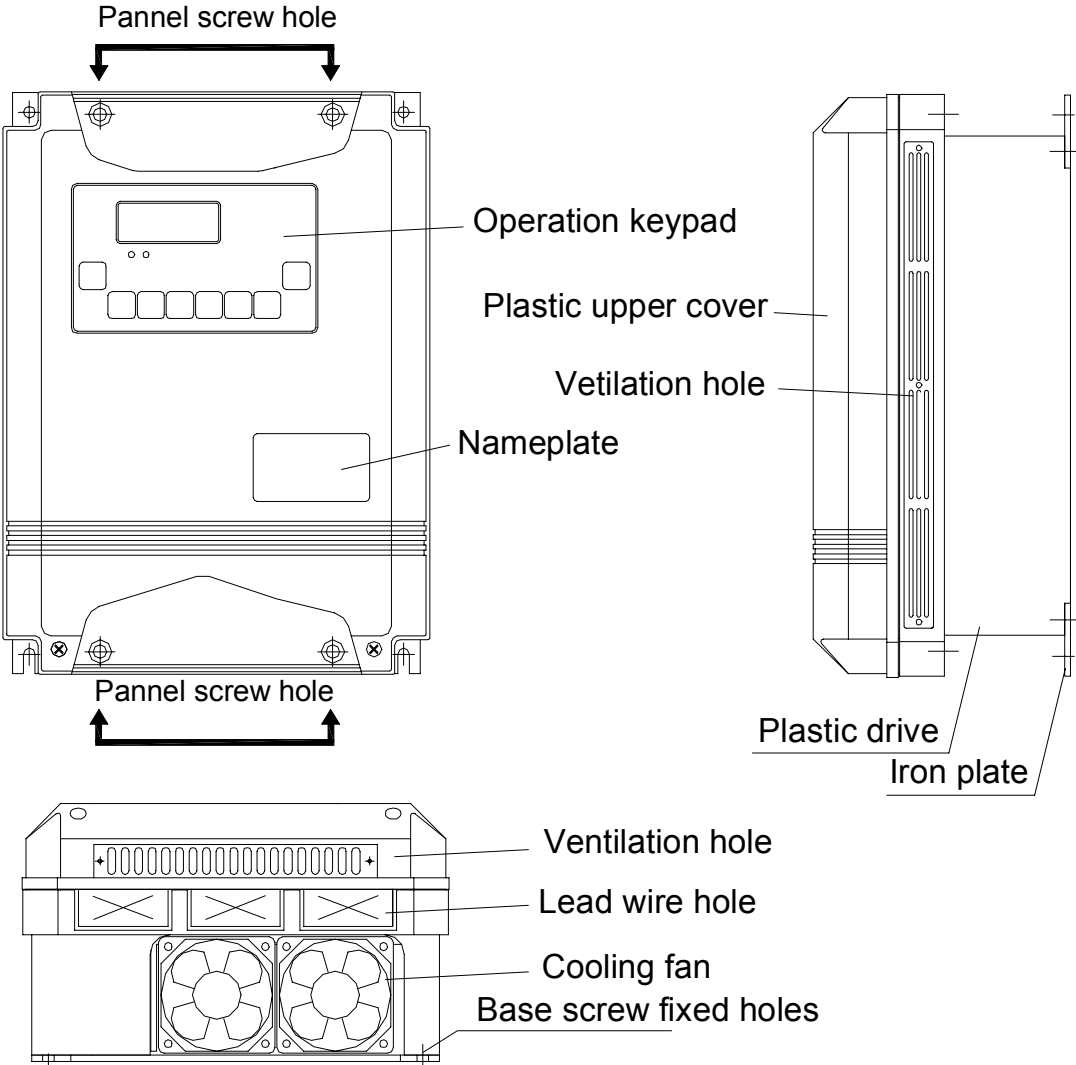
Fig 2

Unit : mm

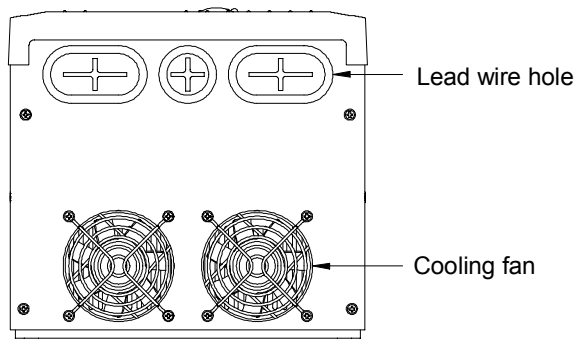
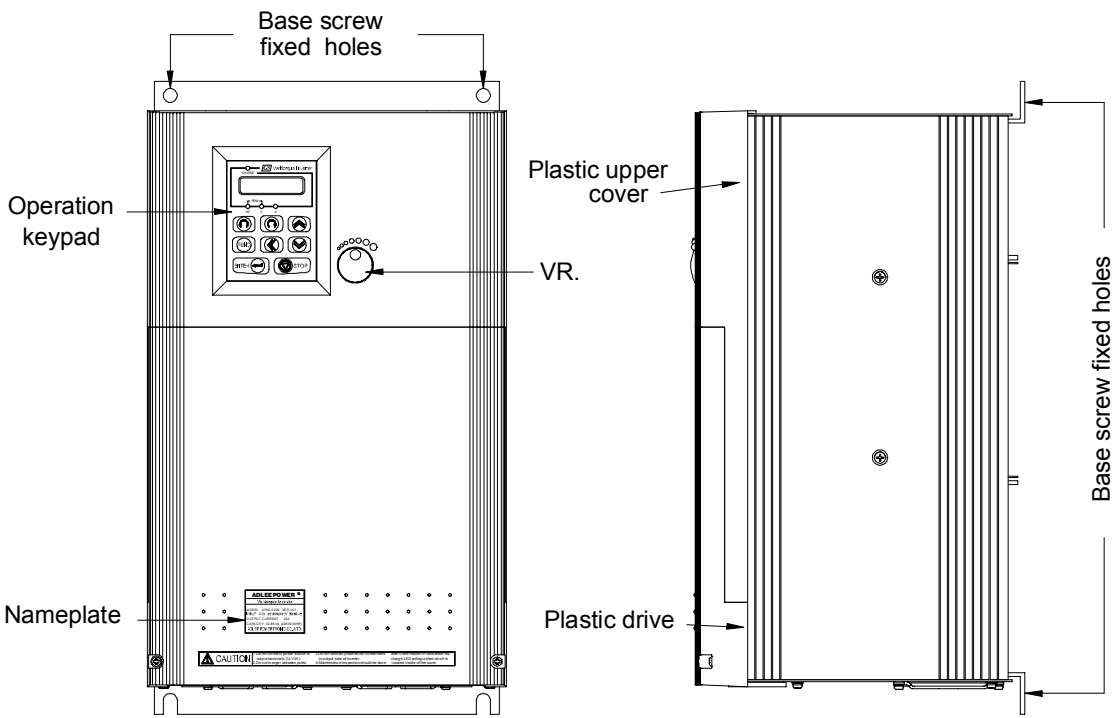
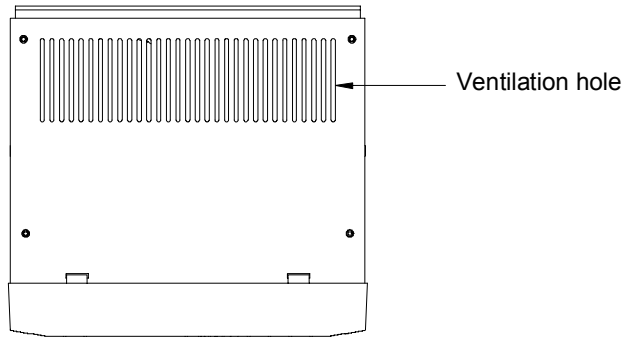


4. EXTERNAL VIEW AND COMPONENT NAMES

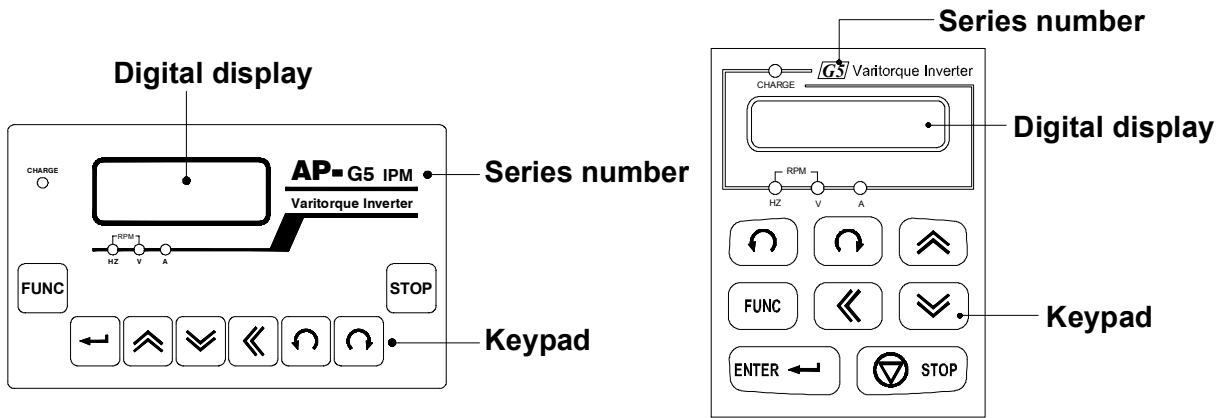
4-1 Parts(AP2G5-37 AP2G5-55 AP2G5-75
 AP4G5-37 AP4G5-55 AP4G5-75 AP4G5-110)



(AP2G5-110 AP2G5-150 AP2G5-185 AP2G5-220
 AP4G5-150 AP4G5-185 AP4G5-220)



4-2 Keypad explication



Operational key		Function key	Description
	FWD RUN	Forward run	Command forward run
	REV RUN	Reverse run	Command reverse run
	SHIFT	Cursor movement	Select the digit
	DOWN	Down	Decrease the parameter value 9~0
	UP	Up	Increase the parameter value 0~9
	Enter	Memory storage	Save the setting parameter value
	FUNC	Function	Press once to select function Fxx and press again to change its content
	STOP	Stop	Stop operation/Return to standby mode

5. INSTALLATION

5-1 Installation environment

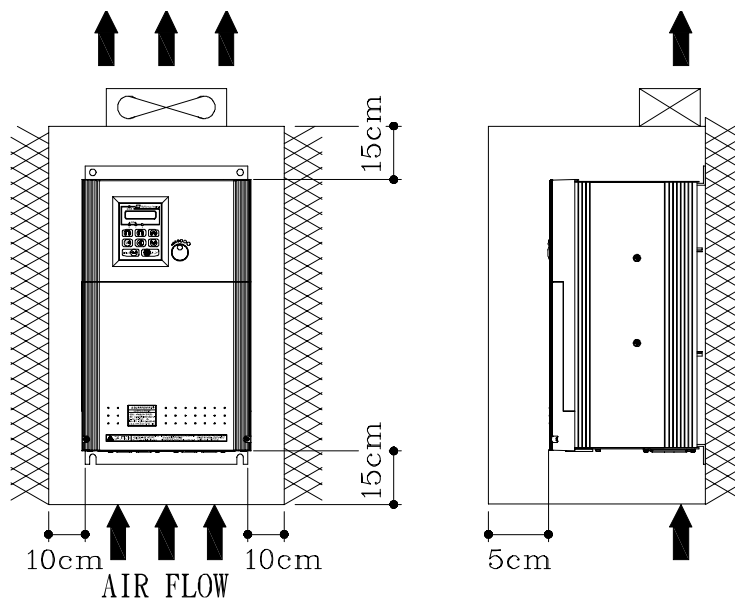
To ensure proper performance and long operating lifetime, follow the recommendations below when choosing a location for installing the APxG5.

Make sure the inverter is protected from the following conditions.

- Ambient temperature : $-10\text{ }^{\circ}\text{C} \sim 45\text{ }^{\circ}\text{C}$ and a good ventilatory condition.
- No rain, moisture.(For enclosed wall-mounted type)
Less dust, oil sprays, metal bits.
- No erodent.
- No direct sunshine, (Avoid using outdoors.) High temperature and falling dust.
- No vibration and Low EMI with electric power.
- Easy to maintain and inspect.

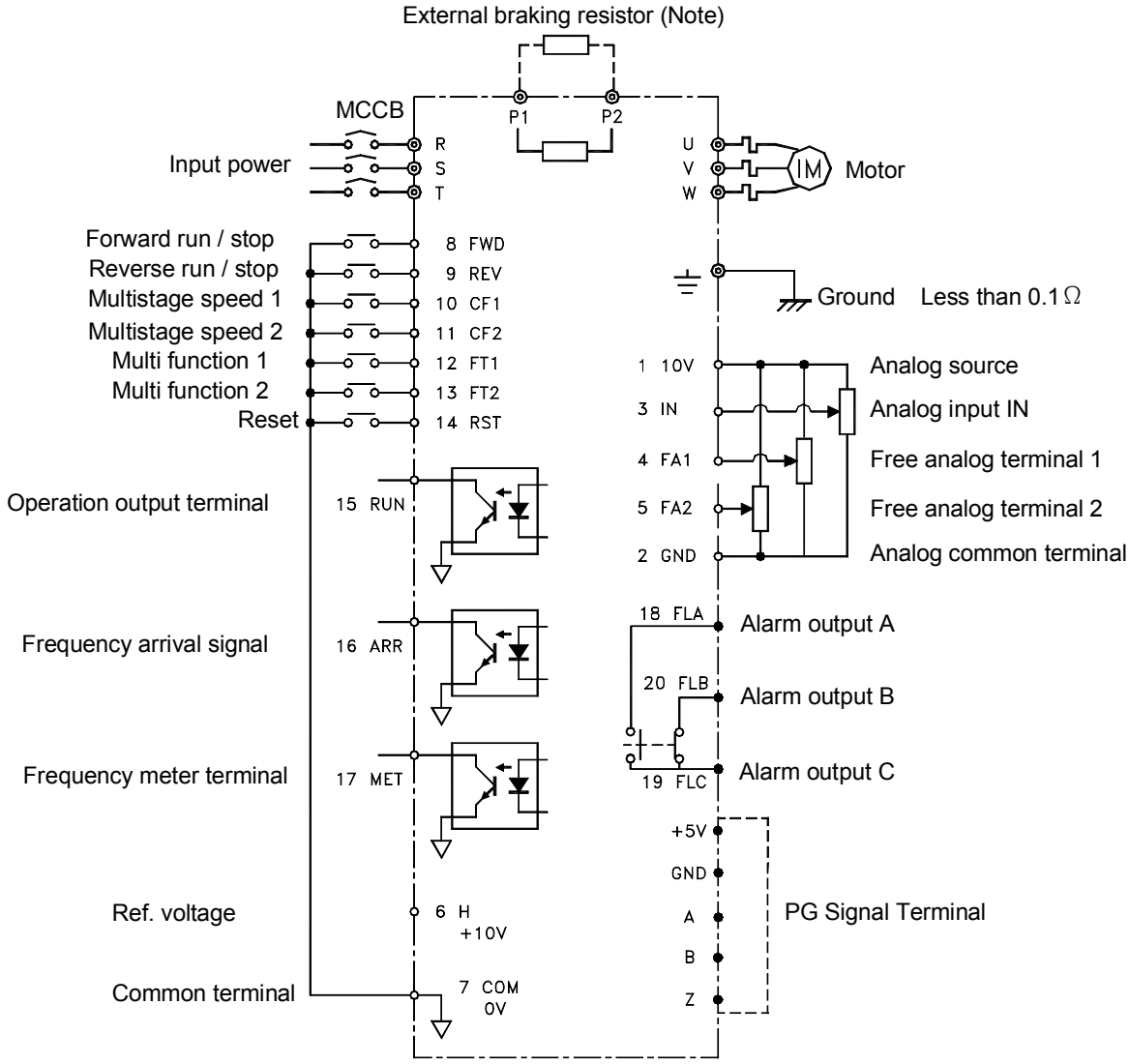
5-2 Installation

1. Install the unit always vertically with at least 15cm marginal spaces around.(See the diagram below)
2. If installation have unscure position, place a board under inverter before install it. Otherwise, the main circuit may be damaged.
3. Installation environment must on nonflammable material such as the steel sheet.



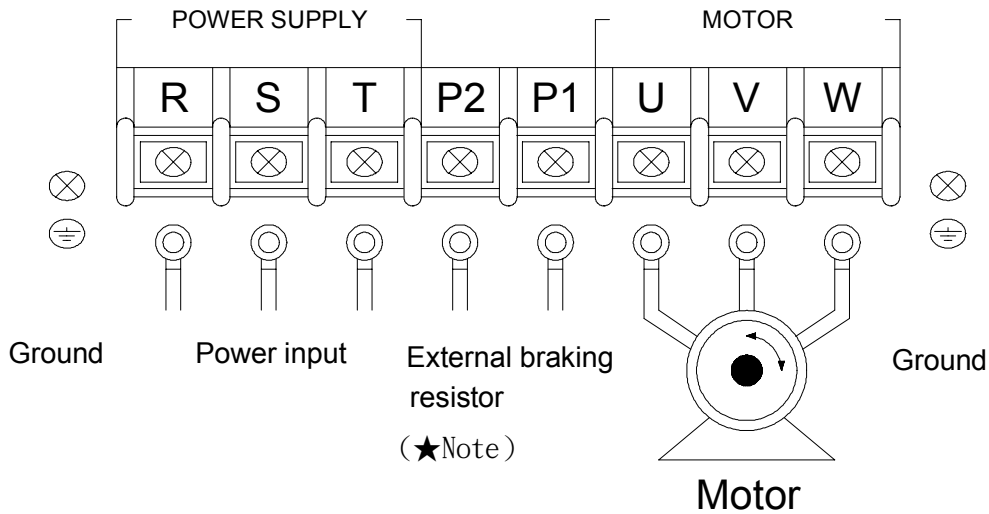
6. DESCRIPTION OF TERMINALS AND WIRING

6-1 Wiring diagram



Note : Disconnect the internal braking resistor, before connect the external brake resistor. (see P1 & P2)

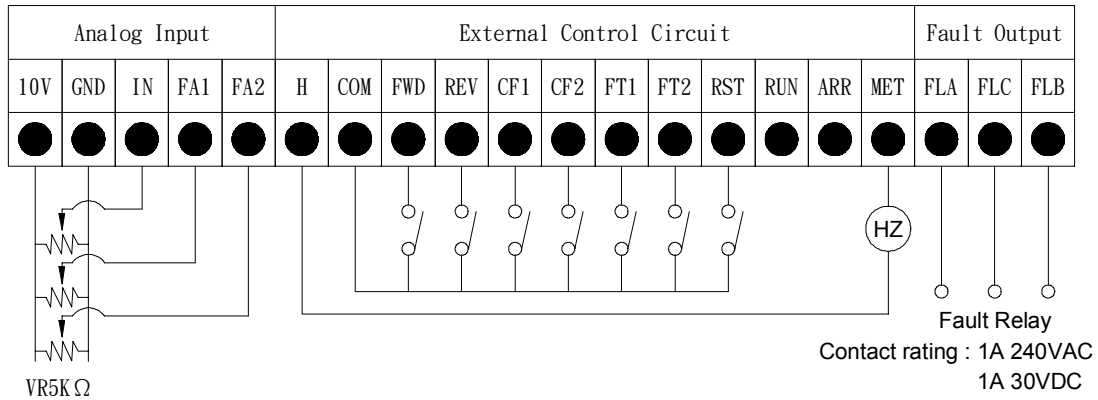
6-2 Main circuit connection diagram and wiring



NO	Main circuit terminal	
	Ground terminal	Ground resistance should not exceed 0.1 Ω
R	Power input	3 φ 220V ± 10% 3 φ 380/440V ± 10% 50/60HZ ± 10%
S		
T		
P1	DC voltage terminal	Regenerative braking resistor connecting terminal
P2		
U	Inverter output	Terminal connecting with motor
V		
W		

★ NOTE : Remove the internal braking resistor in P1 and P2 before connect the external braking resistor to avoid the damage.

6-3 Connection of external control signals



6-4 Analog signal DIP switch setting

DIP SIGNAL	IN	FA1	FA2
0 - 10V	ON <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6	ON <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6	ON <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 1 2 3 4 5 6
0 - 5V	ON <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6	ON <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6	ON <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> 1 2 3 4 5 6
4 - 20mA (Note)	ON <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6	ON <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6	ON <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 1 2 3 4 5 6
Error setting	ON <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6	ON <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6	ON <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6

★ NOTE : 4-20mA input description.

IN please refer to functions F46,F47.

FA1,FA2 please refer to functions F74,F75.

Control circuit terminal																		
No	Symbol	Terminal name	Description															
1	10V	Analog source	Power source +10V of analog terminals															
2	GND	Analog common terminal	Common terminal of free analog terminals															
3	IN	Analog input	See function description F46,F47															
4	FA1	Free analog terminal 1	See function description F74															
5	FA2	Free analog terminal 2	See function description F75															
6	H	Ref. voltage	Basic source (+10V) terminal for control terminal															
7	COM	Common terminal	Common terminal of control board															
8	FWD	Forward operation	Forward operation / stop terminal															
9	REV	Reverse operation	Reverse operation / stop terminal															
10	CF1	Multistage speed terminal	<table border="1"> <thead> <tr> <th>CF1</th> <th>CF2</th> <th>SPEED</th> </tr> </thead> <tbody> <tr> <td>OFF</td> <td>OFF</td> <td>SPEED - 1</td> </tr> <tr> <td>ON</td> <td>OFF</td> <td>SPEED - 2</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>SPEED - 3</td> </tr> <tr> <td>ON</td> <td>ON</td> <td>SPEED - 4</td> </tr> </tbody> </table>	CF1	CF2	SPEED	OFF	OFF	SPEED - 1	ON	OFF	SPEED - 2	OFF	ON	SPEED - 3	ON	ON	SPEED - 4
CF1	CF2			SPEED														
OFF	OFF	SPEED - 1																
ON	OFF	SPEED - 2																
OFF	ON	SPEED - 3																
ON	ON	SPEED - 4																
11	CF2																	
12	FT1	Multi function terminal 1	See functions description of F69															
13	FT2	Multi function terminal 2	See functions description of F70															
14	RST	Reset	Reset															
15	RUN	Operation output terminal	Open collector output 50mA Max.															
16	ARR	Frequency arrival signal																
17	MET	Frequency meter terminal	Connect to frequency meter, please refer to F106															
18	FLA	Alarm output A	Fault alarm contact(normal open)															
19	FLC	Alarm output C	Fault alarm contact(common)															
20	FLB	Alarm output B	Fault alarm contact(normal close)															

PG terminal			
NO	Symbol	Terminal name	Description
1	+5V	Encoder +	Power source of encoder terminals (Note 1)
2	GND	Encoder -	Power GND of encoder terminals
3	A	Encoder Ach output	Ach of encoder terminals
4	B	Encoder Bch output	Bch of encoder terminals
5	Z	Encoder Zch output	Zch of encoder terminals
6	FG	Encoder shield	Encoder shield terminals

Note 1 : The control board “J14” for encoder power source select +5V or 15V. (Factory for +5V)

6-5 Main circuit's breaker and magnetic contactor for wiring

Model	AP2G5							AP4G5						
	37	55	75	110	150	185	220	37	55	75	110	150	185	220
Model No	37	55	75	110	150	185	220	37	55	75	110	150	185	220
Capacity(KVA)	6.5	9.2	12.6	17.6	23.3	29	34	6.5	9.2	12.6	17.5	23.6	29	32.8
Current(A)	17	24	33	46	61	76	90	9	12	17	23	31	38	42
Circuit Breaker (MCCB) (A)	20	30	50	75	100	125	150	15	20	30	50	50	75	75
Electro-Magnetic Contactor (MC) (A)	18	35	50	65	80	93	93	12	18	18	33	48	50	50
Thermal relay (RC) (A)	15	20	28	40	55	67	80	6.8	9	15	20	28	40	40
FUSE(A)	30	40	60	75	100	125	150	15	20	30	50	50	75	75
Wire gage(AWG)	10	8	6	6	4	2	1	14	12	8	8	8	6	6

For safety consideration, please install molded-case circuit breaker (MCCB) or magnetic contactor (MC) between AC power source and the inverter AC power input terminals RST.

6-6 Surge absorber

In order to prevent malfunction, provide the surge absorber on the coils of the electromagnetic contactors, relays and other devices which are to be used adjacent of the inverter.

6-7 Cable size and length

1. It is necessary to consider line to line voltage drop which is below 2% rated voltage.

Line to line voltage drop(V)

$$= \sqrt{3} \times \text{power line resistance}(\Omega / \text{km}) \times \text{power line length}(\text{m}) \times \text{current}(\text{A}) \times 10^{-3}$$

2. If the total wiring distance between inverter and motor is excessively long and the inverter carrier frequency (main transistor switching frequency) is high, harmonic leakage current from the cable will adversely affect the inverter and peripheral devices. If the wiring distance between inverter and motor is long, reduce frequency can be set by constant F20.

Distance Inverter → Motor	under 25M	under 50M	under 100M	over 100m
Carrier	under 16KHz	under 10KHz	under 5KHz	under 2.5KHz

6-8 Cautionary points for wiring

A. Main circuit

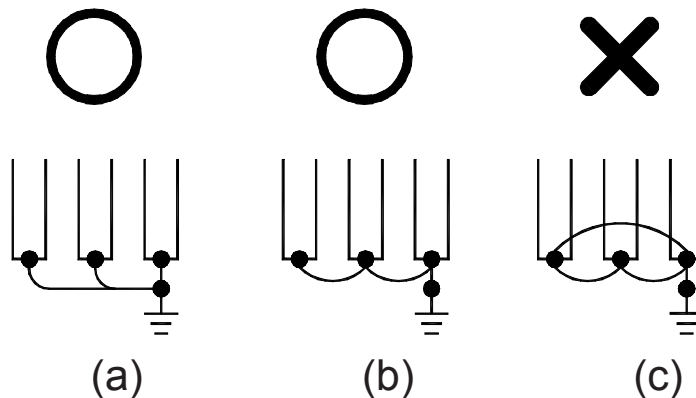
1. Do not connect the cables of the power source side(R,S,T) to the U V and W output terminals.
2. Connect output terminals U, V and W to motor lead wires U, V and W. Verify that the motor rotates in the forward direction (CCW counterclockwise when viewed from the motor load side) with the forward run command. If the motor rotation is incorrect, exchange any two of output terminals U, V and W.
3. Never touch the output circuit directly or put the output line in contact with the inverter case. Otherwise, it may cause an electrical shock or grounding short. In addition, never short circuit the output line.
4. Prohibit of connection of phase advancing capacitor of LC/RC noise filter.
5. The distance between main circuit wires of the inverter and other equipment is as far as possible.

B. Control circuit wiring signal

1. Separate control circuit wires from power cables to prevent erroneous operation caused by noise interference.
2. Use shielded wires for control circuit wires.
3. To wire the external control signals, please refer to 6-3.

C. Grounding

1. \oplus Ground resistance less than 0.1Ω .
2. The ground wires must obey international standards and keep the length as short as possible.
3. Never ground the inverter in common with welding machines, motors or an other large-current electrical equipment. To connect all of the ground wires separate from wires for large-current electrical equipment.
4. When using several inverter units side by side, ground the units as shown in (a) or (b). Do not loop the ground wires as shown in (c).



7. OPERATION TEST

7-1 Pre-check points

- All wiring are connected correctly.
- The motor power output is fit inverter's specification.
- Wire clips or screws are not left in the unit.
- Screw-type terminals are screwed tightly.
- The cover of inverter's is fixed tightly.

7-2 Cautions for operating test

- Avoid damaging the machine, please do the operation test by no load.
- Before input power, check the voltage and wiring are correct.
- After input power, any unusual noise, smoke or smell please turn OFF power immediately.

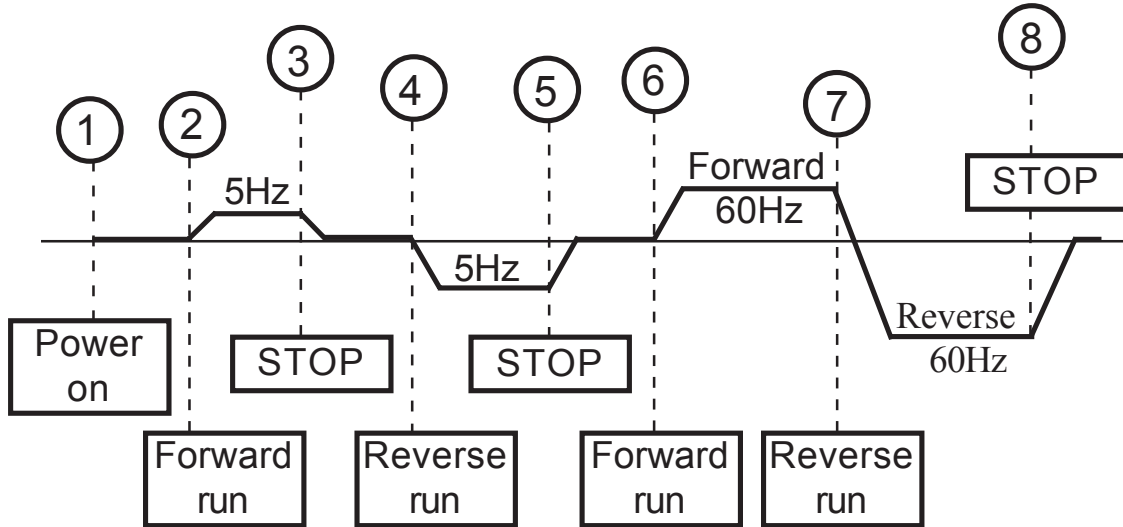
Confirm the following list before operation :

- Check motor operation smoothly.
- Correct motor operating direction.
- No unusual vibration happened.
- Check acceleration and deceleration speed is smoothly.
- Load current is below the rated current.
- Correct operational pad display indicator.

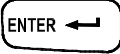
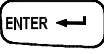




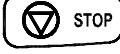





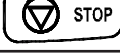
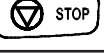




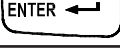
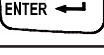


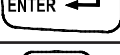
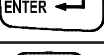






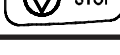
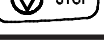
7-3 Setting for operation test

(A) Operate by keypad

The diagram below shows a operational pattern :

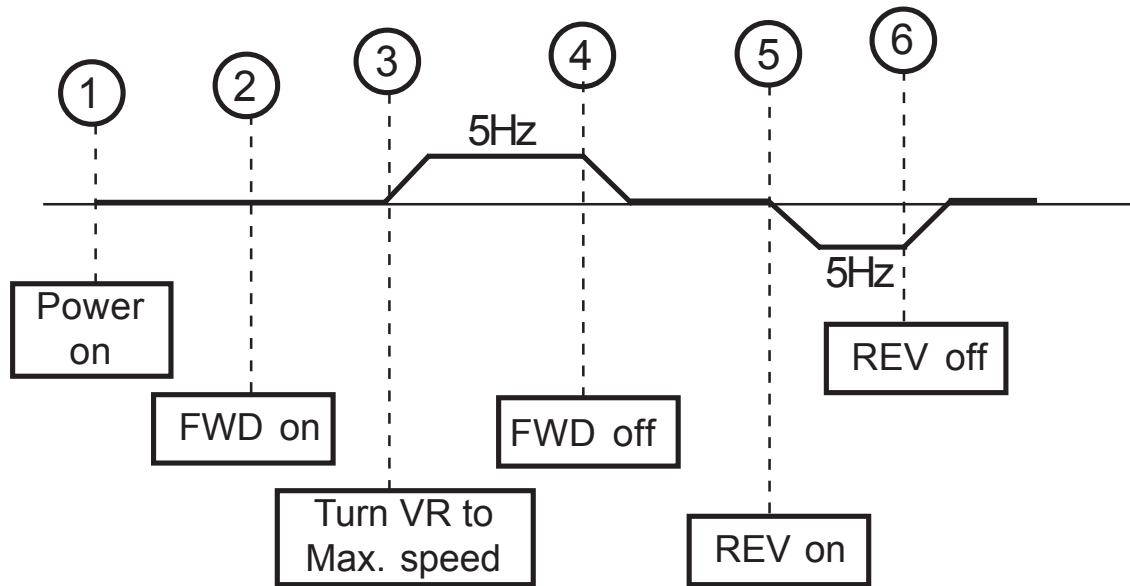


Sequence	Display indicator	Description
	AdLEE	In waiting mode
<input type="button" value="FUNC"/>	F 000	Press <input type="button" value="FUNC"/> mode F □□□
<input type="button" value="↑↓↵"/>	F 036	Press <input type="button" value="↑↓↵"/> turning to F036
<input type="button" value="ENTER ↵"/>	000	Press <input type="button" value="ENTER ↵"/> , enter F036 to set content
<input type="button" value="↑↓↵"/>	005	Press <input type="button" value="↑↓↵"/> turning to F036(5HZ)
<input type="button" value="ENTER ↵"/>	AdLEE	Press <input type="button" value="ENTER ↵"/> confirm
<input type="button" value="FUNC"/>	F 036	Press <input type="button" value="FUNC"/> showing F036
<input type="button" value="↑↓↵"/>	F 023	Press <input type="button" value="↑↓↵"/> turning to F023
<input type="button" value="ENTER ↵"/>	006	Press <input type="button" value="ENTER ↵"/> , enter F023 to set content
<input type="button" value="↑↓↵"/>	002	Press <input type="button" value="↑↓↵"/> turning to F023(mode 2)

Sequence	Display indicator	Description
	AdLEE	Press  confirm
	rEAdY	Press  ready to forward run
	□	Press  start forward run
	AdLEE	Press  stop
	rEAdY	Press  ready to reverse run
	□	Press  start reverse run
	AdLEE	Press  stop
	F 023	Press  showing F023
	F 036	Press  turning to F036
	005	Press  enter F036
	060	Press  turning to F036(60HZ)
	AdLEE	Press  confirm
	rEAdY	Press  ready to forward run
	□	Press  start forward run
	□	Press  start reverse run
	AdLEE	Press  stop

(B) Operation external terminal signal

The diagram below shows a operational pattern :



Sequence	Display indicator	Description
	AdLEE	In waiting mode
<input type="button" value="FUNC"/>	F 000	Press <input type="button" value="FUNC"/> mode F <input type="text" value=""/> <input type="text" value=""/> <input type="text" value=""/>
<input type="button" value="▲"/> <input type="button" value="▼"/> <input type="button" value="◀"/>	F 046	Press <input type="button" value="▲"/> <input type="button" value="▼"/> <input type="button" value="◀"/> turning to F046
<input type="button" value="ENTER →"/>	60.00	Press <input type="button" value="ENTER →"/> , enter F046 to set content
<input type="button" value="▲"/> <input type="button" value="▼"/> <input type="button" value="◀"/>	5.00	Press <input type="button" value="▲"/> <input type="button" value="▼"/> <input type="button" value="◀"/> turning to F046(5HZ)
<input type="button" value="ENTER →"/>	AdLEE	Press <input type="button" value="ENTER →"/> confirm
<input type="button" value="FUNC"/>	F 046	Press <input type="button" value="FUNC"/> showing F046
<input type="button" value="▲"/> <input type="button" value="▼"/> <input type="button" value="◀"/>	F 023	Press <input type="button" value="▲"/> <input type="button" value="▼"/> <input type="button" value="◀"/> turning to F023
<input type="button" value="ENTER →"/>	2	Press <input type="button" value="ENTER →"/> , enter F023 to set content

Sequence	Display indicator	Description
	2	Press to F023 (mode 2)
	AdLEE	Press confirm
	F 023	Press showing F023
	F 024	Press turning to F024
	0	Press enter F024 to set content
	1	Press turning to F024(mode 1)
	AdLEE	Press confirm
	F 024	Press showing F024
	F 025	Press turning to F025
	0	Press , enter F025 to set content
	2	Press turning to F025(mode 2)
	AdLEE	Press confirm
		Close between "FWD" and "COM" terminals
		Turn the "VR" to max. resistance
		Open between "FWD" and "COM" terminals
		Close between "REV" and "COM" terminals
		Open between "REV" and "COM" terminals

8. CONTROL MODE SETTING

8-1 Control mode selection

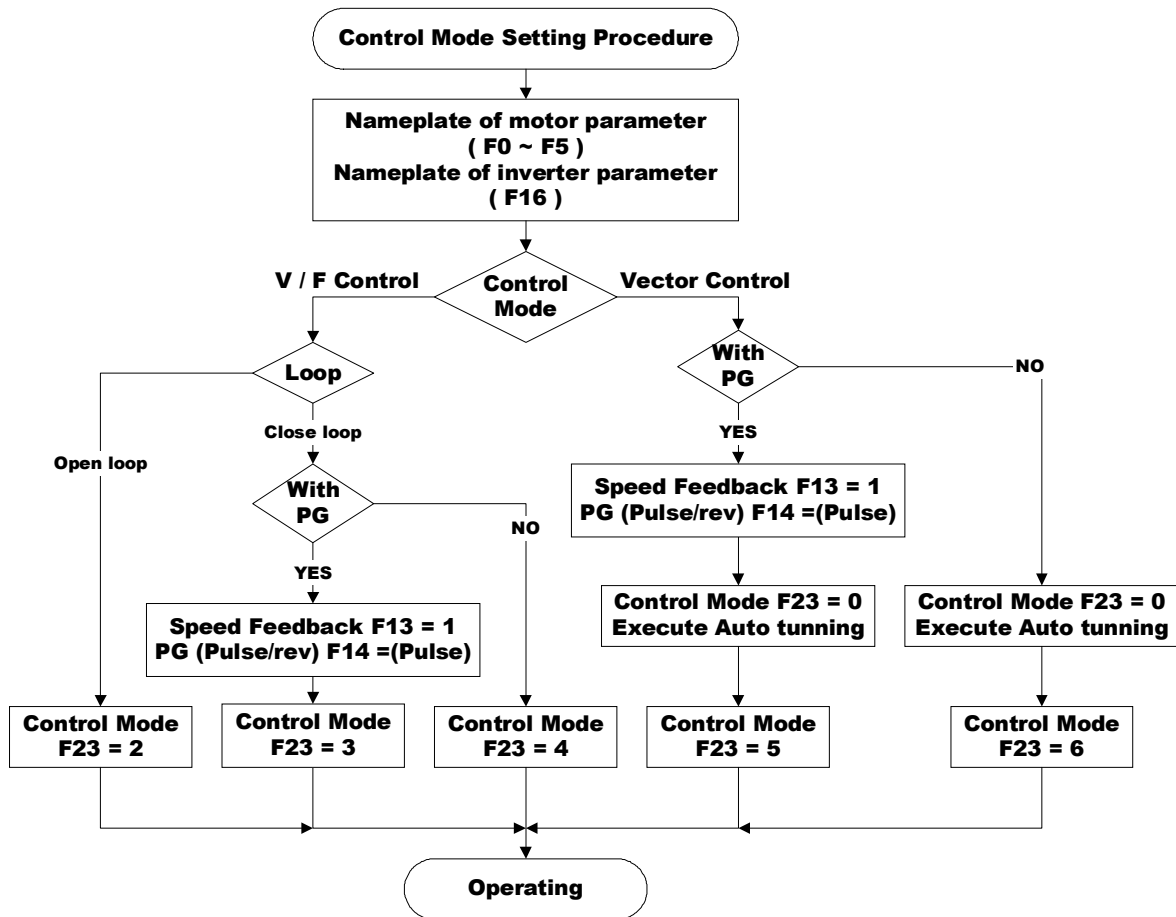
APxG5 provides 5 different control modes :

1. v/f open loop control.
2. v/f close loop control with PG (pulse generator).
3. v/f sensorless close loop control.
4. Current vector with PG close loop control.
5. Sensorless current vector control.

The performance depends on the application by using keypad.

V/F open loop control mode is a factory setting.(F23=2)

Please follow the flow chart below to set control mode and input motor parameter.











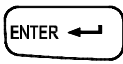
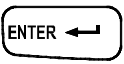




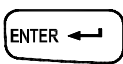
Note : It needs to key in the motor parameters while setting F23=4, 5,6. If the motor parameters are unknown, please follow the “Auto Turning Procedure” to set up these parameters.

8-2 Control mode characteristics


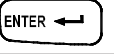
Control mode	V/F open loop control	V/F close loop control with PG (pulse generation)	V/F sensorless close loop	Current vector with PG close loop control	Current vector Close loop control
Common control	Voltage / Frequency control (Open loop)	Voltage / Frequency control with speed compensation (Close loop)	Voltage / Frequency control (Close loop)	Current vector with PG control (Close loop)	Current vector with no PG control (Close loop)
Encoder	NO	YES (PG)	NO	YES (PG)	NO
Regulated speed range	1 : 40	1 : 40	1 : 40	1 : 1000	1 : 100
Start torque	150% / 3HZ	150% / 3HZ	150% / 3HZ	150% / 0.01HZ	150% / 1HZ
Speed resolution	2% ~ 3%	0.03%	1% ~ 2%	0.02%	0.2%
Torque control	NO	NO	NO	YES	NO
Application	Drive multi-motor at the same time. Can't Auto tuning	Machine with pulse generation	Variable speed control application	High resolution speed control and torque control	Variable speed control application

8-3 Control mode change

Example of changing V/F open loop control to vector close loop control with PG.

Sequence	Display indicator	Description
	AdLEE	In waiting mode
	F 000	Press  show F □□□
  	F 023	Press    turning to F023
	002	Press  , enter F023 to set content
	005	Press    turning to F023(mode 5)
	AdLEE	After all setting , functions do not save to external memory. That need to execute F177 to process it. Then, it will be valid when restart.












































































8-4 Motor parameter Auto tuning procedure

 Caution
<ul style="list-style-type: none"> . "Auto tuning" requires free shift of motor. . During "Auto tuning" , all external control signals are invalid. . During "Auto tuning", motor rotates with obvious magnetic noise due to the inverter change carrier frequency to 5KHZ. . Before executing "Auto tuning" , make sure motor is in stationary status, then press  key.

[Auto inspection of operation procedure]

Procedure		Method and operate																																													
1	Safety notice	<ul style="list-style-type: none"> . Please make sure the motor is separated from machinery. . Please make sure the motor without surroundings people. . Please check the machinery braking slack. . Take off shaft key. 																																													
2	Inverter input power	<ul style="list-style-type: none"> . Check inverter operating normally. . Check direction of PG rotation. 																																													
3	Control mode setting	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Sequence</th> <th style="width: 20%;">Display indicator</th> <th style="width: 65%;">Description</th> </tr> </thead> <tbody> <tr> <td></td> <td style="text-align: center;">AdLEE</td> <td>In waiting mode</td> </tr> <tr> <td style="text-align: center;">FUNC</td> <td style="text-align: center;">F 0</td> <td>Press mode F <input style="width: 20px;" type="text"/> <input style="width: 20px;" type="text"/> <input style="width: 20px;" type="text"/></td> </tr> <tr> <td style="text-align: center;"> </td> <td style="text-align: center;">F 23</td> <td></td> </tr> <tr> <td style="text-align: center;"></td> <td style="text-align: center;">2</td> <td>Control mode factory setting is 2V/F open loop control</td> </tr> <tr> <td style="text-align: center;"> </td> <td style="text-align: center;">0</td> <td>Press adjust control mode 0, electric parameter inspection</td> </tr> <tr> <td style="text-align: center;"></td> <td style="text-align: center;">AdLEE</td> <td></td> </tr> <tr> <td style="text-align: center;"></td> <td style="text-align: center;">rEAdY</td> <td></td> </tr> <tr> <td style="text-align: center;"></td> <td style="text-align: center;">Pr AL</td> <td>Waiting for electric parameter turning.</td> </tr> <tr> <td></td> <td style="text-align: center;">rEAdY</td> <td>Finished parameter turning</td> </tr> <tr> <td style="text-align: center;">FUNC</td> <td style="text-align: center;">F 23</td> <td></td> </tr> <tr> <td style="text-align: center;"> </td> <td style="text-align: center;">F 177</td> <td>Press to adjust F177 to save the recently parameter</td> </tr> <tr> <td style="text-align: center;"></td> <td style="text-align: center;">0</td> <td>"0" nonsave</td> </tr> <tr> <td style="text-align: center;"></td> <td style="text-align: center;">1</td> <td>"1" save</td> </tr> <tr> <td style="text-align: center;"></td> <td style="text-align: center;">AdLEE</td> <td>Finish parameter tuning then save</td> </tr> </tbody> </table>	Sequence	Display indicator	Description		AdLEE	In waiting mode	FUNC	F 0	Press mode F <input style="width: 20px;" type="text"/> <input style="width: 20px;" type="text"/> <input style="width: 20px;" type="text"/>		F 23			2	Control mode factory setting is 2V/F open loop control		0	Press adjust control mode 0, electric parameter inspection		AdLEE			rEAdY			Pr AL	Waiting for electric parameter turning.		rEAdY	Finished parameter turning	FUNC	F 23			F 177	Press to adjust F177 to save the recently parameter		0	"0" nonsave		1	"1" save		AdLEE	Finish parameter tuning then save
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			1	"1" save																																											
	AdLEE	Finish parameter tuning then save																																													

[Mechanical inspection of operation procedure]

Procedure		Method and operate																																													
1	Safety notice	<ul style="list-style-type: none"> . Please make sure the motor is separated from machinery. . Please make sure the motor without surroundings people. . Please check the machinery braking slack. . Check the PG install completion. 																																													
2	Inverter input power	<ul style="list-style-type: none"> . Check inverter operation normally. . Check direction of PG rotation. 																																													
3	Control mode setting	<table border="1"> <thead> <tr> <th>Sequence</th> <th>Display indicator</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td></td> <td>AdLEE</td> <td>In waiting mode</td> </tr> <tr> <td></td> <td>F 0</td> <td>Press  mode F <input type="text"/> <input type="text"/> <input type="text"/></td> </tr> <tr> <td>  </td> <td>F 23</td> <td></td> </tr> <tr> <td></td> <td>2</td> <td>Control mode factory setting is 2V/F open loop control</td> </tr> <tr> <td>  </td> <td>1</td> <td>Press    adjust control mode 1 electric parameter inspection</td> </tr> <tr> <td></td> <td>AdLEE</td> <td></td> </tr> <tr> <td></td> <td>rEAdY</td> <td></td> </tr> <tr> <td></td> <td>Pr-Jn7</td> <td>Waiting for mechanical parameter turning.</td> </tr> <tr> <td></td> <td>rEAdY</td> <td>Finished parameter turning</td> </tr> <tr> <td></td> <td>F 23</td> <td></td> </tr> <tr> <td>  </td> <td>F 177</td> <td>Press    to adjust F177 to save the recently parameter</td> </tr> <tr> <td></td> <td>0</td> <td>"0" nonsave</td> </tr> <tr> <td></td> <td>1</td> <td>"1" save</td> </tr> <tr> <td></td> <td>AdLEE</td> <td>Finish parameter tuning then save</td> </tr> </tbody> </table>	Sequence	Display indicator	Description		AdLEE	In waiting mode		F 0	Press  mode F <input type="text"/> <input type="text"/> <input type="text"/>	  	F 23			2	Control mode factory setting is 2V/F open loop control	  	1	Press    adjust control mode 1 electric parameter inspection		AdLEE			rEAdY			Pr-Jn7	Waiting for mechanical parameter turning.		rEAdY	Finished parameter turning		F 23		  	F 177	Press    to adjust F177 to save the recently parameter		0	"0" nonsave		1	"1" save		AdLEE	Finish parameter tuning then save
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			1	"1" save																																											
			AdLEE	Finish parameter tuning then save																																											

9. PARAMETER EXPLANATIONS

9-1 Parameter's lists (1)

Display Order	Function	Standard Setting Value	Adjustable Range	Unit	Remark
MOTOR NAMEPLATE					
F00	Rated line voltage(rms)	220/380/440	± 10%	1V	
F01	Rated line current(rms)	3.4/2.0/1.7	1.5~130.0	0.1A	
F02	Rated frequency	60.00	50.0~70.0	0.1Hz	
F03	Rated R.P.M	1700	0~4200	Rpm	
F04	Horse power	1.0	0.5~50.0	0.1Hp	
F05	Poles	4	2~12	Pole	
F06	Power factor	0.80	0.40~1.00	0.01	
MOTOR PARAMETER					
F07	Stator resistor	20000	8192~32767		
F08	Rotor resistor	16000	8192~32767		
F09	Stator self inductance	18000	13100~28700		
F10	Mutual inductance	17500	11800~25800		
F11	Reserved				
F12	Machnical constant	1500	0~30000		
INVERTER PARAMETER					
F13	Feedback	0	0~1		
F14	Encoder(slit/turn)	1024	600~2500	1Pluse	
F15	Encoder direction	1	-1~1		
F16	RST AC input voltage(rms)	220/380/440	180~500	1V	
F17	Reserved				
F18	Reserved				
PWM PARAMETER					
F19	PWM adjustment mode	1	0~2		

9-1 Parameter's lists (2)

Display Order	Function	Standard Setting Value	Adjustable Range	Unit	Remark
F20	Carrier frequency	5000	2000~16000	1Hz	
F21	Percentage of dead time compensation	75	0~100	%	
F22	Reserved				
CONTROL MODE					
F23	Control mode setting	2	0~6		
TURNING CONTROL PARAMETER					
F24	Terminal/keypad command	0	0~1		
F25	Command source	0	0~3		
F26	Jog mode	0	0~1		
F27	Search speed function	0	0~1		
F28	Stop mode	1	0~2		
F29	DC braking time	0	0~25.0	0.1Sec	
F30	DC braking voltage	0	0~0.200	0.001 PU	
F31	Reserved				
SPEED CONFINEMENT					
F32	CW or CCW or CW/CCW	0	0~2		
F33	Minimum frequency limit	0	0~400.0	0.1Hz	
F34	Maximum frequency limit	60.0	0~400.0	0.1Hz	
F35	Start frequency	0	0~30.0	0.1Hz	
SPEED SETTING					
F36	Master speed	0	0~400.0	0.1Hz	
F37	1 st speed	5.0	0~400.0	0.1Hz	

9-1 Parameter's lists (3)

Display Order	Function	Standard Setting Value	Adjustable Range	Unit	Remark
F38	2 nd speed	10.0	0~400.0	0.1Hz	
F39	3 rd speed	15.0	0~400.0	0.1Hz	
F40	4 th speed	20.0	0~400.0	0.1Hz	
F41	5 th speed	30.0	0~400.0	0.1Hz	
F42	6 th speed	40.0	0~400.0	0.1Hz	
F43	7 th speed	50.0	0~400.0	0.1Hz	
F44	8 th speed	60.0	0~400.0	0.1Hz	
F45	Jogging speed	5.0	0~400.0	0.1Hz	
F46	Max. input analog frequency / 5V	60.0	0~400.0	0.1Hz	
F47	Analog input offset	0	-400.0~400.0	0.1Hz	
FREQUENCY JUMP					
F48	Jump frequency range	0	0~20.0	0.1Hz	
F49	Frequency jump 1	10.0	0~400.0	0.1Hz	
F50	Frequency jump 2	20.0	0~400.0	0.1Hz	
F51	Frequency jump 3	40.0	0~400.0	0.1Hz	
ACCELERATION AND DECELERATION TIME					
F52	Acc. / Dec. Slope	1	1~4		
ACCELERATION AND DECELERATION TIME (1)					
F53	Acceleration time 1	3.0	0.2~1200.0	0.1Sec	
F54	Acceleration curve 1	50	0~100	1%	
F55	Deceleration time 1	3.0	0.2~1200.0	0.1Sec	
F56	Deceleration curve 1	50	0~100	1%	
ACCELERATION AND DECELERATION TIME (2)					
F57	Acceleration time 2	3.0	0.2~1200.0	0.1Sec	

9-1 Parameter's lists (4)

Display Order	Function	Standard Setting Value	Adjustable Range	Unit	Remark
F58	Acceleration curve 2	50	0~100	1%	
F59	Deceleration time 2	3.0	0.2~1200.0	0.1Sec	
F60	Deceleration curve 2	50	0~100	1%	
ACCELERATION AND DECELERATION TIME (3)					
F61	Acceleration time 3	3.0	0.2~1200.0	0.1Sec	
F62	Acceleration curve 3	50	0~100	1%	
F63	Deceleration time 3	3.0	0.2~1200.0	0.1Sec	
F64	Deceleration curve 3	50	0~100	1%	
ACCELERATION AND DECELERATION TIME (4)					
F65	Acceleration time 4	3.0	0.2~1200.0	0.1Sec	
F66	Acceleration curve 4	50	0~100	1%	
F67	Deceleration time 4	3.0	0.2~1200.0	0.1Sec	
F68	Deceleration curve 4	50	0~100	1%	
DIGITAL INPUT					
F69	Multi-function terminal (FT1)	0	0~15		
F70	Multi-function terminal (FT2)	0	0~15		
DIGITAL OUTPUT					
F71	Multi function setting (Output digital ARR)	0	0~1		
F72	Frequency arrive	10	0~100	1%	
F73	Number of pulse/cycle	1	1~36		
FREE ANALOG INPUT					
F74	Multi-function setting (Analog input FA1)	0	0~20		

9-1 Parameter's lists (5)

Display Order	Function	Standard Setting Value	Adjustable Range	Unit	Remark
F75	Multi-function setting (Analog input FA2)	0	0~20		
MAGNETIC FLUX SETTING					
F76	Max. voltage frequency	1	1~2		
F77	Max. voltage 1	0.80	0.50~1.00	0.01 PU	
F78	Max. voltage frequency 1	1.00	0.50~2.00	0.01 PU	
F79	Max. voltage 2	0.80	0.50~1.00	0.01 PU	
F80	Max. voltage frequency 2	1.00	0.50~2.00	0.01 PU	
F81	Flux curve	0	-10~5		
F82	Efficiency control	0	0~1		
INCREASE VOLTAGE					
F83	Voltage boost	0	0~0.200	0.001 PU	
F84	Voltage boost mode	0	0~2		
SPEED CONTROL PARAMETER					
F85	V/F control P gain	30	0~100	1%	
F86	V/F control I gain	20.0	0~100.0	0.1%	
F87	Flux vector control P gain	40	0~100.0	1%	
F88	Flux vector control I gain	20.0	0~100.0	0.1%	
F89	Sensorless control P gain	30	0~100	1%	
F90	Sensorless control I gain	15.0	0~100.0	0.1%	
F91	Torque limit	0.75	0~0.9	0.1%	

9-1 Parameter's lists (6)

Display Order	Function	Standard Setting Value	Adjustable Range	Unit	Remark
TORQUE COMMAND					
F92	Voltage / torque control mode	0	0~1		
F93	Source of torque command	0	0~1		
F94	Torque sensor command source	0	-2.00~2.00		
F95	Torque command of jogging operation	0	0~2.00	0.01 PU	
F96	Max. current of torque command (analog input)	1.00	0~2.00	0.01 PU	
F97	Torque offset analog input	0	-2.00~2.00	0.01 PU	
CURRENT CONTROL					
F98	Current loop bandwidth	1000	0~1200	RPM	
F99	Magnetization voltage limit / (2*Vdc/3)	14.5	0~20.0	0.1%	
F100	Torque voltage limit / (2*Vdc/3)	85.0	0~86.6	0.1%	
ESTIMATOR					
F101	Reserved				
F102	Reserved				
F103	Slip compensation gain	100	50~150	1%	
DIGITAL OPERATOR SETTING					
F104	Keypad displays variable selection	1	0~15		
F105	Speed display unit	1	0~1		
ANALOG SIGNAL OUTPUT DISPLAY SETTING PARAMETER					

9-1 Parameter's lists (7)

Display Order	Function	Standard Setting Value	Adjustable Range	Unit	Remark
F106	MET display variable selection	1	0~15		
F107	MET polarity setting	0	0~1		
F108	MET signal setting	1.00	0.50~4.00	0.01 PU	
F109	Reserved				
F110	Reserved				
F111	Reserved				
MULTI-COUNT TIMER FUNCTION					
F112	Multi-timer function	0	0~2		
F113	Point setting	2	2~20		
F114	Cycle number	1	1~32767	1Cycle	
F115	1 st point status	0	0~255		
F116	1 st point time	1	1~32767	1Sec	
F117	2 nd point status	0	0~255		
F118	2 nd point time	1	1~32767	1Sec	
F119	3 rd point status	0	0~255		
F120	3 rd point time	1	1~32767	1Sec	
F121	4 th point status	0	0~255		
F122	4 th point time	1	1~32767	1Sec	
F123	5 th point status	0	0~255		
F124	5 th point time	1	1~32767	1Sec	
F125	6 th point status	0	0~255		
F126	6 th point time	1	1~32767	1Sec	
F127	7 th point status	0	0~255		

9-1 Parameter's lists (8)

Display Order	Function	Standard Setting Value	Adjustable Range	Unit	Remark
F128	7 th point time	1	1~32767	1Sec	
F129	8 th point status	0	0~255		
F130	8 th point time	1	1~32767	1Sec	
F131	9 th point status	0	0~255		
F132	9 th point time	1	1~32767	1Sec	
F133	10 th point status	0	0~255		
F134	10 th point time	1	1~32767	1Sec	
F135	11 th point status	0	0~255		
F136	11 th point time	1	1~32767	1Sec	
F137	12 th point status	0	0~255		
F138	12 th point time	1	1~32767	1Sec	
F139	13 th point status	0	0~255		
F140	13 th point time	1	1~32767	1Sec	
F141	14 th point status	0	0~255		
F142	14 th point time	1	1~32767	1Sec	
F143	15 th point status	0	0~255		
F144	15 th point time	1	1~32767	1Sec	
F145	16 th point status	0	0~255		
F146	16 th point time	1	1~32767	1Sec	
F147	17 th point status	0	0~255		
F148	17 th point time	1	1~32767	1Sec	
F149	18 th point status	0	0~255		
F150	18 th point time	1	1~32767	1Sec	
F151	19 th point status	0	0~255		
F152	19 th point time	1	1~32767	1Sec	

9-1 Parameter's lists (9)

Display Order	Function	Standard Setting Value	Adjustable Range	Unit	Remark
F153	20 th point status	0	0~255		
F154	20 th point time	1	1~32767	1Sec	
ERROR RECORD					
F155	The last error record	0	0~40		
F156	The first error record before the last	0	0~40		
F157	The second error record before the last	0	0~40		
F158	The third error record before the last	0	0~40		
F159	Clear error records	0	0~1		
OVERLOAD					
F160	Overload current limit	1.50	1.00~2.50	0.01 PU	
F161	Overlad time limit	5.0	0.1~120.0	0.1Sec	
STALL PREVENTION					
F162	Stall prevention	0	0~1		
F163	Over voltage stall prevention	110	105~125	1%	
F164	Over current stall prevention	1.50	0.50~2.50	0.01 PU	
F165~ F167	Reserved				
F168	Speed ratio of display	1	0.01~100		
F169~ F175	Reserved				
OTHER					
F176	Initial	0	0~3		
F177	Save setting parameters	0	0~1		
F178	Lock	0	0~2		
F179	Key in password	0	-32767~32767		
F180	Password lock	0	-32767~32767		

9-2 Functional Parameters

To consider users' understanding and to make ADLEE vector inverter work more efficiently, this chapter will introduce the functions as a whole and will divide them into 9 sub-parameters. In most application, users can accomplish the installation before start-up, based on the functions related from the following parameters.

9 Sub-parameter group as following :

9-2-1 : User parameters

9-2-2 : Basic parameters

9-2-3 : Operating method parameters

9-2-4 : Input / output function parameters

9-2-5 : Multi-step speed and auto tuning parameters

9-2-6 : Protection parameters

9-2-7 : Motor parameters

9-2-8 : Special parameters

9-2-9 : PI control parameters

9-2-1 User parameters

Display Order	Function	Display Order	Function
F23	Control mode setting	F176	Initial parameters
F24	Terminal / keypad command	F177	Save setting parameters
F25	Command source	F178	Lock
F104	Keypad displays variable selection	F179	Key in password
F105	Speed display unit	F180	Password lock
F168	Speed ratio of display		

9-2-2 Basic parameters

Display Order	Function	Display Order	Function
F26	Jog mode	F61	Acceleration time 3
F33	Minimum frequency limit	F62	Acceleration curve 3
F34	Maximum frequency limit	F63	Deceleration time 3
F35	Start frequency	F64	Deceleration curve 3
F45	Jogging speed	F65	Acceleration time 4
F52	Acc. / Dec. slope	F66	Acceleration curve 4
F53	Acceleration time 1	F67	Deceleration time 4
F54	Acceleration curve 1	F68	Deceleration curve 4
F55	Deceleration time 1	F76	Max. voltage frequency
F56	Deceleration curve 1	F77	Max. voltage 1
F57	Acceleration time 2	F78	Max. voltage frequency 1
F58	Acceleration curve 2	F79	Max. voltage 2
F59	Deceleration time 2	F80	Max. voltage frequency 2
F60	Deceleration curve 2	F81	Flux curve

9-2-3 Operating method parameters

Display Order	Function	Display Order	Function
F19	PWM adjustment mode	F29	DC braking time
F20	Carrier frequency	F32	CW or CCW or CW/CCW
F27	Search speed function	F69	Multi-function terminal (FT1)

Follow 9-2-3 parameter

Display Order	Function	Display Order	Function
F70	Multi-function terminal (FT2)	F93	Source of torque command
F82	Efficiency control	F94	Torque sensor command source
F92	Voltage / torque control mode	F95	Torque mode of jogging operation

9-2-4 Input / output function parameters

Display Order	Function	Display Order	Function
F13	Feedback	F73	Number of pulse/cycle
F14	Encoder(slit/turn)	F74	Multi-function setting (Analog input FA1)
F15	Encoder direction	F75	Multi-function setting (Analog input FA2)
F16	RST AC input voltage(rms)	F96	Max. current of torque command (analog input)
F46	Max. input analog frequency / 5V	F97	Torque offset analog input
F47	Analog input offset	F106	MET display variable selection
F71	Multi function setting (Output digital ARR)	F107	MET polarity setting
F72	Frequency arrive	F108	MET signal setting

9-2-5 Multi-step speed and auto tuning parameters

Display Order	Function	Display Order	Function
F36	Master speed	F128	7 th point time
F37	1 st speed	F129	8 th point status
F38	2 nd speed	F130	8 th point time
F39	3 rd speed	F131	9 th point status
F40	4 th speed	F132	9 th point time
F41	5 th speed	F133	10 th point status
F42	6 th speed	F134	10 th point time
F43	7 th speed	F135	11 th point status
F44	8 th speed	F136	11 th point time
F115	1 st point status	F137	12 th point status
F116	1 st point time	F138	12 th point time
F117	2 nd point status	F139	13 th point status
F118	2 nd point time	F140	13 th point time
F119	3 rd point status	F141	14 th point status
F120	3 rd point time	F142	14 th point time
F121	4 th point status	F143	15 th point status
F122	4 th point time	F144	15 th point time
F123	5 th point status	F145	16 th point status
F124	5 th point time	F146	16 th point time
F125	6 th point status	F147	17 th point status
F126	6 th point time	F148	17 th point time
F127	7 th point status	F149	18 th point status

Follow by 9-2-5 parameter

Display Order	Function	Display Order	Function
F150	18 th point time	F153	20 th point status
F151	19 th point status	F154	20 th point time
F152	19 th point time		

9-2-6 Protection parameters

Display Order	Function	Display Order	Function
F28	Stop mode	F157	The second error record before the last
F91	Torque limit	F158	The third error record before the last
F99	Magnetization voltage limit $/(2 \cdot V_{dc}/3)$	F159	Clear error records
F100	Torque voltage limit $/(2 \cdot V_{dc}/3)$	F160	Overload current limit
F155	The last error record	F161	Overload time limit
F156	The first error record before the last	F162	Stall prevention

9-2-7 Motor parameters

Display Order	Function	Display Order	Function
F00	Rated line voltage(rms)	F03	Rated R.P.M
F01	Rated line current(rms)	F04	Horse power
F02	Rated frequency	F05	Poles

Follow by 9-2-7 parameter

Display Order	Function	Display Order	Function
F06	Power factor	F09	Stator self inductance
F07	Stator resistor	F10	Mutual inductance
F08	Rotor resistor	F12	Machnical constant

9-2-8 Special parameters

Display Order	Function	Display Order	Function
F21	Percentage of dead time compensation	F83	Voltage boost
F30	DC braking voltage	F84	Voltage boost mode
F48	Jump frequency range	F103	Slip compensation gain
F49	Frequency jump 1	F112	Multi-timer function
F50	Frequency jump 2	F113	Point setting
F51	Frequency jump 3	F114	Cycle number

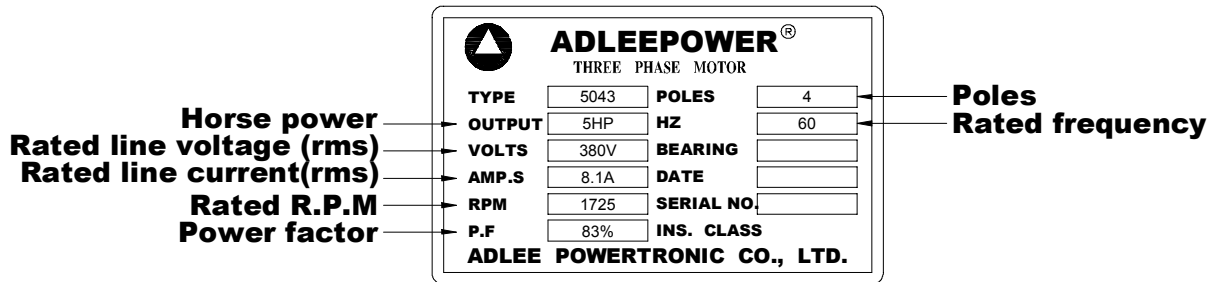
9-2-9 PI control parameters

Display Order	Function	Display Order	Function
F85	V/F control P gain	F89	Sensorless control P gain
F86	V/F control I gain	F90	Sensorless control I gain
F87	Flux vector control P gain	F98	Current loop bandwidth
F88	Flux vector control I gain		

9-3 Parameter descriptions

9-3-1 Motor nameplate description(F00~F06)

Example of 380V 5HP motor nameplate



Display code	Function	Description
F00	Rated line voltage(rms)	VOLTS value of motor nameplate. As above VOLTS is 380V.
F01	Rated line current(rms)	AMP.S value of motor nameplate. As above AMP.S is 8.1A.
F02	Rated frequency	HZ value of motor nameplate. As above frequency is 60HZ.
F03	Rated R.P.M	R.P.M value of motor nameplate. As above speed is 1725RPM.
F04	Horse Power	OUTPUT value of motor nameplate. As above output power is 5HP.
F05	Poles	POLES value of motor nameplate. As above motor poles is 4P.
F06	Power factor	PF value of motor nameplate. As above power factory is 83%.

9-3-2 Motor parameter(F07~F12)

Motor parameter can be either-manually assigned, or values are available to be identified by the Auto turning process.

Auto tuning function is setting by F23.

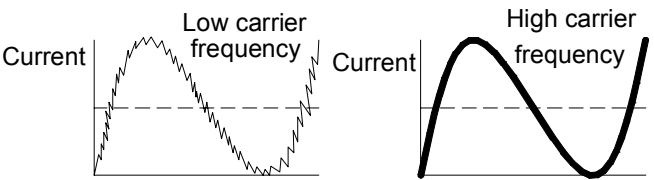
Display code	Function	Description
F07	Stator resistor	$R_{base}=F00/(\sqrt{3} \times F01)$ $L_{base}=R_{base}/2\pi \times F02$ $F07=(R_s/R_{base}) \times 2^{18}$
F08	Rotor resistor	$F08=(R_r/R_{base}) \times 2^{18}$
F09	Stator self inductance	$F09=(L_s/L_{base}) \times 2^{13}$
F10	Mutual inductance	$F10=(L_m/L_{base}) \times 2^{13}$
F12	Machnical constant	Execuce F23=1, the motor must install Encoder.

9-3-3 Inverter parameter(F13~F18)

Display code	Function	Description
F13	Feedback	Check if encoder is in the motor. 0 : No encoder.(Factory setting value) 1 : With encoder. ※ When F13 set to "0", control mode can not select 3 (V/F close loop control) and 5 (Flux vector close loop control).
F14	Encoder (slit/turn)	Please refer to encoder specification.
F15	Encoder direction	1 : Clockwise.(Factory setting value) -1 : Anti-Clockwise.

Display code	Function	Description
F16	RST AC input voltage(rms)	Inverter input voltage.

9-3-4 PWM parameter(F19~F22)



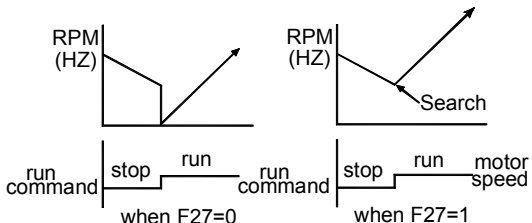
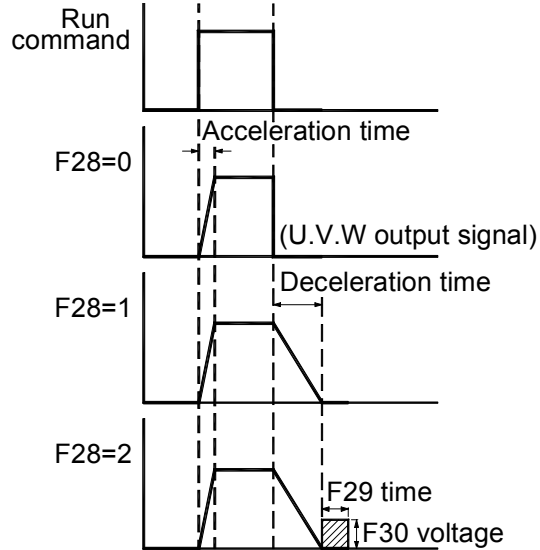
Display code	Function	Description
F19	PWM adjustment mode	0 : Sine PWM. 1 : 3 phase SVPWM (Factory setting value). 2 : Single phase SVPWM.
F20	Carrier frequency	Increase the carrier frequency would reduce motor noise. But efficiency might be decreased. Reduce the carrier frequency would increase noise and reduce motor current, then gain better efficiency. Factory setting is 5K. Setting range 2K ~ 16K. 
F21	Percentage of dead time compensation	Use for V/F control. F23=2 or F23=3 this function is using for smooth motor running when motor is vibrating.

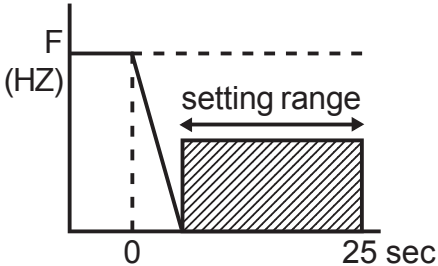
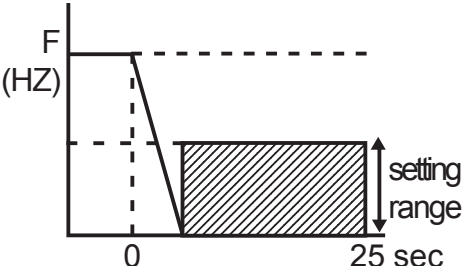
9-3-5 Control mode parameter(F23)

Display code	Function	Description
F23	Control mode setting	0 : Electric parameters tuning. 1 : Mechanical parameters tuning. 2 : V/F open loop control. 3 : V/F close loop control with PG. 4 : V/F sensorless close loop control. 5 : Current vector with PG close loop control. 6 : Sensorless current vector control. ※ Set F23=0 the motor must separate with load the testing. ※ Set F23=1 the motor must join with load then testing.

9-3-6 Operation mode parameter(F24~F31)

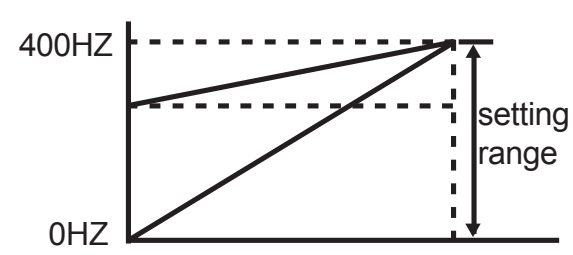
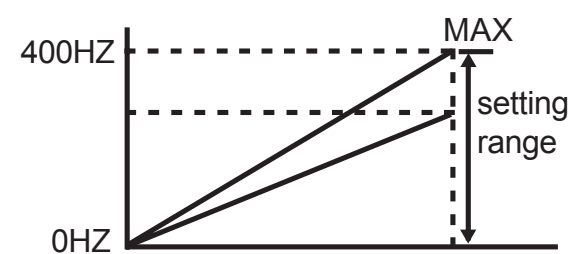
Display code	Function	Description
F24	Terminal / keypad command	0 : Keypad.(Factory setting value) 1 : Terminal. If F24=1, but using the keypad control, the "Err21" signal will be occurred. Setting range 0 or 1.
F25	Command source	0 : Digital input, operate by keypad. (Factory setting value) 1 : Digital input terminal, select from speed 1~8 by external terminal. 2 : Internal analog command, speed command from VR on pannel. 3 : External analog command, speed command from IN, FA1, FA2.
F26	Jog mode	0 : Normal.(Factory setting value) 1 : Jog mode.

Display code	Function	Description
F27	Search speed function	<p>When setting jogging function, the  and  are digital operator. Jogging frequency is setting by F45. Do not set F26, if jog mode is controlling by terminal, set F69,F70 directly.</p> <p>To re-start the inverter, the inverter will search motor speed, and output suitable frequency to prevent vibration. When factory setting F27=0, the motor start is from frequency low limit. Search speed is settled by F27=1.</p> 
F28	Stop mode	<p>0 : Free running. 1 : Dynamic brake. (Factory setting value) 2 : Dynamic brake and DC braking.</p> 

Display code	Function	Description
F29	DC braking time	<p>DC brake time is set by F29. When the frequency is decreased to 0.5HZ(F35), it will enter to DC brake by auto running. Factory setting is 0 sec. Setting range is 0~25 sec.</p>  <p>※ Only when F28 =2, this function is enable.</p>
F30	DC braking voltage	<p>Different DC brake voltage can be set by F30. It could increase and decrease the brake energy. Factory setting is 0. Setting range is (0~0.2) × Rated voltage.</p>  <p>※ Only when F28 =2, this function is enable.</p>

9-3-7 Speed limit parameter(F32~F35)

Display code	Function	Description
F32	CW or CCW or CW/CCW	Select Forward, Reverse , or Forward/Reverse operation mode.

Display code	Function	Description
F33	Minimum frequency limit	<p>Error operating signal "Err22" display means when manipulation error. Setting range 0~2. 0 : CW / CCW.(Factory setting value) 1 : CW. 2 : CCW.</p> <p>Setting or adjusting frequency low limit. Factory setting is 0HZ. Setting range 0HZ~400HZ.</p> 
F34	Maximum frequency limit	<p>Setting or adjusting frequency high limit. Factory setting is 400HZ. Setting range 0HZ~400HZ.</p>  <p>(Max. VR Input) speed command</p>
F35	Start frequency	<p>Using this function, please check over current when the motor speed is acceleration and check over voltage when the motor speed is deceleration. Factory setting is 0HZ. Setting range 0HZ~30HZ.</p>

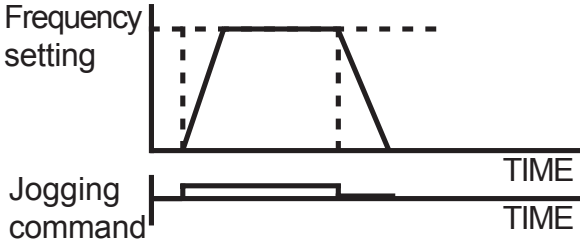


Display code	Function	Description
		<p>The diagram shows two waveforms over time. The top waveform, labeled 'Frequency setting', starts at 0.5HZ, rises linearly to 30HZ, and then remains constant at 30HZ. The bottom waveform, labeled 'Running command', starts at a low level and transitions to a high level at the same time the frequency begins to rise, remaining high until the frequency reaches 30HZ and then returns to low.</p>

9-3-8 Speed mode and multi-speed(F36~F47)

Display code	Function	Description
F36	Master speed	Press keypad to modify frequency or RPM, increase frequency, decrease frequency, save setting value. Setting range 0HZ~400HZ.
F37	1 st speed	Factory setting is 5HZ. Setting range 0HZ~400HZ.
F38	2 nd speed	Factory setting is 10HZ. Setting range 0HZ~400HZ.
F39	3 rd speed	Factory setting is 15HZ. Setting range 0HZ~400HZ.
F40	4 th speed	The multi-speed setting depends on the terminal control CF1 & CF2. Factory setting is 20HZ. Setting range 0HZ~400HZ.

The diagram shows the relationship between control signals and output frequency. The 'Operation signal' is a pulse that starts when the output frequency begins to rise. 'CF1' and 'CF2' are control signals that are active (ON) during the frequency transitions. The 'Output frequency' shows four distinct steps: speed 1, speed 2, speed 3, and speed 4, each corresponding to a specific combination of CF1 and CF2 signals.

CF2	CF1	Terminal Speed
OFF	OFF	SPEED - 1
OFF	ON	SPEED - 2
ON	OFF	SPEED - 3
ON	ON	SPEED - 4

Display code	Function	Description																																													
F41~ F44	5 th ~8 th speed	<p>8th speed setting is showing below :</p> <ol style="list-style-type: none"> 1. F24=1(Terminal command). 2. F69 or F70=6 (Function command) (FT1 or FT2 → CF3) <table border="1" data-bbox="716 453 1393 976"> <thead> <tr> <th>Function</th> <th>Speed</th> <th>CF3</th> <th>CF2</th> <th>CF1</th> </tr> </thead> <tbody> <tr> <td>F37</td> <td>Speed 1</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>F38</td> <td>Speed 2</td> <td>OFF</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>F39</td> <td>Speed 3</td> <td>OFF</td> <td>ON</td> <td>OFF</td> </tr> <tr> <td>F40</td> <td>Speed 4</td> <td>OFF</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>F41</td> <td>Speed 5</td> <td>ON</td> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>F42</td> <td>Speed 6</td> <td>ON</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>F43</td> <td>Speed 7</td> <td>ON</td> <td>ON</td> <td>OFF</td> </tr> <tr> <td>F44</td> <td>Speed 8</td> <td>ON</td> <td>ON</td> <td>ON</td> </tr> </tbody> </table>	Function	Speed	CF3	CF2	CF1	F37	Speed 1	OFF	OFF	OFF	F38	Speed 2	OFF	OFF	ON	F39	Speed 3	OFF	ON	OFF	F40	Speed 4	OFF	ON	ON	F41	Speed 5	ON	OFF	OFF	F42	Speed 6	ON	OFF	ON	F43	Speed 7	ON	ON	OFF	F44	Speed 8	ON	ON	ON
Function	Speed	CF3	CF2	CF1																																											
F37	Speed 1	OFF	OFF	OFF																																											
F38	Speed 2	OFF	OFF	ON																																											
F39	Speed 3	OFF	ON	OFF																																											
F40	Speed 4	OFF	ON	ON																																											
F41	Speed 5	ON	OFF	OFF																																											
F42	Speed 6	ON	OFF	ON																																											
F43	Speed 7	ON	ON	OFF																																											
F44	Speed 8	ON	ON	ON																																											
F45	Jogging speed	<p>Jogging frequency within 400HZ can set jogging mode by keypad or terminal. (Please refer to F70) Factory setting is 5HZ. Setting range 0HZ~400HZ.</p> 																																													
F46	Max. input analog frequency/5V	<p>Max. analog signal entry (VR) frequency setting.</p> <div style="display: flex; justify-content: space-around;"> <div data-bbox="755 1575 1031 1795">  <p>When F46=400 VR adjust to Max. value Output : 400HZ</p> </div> <div data-bbox="1096 1575 1372 1795">  <p>When F46=200 VR adjust to Max. value Output : 200HZ</p> </div> </div>																																													

Display code	Function	Description
F47	Analog input offset	<p>This function is to adjust analog signal offset. The regular output could be constant greater or less than setting.</p> <p>When F47=5HZ, the real output curve constantly more than input command 5HZ</p> <p>Analog input signal (IN, FA1, FA2)</p> <p>When F47=-5HZ, the real output curve constantly more than input command 5HZ</p> <p>This function can be applied to rolling cloth or rolling paper machines. Please refer to application examples 6.</p>

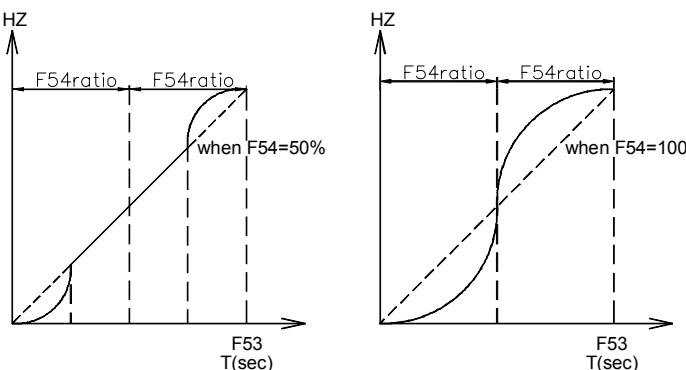
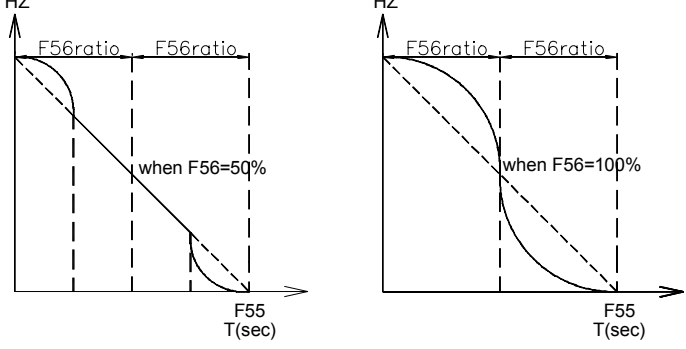
9-3-9 Frequency jump(F48~F51)

Display code	Function	Description
F48	Jump frequency range	<p>Resonance frequency range setting. Factory setting is 0HZ. Setting range 0HZ~20HZ.</p>
F49	Frequency jump 1	<p>Avoid first frequency resonance operation point. Factory setting is 10HZ. Setting range 0HZ~400HZ.</p>

Display code	Function	Description
F50	Frequency jump 2	Avoid second frequency resonance operation point. Factory setting is 20HZ. Setting range 0HZ~400HZ.
F51	Frequency jump 3	Avoid third frequency resonance operation point. Factory setting is 40HZ. Setting range 0HZ~400HZ.

9-3-10 Acceleration/Deceleration control parameter(F52~F68)

Display code	Function	Description
F52	Acc. / Dec. Slope	1 : F53~F56 setting.(Factory setting value) 2 : F57~F60 setting. 3 : F61~F64 setting. 4 : F65~F68 setting.
F53	Acceleration time 1	Acceleration time 1.
F54	Acceleration curve 1	Acceleration curve 1. S curve can reduce machinery's vibration that create by start or stop.

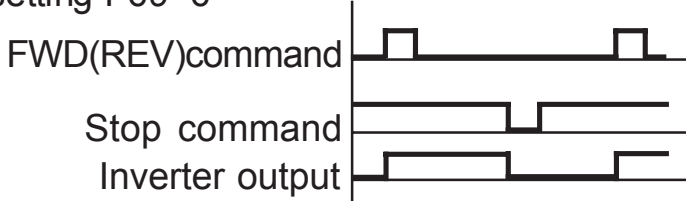
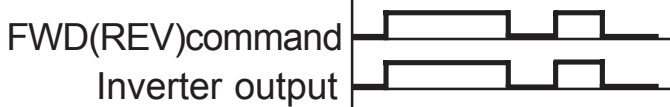
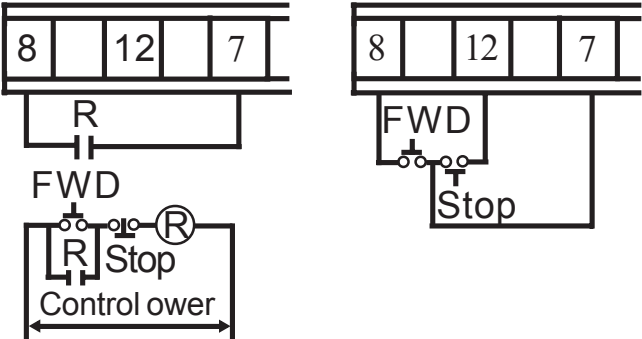
Display code	Function	Description
		 <p data-bbox="706 682 1404 1102">This function can set acceleration time and S curve occupy rate. (Parameter 0~100%). When it set 0 means S curve occupy total time's 0%, to it's straight acceleration. 1~100 is S curve acceleration. When value is greater that means S curve occupy total acceleration time's proportion is greater. When set 100% means total acceleration time is S curve.</p>
F55	Deceleration time 1	Deceleration time 1.
F56	Deceleration curve 1	Deceleration curve 1.
F57~ F60	ACC/DEC 2	 <p data-bbox="706 1701 1404 1795">Acceleration/deceleration adjustment parameter 2.</p>


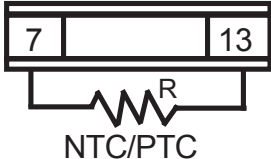
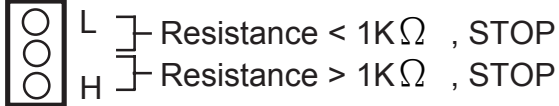
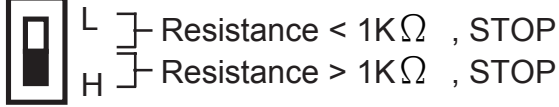
Display code	Function	Description
F61~ F64	ACC/DEC 3	Acceleration/deceleration adjustment parameter 3.
F65~ F68	ACC/DEC 4	Acceleration/deceleration adjustment parameter 4.

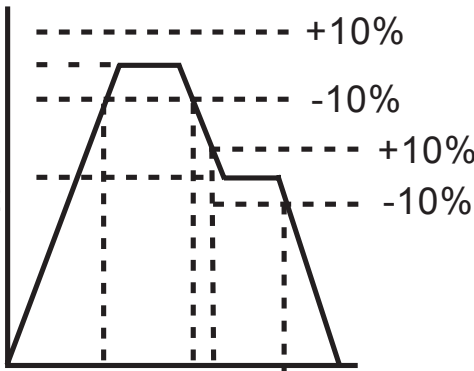

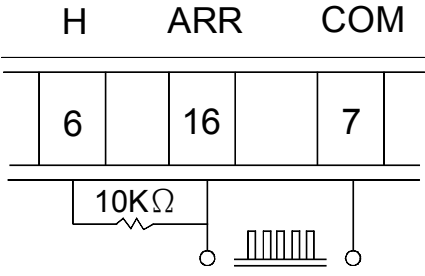
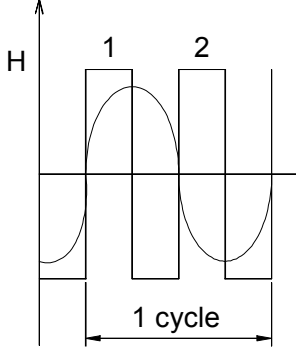
9-3-11 Digital terminal input(F69~F73)

Display code	Function	Description																				
F69 F70	Multi-function terminal (FT1) Multi-function terminal (FT2)	<p>FT terminal is using same terminal to do multi-function. First define FT1 or FT2 as the following table's function. Then input signal by correspond terminal.</p> <table border="1"> <thead> <tr> <th>Setting</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>F69 or F70=0</td> <td>-----</td> </tr> <tr> <td>F69 or F70=1</td> <td>Jog mode</td> </tr> <tr> <td>F69 or F70=2</td> <td>5-8 speed setting terminal (Note 1)</td> </tr> <tr> <td>F69 or F70=3</td> <td>ACC/DEC time selection (Note 2)</td> </tr> <tr> <td>F69 or F70=4</td> <td>Max. voltage frequency selection (Note 3)</td> </tr> <tr> <td>F69 or F70=5</td> <td>Free-run stop</td> </tr> <tr> <td>F69 or F70=6</td> <td>3-wire circuit connection-stop (Note 4)</td> </tr> <tr> <td>F69 or F70=7</td> <td>External over temperature command (Note 5)</td> </tr> <tr> <td>F69 or F70=8~15</td> <td>Reserved</td> </tr> </tbody> </table>	Setting	Function	F69 or F70=0	-----	F69 or F70=1	Jog mode	F69 or F70=2	5-8 speed setting terminal (Note 1)	F69 or F70=3	ACC/DEC time selection (Note 2)	F69 or F70=4	Max. voltage frequency selection (Note 3)	F69 or F70=5	Free-run stop	F69 or F70=6	3-wire circuit connection-stop (Note 4)	F69 or F70=7	External over temperature command (Note 5)	F69 or F70=8~15	Reserved
Setting	Function																					
F69 or F70=0	-----																					
F69 or F70=1	Jog mode																					
F69 or F70=2	5-8 speed setting terminal (Note 1)																					
F69 or F70=3	ACC/DEC time selection (Note 2)																					
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F69 or F70=6	3-wire circuit connection-stop (Note 4)																					
F69 or F70=7	External over temperature command (Note 5)																					
F69 or F70=8~15	Reserved																					

Display code	Function	Description																											
		<p>Note 1 : 5-8 stage speeds setting. To set 5-8 stage speeds by selecting FT1 or FT2 as CF3. Ex : Selecting FT1 as CF3, set F69=2. Selecting FT2 as CF3, set F70=2.</p> <p>Note 2 : ACC/DEC selection There are 4 groups ACC/DEC functions for selection. If 4 groups ACC/DEC functions are used, FT1 and FT2 must be used simultaneously. Set F69 and F70 at 3 simultaneously.</p> <table border="1" data-bbox="740 814 1386 1146"> <thead> <tr> <th>Selection</th> <th>FT2</th> <th>FT1</th> </tr> </thead> <tbody> <tr> <td>1st ACC/DEC</td> <td>0</td> <td>0</td> </tr> <tr> <td>2nd ACC/DEC</td> <td>0</td> <td>1</td> </tr> <tr> <td>3rd ACC/DEC</td> <td>1</td> <td>0</td> </tr> <tr> <td>4th ACC/DEC</td> <td>1</td> <td>1</td> </tr> </tbody> </table> <p>If FT1 and FT2 are not used simultaneously, then ACC/DEC function could set 2 stages speeds only, what ever using FT1 or FT2.</p> <table border="1" data-bbox="824 1362 1279 1564"> <thead> <tr> <th>Selection</th> <th>FT1</th> </tr> </thead> <tbody> <tr> <td>1st ACC/DEC</td> <td>0</td> </tr> <tr> <td>2nd ACC/DEC</td> <td>1</td> </tr> </tbody> </table> <table border="1" data-bbox="824 1587 1279 1789"> <thead> <tr> <th>Selection</th> <th>FT2</th> </tr> </thead> <tbody> <tr> <td>1st ACC/DEC</td> <td>0</td> </tr> <tr> <td>2nd ACC/DEC</td> <td>1</td> </tr> </tbody> </table>	Selection	FT2	FT1	1 st ACC/DEC	0	0	2 nd ACC/DEC	0	1	3 rd ACC/DEC	1	0	4 th ACC/DEC	1	1	Selection	FT1	1 st ACC/DEC	0	2 nd ACC/DEC	1	Selection	FT2	1 st ACC/DEC	0	2 nd ACC/DEC	1
Selection	FT2	FT1																											
1 st ACC/DEC	0	0																											
2 nd ACC/DEC	0	1																											
3 rd ACC/DEC	1	0																											
4 th ACC/DEC	1	1																											
Selection	FT1																												
1 st ACC/DEC	0																												
2 nd ACC/DEC	1																												
Selection	FT2																												
1 st ACC/DEC	0																												
2 nd ACC/DEC	1																												

Display code	Function	Description												
		<p>Note 3 : Max. voltage frequency selection To select Max. voltage frequency, set F69 or F70=4 and using FT1 or FT2 for selection.</p> <table border="1" data-bbox="751 447 1378 632"> <thead> <tr> <th>Selection</th> <th>FT1(F69=4)</th> </tr> </thead> <tbody> <tr> <td>Max. voltage frequency1</td> <td>0</td> </tr> <tr> <td>Max. voltage frequency 2</td> <td>1</td> </tr> </tbody> </table> <table border="1" data-bbox="751 653 1378 837"> <thead> <tr> <th>Selection</th> <th>FT2(F70=4)</th> </tr> </thead> <tbody> <tr> <td>Max. voltage frequency1</td> <td>0</td> </tr> <tr> <td>Max. voltage frequency 2</td> <td>1</td> </tr> </tbody> </table> <p>Note 4 : 3-wire circuit connection diagram setting F69=6</p>  <p>General wiring Setting F24=1 (terminal control)</p>  <p>Ex : General Ex : 3-wire circuit connection</p> 	Selection	FT1(F69=4)	Max. voltage frequency1	0	Max. voltage frequency 2	1	Selection	FT2(F70=4)	Max. voltage frequency1	0	Max. voltage frequency 2	1
Selection	FT1(F69=4)													
Max. voltage frequency1	0													
Max. voltage frequency 2	1													
Selection	FT2(F70=4)													
Max. voltage frequency1	0													
Max. voltage frequency 2	1													

Display code	Function	Description
		<p>Note 5 : Over temperature</p> <p>1. Use FT1. (F69=7 OVER Tep. switch)</p>  <p>when FT1 & COM are short circuit. The inverter will stop.</p> <p>2. Use FT2. (F70=7 Thermistor)</p> <p>FT2=7(Thermistor)</p>  <p>★ J5 for FT2 function select</p> <p>J5(FT2)</p>  <p>5-10HP</p>  <p>15-30HP</p> <p>F71 Multi function setting(Digital output ARR)</p> <p>0 : ARR terminal set on frequency arrive function.(F72) 1 : ARR terminal set on frequency pulse output function.(F73)</p> <p>F72 Frequency arrive</p> <p>When running frequency is same as below, ARR terminal will output "ON".</p> <p>1. Acceleration condition, when running frequency \geq setting frequency \times (1-F72), the signal will be occurred.</p> <p>2. Deceleration condition, when running frequency \leq setting frequency \times (1+F72), the signal will be occurred.</p> <p>3. Factory setting is 10%. Setting range 0~100%.</p>

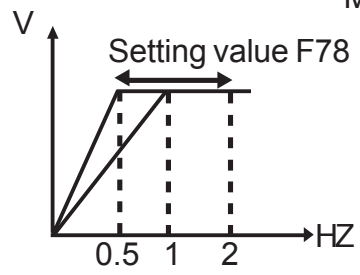
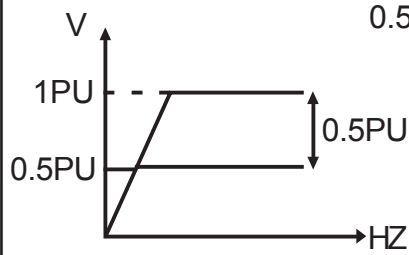
Display code	Function	Description
F73	Number of pulse/cycle	<p>Setting frequency1</p> <p>Setting frequency2</p>  <p>Output ARR Terminal Open collect wave form</p>  <p>When F71=1, ARR terminal output the pulse frequency. The output frequency is running frequency × F73=ARR output pulse frequency. EX : F71=1 F73=2 Wire connection</p>  <p>Output</p> 

9-3-12 Analog terminal input(F74~F75)

Display code	Function	Description																																																									
F74	Multi-function setting (Analog input FA1)	FA terminal provide analog signal, change parameter function. Using each terminal to select each function, the analog signal input to this terminal for speed selection control.																																																									
F75	Multi-function setting (Analog input FA2)																																																										
<table border="1"> <thead> <tr> <th>Setting</th> <th>Function</th> <th>Setting Range Min~Max</th> </tr> </thead> <tbody> <tr> <td>F74 or F75=0</td> <td>-----</td> <td>-----</td> </tr> <tr> <td>F74 or F75=1</td> <td>Speed 1</td> <td>0~F37 value</td> </tr> <tr> <td>F74 or F75=2</td> <td>Speed 2</td> <td>0~F38 value</td> </tr> <tr> <td>F74 or F75=3</td> <td>Speed 3</td> <td>0~F39 value</td> </tr> <tr> <td>F74 or F75=4</td> <td>Speed 4</td> <td>0~F40 value</td> </tr> <tr> <td>F74 or F75=5</td> <td>Speed 5</td> <td>0~F41 value</td> </tr> <tr> <td>F74 or F75=6</td> <td>Speed 6</td> <td>0~F42 value</td> </tr> <tr> <td>F74 or F75=7</td> <td>Speed 7</td> <td>0~F43 value</td> </tr> <tr> <td>F74 or F75=8</td> <td>Speed 8</td> <td>0~F44 value</td> </tr> <tr> <td>F74 or F75=9</td> <td>ACC 1</td> <td>0~F53 value</td> </tr> <tr> <td>F74 or F75=10</td> <td>DEC 1</td> <td>0~F55 value</td> </tr> <tr> <td>F74 or F75=11</td> <td>ACC 2</td> <td>0~F57 value</td> </tr> <tr> <td>F74 or F75=12</td> <td>DEC 2</td> <td>0~F59 value</td> </tr> <tr> <td>F74 or F75=13</td> <td>ACC 3</td> <td>0~F61 value</td> </tr> <tr> <td>F74 or F75=14</td> <td>DEC 3</td> <td>0~F63 value</td> </tr> <tr> <td>F74 or F75=15</td> <td>ACC 4</td> <td>0~F65 value</td> </tr> <tr> <td>F74 or F75=16</td> <td>DEC 4</td> <td>0~F67 value</td> </tr> <tr> <td>F74 or F75=17</td> <td>Voltage boost</td> <td>0~F83 value</td> </tr> </tbody> </table>			Setting	Function	Setting Range Min~Max	F74 or F75=0	-----	-----	F74 or F75=1	Speed 1	0~F37 value	F74 or F75=2	Speed 2	0~F38 value	F74 or F75=3	Speed 3	0~F39 value	F74 or F75=4	Speed 4	0~F40 value	F74 or F75=5	Speed 5	0~F41 value	F74 or F75=6	Speed 6	0~F42 value	F74 or F75=7	Speed 7	0~F43 value	F74 or F75=8	Speed 8	0~F44 value	F74 or F75=9	ACC 1	0~F53 value	F74 or F75=10	DEC 1	0~F55 value	F74 or F75=11	ACC 2	0~F57 value	F74 or F75=12	DEC 2	0~F59 value	F74 or F75=13	ACC 3	0~F61 value	F74 or F75=14	DEC 3	0~F63 value	F74 or F75=15	ACC 4	0~F65 value	F74 or F75=16	DEC 4	0~F67 value	F74 or F75=17	Voltage boost	0~F83 value
Setting	Function	Setting Range Min~Max																																																									
F74 or F75=0	-----	-----																																																									
F74 or F75=1	Speed 1	0~F37 value																																																									
F74 or F75=2	Speed 2	0~F38 value																																																									
F74 or F75=3	Speed 3	0~F39 value																																																									
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F74 or F75=5	Speed 5	0~F41 value																																																									
F74 or F75=6	Speed 6	0~F42 value																																																									
F74 or F75=7	Speed 7	0~F43 value																																																									
F74 or F75=8	Speed 8	0~F44 value																																																									
F74 or F75=9	ACC 1	0~F53 value																																																									
F74 or F75=10	DEC 1	0~F55 value																																																									
F74 or F75=11	ACC 2	0~F57 value																																																									
F74 or F75=12	DEC 2	0~F59 value																																																									
F74 or F75=13	ACC 3	0~F61 value																																																									
F74 or F75=14	DEC 3	0~F63 value																																																									
F74 or F75=15	ACC 4	0~F65 value																																																									
F74 or F75=16	DEC 4	0~F67 value																																																									
F74 or F75=17	Voltage boost	0~F83 value																																																									

9-3-13 Voltage/Frequency limit and flux parameter(F76~F82)

Display code	Function	Description
F76	Max. voltage frequency	1 : Max. Voltage frequency 1. (Factory setting value) 2 : Max. Voltage frequency 2.
F77	Max. voltage 1	Unit explanation : 1PU="F00" rated line voltage, it is shown in motor nameplate. 1PU=Rated voltage X 1 =Rated voltage 0.5PU=Rated voltage X 0.5 =1/2 Rated voltage ※ Only use with F78
F78	Max. voltage frequency 1	Unit explanation : 1PU is homologous as "F02", it is shown in motor nameplate. Setting range 0.5~2 Min. scale 0.01 ※ Only use with F78
F79	Max. voltage 2	Refer to F77.
F80	Max. voltage frequency 2	Refer to F78.
F81	Flux curve	In the same frequency can get different output voltage when the F81 is adjusted. It is suitable for fan, blowing machine and Pump etc...



Display code	Function	Description
F82	Efficiency control	<p> F81=0 (for constant torque use) F81=-1 ~ -10 (for reduce torque use) </p> <p> ※ This function only use in close loop mode and low load fluctuation. It means F23 need to set at 3 or 5. When start efficiency mode, inverter will auto search the feedback signal and adjust the output energy to achieve electricity saving purpose. 0 : Normal mode. (Factory setting value) 1 : Efficiency control mode. </p>

9-3-14 Voltage promotion parameter(F83~F84)

Display code	Function	Description
F83	Voltage boost	<p>Using this function to increase torque at low speed. If voltage boost is too high, it will cause over current and high noise.</p> <p>※ This function have to operate with F84.</p> <p> V F=0.001~0.2PU when F83=0 0.2PU 1/2PU frequency 1PU frequency F </p>

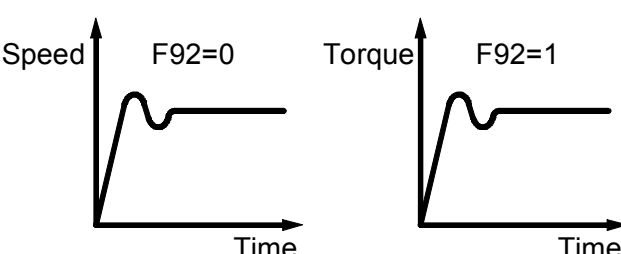
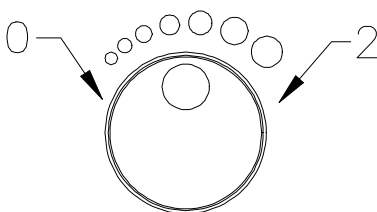
Display code	Function	Description
F84	Voltage boost mode	0 : No compensation. (Factory setting value) 1 : To use setting value of F83 to do constant compensate and promote. 2 : Compensate and promote automatically.

9-3-15 Speed control bandwidth(F85~F91)

Display code	Function	Description
F85	V/F control P gain	V/F speed control P gain.
F86	V/F control I gain	V/F speed control I gain.
F87	Flux vector control P gain	Vector speed control P gain.
F88	Flux vector control I gain	Vector speed control I gain.
F89	Sensorless control P gain	Sensorless speed control P gain.
F90	Sensorless control I gain	Sensorless speed control I gain.
F91	Torque limit	Torque current limits. ※ Torque current limit only use in close loop control mode.

9-3-16 Torque control mode parameter(F92~F97)

Display code	Function	Description
F92	Voltage / torque control mode	(F92~F97 can only operate in close loop vector control mode).

Display code	Function	Description
		<p>0 : Speed control. (Factory setting value) 1 : Torque control.</p> 
F93	Source of torque command	<p>0 : Keypad. (Factory setting value) 1 : Analog input. (IN) When F93=0, torque command is input by F94. When F93=1, torque command is input by external analog.</p>
F94	Torque sensor command source	<p>When F93=0, torque command is setting by this function.</p>
F95	Torque command of jogging operation	<p>While using torque control jogging function, the jogging torque command is setting by F95.</p>
F96	Max. current of torque command (analog input)	<p>Set external analog input, maximum value. Ex : Use external analogy (VR) torque control, if F96=2, the max. VR value is 2PU.</p> 
F97	Torque offset analog input	<p>This function is analog input signal for rate adjustment. It can let real output constantly greater or less then setting value.</p>

Display code	Function	Description

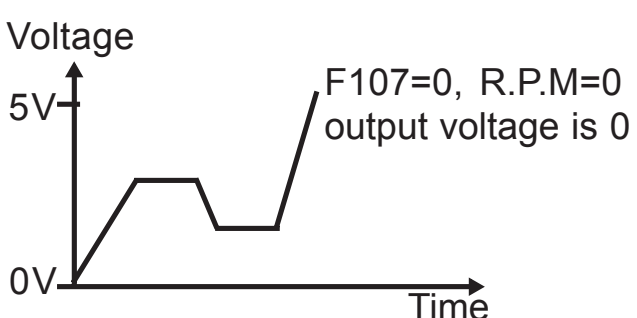
9-3-17 Current mode control parameter(F98~F100)

Display code	Function	Description
F98	Current loop bandwidth	Current loop gaining.
F99	Magnetization voltage limit / $(2 \cdot V_{dc}/3)$	This value define magnetization voltage's limit.
F100	Torque voltage limit / $(2 \cdot V_{dc}/3)$	This value define torque voltage limit.

9-3-18 Estimator parameter(F101~F103)

Display code	Function	Description
F103	Slip compensation gain	While using sensorless V/F control and vector without PG control, according to current output signal to calculate motor RPM that can set slip compensation gain to compensate output frequency.

9-3-20 Analog signal output display setting parameter
(F106~F111)

Display code	Function	Description
F106	MET display variable selection	0 : Non-display. 1 : Reference speed. (Factory setting value) 2 : Feedback speed. 3 : Estimate speed. 4 : Power frequency. 5 : Slip frequency. 6 : Voltage amplitude. 7 : Magnetization voltage. 8 : Torque voltage. 9 : Current amplitude. 10 : Magnetization current command. 11 : Torque current command. 12 : Magnetization current. 13 : Torque current. 14 : Apparent power. 15 : Imaginary power.
F107	MET polarity setting	0 : Without polarity. (Factory setting value) 1 : Polarity.  <p>When F107=0, MET without polarity output. Don't care about "+" and "-". Only look at output value.</p>

Display code	Function	Description
F108	MET signal setting	<p>Voltage</p> <p>F107=1, R.P.M=0 its output voltage is 2.5V</p> <p>5V</p> <p>2.5V</p> <p>0V</p> <p>Time</p> <p>Anode pole</p> <p>Negative pole</p> <ol style="list-style-type: none"> 1. Meter is 10V at 60HZ (same as H terminal) : set F108=60 2. Meter's voltage is lower than 10V : Ex : Meter is 5V ∴ $10V \div 5V=2$ ∴ $F108=60 \times 2=120$ 3. Meter's voltage is higher than 10V. The meter cannot have full scale output.

9-3-21 Timer(F112~F154)

Display code	Function	Description
F112	Multi-timer function	<p>0 : Disable. (Factory setting value)</p> <p>1 : Finite cycle(Cyclic execute by F114)</p> <p>2 : Infinite cycle(Do loop infinite till push the "STOP" key.</p> <p>✘ Confirm F113~F154 has set correctly before F112 setting 1 or 2.</p> <p>✘ Confirm F113~F154 has set correctly before F112 setting 1 or 2.</p>
F113	Point setting	<p>When F112=1 or 2, F113 enable.</p> <p>✘ Set all points parameters before setting F113.</p>

Display code	Function	Description																																																																																
F114	Cycle number	When F112=1, F114 enable.																																																																																
F115	1 st point status	Setting method : (Max. voltage select)× 128+(Acc./Dec. curve selection) × 32+(speed)× 4+ (1:Forward 2:Reserve 0 or 3:Stop)																																																																																
		<table border="1"> <thead> <tr> <th colspan="2">Max. Voltage/ Frequency</th> <th colspan="2">ACC/DEC</th> <th colspan="2">Speed</th> <th colspan="2">Direction</th> </tr> <tr> <th>No.</th> <th>Value</th> <th>No.</th> <th>Value</th> <th>No.</th> <th>Value</th> <th>No.</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>0</td> <td>1</td> <td>0</td> <td>1</td> <td>0</td> <td>Stop</td> <td>0</td> </tr> <tr> <td>2</td> <td>128</td> <td>2</td> <td>32</td> <td>2</td> <td>4</td> <td>FWD</td> <td>1</td> </tr> <tr> <td></td> <td></td> <td>3</td> <td>64</td> <td>3</td> <td>8</td> <td>REV</td> <td>2</td> </tr> <tr> <td></td> <td></td> <td>4</td> <td>96</td> <td>4</td> <td>12</td> <td>Stop</td> <td>3</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>5</td> <td>16</td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>6</td> <td>20</td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>7</td> <td>24</td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>8</td> <td>28</td> <td></td> <td></td> </tr> </tbody> </table>	Max. Voltage/ Frequency		ACC/DEC		Speed		Direction		No.	Value	No.	Value	No.	Value	No.	Value	1	0	1	0	1	0	Stop	0	2	128	2	32	2	4	FWD	1			3	64	3	8	REV	2			4	96	4	12	Stop	3					5	16							6	20							7	24							8	28		
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		Ex : 1 st V/F curve (F77,F78) 2 nd ACC/DEC (F57~F60) 2 nd speed (F37) Forward operation 0+32+4+1=37 So F115=37																																																																																
F116	1 st point time	1~32767 sec.																																																																																
F117~ F154	n th point status and time	The setting similar with F115~F116.																																																																																

9-3-22 Error records(F155~F159)

Display code	Function	Description
F155	The last error record	Recording inverter protection error reason for machinists' reference.
F156	The first error record before the last	When second error occurred, the first error is recorded in F156.
F157	The second error record before the last	When third error occurred, the second error is recorded in F157.
F158	The third error record before the last	When fourth error occurred, the third error is recorded in F158.
F159	Clear error records	When error is repaired, please execute F159=1 to clear all error records. 0 : Do not clear. (Factory setting value) 1 : Clear.



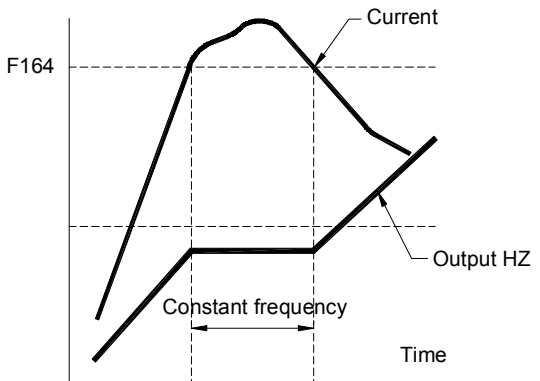
9-3-23 Over load(F160~F161)

Display code	Function	Description
F160	Overload current limit	This parameter is for adjusting inverter output overload current protection level. It needs to use with F161 overload time limit.
F161	Overload time limit	When inverter output current over F160 protection level, inverter will calculate time automatically. Inverter will stop, if reach the time limit.

Display code	Function	Description

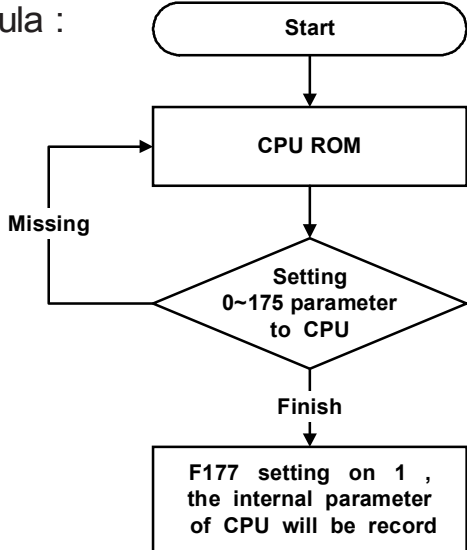
9-3-24 Stall prevention(F162~F164)

Display code	Function	Description
F162	Stall prevention	<p>0 : Disable. (Factory setting value) 1 : Enable.</p> <p>When enable F162, if any overload (150%) during ACC/DEC period, inverter will increase ACC/DEC time to prevent inverter to go into fail safe mode.</p>
F163	Over voltage stall prevention	<p>During DEC, motor generate dynamic braking energy to inverter, the AC voltage will be increased. If it reaches the F163 value, the motor will stop deceleration (output constant frequency) until the voltage is reduced to be under F163 value.</p>
F164	Over current stall prevention	<p>During ACC, if ACC time is too short or load is too heavy, the current will reach F164 value, inverter will stop to ACC until current is lower than F164 value.</p>

Display code	Function	Description
F168	Speed ratio of display	 <p>F168=(real speed after reducer)/(inverter output speed) Ex : F168=(real speed after reducer)/(inverter output speed=1800) =0.1 When F168 set 0.1, inverter operate at 60HZ, the 7 segment display will display "180" RPM.</p>

9-3-25 Other item(F176~F180)

Display code	Function	Description
F176	Initial parameter	0 : User's parameter. (Factory setting value) 1 : Reset to 220VAC initial parameter. 2 : Reset to 380VAC initial parameter. 3 : Reset to 440VAC initial parameter.
F177	Save setting parameters	0 : Non-save. (Factory setting value) 1 : Save as user's new parameters. <input type="button" value="ENTER ←"/> is a confirmed keypad, when the parameter is set. To set F177 of "1" and save in the permanent memory. The parameter will be performed for next operation.

Display code	Function	Description
F178	Lock	<p>✘ If the parameter is not set of "1", will be shown the original parameter in next operation.</p> <p>Formula :</p>  <pre> graph TD Start([Start]) --> CPU_ROM[CPU ROM] CPU_ROM --> Setting{Setting 0~175 parameter to CPU} Setting -- Missing --> CPU_ROM Setting -- Finish --> Record[F177 setting on 1, the internal parameter of CPU will be record] </pre> <p>0 : Parameter is modifiable. (Factory setting value) 1 : Parameters have been locked. If parameters modification is necessary, F178 should set to 0. 2 : Parameters have been locked. If parameters modify is necessary, key in password first and F178 set to 0. For setting parameter F178=0, then can adjust parameter. If F178=1 then adjust to 0. If F178=2, then go to F179 enter correct password to set.</p>
F179	Key in password	When F178=2. To remove LOCK function, please enter the same password as F180.
F180	Password lock	When F178=0 or 1, this parameter is in un-concealing status. When F178=2 enter password in F179 to unlock password LOCK function.

10. MAINTENANCE AND FAILURE ELIMINATE

Maintenance and inspect regularly, which can make your inverter keep working for long period in right status.

10-1 Attention points of maintenance and inspection

1. During the maintenance and inspection, please turn off the power supply of your inverter (R.S.T.)
2. Make sure the power supply of your inverter(R.S.T.) is off. After the light/brightness has disappeared on the screen, recheck and make the internal guiding light is off, thus, maintaining and inspecting can be done. (Warning : 50V Direct-Current Voltage still remained after the light/brightness is off on the screen)
3. Do not pull-off, take-off or error match of the internal power, filament(wire) material or (wire) circuit while installation or take-off the connection. Otherwise it will cause the damage or unmovem-ent of the inverter (R.S.T.).
4. Power input must be put in the right position while installation.
5. The accessories such as screws, etc, cannot be left inside of the inverter in case of the damage of PC board.
6. Please remain cleanness of inverter, after installation, to avoid dust, oil-gas and moist.

10-2 Regular checking items


1. Make sure the power supply of the voltage is right for the inverter. Especially attent any damage of power-cords or motor-cords).
2. Make sure there do not have any loose of terminal and con-nection. (Whether there will be any broken wires between power-cord and terminal.)
3. Whether there have any dust, dirt, iron filing or any corrosiveness liquid inside of inverter. (Make sure to prevent it and keep R.S.T. clean.)
4. Measurement on insulation resistance is prohibited.
5. Check the output voltage, output current and output frequency.
6. Temperature : check ambient, inverter, and motor temperature to see any unusual temperature happened.
7. Moisture : remaining under 90%. (Water-dropping situation will not be allowed.)
8. Unusual sound or extraordinary vibration during operation. (Do not place inverter on vibration areas.)
9. Regular cleaning for vent hole.

10-3 Trouble shooting

In case of the inverter failure cannot be remove by following methods, please contact with your agent or factory.

Code	Description	Check points and suggestions
ERR01	Over voltage or over current while stand-by	1.The input voltage is too high. 2.Check any short-circuit.
ERR02	Over voltage or over current while acceleration	1.Check any loose screws for U,V,W wiring. 2.Check U,V,W wiring insulation. 3.Increase ACC. time. 4.Reduce F38 voltage boost value. 5.Increase inverter capacity.
ERR03	Over voltage or over current while deceleration	1.Check U,V,W wiring insulation. 2.Increase DEC. time. 3.Connect the external braking resistor. 4.Increase inverter capacity.
ERR04	Over voltage or over current while stable speed	1.Check U,V,W wiring insulation. 2.Check any block of motor. 3.Increase inverter capacity. 4.Check inverter and motor specification.
ERR05	Over temperature protection	1.Check the motor loading. 2.Check the motor rate current. 3.Increase inverter capacity.
ERR06	DC bus over voltage	1.Check the power supply voltage. 2.Check inverter and motor specification equally. 3.Return for repair, if un-eliminate.
ERR07	DC bus under voltage	1.Check the power supply voltage. 2.Check the motor loading. 3.Check any loose phase of input power.

Code	Description	Check points and suggestions
ERR08	Over current is reached time limit	1.Check the motor loading. 2.Reduce F83 voltage boost value. 3.Increase inverter capacity.
ERR11	Current sensor selection range is not matching with motor	1.Whether the parameter setting is correct for motor
ERR15	Pole number is wrong for motor	
ERR12 ERR13 ERR14	U,V,W loose phase or current sensor failure	1.Check U,V,W output voltage. 2.Return for repair, if un-eliminate.
ERR16	Wrong PG signal direction	1.Change F15 setting.
ERR17	Encoder failure	1.Check PG specification (slit/turn), if over F14 max. value. 2.Check PG parameter setting and wiring.
ERR18	Auto tuning failure	1.Load must be disconnected from motor. 2.Check inverter and motor specification equally. 3.Motor parameter and motor specification do not match.
ERR19	EEPROM failure	1.Return for repair
ERR21	Wrong operation command	1.Check the external control signal. 2.Check F24 terminal / keypad command setting.

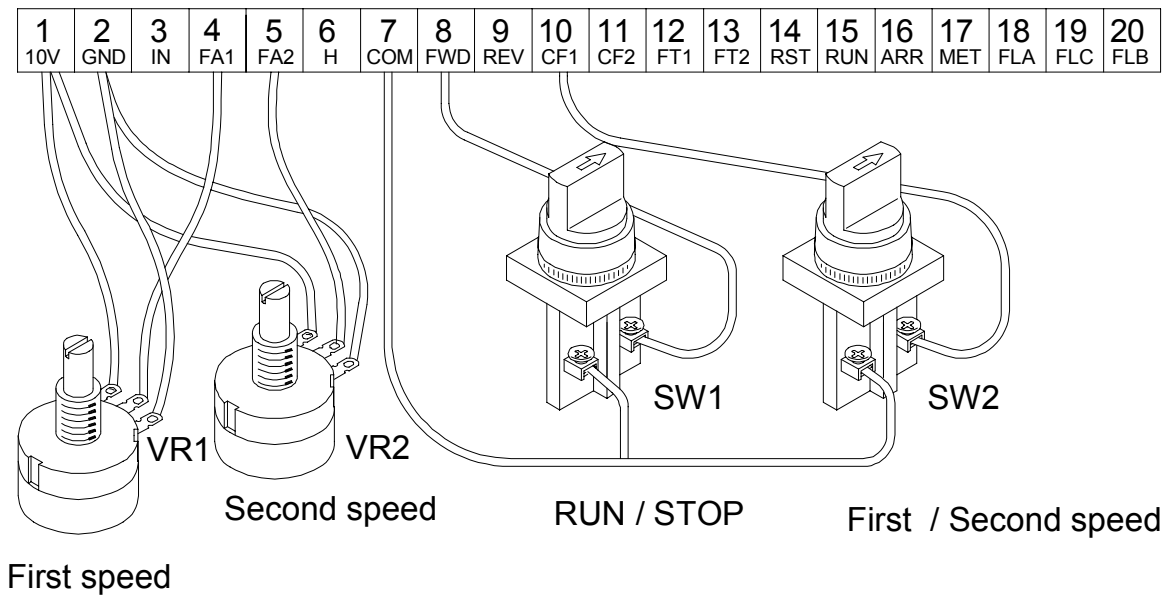
Code	Description	Check points and suggestions
ERR22	Frequency failure	1.Checking operation control parameter and frequency limit parameter.
ERR23 ERR24	Cannot execute without speed feedback	1.Check F23 control mode setting.
ERR25	EEPROM reading error	1.Press  bottom and reset parameter as factory setting number. 2.Factory maintained in case useless.
ERR26	Parameter lock	1.Unlock parameter by F178.
ERR27	Password incorrect	1.Enter right password. 2.Return for repair, if password unknow.
Non-code	No display and charge LED un-light	Return for repair.
Non-code	No display and charge LED lighten	Return for repair.
Non-code	Inverter is operated normally, but motor does not operated correctly	1.Check the motor failure. 2.Check U,V,W wiring. 3.Check motor poles, if motor has many poles, try to use less poles motor. 4.Check loading. 5.Increase torque setting.
Non-code	Cooling fan does not operate	1.Clean fan, if dirty. 2.Change fan, if damaged. 3.Check fan wiring, if loose.

11. APPLICATION

Example 1 : Use 2 external variable resistor for multistage speed command input.

DESCRIPTION :

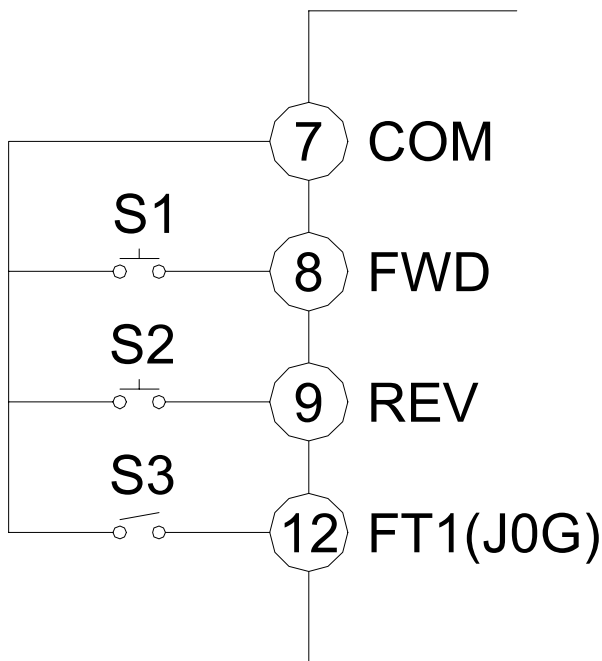
- F24 = 1 (External terminal control)
- F25 = 1 (Select speeds by external digital terminals)
- F74 = 1 (Set FA1 for 1st speed input terminal)
- F75 = 2 (Set FA2 for 2nd speed input terminal)
- SW1 = RUN/STOP
- SW2 = First speed / second speed



Example 2 : Normal / Jog operation

DESCRIPTION :

F36 = Master speed ; User setting
F45 = Jog speed ; User setting
F24 = 1 ; Terminal command (For external)
F69 = 1 ; Define FT1 terminal=JOG
(Foward) function



S1 = FWD SW

S2 = REV SW

S3 = Normal / Jog

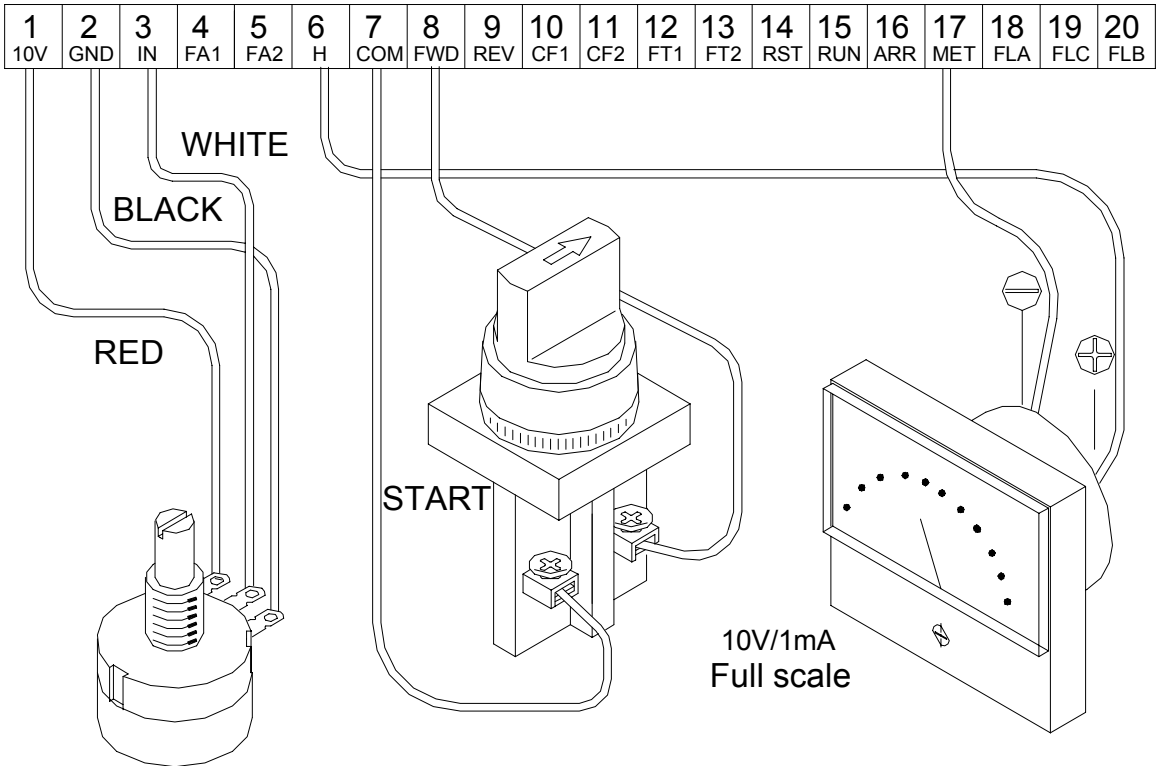
ON = Jogging speed

OFF = Normal speed

Example 3 : Basic external control setup

DESCRIPTION :

- F108 = 60 ; See Maximum value on the meter
- F25 = 3 ; External analog signal 0~10V
- F24 = 1 ; External command

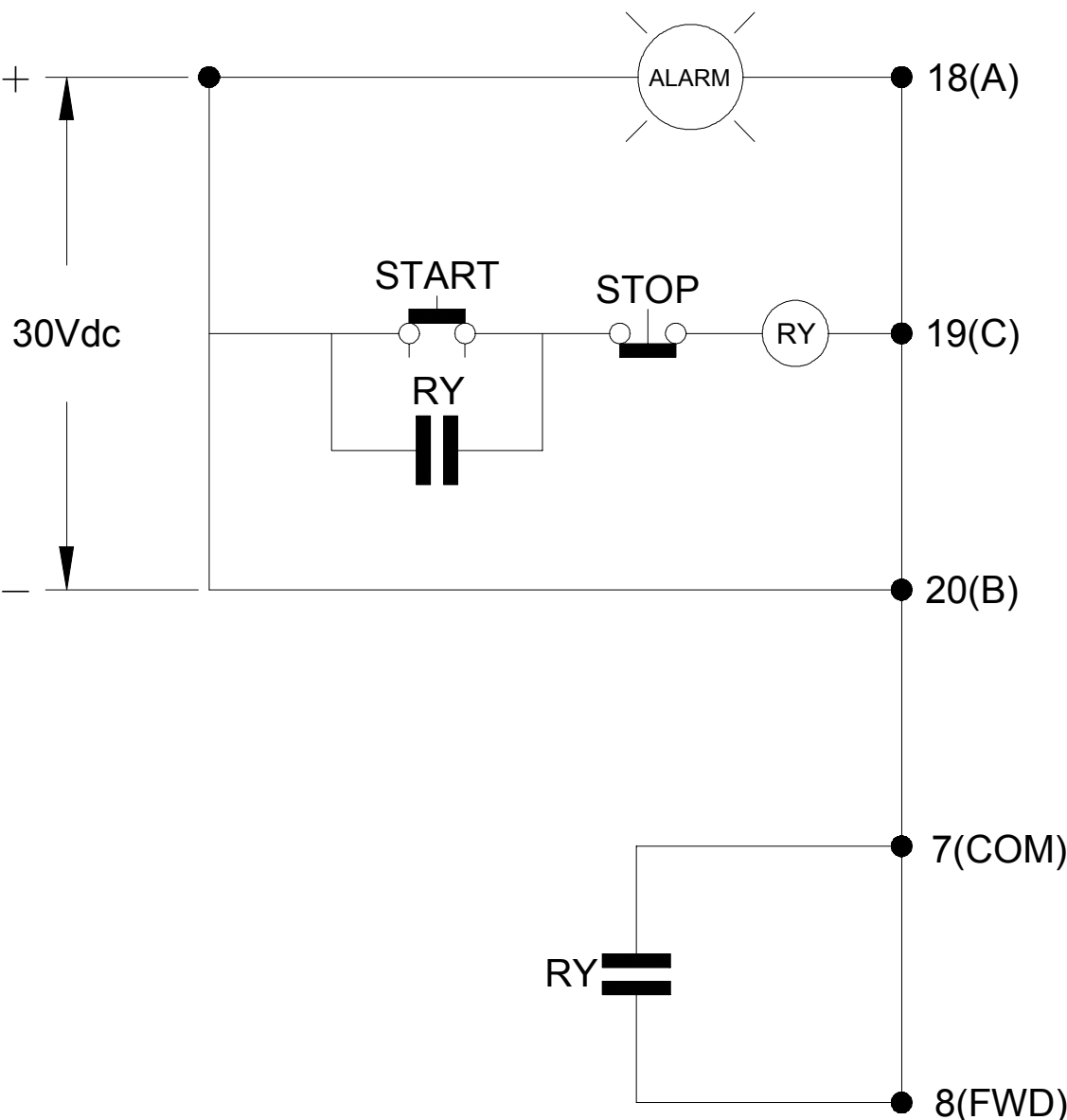


Example 4 : Alarm output

DESCRIPTION :

F24 = 1

; External command

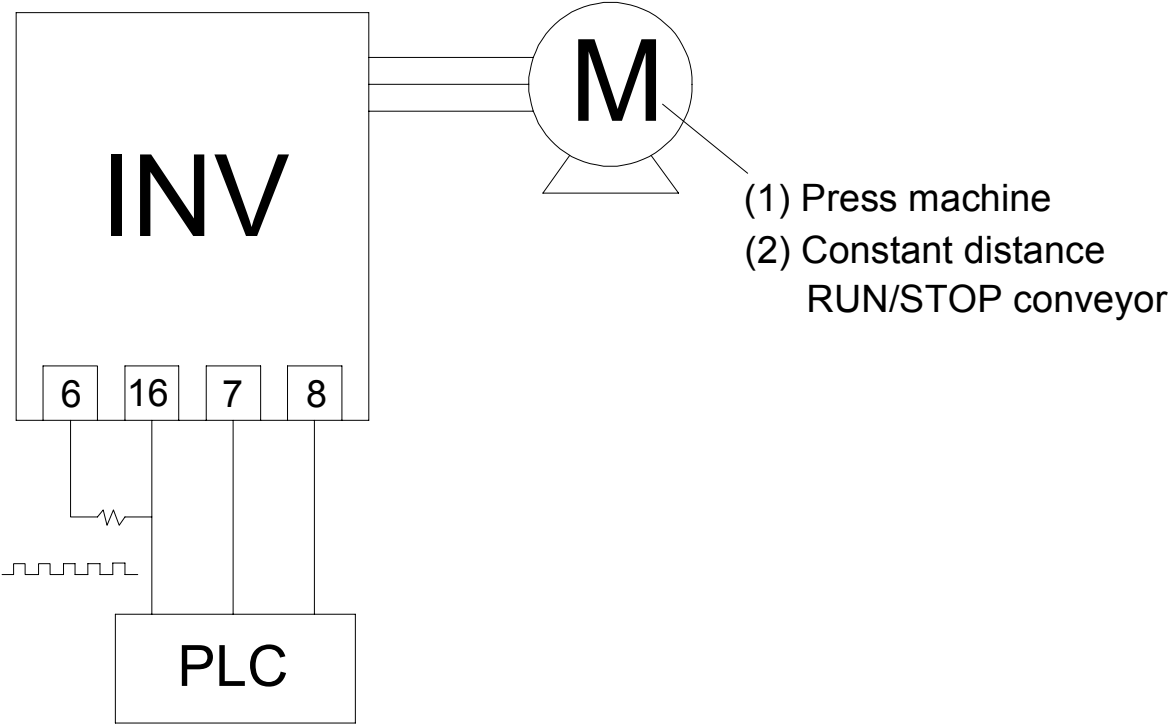


Example 5 : Pulse generator usage

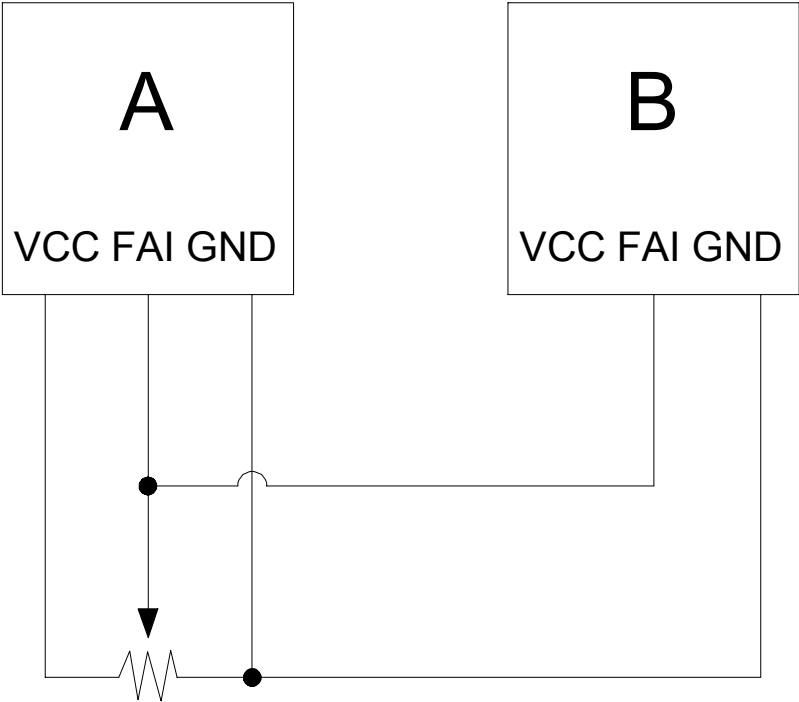
DESCRIPTION :

F71 = 1

F73 = 24 (No. of pulse/rev)



Example 6 : Rolling machine usage



Machine	A	B
Offset	0 HZ	5 HZ
Parameter setting	F24 = 1 F25 = 3 F47 = 0	F24 = 1 F25 = 3 F47 = 1

Relation : B Motor = A Motor + 5HZ

Appendix 1 : Select right inverter

Inverter capacity check method

Description		Related factor
Load characteristics	Load type	Friction loading and weight loading Liquid(viscous) loading Inertia loading Load with poer transmission and accumulation
	Loading speed and torque characteristics	Constant torque Constant power Decreasing torque Decreasing power
	Load characteristics	Motoring Braking or overhauling loading Constant loading Shock loading Repetitive loading High-start torque Low-start torque
Operation	Continuous operation Long-time operation at medium or low speeds Short-time operation	
Rated output	Maximum required output(instantaneous) Constant output (continuous)	
Rated rpm	Maximum rpm Rated rpm	
Power supply	Power supply transformer capacity percentage impedance Voltage fluctuations Number of phases, single phase protection Frequency	
Deterioration of load capacity due to age	Mechanical friction, losses in wiring	
	Duty cycle modification	

	Speed and torque characteristics	Time ratings	Overload capacity	Starting torque
	✕			✕
	✕	✕		
	✕	✕	✕	✕
		✕	✕	
	✕		✕	
	✕			
			✕	✕
			✕	✕
		✕		

Appendix 2 : Inverter capacity calculation formula

Inverter capacity requirement for multidriving

Description	Calculated with overload
Starting requirements are within the inverter capacity	Motor acceleration of 1 minute or less
	$\frac{K P_m}{\eta \cos \phi} [n_T + n_S (k_S - 1)]$ $= P_{c1} [1 + (n_S / n_T)(k_S - 1)]$ $\leq 1.5 \text{ Inverter capacity [KVA]}$
Current within the inverter rated current	$n_T I_m [1 + (n_S / n_T)(k_S - 1)]$ $\leq 1.5 \text{ Inverter capacity [A]}$

Inverter capacity requirement for continuous performance

Description	Calculation method
Require output loading within the allowable range	$K P_m / \eta \cos \phi \leq \text{Inverter capacity [KVA]}$
Motor capacity within the inverter ratings	$\sqrt{3} K V_m I_m 10^{-3} \leq \text{Inverter capacity [KVA]}$
Current within inverter rated capacity	$K I_m \leq \text{Inverter capacity [A]}$

Inverter capacity requirement for starting

Description	Calculation formula ($t_A < 60 \text{ s}$)
Total starting capacity within the inverter rated capacity	$\frac{K N}{973 \eta \cos \phi} \left(t_L + \frac{GD^2 N}{375 t_A} \right) \leq 1.5 \times \text{Inverter capacity (KVA)}$

Description	Calculated with overload
	Motor acceleration of 1 minute or more
	$\frac{K P_m}{\eta \cos \phi} [n_T + n_S (k_S - 1)]$ $= P_{c1} [1 + (n_S / n_T) (k_S - 1)]$ $\leq \text{Inverter capacity [KVA]}$
	$n_T I_m [1 + (n_S / n_T) (k_S - 1)]$ $\leq \text{Inverter capacity [A]}$

Symbol description

P_m : Motor shaft output required for loading(kw)

η : Motor efficiency

$\cos \phi$: Motor power factor

V_m : Motor voltage (V)

I_m : Motor current (A)(current with commercial power supply)

k : Correction factor calculated from currentform factor (1.05 to 1.1, depending on the PWM method)

P_{c1} : Continuous capacity (KVA)

k_S : Motor starting current/motor rated current

n_T : Number of motors in parallel

n_S : Number of simultaneously started motors

GD^2 : Total (GD^2) converted into motor shaft ($kg\cdot m^2$)

t_L : Loading torque (kg-m)

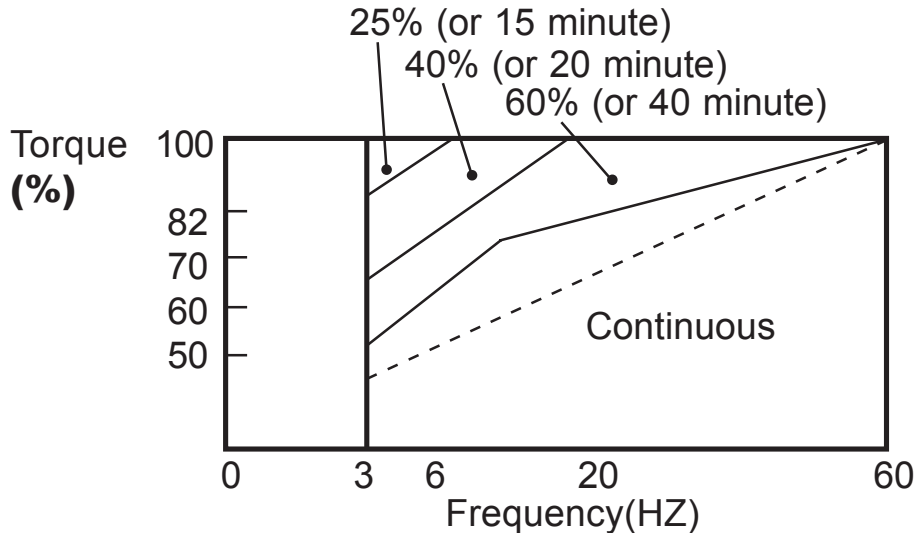
t_A : Motor acceleration time

Appendix 3 : Motor selection reminder

Standard Motor

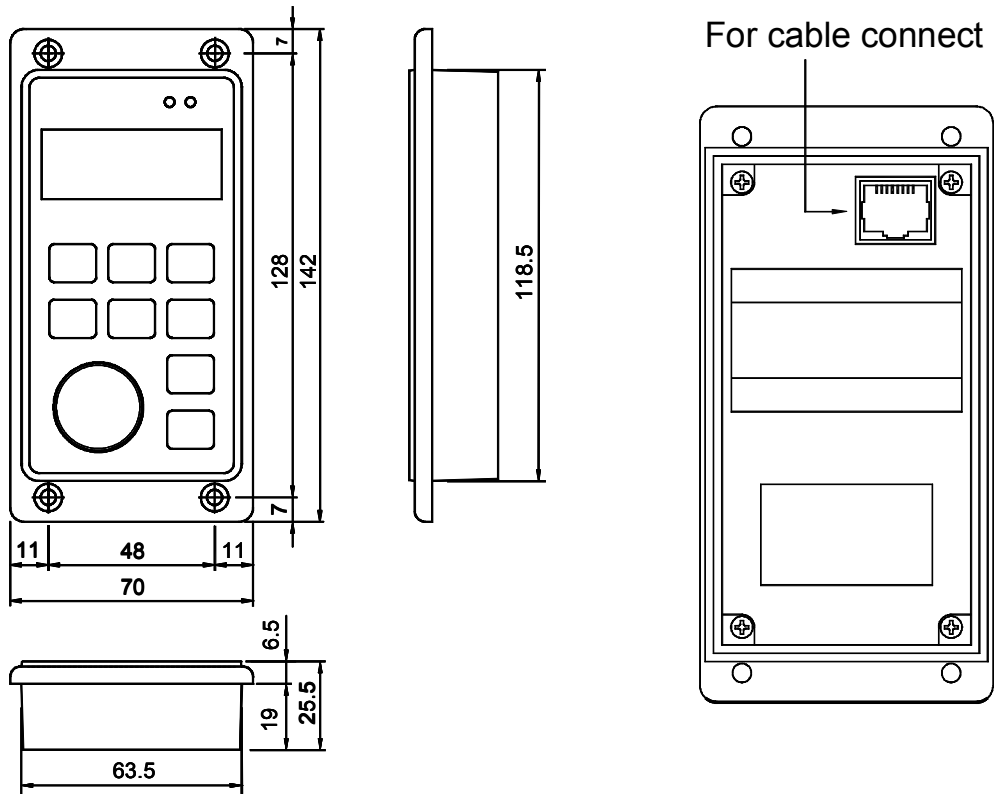
Please pay attention to the following when using inverter to drive standard motor(3 phase induction motor) :

1. When using inverter to drive standard motor, its power loss is higher than using commercial power.
2. When standard motor running at low speed and cooling fan running at low speed then motor running temperature will be risen. So, inverter should NOT running at low speed for a long time except using compulsory cooling inverter motor.
3. When standard motor running at low speed, motor output torque will drop. So, please reduce overloading usage.
4. The following is standard motor overloading permissive diagram :



5. When motor is running at low speed and torque output needs to be 100%, the compulsory cooling inverter motor is required.

Appendix 4 : Remote operator F306



UNIT : mm

Options

A-0000-F00306	Remote operator F306
E-WIAA-G5R001	Cable of 1M long
E-WIAA-G5R003	Cable of 3M long
E-WIAA-G5R005	Cable of 5M long

Please order “R” models for remote control inverters as APxG5-37R, APxG5-55R and APxG5-75R etc., and mark the extension cord length as above table shown.

★ The remote control cable. Please connect to inverter terminal RS485.

★ Standard models change to remot models. Please adjust the control board J8 switch.

Appendix 5 : Optional braking resistor

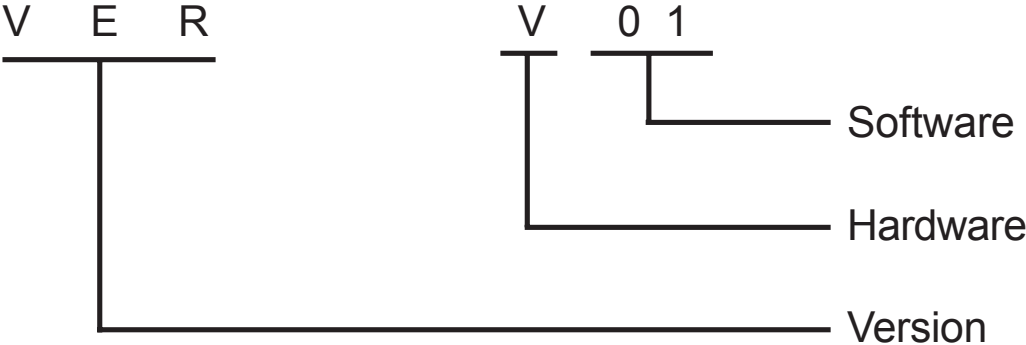
Braking resistor value, are refered to the following table and resistor value should be higher than list below. When connect external braking resistor, the internal braking resistor must be released. Please see the diagram. (P1.P2 terminal wiring)

Braking resistor value table

UNIT : Ω

Model No.	37	55	75	110	150	185	220
AP2	40	20	15	11	8	8	8
AP4	160	180	60	30	30	22	22

Appendix 6 : Version



HARDWARE	DATE	NEW FUNCTIONS

SOFTWARE	DATE	NEW FUNCTIONS

MEMO

MEMO
