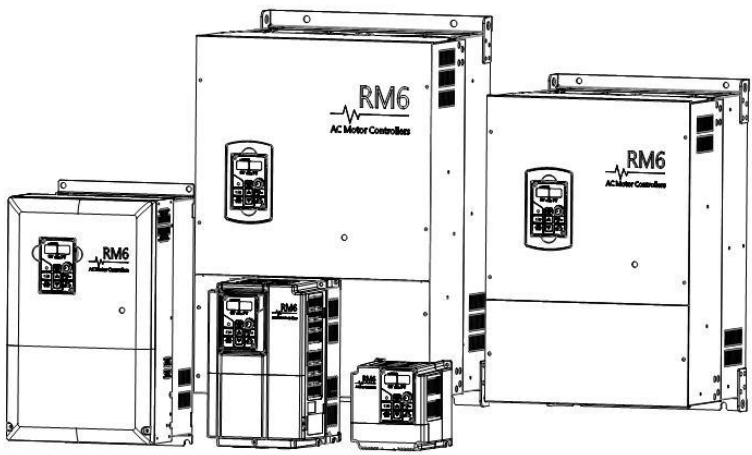
RHYMEBUS

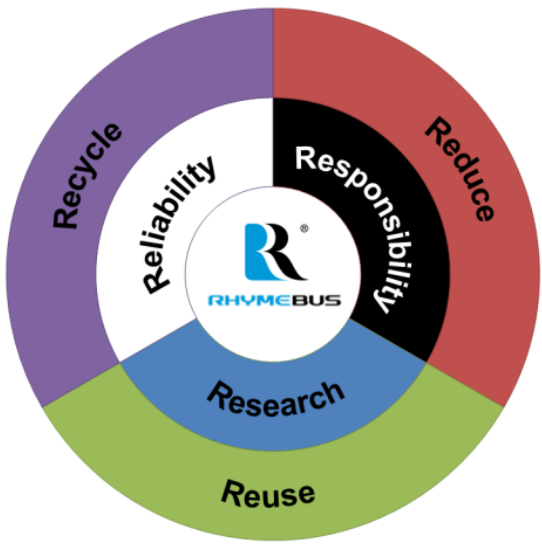
AC MOTOR DRIVE

Operation Manual



RM6F5 series

Quality • Satisfaction • Improvement • Innovation



PREFACE

Thank you for using RHYMEBUS RM6F5 series drive. For proper operations and safety purposes, please do read and follow specific instructions contained in this manual before using the product. The manual shall be placed on the top of the machine, and all the setup parameters and reference numbers must be properly recorded in Attachment 3 to facilitate future maintenance and repairs.

SAFETY PRECAUTION

Please read this manual thoroughly and pay attention to the safety precautions marked with " **DANGER** " or " **CAUTION** " before the installation, wiring, maintenance, or troubleshooting.

Only the qualified personnel may proceed with the installation, wiring, testing, troubleshooting, or other tasks.

※Qualified Personnel: Must be familiar with the fundamentals, structures, characteristics, operating procedures, and installation, and this personnel must read the manual in details and follow the steps of security measures to prevent possible dangers.

DANGER	User may cause the casualty or serious damages if user does not abide by the instructions of the manual to execute the tasks.
CAUTION	User may cause injuries to the people or damage the equipment if user does not abide by the instructions of the manual to execute the tasks.

※Although the " ⚠ " mark may indicate minor damages, serious damages or injuries may be possibly incurred if the caution is not under user's attention.

Installation

⚠ **CAUTION**
a. The installation shall take place only on top of the metal surface or any material with the fire resistant. Any place or location of high temperature, moist, oil and gas, cotton fiber, metal powder and erosive gas shall be avoided.
b. If the product specification indicates IP00 (the protective level of the equipment structure), any human contact is forbidden at the installation location to avoid the electric shock. The option of installing AC reactor(ACL) or DC reactor(DCL) shall be very cautious, too.
c. Please note the surrounding temperature shall not exceed 40°C when the installation needs to be placed inside the control panel.
d. For the environment of storage and installation, please follow the instructions of the environmental conditions illustrated in the sections of the common specification of RM6F5 series.

Wiring

⚠ DANGER

a. Do Not conduct any wiring during the system power ON to avoid the electric shock.

b. R/L1,S/L2,T/L3 are power inputs (electric source terminals) and U/T1,V/T2,W/T3 are drive's outputs connecting to a motor. Please Do Not connect these input and output terminals to P, P⊕, N, N⊖, P1 and PR terminals.

c. Once the wiring is completed, the cover of the drive must be put back and must seal the drive to avoid other's accidental contact.

d. Do Not connect 200V series drives to the electric source of 346/380/415/440/460/480V.

e. The main circuit and multi-function terminals cannot connect to ground (PE).

f. PE ⏚ terminal must be exactly grounded. The grounding method must compliance with the NEC standard or local electrical code.

g. Please refer to the "**section 2-3-4 Description of Terminals"** for the screwing torque of the wiring terminal.

h. Please refer to the national or local electric code for the appropriate specification of the cords and wires.

i. Please install an appropriate Molded Case Circuit Breaker (MCCB) or Fuse at each path of power lines to a drive.

j. Please install the thermal relay between the individual motor and the drive when using one drive to propel several motors.

k. Do Not connect phase advance capacitor, surge absorber, or non-three-phase motor to drive's U/T1,V/T2,W/T3 side.

l. AC reactor(ACL) installation is required when the power capacity exceeds 500kVA or 10 times or more than the drive rated capacity.

m. After power off (30HP below models must wait at least 5 minutes; 40HP~75HP models must wait at least 10 minutes; 100HP above models must wait at least 20 minutes). Do Not touch the drive or perform any unwiring actions before drive indicator light (CHARGE) turns off. Use a multimeter with the DC voltage stage to measure the cross voltage between P(+) and N(-) ports (DC bus voltage must be less than 25V).

n. When the motor do the voltage-proof, insulation testing, unwiring the U/T1,V/T2,W/T3 terminal of drive at first.

⚠ CAUTION

a. The RM6F5 series are designed to drive a three-phase induction motor. Do Not use for single-phase motor or other purposes.

b. The main circuit and control circuit must be wired separately; control circuit must use a shielded or twisted-pair shielded wires to avoid possible interferences.

c. The control circuit must use a shielded or twisted-pair shielded wires to avoid possible interferences and confirm the grounding.

Operation

DANGER

a. Do Not open or remove the cover while power is on or during the operation. Do close up the cover before powering on the drive. Do Not remove the cover except for wiring or periodic inspection when power off.

b. At the function F_051=0, F_078=1, the drive will automatically restart when the power is restored. Stay away from the motor and machine.

c. At the function F_003=0 and F_001=0 or 1, the OFF/RESET key on keypad is ineffective. Please use an emergency stop switch separately for safe operations.

d. The drive can produce high frequency outputs. Before adjusting the frequency, please check the specifications of motor carefully to prevent the motor from unexpected damages.

e. If any of the protective functions have been activated, and the start command is set to terminal control (F_001=0 or 1). First remove the case and check if the all running commands set to OFF. Then press the OFF/RESET key to release the alarm.

CAUTION

a. Do Not touch the heat sink or brake resistors due to the high heat.

b. Some models attach nylon rope when shipping. Do Not proceed the movement or hanging the drive by this nylon rope to avoid unexpecting accident. Please select a suitable rope to proceed the movement or hanging the drive.

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Features

a. Simple and easy control framework, stable system.
Easy installing, single spare parts, only need to set parameter to expand number of machines in parallel connection.(maximum number of machines in parallel connection: four machines.)

b. Smart manual/automatic parallel connection constant pressure separation function.

c. Smart period constant pressure adjustment in Water Supply.

d. Pipeline damage automatic compensation function.
Calculates pipeline damage according to the flow, and automatically adjusts the pressure set value for the water supply in constant pressure.

e. Dry-run protection.

f. Out of curve operation and excessive outlet pressure alarm.

g. Pipe Leakage differential pressure automatic adjustment start and stop.

h. User-friendly advanced control mode.

i. System control mode parameterization set.
Various constant pressure control modes are set within, and you only need to set simple parameters to switch into a different control mode.

j. Process cooling water system.
Specially designed for process cooling water, you can set a minmum number of operating pumps in order to avoid a pump fails during operation.

k. Operation control and management for temperature and cooling fan.

l. Re-start automatically after abnormal tripping.

m. Setting value (SV) and practical value (PV) are shown simultaneously.

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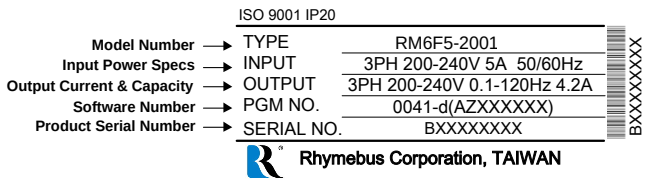
Chapter 1 Cautions Before Installation

1-1 Product Verification

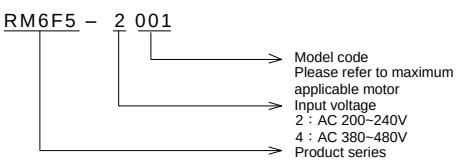
The product has passed the strictest quality test before shipped out from the factory. However, the product might possibly sustain minor damages due to the impact, shaking, vibration, and other factors during the transportation. Please make sure to verify the following items after receiving this product. If the product verification finds anything abnormal, please contact the agent immediately for the further assistance.

1-1-1 Confirmation of Appearance

1. Check up the specifications at shipping label on the carton is identical with the nameplate of drive.
2. Check up the appearance of drive for any paint chipped off, smearing, deformation of shape, etc.
3. Check up the nameplate (as below example by RM6F5-2001) of the drive to verify the product descriptions with the order specification.



1-1-2 The description of nomenclature:



Maximum applicable motor

Model code	HP/kW	
001	1	0.75
002	2	1.5
003	3	2.2
005	5	3.7
007	7.5	5.5
010	10	7.5
015	15	11

Model code	HP/kW	
020	20	15
025	25	18.5
030	30	22
040	40	30
050	50	37
060	60	45
075	75	55

Model code	HP/kW	
100	100	75
125	125	90
150	150	110
175	175	132
200	200	160
250	250	200
300	300	220

Model code	HP/kW	
350	350	250
420	420	315
500	500	375
600	600	450
700	700	500
–	–	–
–	–	–

1-1-3 Confirmation of Accessories

One operation manual is inclusive. Please verify other accessories inclusively such as braking resistor, AC reactor, etc.

※Please refer to the standard specifications to verify the product specifications with your requirements.

1-2 Standard Specifications

1-2-1 Three-Phase 200V Series

Model name (RM6F5-□□□□)	2001	2002	2003	2005	2007	2010	2015
Maximum applicable motor (HP / kW)	1/0.75	2/1.5	3/2.2	5/3.7	7.5/5.5	10/7.5	15/11
Rated output capability (kVA)	1.6	2.6	3.8	5.8	9.5	12	16
Rated output current (A)	4.2	6.8	10	15.2	25	31	42
Rated output voltage (V)	Three-phase 200~240V						
Range of output frequency (Hz)	0.1~120.00Hz						
Power source (ϕ , V, Hz)	Three-phase 200~240V 50/60Hz						
Input current (A)	5	8	12	18	30	41	55
Permissible AC power source fluctuation	176~264V 50/60Hz / ±5%						
Overload protection	120% of drive rated output current for 1 min.						
Cooling method	Nature cooling	Fan cooling					
Applicable safety standards	—						
Protective structure	IP20						
Weight / Mass(kg)	1.8	1.8	1.9	2	5.3	5.3	5.4

Model name (RM6F5-□□□□)	2020	2025	2030	2040	2050	2060	2075	2100
Maximum applicable motor (HP / kW)	20/15	25/18.5	30/22	40/30	50/37	60/45	75/55	100/75
Rated output capability (kVA)	22	28	34	43	55	67	83	105
Rated output current (A)	58	74	90	112	144	175	218	275
Rated output voltage (V)	Three-phase 200~240V							
Range of output frequency (Hz)	0.1~120.00Hz							
Power source (ϕ , V, Hz)	Three-phase 200~240V 50/60Hz							
Input current (A)	66	85	103	128	176	200	240	280
Permissible AC power source fluctuation	176~264V 50/60Hz / ±5%							
Overload protection	120% of drive rated output current for 1 min.							
Cooling method	Fan cooling							
Applicable safety standards	–							
Protective structure	IP20				IP00 (IP20 OPTION)			
Weight / Mass(kg)	5.7	16	16	16	17	40	41	44

Model name (RM6F5-□□□□)	2125	2150	2200	2250	–	–	–	–
Maximum applicable motor (HP / kW)	125/90	150/110	200/160	250/200	–	–	–	–
Rated output capability (kVA)	132	154	223	267	–	–	–	–
Rated output current (A)	346	405	585	700	–	–	–	–
Rated output voltage (V)	Three-phase 200~240V							
Range of output frequency (Hz)	0.1~120.00Hz							
Power source (ϕ , V, Hz)	Three-phase 200~240V 50/60Hz							
Input current (A)	330	380	550	660	–	–	–	–
Permissible AC power source fluctuation	176~264V 50/60Hz / ±5%							
Overload protection	120% of drive rated output current for 1 min.							
Cooling method	Fan cooling							
Applicable safety standards	–							
Protective structure	IP00 (IP20 OPTION)							
Weight / Mass(kg)	61	89	164	164	–	–	–	–

1-2-2 Three-Phase 400V Series

Model name (RM6F5-□□□□)	4001	4002	4003	4005	4007	4010	4015	4020
Maximum applicable motor (HP / kW)	1/0.75	2/1.5	3/2.2	5/3.7	7.5/5.5	10/7.5	15/11	20/15
Rated output capability (kVA)	1.9	2.7	3.7	6.1	8.4	13	17	23
Rated output current (A)	2.5	3.5	4.8	8	11	17	22	30
Rated output voltage (V)	Three-phase 380~480V							
Range of output frequency (Hz)	0.1~120.00Hz							
Power source (ϕ , V, Hz)	Three-phase 380~480V 50/60Hz							
Input current (A)	3	4.2	5.8	9.6	13	20	25	38
Permissible AC power source fluctuation	332~528V 50/60Hz / ±5%							
Overload protection	120% of drive rated output current for 1 min.							
Cooling method	Nature cooling		Fan cooling					
Applicable safety standards	–							
Protective structure	IP20, UL open type					IP20		
Weight / Mass(kg)	1.8	1.8	1.9	2	2	5.3	5.4	5.6

Model name (RM6F5-□□□□)	4025	4030	4040	4050	4060	4075	4100	4125
Maximum applicable motor (HP / kW)	25/18.5	30/22	40/30	50/37	60/45	75/55	100/75	125/90
Rated output capability (kVA)	28	34	46	56	66	82	105	134
Rated output current (A)	37	45	56	73	87	108	138	176
Rated output voltage (V)	Three-phase 380~480V							
Range of output frequency (Hz)	0.1~400.00Hz							
Power source (ϕ , V, Hz)	Three-phase 380~480V 50/60Hz							
Input current (A)	42	52	64	84	100	130	155	177
Permissible AC power source fluctuation	332~528V 50/60Hz / ±5%							
Overload protection	120% of drive rated output current for 1 min.							
Cooling method	Fan cooling							
Applicable safety standards	–							
Protective structure	IP20						IP00 (IP20 OPTION)	
Weight / Mass(kg)	5.7	5.8	16	16	17	18	44	45

Model name (RM6F5-□□□□)	4150	4175	4200	4250	4300	4350	4420	4500	4600	4700
Maximum applicable motor (HP / kW)	150/ 110	175/ 132	200/ 160	250/ 200	300/ 220	350/ 250	420/ 315	500/ 375	600/ 450	700/ 500
Rated output capability (kVA)	160	193	232	287	316	366	446	533	655	732
Rated output current (A)	210	253	304	377	415	480	585	700	860	960
Rated output voltage (V)	Three-phase 380~480V									
Range of output frequency (Hz)	0.1~120.00Hz									
Power source (ϕ , V, Hz)	Three-phase 380~480V 50/60Hz									
Input current (A)	196	217	282	355	385	440	540	650	800	900
Permissible AC power source fluctuation	332~528V 50/60Hz / ±5%									
Overload protection	120% of drive rated output current for 1 min.									
Cooling method	Fan cooling									
Applicable safety standards	–									
Protective structure	IP00 (IP20 OPTION)							IP00		
Weight / Mass(kg)	47	65	91	95	97	159	163	217	217	272

※The weight illustrated in the standard specifications of RM6F5 series does not include the weights of AC reactor(ACL) and DC reactor(DCL).

1-3 Common Specifications

1-3-1 The Features of Control and Operation

Control Characteristics	Control method	• Voltage vector sinusoidal PWM control (V/F control). • Switching frequency: 800Hz~16kHz.
	Range of frequency setting	0.1~120.00Hz
	Resolution of frequency setting	• Digital Keypad: 0.01Hz • Analog signal: 0.06Hz / 60Hz
	Resolution of output frequency	0.01Hz
	Frequency setting signal	DC 0~10V, 4~20mA.
	Overload protection	120% of drive rated output current for 1 minute.
	DC braking	• Time of DC braking after start / before stop: 0~20.0sec • DC braking frequency at stop: 0.1~60Hz • DC baking level: 0~150% of rated current
	Braking torque	Approximately 20%(with the external braking resistor connected, braking torque is approximately 100%).
	Acceleration/ deceleration time	• 0sec(coast to stop), 0.0~3200.0sec(independent setting of the acceleration / deceleration). • The setting of accel/decel time from 0 to 60Hz is 0.015sec ~ 19,200,000sec(222 days).
	V/F pattern	• Linear, Square curve, 1.7^{th} power curve, 1.5^{th} power curve. • V/F pattern (2 V/F points). • V/F pattern can be adjusted by analog input (Variable voltage (V) adjustment of V/F pattern for acceleration / deceleration).
	Other functions	slip compensation, auto-torque compensation, auto-adjustment for output voltage stability, auto-operation for energy-saving, auto-adjustment of switching frequency, restart after instantaneous power failure, speed tracing, overload detection, PID control, acceleration/deceleration switch, fan control, parameters copy, sequential control, communication control, over pressure protection, pump protection, ON/OFF mode.

Operation Characteristics	Operation method		(FWD)/(REV) rotation control, 9 sets preset speed control, 3 wire start/stop FWD&REV rotation control, Communication control
	Input	Multi-function inputs	4 sets programmable input terminals: X1~X4
			Refer to the function setting description of F_052~F_055
		Analog inputs	• Vin – GND: DC 0~10V • Iin – GND: DC 4~20mA / 2~10V or DC 0~20mA / 0~10V
			Refer to the function setting description of F_040, F_041, and F_126~F_128
	Output	Multi-function outputs	4 sets programmable output detection: Ta2–Tc2, Ta1–Tb1–Tc1, Y1–CME, Y2–CME
			Refer to the function setting description of F_058~F_061
		Analog outputs	• “FM+” – “M-“：DC 0~10V • “AM+” – “M-“：DC 0~10V
			Refer to the function setting description of F_044, F_045, F_129, F_130
Display	Keypad (KP-605)		output frequency, frequency command, output voltage, DC bus voltage, output current, terminal status and heat sink temperature, actual / setting pressure.
	External indicator (DM-501)		Independent external display can be added for up to three sets(96mm * 48mm, 5 digits) to show output frequency, frequency command, output voltage, DC bus voltage, output current, terminal status and heat sink temperature.
Protections	Fault protection	Error trip messages of drive	EEPROM error(EEr), A/D converter error(AdEr), Fuse open(SC), Under voltage during operation(LE1), Drive over current(OC), Grounding fault (GF), Over voltage(OE), Drive overheating(OH), Motor overload(OL), Drive overload(OL1), System overload(OLO), External fault(thr), NTC thermistor sensor fault(ntCF), Keypad interruption during copy(PAdF)
		Error trip messages of drive for pressure control	PID feedback signal error(no Fb), Over pressure(OP), Water shortage(Fb Lo)
		Warning messages of drive	Power source under voltage(LE), Drive output interruption (bb), Coast to stop(Fr), Dynamic brake transistor over voltage(db), Software fault(PrEr), Drive overheating(Ht), Keypad cable trip before connecting(Err_00), Keypad cable trip during operation(Err_01), Over pressure(OP), FWD/REV command input simultaneously(dtF)、Different software version inter-copy(wrF)

	Cooling method	• Nature cooling: 2001, 4001, 4002 models. • Fan cooling: Three fan control methods for cooling(forced air, operation air, temperature level setting) for other models.
Environment	Atmosphere	Non-corrosive or non-conductive, or non-explosive gas or liquid, and non-dusty
	Surrounding temperature	-10°C (14°F) ~ +40°C (104°F) (Non-freezing and non-condensing)
	Storage temperature	-20°C (-4°F) ~ +60°C (149°F)
	Relative humidity	90% RH or less (No-condensing atmosphere)
	Vibration	Less than 5.9m/sec² (0.6G)
	Altitude	Less than 1000m (3280 ft.)

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Chapter 2 Installation and Confirmation

2-1 Basic Equipment

The drive needs the several components for the conjunctive operation. These components are called “basic equipment”, listed in the following:

2-1-1 Power Source: The voltage with three-phase of the power source must meet the drive specifications.

2-1-2 MCCB or NFB: MCCB (Molded Case Circuit Breaker) or NFB (No Fuse Breaker) can withstand the inrush current at instant power ON and provide the overload and over-current protection to the drive.

2-1-3 Drive: The main device of motor control must be chosen in accordance with the rated voltage and current specifications of motor (please refer to 1-2 RM6F5 standard specifications of drives).

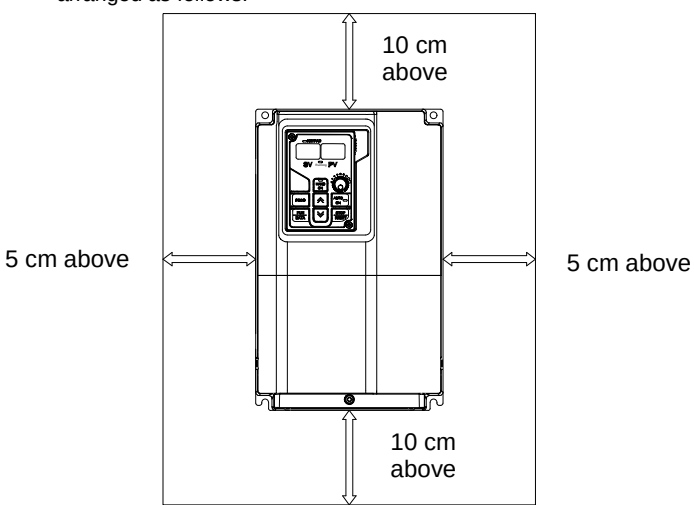
2-1-4 Motor: The specifications of motor are determined from the requirement. Please be cautious to the motor rated current that must not exceed the drive current.

2-2 Installing the Drive

For the safe operation of the drive, please be cautious to the environmental conditions where the drive is going to be installed.

2-2-1 AC Power: AC power input must be complied with the AC power input specification of the drive.(see RM6F5 series standard specifications)

2-2-2 Location: Due to the heat dissipating requirement during the drive operation, please install the drive with clearance space (shown as below figure) around the drive. Therefore, the location of installation shall be arranged as follows:



2-2-3 Arrangement: Due to the heat generated at the machine operation, the drive must be installed in the ventilate space. The installations of drive are shown as below figure 1 and figure 2:

a. Internal cooling

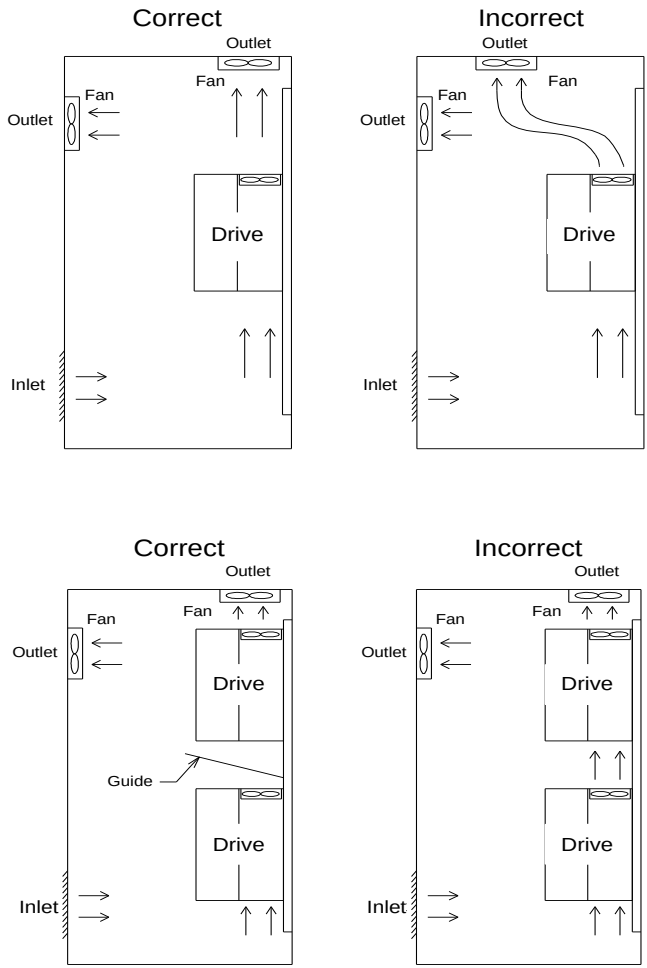


Figure 1: Drive mounting inside the cabinet/control panel

b. External cooling

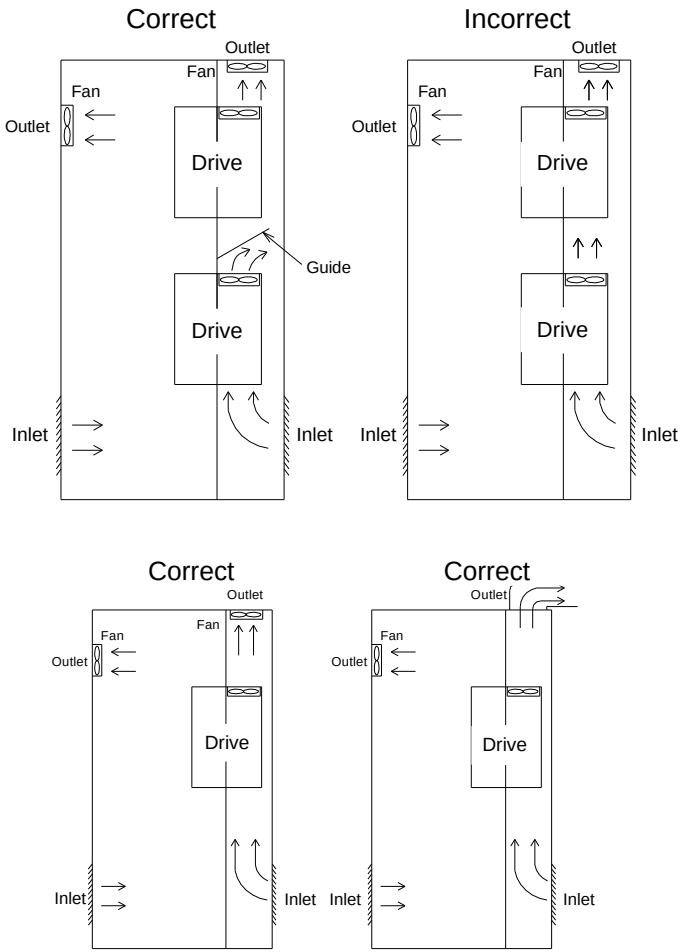


Figure 2: Drive mounting inside the cabinet/control panel

Note: The external cooling is suitable for 2007,4010 above. Please ensure all air vents to be ventilated using the external cooling.

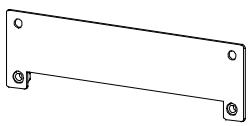
2-2-4 Specifications of Associated Accessories: The specifications of the accessories must be according to the specifications of the drive. Otherwise, the drive will be damaged and the life span of the drive will be shorten.

⚠ Do Not add any phase-advanced capacitor (RC, LC or other capacitance component) between the drive and motor to avoid any accidents.

2-2-5 Cleaning of Environment: The installed location of drive must consider the ventilation, cleanliness and moisture.

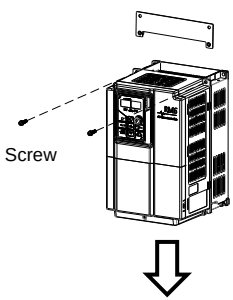
2-2-6 Operator: Only the qualified personnel can perform the operation and troubleshooting.

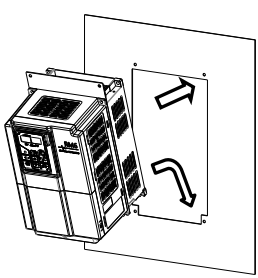
2-2-7 Drive Supporting Frame (option):
(Please refer to opage 172

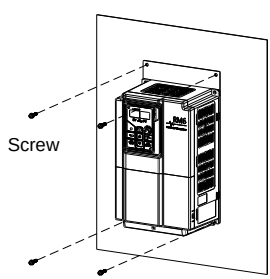


a. Applicable mode: RM6F5-2007 ~ RM6F5-2020；
RM6F5-4010 ~ RM6F5-4030

b. Instruction:



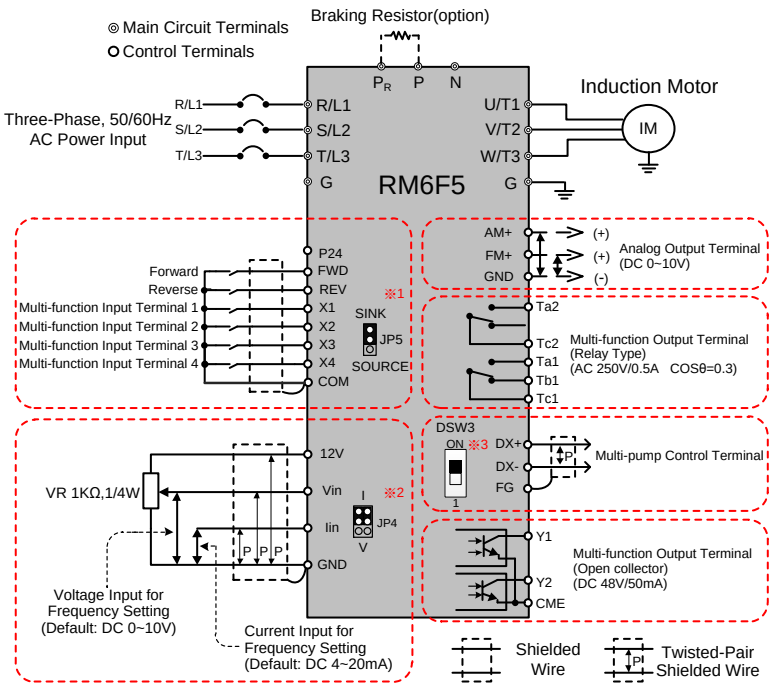




2-3 Descriptions of Terminal and Wiring Diagram

2-3-1 Wiring Diagram

Model: RM6F5-2001 ~ RM6F5-2005;
RM6F5-4001~RM6F5-4007



※1.JP5: SINK / SOURCE selection;
The signal input selection of multi-function input terminal, please see the section **2-3-2 SINK / SOURCE Definition**

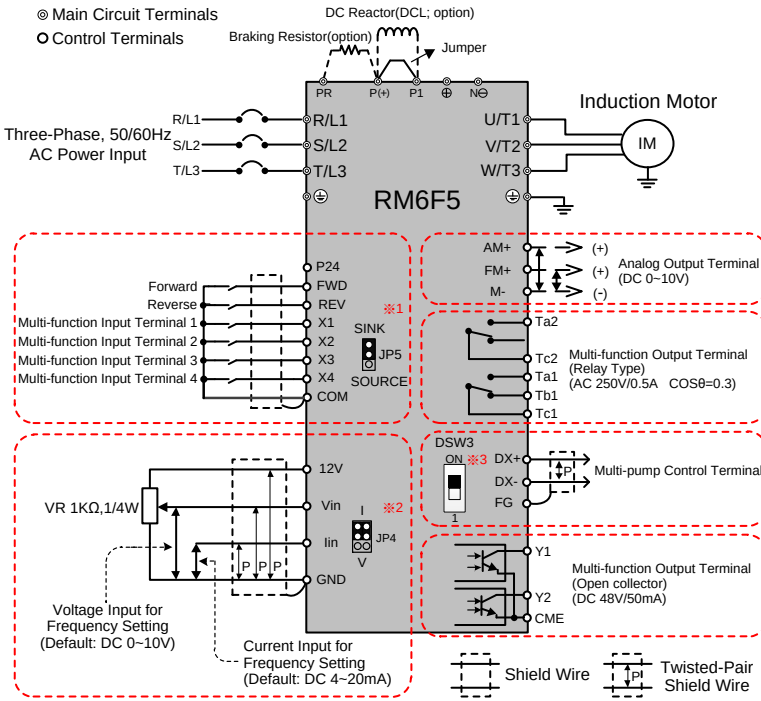
※2.JP4: I / V selection;
I position: Iin-GND terminal is inputted with the current signal.(default)
V position: Iin-GND terminal is inputted with the voltage signal.

※3.DSW3: The terminal resistor selection for multi-pump control: The internal resistance is 100Ω.

※4.The analog input selection is set by F_126 (default: DC 2~10V(4~20mA))

※5.Tightening torque is 5 lb-in(5.7 kgf-cm)

Model: RM6F5-2007 ~ RM6F5-2020;
RM6F5-4010 ~ RM6F5-4030.



※1.JP5: SINK / SOURCE selection;
The signal input selection of multi-function input terminal, please see the section **2-3-2 SINK / SOURCE Definition**

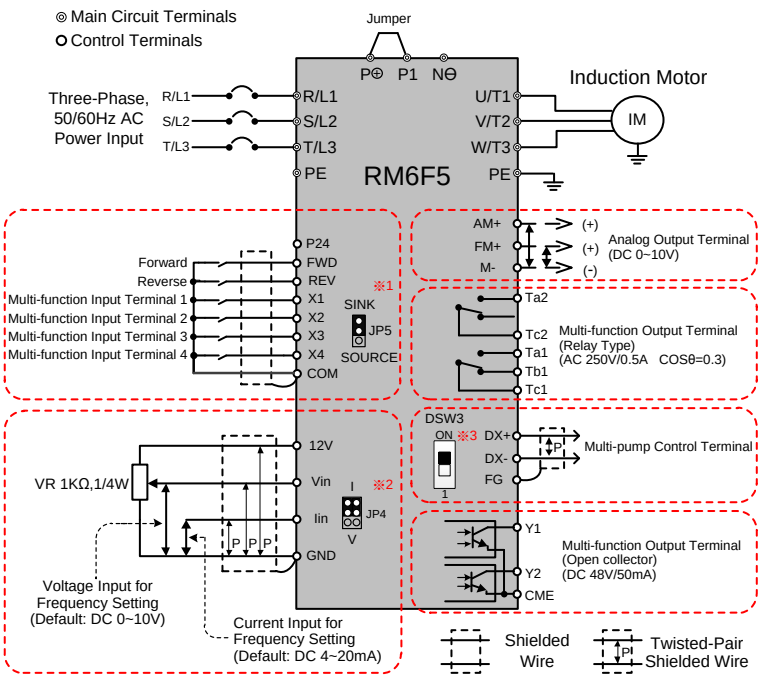
※2.JP4: I / V selection;
I position: Iin-GND terminal is inputted with the current signal.(default)
V position: Iin-GND terminal is inputted with the voltage signal.

※3.DSW3: The terminal resistor selection for multi-pump control: The internal resistance is 100Ω.

※4.The analog input selection is set by F_126 (default: DC 2~10V(4~20mA))

※5.Tightening torque is 5 lb-in(5.7 kgf-cm)

Model: RM6F5-2025 ~ RM6F5-2100;
RM6F5-4040 ~ RM6F5-4150



※1.JP5: SINK / SOURCE selection;
The signal input selection of multi-function input terminal, please see the section **2-3-2 SINK / SOURCE Definition**

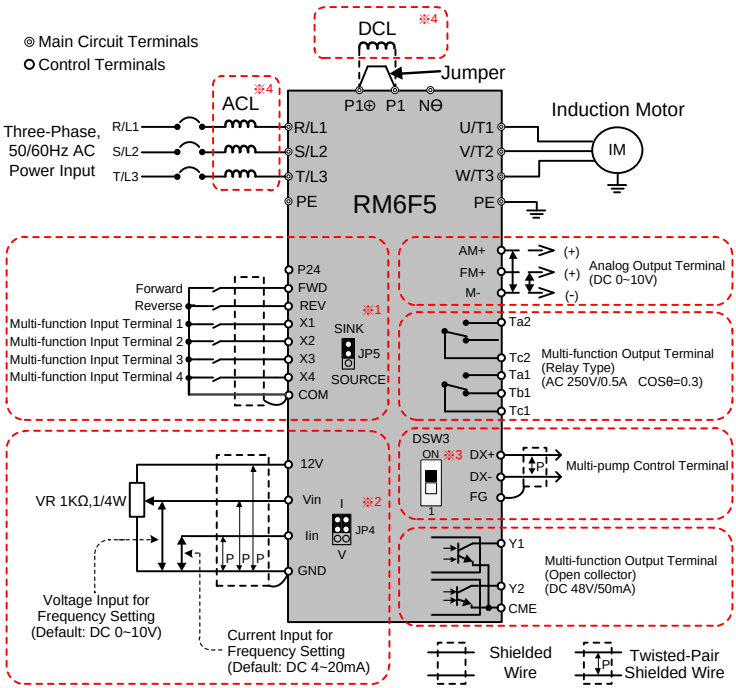
※2.JP4: I / V selection;
I position: Iin-GND terminal is inputted with the current signal. (default)
V position: Iin-GND terminal is inputted with the voltage signal.

※3.DSW3: The terminal resistor selection for multi-pump control: The internal resistance is 100Ω.

※4.The analog input selection is set by F_126 (default: DC 2~10V(4~20mA))

※5.Tightening torque is 5 lb-in(5.7 kgf-cm)

Model: RM6F5-2125 ~ RM6F5-2250;
RM6F5-4175 ~ RM6F5-4700



※1.JP5: SINK / SOURCE selection;
The signal input selection of multi-function input terminal, please see the section **2-3-2 SINK / SOURCE Definition**

※2.JP4: I / V selection;
I position: Iin-GND terminal is inputted with the current signal.(default)
V position: Iin-GND terminal is inputted with the voltage signal.

※3.DSW3: The terminal resistor selection for multi-pump control: The internal resistance is 100Ω.

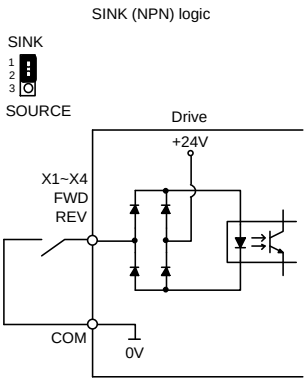
※4.125HP above drives: AC reactor (ACL) is the standard accessory;
200HP above drives: DC reactor (DCL) is the standard accessory.
Please remove the jumper between P1 and P terminal, when connecting the external DC reactor (DCL). Do Not remove the jumper, when DC reactor (DCL) does not be connected.

※5.The analog input selection is set by F_126 (default: DC 2~10V(4~20mA))

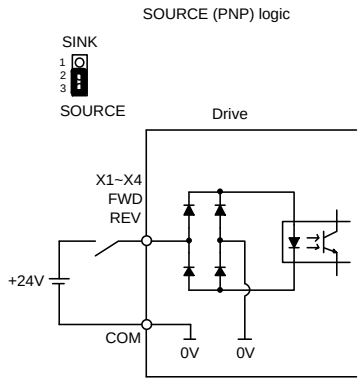
※6.Tightening torque is 6.9 lb-in(8 kgf-cm)

2-3-2 SINK / SOURCE Definition

There are two ways of connection for multi-function input terminals:



(a) Jumper at 1,2 position; SINK mode

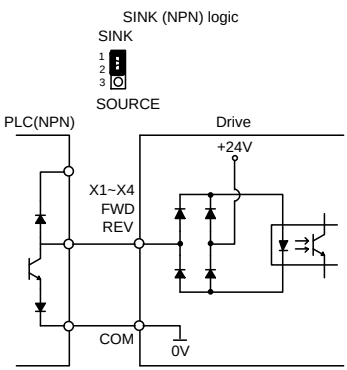


(b) Jumper at 2,3 position; SOURCE mode

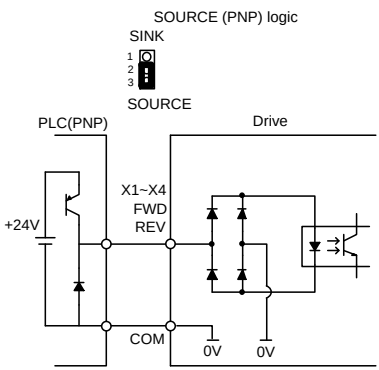
Figure(a) and (b) show two examples by using a switch to control X1 to X4, FWD, or REV terminals with sink or source mode.

2-3-3 Using a PLC Circuit

There are two ways of connection for multi-function input terminals by PLC circuit:



Jumper at 1,2 position; SINK mode



(b) Jumper at 2,3 position; SOURCE mode

Figure(a) and (b) show two examples by using PLC to control X1 to X4, FWD, or REV terminals with sink or source mode.

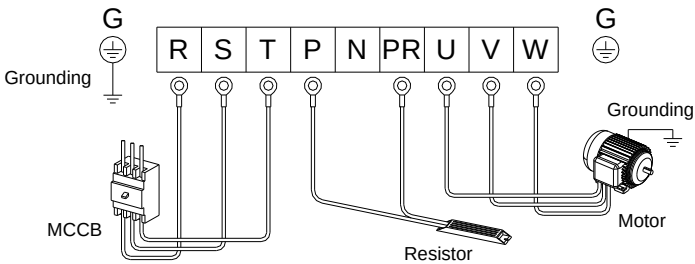
2-3-4 Description of Terminals

a. Main Circuit Terminals

Type	Symbol	Function	Description
Power Source	R,S,T (L1,L2,L3)	AC power source input terminals	Three-phase; sinusoidal power source input terminal.
	⊕, N⊖	DC power source input terminals	External DC power source terminal. ※Only 2007~2020,4010~4030 models have the terminal.
Motor	U,V,W (T1,T2,T3)	Drive outputs to motor terminals	Output three-phase variable frequency and voltage to motor.
Power and Braking	P(+), N⊖	Dynamic brake unit terminal	The terminals can connect to dynamic braking unit (option).
	P⊕, N⊖		
	P, N		
	P, PR	External braking resistor terminal	The terminals can connect to external brake resistor (option).
	P(+), PR		
	P⊕, PR		
	P(+), P1	External reactor terminal	The terminal can connect to DC reactor (DCL) for improving power factor. The default setting is connected by a jumper.
	P⊕, P1		
Grounding	PE ⏚	Grounding terminal	The grounding method must compliance with the NEC standard or local electrical code.

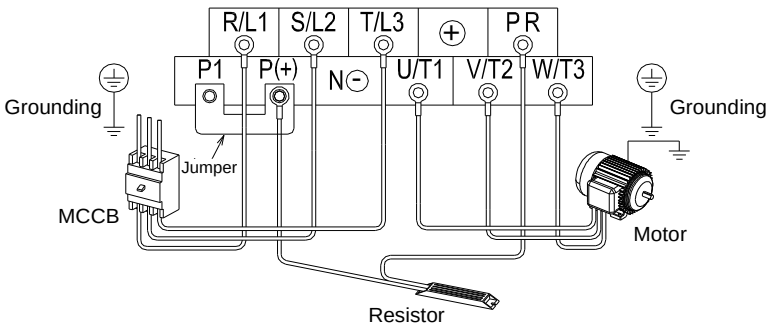
b. Main Circuit Connection

(1)



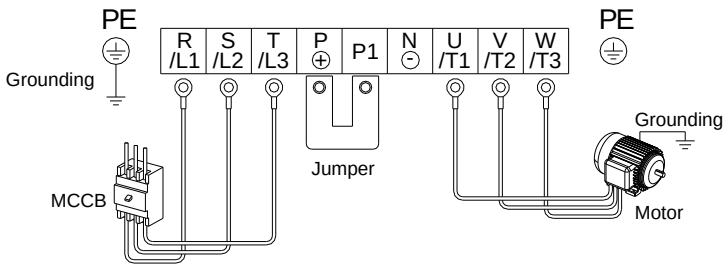
Model number	Terminal screw size	Tightening torque lb-in (kgf-cm)	Grounding terminal size	Tightening torque lb-in (kgf-cm)
RM6F5-_____: 2001, 2002, 2003, 2005; 4001, 4002, 4003, 4005, 4007	M4	13.8 (15)	M4	13.8 (15)

(2)



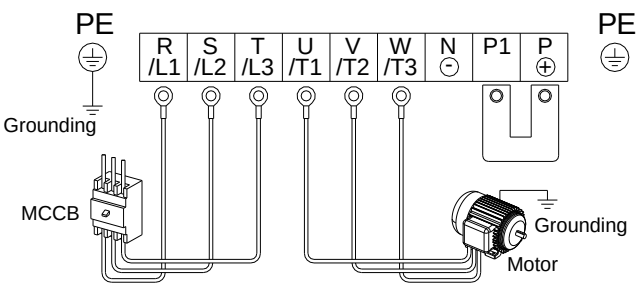
Model number	Terminal screw size	Tightening torque lb-in (kgf-cm)	Grounding terminal size	Tightening torque lb-in (kgf-cm)
RM6F5-_____: 2007, 2010, 2015, 2020; 4010, 4015, 4020, 4025, 4030	M5	20.8 (24)	M4	13.8 (15)

(3)



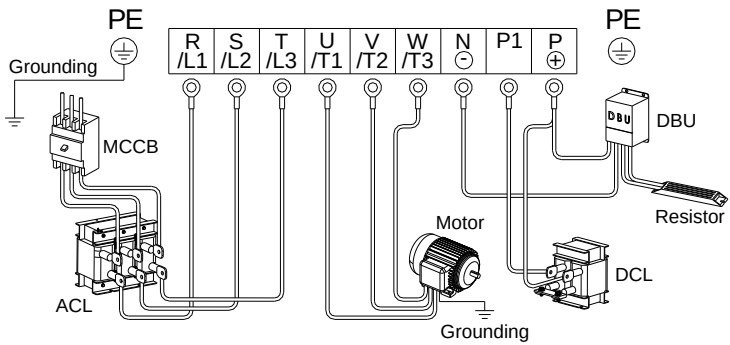
Model number	Terminal screw size	Tightening torque lb-in (kgf-cm)	Grounding terminal size	Tightening torque lb-in (kgf-cm)
RM6F5-_____: 2025, 2030, 2040, 2050 4040, 4050, 4060, 4075	M6	69.4 (80)	M5	20.8 (24)

(4)



Model number	Terminal screw size	Tightening torque lb-in (kgf-cm)	Grounding terminal size	Tightening torque lb-in (kgf-cm)
RM6F5-_____: 2060, 2075, 2100 4100, 4125, 4150	M8	104 (120)	M8	104 (120)

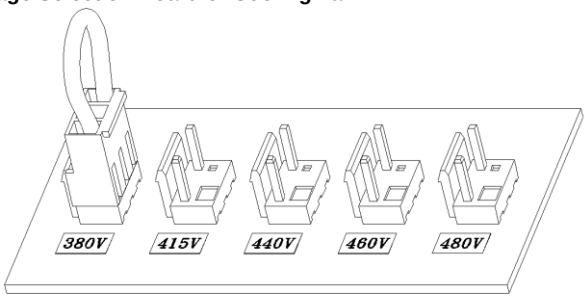
(5)



Model number	Terminal screw size	Tightening torque lb-in (kgf-cm)	Grounding terminal size	Tightening torque lb-in (kgf-cm)
RM6F5-_____: 2125, 2150, 2200, 2250; 4175, 4200, 4250, 4300, 4350, 4420, 4500, 4600, 4700	M12	347 (400)	M8	104 (120)

※Be cautious of the electrodes of DBU when connecting to P ⊕, N ⊖ terminals of drive to avoid any possible damages to drive.

c. Voltage Selection Board of Cooling Fan



※RM6F5-4100 above models have the voltage selection board shown in above figure when removing the main circuit terminal cover of the drive. Please carefully select the jumper position according to the power source (actual power voltage level) to avoid the burnout of the fan or the overheating of the drive.
(EX: When the power source is 460V, to select the position from 380V to 460V)

d. Control Terminals

Type		Symbol	Function	Description
Control circuit terminal	Control power	P24	Power terminal; Control device usage	Output DC+24V; Maximum supplied current is 50mA.
		P12/12V		Output DC+12V; Maximum supplied current is 20mA.
		GND	Common terminal for analog input control	Grounding terminal for control power (P12/12V,P24) and analog input terminal (Vin, Iin).
	Input terminals	FWD	Forward command terminal	Connect the FWD and COM terminals for forward operation. (F_001=0,1,2)
		REV	Reverse command terminal	Connect the REV and COM terminals for reverse operation. (F_001=0,1,2)
		X1	Multi-function input terminal 1	• Connect the X1 and COM terminals and set the function F_052.
		X2	Multi-function input terminal 2	• Connect the X2 and COM terminals and set the function F_053.
		X3	Multi-function input terminal 3	• Connect the X3 and COM terminals and set the function F_054.
		X4	Multi-function input terminal 4	• Connect the X4 and COM terminals and set the function F_055.
		COM	Input common terminal	The common of input control signal terminals. (FWD, REV and X1 ~ X4)
		Vin	Analog input terminal	Input range: DC 0~10V。

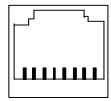
Type		Symbol	Function	Description
		Iin	Analog input terminal	• Input signal selection JP4: I position (current signal) JP4: V position (voltage signal) • Input range: DC 4~20mA (2~10V) or DC 0~20mA (0~10V) • The function is set by F_126.
Control circuit terminal	Output terminals	FM+ AM+	Analog output terminal	• Voltage meter with 10V full scale spec. (meter impedance: 10KΩ above) • Maximum output current: 1mA
		M- (GND)	Common of analog output terminals	Common of analog output terminals.
		Ta1	Multi-function output terminals (relay type)	• N.O (form a contact); The function is set by F_060 • Capacity: AC250V, 0.5AMax, cosθ=0.3
		Tb1		• N.C (form b contact); The function is set by F_060 • Capacity: AC250V, 0.5AMax, cosθ=0.3
		Tc1		Common terminal for Ta1,Tb1.
		Ta2		• N.O (form a contact); The function is set by F_061. • Capacity: AC250V, 0.5AMax, cosθ=0.3
		Tc2		Common terminal for Ta2.
		Y1	Multi-function output terminals (open collector type)	• The function is set by F_058, F_059. • Capacity: DC48V, 50mAMax
		Y2		
		CME		Common terminal of Y1, Y2.
		FG(A8)		Connect the shielded net to FG(A8) and avoid the reflective signal to interfere the signal.
		FM_P		Reserved

e. Control Terminals and Switch for Communication Application

Type	Symbol	Function	Description
Communication terminals	DX+	Multiple pump/ Modbus communication terminal	• Connect the RM6F5 series drives by transmission cable, when the drives control multiple pumps. • Maximum parallel units:2 units
	DX-		
	FG	Grounding terminal of signal transmission	Grounding terminal of shielding wire.
Terminal resistor	DSW3	Terminal resistor switch	• Switch the DSW3 to “ON” position for first and last drives, when parallel control the multi-pump system. • Terminal resistance: 100Ω

Note: The total length of connecting cable can not exceed 500 meters.

f. CN2 / CN3: KP-605 (RJ-45) / Modbus RS-485 Modbus Port



Type	Pin	Function	Description
Modbus(RS-485)/ KP-605 communication	1	Communication transmission terminal (DX+)	Differential input of RS-485 *Note 1 Modbus (RS-485) communication only uses pin1, 2.
	2	Communication transmission terminal (DX-)	
	3	Power terminal of KP-605(+16V)	Only for KP-605 linking
	4	Auto-detect terminal of KP-605	Only for KP-605 linking
	5	Reserved	Reserved
	6		
	7	Common ports of KP-605 power(0V)	Only for KP-605 linking
	8		

Note 1: The terminal resistor(100Ω) selection is set by DSW1(Default setting: ON)

Note 2: When using multiple sets of drive, connect all the DX＋, DX－ terminals of each drive by series, and connect the shielded net of the connection wire to FG terminal.

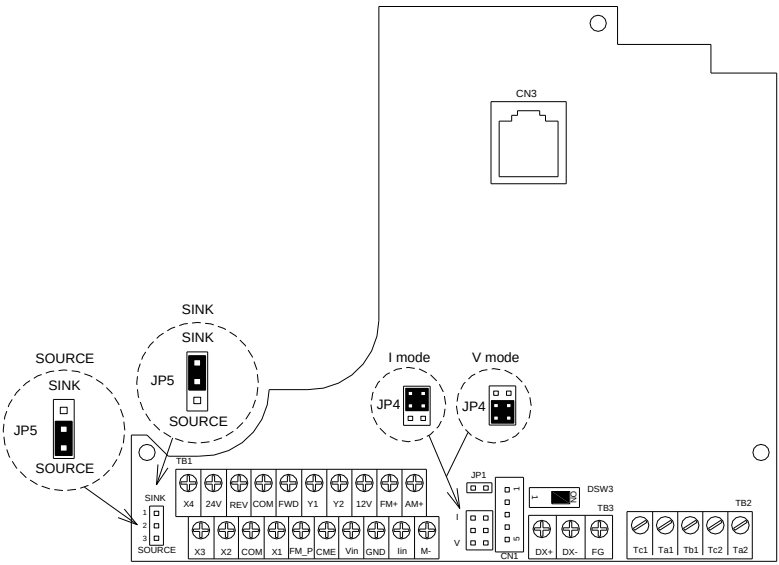
Note 3: The function of terminal resistor is to terminate the electric signal and avoid the reflective signal to interfere the signal. Switch DSW1 to “ON” position of the first and last device and switch to “1” position for other drives. The default value is “ON” position.

Note 4: The cable length from the controllers(PC, PLC) to the last drive cannot exceed 500m.

Note 5: Max. controller number are 31 sets.

2-3-5 Control Board

(1) RM6F5-2001 ~ RM6F5-2005;
RM6F5-4001 ~ RM6F5-4007



CN1: External indicator (DM-501) socket.

CN3: Digital keypad (KP-605) RJ-45 socket / RS-485 communication interface (choose one of the two options)

TB1: Input/Output terminals.

TB2: Multi-function output terminals (relay type).

TB3: Connection terminals for multi-pump control/RS-485 communication interface. (choose one of the two options)

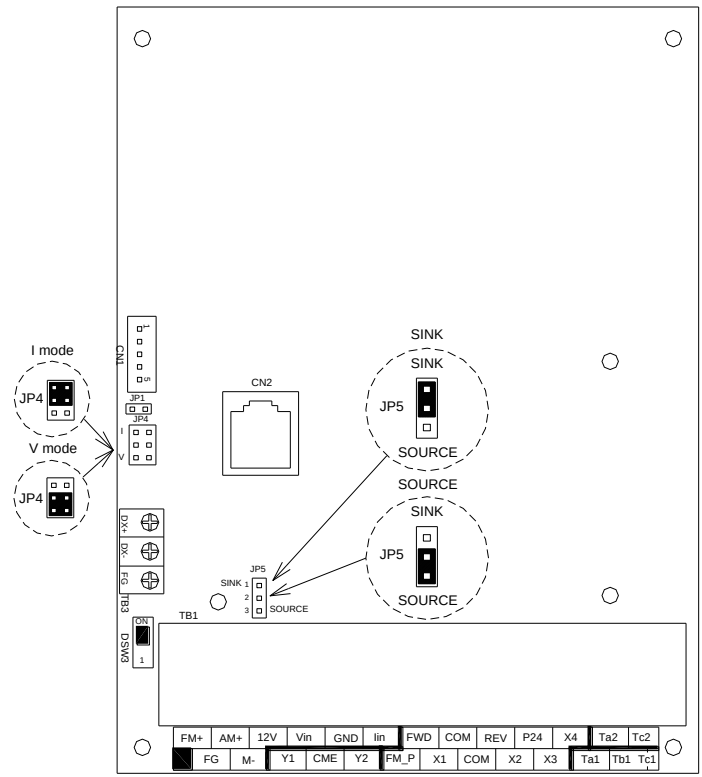
JP1: Input impedance selection of Iin (close: 250Ω ; open: 500Ω); Default: close.

JP4: Input signal type selection of Iin (voltage/current). Default: current

JP5: SINK/SOURCE mode selection of X1 to X4, FWD or REV (refer to page 18). Default: SINK

DSW3: Terminal resistor switch (ON: enable; 1: disable).

(2)RM6F5-2007 ~ RM6F5-2250;
RM6F5-4007 ~ RM6F5-4700



CN1: External indicator (DM-501) socket.

CN2: Digital keypad (KP-605) RJ-45 socket / RS-485 communication interface (choose one of the two options)

TB1: Input/Output terminals.

TB3: Connection terminals for multi-pump control / RS-485 communication interface (choose one of the two options)

JP1: Input impedance selection of Iin (close: 250Ω ; open: 500Ω); Default: close.

JP4: Input signal type selection of Iin (voltage/current). Default: current

JP5: SINK/SOURCE mode selection of X1 to X4, FWD or REV (refer to page 19). Default: SINK

DSW3: Terminal resistor switch (ON: enable; 1: disable).

2-3-6 Wiring Cautions and Specifications

a. Wiring connection between drive and motor due to the variance of the rated power causes the variance of current leakage. The setting of the switching frequency, rated power, and cable length is listed in the below table.

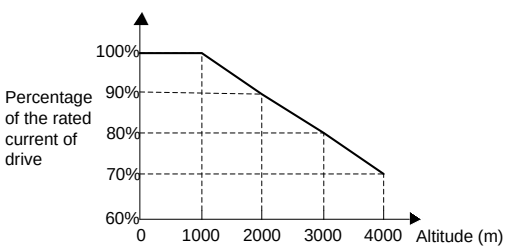
Cable length / Rated power	10m	20m	30m	50m	100m	100m above
1/2~5HP	10KHz	7.5KHz	5KHz	2.5KHz	800Hz	800Hz
7.5~10HP	10KHz	7.5KHz	5KHz	2.5KHz	800Hz	800Hz
15~30HP	7.5KHz	5KHz	2.5KHz	2.5KHz	800Hz	800Hz
40~75HP	5KHz	5KHz	2.5KHz	2.5KHz	800Hz	800Hz
100~700HP	2.5KHz	2.5KHz	2.5KHz	800Hz	800Hz	800Hz

The setting of switching frequency is determined by F_081

F_081	=0	Switching frequency	800Hz	1. Do Not adjust the setting value of switching frequency (F_081) of 75HP above drives while the drive is running. 2. Do Not adjust the setting value of switching frequency (F_081) of 75HP above drives while the drive is running.
	=1		2.5KHz	
	=2		5KHz	
	=3		7.5KHz	
	=4		10KHz	
	=5		12.5KHz	
	=6		15KHz	

b. The wiring length between drive and motor must keep as short as possible. The parasitic capacitance effect is minor within 10 meters. The drive should install an AC reactor (ACL) on the side of drive output terminals U/T1,V/T2,W/T3 and decrease the switching frequency if the wiring length is over 30m.

c. If the altitude over than 1000m , The relationship between drive's rated current and altitude are shown as below figure.



d. Recommend wire size and Molded Case Circuit Breaker(MCCB)

Three-Phase 200V Series

Model number RM6F5-____	Input Current (A)	MCCB (A)	Input wire size (R/L1,S/L2,T/L3) (mm^2)	Control circuit wire size (mm^2)	Grounding wire size (mm^2)
2001	5	10	2.0	0.75~1.25	2.0
2002	8	15	2.0		2.0
2003	12	20	2.0		2.0
2005	18	30	3.5		3.5
2007	30	50	5.5		5.5
2010	41	75	8		8
2015	55	100	14		14
2020	66	125	22		22
2025	85	150	22		22
2030	103	175	38		38
2040	128	200	60		60
2050	176	300	80		80
2060	200	350	100		100
2075	240	400	60*2		60*2
2100	280	500	100*2		100*2
2125	330	500	150*2		150*2
2150	380	600	200*2		200*2
2200	550	800	200*2		200*2
2250	660	1000	250*2		250*2

Three-Phase 400V Series

Model number RM6F5-____	Input Current (A)	MCCB (A)	Input wire size (R/L1,S/L2,T/L3) (mm^2)	Control circuit wire size (mm^2)	Grounding wire size (mm^2)
4001	3	5	2.0	0.75~1.25	2.0
4002	4.2	10	2.0		2.0
4003	5.8	15	2.0		2.0
4005	9.6	20	3.5		3.5
4007	13	30	3.5		3.5
4010	20	30	5.5		5.5
4015	25	40	8.0		8.0
4020	38	75	8.0		8.0
4025	42	75	14		14
4030	52	100	22		22
4040	64	125	22		22
4050	84	150	22		22
4060	100	175	38		38
4075	130	200	60		60
4100	155	250	80		80
4125	177	300	100		100
4150	196	300	60*2		60*2
4175	217	350	100*2		100*2
4200	282	400	100*2		100*2
4250	355	600	150*2		150*2
4300	385	600	200*2		200*2
4350	440	700	250*2		250*2
4420	540	800	250*2		250*2
4500	650	1000	325*2		325*2
4600	800	1200	325*2		325*2
4700	900	1200	325*2		325*2

Cautions:

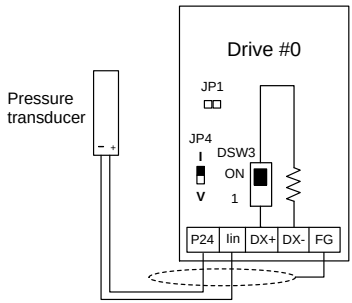
i. Please refer to the local electrical code with respect to the wiring(the loading and continuity, the wire capability for the current and temperature, the length of wiring, and the surrounding temperature must be all considered in order to add or reduce the size of the wire).

ii. Please use the cable that is suitable for 600V, 75℃ above.

iii. This table is only for reference.

2-4 Wiring Diagram and Setting for Single-pump and Multi-pump Applications

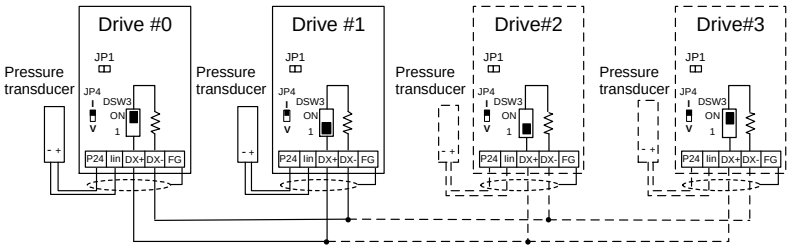
2-4-1 Single Pump Control



Drive #0			
Setting	Description		Content
Func.	F_015	(Selection of Parallel Control Mode)	=1(Single pump)
	F_016	(Set Drive's No. in Parallel Control)	=0(Drive#0)
JP1/JP4 Selection	JP1	Impedance selection of Iin (Open：500Ω；Close：250Ω)	Open
	JP4	Input signal type selection of Iin (Voltage/Current)	I position
Terminal Resistor Switch	DSW3		ON position

2-4-2 Dual & Multi-pump Control (E-mode、F-mode、M-mode)

Wiring 1 (standard wiring)



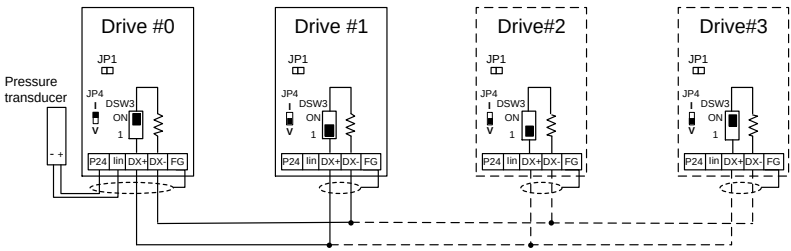
※(Dotted line: more than three pumps according customer requirement to set up)

Drive #0			
Setting	Description		Content
Func.	F_015	(Selection of Parallel Control Mode)	=2 (E-mode) or =3 (F-mode) or =4 (M-mode)
	F_016	(Set Drive's No. in Parallel Control)	=0(Drive#0)
JP1/JP4 Selection	JP1	Impedence selection of Iin (Open：500Ω；Close：250Ω)	Open
	JP4	Input signal type selection of Iin (Voltage/Current)	I position
Terminal Resistor Switch	DSW3		ON position

Auxiliary Drive #1(#2,#3)			
Setting	Description		Content
Func.	F_015	(Selection of Parallel Control Mode)	=2 (E-mode) or =3 (F-mode) or =4 (M-mode)
	F_016	(Set Drive's No. in Parallel Control)	=1
JP1/JP4 Selection	JP1	Impedence selection of Iin (Open：500Ω；Close：250Ω)	Open
	JP4	Input signal type selection of Iin (Voltage/Current)	I position
Terminal Resistor Switch	DSW3		#1, #2: 1 position #3: ON position

※Note: Dual drive (or multi-drive) uses a set of pressure sensor independently.(Suggest that using this wiring standard)

Wiring 2 (Special wiring)



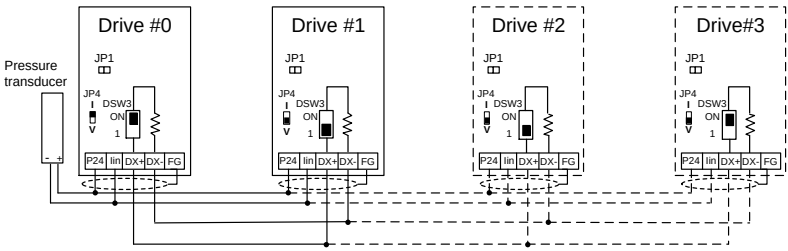
※(Dotted line: more than three pumps according customer requirement to set up)

Drive #0			
Setting	Description		Content
Func.	F_015	(Selection of Parallel Control Mode)	=2 (E-mode) or =3 (F-mode) or =4 (M-mode)
	F_016	(Set drive's No. for Parallel control)	=0(Drive#0)
JP1/JP4 Selection	JP1	Impedence Selection of Iin (Open：500Ω；Close：250Ω)	Open
	JP4	Input Signal Type Selection of Iin (Voltage/Current)	I position
Terminal Resistor Switch	DSW3		ON position

Auxiliary Drive #1 (#2,#3)			
Setting	Description		Content
Func.	F_015	(Selection of Parallel Control Mode)	=2 (E-mode) or =3 (F-mode) or =4 (M-mode)
	F_016	(Set Drive's No. for Parallel Control)	=1
JP1/JP4 Selection	JP1	Impedence Selection of Iin (Open：500Ω；Close：250Ω)	Close
	JP4	Input signal type selection of Iin (Voltage/Current)	V position
Terminal Resistor Switch	DSW3		#1, #2: 1 position #3: ON position

※Note: Dual drive (or multi-drive) share a set of pressure sensor, auxiliary drive's pressure is command by internal communication.

Wiring 3 (Special wiring)



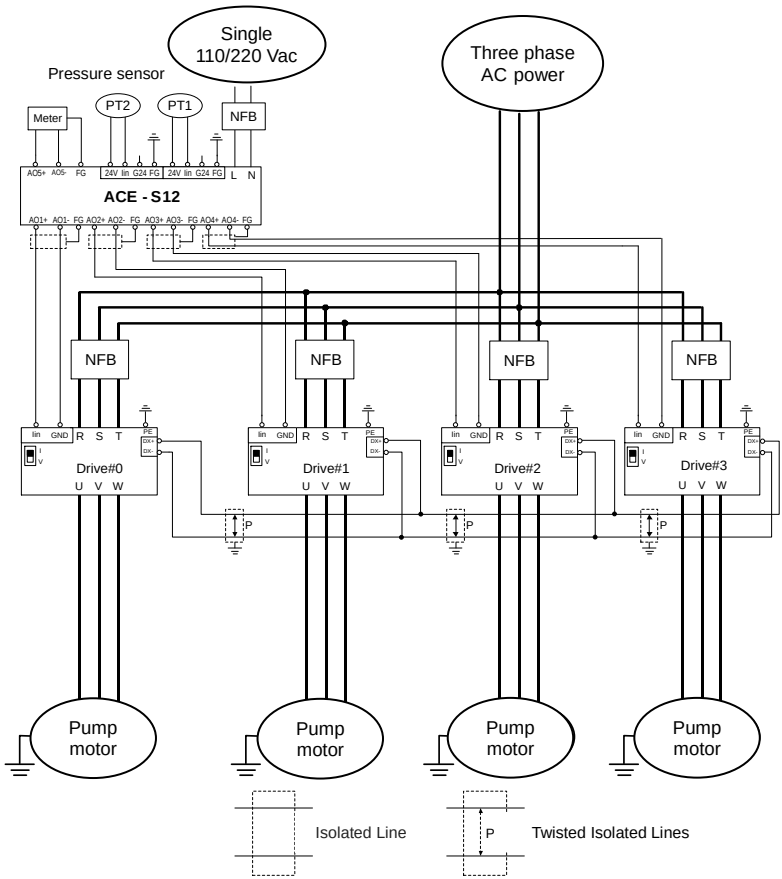
※(Dotted line: more than three pumps according customer requirement to set up)

Drive #0			
Setting	Description		Content
Func.	F_015	(Selection of Parallel Control Mode)	=2 (E-mode) or =3 (F-mode) or =4 (M-mode)
	F_016	(Set Drive's No. for Parallel Control)	=0(Drive#0)
JP1/JP4 Selection	JP1	Impedence selection of Iin (Open：500Ω；Close：250Ω)	Open
	JP4	Input signal type selection of Iin (Voltage/Current)	I position
Terminal Resistor Switch	DSW3		ON position

Auxiliary Drive #1 (#2,#3)			
Setting	Description		Content
Func.	F_015	(Selection of Parallel Control Mode)	=2 (E-mode) or =3 (F-mode) or =4 (M-mode)
	F_016	(Set Drive's No. for Parallel Cntrol)	=1
JP1/JP4 Selection	JP1	Impedence selection of Iin (Open：500Ω；Close：250Ω)	Close
	JP4	Input signal type selection of Iin (Voltage/Current)	V position
Terminal Resistor Switch	DSW3		#1, #2: 1 position #3: ON position

※Note: Dual drive (or multi-drive) independently use a set of pressure sensor and parallel pressure signal. If the drive(#0) error occurs, auxiliary drive (#1,#2,#3) will control pressure signal.

2-4-3 Multi-pump Use of ACE-S12 Signal Distributor Control

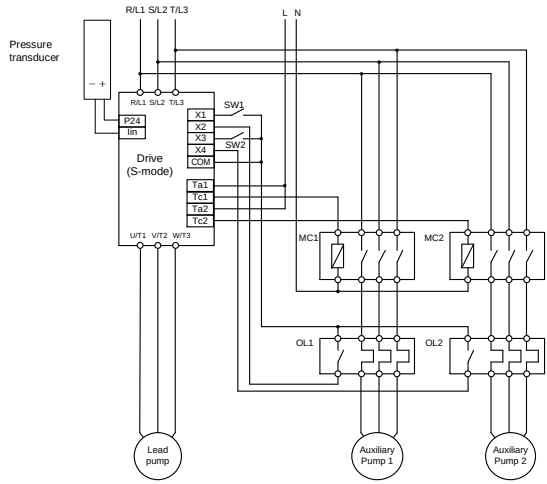


Note:

1. ACE-S12 signal distributor can be made input current signal covert into DC voltage, meanwhile, distributing five set of output (output can switch current DC:4~20mA or DC: 0~10V signal). To reach constant pressure, output signal will distribute the signal to drives(maximum: 4 drives).
2. Wiring: First, pressure sensor connect PT1 , and alternative pressure sensor connect PT2.

2-4-4 Multi-pump Control (S-mode Application)

Wiring (standard wiring)



Drive (S-mode)			
Setting	Description		Setting Content
Func.	F_015	Selection of Control Mode for Parallel Control	=5 (S-mode)
	F_016	Set Drive's No. for Parallel Control	=0(lead drive)
	F_052	Multi-input terminal setting (X1)	=17(multi-pump start command 1)
	F_053	Multi-input terminal setting (X2)	=18(multi-pump start command 2)
	F_054	Multi-input terminal setting (X3)	=19(multi-pump error command 1)
	F_055	Multi-input terminal setting X4)	=20(multi-pump error command 2)
	F_060	Multi-output terminal setting (Ta1,Tb1)	=15(multi-pump start 1detection)
	F_061	Multi-output terminal setting (Ta2/Tc2)	=16(multi-pump start 2 detection)
JP1/JP4 Selection	JP1	Input impedence selection of Iin (Open：500Ω；Close：250Ω)	open
	JP4	Input signal type selection of Iin (Voltage/Current)	I position
Termination Resistors	DSW3		ON position

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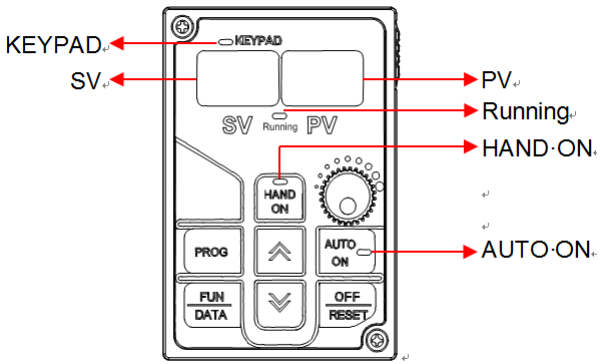
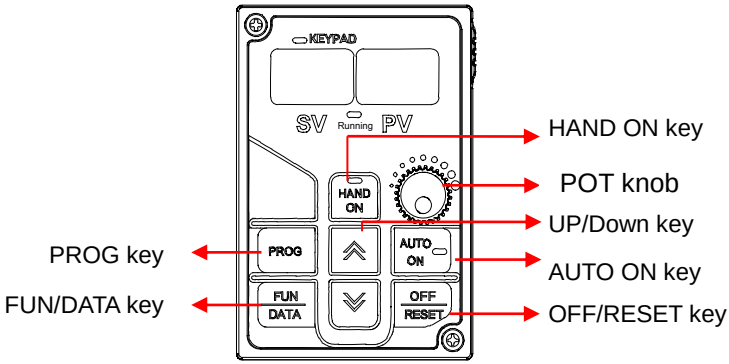
Chapter 3 The Setting of Keypad

3-1 Functions of Keypad (KP-605)



3-1-1 Indicators of Keypad

Symbol	Name	Description
KEYPAD	Lead drive/ communication indicator	1.Indicate the lead drive. 2.In multi-pump control modes, the indicator will be off, when pressing OFF RESET. 3. Parallel connection error(flashing)
SV	Setting pressure indicator	Indicate the setting pressure
PV	Actual pressure indicator	Indicate the actual pressure
Running	Operation indicator	Blinking: Under acceleration or deceleration ON: Constant speed OFF: Stop
HAND ON	Manual mode/ standby indicator	ON: Manual mode/Drive is standing by. OFF: Auto mode/ Stop
AUTO ON	Auto constant pressure/ standby indicator	ON: Auto constant pressure mode/Drive is standing by. OFF: Manual mode/Drive stops.



3-1-2 Keys of Keypad

Symbol	Name	Description
PROG	Function key	1.Enter the function setting mode 2.Back to the monitor mode
FUN DATA	Function/ Parameter key	1.Enter the parameter setting mode 2.Back to the function setting mode 3.Switch the monitor mode
HAND ON	Manual control key	Starting inverter to enter manual control mode.(Auto constant pressure control)
⌃	UP key	Change functions and parameters
⌄	DOWN key	
AUTO ON	Auto constant pressure control	Starting the inverter to auto constant pressure mode.
OFF RESET	Off/Reset key	1.Drive stops (Cut off the output signal of U/T1,V/T2,W/T3 terminals) 2.Error reset.

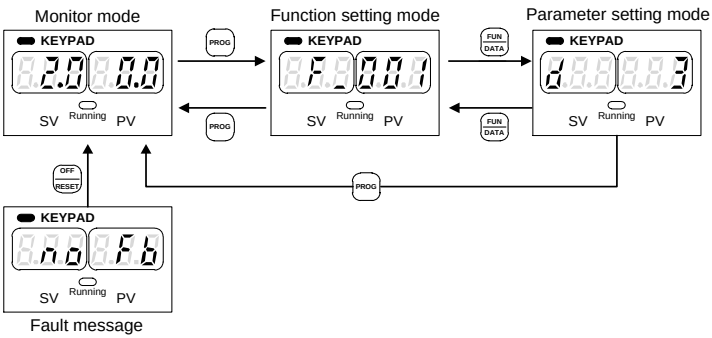
Note:

- KP-605 cables: Only used with 8-pin telephone cable (flat) or Cat.5e cable (AMP)
- 8-pin telephone cable: The cable length must be within 5 meters.
- Compared Cat. 5e cable (AMP): The cable length can be over 5 meters (the longest length is 100 meters)

3-2 The Operation of Keypad(KP-605) and Monitor Mode

3-2-1 Operation of Keypad

The operation of the digital keypad includes fault messages and three modes. The switching methods are shown as below figure:



The operation steps are shown as below table (by default setting)

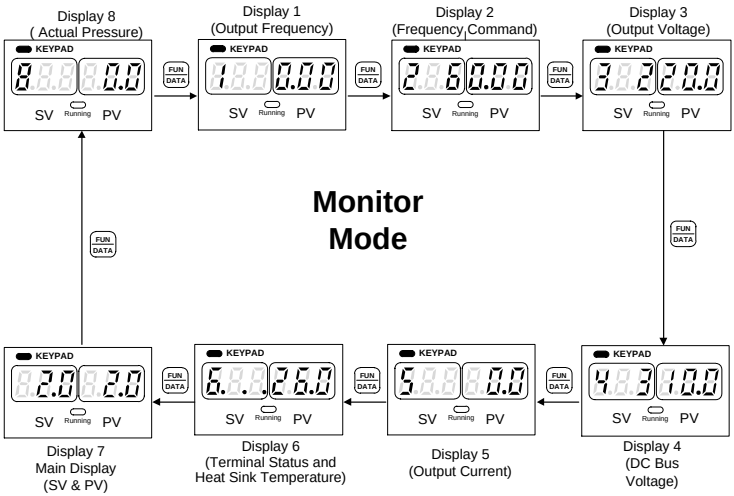
Operation Steps	Display
1.Start the drive and enter the monitor mode.	
2.Press PROG key and enter the function setting mode.	
3.Press FUN DATA key and enter the parameter setting mode.	
4.Press FUN DATA key and return to the function setting mode.	
5.Press PROG key and return to the monitor mode.	

Error message display:

Operation Steps	Display
The fault message displayed during the drive operation	
1.After the error is troubleshooted, press OFF RESET key to clear the fault and return to the monitor mode.	

3-2-2 Description of Monitor Mode

There are seven displays can be selected in the monitor mode. Press FUN DATA to switch the display in accordance with below sequence under monitor mode. User can determine one of seven displays as the main display from function F_006 (Selection of Main Display). Please refer to the following illustrations:



The descriptions of monitor modes are shown as below table (by default setting)

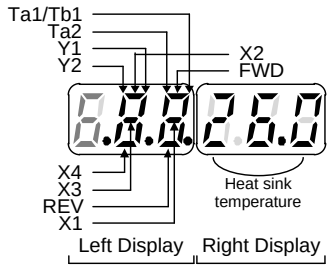
Name	Description	Display
Display 1	Output frequency	
Display 2	Frequency command	
Display 3	Output voltage	
Display 4	DC bus voltage	
Display 5	Output current	
Display 6	Terminal status and heat sink temperature	

Display 7	Setting pressure and actual pressure	
Display 8	Actual flow	

a. Select one of eight displays as the main display in accordance with the table of from F_006 (Selection of Main Display).

b. Determine one of eight displays as the main display according to the application. When the parameter of function is completed without pressing PROG key, the drive will automatically switch back to the main display after 3 minute.

c. The significance of seven-segment displays of Display 6 (Terminal status and heat sink temperature) is shown as below figure.



*grey-color digit in above figure means blinking

Right display: The temperature of heat sink.
Left display:

1.Blinking number “6”: Indicate the Display 6
2.Horizontal line of seven-segment displays: X1~X4, FWD, REV terminals
Vertical line of seven-segment displays: Y1, Y2, Ta1, Tb1, Ta2 terminals

The significance of seven-segment displays

Display	Terminal	Description	Display	Terminal	Description
	FWD	FWD terminal is active		X4	X4 terminal is active
	REV	REV terminal is active		Ta1,Tb1	Ta1,Tb1 terminal is active
	X1	X1 terminal is active		Ta2	Ta2 terminal is active
	X2	X2 terminal is active		Y1	Y1 terminal is active
	X3	X3 terminal is active		Y2	Y2 terminal is active

3-2-3 Description of Function Setting Mode

In function setting mode, there are 194 functions (F_000 ~ F_194) can be selected for RM6F5 series drive, (F_116=1) and the setting steps are as below:

Operation Steps	Display
1.In the monitor mode, press PROG key to enter function setting mode.	
2.Press ⋀ key to increase the function number.	
3.Press ⋁ key to decrease the function number.	

3-2-4 Description of Parameter Setting Mode

In parameter setting mode, the setting range for every function is shown in Chapter 4 - Parameter List.

Operation Steps	Display
1.Select F_001 (Start Command Selection) as the example.	
2.Press FUN DATA key to enter parameter setting mode.	
3.Press ⋁ key to decrease the value of F_001 from 3 (default value) to 2.	
4.Press FUN DATA key and return to function setting mode.	

3-2-5 Operation at Monitor Mode

In monitor mode, user can change the value of setting pressure (SV). The operation steps are shown as below. (by default display)

Operation Steps	Display
1.In monitor mode, the display of setting pressure(SV) and practical pressure(PV) as right figure.	
2.Press ⋀ key for several times or keep pressing the ⋀ to increase the setting value of pressure to 2.5.	
3.After completing the setting, press FUN DATA key within 5 seconds (the setting value is under blinking status) to save the setting value or waiting the drive automatically save the setting value.	

3-2-6 Parameter Copy; Restore Default Value; Save/Restore Setting Value

a. Parameter Copy:

Including writing and readout functions. Parameter settings of two drives can be copied by "rd_EE" and "Wr_EE" functions.

a-1 (Parameter Read Out: Drive parameter → Keypad)

Operation steps	Display
1.In the monitor mode, press PROG key to enter function setting mode.	
2.Press ▼ or ▲ key to select the function to F_194 (Default Setting) and then press FUN DATA key to enter parameter setting mode.	
3.Press ▲ key and then select rd_EE parameter and then press FUN DATA key to execute the parameter readout.	
4.Drive will start to copy the parameters to keypad, and then display the copy process on keypad.	
5.After completing the copy, the keypad will display End message and automatically back to function setting mode.	

a-2 (Parameter Write In: Keypad parameter → Drive)

Operation steps	Display
1.In the monitor mode, press PROG key to enter function setting mode.	
2.Press ▼ or ▲ key to select the function to F_194 (Default Setting) and then press FUN DATA key to enter parameter setting mode.	
3.Press ▲ key and then select Wr_EE parameter and then press FUN DATA key to execute the writing.	
4.Keypad will start to copy the parameters to drive, and then display the copy process on keypad.	
5.After completing the copy, the keypad will display End message and automatically back to function setting mode.	

※***Do Not execute the copy for different software version, otherwise the parameters will occur error and the keypad will display*** 8.UUA.dF ***message.***

a-3: (Parameter Copy: Master→ Slaves)

Except for two methods described above a1 and a2,

It also can use the operation panel of lead drive, through the control wire copy parameter to other auxiliary drive. It allows parameter settings to be easily copied from the drive

Operation steps	Display
1. Through the indicator of lead drive (KEAYPAD) to distinguish location of lead drive. When the indicator becomes brighter ,and the inverter represent for the lead drive.	
2. Press PROG key to enter function setting mode.	
3. Press ⩛ or ⩓ key to select the function to F_194 (Default Setting) and then press FUN DATA key to enter parameter setting mode.	
4. Press ⩓ key to select 8.8.8.CPY and then press FUN DATA key to copy the parameters.	
5. After completing the copy, the keypad will display 8.8.8.cPY message and automatically back to function setting mode.	

※ **When using copy parameter function, please note F_015、F_016、F_091 parameter content can't copy to the slave.**

b. Restore Default Value:

RM6F5 series drive provide 5 default values for using. User can according to the demand to restore default values.

8.dEF.60 (Restore the default value of drive for 60Hz)

8.dEF.50 (Restore the default value of single pump constant pressure control application with 60Hz power source)

8.dEF.52 (Restore the default value of multi-pump constant pressure control application with 60Hz power source)

8.dEF.53 (Restore the default value of single pump constant pressure control application with 50Hz power source)

8.dEF.57 (Restore the default value of multi-pump constant pressure control (S-mode)application with 60Hz power source)

※Be cautious of the usage of this parameter! This parameter will clear the saved setting value via dEF50 parameter.

Select the dEF50 parameter as an example, and the operation steps as below:

Operation Steps	Display
1.Press ▼ or ▲ key selecting the function to F_194 (Default Setting) and then press FUN DATA key to enter parameter setting mode.	
2.Press ▲ key to select dEF50 parameter, and then press FUN DATA key to execute the restoring.	
3.After completing the restoring, the keypad will display End message and back to the function setting mode.	

c . Save / Restore Setting Value:

(Save the setting value)

Operation Steps	Display
1.Press ▼ or ▲ key to select the function to F_194 (Default Setting) and then press FUN DATA key to enter parameter setting mode.	
2.Press ▲ key to select SAv parameter, and then press FUN DATA key to execute the saving.	
3.After completing the saving, the keypad will display End message and back to the function setting mode.	

(Restore the setting value)

Operation Steps	Display
1.Press ▼ or ▲ key to select the function to F_194 (Default Setting) and then press FUN DATA key to enter parameter setting mode.	
2.Press ▲ key to select rES parameter, and then press FUN DATA key to execute the restoring.	
3.After completing the restoring, the keypad will display End message and back to function setting mode.	

Note: “Restore” parameter is activation when the setting value is saved by “Save” parameter.

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Chapter 4 Parameter List

<table>
<tr><th>Func.</th><th>Name</th><th colspan="3">Description</th><th>Range of Setting</th><th>Unit</th><th>Def50</th><th>Page</th></tr>
<tr><td>F_000</td><td>Drive Information</td><td colspan="3">0: Software version (0041-d)
1: Drive model number
2: Drive running hours
3: Drive power supplying time
4: Software checksum code
5: Reserved</td><td>—</td><td>—</td><td>—</td><td>64</td></tr>
<tr><td rowspan="12">F_001</td><td rowspan="12">Start Command Selection</td><td></td><td>Start command</td><td>Rotation direction command</td><td rowspan="12">0~11</td><td rowspan="12">—</td><td rowspan="12">3</td><td rowspan="12">64</td></tr>
<tr><td>0</td><td>FWD or REV terminal</td><td>FWD or REV terminal</td></tr>
<tr><td>1</td><td>FWD terminal</td><td>REV terminal</td></tr>
<tr><td>2</td><td rowspan="3">Keypad “AUTO RUN” key</td><td>FWD, REV terminal</td></tr>
<tr><td>3</td><td>Forward direction</td></tr>
<tr><td>4</td><td>Reverse direction</td></tr>
<tr><td>5~7</td><td>Reserved</td><td>Reserved</td></tr>
<tr><td>8</td><td>RS-485 Communication interface</td><td>RS-485 Communication interface</td></tr>
<tr><td>9</td><td>RS-485 Communication interface</td><td>REV terminal</td></tr>
<tr><td>10</td><td>FWD termial</td><td>RS-485 Communication interface</td></tr>
<tr><td>11</td><td>Keypad “RUN” key</td><td>RS-485 Communication interface</td></tr>
<tr><td>F_002</td><td>Frequency Command Selection</td><td colspan="3">0: Frequency command by analog signal via terminal.
1: Frequency command by keypad.
2: Pressure command by keypad.
3: Frequency command by RS-485.
4: Pressure command by RS-485.</td><td>0~4</td><td>—</td><td>2</td><td>68</td></tr>
<tr><td>F_003</td><td>Selection of “STOP” key Validity</td><td colspan="3">0: Start command by terminal, “STOP” key disabled.
1: Start command by terminal, “STOP” key enabled.</td><td>0,1</td><td>—</td><td>1</td><td>69</td></tr>
<tr><td>F_004</td><td>Setting Value (SV) Selection</td><td colspan="3">0: In the monitor mode, setting value cannot be changed.
1: In the monitor mode, setting value can be changed.</td><td>0,1</td><td>—</td><td>1</td><td>69</td></tr>
<tr><td>F_005</td><td>Auto-Storing of Setting Value Selection</td><td colspan="3">0: In the monitor mode, setting value auto-storing disable.
1: In the monitor mode, setting value auto-storing after 3 minutes.</td><td>0,1</td><td>—</td><td>1</td><td>69</td></tr>
<tr><td>F_006</td><td>Selection of Main Display</td><td colspan="3">Select 1 of 8 “monitor modes” as the main display. *Refer to section 3-2-2.</td><td>1~8</td><td>—</td><td>7</td><td>70</td></tr>
</table>

Func.	Name	Description	Range of Setting	Unit	Def50	Page
F_007	Pressure Transducer Setting	Set upper limit value of pressure in accordance with pressure transducer specification.(pressure setting value is corresponding to maximum voltage or current.	0.0~160.0	0.1bar	10.0	97
F_008	Maximum Allowabel Operating Pressure	Set the maximum operating pressure value (F_007*F_008) in accordance with the specification of pump.	0~100	1%	100	97
F_009	Starting Frequency	The starting frequency of drive.	0.1~10.0	0.1Hz	0.5	75
F_010	Starting Voltage	The voltage correspond to the starting frequency.	0.1~50.0 0.1~100.0	0.1V	8.0 (Note1) 12.0 (Note2)	75
F_011	Base Frequency	The frequency correspond to the base voltage in V/F pattern.	0.1~400.0	0.1Hz	60.0	75
F_012	Base Voltage	The voltage correspond to the base frequency in V/F pattern.	0.1~255.0 0.1~510.0	0.1V	220.0 (Note1) 380.0 (Note2)	75
F_013	Selection of Pump Shift Operation (Parallel control)	0: Disable. 1: Shift the pump operation arriving the operating time (F_024). 2: Shift the pump operation after a drive stops. 3: Both 1 and 2 enabled.	0~3	—	3	100
F_014	Reserved					—
F_015	Control Mode Selection (Parallel control)	0: Disable the functions related to pump. 1: Single pump application. 2: Multi-pump applications; (E-mode) 3: Multi-pump applications; (F-mode) 4: Multi-pump applications; (M-mode) 5. Multi-pump applications; (S-mode)	0~5	—	1	101
F_016	Set Drive's No. for Parallel Control	Set the individual number for every drive. #0 as the lead drive to command others.	0~3	—	0	102

The color as [ ] means the function can be set during the operation.

Func.	Name	Description	Range of Setting	Unit	Def50	Page
F_017	Maximum Output Frequency	The maximum output frequency of drive.	0.1~120.0	0.1Hz	60.0	75
F_018	Reference Frequency of Accel/Decel Time	The frequency corresponding to accel/decel time.	0.01~ 400.00	0.01 Hz	60.00	73
F_019	Primary Acceleration Time	The acceleration time from stop to reference frequency.	0.0~ 3200.0	0.1 sec	1.0 (note3)	73
F_020	Primary Deceleration Time	The deceleration time from reference frequency to stop.	0.0~ 3200.0	0.1 sec	1.0 (note3)	73
F_021	Launch Detection Time (Parallel Control)	In multi-pump control systems, If the pressure decreasing gradually, set the detection time to launch auxiliary drive.	0.0~25.0	0.1 sec	6.0	102
F_022	Launch Detection Level (Parallel Control)	In multi-pump control systems, set the detection level when the pressure decreasing gradually.	0.2~25.0	0.1bar	0.4	102
F_023	Cut-off Frequency (Parallel Control)	In multi-pump control systems,set the cut-off frequency and start frequency for lead/auxiliary drive stopping.	0.0~60.0	0.1Hz	50.0	103
F_024	Pump Auto Shift Time (Parallel Control)	The time of pump shift operation in multi-pumps control system.	0~240	1 hr	24	100
F_025	Cut-off Time (Parallel Control)	In multi-pump control systems, the detection time of pump departs from operation.	0.0~25.0	0.1 sec	10.0	103
F_026	Communi-cation Baud Rate (Parallel Control)	The communication baud rate setting for multi-pump control systems.	0~3	—	1	—
F_027	Secondary Acceleration Time	Multi-function input terminals select the secondary acceleration time.	0.0~ 3200.0	0.1 sec	0.5	73
F_028	Secondary Deceleration Time	Multi-function input terminals select the secondary deceleration time.	0.0~ 3200.0	0.1 sec	0.5	73
F_029	Set S-curve for Accel/Decel Time	Set S-curve to slow the acceleration and deceleration time at start and stop.	0.0~5.0	0.1 sec	0.0	73
F_030	V/F Pattern Selection	0: Linear 1: Square curve. 2: 1.7^{th} power curve. 3: 1.5^{th} power curve.	0~3	—	1	75

The color as [ ] means the function can be set during the operation.

Func.	Name	Description				Range of Setting	Unit	Def50	Page
F_031	Primary Speed	Jog command	Multi-speed level 3 command	Multi-speed level 2 command	Multi-speed level 1 command	0.00~120.00	0.01 Hz	0.00	71
		OFF	OFF	OFF	OFF				
F_032	Preset Speed 1	OFF	OFF	OFF	ON			20.00	71
F_033	Preset Speed 2	OFF	OFF	ON	OFF			25.00	71
F_034	Preset Speed 3	OFF	OFF	ON	ON			30.00	71
F_035	Preset Speed 4	OFF	ON	OFF	OFF			45.00	71
F_036	Preset Speed 5	OFF	ON	OFF	ON			50.00	71
F_037	Preset Speed 6	OFF	ON	ON	OFF			55.00	71
F_038	Preset Speed 7	OFF	ON	ON	ON			60.00	71
F_039	Jog Speed	ON	X	X	X			7.00	71
F_040	Vin Gain	Analog input “Vin” gain ratio adjustment.				0.00~2.00	0.01	1.00	77
F_041	Vin Bias	Analog input “Vin” bias ratio adjustment.				-1.00~1.00	0.01	0.00	78
F_042	Frequency Upper Limit	The upper limit of output frequency= F_017*F_042				0.00~1.00	0.01	1.00	76
F_043	Frequency Lower Limit	The lower limit of output frequency= F_017*F_043				0.00~1.00	0.01	0.00	76
F_044	FM+ Analog Output Signal Selection	0: Output frequency 1: Frequency command 2: Output current 3: “Vin” frequency command 4: “Iin” frequency command				0~4	—	0	80
F_045	FM+ Analog Output Gain	Analog output gain ratio adjustment.				0.00~2.00	0.01	1.00	81
F_046	Motor Overload Protection (OL)	0: Motor overload protection: Disabled 1: Motor overload protection: Enabled(OL) 2: Motor overload protection of independent cooling fans: Enabled(OL)				0~2	—	1	82
F_047	Filter Setting of Analog Frequency	Filter the noise based on analog input signal (F_002=0).				0~255	—	20	79
F_048	Motor Rated Current	Set the value according to the motor rated current.				10%~150% of drive rated current	0.1A	According to the rated current of motor	82
F_049	Motor No-Load Current	Current setting according to the motor’s no-load condition.				0~motor rated current	0.1A	1/3 motor rated current	82
F_050	Motor Slip Compensation	According to the load condition, set the motor slip compensation for motor running at the constant speed. (0.0: Off)				-9.9~10.0	0.1Hz	0.0	82

The color as [ ] means the function can be set during the operation.

Func.	Name	Description		Range of Setting	Unit	Def50	Page
F_051	Operation Condition Memory	Record the last status of drive before power off. 0: Enable (F_001=2,3,4) 1: Disable		0,1	—	0	94
F_052	Multi-function Input Terminal X1	=0: Manual control command 1 of M-mode (F_015=4)	±1: Jog command. ±2: Switch of secondary accel/decel time. ±3: Multi-speed level 1 command ±4: Multi-speed level 2 command ±5: Multi-speed level 3 command ±6: Reset command ±7: External fault command (thr) ±8: Interruption of output command (bb) ±9: Coast to stop command (Fr) ±10: Speed tracing from the maximum frequency ±11: Speed tracing from the setting frequency ±12: Holding command ±13: Under close-loop control condition (F_103≠0), open-loop selection. ±14: Reset the integrator at close-loop control condition. (F_103≠0) ±15: Stop command. ±16: Analog input source selection. ±17:Auxiliary Pump start command 1. ±18: Auxiliary Pump start command 2. ±19: Auxiliary Pump error command 1.(P1_OL) ±20: Auxiliary Pump error command 2.(P2_OL) ±21:Flow sensor input. ±22: Sequential operation control.	-22 ~ +22 (Note 5)	—	9	83
F_053	Multi-function Input Terminal X2	=0: Manual control command 2 of M-mode (F_015=4)				13	
F_054	Multi-function Input Terminal X3	=0: Manual control command 3 of M-mode (F_015=4)				1	
F_055	Multi-function Input Terminal X4	=0: Reserved				2	
F_056	Reserved					—	
F_057	Reserved					—	

The color as [ ] means the function can be set during the operation.

Func.	Name	Description	Range of Setting	Unit	Def50	Page
F_058	Multi-function Output Terminal (Y1)	0: Disable ±1: Standby detection ±2: Constant speed detection. ±3: Zero speed detection. ±4: Frequency detection. ±5: System overload detection. (OLO) ±6: Stall prevention detection. ±7: Low voltage detection. (LE) ±8: Braking detection. ±9: Restart after instantaneous power failure detection. ±10: Restart after error condition detection ±11: Error detection. ±12: Overheating warning detection. (Ht) ±13: Over pressure detection. (OP) ±15: Auxiliary pump 1 detection. ±16: Auxiliary pump 2 detection. ±17: Fan detection during operation.	-17~ +17 (Note 5)	—	1	87
F_059	Multi-function Output Terminal (Y2)				2	
F_060	Multi-function Output Terminal (Ta1,Tb1)				-11	
F_061	Multi-function Output Terminal (Ta2/Tc2)				-3	
F_062	Frequency Detection Range	Set the bandwidth of frequency detection range.	0.0~ 10.0	0.1Hz	2.0	87
F_063	Frequency Detection Level	Set the frequency detection level of multi-function output terminal.	0.0~ 400.0	0.1Hz	0.0	87
F_064	Automatic Boost Voltage Range	According to the load condition, adjust the output voltage of the V/F Pattern. (0.0: Off)	0.0~ 25.5	0.1	1.0	90
F_065	System Overload Detection (OLO)	0: Disable 1: Enable(OLO)	0,1	—	0	91
F_066	System Overload Detecting Selection	0: Detection during constant speed only 1: Detection during operation only	0,1	—	0	91
F_067	Output Setting after System Overload	0: Drive keeps operation when the overload is detected 1: Drive trips to protection when the overload is detected	0,1	—	0	91
F_068	System Overload Detection Level	The output current is larger than the level and exceeds the time interval(F_069) of the overload detection.	30%~ 200% of drive rated current	1%	160	91
F_069	System Overload Detection Time	The output current is larger than the level (F_068) and exceeds the time interval of the overload detection.	0.1~ 25.0	0.1 sec	2.0	91
F_070	Stall Prevention Level at Acceleration	If stall is occurred during acceleration, the motor keeps running at the constant speed.	30%~ 200% of drive rated current	1%	140	92

Func.	Name	Description	Range of Setting	Unit	Def50	Page
F_071	Stall Prevention Level at Constant Speed	While the stall is occurred during constant speed running condition, the prevention of stall is to decrease the speed of motor.	30%~200% of drive rated current	1%	130	92
F_072	Acceleration Time for Stall Prevention during Constant Speed	Set the acceleration time to recover to the constant speed from stall prevention.	0.1~ 3200.0	0.1 sec	3.0 (note3)	92
F_073	Deceleration Time for Stall Prevention during Constant Speed	Set the deceleration time to recover to the constant speed from stall prevention	0.1~ 3200.0	0.1 sec	3.0 (note3)	92
F_074	Stall Prevention Setting at Deceleration	0: Disable 1: Enable	0, 1	—	1	92
F_075	DC Braking Level	Set the current level of DC braking.	0~150% of drive rated current	1%	50	93
F_076	Time Interval of DC Braking at Stop	Set the time for DC braking after drive stopped.	0.0~20.0	0.1 sec	0.2	93
F_077	Time Interval of DC Braking at Start	Set the time for DC braking before drive starts.	0.0~20.0	0.1 sec	0.0	93
F_078	Operation Selection at Instantaneous Power Failure	0: Drive cannot be restarted 1: Drive can be restarted	0~1	—	0	93
F_079	Auto-Restarting Selection for Error Trip Condition	0: Short time interval to auto-restart according to the setting of F_080 (OC,OE,GF only). 1: Long time interval to auto-restart according to the setting value of F_080, F_083 (all errors except Fb Lo).	0~1	—	1	114
F_080	Maximum Reset Time of Auto-Restart at Drive's Error Trip	Set the counting number for drive auto-restart when errors occur.	0~16	1	10	114
F_081	Switching Frequency	The setting value is higher and the motor noise is lower.	0~6	—	6 (note4)	95
F_082	Stop Mode	0: Ramp to stop 1: Coast to stop 2: Coast to stop + DC braking	0~2	—	0	95

Func.	Name	Description	Range of Setting	Unit	Def50	Page
F_083	Time Interval before Auto-Restart	Set the error tripping time interval before drive auto restarts for F_079 when the drive trips to stop.	1~200	10sec	6	114
F_084	Pressure Boost (Water Usage Detection)	Boost the pressure up to detect if the water is used.	0.05~1.00	0.01 bar	0.15	105
F_085	Time Interval of Pressure Boost (Water Usage Detection)	Set the time interval for F_084 to detect if the water is used. (0: off)	0~250	1sec	35	105
F_086	(ON/OFF Mode) Starting Rate Setting	In constant pressure control mode and under low flow condition, setting the starting rate of drive to activate ON/OFF mode. (0: disable)	0~100	1%	0	105
F_087	(ON/OFF Mode) Pressure Dead Band Setting	In ON/OFF mode, drive will auto start/stop the pump in accordance with the setting value. *Start level=SV(Setting pressure) - F_087 Stop level=SV(Setting pressure) + F_087	0.1~25.0	0.1bar	0.3	106
F_088	Speed Tracing Current Level	When the current is higher than the “speed tracing current level”, the output frequency will trace downward.	0~200% of drive rated current	1%	150	94
F_089	Delay Time before Speed Tracing	Set the output delay time before the speed tracing.	0.1~5.0	0.1 sec	0.5	94
F_090	V/F Curve in Speed Tracing	Set the percentage of V/F output voltage at the speed tracing.	0~100%	1%	100	94
F_091	Fault Record	Display the latest 5 error records.	—	—	—	114
F_092	Parameter Setting Lock	0: Parameters are changeable. Maximum frequency cannot exceed 120.0Hz. 1: Parameters are locked. Maximum frequency can not exceed 120.0Hz.	0~3	—	0	96
F_093	Automatic Voltage Regulation (AVR)	0: Disable 1: Enable	0,1	—	1	96
F_094	Drive Overload (OL1)	0: Disable 1: Drive overload 2: Current limit overload protection. 3: Both 1 and 2.	0,1	—	1	94
F_095	Power Source	The value of setting according to the actual power source.	190.0~240.0 340.0~480.0	0.1V	220.0 (200V series) 380.0 (400V series)	96
F_096	Analog Frequency Dead Band	When the signal noise is large, appropriately increase the dead band to stabilize the frequency. But this will reduce the tuning linearity.	0.00~2.55	0.01 Hz	0.00	79
F_097	Digital Input Response Time	When the digital input signal is under the setting time, program will not be activated.	1~16	1ms	10	96

Func.	Name	Description	Range of Setting	Unit	Def50	Page
F_098	Grounding Fault Protection (GF)	0: Disable 1: Enable(GF)	0, 1	—	1	96
F_099	External Indicator 1	Select the monitor mode of external indicator 1 0: Disable	0~8	—	1	70
F_100	External Indicator 2	Select the monitor mode of external indicator 2 0: Disable	0~8	—	5	70
F_101	External Indicator 3	Select the monitor mode of external indicator 3 0: Disable	0~8	—	2	70
F_102	PID Compensation Gain	Compensate the gain for pressure command control under constant pressure control.	0.1~8.0	—	1.0	107
F_103	PID Control Mode Selection	0: Open-loop operation 1: Forward control; D postposition 2: Forward control; D preposition 3: Reverse control; D postposition 4: Reverse control; D preposition	0~4	—	1	107
F_104	P Selection	0: P postposition 1: P preposition	0,1	—	1	107
F_105	Proportional Gain(P)	Set the gain value for deviation adjustment. (0.0: P control disabled)	0.0~25.0	0.1	3.0	107
F_106	Integration Time(I)	Set the integration time for deviation adjustment. (0.0: I control disabled)	0.0~25.0	0.1 sec	1.2	107
F_107	Derivative Time(D)	Set the derivative time for deviation adjustment. (0.00: D control disabled)	0.00~2.50	0.01 sec	0.00	107
F_108	Derivative Time of Feedback	Set the derivative time for feedback signal.	0.00~2.50	0.01 sec	0.00	107
F_109	Integration Upper Limitation	Set the upper limitation value of integrator.	0~200% of maximum frequency	1%	100	—
F_110	Integration Lower Limitation	Set the lower limitation value of integrator.	-100~100% of maximum frequency	1%	0	—
F_111	Offset Adjustment for Integration Time	Adjust the integration time offset.	-100~100% of maximum frequency	1%	65	107
F_112	PID Buffer Space	Set the buffer space of PID output value.	0~255	—	2	—
F_113	Feedback Signal Filter	Filter the feedback signal.	0~255	—	10	—
F_114	Feedback Signal Trip Detection	0: Disable 1: Enable (at F_126=0)	0,1	—	1	97
F_115	(Water Usage) Pressure Boost Time	Set the time of F_084 (Pressure Boost for Water Usage Detection) to detect if the water is used.	0.1~25.0	—	0.6	105
F_116	Parameter Selection	0: F_000 ~ F_134 1: F_000 ~ F_194	0,1	—	0	—

The color as [ ] means the function can be set during the operation.

Func.	Name	Description	Range of Setting	Unit	Def50	Page
F_117	PID Start Range	In constant pressure control mode (F_103≠0), drive will activate PID control when the feedback signal exceeds the dead band.	0.0~10.0	0.1bar	0.3	105
F_118	(Water Shortage Detection) Auto-restart Selection	0: Disable 1: Trip (Fb Lo): Press “RESET” key to reset. 2: Trip (Fb Lo): Power ON again to reset. 3: Trip (Fb Lo): Drive will auto-restarts according to the setting of F_122 (Drive Shutdown Time for Water Shortage)	0~3	—	1	110
F_119	(Water Shortage Detection) Pressure Level	Set the pressure level to detect if pump suffers from water shortage conditions. (0: Disable)	0~100% of pressure command	1%	40	110
F_120	(Water Shortage Detection) Current Level	Set the current level to detect if pump suffers from water shortage conditions. (0: Disable)	0~100% of motor rated current	1%	0	110
F_121	(Water Shortage Detection) TimeDetection	Set the detection time for F_119 and F_120 to detect if a pump suffers from water shortage.	0~250	1sec	60	110
F_122	(Water Shortage) Drive Shutdown Time	Drive will auto-restart after the time setting, when a pump suffers from water shortage. F_118 =3. (0:off)	0~200	1min	5	110
F_123	Analog Input Selection	F_103=0: 0 Vin+Iin; 1 Vin-Iin; 2 Iin-Vin; 3 Vin or Iin(switch by multi-function input Terminal X1~X4) F_103≠0: Vin: Frequency command; Iin: Feedback signal	0~3	—	0	79
F_124	Proportion Type of Pressure Transducer	0: Direct proportion signal. 1: Inverse proportion signal.	0,1	—	0	97
F_125	Speed Command Source Selection under Open-Loop Condition	In the closed-loop control, select the speed command source when PID is disabled by multi-function input terminal.[multi-function input terminal= ±13 (F_103≠0)or press HAND ON] 0: Analog input terminal(Vin). 1: Keypad ⩓ or ⩔ key setting 2: Keypad setting knob 3: RS-485 Communication interface	0~3	—	1	99
F_126	Iin Range Selection	0: 4~20mA (2~10V) 1: 0~20mA (0~10V)	0,1	—	0	98
F_127	Iin Gain (Analog Input)	The gain ratio of analog input terminal Iin.	0.00~2.00	0.01	1.00	77
F_128	Iin Bias (Analog Input)	The bias ratio of analog input terminal Iin.	-1.00~ 1.00	0.01	0.00	78

Func.	Name	Description	Range of Setting	Unit	Def50	Page
F_129	AM+ Analog Output Signal Selection	0: Output frequency. 1: Frequency command. 2: Output current. 3: Vin frequency command. 4: Iin frequency command.	0~4	—	2	80
F_130	AM+ Analog Output Gain	AM+ analog output adjustment ratio.	0.00~2.00	0.01	1.00	81
F_131	Multi-function Output Terminal Ta2/Tc2	The way of settings are same as multi-function output terminals setting. (F_058 ~ F_060)	0.0~10.0	0.1Hz	2.0	87
F_132	DC Braking Frequency at Stop	Active frequency level of DC braking at stop.	0.1~60.0	0.1Hz	0.5	93
F_133	(Water Usage Detection) Drive Standby level	When the frequency during the operation is lower than the setting value, drive will decelerate to 0Hz and entering stand by status.	0~120	1Hz	10	105
F_134	Default Setting	0: Disable CLF: Clear fault records dEF60: Restore the default value of drive for 60Hz. dEF50: Restore the default value of drive for 50Hz. Distributor A setting value for constant pressure setting (single pump) dEF52: Restore the default value of drive for 60Hz.Distributor A setting value for constant pressure setting(multi-pump) dEF53: Restore the default value of drive for 50Hz. SAv: Save the setting value. rES: Restore the setting value. rd_EE: Read the parameters from drive to digital keypad Wr_EE: Write the parameters from digital keypad to drive Cpy: In multi-pump control system, copy lead drive's parameter.			0	—
F_135	Set Standby Drives	In multi-pump control systems, setting the drives standby numbers.	0~3	—	0	104
F_136	Noise Prevention	0: Disable. 1: Enable.	0,1	—	0	112
F_137	Delay Time at Pump Shift Operation	The delay time setting is to remain the stable pressure of the system at the interchanging of the pump operation.	0~250	1sec	10	100
F_138	200% Current Limit	0: Disable. 1: Enable.	0,1	—	0	94

Func.	Name	Description	Range of Setting	Unit	Def50	Page
F_140	NTC Thermistor Setting	0: Disable. 1: Enable.	0,1	—	1	115
F_141	Drive Overheat Pre-alarm Selection	0: Disable 1: Warning (Ht): Continue operation. 2: Warning (Ht): Drive de-rates the switching frequency automatically every 5 minutes. 3: Warning (Ht): Stop operation.	0~3	—	0	115
F_142	Drive Overheat Pre-alarm Level	Set the warning level to prevent drive overheating.	45~85	1℃	70	115
F_143	Drive Overheating Dead Band	Set the temperature dead band of F_142 and F_145.	2.0~10.0	0.1℃	3.0	115
F_144	Fan Control Selection	0: Forced air: Start the fan at power ON. 1: Operation air: Start the fan at running. 2: Temperature level setting: Start the fan according to F_145.	0~2	—	1	115
F_145	Temperature Level of Fan Activation	Set the temperature level of fan activation.	25~60	1℃	50	115
F_146	Minimum Operation Time of Fan	Set the minimum operation time of fan when the fan stops.	0.1~25.0	0.1 min	0.5	115
F_147	Over Pressure Disposal	0: Disable 1: Alarm: Drive keeps operation. 2: Alarm: Drive stops output. 3: Error trip: Drive trips to stop.	0~3	—	0	113
F_148	Over Pressure Level	According to the setting value of F_007 (Pressure Transmitter Setting) to set the over pressure level.	0~100	1%	100	113
F_149	Over Pressure of Detection Time	When the actual pressure exceeds over pressure level (F_007*F_148) with duration (F_149), the detection is activation.	0.0~25.5	0.1 sec	2.0	113
F_150	Continuous Water Supply Control	0:Disable 1:Enable	0,1	—	0	104
F_151	Set the Minimum Pumps during Operation	In parallel control system, set the minimum quantity of pumps during operation.	1~4		1	104
F_155	Communica-tion Address	The host uses the address to send and receive messages from the drive (0: Disable)	0~254	—	0	122
F_156	Baud Rate	0: 4800bps 1: 9600bps 2: 19200bps 3: 38400bps	0~3		1	122

Func.	Name	Description	Range of Setting	Unit	Def50	Page
F_157	Communication Protocol	0: 8,N,2 1: 8,E,1 2: 8,O,1	0~2	—	1	122
F_158	Communication Overtime (Cot)	When the data transmission during communication transmission is interrupted, has no data transmitting, or delays, drive displays “Cot” message (0.0: Communication overtime disable)	0~1000	1sec	0.0	122
F_159	Communication Overtime Disposal	0: Warning (Cot): Continue operation. 1: Warning (Cot): Ramp to stop 2: Warning (Cot): Coast to stop	0~2	—	0	122
F_160	Multi-Function Input Selection	0: Multi-function inputs from multi-function terminals 1: Multi-function inputs from communication control	0,1	—	0	122
F_162	Frequency Upper Limitation by Manual Mode	Setting manual mode for upper limit of frequency command	0~100% maximum of output frequency	1%	100	99
F_163	Frequency Lower Limitation by Manual Mode	Setting manual mode for lower limit of frequency command	0~100% maximum of output frequency	1%	0	99
F_166	K Value of Flow Sensor	Setting value accord with specification of flow sensor	0.1~100.0	1L /Pulse	10.0	116
F_167	Rate of Flow Sensor	Setting rate of flow sensor	0.00~2.00	0.01	1.00	116
F_168	Unit of Flow Sensor	0: LPS 1: CMH	0,1	—	0	116
F_171	Shutoff Head(H)	Setting shutoff head of pump	0~160	0.1bar	12.0	117
F_172	Maximum Flow (Q)	Setting maximum flow of pump	0.0~ 6000.0	0.1L/ min	300.0	117
F_173	Compensation for Pipe Friction Loss	0:Disable 1:Enable	0,1	—	0	117
F_174	The Current in Maximum Flow (I_{Qmax})	Setting current in maximum flow(I_{Qmax})	1~200% of drive rated current	1%	100	117
F_175	The Current in Minimum Flow (I_{Qmin})	Setting current in minimum flow(I_{Qmin})	0~200% of drive rated current	1%	30	117

The color as [ ] means the function can be set during the operation.

Func.	Name	Description	Range of Setting	Unit	Def50	Page
F_176	Pump Flow Rate Compensation for Pipe Friction Loss ($H_{COMP\ max}$)	Setting maximum flow for pipe friction loss	0.1~160	0.1bar	0.0	117
F_177	Response Time Compensation of Pipe Friction Loss	Setting pump for response time compensation of friction loss	1~255	—	40	117
F_180	Sequetial Operation for Start Control	0: Disable 1: Enable	0~1	—	0	119
F_181	Date/ Time Setting	Y: Year	2000~ 2099			118
		M: Month	1~12			
		d :Day	1~31			
		W: Week	Sun.7~ SAt.6			
		H: Hour	0~23			
		MM: Minute	0~59			
F_182	Date/ Time Setting	Y: Year M: Month d: Day W: Week H: Hour MM: Minute ____: Reserved	—	—	—	118
F_183	Sequential Operation Mode	0: Every week 1: Every day	0,1	—	0	119
F_184	Sector 1 Sequential Operation	S: Level selection	OFF,ON	—	OFF	119
		W: Week Sun.7: Sunday Mon.1: Monday TUE.2:Tuesday Wed.3:Wednesday THU.4:Thursday Fri.5:Friday SAt.6:Saturday	Sun.7~ SAt.6	—	Sun.7	
		H: Hour	0~23	hour	0	
		MM: Minute	0~59	min	0	
		C: Pressure command	0.1~160	0.1 bar	0.0	
		SL: Inclined time	0.1~600.0	0.1 sec	0.0	

Func.	Name	Description	Range of Setting	Unit	Def50	Page
F_185	Sector 2 of Sequential Operation	Refer to F_184 setting descrption	—	—	—	119
F_186	Sector 3 of Sequencial Operation	Refer to F_184 setting descrption	—	—	—	119
F_187	Sector 4 of Sequencial Operation	Refer to F_184 setting descrption	—	—	—	119
F_188	Sector 5 of Sequencial Operation	Refer to F_184 setting descrption	—	—	—	119
F_189	Sector 6 of Sequencial Operation	Refer to F_184 setting descrption	—	—	—	119
F_190	Sector 7 of Sequencial Operation	Refer to F_184 setting descrption	—	—	—	119
F_191	Sector 8 of Sequencial Operation	Refer to F_184 setting descrption	—	—	—	119
F_193	Switching Frequency	0: If the drive is overloaded, the swithing frequency can not be adjusted with amount of current. 1: If the drive is overloaded, the switching frequency can be adjusted with amount of current.	0~1	—	—	96
F_194	Default Setting	0: Disable CLF: Clear error records dEF60: Restore the default value of drive for 60Hz. dEF50: Restore the default value of single pump constant pressure control application with 60Hz power source. dEF52: Restore the default value of multi-pump constant pressure control application with 60Hz power source. dEF53: Restore the default value of single pump constant pressure control application with 50Hz power source. dEF57: Restore the default value of multi-pump constant pressure control (S-mode)application with 60Hz power source. SAv: Save the setting value. rES: Restore the setting value. rd_EE: Read the parameters from drive to digital keypad Wr_EE: Write the parameters from digital keypad to drive CPy: In multi-pump control system, copy lead drive's parameter.	—	—	0	—

The color as [ ] means the function can be set during the operation.

Note:
1. 200V Series.
2. 400V Series.
3. 0.5 ~ 5HP: 5.0sec;
   7.5 ~ 30HP: 15.0sec; g
   40HP above: 30.0sec
4. When the setting value of switching frequency(F0.81) exceeds “4”, the drive must be de-rating for usage or selecting the higher capacity of drive.
5. + : Represents a contact (N.O)
   – : Represents b contact (N.C)
6. Setting function F_014、F_056、F_057、F_139、F_152~F_154、F_161、F_164、F_165、F_169、F_170、F_178、F_179、F_192、F_193: Reserved

Chapter 5 Parameter Setting Description

5-1 The Keypad Setup

F_000	Drive Information

0: Software version (0041-d)

a. The drives with different software versions cannot execute readout or writing, otherwise, the parameters will occur error and the keypad (KP-605) will display  message.

b. Please refer to 1-1-2 “The description of nomenclature”.

1: Drive model number.

2: Drive running hours.

3: Drive power supplying time.

4: Software checksum code.

5: Reserved

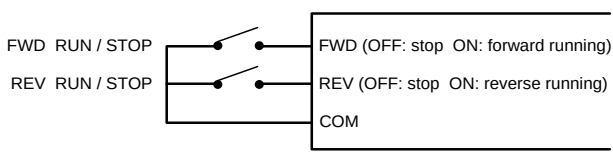
F_001	Start Command Selection

a. F_001=0

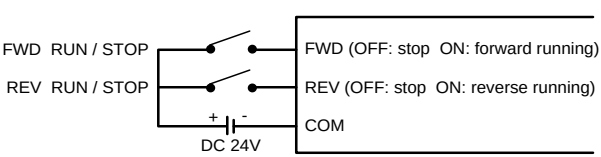
(I). **FWD and REV terminals both control the start command and rotation direction.**

(II). Drive stops operation when FWD and REV terminals are simultaneously open-circuit or short-circuit.

SINK (NPN) mode:



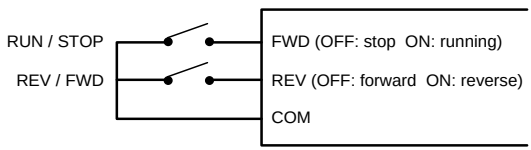
SOURCE (PNP) mode:



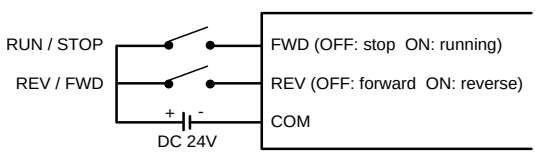
b. F_001=1

Start command by FWD terminal.
Rotation direction command by REV terminal.

SINK (NPN) mode:



SOURCE (PNP) mode:

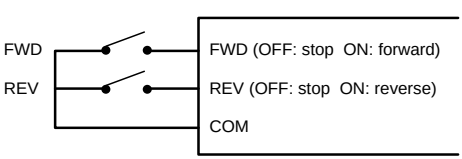


c. F_001=2

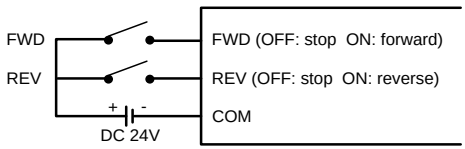
(I). **Start command by keypad "** ON **" key.**
Rotation direction command by FWD or REV terminal.

(II). **Drive stops operation when FWD and REV terminals are simultaneously open-circuit or short-circuit.**

SINK (NPN) mode:



SOURCE (PNP) mode:



d. F_001=3 (default value)

Start command by the keypad "ON" key.
Motor rotates at the forward direction (clockwise).

e. F_001=4

(I). **Start command by keypad "ON" key.**
Motor rotates at the reverse direction (counterclockwise).

(II). **The most left digit of output frequency will show "–".**

f. F_001=8

Start command and rotate direction by the RS-485 communication interface.
Related control command refer to "7-8 Drive Registors and Command Code".

g. F_001=9

Start command by RS-485 communication interface.
Rotation direction command by REV terminal.
Related control command refer to "7-8 Drive Registors and Command Code".

h. F_001=10

Start command by FWD terminal.
Rotation direction command by RS-485 communication interface.
Related control command refer to "6-6 Drive Registors and Command Code".

i. F_001=11

Start command by Keypad
Rotation direction command by RS-485 communication interface.
Related control command refer to "7-8 Drive Registors and Command Code"

Note:

1. When F_001 set to 0 or 2 and FWD-COM and REV-COM are simultaneously open-circuit, the monitor mode will display blanking " - - - - - - " (except "Display 8-terminal status"). If FWD-COM and REV-COM are simultaneously short-circuit, the monitor mode will display blanking " 8.8.8.dEF " (except "Display 8-terminal status").

2. The definition of rotation direction is according to IEC (International Electrotechnical Commission) standard. Observing the motor from axle center side, not the fan side. The standard rotation direction (Forward) is clockwise

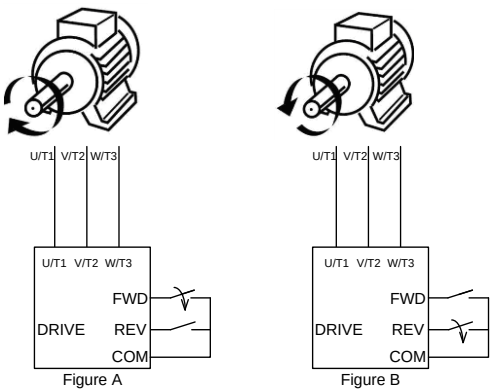


Figure A Figure B

EX: F_001=0,
Forward (FWD) rotation is clockwise (Figure A).
Reverse (REV) rotation is counter-clockwise (Figure B).

F_002	Frequency Command Selection

a. F_002=0

Frequency command by "Vin" or "Iin" analog input terminal (select Vin or Iin analog input sources by F_123).

(I). Vin-GND: Input range DC 0~10V。

※ The gain or bias of frequency command can be set by function F_040 and F_041.

(II). Iin-GND: Select the input signal mode via "JP4" switch.
JP4→I position (current signal); Range: 4~20mA or 0~20mA (set by F_126).
JP4→V position (voltage signal); Range: 2~10V or 0~10V (set by F_126).

※ The gain or bias of frequency command can be set by function F_127 and F_128.

b. F_002=1

Frequency command by keypad.

(I). In keypad KP-605, the primary speed, jog speed and preset speeds (F_009 ~ F_017) can be set during operation and the frequency command can be set under monitor mode.

(II). In keypad KP-605, the pot knob can be defined by speed control.

c. F_002=2

Pressure command by keypad (KP-605).

d. F_002=3

Frequency command by RS-485.

Related control command refer to "6-6 Drive Registors and Command Code"

e. F_002=4

Pressure command by RS-485.

Related control command refer to "6-6 Drive Registors and Command Code"

※ Note: In monitor mode, when F_002 sets 1, 2 or 3, pressing ▲ or ▼ key one time and the frequency command will be blink but not changing. Press the ▲ or ▼ key again to change the frequency command.

F_003	Selection of "STOP" Key Validity

a. F_003=0

When the start command by terminal, the "STOP/RESET" key of keypad disabled.

b. F_003=1

When the start command by terminal, the "STOP/RESET" key of keypad enabled.

c. The applications of "STOP" key.

(I). Emergency stop:

When the start and frequency command are both controlled by multi-function input terminal (F_001=0 or 1), the output frequency will be decreased to 0Hz and displaying 0.00 on keypad by pressing "STOP/RESET" key during operation.

If the drive needs to be restarted, cut off the wire between the terminals of the start command (FWD or REV) and COM and restart the drive again.

(II). Normal stop:

F_001=2 or 3, the start command by "ON" key of keypad KP-201C and the stop is controlled by "STOP/RESET" key.

F_004	Setting Value (SV) Change Selection

a. F_004=0

In the monitor mode, the setting value cannot be changed by KP-605 keypad to avoid possible mistakes and errors.

b. F_004=1

In the monitor mode, the setting value can be changed by KP-605 keypad.

F_005	Setting Value (SV) Auto-Storing

a. F_005=0

In the monitor mode, the setting value will not be saved automatically.

b. F_005=1

In the monitor mode, the setting value will be saved automatically after 3 minutes.

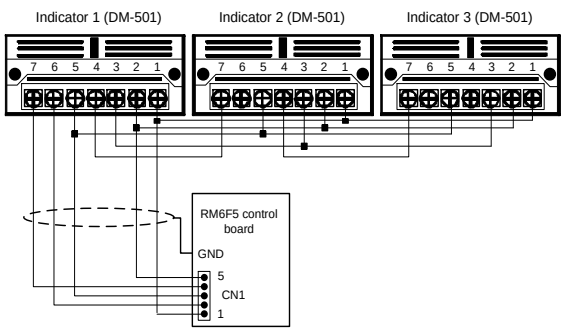
F_006	KP-605 Selection of Main Display

In the monitor mode, there are 8 monitor modes can be selected. The corresponding value and monitor modes are shown as below table:

1. Output Frequency
2. Frequency Command
3. Output Voltage
4. DC bus Voltage
5. Output Current
6. Terminals Status & Temperature
7. Setting Value & Practical Value (default value)

F_099	External Indicator 1
F_100	External Indicator 2
F_101	External Indicator 3

1. External indicator (DM-501) is used for expanding the display of “monitor mode”. DM-501 can be directly connected to the drive without connecting other power source.
2. The setting range of F_099 ~ F_101 is 0 ~ 6, and the significance is shown as below:
   0: Disable the indicator
   1: Output frequency
   2: Frequency command
   3: Output voltage
   4: DC bus voltage
   5: Output current
   6: Terminal status and heat sink temperature
   ※***DM-501 cannot monitor the pressure setting and actual pressure***
3. Please select twisted-pair shield wiring and shielding connected to the GND terminal of drive’s control board.
4. The wiring diagram of external indicators is as follows:



5.The position of connector (CN1), please refer to “2-3-5 Control Board” on page 26,27.

5-2 Preset Speed Setup

F_031	Primary Speed
F_032	Preset Speed 1
F_033	Preset Speed 2
F_034	Preset Speed 3
F_035	Preset Speed 4
F_036	Preset Speed 5
F_037	Preset Speed 6
F_038	Preset Speed 7
F_039	Jog Speed

a. Related functions:

(I) The setting of acceleration and deceleration time (F_018 ~ F_20、F_027、F_029).

(II) The setting of multi-function input terminals (F_052 ~ F_055).

b. Switch of jog speed, primary speed and preset speeds.

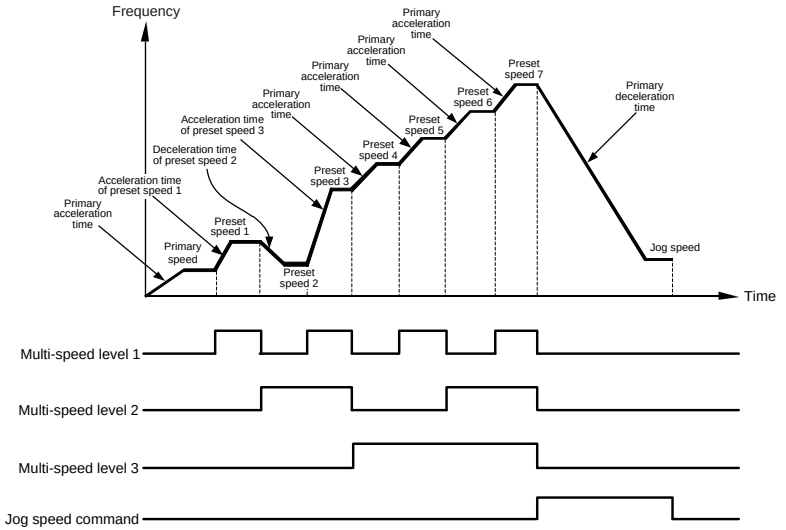
※ ***The ON/OFF conditions as below table are "contact a (N.O)" setting of functions.***

Jog speed command	Multi-speed level 3 command	Multi-speed level 2 command	Multi-speed level 1 command	Command Description
ON	**X**	**X**	**X**	Jog speed
OFF	OFF	OFF	OFF	Primary speed
OFF	OFF	OFF	ON	Preset speed 1
OFF	OFF	ON	OFF	Preset speed 2
OFF	OFF	ON	ON	Preset speed 3
OFF	ON	OFF	OFF	Preset speed 4
OFF	ON	OFF	ON	Preset speed 5
OFF	ON	ON	OFF	Preset speed 6
OFF	ON	ON	ON	Preset speed 7

Note:

1. " **X** " : Don't care
2. The following chart shows jog speed having highest precedence, and jog speed command is ON, the motor is running at jog speed
3. Jog speed command and the multi-speed commands are programmed by the multi-function input terminals (X1 ~ X4) by functions (F_052 ~ F055). ON / OFF the terminal in accordance with above table to switch the speed.
4. " ON " :
   The terminal is short-circuit at contact a (N.O) setting.
   The terminal is open-circuit at contact b (N.C) setting.
   " OFF " :
   The terminal is open-circuit at contact a (N.O) setting
   The terminal is short-circuit at contact b (N.C) setting.
5. The priority of speed command: Jog speed>Multi-sped>primary speed

c. Multi-speed and acceleration/deceleration time



※ The acceleration / deceleration time of jog speed and preset speed 4~7 are according to the setting of primary acceleration / deceleration time (F_019, F_020).

※ Jog speed control include start command. When drive stop, activating the jog speed command can start the drive without start command.

※ Analog input terminals (Vin, Iin) are disabilities under jog speed, preset speed 1~7 and primary speed control.

※ Please refer to F_019 ~ F_020 for acceleration / deceleration time setting.

5-3 Multi-Speed Accel./Decel. Time Setup

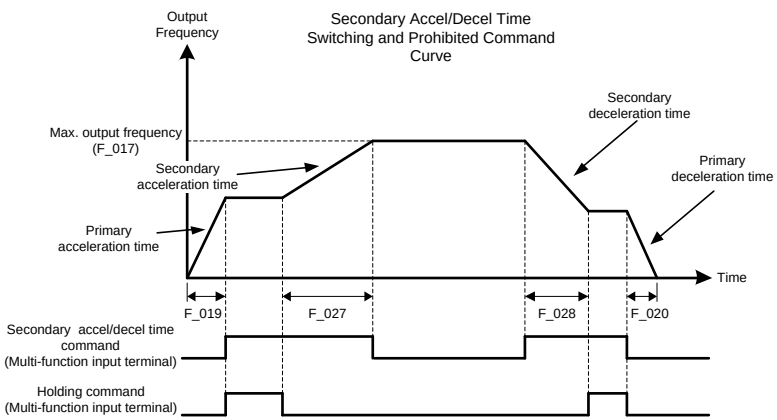
F_018	Reference Frequency of Accel/Decel Time
F_019	Primary Acceleration Time
F_020	Primary Deceleration Time
F_027	Secondary Acceleration Time
F_028	Secondary Deceleration Time
F_029	Set S-curve for Accel/Decel Time

a. The multi-speeds acceleration / deceleration time is the time interval from 0Hz to the setting of F_018 (Reference Frequency of Accel/Decel Time). Multi-speed level commands can simultaneously control preset speeds and the preset speed acceleration / deceleration time.

b. The acceleration / deceleration time of primary speed, preset speed 4 ~ 7 and jog speed are controlled by the setting of primary acceleration / deceleration time.

c. The switch between primary accel / decel and secondary accel / decel can be selected by multi-function input terminals.

Illustration is as follows:



d. The “holding command” is disabled when STOP command is activated.

※STOP command:

(I) When F_001 set 0 or 2, “FWD” and “REV” terminals are simultaneously short-circuit or open-circuit.

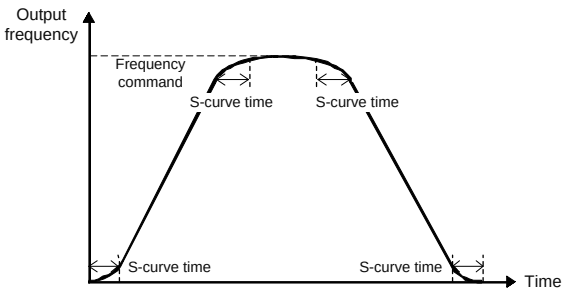
(II) When F_001 set 1, “FWD” terminal is open-circuit.

(III) When F_003 set 1, pressing the “OFF RESET” key.

(IV) Press the “OFF RESET” key when start command by keypad.

e. Set the S-curve function depend on the application to buffer the impact during start, stop, acceleration and deceleration.

EX: To buffer the impact when the object fall on the conveyor line or the running of elevator.



5-4 V/F Pattern Setup

F_009	Starting Frequency	Range: 0.1~10.0Hz

F_010	Starting Voltage

The range of 200V series is 0.1 ~ 50.0V.
The range of 400V series is 0.1 ~ 100.0V.

F_011	Base Frequency

Motor base frequency;
The setting must be according to the nameplate of motor.

F_012	Base Voltage

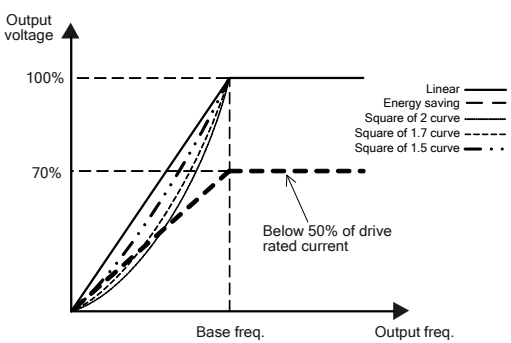
Motor base voltage;
The setting must be according to the nameplate of motor.
(200V series: 0.1~255.0V; 400V series: 0.1~510.0V)

F_017	Maximum Output Frequency

RM5P series: The setting range of max output frequency is 0.1 ~ 120.0.

F_030	V/F Pattern Selection

a. The settings are listed as below:
0: Linear
1: Energy saving mode (Auto-adjust V/F according to the loads)
2: Square curve
3: 1.7th power curve



F_042	Frequency Upper Limit

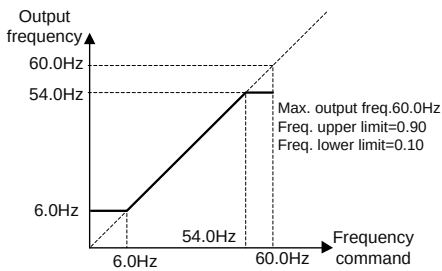
Set the ratio of the frequency upper limit (1.00=maximum output frequency), and the setting range is 0.00~1.00

Output frequency upper limit = Frequency upper limit (F_042) × Maximum output frequency (F_017)

F_043	Frequency Lower Limit

Set the ratio of the frequency lower limit (1.00=maximum output frequency), and the setting range is 0.00~1.00

Output frequency lower limit = Frequency lower limit (F_043) × Maximum output frequency (F0_17)



5-5 Analog Input Command Setup

The analog input terminals:
"Vin" – "GND": 0~10V;
"Iin" – "GND": 4~20mA (2~10V) or 0~20mA (0~10V)

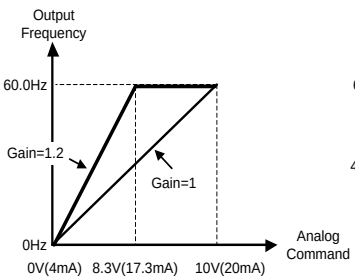
F_040	Vin Gain	Rate 0~2.00
F_127	Analog Input Gain (Iin)	

a. (General Mode)

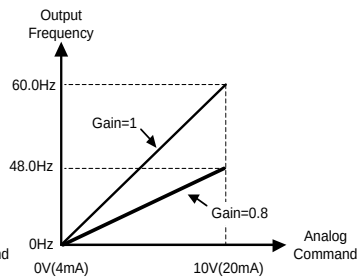
The corresponding frequency command value of analog command =
Maximum output frequency (F_017) x Analog input gain (F_040 or F_127)

EX: If analog input bias (F_041 or F_128) = 0.00

Maximum output frequency = 60.0Hz
Analog input gain = 1.20



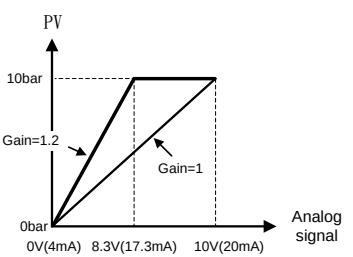
Maximum output frequency = 60.0Hz
Analog input gain = 0.80



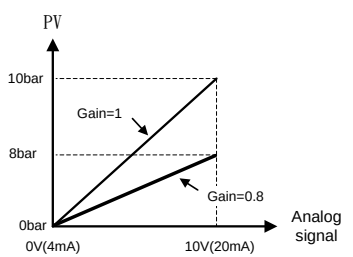
b. (F_103≠0)

Iin- PV value = Maximum transmitter(F_007) x Analog input gain(F_40 or F_127)
EX: If analog input bias (F_041 or F_128) = 0.00

Maximum transmitter=10bar
Analog input gain = 1.20



Maximum transmitter=10bar
Analog input gain = 0.80



F_041	Vin Bias	Bias -1.00~1.00
F_128	Iin Bias	

a.(General Mode)

The corresponding frequency command value of analog command (C.V) = Maximum output freq. (F_017) x Analog input bias (F_041 or F_128)

EX: If analog input gain (F_040 or F_127) = 1.00

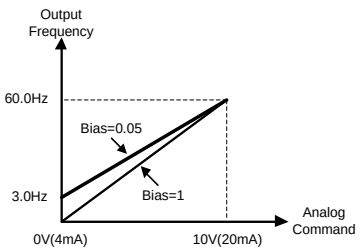
Maximum output frequency =60.0Hz
Analog input bias=0.05

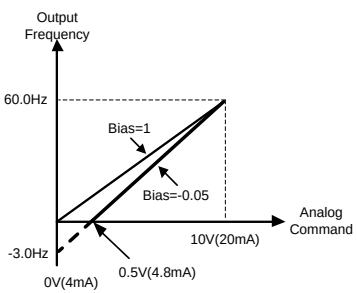
Maximum output frequency =60.0Hz
Analog input bias=-0.05

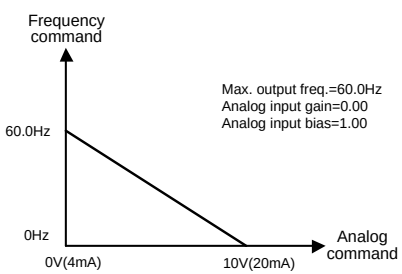
$$\text{Freq.command} = \frac{(\text{Max. freq. command} - \text{C.V})}{10\text{V (or 20mA)}} \times (\text{Analog command}) + \text{C.V}$$

* C.V = The corresponding frequency command value of analog command

Example of reverse control application:







b. (F_103≠0)

The corresponding PV value of Iin analog input bais =
Maximum transducer (F_007) x Analog input bias (F_128)

F_123	Analog Input Selection

	F_103=0	F_103≠0
0:	Vin+Iin	Vin: Frequency command Iin: Feedback signal
1:	Vin-Iin	
2:	Iin-Vin	
3:	Vin or Iin (X1 ~ X4)	

F_047	Filter Setting of Analog Input Signal

a. Filter the analog input signal when the frequency command by analog input terminals. (F_002=0).

b. The larger setting value will cause the slower response.

c. 0: Disable the filtering.

F_096	Analog Input Dead Band

a. When the noise of analog input signal is large, appropriately increase the dead band to stabilize the frequency command. But adjusting this function will reduce the tuning linearity of input signal.

b. This setting must be applied along with the F_047.

5-6 Analog Output Setup

The analog output terminals:

“FM+” – “M-”: DC 0 ~ 10V;

“AM+” – “M-”: DC 0 ~ 10V

(1/2 HP ~ 5HP models are marked by “FM+” – “GND” and “AM+” – “GND”)

F_044	Analog Output Signal Selection(FM+)
F_129	Analog Output Signal Selection(AM+)

0: Output frequency
The analong output terminal(FM+ or AM+) outputs DC 0~10V to correspond the output frequency. (the terminal will output signal when drive operation)

1: Frequency command
The analong output terminal(FM+ or AM+) outputs DC 0~10V to correspond the frequency command. (the terminal will output when drive is operation or stop)

2: Output current
The analong output terminal(FM+ or AM+) outputs DC 0~10V to correspond the output current. (max. corresponding value is rated output current of drive)

3: “Vin” analog input signal
The analong output terminal(FM+ or AM+) outputs DC 0~10V to correspond the signal of “Vin” analong input terminal. (the setting is activation when F_124=1)

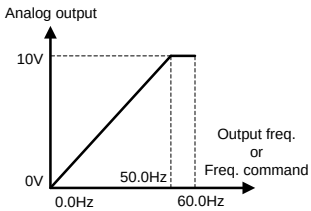
4: “Iin” analog input signal
The analong output terminal(FM+ or AM+) outputs DC 0~10V to correspond the signal of “Iin” analong input terminal. (the setting is activation when F_125=1)

F_045	Analog Output Gain(FM+)
F_130	Analog Output Gain(AM+)

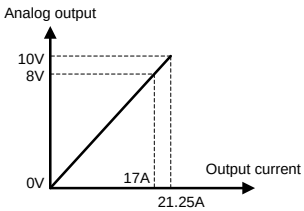
a. Analog output gain = $\frac{\text{Maximum output freq.}}{\text{Output freq. (freq. command)}}$ or $\frac{\text{Drive rated current}}{\text{Output current}}$

b. Analog output curve

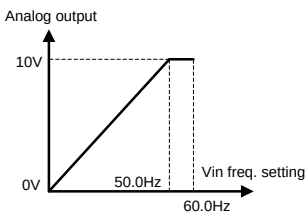
Maximum output freq. = 60.0Hz
Analog output signal selection = 0, 1
Analog output gain = 1.20



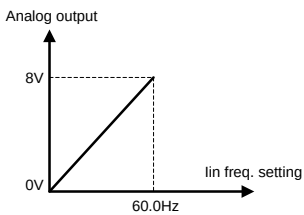
Driver rated current = 17A
Analog output signal selection = 2
Analog output gain = 0.80



Maximum output freq. = 60.0Hz
Analog output signal selection = 3
Analog output gain = 1.20



Maximum output freq. = 60.0Hz
Analog output signal selection = 4
Analog output gain = 0.08



5-7 Motor Protecti Primary Frequency on Setup

F_046	Motor Overload Protection (OL)

Enable the function can preventing the motor from damage by operating in the overload condition for a long time.
0: Disable
1: Overload protection for dependent cooling fan type motor: Enabled (OL)
2: Overload protection for independent cooling fan type motor: Enabled (OL)

F_048	Motor Rated Current

F_049	Motor No-Load Current

F_050	Motor Slip Compensation

a. The slip of motor is variable depending on the load. When the load current is over the level of slip compensation, the drive will compensate the output frequency to output constant speed. The setting range is -9.9~10.0Hz.
b. Compensation frequency =

$$\frac{\text{Loading current} - (\text{No} - \text{load current (F\_049)})}{\text{Rated current(F\_048)} - (\text{No - load current (F\_049)})} \times \text{Slip compensation(F\_050)}$$

5-8 Multi-Function Input Setup

F_052	Multi-function Input Terminal (X1)
F_053	Multi-function Input Terminal (X2)
F_054	Multi-function Input Terminal (X3)
F_055	Multi-function Input Terminal (X4)

a. "＋" represents positive logic (N.O; contact a)

b. "－" represents negative logic (N.C; contact b)

c. Multi-function terminals X1 ~ X4 can be set to perform following functions:

0: As F_015 = 4 (Under draining multi-pump control mode), F_052、F_053、F_054=0. Pump start/stop control by multi-input terminal (X1,X2,X3). This funtion is suggested to be used, drive will start/stop in sequence when any terminal is activated.

±1: Jog command (refer to F_039)

±2: Secondary accel/decel time command (refer to F_027, F_028)

±3: Multi-speed level 1 command (refer to F_032 ~ F_038)

±4: Multi-speed level 2 command (refer to F_032 ~ F_038)

±5: Multi-speed level 3 command (refer to F_032 ~ F_038)

±6: Reset command

When the drive trips to stop, executing reset command can clear the fault

±7: External fault command (thr)

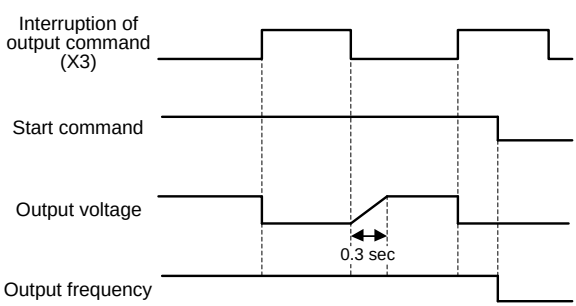
a. When the terminal received the fault command during operation, drive trips to stop.

b. This function is disabled when the drive at stop condition

±8: Interruption of output command (bb)

The parameter can interrupt the output voltage of drive.

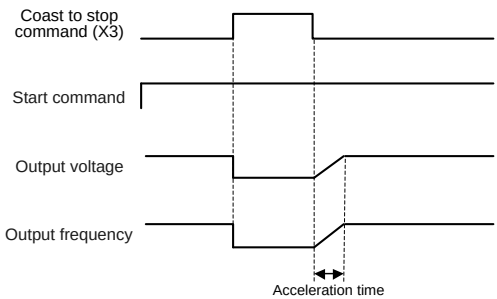
Interruption of output command (F_054=8)



±9: Coast to stop command (Fr)

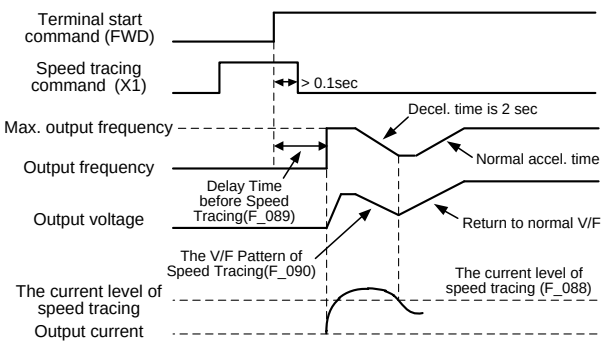
Cut off the control of motor from drive immediately.

Coast to stop command (F_055=9)



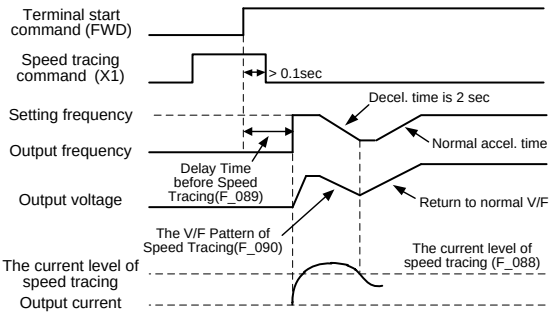
±10: Speed tracing from the maximum frequency

Speed tracing from the maximum frequency (F_053=10)



±11: Speed tracing from the setting frequency

Speed tracing from the setting frequency
(F_053=11)



±12: Accel/Decel disable (Please refer to page 74)

±13: In closed-loop control (F_103 ≠ 0), opened-loop selection.

* In closed-loop control, temporarily run bypass signa ,controlled by analog input signal (Vin or Iin) or frequency command of preset speed.

±14: In closed-loop control (F_103 ≠ 0), integrator reset.

±15: Stop command

*After the terminal is acted, the drive will decelerate and stop.

±16: Analog input source selection

Select Vin or Iin to as the analog input signal.

F_123 = 3 (Vin or Iin)

+16	Terminals short circuited: Vin Analog Input Source
	Terminals open circuited: Iin Analog Input Source
-16	Terminals short circuited: Iin Analog Input Source
	Terminals open circuited: Vin Analog Input Source

±17: Auxiliary pump start command 1

±18: Auxiliary pump start command 2

*Auxiliary pump 1, 2 start command, only suitable for S-mode.

*Please refer to “2-4-4 multi-pump control (S-mode)”。

±19: Auxiliary pump error command (P1_OL)

±20: Auxiliary pump error command (P2_OL)

*In S-mode control, auxiliary pump 1, 2 error signal command.

If the error state was removed, the drive will return to normal status.

*Please refer to “2-4-4 multi-pump control (S-mode)” on page36.

±21: Flow sensor input

*Flow sensor input signal, please refer to “6-11 Flow sensor” description”。

±22: Sequential operation start command,

*please refer to “6-13-2 Sequential operation control ” description on page 122.

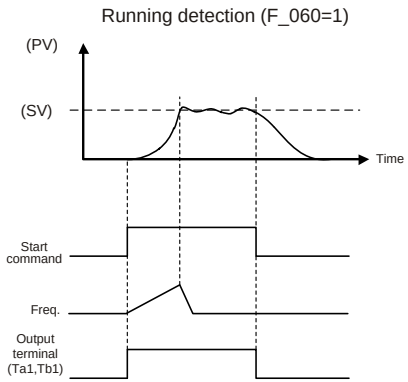
5-9 Multi-Function Output Setup

F_058	Multi-function Output Terminal (Y1)
F_059	Multi-function Output Terminal (Y2)
F_060	Multi-function Output Terminal (Ta1,Tb1/Tc1)
F_061	Multi-function Output Terminal (Ta2/Tc2)

0: Disable

±1: Running detection

Press AUTO ON, the drive will detect at start



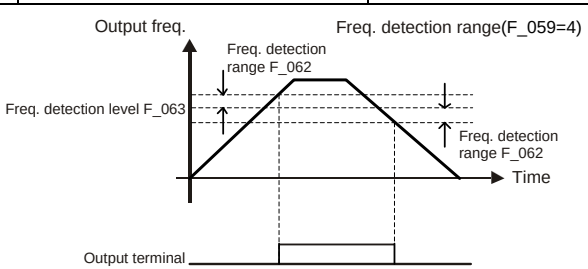
±2: Constant speed detection
Detection at constant speed

±3: Zero speed detection

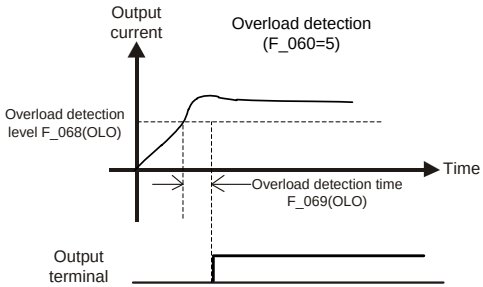
F_131	Constant speed detection range	0.0~10.0Hz

±4: Frequency detection

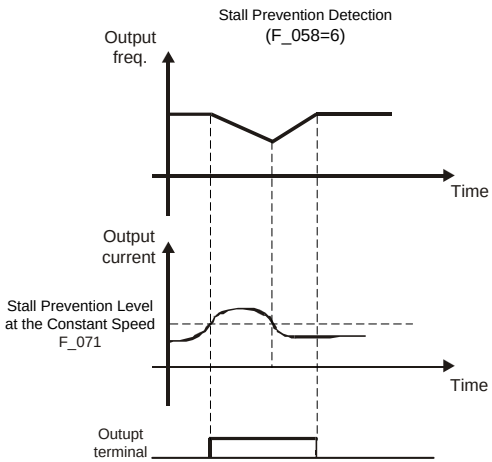
F_062	Frequency detection range	0~10Hz
F_063	Frequency detection level	0~120Hz



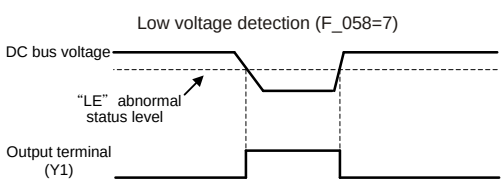
±5: Overload detection(OLO)



±6: Stall prevention detection



±7: Low voltage detection(LE)

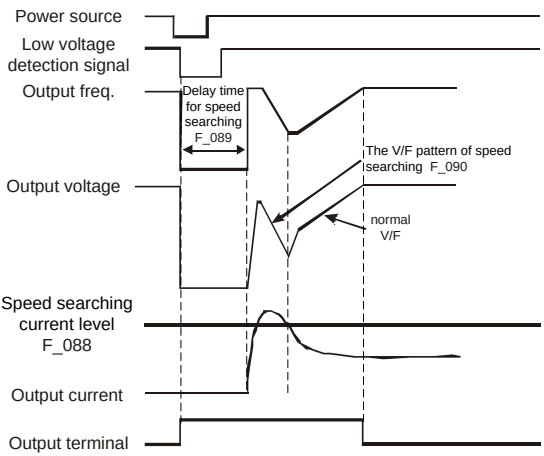


±8: Braking transistor is active detection.

Detection when the DC bus voltage of drive is higher than the dynamic brake voltage.

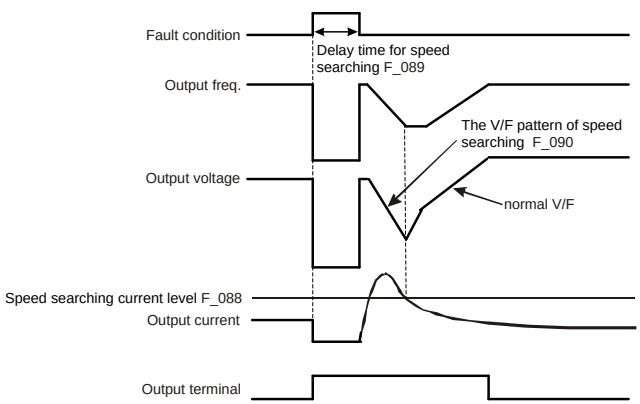
±9: Restart after instantaneous power failure detection
Enable when F_078 is set to 1.

Restart after instantaneous power failure detection (F_058=9)

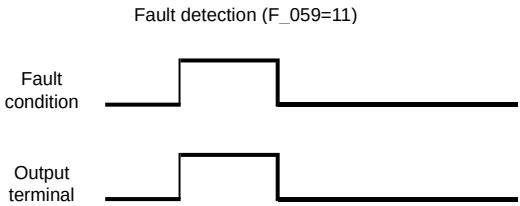


±10: Restart after fault condition detection

Restart after fault condition detection (F_058=10)



±11: Fault detection



±12: Overheating detection (Ht)
Detection level is set by F_142(Ht)
±13: Over pressure detection (OP)
Detection level is set by F_148(OP)
±14: Reserved
±15: Auxiliary pump 1detection
±16: Auxiliary pump 2 detection
*Control mode when F_015 is set to 5.
* Please refer to “2-4-4 multi-pump control (S-mode)” on page36.
±17: Fan detection during operation
*Please refer to F_144 “Fan control selection”

5-10 Automatic Torque Compensation

F_064	Automatic Boost Voltage Range	0~25.5V

Dynamic compensation by voltage to avoid any insufficient voltage at heavy-duty load.
The adjustment method is to minimize the output current by adjusting the parameter.
(maximum power factor).
Higher compensation setting will result higher current.

5-11 System Overload Detection SetUp

F_065	System Overload Detection(OLO)

a. The settings are listed as below:

0: Disable
1: Enable (OLO)

F_066	System Overload Detection Status

0: Detection at constant speed only.

1: Detection at operation: Including the system overload at acceleration, deceleration or constant speed.

F_067	Output Setting of System Overload

0: Drive continues running after the system overload is detected

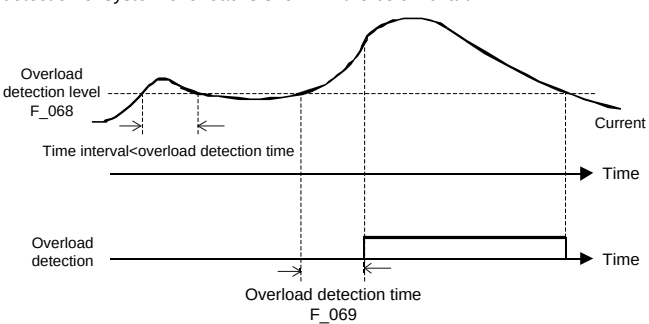
1: Drive trips after the system overload is detected.

F_068	System Overload Detection Level

Setting the level of current for system overload detection, and the setting range is 30~200% of drive rated current.

F_069	System Overload Detection Time

a. The detection of system overload is shown in the below chart:



b. The operation panel displays “OLO”, when the system overload time is over the setting value of system overload detection time (F_069).

c. Setting range: 0.1~25.

5-12 Stall Prevention SetUp

F_070	Stall Prevention Level at the Acceleration	Setting range is 30%~200% of drive's rated current
F_071	Stall Prevention Level at the Constant Speed	

If stall is occurred during acceleration or constant speed, the motor keeps running at the constant speed (200%: Off), and the setting range is 30%~200% of drive's rated current

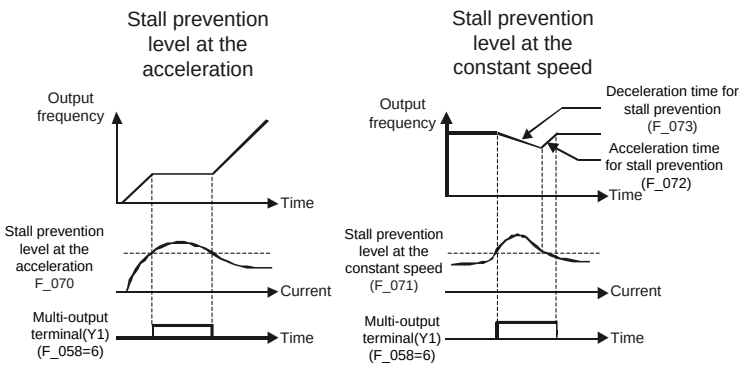
F_072	Acceleration Time for Stall Prevention during the Constant Speed
F_073	Deceleration Time for Stall Prevention during the Constant Speed

Setting range is 0.1~3200.0 sec.

F_074	Deceleration Stall Prevention

0: Deceleration stall prevention: Disabled

1: Deceleration stall prevention: Enabled



a. The function of the stall prevention during the deceleration is to maintain a constant speed when the deceleration is stalling.

b. When connecting a dynamic brake unit, F074 function can be disabled according to the operation requirement

c. If the DC bus voltage of the drive is higher than the dynamic brake voltage level when drive stops, the operation panel or external keypad will display "Hv". "RUN" key of the operation panel and digital keypad can't start the drive. If the DC bus voltage is less than the dynamic brake voltage level, the drive will be automatically recovered and the display will be back to the main display.

5-13 DC Braking Set Up

F_075	DC Braking Level

a. Set the current level of DC braking.
b. The setting range is 0~150% of drive rated current.

F_076	Time Interval of DC Braking at Start

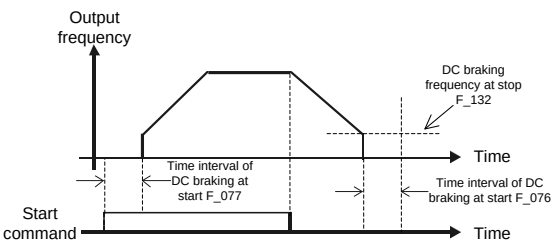
Set the DC braking for motor random running at start. The setting range is 0.0~20.0.

F_077	Time Interval of DC Braking at Stop

Set the DC braking of ramp to stop. The setting range is 0.0~20.0 sec.

F_132	DC Braking Frequency at Stop

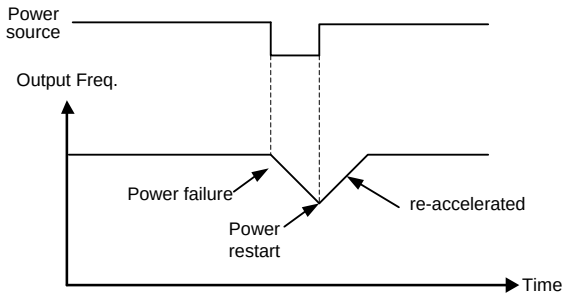
a. Set the DC braking frequency at stop. The setting range is 0.1~60.0.
b. If changing the setting value of frequency below the starting frequency(F2.33), the drive will stop by DC braking, and the DC Braking Frequency at Stop(F3.25) will be not active.



5-14 Operation Selection at Instantaneous Power Failure

F_078	Operation Selection at Instantaneous Power Failure

a. The settings are listed as below:
0: Drive cannot be restarted at instantaneous power failure.
1: Drive can be restarted at instantaneous power failure.
(see the function description of the restart after instantaneous power failure detection of multi-function output setting)
2: Ramp to stop
3: When the power is restored during the ramp to stop interval, the drive is restarted and re-accelerated again.



F_051	Start Command Memory	0: Enable (F_001=2,3,4 enable) 1: Disable

5-15 Speed Tracing

F_088	Speed Tracing Current Level	The setting range is 0~200% of drive rated current.
F_089	Delay Time for Speed Tracing	Set the output delay time before the speed tracing. The setting range is 0.1~60.0 sec.
F_090	The V/F Pattern of Speed Tracing	The setting range is 0~100%

a. When the drive current is greater than the current level of speed tracing (F_088), the output frequency is tracing downwardly to reach the current level of speed tracing.

b. The speed tracing function is mainly used for tracing the speed for the drive restart after instantaneous power failure/flying start, the drive fault restart, or the speed tracing command is given by the input terminal.

c. See the function description of multi-function input terminals for speed tracing on page 85.

5-16 Current Limitation

F_138	Current Limitation	0：Disable 1：Enable
F_094	Drive Overload(OL1)	0: Disable 1: Thermal protection 2: Current limit overload protection 3: Both 1 and 2 enable

5-17 Others Function

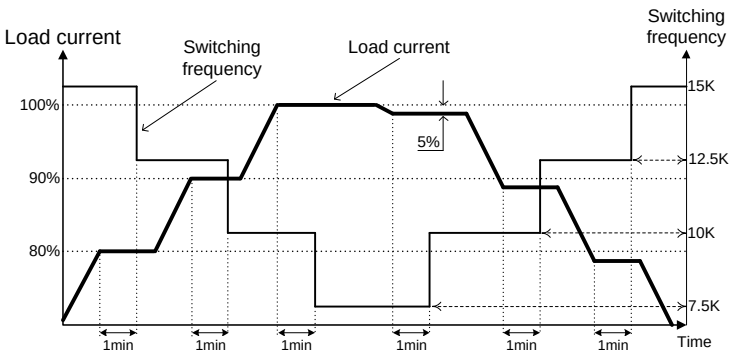
F_081	Switching Frequency

When the value of F_081 is set to “0”, the switching frequency of PWM voltage will be 800Hz and others switching frequency = F_081×2.5kHz.
The higher switching frequency has less noise. But using higher switching frequency must consider the cable length between drive and motor and must be adjusted according the connection distance between drive and motor. (Refer to the 2-3-6)

※Upper limit of switching frequency

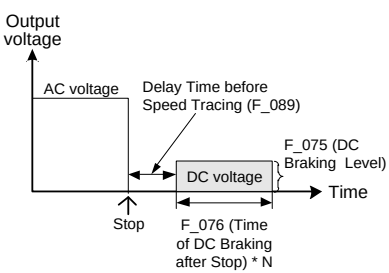
RM6E(9916): 1/2HP~75HP → 15kHz
Above 100HP → 10kHz

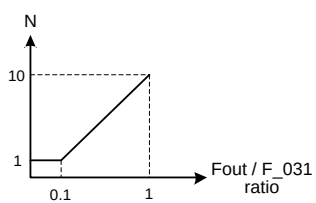
※ Switching frequency will be modulated with load automatically.



F_082	Stop Mode	0: Ramp to stop 1: Coast to stop 2: Coast to stop + DC braking

When the value of F_082 is set to “2”, the operation characteristic is shown as below figure:





*F_031 (Maximum Output Frequency)

When the output current of drive is abnormal at DC braking, appropriately increase the setting value of F_089 (Delay Time before Speed Tracing).

F_092	Parameter Setting Lock

0: Parameters are changeable.
1: Parameters are locked.
2&3: Reversed
※ According F_004 setting to change selection of setting value (SV)

F_093	Automatic Voltage Regulation (AVR)	0: Disable 1: Enable

F_095	Power Source

The setting value according to the actual power source voltage.
200V series setting range: 190.0 ~ 240.0V;
400V series setting range: 340.0 ~ 480.0V.

When the drive is power ON for first time and the power source voltage is lower than the 90% of F_095 setting value, the drive will display “LE” warning message.
After the power ON for drive, the drive displays “LE” message when the power source is lower than the 70% of F_095 setting value.

F_098	Grounding Fault Protection (GF)	0: Disable 1: Enable

F_097	Digital Input Response Time	Range: 1~16ms (default: 10ms)

If the signal length of digital inputs is smaller than the digital input response time, drive software will reject the input signal and do no process to input signal.

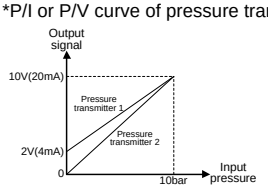
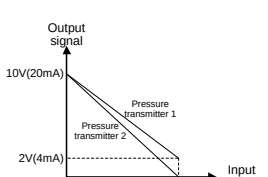
F_193	Decrease the Switching Frequency

0: If the drive is overloaded, the swithing frequency can not be adjusted with amount of current.
1: If the drive is overloaded, the switching frequency can be adjusted with amount of current.

6. Parameter Description of Pump

6-1 Related Settings of Feedback Signal (pressure transmitter) and Pump (default: Iin analog input terminal)

• 6-1-1 Feedback Signal (pressure transmitter)

Func.	Name	Description
F_007	Pressure Transmitter Setting	• **Set the upper limit value of pressure in accordance with pressure transmitter specification.** *The upper limit value of pressure is corresponding to the maximum input signal of Vin or Iin. *Recommend to select a high precision type (<±0.5%) pressure transmitter to provide the drive better feedback signal.
F_008	Maximum Allowable Operational Pressure	• **Set the percentage to F_007 in accordance with the specification of pump.** *The setting can adjust the maximum operational pressure in accordance with the specification of the pump or can prevent the water pipe from harm by setting too high pressure. *According to the specification of the pump to set the operational pressure value: F_007 * F_008. *Example: Maximum pressure value of the pressure transmitter = 10.0bar; F_008 = 50% →Maximum operational pressure of the drive = F_007(10.0bar) * F_008(50%) = 5.0bar.
F_114	Feedback Signal Trip Detection	**=0: Disable** *Disable the trip detection.
		=1: Enable. *Enable the trip detection. *F_126 must be set to "0". *When the feedback signal (default: Iin input) is below 4mA, the keypad will display "AErr" message.
F_124	Proportion Type of Pressure Transducer	**=0: Direct proportion type signal.** *P/I or P/V curve of pressure transducer 
		=1: Inverse proportion signal. *P/I or P/V curve of pressure transducer 

Func.	Name	Description
F_125	**Selection of Frequency Command by Manaul Mode under Close-Loop Condition**	**=0: Analog input terminal (Vin)** **=1: Keypad "▲" or "▼" key setting** **=2: Keypad setting knob** **=3: RS-485 Communication interface** *In close-loop control, select the speed command source when feedback signal is bypassed in temporary. ***When the multi-function input terminal is set to ±13 (Under close-loop control condition (F_103≠0), open-loop selection.)**
F_126	**Iin Range Selection**	**=0: 4~20mA (2~10V).** **=1: 0~20mA (0~10V).** *According to the specification of pressure transmitter to select the Iin range.
F_127	**Iin Gain (Analog Input)**	• **The gain ratio of analog input terminal Iin.** *Set the gain ratio for the feedback signal from pressure transmitter.
F_128	**Iin Bias (Analog Input)**	• **The bias ratio of analog input terminal Iin.** *Set the bias ratio for the feedback signal from pressure transmitter.

• 6-1-2 Manual Mode

1. When the multi-function input terminal is set to +13 (Under close-loop control condition (F_103≠0), open-loop selection.)
2. Press HAND ON key to control.

Example:

- **Automatic Mode → Manual Mode, press HAND ON key (HAND ON LED light)**
- **Manual Mode → Automatic Mode, press HAND ON key (HAND ON LED light)**

*****The drive will resume to the previous frequency setting when the manual mode turns off.

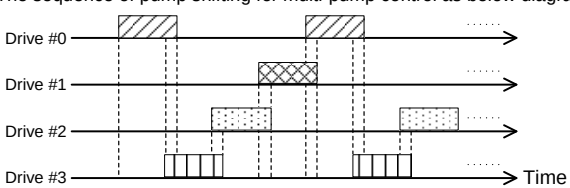
Func.	Name	Description
F_125	**Selection of Frequency Command by Manaul Mode under Close-Loop Condition**	**=0: Analog input terminal (Vin)** **=1: Keypad "▲" or "▼" key setting** **=2: Keypad setting knob** **=3: RS-485 Communication interface** *In close-loop control, select the speed command source when feedback signal is bypassed in temporary.
F_162	**Frequency Upper Limitation by Manual Mode**	***** Setting Frequency Upper Limitation: The drive only follow F_162 setting value. ***** Upper Limitation(Manual Mode) = Maximum output frequency (F_017)*F_162 * Setting range: 0~100%(default value:100)
F_163	**Frequency Lower Limitation by Manual Mode**	***** Setting Frequency Lower Limitation: The drive only follow F_163 setting value. ***** Upper Limitation(Manual Mode) = Maximum output frequency (F_017)*F_163 * Setting range: 0~100%(default value:100)

6-2 Sequential Operation and Parallel Control of Multi-pump

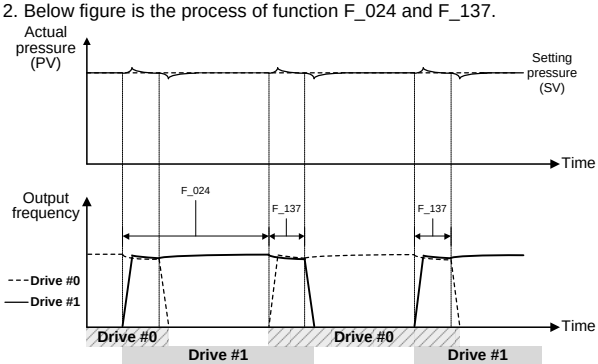
• 6-2-1 Sequential Control for Multi-Pump(Only used for F-mode、E-mode)

Func.	Name	Description
F_013	Pump Shift Operation (Parallel control)	**=0: Disable.**
		=1: Shift the pump operation after the operating time (F_024). *The function is to shift the operation from one pump to another when the operating time (F_024) reaches.
		=2: Shift the pump operation after a drive stops. *The function is to shift the operation from one pump to another after an operating pump drive comes to stop.
		=3: Both 1 and 2 enable.
F_024	Pump Auto Shift Time (Parallel control)	• **Set the pump operating time of the sequential control in multi-pump control.** *Setting range:0~240hr. *0: Disable. (drive will not execute sequential operation.)
F_137	Delay Time at Pump Shifting	• **The delay time setting is to remain the stable pressure of the system at the interchanging of the pump operation.** *Default: 10sec. *During the pump shifting, the system pressure becomes unstable when one pump drive disengages and another pump drive engages. The delay time is to increase the disengaging time of the current pump drive to stabilize the system pressure.

1. The sequence of pump shifting for multi-pump control as below diagram.

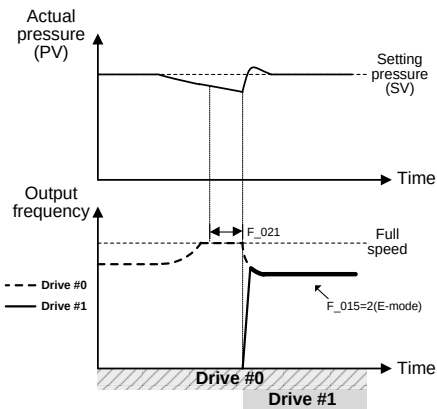


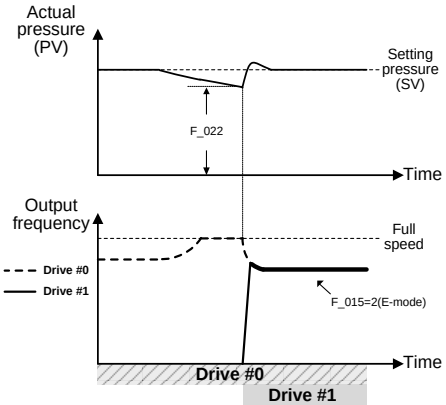
2. Below figure is the process of function F_024 and F_137.



Func.	Name	Description
F_015	Control Mode Selection (Pump Parallel)	**=0: Disable the functions related to pump.**
		=1: Single pump application. *Constant pressure is controlled by single pump.
		=2: Multi-pump applications; E-mode (Equal-mode). *Pumps run at identical speed to maintain the pressure in constant. *Recommend to select this mode for 2 pump applications to increase the efficiency and save the energy.
		=3: Multi-pump applications; F-mode (Full-mode). *Only one pump auto-adjusts the speed, and other pumps run at full speed when the multi-pump system outputs the constant pressure. *Recommend to select this mode for more than 2-pump operations to increase the efficiency and save the energy.
		=4: Multi-pump applications; M-mode (Manual-mode). *Pump ON/OFF is controlled by multi-function input terminals (X1, X2, X3). *F_052, F_053, F_054 must set to “0”. *Drive will start/stop in sequence when any terminal is activated. *Recommend to select this mode when installing or trial running the pump.
		=5: Multi-pump applications; S-modet *Lead pump which have an automatic speed control, auxiliary pump1 or pump 2 will follow setting condition to run. AC power start operating to maintain constant pressure. *Start condition of sequential operation: Lead Pump →Auxiliary Pump1→ Auxiliary Pump2 (1) When lead pump run at full speed, but PV value < F_022 (Start detection level), the multi- output terminal will detect immediately and start the auxiliary pump 1 (AC power); And so on, auxiliary pump 2 will start in sequence. (2) When lead pump run at full speed, and operating time > F_021(Start detection time), the muti-output terminal may detect immediately and start auxiliary pump 1 (AC power); And so on, auxiliary pump2 will start in sequence. *Stop sequential operation: Auxiliary Pump2→ Auxiliary Pump1→ Lead Pump *Auxiliary pump stop condition: (1) When PV value > F_022(Start detection level), the muti-output terminal may detect immediately and stop auxiliary pump 2(AC power stop), and so on, auxiliary pump 1 will stop in sequence; When operating frequency of lead pump < F_133(Drive standby level), lead pump will decelerate and stop.

		(2) When the operating frequency value < F_023 (Departing frequency of pump), and operating time > F_025(Departing time), the multi- output terminal may detect immediately and stop auxiliary pump 2. And so on, auxiliary pump 1 will stop in sequence; When the operating frequency of lead drive < F_133(Drive standby level), lead pump will decelerate and stop.
F_016	**Set Drive's No. for Parallel Control**	• **Set the individual number to each drive.** *In multi-pump control systems, assign the activating number to each drive for parallel control. Lead drive (the smallest number) will order command to other drives. *The smallest number stand for lead drive. When the lead drive occurs fault or pressed the OFF/RESET key, the drive with following number will become lead drive to order the command to other drives.

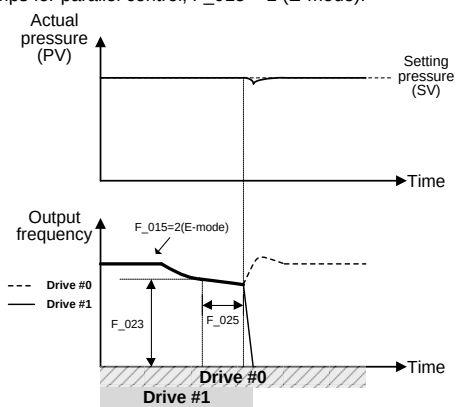
Func.	Name	Description
F_021	**Launch Detection Time (Parallel Control)**	• **In multi-pump control systems, set the detection time of pump for parallel start up.** *In multi-pump control systems, the standby pumps will parallel control in sequence when the operating drive runs at full speed for a time by setting value of F_021. *Setting range: 0.0~25.0sec. 
F_022	**Launch Detection Level (Parallel Control)**	• **In multi-pump control systems, set the detection level of pump for parallel start up.** *In multi-pump control systems, the standby pumps will parallel control in sequence when the operating drive runs at full speed and the actual pressure is still below the setting value.



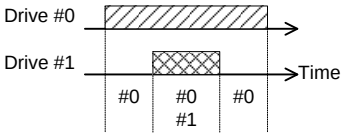
F_023	**Cut-off Frequency of Parallel Control**	• **In multi-pump control systems, set the cut-off frequency to cut off the pump operation.**
F_025	**Cut-off Time of Parallel Control**	• **In multi-pump control systems, set the cut-off time to cut off the pump operation.**

1.In multi-pump control systems (E-mode or S-mode), when the output frequency is below the F_023 and maintaining the time interval (F_025), the drive will depart from the parallel control system in sequence (Last in - First out).

*Example: Two pumps for parallel control; F_015 = 2 (E-mode).



2.In multi-pump control systems, drives will start / cut off the operation in accordance with below diagram.



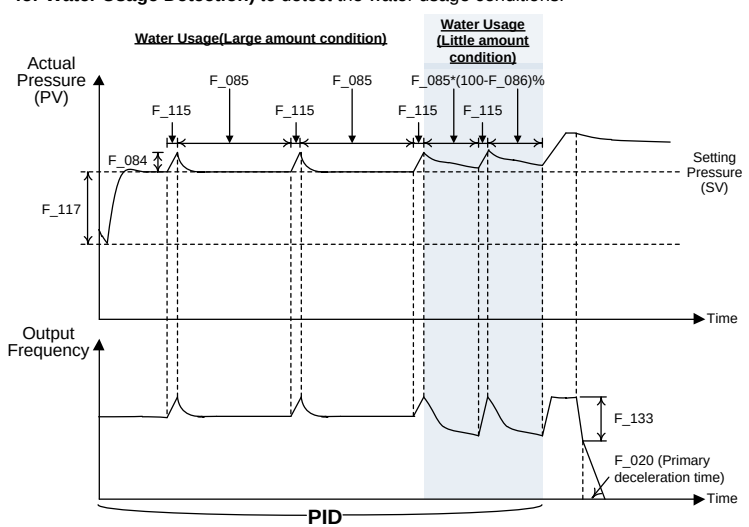
F_135	**Drives Standby Numbers of Multi-pumps Control system**	• **In multi-pump control systems, setting the number of drives standing by.** *According to the condition of applications, users can set the standing by number of drives to protect the system. *Setting range: 0~3 units.(0: disable) ****The default parallel number of drives are 2 sets.*** *Valid setting of standing by drives as below.
F_150	**Continuous Water Supply Control**	0:Disable 1: Enable(default)
F_151	**Less Pumps set during Operation**	In multi-pump control systems, deploying the number of operating pumps and maintaining the system pressure within certain acceptable limits. Setting range: 0~1 pump (0: Disable ; Default value: 1 pump)

6-3 Constant Pressure Control Mode and ON / OFF Mode

• 6-3-1 Constant Pressure Control Mode

Func.	Name	Description
F_084	Pressure Boost for Water Usage Detection	• Boost the pressure up to detect if the water is used.
F_085	Time Interval of Pressure Boost for Water Usage Detection	• Set the time interval for F_084 to detect if the water is used. *0: off
F_086	ON/OFF Mode Starting Rate Setting	• In constant pressure control mode and lower water usage condition, setting the starting rate of drive switch to ON/OFF mode. *0: Disable the ON / OFF mode *The lower setting value means the flow rate
F_115	Acceleration Time of Pressure Boost	• Set the time of F_084 (Pressure Boost for Water Usage Detection) to detect if the water is used.
F_117	Pressure Dead Band Setting	• In constant pressure control mode (F_103≠0), drive will activate PID control when the feedback signal exceeds the dead band.
F_133	Drive Stop Frequency of Water Usage Detection	• When the operation frequency is lower than the setting value, drive will ramp to stop.

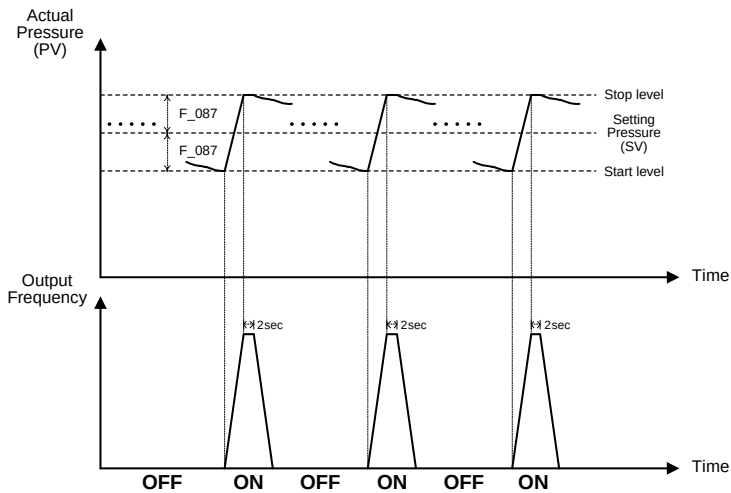
1. In constant pressure control mode, drive will auto-detect the water usage according to the setting of **F_084 (Pressure Boost for Water Usage Detection)** and **F_115 (Acceleration Time of Pressure Boost)** with the time interval of **F_085 (Time Interval of Pressure Boost for Water Usage Detection)** to detect the water usage conditions.



• 6-3-2 ON / OFF Control Mode

Func.	Name	Description
F_087	**ON / OFF Mode Pressure Dead Band Setting**	**• In ON/OFF mode, drive will auto start/stop the pump in accordance with the setting of setting value.** *Start level=SV(Setting pressure) - F_087 Stop level=SV(Setting pressure) + F_087 *Example: SV=2.0bar, F_087 = 0.3bar When PV(actual pressure) = 1.7bar → Drive starts When PV(actual pressure) = 2.3bar → Drive stops

1. In ON / OFF control mode, drive will start / stop in accordance with the setting of F_087.
2. When the drive is operating under ON / OFF control mode, There are two dots will be shown on display of keypad at SV and PV indicators.
3. The positions of dots:

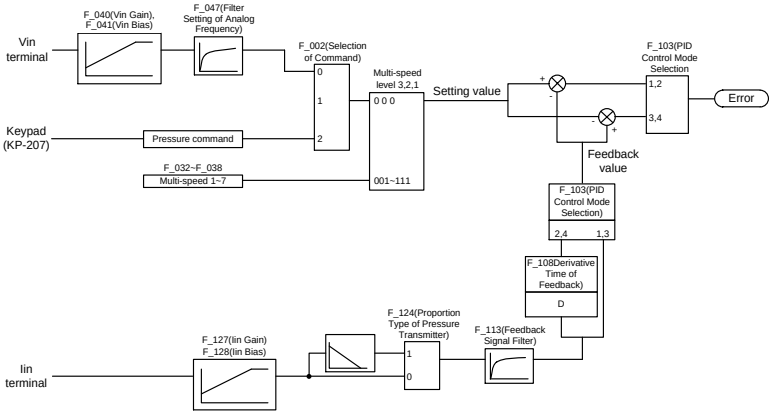


6-4 PID Control Functions

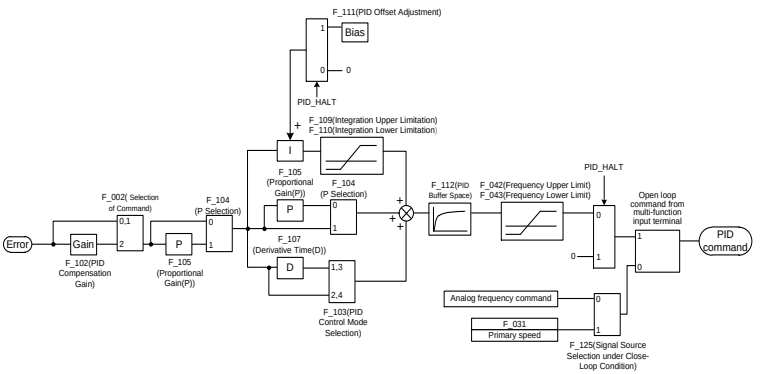
• 6-4-1 PID Control Functions

Func.	Name	Description
F_102	PID Compensation Gain	• **Compensate the gain for pressure command control under constant pressure control.**
F_103	PID Control Mode Selection	**=0: Open-loop operation** *Disable the feedback signal from the pressure transmitter.
		=1: Forward control; D postposition *When the actual pressure (PV) is lower than the setting pressure (SV), the drive will start to accelerate. *Forward control: When the system actual value is less than the setting value, the drive will start to accelerate.
		=2: Forward control; D preposition *Forward control: When the system actual value is less than the setting value, the drive will start to accelerate.
		=3: Reverse control; D postposition *Reverse control: When the system actual value is less than the setting value, the drive will start to decelerate.
		=4: Reverse control; D preposition *Reverse control: When the system actual value is less than the setting value, the drive will start to decelerate.
F_104	P Selection	**=0: P postposition**
		=1: P preposition
F_105	Proportional Gain(P)	• **Set the gain value for deviation adjustment.** (0.0: "P" control disabled) *To adjust the stable time. *Increase the value: Increase the response speed of constant pressure control system. *Decrease the value: Reduce the oscillation and response speed.
F_106	Integration Time(I)	• **Set the integration time for deviation adjustment.** (0.0: "I" control disabled) *To adjust the error value at stable state. *Increase the value: Reduce the error value. The response speed of constant pressure control system will be decreased. *Decrease the value: The response speed of constant pressure control will be increased, but the error amount will be increased.
F_107	Derivative Time(D)	• **Set the derivative time for deviation adjustment.** (0.00: "D" control disabled) *To adjust the amount of overshooting. *Increase the value: Reduce the overshooting of pressure, but motor is easier vibration. *Decrease the unstable vibration factor of motor, but the pressure is easier overshooting.
F_108	Derivative Time of Feedback	• **Set the derivative time for feedback signal.**
F_111	Offset Adjustment for Integration Time	• **Adjust the PID control offset.**

- *6-4-1 The block diagram of setting value and feedback value.*



- *6-4-2 The block diagram of PID control.*

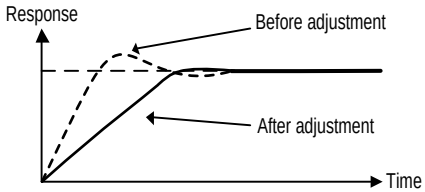


- *6-4-3 PID adjustment*

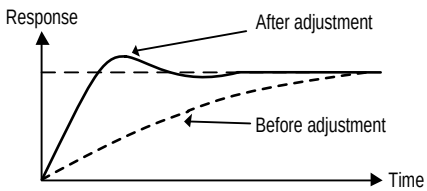
The system reaction condition can be adjusted by P, I, D to improve the system efficiency. Improper setting may cause system oscillated, please follow below adjustment steps to keep system stable.

1. Gradually increase the value of proportional gain(P).
2. Gradually decrease the value of integration time(I).
3. Gradually increase the value of derivative time(D).

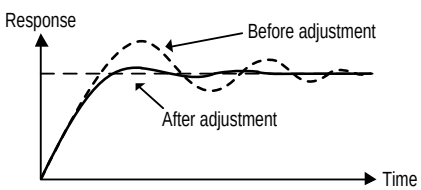
(1) Over-tuning suppression
Increasing the integration time (I) and decrease the derivative time(D).



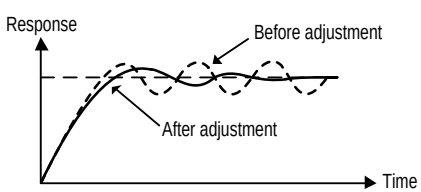
(2) Advance stabilizing
Decreasing the integration time (I) and increase the derivative time (D).



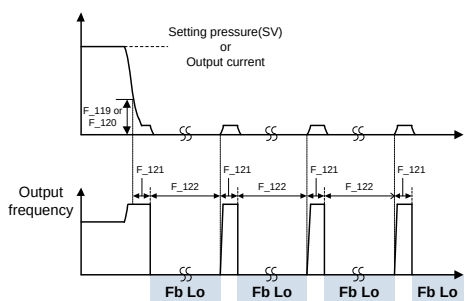
(3)Reducing the oscillation in the short period
When the oscillation happens in the cycle that longer than the setting time of integration, the integration setting is too strong causing the system oscillation. Set longer time of integration to stabilize the system and reduce the oscillation.



(4) Reducing the oscillation of continuous period
If the system appears the continuous oscillation caused by higher derivative value, shortening the derivative time can reduce the system oscillation.

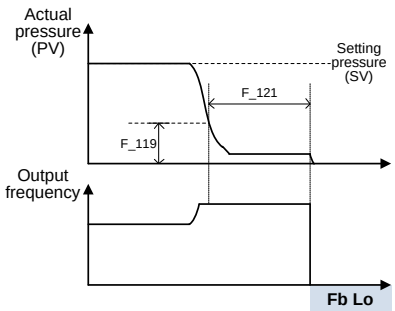


6-5 Pump Protection

Func.	Name	Description
F_118	Water Shortage Trip Recovery	**=0: Disable** *When the pump suffers from water shortage or conditions, the pump keeps running. ***Warning: Pump will be easily damaged.***
		=1: Trip (Fb Lo);Press "RESET" key to reset *When the pump suffers from water shortage conditions, the drive will trip to stop and display Fb Lo. *Must press OFF/RESET key to clear the error. *When the OFF/RESET key of the lead drive is pressed, the drive with following number after the lead drive now becomes the new lead drive.
		=2: Trip (Fb Lo);Power ON again to reset *When the pump suffers from water shortage conditions, the drive will trip to stop and display Fb Lo. *Drive must Power ON again to reset.
		=3: Trip (Fb Lo);Drive will auto-restarting according to the setting of F_122 (Drive Shutdown Time for Water Shortage) *When the drive suffers from water shortage conditions, the drive will trip to stop and display Fb Lo The drive will auto restart after the setting time of F_122.
F_119	Water Shortage Detection by Pressure Level	• **Set the pressure level to detect if pump suffers from water shortage conditions.** *Detection engages when the drive runs at full speed. *0: Disable
F_120	Water Shortage Detection by Current Level	• **Set the current level to detect if pump suffers from water shortage conditions.** *Detection engages when the drive runs at full speed. *0: Disable
F_121	Time of Water Shortage Detection	• **Set the detection time for F_119 and F_120 to detect if pump suffers from water shortage.** *0: Disable
F_122	Drive Shutdown Time for Water Shortage	• **Drive will auto-restart after the time setting, when pump suffers from water shortage and F_118 is set to 3.** *Shutdown time interval = F_122 *0: off 

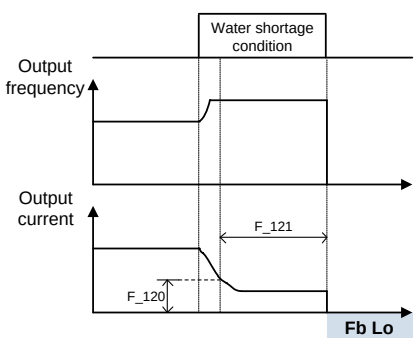
- *6-5-1 Cavitation Phenomenon*

When the drive runs at full speed and actual pressure (PV) is lower than the setting value of F_119 (Water Shortage Detection by Pressure Level) with a time interval (F_121 Time of Water Shortage Detection), the drive will trip to avoid the cavitation phenomenon appearing in pump systems.



- *6-5-2 Dry Running*

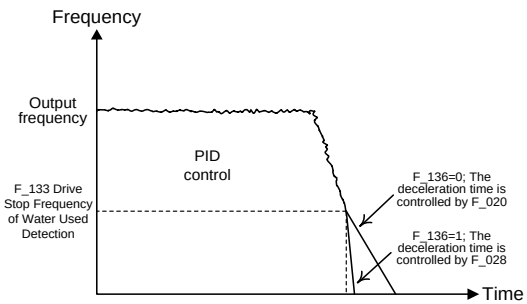
When the drive runs at full speed and the output current of the drive is lower than F_048 (Motor Rated Current) * F_120 (Water Shortage Detection by Current Level) with a time interval (F_121 Time of Water Shortage Detection), the drive will trip to avoid dry running conditions appearing in pump systems.



6-6 Noise Prevention

Func.	Name	Description
F_028	Secondary Deceleration Time	• Default value: 0.5sec
F_133	Drive Stop Frequency for Water Usage Detection	• When the operation frequency is lower than the setting value, drive will ramp to stop.
F_136	Noise Prevention	=0: Disable *When the output frequency decreases to the setting of F_133, the drive will ramp to stop in accordance with the setting of F_020 (Primary Deceleration Time).
		=1: Enable *When the output frequency decreases to the setting of F_133, the drive will ramp to stop in accordance with the setting of F_028 (Secondary Deceleration Time).

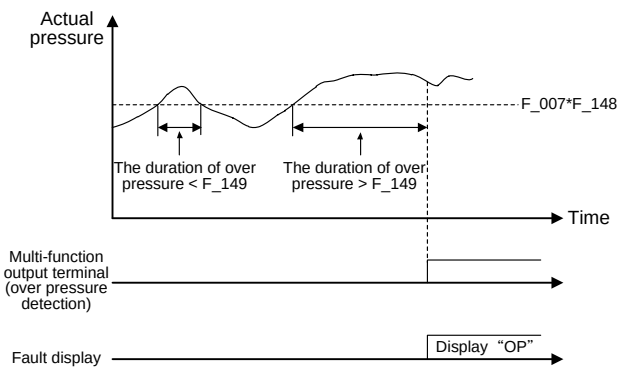
1.The pump might produce noise when stopping due to the friction of the pump shaft seal. Enable F_136 and adjust the suitable setting value of F_028 to reduce the noise.



6-7 Water Pipe and System Protection – Over Pressure

Func.	Name	Description
F_147	Over Pressure Disposal	**=0: Disable**
		=1: Alarm: Drive keeps operation. *The SV indicator of keypad will display blinking OP character and the pump keeps running till the actual pressure reaches the setting pressure.
		=2: Alarm: Drive stops output. *The SV indicator of keypad will display blinking OP character and the drive ramps to stop.
		=3: Error trip: Drive trips to stop. *When the actual pressure is over the setting value of F_007 (Pressure Transmitter Setting) * F_148, the drive will trip to stop and display blinking OP character. *Press the OFF/RESET key to restart the drive again, when drive trips to stop.
F_148	Over Pressure Level	• **According to the setting value of F_007 (Pressure Transmitter Setting) to set the over pressure level.** *Set the over pressure level in accordance with maximum pressure of water pipe or system.
F_149	Over Pressure Detection Time	• **When the actual pressure exceeds over pressure level (F_007*F_148) with duration (F_149), the detection is activation.**

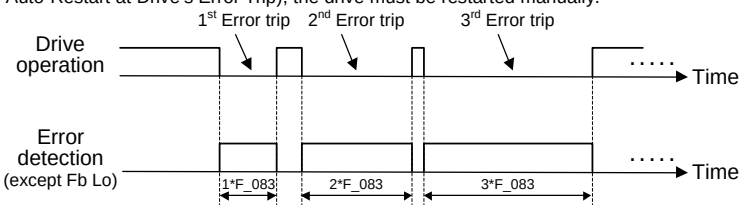
1.The over pressure detection is activated when the over pressure condition > F_007 (Pressure Transmitter Setting) x F_148 (Over Pressure Level) during F_149 (Over Pressure Detection Time)



6-8 Error Trip Disposals

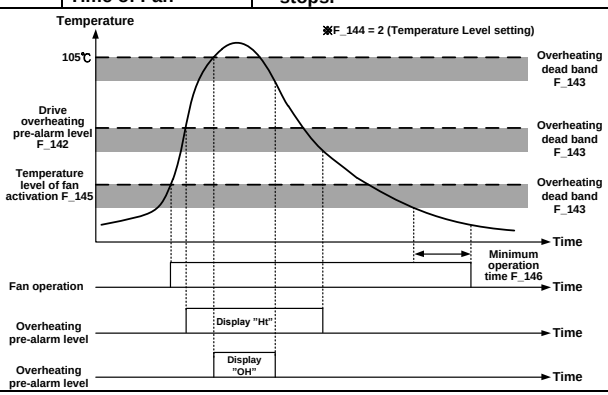
Func.	Name	Description
F_079	Auto-Restart Selection for Error Trip Condition	**=0: Short time interval to auto-restart according to the setting of F_080 (OC,OE,GF only).** *Drive will trip to stop, when the numbers of drive errors (only OC,OE,GF) occurs over the setting of F_080 (Numbers of Auto-Restart at Drive's Error Trip). *OC(Drive over current), OE(Over voltage), GF(Grounding fault).
		=1: Long time interval to auto-restart according to the setting value of F_080, F_083 (all errors except "Fb Lo"). *Drive will auto-restart by the time interval setting of F_083 (Error Tripping Time Interval before Auto-Restart).
F_080	Maximum Reset Times of Error Trip Conditions	• **Set the counting number for drive auto-restart when errors occur.** ***Note: When the numbers of drive's auto-restart reach the setting value of F_080, the drive must be restarted manually.*** *The drive will auto-restart according to the setting value after tripping to stop. *When the setting value sets to "0", the drive will not restart after an error occurs. *If a drive is operating over 24hrs without any error trip, the drive will automatically reset the counting number.
F_083	Time Interval of Drive Auto-Restart	• **Set the error tripping time interval before drive auto restarts for F_079 (Auto-Restart Selection of Error Trip) when the drive trips to stop.** *Unit: 10sec; Default value = 6: F_083= 6x10sec = 60sec ※***Error tripping time interval (counting number is defined by the drive internal counter.*** *1st time interval = 1 x F_083; 2nd time interval = 2 x F_083 3rd time interval = 3 x F_083 and so on.
F_091	Fault Record	• **Display the latest 5 error records.** *The first one record is the latest error message, and represented by the number of "1". *Selecting "CLF" parameter of F_154 can clear error records.

1.When the drive trips to stop, the drive will auto-restart with the time interval (the number of error trip * F_083). If the auto-restart times are over the setting of F_080 (Number of Auto-Restart at Drive's Error Trip), the drive must be restarted manually.



6-9 Overheating Disposals

Func.	Name	Description
F_140	NTC Thermistor Setting	**=0: Disable.** *Disable the NTC thermistor. *The "Ht" fault detection is disabled. *The display 6 (terminal status and heat sink temperature) of drive monitor mode will not display heat sink's temperature. **=1: Enable.** *Enable the NTC thermistor.
F_141	Drive Overheat Pre-alarm Selection	**=0: Disable.** **=1: Warning (Ht):** *Continue operation. **=2: Warning (Ht):** *Drive automatically de-rates the switching frequency every 5 minutes. **=3: Warning (Ht):** *Drive trips to "Ht" protection and stop the drive operation, when the temperature of heat sink is over F_142. *The cooling fan will restart, when the temperature is lower than the drive overheating dead band (F_143).
F_142	Drive Overheat Pre-alarm Level	• **Set the warning level for overheating detection.**
F_143	Drive Overheating Dead Band	• **Set the temperature dead band of F_142 and F_145.**
F_144	Fan Control Selection	**=0: Forced air.** *Fan will start running at drive power ON.
		=1: Operation air. *Fan will start running when the drive is running.
		=2: Temperature level setting *Fan will start running when the temperature is over the setting level of F_145.
F_145	Temperature Level of Fan Activation	• **Set the temperature level of fan activation.**
F_146	Minimum Operation Time of Fan	• **Set the minimum operation time for fan when the fan stops.**



6-10 Flow Sensor

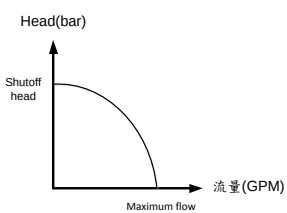
Func.	Name	Description
F_166	**Flow Sensor K Value**	A default flow sensor K value, based on the flow sensor specification.
F_167	**Flow Sensor Rate**	Set up the rate of flow sensor. Range: 0.00~2.00 (default: 1.00)
F_168	**Flow Sensor Display Unit**	0 : LPS(l/sec) (default value) 1: CMH(m3/hr)

1. Flow sensor specification: Pulse input type.
2. Flow sensor formula:
   Flow rate(l/sec)= Input pulses(pulse/sec)* Flow sensor K value(l/ pulse)* Flow sensor rate
3. Flow sensor input signal can connect multi-input terminal(X1~X4), F_52~F_055 set 21.

6-11 Compensation for Pipe Friction Loss

Func.	Name	Content
F_171	**Shutoff Head(H)**	Setting "shut-off" head of a pump. Range: 0.1~160.0 bar (default value:12.0)
F_172	**Maximum Flow (Q)**	Setting maximum flow of pump. Range: 0.0~6000.0 L/min (default value:300.0)
F_173	**Pipe friction loss compensation**	0: Disable 1: Enable
F_174	**Current in Maximum Flow (I_{Qmax})**	Setting current in maximum flow. (I_{Qmax}) Range: 1~200% (default value:100)
F_175	**Current in Minimum Flow (IQmin)**	Setting current in minimum flow. (I_{Qmax}) Range: 1~200% (default value:30)
F_176	**Pump Flow Rate Compensation for Pipe Friction Loss (HCOMP max)**	Setting Pipe Friction Loss in maximum flow. Range:0.1~160.0 bar (default value:0.0)
F_177	**Response Time Compensation of Pipe Friction Loss**	Setting Response Time Compensation for Pipe Friction Loss. Range:0.1~255 (default value:40)

1. Maximum flow of pump curve (Q) and shutoff head (H)



2. According compensation of pipe friction loss which makes end pressure reach a constant pressure.
3. Compensation of Pipe Friction Loss:

$$H_{COMP} = (\text{Output current} - I_{Qmin}) \ / \ (I_{Qmax} - I_{Qmin}) * H_{COMP\,max}$$

6-12 Sequential Operation Control

- *6-12-1 Time setting display*

Func.	Name	Description	
		Content	**Range**
F_181	Time Setting	Y: Year	2000~2099
		n: Month	1~12
		d: Day	1~31
		u: Week	SUn.7 (Sunday)
			nOn.1 (Monday)
			tUE.2 (Tuesday)
			uEd.3 (Wednesday)
			tHU.4 (Thursday)
			Fri.5 (Friday)
			Sat.6 (Saturday)
		H: Hour	0~23
		nn: Minute	0~59
		Reserved	–
When entering F_181function, ▲▼ key to adjust the time, FUN DATA key to switch the setting display.			

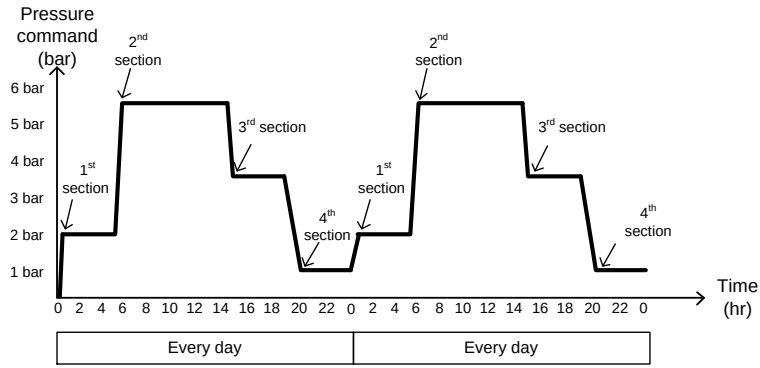
Func.	Name	Description	
		Content	**Setting Range**
F_182	Time Display	Y: Year	2000~2099
		n: Month	1~12
		d: Day	1~31
		u: Week	SUn.7 (Sunday)
		H: Hour	0~23
		nn: Minute	0~59
		Reserved	–
When entering F_182 function, ▲▼ key to switch the setting display.			

6-12-2 Operation sequential control

Func.	Name	Description
F_180	**Sequece Operation for Start Control**	0: Close 1: Open
F_183	**Operation Mode for Sequential Operation Contro**	0: Every week 1: Every day
F_184	**Setting Sector 1 of Sequential Operation**	S: Level selection (ON / OFF) u: Week setting H: Hour setting nn: Minute setting C: Pressure command setting SL: Incline time
F_185	**Setting Sector 2 of Sequencial Operation**	
F_186	**Setting Sector 3 of Sequencial Operation**	
F_187	**Setting Sector 4 of Sequencial Operation**	
F_188	**Setting Sector 5 of Sequencial Operation**	
F_189	**Setting Sector 6 of Sequencial Operation**	
F_190	**Setting Sector 7 of Sequencial Operation**	
F_191	**Setting Sector 8 of Sequencial Operation**	

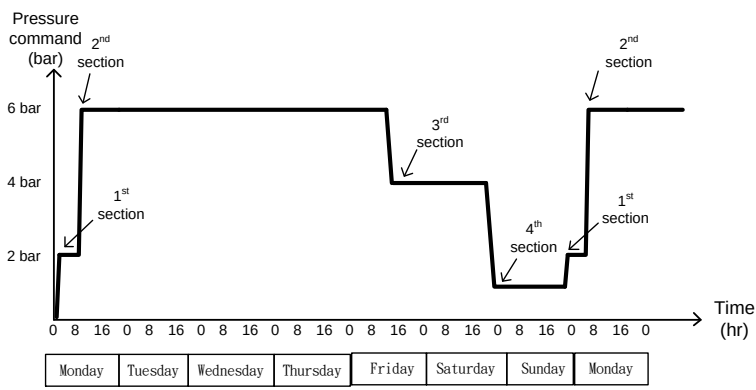
1. Sequential control offer 8 periods can be set.
2. Sequential control offer 2 operating modes: daily, weekly.

Example 1: Operating mode lets user set a daily and four peirods can be set at most.



When executing the sequential program, the drive is based on all function settings and calculating the time from now until the next day.
Sequential operation will run through each sector till 4 sector complete and automatically restarts running from 1st sector. The sequential operation will stop only when the start command of sequential operation control is OFF.

Example 2: Operating mode lets user set a weekly and four peirods can be set at most.



When executing the sequential program, the drive's operation is based on all function settings and calculating the time from now until the next week.
Sequential operation will run through each sector till 4 sector complete and automatically restarts running from 1st sector. The sequential operation will stop only when the start command of sequential operation control is OFF.

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Chapter 7 Communication Description

7-1 Communication wiring

Please refer to “2-3-4 Description of Terminals
5. Control Terminals and Switch for Communication Application
6. CN2 / CN3: KP-605 (RJ-45) / Modbus RS-485 Modbus Port.

7-2 Communication Setting

F_155	Communication Address	0: disable

The followers use the address to send and receive messages.
Setting range: 0~254 (0: disable)

F_156	Communica-tion Baud Rate	0: 4800bps 2: 19200bps 1: 9600bps 3: 38400bps
F_157	Communication Protocol	0: 8,N,2 1: 8,E,1 2: 8,O,1
F_158	Communication Overtime (Cot)	0.0 sec: No overtime detection 0.1~100.0 sec: The setting of over time detectoin.
F_159	Communication Overtime Disposal	0: Warning (Cot)；Continue operation 1: Warning (Cot)；Ramp to stop 2: Warning (Cot)；Coast to stop
F_160	Control Selection of Multi-Function Input Terminals	0: Multi-function input terminals selves 1: Multi-function input terminals command by communication interface

7-3 Communication Protocol

Serial data transmission is an asynchronous serial data transmission: 1 frame = 11 bits (3 types of format shown in below figures)

● 8,N,2: 1 start bit，8 data bits，2 stop bits

START	BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7	STOP	STOP

● 8,E,1: 1 start bit，8 data bits，1 even parity bit，1 stop bit

START	BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7	EVEN PARITY	STOP

● 8,O,1: 1 start bit，8 data bits，1 odd parity bit，1 stop bit

START	BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7	ODD PARITY	STOP

7-4 Message Format

Address (Drive)	OP Code	Data n	…	Data 1	Data 0	CRC 0	CRC1	END
Drive Address No. (1 Byte)	Operation Message (1 Byte)	Data Message (Data length "n": depending on OP Code)				CRC Checksum		No Transmitting ≧10ms

●**Address:** Drive address number for host to control

00H: The host broadcasts messages to all receivers (drives). All receivers only receive the message but has no messages returned to the host.

01H~**FEH:** The host designates the receiver (drive) by defining the drive address number.

●**OP Code(Operation Code):** The operation of the host to the drive

03H- Read multi-registers
06H- Write to single register
08H- Receiver detection
10H- Write to multi-registers

●**Data:** Including start register, several registers, data length (maximum 8 data), data content (maximum 16 bits)

Note: Data length – 1 byte, others – 1 word(2 bytes)

●**CRC Checksum:** Cyclical Redundancy Check performs XOR and bit shifting operations for all hexadecimal values in the message to generate the checksum code to verify the communication validity. Checksum is to sum all message bits for 16-bit CRC calculations. (See CRC Checksum)

●**Message Length:** Message length is listed in between maximum and minimum values. Message lengths of OP code 03H and 10H are dependent on the number of registers required in one message. (See Operation Code(OP Code) Description)

OP Code	Description	Instruction Code		Return Code	
		Min(bytes)	Max(bytes)	Min(bytes)	Max(bytes)
03H	Read multi-registers	8	8	7	21
06H	Write to single register	8	8	8	8
08H	Drive Detection	8	8	8	8
10H	Write to multi-registers	11	25	8	8

●Operation Code(OP Code) Description:

※03H (Read multi-registers):

Example: Read data from registers 2101H and 2102H of the drive 1

Message Code (Host to Drive)

Address	OP Code	Starting Register		Register Numbers to Readout		CRC Checksum	
		MSB	LSB	MSB	LSB	LSB	MSB
02H	03H	21H	01H	00H	02H	9FH	C4H

This example shows the host to read the drive data from 2 registers of the drive. The host identifies drive 1 by calling the drive address (02H) with the "read" operation command (03H) to read the drive data from the registers (2101H – starting register) to the register (2102H – Register Numbers to Readout defines the numbers of register for data readouts).

Return Code (Drive to Host)

Address	OP Code	Data Bytes	2101H(Register) Data		2102H(Register) Data		CRC Checksum	
			MSB	LSB	MSB	LSB	LSB	MSB
02H	03H	04H	55H	00H	17H	70H	D6H	EBH

The host reads registers 2101H and 2102H of drive (02H) (drive status and speed command). After the drive receives the host's command, the drive returns 4 bytes data (2101H=5500H and 2102H=1770H) to the host.

Caution: The host cannot simultaneously broadcast 03H OP code to drives when multiple drives connected or all drives reject host's OP code.

※06H (Write to single register)

Example: Write a data (1770H) into the drive register (2001H)

Message Code (Host to Drive)

Address	OP Code	Drive Register		Register Data		CRC Checksum	
		MSB	LSB	MSB	LSB	LSB	MSB
02H	06H	20H	01H	17H	70H	DDH	EDH

This example shows the host to write the data (1770H) to the register (2001H) of the drive. The host identifies drive 1 by calling the drive address (02H) with the "write" operation command (06H) to write the data (1770H) into the register (2001H).

Return Code (Drive to Host)

Address	OP Code	Drive Register		Register Data		CRC Checksum	
		MSB	LSB	MSB	LSB	LSB	MSB
02H	06H	20H	01H	17H	70H	DDH	EDH

The host writes data 1770H into the drive register 2001H. After receiving data from the host and writing data into drive's registers, the drive returns the original receiving message to the host. OP code-06H of the host can synchronously broadcast to all drives but has no return code to the host.

※08H (Drive detection): Only use when testing the communication

OP code – 08H is to detect if the drive is correctly receiving the data from the host. The main purpose of using this OP code is to ensure the host data to be correctly sent to the drive.

Example: Verify the data (0000H and AA55H) to be correctly received by the drive.

Message Code (Host to Drive)

Address	OP Code	Data 1		Data 2		CRC Checksum	
		MSB	LSB	MSB	LSB	LSB	MSB
02H	08H	00H	00H	AAH	55H	5EH	A7H

The host sends OP-code (08H) to verify the data 0000H and AA55H to be correctly received by the drive.

Return Code (Drive to Host)

Address	OP Code	Data 1		Data 2		CRC Checksum	
		MSB	LSB	MSB	LSB	LSB	MSB
02H	08H	00H	00H	AAH	55H	5EH	A7H

The drive returns the same message to the host to confirm the data well received from the host. Data 1 must be 0000H but Data 2 can be any values.

Note: The host cannot simultaneously broadcast 08H OP code to all drives when multiple drives connected or drives reject drive's OP codes.

※10H (Write to multi-registers)

When multiple data need to write into the drive from the host, the host can define how many registers and data to be written into the drive.
This example is illustrating 2 data (1011H and 1770H) from the host to be written into 2 drive registers (2000H and 2001H).

Message Code (Host to Drive)

Address	OP Code	Starting Register		Register Number to Write		Data Length	Data 1		Data 2		CRC Checksum	
		MSB	LSB	MSB	LSB		MSB	LSB	MSB	LSB	LSB	MSB
02H	10H	20H	00H	00H	02H	04H	10H	11H	17H	70H	3FH	FBH

The host calls the drive 1 by defining the drive address (02H) with the write to multi-registers OP code (10H) to write 2 data (1011H and 1770H) into the drive registers (2000H and 2001H) which are defined by calling starting register (2000H) with "register number to write" (0002H). In this example, if user has 4 data to write to 4 drive registers, the message code can be as follows:

a. Starting register: 2000H (still)
b. Register number to write: 0004H

Then, 4 data will be sequentially written into 4 registers starting from 2000H, 2001H, 2002H, to 2003H.

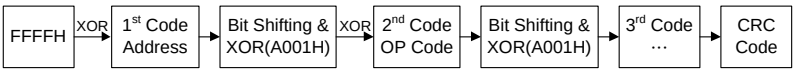
Return Code (Drive to Host)

Address	OP Code	Starting Register		Register Numbers to Write		CRC Checksum	
		MSB	LSB	MSB	LSB	LSB	MSB
02H	10H	20H	00H	00H	02H	4AH	3BH

The host writes 2 data (1011H and 1770H) with total data length 4 byte to 2000H and 2001H registers of drive. The drive receives and writes the data to the registers, and then returns the message to the host. The host can synchronously broadcast all drives to write multi-data to multi-registers in order to change the data synchronously.

7-5 CRC Checksum Algorithm

CRC checksum code is to verify the message validity during the communication and its algorithm is to apply each code in the message to perform XOR and bit shifting operations to generate the CRC code.
Here is the checksum algorithm diagram to generate CRC code.



The following example of showing how CRC code is generated.

Example: To generate CRC code D140 from Address Code: 02H and OP Code: 03H

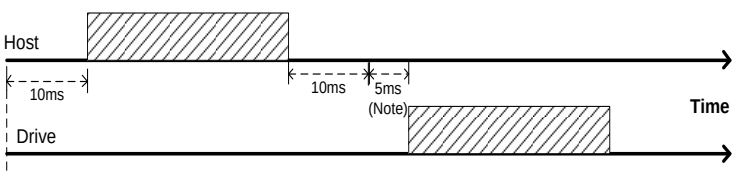
```
                1 1 1 1  1 1 1 1  1 1 1 1  1 1 1 1
First Code 02H  ---------------------------------------
                0 0 0 0  0 0 1 0  0 0 0 0  0 0 1 0   XOR
                1 1 1 1  1 1 1 1  1 1 1 1  1 1 0 1
MOVE 1          0 1 1 1  1 1 1 1  1 1 1 1  1 1 1 0 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                ---------------------------------------
                1 1 0 1  1 1 1 1  1 1 1 1  1 1 1 1
MOVE 2          0 1 1 0  1 1 1 1  1 1 1 1  1 1 1 1 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                ---------------------------------------
                1 1 0 0  1 1 1 1  1 1 1 1  1 1 1 0
MOVE 3          0 1 1 0  0 1 1 1  1 1 1 1  1 1 1 1 | 0
MOVE 4          0 0 1 1  0 0 1 1  1 1 1 1  1 1 1 1 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                ---------------------------------------
                1 0 0 1  0 0 1 1  1 1 1 1  1 1 1 0
MOVE 5          0 1 0 0  1 0 0 1  1 1 1 1  1 1 1 1 | 0
MOVE 6          0 0 1 0  0 1 0 0  1 1 1 1  1 1 1 1 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                ---------------------------------------
                1 0 0 0  0 1 0 0  1 1 1 1  1 1 1 0
MOVE 7          0 1 0 0  0 0 1 0  0 1 1 1  1 1 1 1 | 0
MOVE 8          0 0 1 0  0 0 0 1  0 0 1 1  1 1 1 1 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                ---------------------------------------
                1 0 0 0  0 0 0 1  0 0 1 1  1 1 1 0
Second Code 03H ---------------------------------------
                0 0 0 0  0 0 1 1  0 0 0 0  0 0 1 1
                1 0 0 0  0 0 0 1  0 0 1 1  1 1 0 1
MOVE 1          0 1 0 0  0 0 0 0  1 0 0 1  1 1 1 0 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                ---------------------------------------
                1 1 1 0  0 0 0 0  1 0 0 1  1 1 1 1
MOVE 2          0 1 1 1  0 0 0 0  0 1 0 0  1 1 1 1 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                ---------------------------------------
                1 1 0 1  0 0 0 0  0 1 0 0  1 1 1 0
MOVE 3          0 1 1 0  1 0 0 0  0 0 1 0  0 1 1 1 | 0
MOVE 4          0 0 1 1  0 1 0 0  0 0 0 1  0 0 1 1 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                ---------------------------------------
                1 0 0 1  0 1 0 0  0 0 0 1  0 0 1 0
MOVE 5          0 1 0 0  1 0 1 0  0 0 0 0  1 0 0 1 | 0
MOVE 6          0 0 1 0  0 1 0 1  0 0 0 0  0 1 0 0 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                ---------------------------------------
                1 0 0 0  0 1 0 1  0 0 0 0  0 1 0 1
MOVE 7          0 1 0 0  0 0 1 0  1 0 0 0  0 0 1 0 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                ---------------------------------------
                1 1 1 0  0 0 1 0  1 0 0 0  0 0 1 1
MOVE 8          0 1 1 1  0 0 0 1  0 1 0 0  0 0 0 1 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                ---------------------------------------
                1 1 0 1  0 0 0 1  0 1 0 0  0 0 0 0
CRC :           D        1        4        0
```

The following example of using C language to create a sample program for CRC checksum algorithm

Example: C language sample program

```
unsigned char *data;                    // Message pointer
unsigned char length;                   // Message length
unsigned int crc_chk(unsigned char *data,unsigned char length)
{
        int i;
        unsigned int reg_crc=0xffff;
        while(length--)
         {
           reg_crc^=*data++;
           for(i=0;i<8;i++)
               if(reg_crc&0x01)
                  reg_crc=(reg_crc>>1)^0xa001;
               else
                  reg_crc=reg_crc>>1;
         }
}
```

7-6 Processing Time of Communication Transmission



The communication waits for 10ms to start the communication transmission after the drive powers on or the communication function of the drive changes. The drive needs 5ms processing time to return the message to the host after the message are received from the host. If the host only broadcasts to the drive, the host can start sending the message code after 5ms.

Note: if the message code is to “Read” or “Write” the parameter, the drive needs 100ms processing time to return the message to the host.

7-7 Communication Troubleshooting

1. When error occurs at the communication network, the drive provides the self-testing function to identify where error occurs. Please check communication function settings to verify the validity of functions.

2. When the host receives returned error messages from a drive, the host sends the invalid operation command to drive. The following table is the error message format.

Address	OP Code	Error Code	CRC Checksum	
			LSB	MSB
02H	1xxxxxxxB	xxH	xxH	xxH

OP code sets MSB (bit7) as 1 for the original command message, but error code gives different values according to different types of errors. The below table is describing types of error code:

Error Code	Error Type	Descriptions
0 0	Serial communication format error	Parity error of serial communication
0 1		Data frame error of serial communication
0 2		Over-bit error of serial communication
0 3	Modbus OP code error	OP code is not in either 03H,06H,08H, or 10H
0 4	Modbus CRC error	CRC checksum error
0 5	Modbus data range error	1. Data length in transmission not matched with the protocol 2. Data range over the register length at “write”
0 6	Modbus register characteristics error	Registers writes into read-only registers
0 7	Modbus register error	No-defined registers

7-8 Drive Registers and Command Code

●Registers – Write Operation

Reg. No.	Name	Description	
10nnH (**Note4**)	Function setting	Drive function setting/monitoring; nn=F_000 ~ F_194 Example: F0_19=1013H	
2000H	Operation command 1	b0~b1	00: No use
			01: Stop
			10: Start
			11: JOG command
		b2~b3	Reserved
		b4~b5	00: No use
			01: Forward command
			10: Reverse command
			11: Rotation direction change command
		b6~b7	00: Primary accel/decel time
			01: Second accel/decel time
			10: Third accel/decel time
			11: Fourth accel/decel time
		b8~bA	000: Primary speed (communication)
			001: Preset speed 1
			010: Preset speed 2
			011: Preset speed 3
			100: Preset speed 4
			101: Preset speed 5
			110: Preset speed 6
			111: Preset speed 7
		bB	Reserved
		bC~bD	00: No use
			01: b6~bA functions *Note 1
			10: Enable operation command 2 resister.
			11: Disable 01 and 10
		bE~bF	Reserved
2001H	Frequency command	Primary frequency is set by communication (unit: 0.01Hz)	
2002H	Operation command 2	b0	1: External fault command
		b1	1: Reset command
		b2	1: Jog command
		b3	1: Output interruption command
		b4	1: Coast to stop command
		b5	1: Secondary accel/decel command
		b6	1: Accel/decel prohibition command
		b7	1: Select analog input source
		bA~bF	Reserved
2003H	Constant pressure setting	Setting value (SV) is controlled by communication. (Unit: 0.1 bar)	

●**Registers – Read Operation**

Reg. No.	Name	Description	
2100H	Drive error code	00H	No error
		01H	Drive over current (OC)
		02H	Over voltage (OE)
		03H	Drive overheat (OH)
		04H	Drive overload (OL1)(OL2)
		05H	Motor overload (OL)
		06H	External fault (EF)
		07H	Short protection (SC)
		08H	A/D converter error (AdEr)
		09H-12H	Reserved
		13H	Grounding fault (GF)
		14H	Under voltage during operation (LE1)
		15H	EEPROM error (EEr)
		16H	Reserved
		17H	Drive output interruption (bb)
		18H	System overload (OLO)
		19~20	Reserved
		21	Coast to stop (Fr)
		22H-30H	Reserved
		31H	PID feedback signal error.
		32H	Water shortage protection(noFB)
		33H	Over pressure protection(OP)
2101H	Drive status 1	b0~b7	Reserved
		b8	1: Frequency control by communication
		b9	1: Frequency control by analog inputs
		bA	1: Operation command by communication
		bB	1: Parameter locking
		bC	1: Drive running status
		bD	1: Jog running status
		bE	1: Forward indication
		bF	1: Reverse indication
2102H	Frequency command	Monitor drive's frequency command (unit: 0.01Hz)	
2103H	Output frequency	Monitor drive's output frequency(unit: 0.01Hz)	
2104H	Output current	Monitor drive's output current(unit: 0.1A)	
2105H	DC bus voltage	Monitor drive's DC bus voltage(unit: 0.1V)	
2106H	Output voltage	Monitor drive's AC output voltage(unit: 0.1V)	
2107H	Frequency of multi-speed	Monitor drive's frequency of multi-speed *Note 2	
2108H	PV value	Monitor drive's PV value (unit: 0.1 bar)	
2109H	Reserved		
210AH	Reserved		
210BH	Reserved		
210CH	Reserved		

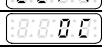
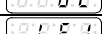
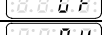
210DH	Reserved		
210EH	Reserved		
210FH	Reserved		
2300H	I/O terminal status	b0	Reserved
		b1	Reserved
		b2	1: X1 terminal operation
		b3	1: X2 terminal operation
		b4	1: X3 terminal operation
		b5	1: X4 terminal operation
		b6	Reserved
		b7	Reserved
		b8	1: Y1 terminal detection
		b9	Reserved
		bA	Reserved
		bB	Reserved
		bC	1: Primary speed by analog input
		bD	1: Primary speed by operation panel
		bE	1: Primary speed by UP/DOWN command
		bF	1: Primary speed by communication
2301H	Drive status 2	b0	Reserved
		b1	1: Constant speed
		b2	1: Zero speed
		b3	1: Frequency detection
		b4	1: System overload
		b5	1: Stall prevention
		b6	Reserved
		b7	1: Braking action
		b8	Reserved
		b9	Reserved
		bA	1: Error signal
		bB~bF	Reserved
2302H	Reserved		
2303H	Fault record 1	Fault record 1 *Note 3	
2304H	Fault record 2	Fault record 2 *Note 3	
2305H	Fault record 3	Fault record 3 *Note 3	
2306H	Fault record 4	Fault record 4 *Note 3	
2307H	Fault record 5	Fault record 5 *Note 3	

Note:

1. When b6 ~ bA function is enabled, multi-function command –Multi-speed 1, 2, 3, will be inactive.

2. 0: Analog
   1: Primary speed
   2~8: Multi-speed 1~7
   9: Jog speed
   11: Communication

3. Fault record table

Error code	Drive display	Description
01H	 (AdEr)	A/D converter error
02H	 (Fot)	IGBT module error
03H	 (EEr1)	Internal memory error
08H	 (OC)	Drive over current
0CH	 (OE)	Over voltage
0DH	 (LE1)	Under voltage during operation
0EH	 (GF)	Grounding fault
0FH	 (OH)	Drive overheat
10H	 (OL)	Motor overload
11H	 (OL1)	Drive overload
12H	 (OLO)	System overload
13H	 (EF)	External fault
14H	 (PAdF)	Keypad interruption during copy
16H	 (ntcF)	Thermal sensor fault
17H	 (OH2)	Motor overheat
18H	 (noFb)	PID feedback signal error
19H	 (OL2)	Drive current limit

4.AGnnH—Write and read allowed
2000H~2002H—Write only, read prohibited
2100H~210FH—Read only, write prohibited

7-9 Programming Examples – Register and Command

7-9-1 Access Drive Function Setting – Write Operation

Write a single register to access drive function setting:
Ex: Set function F_031 (primary speed) = 30 Hz
a. Register address: 001FH (31 (decimal) = 001FH (hex))
b. Speed = ： 0BB8H (30Hz ➔ 30.00Hz(resolution: 0.01Hz) ➔ 30.00 ÷ 0.01 = 3000 (decimal) = 0BB8H (hex)

Code to write to drive register from the host (CRC exclusive)

Address	OP Code	Drive Register		Register Data	
		MSB	LSB	MSB	LSB
01H	06H	00H	1FH	0BH	B8H

7-9-2 Host Control to Drive – Write Operation

When the host control by Modbus communication, user can simply create an icon or active key/button to activate the drive. The following examples shows how to program the communication control.

1. Start the drive:
a. Create an icon or active button/key on the host for “Drive Start”
b. Program the host with the following code for “Drive Start”
c. The drive register to be written for start operation: 2000H
d. The register data for start operation: 0002H

Address	OP Code	Drive Register		Register Data	
		MSB	LSB	MSB	LSB
01H	06H	20H	00H	00H	02H

2. Forward rotation command:
a. Create an icon or active button/key on the host for “Forward”
b. Program the host with following code for “Forward” rotation control
c. The drive register to be written for forward command: 2000H
d. The register data for forward command: 0010H

Address	OP Code	Drive Register		Register Data	
		MSB	LSB	MSB	LSB
01H	06H	20H	00H	00H	10H

3. Speed Setting (frequency command) – without using drive function setting:
Set the speed to be 30.05Hz (resolution: 0.01Hz)
a. The drive register to be written for Speed setting(frequency command): 2001H
b. Convert 30.05Hz to hexadecimal value:
30.05 x 100 (by the resolution) = 3005 (decimal) = 0BBDH

Address	OP Code	Drive Register		Register Data	
		MSB	LSB	MSB	LSB
01H	06H	20H	01H	0BH	BDH

4.Primary Acceleration/Deceleration Time Setting:

Set the acceleration/deceleration time = 1.5 seconds (resolution: 0.1 seconds)

a. Set F_019 (Primary accel time) = 1.5 seconds
Convert F_019 to hexadecimal value for generating register number: 18 (decimal) = 12H
Convert 1.5 seconds to hex value: 1.5 x 10 (by resolution) = 15 (decimal) = 000FH

b. Set F_020 (Primary decel time) = 1.5 seconds
Convert F_020 to hex value: 19 (decimal) = 13H

c. Select primary accel/decel time command: register: 2000H, register data = 00 (b6,b7)

Set the acceleration time F_019 = 1.5 seconds

Address	OP Code	Drive Register		Register Data	
		MSB	LSB	MSB	LSB
01H	06H	A2H	12H	00H	0FH

Set the deceleration time F_020 = 1.5 seconds

Address	OP Code	Drive Register		Register Data	
		MSB	LSB	MSB	LSB
01H	06H	A2H	13H	00H	0FH

Select primary acceleration/deceleration time

Address	OP Code	Drive Register		Register Data	
		MSB	LSB	MSB	LSB
01H	06H	20H	00H	00H	00H

7-9-3 Host Control to Drive – Read Operation

1. Drive Error Trips (Fault Code):

Example: Drive error trips due to “GF” (grounding fault) and the fault message displayed at the host.

1) The host sends the below codes to access the drive register to monitor drive faults (read only one register data)
a.-Drive register: 2100H
b.-Number of register to read: 1 ➔ 0001H

Message Code (Host to Drive)

Address	OP Code	Drive Register		Register Numbers to Readout	
		MSB	LSB	MSB	LSB
01H	03H	21H	00H	00H	01H

2) The drive returns the fault code to the host when “GF” occurs:
-GF code: 0DH

Return Code (Drive to Host)

Address	OP Code	Data Byte	2100H(Register) Data	
			MSB	LSB
01H	03H	04H	00H	0DH

c. Program the host to convert register data 000DH to “GF” message

2. Drive Frequency Output Readout:

Example: If the drive frequency outputs = 40.65Hz, read the data output from the drive and display 40.05Hz in the host.

a. The host sends the below codes to access the drive register to read out the frequency output data (read only one register data)
-Drive register: 2103H
-Number of register to read: 1 ➔ 0001H

Message Code (Host to Drive)

Address	OP Code	Drive Register		Register Numbers to Readout	
		MSB	LSB	MSB	LSB
01H	03H	21H	03H	00H	01H

b. The drive returns the frequency output readouts to the host
-Output frequency readouts from the drive (2103H register data):

Return Code (Drive to Host)

Address	OP Code	Data Byte	2103H(Register) Data	
			MSB	LSB
01H	03H	04H	0FH	E1H

c. Program the host to convert register data 0FE1H (Hex value) = 4065 (Decimal value)

d. Display the output frequency (resolution = 0.01): 4065/100 = 40.65 (unit in Hz)

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Chapter 8 Operation Procedures and Fault Protection

8-1 Operation Procedures

⚠ DANGER

1. Do Not remove wires when the internal indicator of the drive remains ON.
2. After power off (30HP below models must wait at least 5 minutes; 40HP~75HP models must wait at least 10 minutes; 100HP above models must wait at least 20 minutes), Do Not perform any unwiring actions before drive indicator light (CHARGE) turns off. Use a multimeter with the DC voltage stage to measure the cross voltage between P(+) and N(-) ports (DC bus voltage must be less than 25V).

⚠ CAUTION

1. Check if the shield of wire is broken after wiring is completed to avoid electric leakage or short circuit.
2. Screws on the terminal must be fastened.

A. Verify and check the compatibility between power source, voltage, motor, and drive.

B. Connect the power to drive R/L1, S/L2, T/L3 (three-phases) or R/L1, S/L2 terminals (single-phase).

C. Set all required parameters and functions after power is ON and measure the output voltage of the drive at U/T1, V/T2, W/T3 terminals to verify if the output voltage and current are valid. Press OFF RESET when completing all verifications.

D. Switch off the power and wait for drive's power indicators off, and then connect drive's U/T1, V/T2, W/T3 terminals to the motor.

E. Operate the motor with the drive by low speed after power ON to verify the validity of the motor rotation direction and then to slowly increase the motor speed.

F. Motor start or stop must be controlled by drive control signal instead of switching the power ON / OFF. The lifetime of the drive will be significantly reduced if the invalid operation using the switch control of the power is applied to motor control.

G. Because the starting current of motor is 6~8 times of rated current, Do NOT install the magnetic contactor between the drive and motor for the motor operation.

H. When using the single-phase power source to drive the three-phase drive (not the standard type of single-phase power input), first confirm the horsepower of motor, and then calculate the motor rated current by multiplying the motor rated current by 2 times to the base value of drive rated current. The drive selection for this single-phase power must have the rated current equal to the calculated drive rated value.

Formula: Motor rated current × 2 = Drive rated output current

Example:

a. Drive selection:

Motor specification: 220VAC, 1HP ; rated current: 3.1A

Base value of drive rated current=3.1 (A) × 2 = 6.2 (A)

Drive specifications: 220VAC, 1HP drive = 5A (rated output current)
2HP drive = 8A (rated output current)

⇨ Select 2HP drive for 1HP AC motor.

b. Wiring of power: Connect the single-phase power line to R, S terminals.

c. Parameter settings:
Please reset below functions. If the parameters are not modified, the motor and drive could be possibly damaged.

F_048 Motor Rated Current = 3.1A
(the setting must be based on the motor rated current)

F_068 System Overload Detection Level = 80
(the half of the default setting value 160%)

F_071 Stall Prevention Level at Constant Speed = 80
(the half of the default setting value 160%)

8-2 Fault Protection Display and Troubleshooting

a: Description:

The drive has well protection functions to protect drive and motor when faults occur. When the fault occurs, the drive trips by the protection functions and display fault message on keypad. After the fault is troubleshooted, reset the drive by pressing OFF/RESET of keypad or command the drive to reset through multi-function input terminals by an external reset signal

b: Protection and Troubleshooting List:

Error Trip Messages of Drive

Display	Description	Cause	Troubleshooting
(EEr) 	**EEPROM error**	●EEPROM data write fault. ●EEPROM component defected.	●Please reset all parameters to default value and restart the drive. ●Return the drive to repair, when the fault cannot be eliminated.
(AdEr) 	**A/D converter error**	— — —	Please call customer service for drive repair.
(SC) 	**Fuse open**	●Drive internal fuse open. ●IGBT power module damage.	Please call customer service for drive repair.
(SC1) 	**Short circuit protection**	The output terminals of drive are short.	Check wires of U/T1,V/T2,W/T3 terminals to verify if there is short between terminals.
(LE1) 	**Under voltage during operation** The internal DC bus voltage level is below 70%.	●Phase failure of input power. ●Instantaneous power off. ●Voltage variation of power source is too high. ●Motor with instant overload causing the high voltage drop.	Increase the power capacity by selecting higher capacity drive to avoid the voltage drop of the power cord.

Error Trip Messages of Drive

Display	Description	Cause	Troubleshooting
(OC) 	**Drive over current** The output current of drive during operation exceeds 220% of drive's rated current.	●The output terminals of drive are short. ●The load is too heavy. ●The acceleration time is too short. ●Drive starts at zero speed while the motor is still running in rotation condition. ●Wrong wiring or bad insulation. ●Starting voltage is too high. ●The motor terminal installs an advance-phase or filter capacitor.	●Check wires of U/T1,V/T2,W/T3 terminals to verify if there is short between terminals. ●Check the motor and drive compatibility. ●Check if the motor operated in over-rated condition. ●Check if the the acceleration time is too short.
(GF) 	**Grounding fault** ●The three-phase output current is unbalance and exceeding the detection level of grounding fault. ●Grounding fault protection: F_098	The output terminal of the drive is short or grounding.	Check the insulation value of motor and the shield of motor's wire.
(OE) 	**Over voltage** ●The internal DC bus voltage of drive is over the protection level. ●100V / 200V series: About DC410V. ●400V series: About DC820V.	●The deceleration time of motor is too short causing the regeneration voltage on DC bus too high. ●Power voltage is too high.	●Increase the "deceleration time" or use high torque braking and dynamic brake unit to reduce input voltage. ●Check if the power input is within drive's rated input range. ●Add AC reactor at power input terminal.

Error Trip Messages of Drive

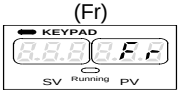
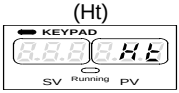
Display	Description	Cause	Troubleshooting
(OH) 	**Drive overheating** The temperature of drive's heat sink reaches the 105℃.	●The surrounding temperature is too high. ●The heat sink has foreign body. ●The cooling fan of drive is fault.	●Improve the system ventilation. ●Clean the foreign body on the heat sink. ●Return the drive to replace the cooling fan.
(OL) 	**Motor overload** Operation current exceeds 150% of motor's rated current and reaches the motor overload protection time.	●Motor is overloaded. ●The voltage setting of V/F pattern is too high or too low. ●The current setting of motor's rated current is invalid.	●Check the load of motor. ●Check if the acceleration or deceleration time is too short. ●Check if V/F setting is proper. ●Check if the rated current setting is valid.
(OL1) 	**Drive overload** Operation current exceeds 150% of drive's rated current for 1 minute.	●Motor overload. ●The voltage setting of V/F pattern is too high or too low. ●Drive capacity is too small.	●Check whether the motor is overloaded. ●Check the load of motor if overload. ●Check whether the acceleration or deceleration time is too short. ●Check if V/F setting is proper. ●Select the higher capacity of drive.
(OLO) 	**Syste9m overload** ●Load system is overload and the operation current reaches the active level. ●Detection level: F_068. ●Detection time: F_069.	— — —	Check the usage of mechanical equipment.

Error Trip Messages of Drive

Display	Description	Cause	Troubleshooting
(thr) 	**External fault**	The multi-function terminal receives the external fault signal.	Clear the external fault and then press OFF/RESET key.
(ntCF) 	**NTC thermistor sensor fault**	●NTC thermistor sensor broke down. ●The wiring connection of the NTC thermistor sensor is loose.	●Check whether the NTC thermistor sensor is normal. ●Check whether the wire of NTC thermistor sensor is normal.
(PAdF) 	**Keypad interruption during copy**	●The connecting wire of the keypad is loosen. ●The keypad jack of the drive is oxidized.	Check the connecting wire of keypad.
(no Fb) 	**PID feedback signal error**	The feedback signal wire is loosen/ tripped.	Check the feedback signal wire.
(OP) 	**Over pressure**	●The setting value of F148 is not appropriate. ●Pump oulet pressure is too high. ●The water valve shut down immediately. ●The pressure sensor is abnormal.	●Check whether the setting value of F148 is appropriate. ●Check whether the pressure of water pipe is normal. ●Check whether the pressure sensor is normal.
(Fb Lo) 	**Water shortage protection** ●Pressure level of water shortage F_119 ●Current level of water shortage F_120 ●Detection time of water shortage F_121	●Outflow is greater than inflow. ●Pump cannot suck up any water. ●The inlet of pump is blocked.	●Check whether the water usage is under the normal condition. ●Check whether the water storage tank is lack of water. ●Check whether the inlet is blocked .

Warning Messages of Drive

*When the drive displays below messages, drive stops output. If the abnormal condition is removed, the drive auto recovers the normal operation.

Display	Description	Cause	Troubleshooting
(LE) 	**Power source under voltage** The internal DC bus voltage level is below 70%.	The voltage of power source is too low.	Check if the voltage of power source is valid.
(bb) 	**Drive output interruption**	Drive stops the output when the output interruption command is activated.	Clear drive output interruption command.
(Fr) 	**Coast to stop**	Drive stops the output when the coast to stop command is activated.	Clear “coast to stop” command.
(db) 	**Dynamic brake over voltage** The internal DC bus voltage of drive is over the protection level.	DC bus voltage is too high .	Increase the “deceleration time” or use high torque braking method and add dynamic brake unit.
(PrEr) 	**Program fault**	— — —	Check the software version of drive.
(Ht) 	**Drive overheating** ●The temperature of drive’s heat sink reaches the warning level. ●Warning level: F_142.	●The surrounding temperature is too high. ●The heat sink has foreign body. ●The cooling fan of drive is fault.	●Improve the system ventilation. ●Clean the dust on the heat sink. ●Return the drive to replace the cooling fan.
(Err_00)  (Err_01) 	**Err_00: Keypad cable trip before connecting** **Err_01: Keypad cable trip during operation**	●The connecting wire of the keypad is loose. ●The keypad jack of the drive is oxidized.	Check the wire between the keypad and drive.

Display	Description	Cause	Troubleshooting
(dtF) 	**Direction command error**	Forward and reverse commands are inputted to the drive simultaneously	Check the direction command.
(Wr_F) 	**Different software version inter-copy**	The software version of drive is different.	Check up the software version.
(OP) 	**Over pressure** ●Over pressure level: F_148 ●Detect time of over pressure: F_149	●The setting value of F148 is not appropriate. ●Pump oulet pressure is too high. ●The water valve shut down immediately. ●The pressure sensor is abnormal.	●Check the settings of function (F_148~F149) ●Check the pressure of pump system and water pipes.
(CPyF) 	**Parameter copy fault**	● In the parallel control, the software version of auxiliary drive do not correspond with the host drive.	● The software version of auxiliary drives must be correspond with the host drive.

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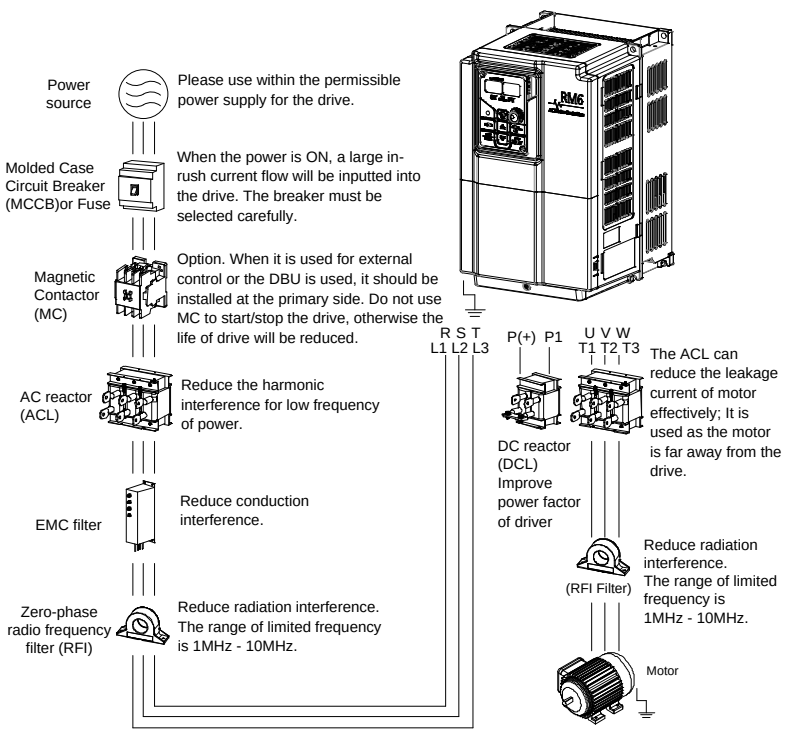
Appendix A Peripheral Equipment of Drive

CAUTION

1. When the drive requires the following equipment, please select the proper external equipment. The incorrect system setup will result the failure of drive, reduce the of drive's service life time, and even damage the drive.
2. The surrounding temperature will influence drive's service life time. Please monitor the temperature to avoid of exceeding the temperature specifications, especially as drive installed at a closed place. In addition, the control signal should be far away from main loop to avoid of the signal interference.
3. The motor and drive should be grounded well to avoid of electric shocks. Motor's grounding must connect to drive's grounding terminal.

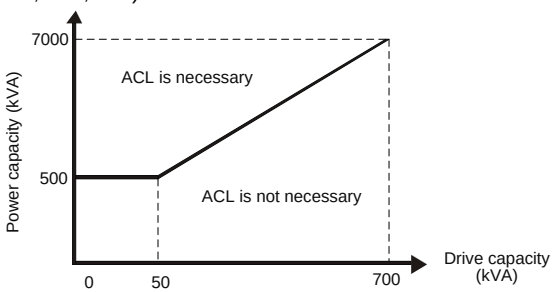


Appendix B Selection of AC Reactor(ACL)

⚠ CAUTION
Due to the AC reactor(ACL) or DC reactor(DCL) possibly produce the heat (about 100℃) in use, please Do NOT touch the reactor and caution the environment conditions.

a. Suppress the harmonic current of power and improve the power faction is the main function of the ACL and DCL. Connect the ACL at the power source input terminal of the drive also can suppress the surge voltage to protect the drive.

b. When the power capacity is over 500kVA or more than ten times of the rated capacity of the drive, adding the ACL (as below figure) is necessary. The input terminal (R/L1,S/L2,T/L3) of the drive must connect ACL.



c. When the heater (with the SCR), air compressor, high-frequency equipment, or welding machine is installed at the same power source site, the harmonic current will interfere the drive. Thus, add the ACL at the input terminal (R/L1,S/L2,T/L3) of the drive is required.

d. When multiple drives of high horse power are used, due to harmonic wave exerted, adding ACL at the input terminal (R/L1,S/L2,T/L3) of the drives is required to prevent the drives from the possible interference and power quality deterioration.

e. When the cable length between the drive and motor is over 30 meters or multiple motors are used in parallel, please add ACL at the output terminal of the drive.

f. Add the ACL at the input terminal(R/L1,S/L2,T/L3), the power factor is above 75%; Add ACL and DCL, the power factor is above 90%.(the specifications of ACL and DCL, please refer to page 149 ~150)

g. When horse power of drive is 100HP(included) or above, ACL is the standard equipment. When the drive is 175HP(included) or above, DCL is the standard equipment.

h. The connecting cable between the drive and DCL must be the same specifications with the cable of input terminal(R/L1,S/L2,T/L3).

i. For installation, in accordance with the motor capacity to select the suitable ACL to use and the specifications list are as below:

Appendix B Selection of AC Reactor(ACL)

AC Reactor (ACL) Specifications

Drive model number	Input (R/L1,S/L2, T/L3)		Output (U/T1,V/T2, W/T3)		Drive model number	Input (R/L1,S/L2, T/L3)		Output (U/T1,V/T2, W/T3)	
	(mH)	(A)	(mH)	(A)		(mH)	(A)	(mH)	(A)
RM6F5-2001	0.45	15	0.45	15	RM6F5-4001	0.45	15	0.45	15
RM6F5-2002	0.45	15	0.45	15	RM6F5-4002	0.45	15	0.45	15
RM6F5-2003	0.45	15	0.45	15	RM6F5-4003	0.45	15	0.45	15
RM6F5-2005	0.45	15	0.45	15	RM6F5-4005	0.45	15	0.45	15
RM6F5-2007	0.2	30	0.2	30	RM6F5-4007	0.45	15	0.45	15
RM6F5-2010	0.2	30	0.13	50	RM6F5-4010	0.2	30	0.2	30
RM6F5-2015	0.13	50	0.13	50	RM6F5-4015	0.2	30	0.2	30
RM6F5-2020	0.13	50	0.07	75	RM6F5-4020	0.2	30	0 .13	50
RM6F5-2025	0.07	75	0.05	100	RM6F5-4025	0.13	50	0.13	50
RM6F5-2030	0.05	100	0.05	100	RM6F5-4030	0.13	50	0.13	50
RM6F5-2040	0.05	100	0.035	150	RM6F5-4040	0.13	50	0.07	75
RM6F5-2050	0.035	150	0.025	200	RM6F5-4050	0.07	75	0.05	100
RM6F5-2060	0.025	200	0.025	200	RM6F5-4060	0.05	100	0.05	100
RM6F5-2075	0.025	200	0.015	300	RM6F5-4075	0.05	100	0.035	150
RM6F5-2100	0.015	300	0.013	400	RM6F5-4100	0.025	200	0.025	200
RM6F5-2125	0.013	400	0.013	400	RM6F5-4125	0.015	300	0.015	300
RM6F5-2150	0.01	600	0.01	600	RM6F5-4150	0.015	300	0.015	300
RM6F5-2200	0.006	800	0.006	800	RM6F5-4175	0.015	300	0.015	300
RM6F5-2250	0.006	800	0.005	1000	RM6F5-4200	0.015	300	0.013	400
-	-	-	-	-	RM6F5-4250	0.013	400	0.03	400
-	-	-	-	-	RM6F5-4300	0.013	400	0.01	600
-	-	-	-	-	RM6F5-4350	0.01	600	0.01	600
-	-	-	-	-	RM6F5-4420	0.01	600	0.006	800
-	-	-	-	-	RM6F5-4500	0.006	800	0.006	800
-	-	-	-	-	RM6F5-4600	0.006	800	0.005	1000
					RM6F5-4700	0.005	1000	0.005	1000

DC Reactor (DCL) Specifications

Drive model number	200V Series		Drive model number	400V Series	
	(mH)	(A)		(mH)	(A)
RM6F5-2007	1.2	30	RM6F5-4007	1.5	20
RM6F5-2010	1.2	30	RM6F5-4010	1.5	20
RM6F5-2015	0.9	50	RM6F5-4015	1.2	30
RM6F5-2020	0.5	75	RM6F5-4020	1.2	30
RM6F5-2025	0.5	75	RM6F5-4025	0.9	50
RM6F5-2030	0.4	100	RM6F5-4030	0.9	50
RM6F5-2040	0.4	100	RM6F5-4040	0.9	50
RM6F5-2050	0.25	150	RM6F5-4050	0.5	75
RM6F5-2060	0.2	200	RM6F5-4060	0.4	100
RM6F5-2075	0.2	200	RM6F5-4075	0.4	100
RM6F5-2100	0.15	300	RM6F5-4100	0.25	150
RM6F5-2125	0.177	400	RM6F5-4125	0.2	200
RM6F5-2150	0.126	600	RM6F5-4150	0.2	200
RM6F5-2200	0.126	600	RM6F5-4175	0.15	300
RM6F5-2250	0.09	800	RM6F5-4200	0.15	300
-	-	-	RM6F5-4250	0.177	400
-	-	-	RM6F5-4300	0.177	400
-	-	-	RM6F5-4350	0.126	600
-	-	-	RM6F5-4420	0.126	600
-	-	-	RM6F5-4500	0.09	800
-	-	-	RM6F5-4600	0.09	800
			RM6F5-4700	0.07	1000

Outline dimensions of AC reactor (ACL)

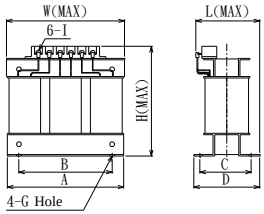


Figure A

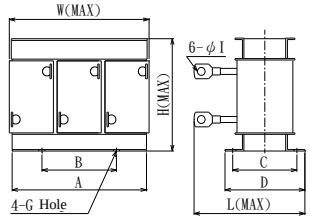


Figure B

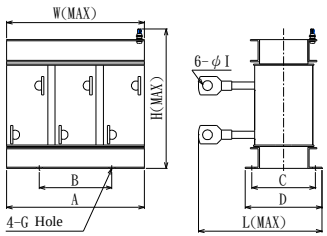


Figure C

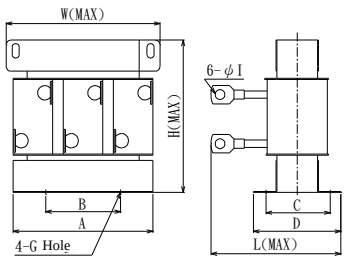


Figure D

Specifications of AC reactor (ACL)

Capacity	Figure	A	B	C	D	W (MAX)	L (MAX)	H (MAX)	G	I	Weight (kg)
0.4mH/15A	A	150	80	66	85	152	97	146	16×8	M4	4.0
0.2mH/30A	B	150	80	66	85	152	127	130	16×8	6	4.2
0.13mH/50A	B	150	80	68	85	152	134	131	16×8	6	4.6
0.07mH/75A	B	150	80	68	85	151	134	131	16×8	6	4.8
0.05mH/100A	B	180	100	77	97	182	145	149	16×8	8	8.0
0.035mH/150A	B	180	100	77	97	182	148	149	16×8	8	8.6
0.025mH/200A	B	180	100	90	107	182	165	153	16×8	8	9.8
0.015mH//300A	C	190	120	104	130	225	220	210	25×14	12	19
0.013mH//400A	C	230	120	104	130	230	240	200	22×10	12	20.2
0.01mH//600A	C	280	140	120	135	280	270	235	22×10	16	29.3
0.006mH/800A	D	300	150	140	174	300	300	305	25×13	15	65
0.005mH/1000A	D	350	160	145	184	350	290	320	25×13	14	84.6

(unit: mm)

Outline dimensions of DC reactor (DCL)

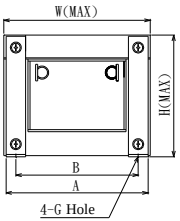


Figure A

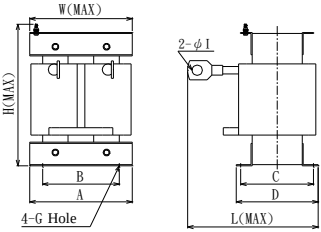


Figure B

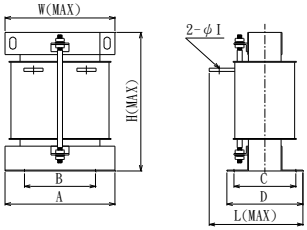


Figure C

Specifications of DC reactor (DCL)

Capacity	Figure	A	B	C	D	W (MAX)	L (MAX)	H (MAX)	G	I	Weight (kg)
1.5mH/20A	A	96	80	81	98	96	120	85	11×5	5	3.0
1.2mH/30A	A	114	95	89	110	114	150	100	13×6	6	4.4
0.9mH/50A	A	134	111	87	107	134	160	115	14×6	6	6.5
0.5mH/75A	A	134	111	87	107	134	160	115	14×6	6	6.8
0.4mH/100A	A	162	135	102	133	162	180	140	17×8	8	12.5
0.25mH/150A	A	162	135	114	145	162	188	140	17×8	8	13.8
0.2mH/200A	A	162	135	122	153	162	200	139	17×8	8	15.5
0.15mH/300A	B	160	120	123	140	190	225	230	21×10	12	19
0.177mH/400A	B	200	150	160	170	200	280	270	22×13	12	34.7
0.126mH/600A	C	240	182	175	194	240	320	315	20×13	14	60.5
0.09mH/800A	C	250	150	150	190	250	290	385	25×13	15	72
0.07mH/1000A	C	270	160	155	200	270	310	400	25×13	15	86

(unit: mm)

Appendix C Selection of EMC Filter

ElectroMagnetic Interference(EMI) is a major bother of drive. Drive will generate high-frequency / low-frequency noise to interfere the peripheral equipment by radiation or conduction during running. In many countries especially in Europe have the strict limit for the AC motor drive generated the electromagnetic interference. By installing the EMC filter can reduce much electromagnetic(conduction) interference from drive.

⚠ CAUTION

(1) Keep all grounding connections as short as physically possible.
(2) Use the largest area as grounding conductor, for example the cabinet wall.
(3) The filter must be mounted on the same panel as the drive.

Recommending specification of EMC filter

Select an EMC filter in accordance with the model number of drive to suppress drive's electromagnetic(conduction) interference.

200V Series

Drive model number	EMC filter model number	EMC filter rated current / phase
RM6F5-2001	FN3270H-10-44	10A / 3Ψ
RM6F5-2002	FN3270H-10-44	10A / 3Ψ
RM6F5-2003	FN3270H-20-44	20A / 3Ψ
RM6F5-2005	FN3270H-20-44	20A / 3Ψ
RM6F5-2007	FN3270H-35-33	35A / 3Ψ
RM6F5-2010	FN3270H-35-33	35A / 3Ψ
RM6F5-2015	FN3270H-50-34	50A / 3Ψ
RM6F5-2020	FN3270H-65-34	65A / 3Ψ
RM6F5-2025	FN3270H-80-35	80A / 3Ψ
RM6F5-2030	FN3270H-100-35	100A / 3Ψ
RM6F5-2040	FN3270H-150-99	150A / 3Ψ
RM6F5-2050	FN3270H-200-99	200A / 3Ψ
RM6F5-2060	FN3270H-200-99	200A / 3Ψ
RM6F5-2075	FN3270H-250-99	250A / 3Ψ
RM6F5-2100	FN3270H-320-99	320A / 3Ψ
RM6F5-2125	FN3270H-400-99	400A / 3Ψ
RM6F5-2150	FN3270H-600-99	600A / 3Ψ
RM6F5-2200	FN3270H-800-99	800A / 3Ψ
RM6F5-2250	FN3270H-800-99	800A / 3Ψ

400V Series

Drive model number	EMC filter model number	EMC filter rated current / phase
RM6F5-4001	FN3270H-10-44	10A / 3Ψ
RM6F5-4002	FN3270H-10-44	10A / 3Ψ
RM6F5-4003	FN3270H-10-44	10A / 3Ψ
RM6F5-4005	FN3270H-10-44	10A / 3Ψ
RM6F5-4007	FN3270H-20-44	20A / 3Ψ
RM6F5-4010	FN3270H-20-44	20A / 3Ψ
RM6F5-4015	FN3270H-35-33	35A / 3Ψ
RM6F5-4020	FN3270H-35-33	35A / 3Ψ
RM6F5-4025	FN3270H-50-34	50A / 3Ψ
RM6F5-4030	FN3270H-50-34	50A / 3Ψ
RM6F5-4040	FN3270H-65-34	65A / 3Ψ
RM6F5-4050	FN3270H-80-35	80A / 3Ψ
RM6F5-4060	FN3270H-100-35	100A / 3Ψ
RM6F5-4075	FN3270H-150-99	150A / 3Ψ
RM6F5-4100	FN3270H-200-99	200A / 3Ψ
RM6F5-4125	FN3270H-200-99	200A / 3Ψ
RM6F5-4150	FN3270H-250-99	250A / 3Ψ
RM6F5-4175	FN3270H-320-99	320A / 3Ψ
RM6F5-4200	FN3270H-320-99	320A / 3Ψ
RM6F5-4250	FN3270H-400-99	400A / 3Ψ
RM6F5-4300	FN3270H-600-99	600A / 3Ψ
RM6F5-4350	FN3270H-600-99	600A / 3Ψ
RM6F5-4420	FN3270H-800-99	800A / 3Ψ
RM6F5-4500	FN3270H-800-99	800A / 3Ψ
RM6F5-4600	FN3270H-1000-99	1000A / 3Ψ
RM6F5-4700	FN3270H-1000-99	1000A / 3Ψ

Note:
1. The leakage current of FN2090 series approximately 0.5mA ~ 1.02mA
2. The leakage current of FN3270 series approximately 26.4mA ~ 59.5mA

Appendix D Zero-Phase Radio Frequency Filter Selection

Please read this manual carefully to understand the correct and safety operations before using the product to prevent possible personnel injuries caused by false operations.

⚠ CAUTION
(1) Do Not touch zero-phase radio frequency filter to prevent the scald burn from the extreme high temperature when power is on, just off, or during the operation. (2) While lift up product, please note the weight of product and move it with proper method to avoid possible injuries.(Please be more cautions to the sharp parts). (3) Wiring or inspection must be done by qualified professional technicians.

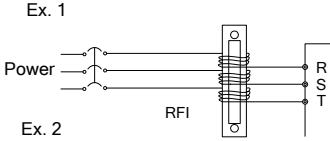
By installing the RFI filter(s), it can reduce the radio frequency interference generated by drive.
Because the RFI filter is constructed by ferrite core, it is not related to the capacity and voltage of drive.

1. Specification of product:

	Applied Model	RM6E1
Environmental Condition	Use Place	(1) Clean place without high temperature, high humidity, and flammable gases. (2) If the zero-phase radio frequency filter is installed inside the power distribution panel, the around temperature should not exceed the range(-10~ +50℃). (3) The heat will be generated in the zero-phase radio frequency filter, so the space should be reserved for heat dissipation.
	Ambient Temperature	-10 ~ +40℃(no condensation)
	Ambient Humidity	90%RH(no dew)
	Ambient Gas	No corrosive gas, and no flammable gas
	Vibration	5.9m/ sec^2(0.6G) below

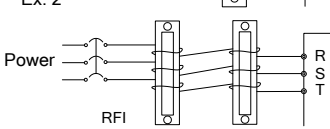
2. Wiring for RFI: Connect the RFI filter in accordance with the following wiring diagram.
(1) Install the RFI filter at the power source site of the drive

Ex. 1



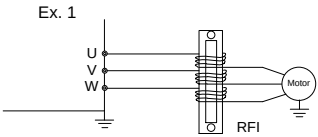
Pass all 3-phase power cords through RFI filter in same direction with same coil number, and then connect to the power input terminal of the drive. Caution: Do Not exceed 4 coils to prevent overheat of RFI filter.

Ex. 2

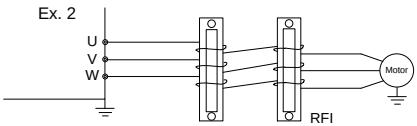


(Note)
Either the ground wire or the four-core cable with ground wire cannot pass through RFI filter; otherwise the filtration effect will be reduced.

(2) Install the RFI filter at the output site of the drive

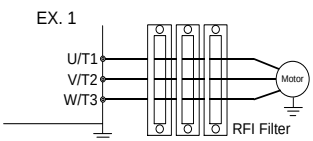


Pass all 3-phase power cords through RFI filter in same direction with same coil number, and then connect to motor terminals of the drive. Caution: Do Not exceed 4 coils to prevent overheat of RFI filter.



(Note)
Either the ground wire or the four-core cable with ground wire cannot pass through RFI filter; otherwise the filtration will be reduced.

(3) If the power cords are too thick to be winded, pass the power cords through RFI filter directly, and connect two or more RFI in series.



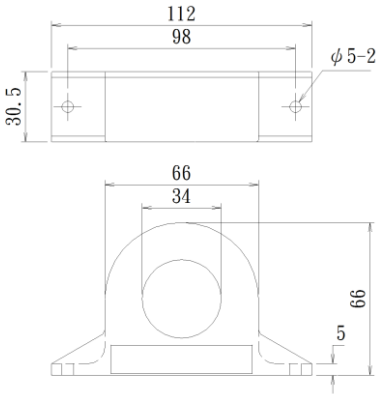
Pass all 3-phase power cords through RFI filter in same direction with same coil number, and then connect to motor terminals of the drive.

(Note)
Either the ground wire or the four-core cable with ground wire cannot pass through RFI filter; otherwise the filtration will be reduced.

3. Recommend to use power cords as many as possible of coil number. If the RFI filter is overheated, please reduce the coil number to reduce temperature.

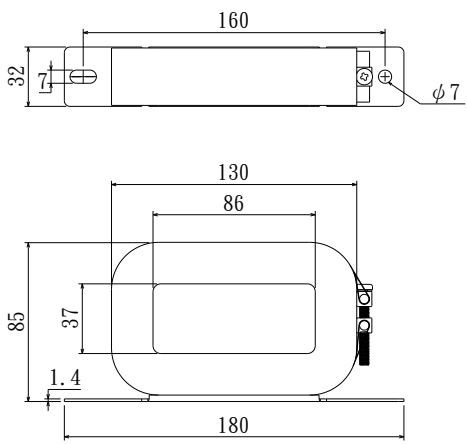
Wire Size (mm²)	Coil Number of 3-Phase Wire	Selected Model
2 / 3.5	4	RFI-01
5.5	3	
8 / 14	2	
22	1	
22 / 38	4	RFI-02
50/60	2	
80 / 100 / 125 / 150	1	
50/60	3	RFI-03
80 / 100 / 125 / 150	2	
200	1	
50 / 60	4	RFI-04
80 / 100	3	
125 / 150	2	
200	2	
250	1	

4. Outline dimensions of RFI-01:



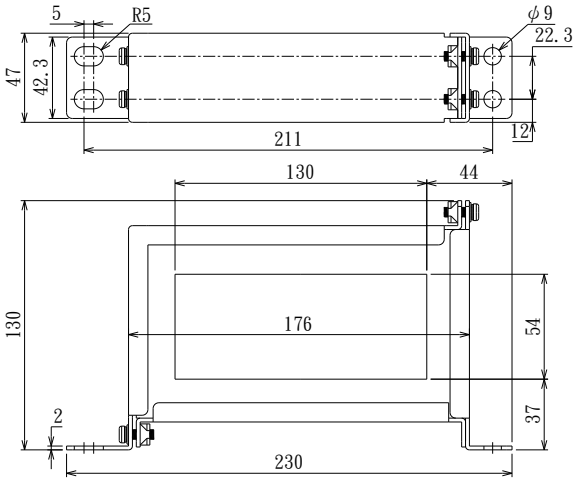
(unit: mm)

5. Outline dimensions of RFI-02



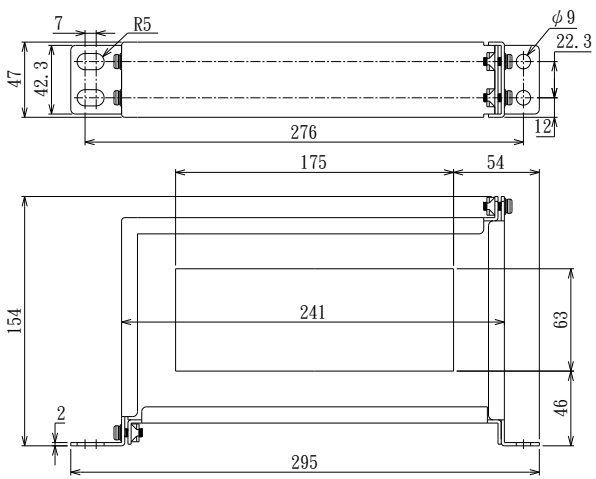
(unit: mm)

6. Outline dimensions of RFI-03



(unit: mm)

7. Outline dimensions of RFI-04



(unit: mm)

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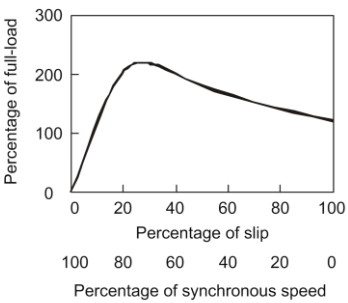
Appendix E Selection of Motor

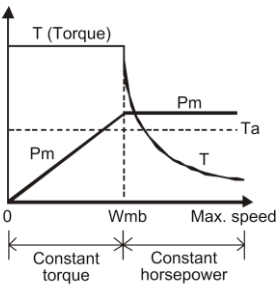
a. Standard Motor

a. Must be used the 3-phase induction motor as load.

b. Motor cannot run at the low-speed operation for a long time because the cooling fan speed can be decreased as well as the motor temperature can be increased. For the long-time and low-speed operation, use the variable-frequency motor with the independent cooling fan.

c. Standard 3-phase induction motor (NEMA B) characteristics as follows:



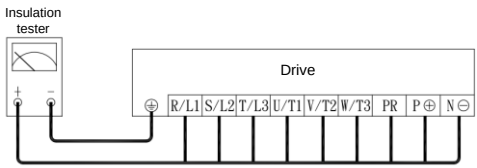


d. When the motor speed exceeds the rated speed(50/60HZ), the torque will be decreased while the motor speed increasing.

e. Check the motor insulation. The standard requirement is 500V (or 1000V) / 100MΩ above.

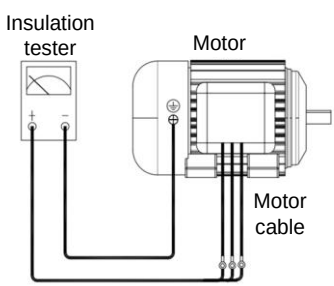
b.Insulation Measurement of Drive and Motor

1. Measure the drive insulation impedance
   a. Please extremely cautious the following steps to test the main circuit insulation of drive. Any incaution operations while testing the drive insulation may possibly harm operating personnel and cause serious damages to drive.
   b. Remove all wiring at power terminal (main circuit) and control circuit terminal before the testing is performed. Please follow the below diagram to wire all power terminals in parallel with an insulation tester for drive insulation test.
   c. Using an insulation tester with DC500V to test the insulation value of drive. The drive insulation impedance must be greater than 20MΩ. If drive insulation impedance is below 20MΩ, replace a drive and contact the customer support for repair service of drive.



Drive Insulation Impedance Measurement

2. Measure the motor insulation impedance
   a. Remove the U/T1, V/T2, W/T3 cables of motor from the drive before measuring the motor insulation impedance, and then measure the motor insulation impedance (including motor cables) using the insulation tester with DC500V. The motor insulation impedance (including motor cables) must be greater than 20MΩ.
   b. If motor insulation impedance is less than 20MΩ, Do Not connect motor with a drive or the drive lifetime may be shorten or the drive may be possibly damaged due to insufficient motor insulation.
   c. Please follow the below connection diagram for motor insulation test. Motor cables must be connected in parallel to the insulation tester with DC500V to test the insulation, and the motor insulation impedance must be greater than 20MΩ to connect the drive.



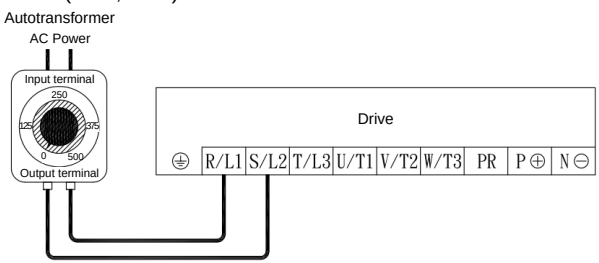
Motor Insulation Impedance Measurement (Including Motor Cables)

Appendix F Instruction of Drive Charging

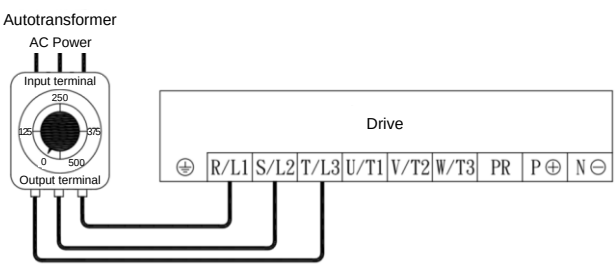
Caution: If the drive is unused or stored in the storage over 1 year, the surface of aluminum foil of electrolytic capacitor within the drive will be oxidized and cracked causing the L and C value up. This is the common characteristics of capacitor. Therefore, with directly applying the voltage and high current to drive after the drive is placed for a long time, the drive may be damaged due to the oxide film cracked.

A. If the drive is stored or non-used (no power ON) over 1 year, it is necessary to charge the drive by autotransformer for 30 minutes from 0 volt to the half of drive's rated voltage and then to apply drive rated voltage to charge the drive for another 30 minutes.

B. When charging the internal capacitor of drive, the wiring between autotransformer and terminals (R/L1, S/L2) of drive is shown as below:



Connection diagram between autotransformer and drive (single-phase series drive)



Connection diagram between autotransformer and drive (Three-phase series drive)

Note: If the drive is already applied with drive rated voltage and doesn't display  , on the display of the keypad, please contact the customer service for repair service.

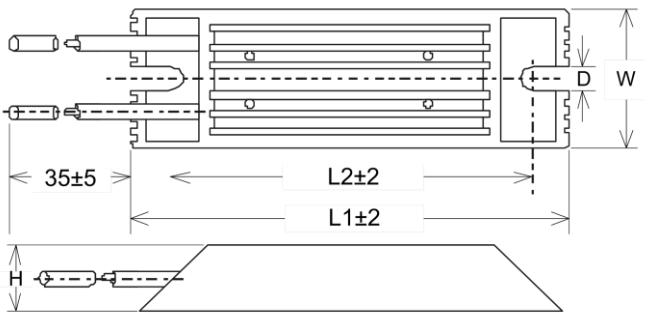
Appendix G Dynamic Brake Unit and Braking Resistor

a. Braking transistor is installed in the following models

RM6-2001B3 ~ RM6-2040B3;
RM6-4001B3 ~ RM6-4060B3

b. Outline of braking resistor (option)

Aluminum Case Resistor



c. Rated specification of braking resistor

Model number	Specification	Dimensions (mm)					Max. weight (g)
		L1	L2	W	H	D	
MHL100-100	100W/100Ω	165	150	40	20	5.3	200
MHL100-400	100W/400Ω	165	150	40	20	5.3	200
MHL500-40	500W/40Ω	335	320	60	30	5.3	1100

※Notes:

1. When the braking is frequently applied, please increase the resistor wattage and add the cooling fan to prevent the resistor from overheating.
2. Aluminum case resistors have the better thermal performance. Please select 1.2 times rated power resistor by using general wirewound type resistor.
3. Please use the heat-resistant wire for the brake resistor wiring.

⚠ **DANGER**
When the dynamic brake unit is fault, the braking transistor maybe turn on for full cycle. Add the thermal protection device to cut off the power at high temperature to avoid the drive burnout (refer to the section f of Appendix D for wiring of braking resistor).

d. Recommending specification of braking resistor

AC 200V Series

Model number of drive	Braking resistor specification		Approximate braking torque (10%ED)
	Minimum specification	Recommending combination	
RM6F5-2001	100Ω/100W	MHL100-100*1	170
RM6F5-2002			105
RM6F5-2003	100Ω/500W	MHL500-40*1	75
RM6F5-2005	40Ω/500W		120
RM6F5-2007	20Ω/1000W	MHL500-40*2 (2pcs in parallel)	145
RM6F5-2010			115
RM6F5-2015			85
RM6F5-2020	13.3Ω/1500W	MHL500-40*3 (3pcs in parallel)	95
RM6F5-2025	10Ω/2000W	MHL500-40*4 (4pcs in parallel)	100
RM6F5-2030	8Ω/2500W	MHL500-40*5 (5pcs in parallel)	100
RM6F5-2040	6.6Ω/3000W	MHL500-40*6 (6pcs in parallel)	100

AC 400V Series

Model number of drive	Braking resistor specification		Approximate braking torque (10%ED)
	Minimum specification	Recommending combination	
RM6F5-4001	400Ω/100W	MHL100-400*1	145
RM6F5-4002	400Ω/200W	MHL100-400*2 (2pcs in parallel)	105
RM6F5-4003	200Ω/300W	MHL100-400*2 (2pcs in parallel)	150
RM6F5-4005	133.3Ω/300W	MHL100-400*3 (3pcs in parallel)	135
RM6F5-4007	100Ω/400W	MHL100-400*4 (4pcs in parallel)	130
RM6F5-4010	80Ω/1000W	MHL500-40*2 (2 sets in series)	105
RM6F5-4015			80
RM6F5-4020	40Ω/2000W	MHL500-40*4 (2pcs in parallel, 2 sets in series)	120
RM6F5-4025			100
RM6F5-4030	27Ω/3000W	MHL500-40*6 (3pcs in parallel, 2 sets in series)	120
RM6F5-4040	20Ω/4000W	MHL500-40*8 (4pcs in parallel, 2 sets in series)	130
RM6F5-4050			100
RM6F5-4060	13.3Ω/6000W	MHL500-40*12 (6pcs in parallel, 2 sets in series)	125

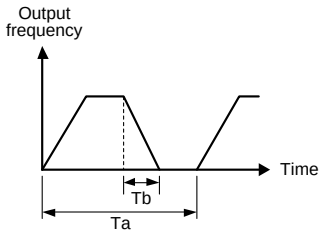
e. Recommending specification of dynamic brake unit (DBU) and braking resistor

AC 200V Series

Drive	DBU specification		Braking resistor specification		Approximate braking torque (10%ED)
Model number	Model (DBU6-)	Unit (set)	Recommending combination	Unit (set)	
RM6F5-2125	L400	1	MHL500-40*18 (9000W / 2.2Ω; 18pcs in parallel)	1	95
RM6F5-2150	L400	1	MHL500-40*22 (11000W / 1.82Ω; 22pcs in parallel)	1	100
RM6F5-2200	L400	2	MHL500-40*26 (9000W / 2.2Ω; 18pcs in parallel)	2	110
RM6F5-2250	L400	2	MHL500-40*22 (11000W / 1.82Ω; 22pcs in parallel)	2	115

AC 400V Series

Drive	DBU specification		Braking resistor specification		Approximate braking torque (10%ED)
Model number	Model (DBU6-)	Unit (set)	Recommending combination	Unit (set)	
RM6F5-4125	H200	1	MHL500-40*24 (12000W / 6.6Ω; 12pcs in parallel, 2 sets in series)	1	125
RM6F5-4150					105
RM6F5-4175	H300	1	MHL500-40*36 (18000W / 4.4Ω; 18pcs in parallel, 2 sets in series)	1	130
RM6F5-4200					105
RM6F5-4250	H400	1	MHL500-40*48 (24000W / 3.3Ω; 24pcs in parallel, 2 sets in series)	1	115
RM6F5-4300					105
RM6F5-4350	H300	2	MHL500-40*36 (18000W / 4.4Ω; 18pcs in parallel, 2 sets in series)	2	135
RM6F5-4420	H300	2	MHL500-40*40 (20000W / 4Ω; 20pcs in parallel, 2 sets in series)	2	140
RM6F5-4500	H400	2	MHL500-40*44 (22000W / 3.63Ω; 22pcs in parallel, 2 sets in series)	2	115
RM6F5-4600	H400	2	MHL500-40*52 (26000W / 3.08Ω; 26pcs in parallel, 2 sets in series)	2	110
RM6F5-4700	H400	3	MHL500-40*44 (22000W / 3.63Ω; 22pcs in parallel, 2 sets in series)	3	125



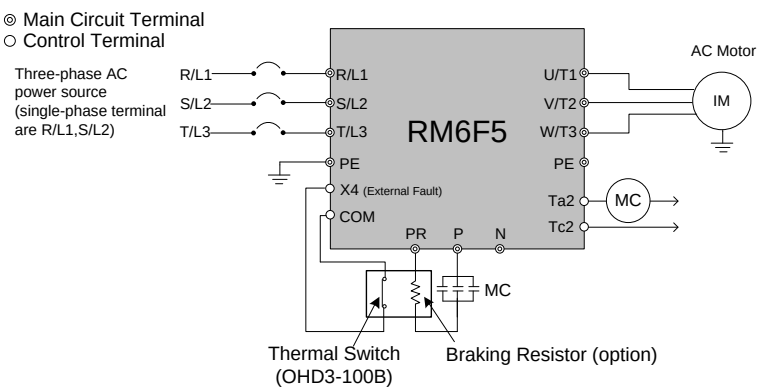
Note:

1. %ED (Effective Duty Cycle) = Tb/Ta*100% (continuous operation time Tb<15 sec).The definition is shown as above figure.
2. Above wattages of table is defined at 10%ED.
3. 200V series drive or DBU braking activation voltage is DC 395V
4. 400V series drive or DBU braking activation voltage is DC 790V

f. Wiring Diagram of External Braking Resistor and Thermal Switch

⚠ CAUTION
Strongly recommend to Install the thermal switch for the brake protection to prevent the brake from any possible damages caused by the overheating on the braking resistor. Please refer to the figure 1 and 2 as following for the wiring diagram.

1.) Wiring diagram a



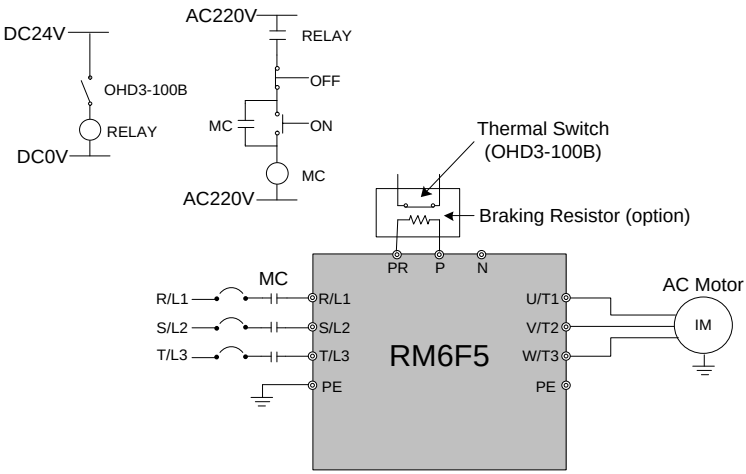
(Figure 1)

(1) Use the thermal switch to protect the temperature of braking resistor and generate an external fault signal to the multi-function terminal (X4) to stop the drive when the braking resistor is overheating and interrupt the connection of magnet contactor (MC) by output terminals Ta2 / Tc2.

(2) Set the multi-function terminal (X4) to “-7” (External fault).

(3) Set the multi-function terminal (Ta2 / Tc2) to “-11” (Error detection).

2.) Wiring diagram b



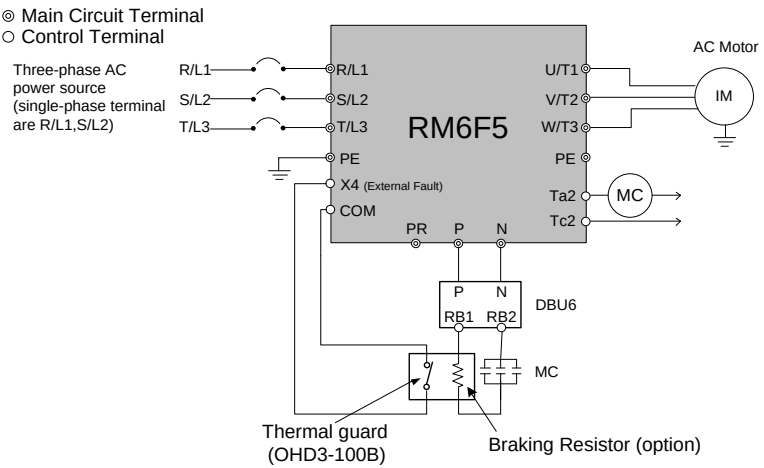
(Figure 2)

When the drive power is controlled by the magnet contactor (MC), use the thermal switch to control magnet contactor (MC). When the braking resistor is overheating, the contactor (MC) is disconnected.

g. Wiring Diagram of External Dynamic Brake Unit(DBU6) and Thermal Switch

⚠ CAUTION
Strongly recommend to Install the thermal switch for the brake protection to prevent the brake from any possible damages caused by the overheating on the braking resistor. Please refer to the figure 1 and 2 as following for the wiring diagram.

1.) Wiring diagram a



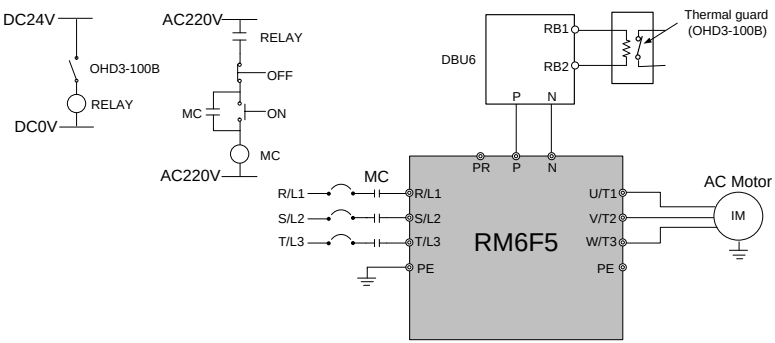
(Figure 1)

(1) Use the thermal switch to protect the temperature of braking resistor and generate an external fault signal to the multi-function terminal (X4) to stop the drive when the braking resistor is overheating and interrupt the connection of magnet contactor (MC) by output terminals Ta2 / Tc2.

(2) Set the multi-function terminals (X4) to “-7” (External fault).

(3) Set the multi-function terminals (Ta2 / Tc2) to “-11” (Error detection).

2.) Wiring diagram b



(Figure 2)

When the drive power is controlled by the magnet contactor (MC), use the thermal switch to control magnet contactor (MC). When the braking resistor is overheating, the contactor (MC) is disconnected.

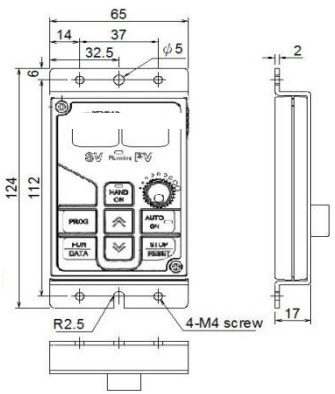
Appendix H Instruction of Remote Controller and External Display

a. Remote controller: KP-605

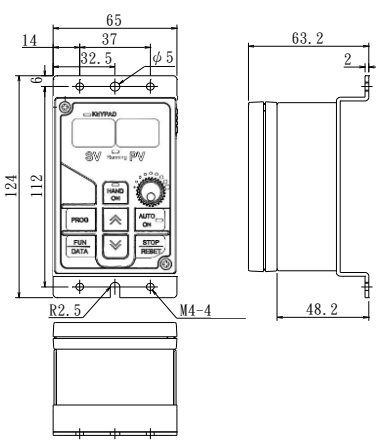
Two types of the remote controller: Internal panel type and external panel type:

1. Dimension of internal panel type (consist of A-01, KP-605

(unit: mm)



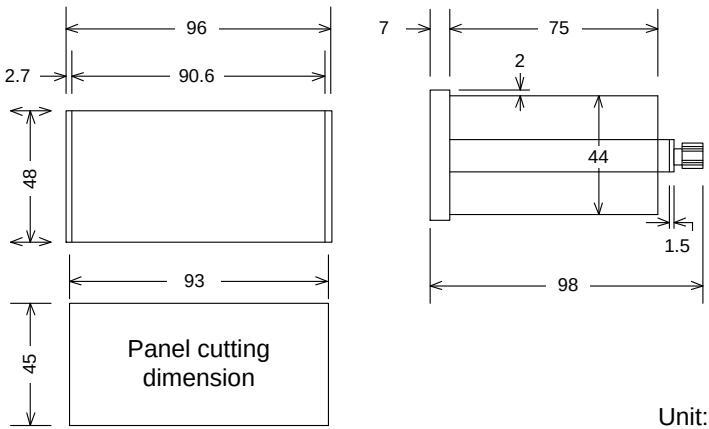
2. Dimension of external panel type (consist of A-01, A-02, KP-605)



(Unit: mm)

b. External display: DM-501

1. Outline dimensions



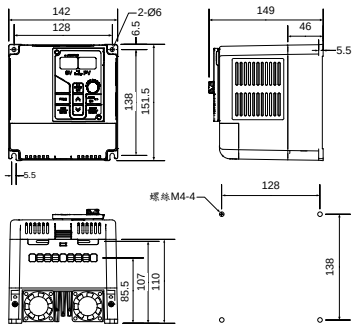
Unit:mm

2. Appearance of display panel

3. The standard length of 2.54/5P wires is 1.5 m and 3 m respectively. Do not exceed this length.

Appendix I Outline Dimension Drawing of Drives

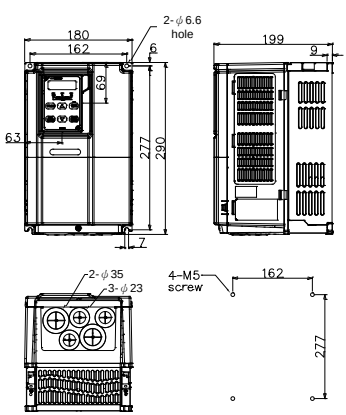
Model Number: RM6F5-2001 ~ RM6F5-2005;
RM6F5-4001 ~ RM6F5-4007



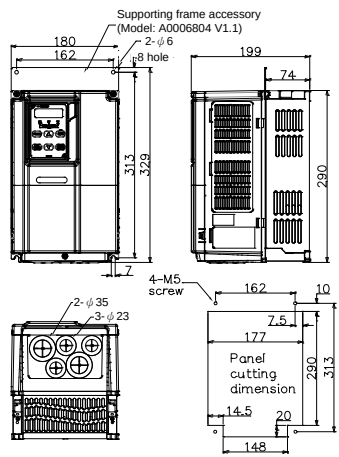
(unit: mm)

Model Number: RM6F5-2007 ~ RM6F5-2020;
RM6F5-4010 ~ RM6F5-4030

Internal cooling type



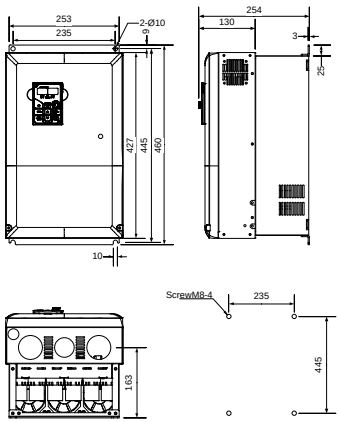
External cooling type



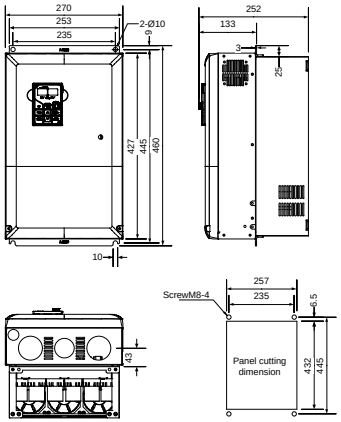
(unit: mm)

Model Number: RM6F5-2025 ~ RM6F5-2050;
RM6F5-4040 ~ RM6F5-4075

Internal cooling type



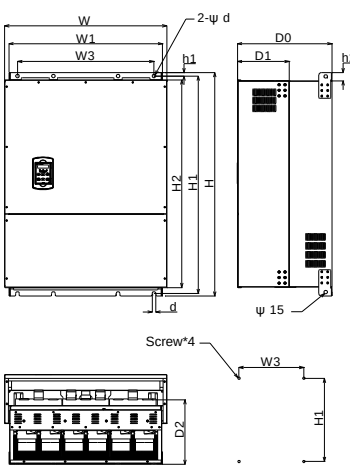
External cooling type



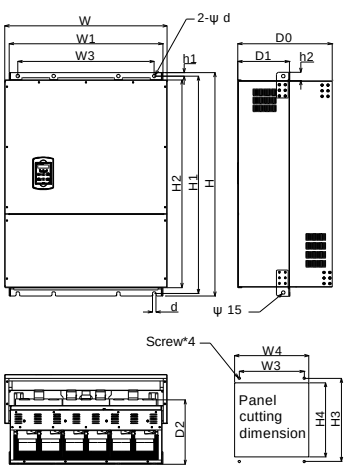
(unit: mm)

Model Number: RM6F5-2060 ~ RM6F5-2250;
RM6F5-4100 ~ RM6F5-4700

Internal cooling type



External cooling type



*Refer to below table for outline dimension

(unit: mm)

RM6F5 series 200V Series

Mounting hole (mm)	Model number	Dimension (mm)																			Mounting hole (mm)
		W	W1	W3	W4	H	H1	H2	H3	H4	h1	h2	h3	D0	D1	D2	d	d1	Ref.		
M8	RM6F5-2060B3 RM6F5-2075B3 RM6F5-2100B3	386	361	275	365	584	562	539	564	545	11	25	10	325	170	242	10	3	Refer to P.110 figure		M8
M10	RM6F5-2125B3	446	418	275	427	685	660	630	662	634	14	30	12	334	172	246	12	3			M10
M12	RM6F5-2150B3	508	479	275	487	818	785	751	788	758	19	35	12	366	183	257	15	3			M12
	RM6F5-2200B3 RM6F5-2250B3	696	654	580	657	1000	974	929	978	936	15	39	18	405	224	294	15	3			

Model number	Dimension (mm)																		
	W	W1	W3	W4	H	H1	H2	H3	H4	h1	h2	h3	D0	D1	D2	d	d1	Ref.
RM6F5-4100B3 RM6F5-4125B3 RM6F5-4150B3	386	361	275	365	584	562	539	564	545	11	25	10	325	170	242	10	3	Refer to P.110 figure
RM6F5-4175B3	446	418	275	427	685	660	630	662	634	14	30	12	334	172	246	12	3	
RM6F5-4200B3 RM6F5-4250B3 RM6F5-4300B3	508	479	275	487	818	785	751	788	758	19	35	12	366	183	257	15	3	
RM6F5-4350B3 RM6F5-4420B3	696	654	580	657	1000	974	929	978	936	15	39	18	405	224	294	15	3	
RM6F5-4500B3 RM6F5-4600B3 RM6F5-4700B3	992	954	710	958	1030	1003	963	1007	968	15	39	19	419	235	308	15	3	

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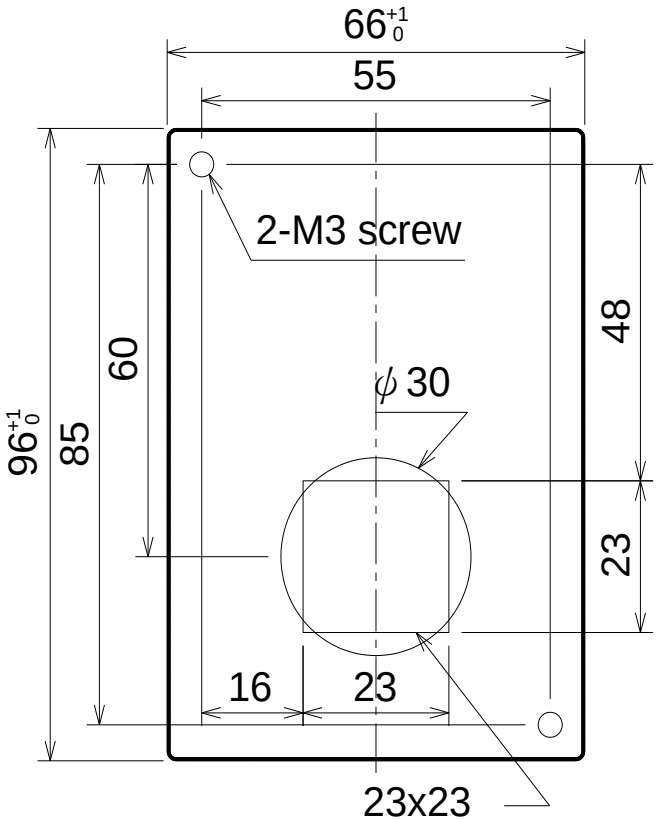
Attachment 1 Dimension of Keypad (KP-605)



Scale: 1:1
Unit: mm

Attachment 2 Default Value List

Func.	Name	dEF 60	dEF 50	dEF 52	dEF 53	dEF 57
F_000	Drive Information	–	–	–	–	–
F_001	Start Command Selection	3	3	3	3	3
F_002	Frequency Command Selection	1	2	2	2	2
F_003	Selection of “STOP” Key Validity	1	1	1	1	1
F_004	Setting Value (SV) Selection	1	1	1	1	1
F_005	Auto-Storing of Setting Value Selection	1	1	1	1	1
F_006	Selection of Main Display	1	7	7	7	7
F_007	Pressure Transducer Setting	10.0	10.0	10.0	10.0	10.0
F_008	Maximum Allowabel Operating Pressure	100	100	100	100	100
F_009	Starting Frequency	0.5	0.5	0.5	0.5	0.5
F_010	Starting Voltage	8.0	8.0	8.0	8.0	8.0
F_011	Base Frequency	60.0	60.0	60.0	50.0	60.0
F_012	Base Voltage	220.0	220.0	220.0	220.0	220.0
F_013	Selection of Pump Shift Operation (Parallel control)	3	3	3	3	3
F_015	Control Mode Selection (Parallel control)	0	1	2	1	5
F_016	Set Drive’s No. for Parallel Control	0	0	0	0	0
F_017	Maximum Output Frequency	60.0	60.0	60.0	50.0	60.0
F_018	Reference Frequency of Accel/Decel Time	60.00	60.00	60.0	50.00	60.00
F_019	Primary Acceleration Time	5.0	3.0	3.0	3.0	1.0
F_020	Primary Deceleration Time	5.0	3.0	3.0	3.0	1.0
F_021	Launch Detection Time (Parallel Control)	6.0	6.0	6.0	6.0	6.0
F_022	Launch Detection Level (Parallel Control)	0.4	0.4	0.4	0.4	0.4
F_023	Cut-off Frequency (Parallel Control)	50.0	50.0	50.0	42.0	50.0

Func.	Name	dEF 60	dEF 50	dEF 52	dEF 53	dEF 57
F_024	Pump Auto Shift Time (Parallel Control)	24	24	24	24	24
F_025	Cut-off Time (Parallel Control)	10.0	10.0	10.0	10.0	10.0
F_026	Communi-cation Baud Rate (Parallel Control)	1	1	1	1	1
F_027	Secondary Acceleration Time	0.5	0.5	0.5	0.5	0.5
F_028	Secondary Deceleration Time	0.5	0.5	0.5	0.5	0.5
F_029	Set S-curve for Accel/Decel Time	0.0	0.0	0.0	0.0	0.0
F_030	V/F Pattern Selection	0	1	1	1	1
F_031	Primary Speed	60.00	0.00	0.00	0.00	0.00
F_032	Preset Speed 1	20.00	20.00	20.00	20.00	20.00
F_033	Preset Speed 2	25.00	25.00	25.00	25.00	25.00
F_034	Preset Speed 3	30.00	30.00	30.00	30.00	30.00
F_035	Preset Speed 4	45.00	45.00	45.00	45.00	45.00
F_036	Preset Speed 5	50.00	50.00	50.00	50.00	50.00
F_037	Preset Speed 6	55.00	55.00	55.00	55.00	55.00
F_038	Preset Speed 7	60.00	60.00	60.00	50.00	60.00
F_039	Jog Speed	7.00	7.00	7.00	7.00	7.00
F_040	Vin Gain	1.00	1.00	1.00	1.00	1.00
F_041	Vin Bias	0.00	0.00	0.00	0.00	0.00
F_042	Frequency Upper Limit	1.00	1.00	1.00	1.00	1.00
F_043	Frequency Lower Limit	0.00	0.00	0.00	0.00	0.00
F_044	FM+ Analog Output Signal Selection	0	0	0	0	0
F_045	FM+ Analog Output Gain	1.00	1.00	1.00	1.00	1.00
F_046	Motor Overload Protection (OL)	1	1	1	1	1
F_047	Filter Setting of Analog Frequency	20	20	20	20	20
F_048	Motor Rated Current	—	—	—	—	—
F_049	Motor No-Load Current	—	—	—	—	—
F_050	Motor Slip Compensation	0.0	0.0	0.0	0.0	0.0
F_051	Operation Condition Memory	1	0	0	0	0
F_052	Multi-function Input Terminal X1	3	3	3	3	17

Func.	Name	dEF 60	dEF 50	dEF 52	dEF 53	dEF 57
F_053	Multi-function Input Terminal X2	4	4	4	4	18
F_054	Multi-function Input Terminal X3	1	1	1	1	19
F_055	Multi-function Input Terminal X4	2	2	5	2	20
F_058	Multi-function Output Terminal Y1	1	1	1	1	1
F_059	Multi-function Output Terminal Y2	2	2	2	2	2
F_060	Multi-function Output Terminal Ta1,Tb1	11	11	11	11	11
F_061	Multi-function Input Terminal	2	2.0	2.0	2.0	2.0
F_062	Frequency Detection Range	2.0	2.0	2.0	2.0	2.0
F_063	Frequency Detection Level	0.0	0.0	0.0	0.0	0.0
F_064	Automatic Boost Voltage Range	1.0	1.0	1.0	1.0	1.0
F_065	System Overload Detection (OLO)	0	0	0	0	0
F_066	System Overload Detecting Selection	0	0	0	0	0
F_067	Output Setting after System Overload	0	0	0	0	0
F_068	System Overload Detection Level	160	160	160	160	160
F_069	System Overload Detection Time	2.0	2.0	2.0	2.0	2.0
F_070	Stall Prevention Level at Acceleration	170	170	170	170	170
F_071	Stall Prevention Level at Constant Speed	160	160	160	160	160
F_072	Acceleration Time Setting after Stall Prevention under Constant Speed	5.0	3.0	3.0	3.0	3.0
F_073	Deceleration Time for Stall Prevention under Constant Speed	5.0	3.0	3.0	3.0	3.0
F_074	Stall Prevention Setting at Deceleration	1	1	1	1	1
F_075	DC Braking Level	50	50	50	50	50

Func.	Name	dEF 60	dEF 50	dEF 52	dEF 53	dEF 57
F_076	Time of DC Braking after Stop	0.5	0.2	0.0	0.2	0.2
F_077	Time of DC Braking before Start	0.0	0.0	0.0	0.0	0.0
F_078	Operation Selection at Instantaneous Power Failure	0	0	0	0	0
F_079	Auto-Restart Selection for Error Trip Condition	0	1	1	1	1
F_080	Maximum Reset Time of Auto-Restart at Drive's Error Trip	0	10	10	10	10
F_081	Switching Frequency	1	6	6	6	6
F_082	Stop Mode	0	0	0	0	0
F_083	Time Interval before Auto-Restart	6	6	6	6	6
F_084	Pressure Boost for Water Usage Detection	0.15	0.15	0.15	0.15	0.15
F_085	Time Interval of Pressure Boost for Water Usage Detection	0	35	35	35	35
F_086	ON/OFF Mode Starting Rate Setting	0	0	0	0	0
F_087	ON/OFF Mode Pressure Dead Band Setting	0.3	0.3	0.3	0.3	0.3
F_088	The Current Level of Speed Tracing	150	150	150	150	150
F_089	Delay Time for Speed Tracing	0.5	0.5	0.5	0.5	0.5
F_090	The V/F Pattern of Speed Tracing	100	100	100	100	100
F_091	Error Record	—	—	—	—	—
F_092	Parameter Setting Lock	0	0	0	0	0
F_093	Automatic Voltage Regulation (AVR)	1	1	1	1	1
F_094	Drive Overload (OL1)	1	1	1	1	1
F_095	Power Source	220.0	220.0	220.0	220.0	220.0
F_096	Analog Frequency Dead Band	0.00	0.00	0.00	0.00	0.00
F_097	Digital Input Response Time	10	10	10	10	10

Attachment 2 Default Value List

Func.	Name	dEF 60	dEF 50	dEF 52	dEF 53	dEF 57
F_098	Grounding Fault Protection (GF)	1	1	1	1	1
F_099	External Indicator 1	1	1	1	1	1
F_100	External Indicator 2	5	5	5	5	5
F_101	External Indicator 3	2	2	2	2	2
F_102	PID Compensation Gain	1.0	1.0	1.0	1.0	1.0
F_103	PID Control Mode Selection	0	1	0	1	1
F_104	P Selection	1	1	1	1	1
F_105	Proportional Gain(P)	3.0	3.0	3.0	3.0	3.0
F_106	Integration Time(I)	1.2	1.2	1.2	1.2	1.2
F_107	Derivative Time(D)	0.00	0.00	0.00	0.00	0.00
F_108	Derivative Time of Feedback	0.00	0.00	0.00	0.00	0.00
F_109	Integration Upper Limitation	100	100	100	100	100
F_110	Integration Lower Limitation	0	0	0	0	0
F_111	PID Offset Adjustment	0	65	65	65	65
F_112	PID Buffer Space	2	2	2	2	2
F_113	Feedback Signal Filter	10	10	10	10	10
F_114	Feedback Signal Trip Detection	0	1	0	1	1
F_115	Acceleration Time of Pressure Boost	0.6	0.6	0.6	0.6	0.6
F_116	Parameter Selection	0	0	0	0	0
F_117	PID Start Range	0.3	0.3	0.3	0.3	0.3
F_118	Auto-restart Selection of Water Shortag	0	3	0	3	3
F_119	Pressre Level of Water Shortag	0	40	0	40	40
F_120	Current Leve Detectionl of Water Shortage	0	0	0	0	0
F_121	Time Detection of Water Shortage	60	60	60	60	60
F_122	Drive Shutdown Time for Water Shortage	5	5	5	5	5
F_123	Analog Input Selection	0	0	0	0	0
F_124	Proportion Type of Pressure Transmitter	0	0	0	0	0

Func.	Name	dEF 60	dEF 50	dEF 52	dEF 53	dEF 57
F_125	Speed Command Source Selection under Close-Loop Condition	1	1	1	1	1
F_126	Iin Range Selection	0	0	0	0	0
F_127	Iin Gain (Analog Input)	1.00	1.00	1.00	1.00	1.00
F_128	Iin Bias (Analog Input)	0.00	0.00	0.00	0.00	0.00
F_129	AM+ Analog Output Signal Selection	2	2	2	2	2
F_130	AM+ Analog Output Gain	1.00	1.00	1.00	1.00	1.00
F_131	Multi-function Output Terminal Ta2/Tc2	1	1	1	1	1
F_132	DC Braking Frequency at Stop	0.5	0.5	0.5	0.5	0.5
F_133	Drive Standby level (Water Detection)	0	10	0	10	10
F_134	Default Setting	10	10	10	10	10
F_135	Number of Drives Standing By	0	0	0	0	0
F_136	Noise Prevention	0	0	0	0	0
F_137	Delay Time at Pump Exchange Operation	0	0	0	0	0
F_138	200% Current Limit	0	0	0	0	0
F_139	Reserved	0	0	0	0	0
F_140	NTC Thermistor Setting	1	1	1	1	1
F_141	Drive Overheat Pre-alarm Selection	0	0	0	0	0
F_142	Drive Overheat Pre-alarm Level	70	70	70	70	70
F_143	Drive Overheating Dead Band	3.0	3.0	3.0	3.0	3.0
F_144	Fan Control Selection	1	1	1	1	1
F_145	Temperature Level of Fan Activation	50	50	50	50	50
F_146	Minimum Operation Time of Fan	0.5	0.5	0.5	0.5	0.5
F_147	Over Pressure Disposal	0	0	0	0	0
F_148	Over Pressure Level	100	100	100	100	100
F_149	Over Pressure Detection Time	2.0	2.0	2.0	2.0	2.0

Attachment 2 Default Value List

Func.	Name	dEF 60	dEF 50	dEF 52	dEF 53	dEF 57
F_150	Continuous Water Supply Control	0	0	0	0	0
F_151	Set the Minimum Pumps during Operation	1	1	1	1	1
F_155	Communica-tion Address	0	0	0	0	0
F_156	Baud Rate	1	1	1	1	1
F_157	Communica-tion Protocol	1	1	1	1	1
F_158	Communica-tion Overtime (Cot)	0.0	0.0	0.0	0.0	0.0
F_159	Communica-tion Overtime Disposal	0	0	0	0	0
F_160	Multi-Function Input Selection	0	0	0	0	0
F_162	Frequency Upper Limitation by Manual Mode	100	100	100	100	100
F_163	Frequency Lower Limitation by Manual Mode	0	0	0	0	0
F_166	K Value of Flow Sensor	10.0	10.0	10.0	10.0	10.0
F_167	Rate of Flow Sensor	1.00	1.00	1.00	1.00	1.00
F_168	Unit of Flow Sensor	0	0	0	0	0
F_171	Shutoff Head(H)	12.0	12.0	12.0	12.0	12.0
F_172	Maximum Flow (Q)	300.0	300.0	300.0	300.0	300.0
F_173	Compensation for Pipe Friction Loss	0	0	0	0	0
F_174	The Current in Maximum Flow (I_{Qmax})	100	100	100	100	100
F_175	The Current in Minimum Flow (I_{Qmin})	30	30	30	30	30
F_176	Pump Flow Rate Compensation for Pipe Friction Loss ($H_{COMP\ max}$)	0.0	0.0	0.0	0.0	0.0
F_177	Response Time Compensation of Pipe Friction Loss	40	40	40	40	40
F_180	Sequetial Operation for Start Control	0	0	0	0	0

Func.	Name	dEF 60	dEF 50	dEF 52	dEF 53	dEF 57
F_181	Date/ Time Setting	–	–	–	–	–
F_182	Date/ Time Setting	–	–	–	–	–
F_183	Sequential Operation Mode	0	0	0	0	0
F_184	Setting Sector 1 of Sequential Operation	–	–	–	–	–
F_185	Setting Sector 2 of Sequencial Operation	–	–	–	–	–
F_186	Setting Sector of Sequencial Operation	–	–	–	–	–
F_187	Setting Sector 4 of Sequencial Operation	–	–	–	–	–
F_188	Setting Sector 5 of Sequencial Operation	–	–	–	–	–
F_189	Setting Sector 6of Sequencial Operation	–	–	–	–	–
F_190	Setting Sector 7 of Sequencial Operation	–	–	–	–	–
F_191	Setting Sector 8 of Sequencial Operation	–	–	–	–	–
F_193	Switching Frequency	–	–	–	–	–
F_194	Default Setting	0	0	0	0	0

Attachment 3 Setting Memo

Func.	Description	dEF50	Setting Value
F_000		–	
F_001		3	
F_002		2	
F_003		1	
F_004		1	
F_005		1	
F_006		7	
F_007		10.0	
F_008		100	
F_009		0.5	
F_010		8.0 12.0	
F_011		60.0	
F_012		220.0 380.0	
F_013		3	
F_014		–	
F_015		1	
F_016		0	
F_017		60.0	
F_018		60.00	
F_019		1.0	
F_020		1.0	
F_021		6.0	
F_022		0.4	
F_023		50.0	
F_024		24	

Func.	Description	dEF50	Setting Value
F_025		10.0	
F_026		1	
F_027		0.5	
F_028		0.5	
F_029		0.0	
F_030		1	
F_031		0.00	
F_032		20.00	
F_033		25.00	
F_034		30.00	
F_035		45.00	
F_036		50.00	
F_037		55.00	
F_038		60.00	
F_039		7.00	
F_040		1.00	
F_041		0.00	
F_042		1.00	
F_043		0.00	
F_044		0	
F_045		1.00	
F_046		1	
F_047		20	
F_048		–	

Func.	Description	dEF50	Setting Value
F_049		–	
F_050		0.0	
F_051		0	
F_052		9	
F_053		13	
F_054		1	
F_055		2	
F_056		–	
F_057		–	
F_058		1	
F_059		2	
F_060		-11	
F_061		-3	
F_062		2.0	
F_063		0.0	
F_064		1.0	
F_065		0	
F_066		0	
F_067		0	
F_068		160	
F_069		2.0	
F_070		140	
F_071		130	
F_072		3.0	
F_073		3.0	
F_098		1	

Func.	Description	dEF50	Setting Value
F_074		1	
F_075		50	
F_076		0.2	
F_077		0.0	
F_078		0	
F_079		1	
F_080		10	
F_081		6	
F_082		0	
F_083		6	
F_084		0.15	
F_085		35	
F_086		0	
F_087		0.3	
F_088		150	
F_089		0.5	
F_090		100	
F_091		–	
F_092		0	
F_093		1	
F_094		1	
F_095		220.0 (200Vseries)	
		380.0 (400Vseries)	
F_096		0.00	
F_097		10	
F_098		1	

Func.	Description	dEF50	Setting Value
F_099		1	
F_100		5	
F_101		2	
F_102		1.0	
F_103		1	
F_104		1	
F_105		3.0	
F_106		1.2	
F_107		0.00	
F_108		0.00	
F_109		100	
F_110		0	
F_111		65	
F_112		2	
F_113		10	
F_114		1	
F_115		0.6	
F_116		0	
F_117		0.3	
F_118		1	
F_119		40	
F_120		0	
F_121		60	
F_122		5	
F_123		0	
F_124		0	
F_125		1	
F_126		0	
F_127		1.00	

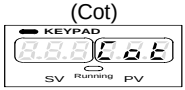
Func.	Description	dEF50	Setting Value
F_128		0.00	
F_129		2	
F_130		1.00	
F_131		2.0	
F_132		0.5	
F_133		10	
F_134		0	
F_135		0	
F_136		0	
F_137		10	
F_138		0	
F_139		–	
F_140		0	
F_141		0	
F_142		70	
F_143		3.0	
F_144		1	
F_145		50	
F_146		0.5	
F_147		0	
F_148		100	
F_149		2.0	
F_150		0	
F_155		0	
F_156		1	
F_157		1	
F_158		0.0	
F_159		0	
F_173		0	

Func.	Description	dEF50	Setting Value
F_162		100	
F_163		0	
F_166		10.0	
F_167		1.00	
F_168		0	
F_171		12.0	
F_172		300.0	

Func.	Description	dEF50	Setting Value
F_174		100	
F_175		30	
F_176		0.0	
F_177		40	
F_180		0	
F_183		0	
F_194		0	

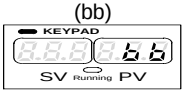
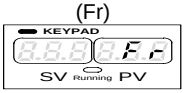
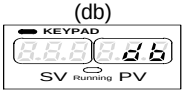
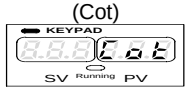
Attachment 4 Fault Display

Error Trip Messages of Drive

Display	Description	Display	Description
(EEr) 	EEPROM error	(OH) 	Drive overheating
(AdEr) 	A/D converter error	(Cot) 	Modbus communication overtime
(SC) 	Fuse open	(OL) 	Motor overload
(LE1) 	Under voltage during operation	(OL1) 	Drive overload
(OC) 	Drive over current	(OLO) 	System overload
(GF) 	Grounding fault	(thr) 	External fault
(OP) 	Over pressure	(ntCF) 	NTC Thermistor sensor fault
(OE) 	Over voltage	(PAdF) 	Keypad interruption during copy
(no Fb) 	PID feedback signal error	(Fb Lo) 	Water shortage

Warning Messages of Drive

*When the drive displays below messages, drive will stop output. If the abnormal condition is removed, the drive will auto-restarting.

Display	Description	Display	Description
(LE) 	Power source under voltage	(Ht) 	Drive overheating
(bb) 	Drive output interruption	(Err_00)  (Err_01) 	Err_00: Keypad cable trip before connecting Err_01: Keypad cable trip during operation
(Fr) 	Coast to stop	(dtF) 	Direction command error
(db) 	Dynamic brake transistor over voltage	(Wr_F) 	Different software version inter-copy
(PrEr) 	Software fault	(OP) 	Over pressure
(CPyF) 	Parameter copy error	(Cot) 	Modbus communication overtime