

## Digital(Di)Input

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F67	Digital Input Scan Cycle	1~5000	0.2ms	10

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

×	F68	Di1, Di2 Setup	0~1		0
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- ◎ This function sets up only terminals Di1 and Di 2, and only corresponding to 2-way operation controls and adaptation to the multi-function 1: 3-way Operation(Di3) control. All other functions do not fall with the operation scope of Di1 and Di2.

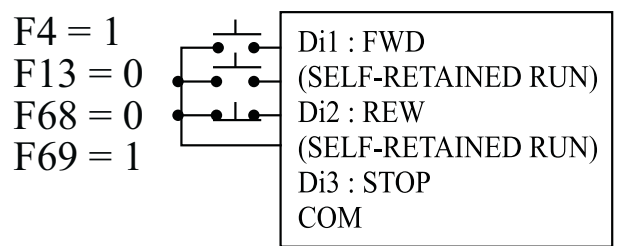
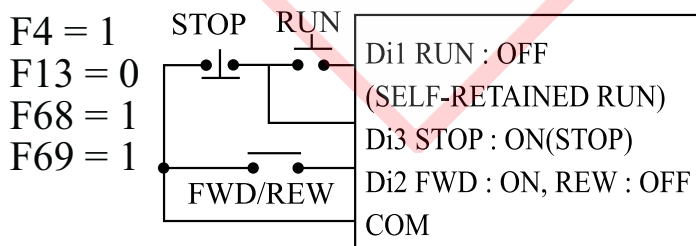
### ■ 0 : 2-Way Control-Di1(FWD/STOP), Di2(REV/STOP).



### ■ 1 : 2-Way Control-Di1(RUN/STOP), Di2(FWD/REV).



- ◎ F69 = **1 : 3-Way Control Operation** (Di3), (Any input terminals from Di3~Di8 may define this function in conjunction with Di1, Di2 terminals of F68.)



# V –Description of parameter functions–

R : Parameter is changeable during operation (○)

R	Parameter	Designation	Description	Range	Ex-factory Sett
×	F69	Di3 Setup	<p>◆ Multi-function input terminals may be set up for particular use as desired. To apply such function Refer to description of function.</p> <p>◆ No specific sequence is specified for the function of these six terminals; however, the setting should never be repeated with the exception of the setting of 0: Disabled.</p>	0~24	2
×	F70	Di4 Setup		0~24	4
×	F71	Di5 Setup		0~24	5
×	F72	Di6 Setup		0~24	6
×	F73	Di7 Setup		0~24	9
×	F74	Di8 Setup		0~24	18

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



INHIBIT

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

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

Multi-stage command Terminal 16-Stage Speeds	Din Multi-Stage Command 4 $2^3 = 8$	Din Multi-Stage Command 3 $2^2 = 4$	Din Multi-Stage Command 2 $2^1 = 2$	Din Multi-Stage Command 1 $2^0 = 1$
Master Speed	OFF	OFF	OFF	OFF
Stage 1 Speed	OFF	OFF	OFF	ON
Stage 2 Speed	OFF	OFF	ON	OFF
Stage 3 Speed	OFF	OFF	ON	ON
Stage 4 Speed	OFF	ON	OFF	OFF
Stage 5 Speed	OFF	ON	OFF	ON

Multi-stage command Terminal 16-Stage Speeds	Din Multi-Stage Command 4 $2^3 = 8$	Din Multi-Stage Command 3 $2^2 = 4$	Din Multi-Stage Command 2 $2^1 = 2$	Din Multi-Stage Command 1 $2^0 = 1$
Stage 6 Speed	OFF	ON	ON	OFF
Stage 7 Speed	OFF	ON	ON	ON
Stage 8 Speed	ON	OFF	OFF	OFF
Stage 9 Speed	ON	OFF	OFF	ON
Stage 10 Speed	ON	OFF	ON	OFF
Stage 11 Speed	ON	OFF	ON	ON
Stage 12 Speed	ON	ON	OFF	OFF
Stage 13 Speed	ON	ON	OFF	ON
Stage 14 Speed	ON	ON	ON	OFF
Stage 15 Speed	ON	ON	ON	ON

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

■ <b>10: Acceleration/Deceleration Time Command 1</b>	Acceleration/Deceleration time of AC drive can be selected from this function and the input status of terminal, four types of acceleration / deceleration in total available for selection.
■ <b>11: Acceleration/Deceleration Time Command 2</b>	

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

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

※ **Note 1 : Din represents the definition given to any digital terminal input Di3 ~ Di8.**

- **12: Master Speed Increase** — The master-speed frequency increase signal is input from the multifunctional terminal; F35 set value will be taken to perform acceleration for master-speed increase for a F35 set value  $\geq 20$  seconds while 20 seconds will be taken to perform acceleration for master-speed increase for a F35 set value  $< 20$  seconds.

- **13 : Master Speed Decrease** — The master-speed frequency decrease signal is input from the multifunctional terminal; F36 set value will be taken to perform deceleration for master-speed decrease for a F36 set value  $\geq 20$  seconds while 20 seconds will be taken to perform deceleration for master-speed increase for a F36 set value is  $< 20$  seconds.
- ◎ These two functions may be set by function terminal to provide external control over the frequency of the master speed. They permit two-way operation with the [ increase (▲) and decrease (▲) ] from the operator; however, the control priority for F5 Frequency Command source control must be set at 0 : Digital operation panel.
- **14 : Automatic Operation** — when automatic operation is effectively set, its priority is next higher to the inching command.
- **15:Auto Operation Suspended** — When the programmable automatic operation function is selected and the function terminal is activated, the ac drive starts to execute the sequential operation according to the preset 16-stage speed frequency. The operation may be suspended by using the function of Suspension Terminal and resumed when the suspension is over. If the operation is resumed by turning off the Automatic Operation Terminal, the operation procedure starts to execute from the original point.
- **16 : Counter Signal Input** — The width of the trigger-off signal shall not be less than 2ms while paying attention to the setting of the related Parameter F67.
- **17 : Counter Zero-in** — When enabled this functional terminal, the signal from externally triggered signal, such as signal from the proximity switch and photoelectric detector, can be input the count terminal, and then the frequency inverter will follow to count and check the set values relevant to the Parameter F67. To zero the count value, use this Counter Zero-in terminal to proceed the zeroing.
- **18 : Free Run Stop** — When the function terminal signal is inputted, the ac drive immediately turns off its output for the motor to coast to stop due to the system friction .
- **19 : Auto Save Energy Operation** — When the function terminal signal is inputted, the ac drive starts to perform internal operation to control the operation at an optimal efficiency setting. (For details, refer to F124.)
- **20 : Second Unit PID** — Start the internal 2nd PID Gain Ratio Mode.(F197~F200)
- **21 : Di activates PID** — PID control module is activated by the input from themulti-function terminal. (For details, refer to F186).
- **22 : Di activates AV2** — When selected Di for activation, the frequency command source shall be AI mandatorily.AV2.
- **23 : Di activates AI** — When selected Di for activation, the frequency command source shall be AI mandatorily.
- ※ When this function is in use, other functions shall not be given to AV2 and AI for usage (Such as F5, F174, F187~F189).
- ※ Priority : Inching > Auto operation > Di activates AV2 > Di activates AI > Multi-stage speed command > F5 frequency command source .
- **24: Zero servo** — After inputting the functional signal, the ac drive will decrease the frequency to 0 Hz according to the deceleration time, or charge the current when received the command at stop so as to enable the motor rotor to rotate constantly without drifting.

- ※ When set F147 control mode to **2 : Open Loop V/F vector Control**, **3 : Closed Loop V/F vector Control** and **4 : Sensorless V/F vector Control**, the charging current controlled by zero-servo shall be established by F126 voltage-increase value.
- ※ When set F147 control mode to **5 : Closed Loop Flux Vector Control**, **6 : Sensorless Flux Vector Control**, the setting to F171 low-speed magnetic-field magnification factor shall control the current charging from zero-servo.

## Digital (Do) Output

R	Parameter	Designation	Description	Range	Ex-factory Setting
×	F75	Relay1 Setup	No specific setup sequence is specified for the function of these output terminals. Upon selecting the function, read first the description and related requirements of the function.	0~12	1
×	F76	DO1 Setup			11
×	F77	DO2 Setup			6
×	F78	DO3 Setup			7
×	F79	Relay2 Setup			3

- **0: Disabled** — This function allows the output terminal function to be in the states of being disabled.
- **1: Output in Case of Abnormality (NO)** — In case of any abnormality detected by the ac drive, the contact is in closed status.
- **2 : Output in Case of Abnormality (NC)** — If any abnormality is detected by the ac drive, or CPU is losing POWER, this contact turns into open status. The normal output is closed status.
- **3 : In Operation** — When the ac drive enters into standby mode or is in operation, this contact is in closed status.
- **4: Frequency Attained 1** — When the output frequency of the ac drive reaches Specified Frequency 1 (F81), this contact is in closed status.
- **5 : Frequency Attained 2** — When the output frequency of the ac drive reaches Specified Frequency 2(F82), this contact is in closed status.
- **6 : Consistent Frequency** — When the output frequency of the ac drive is consistent with the setting for the Master Speed through Stage 15 frequency, the range to judge the consistent frequency is set by (F80), and this contact within that range is in closed status. (Unsuitable application On the Analog signal speed command).
- **7 : Overload Alarm** — When the ac drive detects output overload, this contract is in closed status. The OL value = (F142) Rated current of the Motor (F96) overload current level time-counting.
- **8 : OL Timing Forecas** — When the multiplication value of electronic thermal sensor built in the ac drive has reached 80% of the time of trip-off level, this contact is in closed status. The OL level is set with (F96); and the multiplication time, with (F97).
- **9: Counter Cycle is Up** — When the ac drive is performing external count and F84 the numeric value of the counting is equal to the setting of, this contact is in closed status, and then clear the numeric value to restart counting.



## V –Description of parameter functions–

R : Parameter is changeable during operation (○)

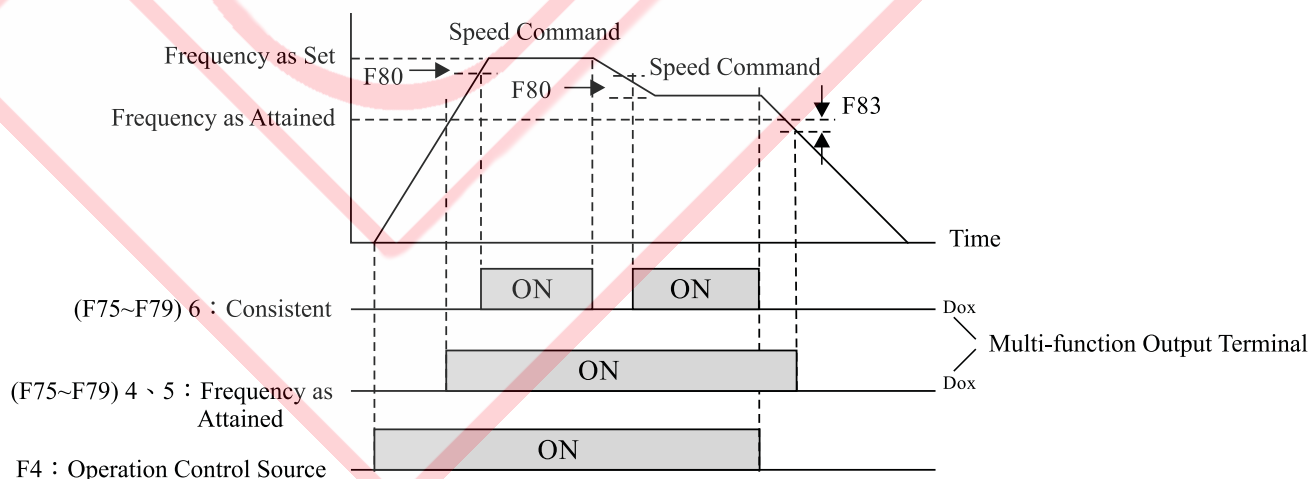
- **10 : Comparator Counting is Up**— When the ac drive is performing external **F85** count and the numeric value of the counting is equal to the setting of, this contact is in closed status, and then clear the numeric value restart counting.
- **11 : Zero-Speed Detected**— When the ac drive is in downtime or the frequency set is smaller than the setting of the minimum activation frequency, this Contact is in closed status.
- **12 : Timer function output**— When activating the ac drive for operation, the contacts at the multifunctional output terminal (Timer function output) will be closed in response to the F86 ON-Delay Time Counting; and this function must be associated with the F6 DC Brake Function while the DC Brake energy can be set according to the requirement.

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F80	Frequency consistent width	0.0~10.0	Hz	1.0

- ◎ When the output frequency falls between the frequency setup range of  $\pm$ F80 the output multi-function terminal remains at ON status.

×	F81	Frequency Attained 1	0.0~400.0	Hz	60.0
×	F82	Frequency Attained 2	0.0~400.0	Hz	60.0
×	F83	Magnetic Stagnation Width Attained	0.0~10.0	Hz	1.0

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

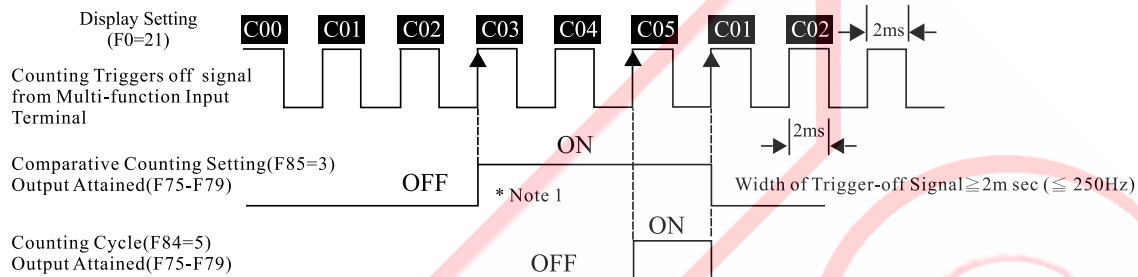


×	F84	Counting Cycle	0~30000	P	1000
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- ◎ This parameter is applied to set up the counting cycle of the built-in counter. Once the counting reaches the preset value of the counting cycle, any multi- function output terminal may be selected to trigger the terminal output (Fig.1).

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F85	Comparative Counting	0~30000	P	500

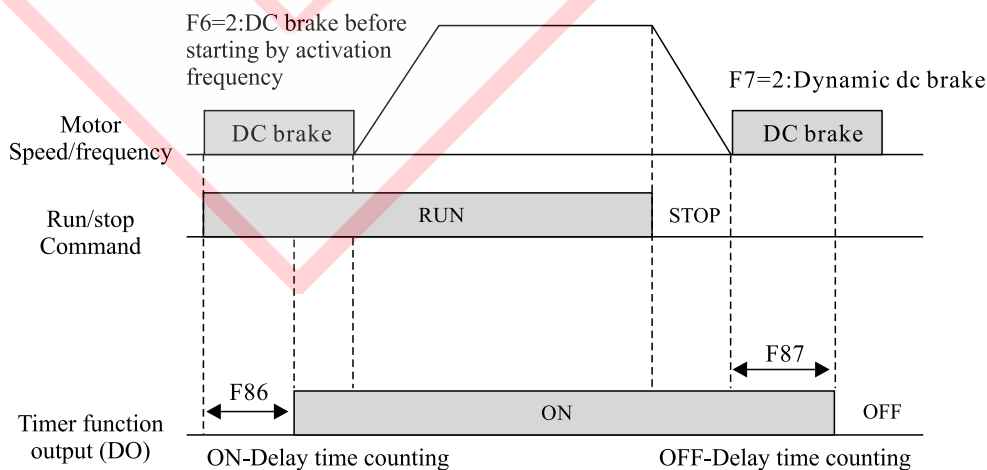
- ◎ This parameter is applied to set up the comparison value of the built-in counter. Once the counting reaches the preset value of the counting cycle, any multi- function output terminal may be selected to trigger the terminal output to enter into ON status, and then enter into OFF status until the F85 counting cycle setting is up(Fig. 1).



(Fig 1) \*Note 1 : Attention to description and setting of parameter F67 is urged.

×	F86	ON-Delay Time Counting	0.00~60.00	Sec	0.00
×	F87	OFF-Delay Time Counting	0.00~60.00	Sec	0.00

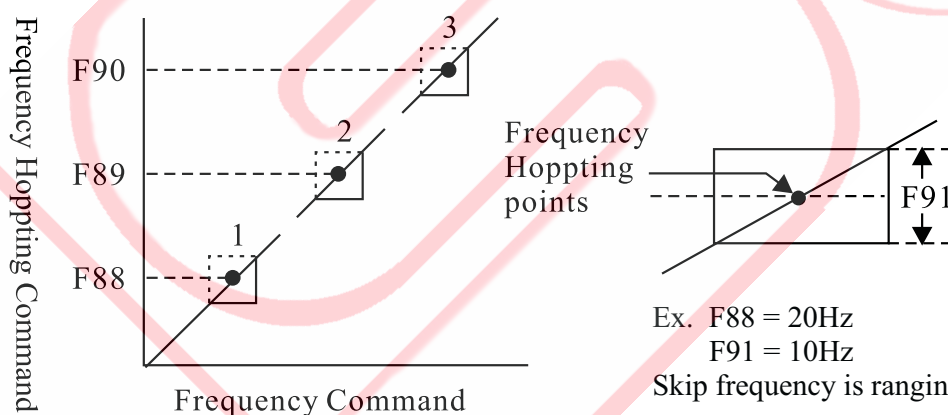
- ◆ A suitable ON/OFF delay time (F86, F87) setup can eliminate the bounce noise from general detectors and switches, or can be applied to a field where other special requirement in mechanics is needed.
- ◆ When activating the ac drive for operation, the contacts at the multifunctional output terminal (Timer function output) will be closed in response to the F86 ON-Delay Time Counting; and this function must be associated with the F6 DC Brake Function while the DC Brake energy can be set according to the requirement.
- ◆ When stopping the ac drive, the contacts at the multifunctional output terminal (Timer function output) will be open-circuit in response to the F87 OFF-Delay Time Counting; and this function must be associated with the F7 DC Brake Function while the DC Brake energy can be set according to the requirement.



## Jumping Frequency

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F88	Frequency Skip 2	0.0~400.0	Hz	0.0
×	F89	Frequency Skip 2	0.0~400.0	Hz	0.0
×	F90	Frequency Skip 3	0.0~400.0	Hz	0.0
×	F91	Frequency Skip Width	0.0~10.0	Hz	0.0

- ◆ Functions of Frequency Skip and Frequency Skip Width are exclusively provided to avoid resonance to the mechanical system under certain frequency, where it is unavoidable to pass through during acceleration or deceleration, and operation under such frequency is strictly prohibited.
- ◆ If the frequency skip width is set at 0Hz, all the frequency-skip points are void.
- ◆ Frequency skip conditions must satisfy  $F88 \leq F89 \leq F90$ , and the operation must be provided in sequence as set. Skip frequencies respectively at Points 1, 2, 3 may be partially or entirely overlapped to increase the operation of bandwidth from different segments, and to serve as the frequency skip area for one point or two points.



## Motor Protection Setup

×	F92	Stalling protection setup	0~31		3
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- **bit 0 : Protection function F93**— To enable the function for stalling voltage protection during deceleration.
- **bit 1 : Protection function F94**— To enable the function for stalling current protection during acceleration.
- **bit 2 : Protection function F96**— To enable the function electronic thermal relay.
- **bit 3 : Inhibit inertia at motor start**— To convert the motor-regenerative energy into motor magnetic field for inhibiting the consumption a little bit.



■ **bit 4 : Automatic Voltage Regulation(AVR)** – To enable the function of Automatic Voltage Regulation (AVR).

- ◎ When the input power supply is higher than the maximum output voltage (U.V.W.) set to function (F121), this AVR function is able to regulate the voltage within the set value of F121 automatically; thus, the motor can have a stable torque output, and the motor is not easy to access a temperature rise to increase the torque sharply, either. However, when the input power supply is lower than the set value of F121, the output voltage will vary with the input voltage as well.



INHIBIT

**AVR shall not be activated for compensation of variation when enabled 5: Close-loop vector control and 6: Sensor-less vector control in (F147) control mode.**

## ※ Digital increment table

Set values	Bit 4 2 <sup>4</sup> =16	Bit 3 2 <sup>3</sup> =8	Bit 2 2 <sup>2</sup> =4	Bit 1 2 <sup>1</sup> =2	Bit 0 2 <sup>0</sup> =1	Set values	Bit 4 2 <sup>4</sup> =16	Bit 3 2 <sup>3</sup> =8	Bit 2 2 <sup>2</sup> =4	Bit 1 2 <sup>1</sup> =2	Bit 0 2 <sup>0</sup> =1
0	×	×	×	×	×	16	○	×	×	×	×
1	×	×	×	×	○	17	○	×	×	×	○
2	×	×	×	○	×	18	○	×	×	○	×
3	×	×	×	○	○	19	○	×	×	○	○
4	×	×	○	×	×	20	○	×	○	×	×
5	×	×	○	×	○	21	○	×	○	×	○
6	×	×	○	○	×	22	○	×	○	○	×
7	×	×	○	○	○	23	○	×	○	○	○
8	×	○	×	×	×	24	○	○	×	×	×
9	×	○	×	×	○	25	○	○	×	×	○
10	×	○	×	○	×	26	○	○	×	○	×
11	×	○	×	○	○	27	○	○	×	○	○
12	×	○	○	×	×	28	○	○	○	×	×
13	×	○	○	×	○	29	○	○	○	×	○
14	×	○	○	○	×	30	○	○	○	○	×
15	×	○	○	○	○	31	○	○	○	○	○

※ ○ : protection function enabled, × : protection function disabled, no protection function when set value is 0.

# V -Description of parameter functions-

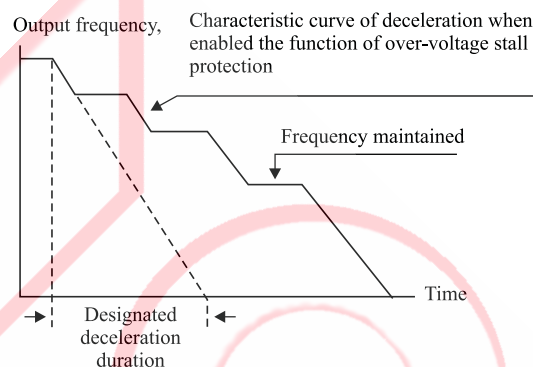
R : Parameter is changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F93	Deceleration Stalling voltage Setup	1.00~1.25		1.20

- ⊙ In performing deceleration, the ac drive will stop decelerating (output frequency suspended from decreasing) due to rising DC bus voltage when the motor regenerates energy into the ac drive due to the high motor load inertia; The ac drive will continue to perform deceleration only when the dc bus voltage falls below the setting.

- ⊙ Stalling voltage level = (F129)RST Mains input voltage  $\times$  1.414  $\times$  (F93) Stalling Voltage %.

**Example :** Stalling voltage level =  
 $220\text{Vac} \times 1.414 \times 120\% = 373\text{Vdc}$

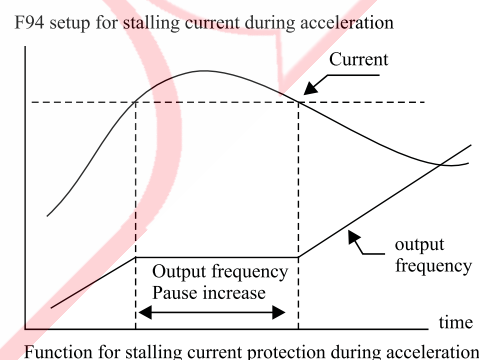


×	F94	Acceleration Stalling Current Setup	0.50~2.50	Pu	1.50
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- ⊙ In performing acceleration, the AC drive will **stop the acceleration** (Output frequency is suspended from increasing) when the output current increase from the AC drive is over the setting of the stalling current level due to fast acceleration or overload of motor; and the AC drive continues to accelerate only when the current falls below the setting.

- ⊙ Stalling current level = (F142) Motor Rated Current  $\times$  (F94) Stalling Current Gain.

**[Example]:** Stalling Current Level =  
 $4\text{A} \times 150\% = 6.0\text{A}$



WARNING

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

×	F95	Start Thermal relays the current setting of position	0.80~1.30	Pu	1.00
×	F96	Current level of electronic thermal relay	1.00~2.50	Pu	1.50
×	F97	Acting time of electronic thermal relay	0.1~120.0	Sec	60.0

$$\int_0^t (I_A^2(t) - F_{95}^2) \cdot dt > (F_{96}^2 - F_{95}^2) \cdot F_{97} \Rightarrow \text{Activate the thermal relay}$$

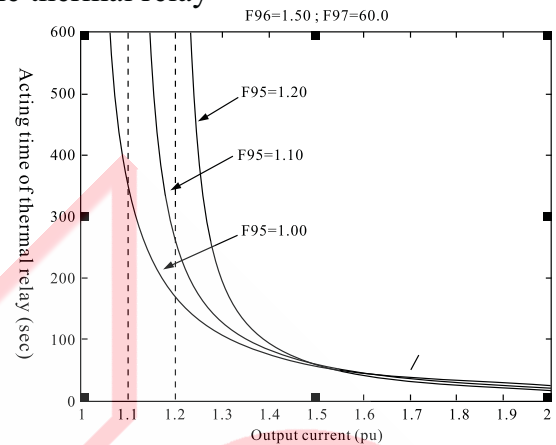
Where,  $I_A(t)$  is the output current.

**Example:**  $F_{95} = 1.00$  ,  $F_{96} = 1.50$  ,  $F_{97} = 60.0$  seconds;  
if  $I_A(t) = 1.2pu$ , then the thermal relay will be activated or 170.45 seconds; the computation is as follow :

$$\int_0^t (1.20^2 - 1.00^2) \cdot dt \leq (1.5^2 - 1.00^2) \cdot 60.0$$

$$\Rightarrow 0.44 \times t \leq 75$$

$$\Rightarrow t \leq 170.45 \text{ sec}$$



The acting duration of thermal relay varies with different output currents as shown in Figure 1. Increase of F95 (to enable the thermal relay to initiate the integral current level) can heighten the protection level of thermal relay; for example, an output current below 1.20pu will not trigger the thermal relay at F95=1.20 as shown in the illustration.

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F98	V/F Output current Limit	0.20~1.45		1.30

◆ When set F147=2, or 3, or 4, and output current in excess of the set value, then the AC drive will be reduced thereof output voltage quickly to protect the AC drive from tripping at over-current; so the ideal setting is to have the F94 set value less than F98 set value by more than 20%.

※ Note : Output current limit level : Rated current of frequency x 2 x F98 set value.

×	F99	Leaking current,3-phase current,and abnormal level setup	0.001~0.500	Pu	0.250
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◎ This function is designed to protect the output side of inverter from bad wiring construction and defective motor insulation. When detected a current over the set value for abnormal level from the three phases at output side (U.V.W.) of inverter, it is an abnormal leaking current.

×	F100	Over Temp. Protection Setup	60.00~95.00	°C	88.00
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◎ This function is provided to detect the temperature protection level of the built- in heat sink. Once the setting is challenged, the ac drive trips to protect from overheating.

×	F101	Fan Activating Temp. Setup	40.00~60.00	°C	45.00
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◎ Upon Power ON, the fans automatically run for one minute and then revert to the control by the fans activation temperature setting.

# V -Description of parameter functions-

R : Parameter is changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F102	Brake Discharge Level	1.12~1.40		1.20

- ◆ Discharge Brake Level = F129(R.S.T Mains input voltage) × 1.414 × F102(DC-bus Brake Level).

Example : F129 = 220V F102 = 1.20

Discharge **Brake** Level = **220Vac** × **1.414** × **1.20** = **373Vdc** (discharge level.)



WARNING

**Built-in Dynamic Braking has been provided for the ac drive of 11KW or less. External braking unit must be provided for AC drive of other Hp spec.**

## Automatic Operation function

×	F103	Automatic Operation Mode	0~4		0
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- **0 : Disable** — Automatic operation is disabled.
- **1 : Reciprocal mode** — To perform reciprocal automatic operation from Master Speed through Stage 15 Speed.
- **Reciprocal Fashion Performed** — Master Speed → Stage 1 Speed ... Stage 15 Speed → Stage 14 Speed ... Master Speed → Master Speed ... etc, and then the operation is continued in reverse order to complete a cycle of a total of 32 speeds. The number of cycle times is set by **F104** and displayed with the stage speed monitor. The ac drive automatically stops once the setting of cycle times is up.
- **2 : Cyclic mode** — To perform automatic operation clockwise from Master Speed through Stage 15 Speed.
- **Cyclic Fashion Performed** — The automatic operation is performed clockwise from Master Speed ... Stage 1 Speed ... Stage 15 Speed → Master Speed → Stage 15 Speed ... etc. It is repeated clockwise with the number of cycles to be set by F104 and displayed on the stage speed monitor together with the number of cycles and stage speed. The ac speed automatically stops when the setting of cycle times is up.
- **3 : Master Speed after Reciprocation mode** — This function is performed same as that described in the setting of 1: Reciprocal fashion with the exception that the master speed frequency operates upon the expiry of the number of cycles.
- **4 : Master Speed after Cyclic mode** — This function is performed same as that described in the setting of 2: Cyclic fashion with the exception that the master speed frequency operates upon the expiry of the number of cycles.



WARNING

**Once Automatic Operation setup is done , the execution is subjected to the programmed mode of the multi-function input terminals 14 : Automatic Operation and 15 : Automatic Operation Suspended. The automatic operation control is second in priority to the inching frequency command while the Operation Control and Frequency Command fails to execute operation control(settings 1~4 enable activation of automatic operation) (Refer Page 5-19~5-21).**

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F104	Number of Cycles	1~1000	Cycle	1

◎ This function defines the number of operation cycles needed in automatic operation.

×	F105	Time of automatic operation mode at Master speed	-30000~30000	Sec	5
×	F106	Time of automatic operation mode at stage 1	-30000~30000	Sec	0
×	F107	Time of automatic operation mode at stage 2	-30000~30000	Sec	0
×	F108	Time of automatic operation mode at stage 3	-30000~30000	Sec	0
×	F109	Time of automatic operation mode at stage 4	-30000~30000	Sec	0
×	F110	Time of automatic operation mode at stage 5	-30000~30000	Sec	0
×	F111	Time of automatic operation mode at stage 6	-30000~30000	Sec	0
×	F112	Time of automatic operation mode at stage 7	-30000~30000	Sec	0
×	F113	Time of automatic operation mode at stage 8	-30000~30000	Sec	0
×	F114	Time of automatic operation mode at stage 9	-30000~30000	Sec	0
×	F115	Time of automatic operation mode at stage 10	-30000~30000	Sec	0
×	F116	Time of automatic operation mode at stage 11	-30000~30000	Sec	0
×	F117	Time of automatic operation mode at stage 12	-30000~30000	Sec	0
×	F118	Time of automatic operation mode at stage 13	-30000~30000	Sec	0
×	F119	Time of automatic operation mode at stage 14	-30000~30000	Sec	0
×	F120	Time of automatic operation mode at stage 15	-30000~30000	Sec	0

◎ To set the operation time and direction by the stage speed enabled. The setting of negative value is for operation in reverse direction and operation time counts; and the setting of positive value is for forward direction and operation time counts. Refer to the setting given in F13 if FWD and REV operation control is required.

◎ Frequency of any stage of speed may be set at 0Hz in the course of performing the stage speed in automatic operation to provide the function of stop by timer; and the frequency of any stage speed may be set to be disabled by setting the automatic operation time at 0 sec to skip to the frequency of the next stage speed. please see parameter setup F17~F32.

※ The positive & negative signs shown in F105~F120 denote the running direction.



## Magnetic flux setup

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F121	Maximum Output Voltage (U.V.W)	0.50~1.00	Pu	1.00

- ◎ The range of the input voltage to the ac drive may be of AC 180V~240V (or 380V~480V). The maximum output voltage may be set by this parameter function for the maximum rms voltage to compensate for the rated voltage of the motor.

Output voltage = (F141) Motor rated voltage × (F121) Maximum output voltage

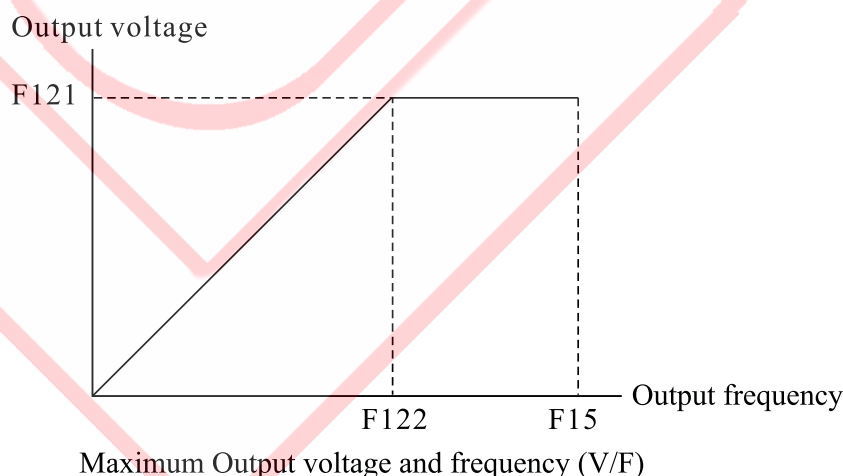
※ The setting for F21 maximum output voltage at 1.00 is optimum when (F147) control mode is selected at **2 : Open Loop V/F vector Control**, **3 : Closed Loop V/F vector Control**, or **4 : Sensorless V/F vector Control**.

※ **ATTENTION!** The maximum output voltage should not be greater than 95% and the internal must be done with adjustment of magnetic filed control function if **5 : Closed Loop Flux Vector Control** or **6 : Sensorless Flux Vector Control** is selected from (F147) control mode. Any setting greater than 95% will be made at the cost of mtic field compensation efficiency, and even resulting in tripping. The optimum setting is (90%~95%).

×	F122	Maximum Voltage Frequency	0.50~2.00	Pu	1.00
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- ◎ The setting of output voltage, frequency of ac drive has to be comply with motor's

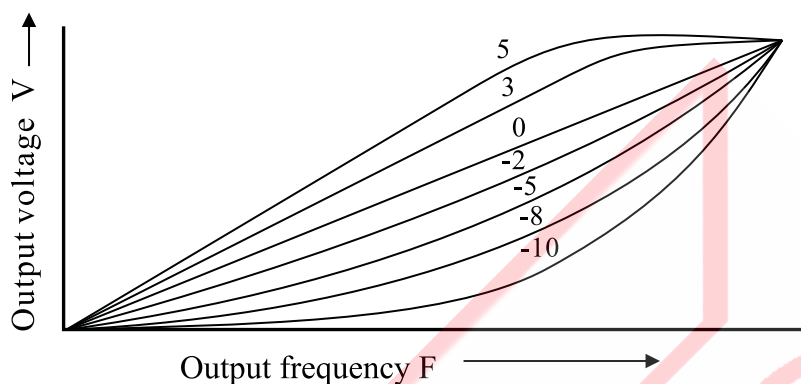
**【normal rated. [Max. voltage frequency (1.00) will be based on F143 rated frequency】 .**



×	F123	V/F Curve option	-10~5		0
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- ◎ The relation between output voltage and output frequency is defined in terms of square decrease, linear or square increase changes as illustrated below.
- ◎ With the setting of 0, it relates to a linear V/F curve applicable to the load of a constant torque.

- ◎ With the setting selected from the range of -1 ~ -10, it relates to square decrease V/F curve, applicable to blower and pump.
- ◎ With the setting elected from the range of 1 ~ 5, it relates to square increase V/F curve.



R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F124	Energy-saving Control Mode	0~2		0

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

■ **0 : Normal Mode** — Motor operation controlled in normal mode without activating economy control.

■ **1 : Efficiency control mode** — Economy control command to be controlled by internal calculation.

■ **2 : External Terminal Control** — Economy control command to be controlled by external terminal input signals.

※ **Recommendation:** In selecting the save energy control function from (F147) control mode, 5: Closed Loop Flux Vector Control and 3: Closed Loop V/F vector Control are preferred; followed by 4: Sensorless V/F vector Control and 6: Sensorless Flux Vector Control; while 2: Open Loop V/F vector Control fails to perform economy control.

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

○	F125	Oscillation inhibit gain	0.0~100.0	%	15.0
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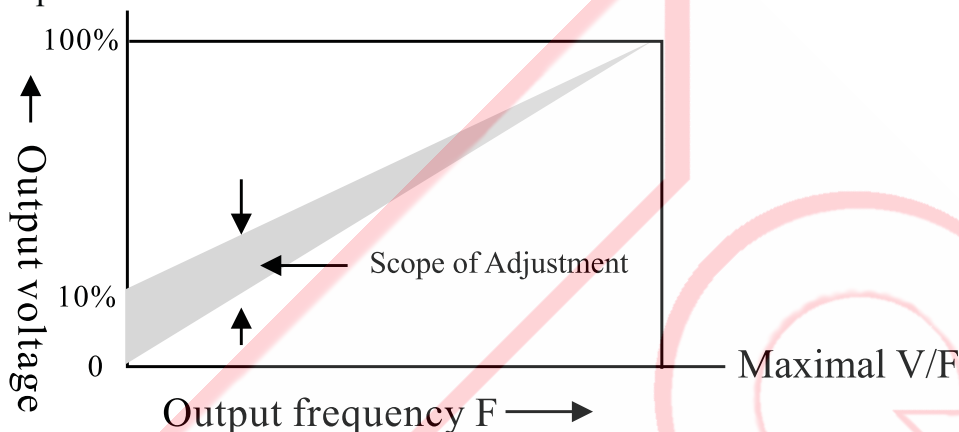
- ◆ A current oscillation will be taking place when running the motor at a certain section of frequency; by then, adjusting the set value of parameter can effectively correct the situation. The current-oscillating area with a higher horsepower will appear at a lower frequency bandwidth; that means the set value can be increased duly. However, an excessive setting may be prone to generating a too-big excitation current; so please make the adjustment appropriately.
- ◆ This parameter is an exclusive function for V/F control mode. (The control mode of F147=2, 3, or 4)

## V –Description of parameter functions–

R : Parameter is changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory Setting
○	F126	Voltage boosting value (V/F Torque Compensation Setting)	0.000~0.100	Pu	0.020

- ◆ This function provides the means for proper adjustment of the corresponding output voltage at 0Hz so as to improve the torque performance of the motor as demonstrated in the lower speed area.



The voltage increased at 0Hz=  $F141 \times F126$   
 Example :  $220\text{Vac} \times 0.020 = 4.4\text{Vac}$  (Boost)

- ◆ Excessive adjustment will cause high motor current resulting in overload, and further leading to the activation of functions (F94~F96) of output limiting current. Therefore, confirm the output current value displayed under F0=12 before making the adjustment for the optimum setting.
- ◆ Unless otherwise specified, 3Hz is sufficient to activate the motor to run in the V/F control mode.

×	F127	PWM Modulation Method	1~2		1
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■ **1: 3-Phase SVPWM Modulation** — Use of 3-phase modulation driven motor obtains the smoothest current output and comparatively quiet operation.

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

◎ Excessively long wiring for the motor is prone to reflective voltage feedback (tidal effects) from the motor, and this acts as additional load to the ac drive (power loss). In such case, the use of 2-phase modulation driven motor and lower setting of F128 switching frequency would help to reduce the reflective motor voltage, harmonics, and EMI problem.

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

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

R : Parameter is changeable during operation (○)

## -Description of parameter functions- V

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F128	PWM Switching Frequency	1000~16000	Hz	5000

- ◆ This parameter sets up the carrier frequency in PWM output.
- ◆ The setting level of the carrier frequency will affect the EMI noise of the motor, switching loss of the IGBT and the heat dissipation due to switching loss as stated in the table given below:

Carrier F	Electromagnetic Noise	Switching	Heat Dissipation	Torque	Harmonics
1KHz ↕ 16KHZ	High ↕ Low	Low ↕ High	Low ↕ High	High ↕ Low	Low ↕ High

×	F129	RST Input Voltage (rms)	150~500	Vac	220
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- ◎ This parameter defines the standard input power supply voltage to the ac drive. The voltage working level and the voltage of ac drive would determine all related voltage working levels and voltage protection levels according to this parameter.

◎ F129 set value shall satisfy :  $F129 \leq 1.5 \times F141$

×	F130	Vdc gain(read only)	50~300	Fold	140
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- ◆ This parameter is to adjust the gain of DC-BUS voltage at both sides of capacitor; and the result from the gain will become one of the important parameters to the operation of [F0=10: Normal state voltage at dc side (Vdc)].

### FM 1 AO waveform output (No.2.31 Special-Purpose)

×	F131	FM1 Analog output mode	0~1		0
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- **0 : PWM Pulse Output**— DC voltage is output to the FM1 terminal with the maximum range of DC0~10V/1mA.
- **1 : Pulse Frequency Output**— Pulse frequency output equivalent to the output frequency x multiplying factor (F132) is output to the FM1 terminal.

○	F132	Multiple ratio of pulse frequency 1	1~36		1
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- ◎ Pulse frequency = output frequency × multiplying factor of pulse (with the maximum output of the pulse frequency at 1.25 KHz).

○	F133	FM1 Multifunctional output setup	0~21		1
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- ◎ Outputting an analog DC voltage DC 0~10V/1mA signal in a FM pulse manner can be taken to monitor the following 21 running status values of frequency inverter.(Similar to the function of F0 status display in Operator)

# V –Description of parameter functions–

R : Parameter is changeable during operation (○)

Setting	Function (100% Implication)	Setting	Function (100% Implication)
0	No output	11	Excitation Current Command
1	Motor Output Speed	12	Torque Current Command
2	PG Feedback Speed	13	Excitation Current
3	Pulse Frequency Command	14	Torque Current
4	Sensor-less Vector Output Speed	15	True Power
5	Power supply Source Frequency	16	Reactive Power
6	Slip Frequency	17	PID% Output
7	Output Voltage	18	Keypad operate signal AV
8	Excitation Voltage	19	AV1
9	Torque Voltage	20	AV2
10	Output Current	21	AI

○	F134	FM1 Analog output gain/10V	0.50~8.00	Pu	1.00
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◎ This function is applied to adjust the multiplying factor of the analog output of full voltage

×	F135	FM1 Analog polarity setup	0~1		0
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◎ Polarity setup is essentially done with DC 5V as the potential point at "0". Accordingly, any voltage greater than DC 5V relates to FWD speed signal; and smaller than DC 5V relates to REV speed signal. This function is applicable only to the display of output frequency or speed); therefore, any other function given with the polarity setup is of no significance.

■ **0 : Without Polarity** — with 0V as the reference point, and with no capability to identify FWD and REV.

■ **1: With Polarity** — with 5V as the reference point, and with the capability to identify FWD and REV.

## FM 2 AO waveform output (No.2.31 Special-Purpose)

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F136	FM2 Analog output mode	0~1		0
○	F137	Multiple ratio of pulse frequency 2	1~36		1
○	F138	FM2 Multifunctional output setup	0~21		10
○	F139	FM2 Analog output gain/10V	0.50~8.00	Pu	1.00
×	F140	FM2 Analog polarity setup	0~1		0

◎ Refer to FM1 parameter functions as FM2 parameter functions given in F136~F140 above are the same as that provided by FM1.



## AC Drive Parameters (No.2.32 Special-Purpose)

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F131	Longest outage duration allowable	0~5000	ms	20

- ◆ If the power outage time is less than the allowable set value of time, it will follow the cycle of sequence to restart machine; otherwise, it will trip directly and display Err7 (DC voltage too low). During the low-voltage period, PWM output will be turned off and Lu warning will be displayed at the same time.

※ **Current vector control mode is not suitable for the function to follow the cycle of sequence to restart machine after power restoration from power outage.**

○	F132	Terminal-actuating setup for failure reset and after power restoration	0~1		0
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- **0 : Direct Start** — When set 1: Digital input terminal control to F4 (Running Control source), and running control terminal (Di1 or Di2) is at normal close (ON) position, the frequency inverter will be started its running directly after inputting the power supply, power restoration and failure reset.

- **1 : Return the Start Command Terminal (Di)** — When set 1: Digital input terminal control to F4 (Running Control source), and running control terminal (Di1 or Di2) is at normal close (ON), the frequency inverter will be started its running provided that command terminal (Di1 or Di2) shall be restarted (OFF first→ and then ON) after inputting the power supply, power restoration and failure reset.

## FM 1 AO analogy output (No.2.32 Special-Purpose)

×	F133	FM 1 Ouput Mode	0~2		0
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- **0 : 0 ~ 10V** — FM 1 output corresponding value: 0~10V
- **1 : ±10V** — FM 1 output corresponding value : ±10V
- **2 : 4 ~ 20mA** — FM 1 output corresponding value:4~20mA

○	F134	FM1 Multifunctional output setup	1~21		1
○	F135	0V/4mA Bias Gain	0.0~700.0	%	0.0
○	F136	10V/20mA Gain	0.0~700.0	%	100

- ◎ Outputting an analog DC voltage signal in an analog manner can be taken to monitor the following 21 running status values.(Similar to the function of F0 status display in Operator)

# V –Description of parameter functions–

R : Parameter is changeable during operation (○)

Setting	Function (100% Implication)	Setting	Function (100% Implication)
0	No output	11	Excitation Current Command
1	Motor Output Speed	12	Torque Current Command
2	PG Feedback Speed	13	Excitation Current
3	Pulse Frequency Command	14	Torque Current
4	Sensor-less Vector Output Speed	15	True Power
5	Power supply Source Frequency	16	Reactive Power
6	Slip Frequency	17	PID% Output
7	Output Voltage	18	Keypad operate signal AV
8	Excitation Voltage	19	AV1
9	Torque Voltage	20	AV2
10	Output Current	21	AI

## FM 2 AO analogy output (No.2.32 Special-Purpose)

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F137	FM2 Output Mode	0~2		0

■ **0 : 0 ~ 10V** — FM 2 output corresponding value: 0~10V

■ **1 : ±10V** — FM 2 output corresponding value : ±10V

■ **2 : 4 ~ 20mA** — FM 2 output corresponding value:4~20mA

○	F138	FM2 Multifunctional output setup	1~21		1
○	F139	0V/4mA Bias Gain	0.0~700.0	%	0.0
○	F140	10V/20mA Gain	0.0~700.0	%	100

◎ For the functions of FM2 parameter in the foregoing parameters F137 ~F140, please refer to the functions of FM1 parameter for the identical functions.

## Motor nameplate

×	F141	Rated Voltage (rms)	150~500	V	N (Note 1, 2)
×	F142	Rated Current (rms)	1.0~1000.0	A	N(Note 1)
×	F143	Rated Frequency (Hz)	10.0~150.0	Hz	N(Note 1)

◆ F141~F146 related to the parameter group are to set up the nameplate of the motor; setting must be defined according to those rated settings on the motor nameplate.

(Note 2 : F141 : motor's rated voltage must  $\geq$  F129  $\div$  1.5)

- ◆ When the capacity of drive is bigger than the motor, the setting of F142 has to be bigger than rated current of drive divided 9. (F142>the drive rated current ÷9)
- ◆ The range of F142 from minimum to maximum is [Rated current of ac drive x (0.16 ~1.3)].
- ◆ Rated voltage, rated current and rated frequency set as above for the type of the motor are related to parameter functions of the ac drive driven motor. (N1: N=ex-factory setting varies according to the respective ac drive used)
- ※ **When applied to a vector control mode, it is a must to know the correct set value of motor parameters in order to obtain a better motor speed-response curve and torque-characteristic curve.**

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F144	Rated Speed	0~9000	rpm	N(Note 1)

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

×	F145	HP	0.5~600.0	HP	N(Note 1)
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- ◆ This parameter is related to the output rated power of the motor, please set up it according to the horsepower (HP).

Example : 1.5KW / 0.75KW = 2.0HP

×	F146	No. of poles	2~32	P	N(Note 1)
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- ◆ Setting is defined with the number of poles of the motor
- ◆ With V/F control, synchronous speed of the motor is achieved to correctly display the speed.
- ◆ With vector control, the ac drive uses the setting of this parameter as reference to perform the speed vector control calculation.

※ **Note 1: Different setup for F141~ F146 shall be made according to the practically different motor capacities.**

## Control Mode

×	F147	Control Mode Setup	-1~6		2
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- **-1 : Static Electric Motor Parameter Auto-tuning**— This function is to be used in some machinery equipment with heavy-load coupled that fail to be performed the dynamic parameter detection; however, it is necessary to correctly set up the F160 (Motor no-load current %) so that the motor electric parameter groups (F156~F159) can be detected in full with accuracy less than 0: Electric Motor Parameter Auto-tuning.

- **0: Static electric Parameter Detection** — The electric characteristics of the motor can be automatically calibrated through the auto-tuning of the static and dynamic parameters built in this parameter at F156~F160. (F156~F160)(F156~F160)

**Dynamic parameter tuning: By taking the forward rotation command to perform the operation at 2/3 speed (40Hz) of motor's rated frequency (60Hz) is able to carry out the detection of motor parameters at no-load or less than 50% load. )**

※ **Note: Display Pr RL (detection function)**

- **1: Mechanical Parameter Detection** — The mechanical inertia constant of the motor can be automatically calibrated by automatically setting up the mechanical constant value through the auto-tuning function of dynamic parameters built in parameter F161.
- **2: Open Loop scalar Control** — The AC drive outputs SVPWM waveform to the motor.
- **3: Closed Loop scalar Control** — The encoder mounted on the motor performs speed feedback for slip compensation so that the speed of the motor follows the speed command closely in high precision speed control.
- **4: Sensorless scalar Control** — Relates to the voltage type sensorless control er, whereby the voltage command and feedback current signal are applied to estimate the stator magnetic flux and determines the slip for making the frequency compensation.
- **5: Closed Loop Vector Control** — Relates to a current type closed loop(attached with PG) vector controller, to provide similar servo drive control with high precision speed response and torque control.
- **6: Sensorless Vector Control** — Relates to a current type sensorless vector controller, whereby the current command and feedback current error are applied to provide torque current compensation, The torque characteristics in the lower speed area using this mode outperforms the voltage control type, and provided smaller speed slip.

※ **The parameters F141~F146 of motor's nameplate to execute 0: Electric Motor Parameter Auto-tuning (Pr RL) must be firstly set if the control mode is set to 5: Closed Loop Flux Vector Control or 6: Sensorless Flux Vector Control; after its successfully execution, follow to set the 5: Closed Loop Flux Vector Control or 6: Sensorless Flux Vector Control accordingly. (Please see P4-2).**

**PROMPT : The application of 5: Closed Loop Flux Vector Control or 6: Sensorless FluxVector Control Mode must fall with the high speed [approximately 110% of the motor rated speed] where speed precision is the essence. Set up the following Parameter groups upon completing the electric parameter calibration:**

1. F121 = 0.90~0.95
2. F128 =1K~8K[Carrier Frequency]

## Encoder Setup

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F148	Speed Feedback	0~1		0

■ **0 : No Feedback**— Speed feedback disabled.

■ **1 : Encoder (PG)**— To perform speed feedback control to the master controller.

×	F149	Encoder (PG) Pulse	600~2500	P/rev	1024
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◎ Please set up a correct number of pulse wave in order to perform a precise speed control.

×	F150	Encoder (PG) Direction	-1~1		1
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■ **-1 : B leads A**— the motor operates in REV direction.

■ **0 : Single-phase pulse command**— Single-phase feedback allows only one-direction operation.

■ **1 : A leads B**— the motor operates in FWD direction.

○	F151	Encoder (PG) feedback speed / filtration time	0.0~100.0	ms	2.0
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◆ This function can be taken to filter out the noises generated from the pulse waves of motor and Encoder.

×	F152	PG OFF-line detection time	0.00~10.00	Second	3.00
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◆ PG off-line detection time (F152) is able to detect if the wire connection of Encoder is broken or bad connection.

◆ When set the detection time to 0.00, function for detecting the PG broken wire is disabled. This function is suitable for torque limit and torque control.

×	F153	Pulse command	600~2500	P/rev	1024
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◎ To set up the pulse number command needed per revolution of motor. (The maximum response input pulse frequency is 300 KHz).

$$F_P(\text{Hz}) = \frac{\text{Motor's revolving speed at the highest output}}{60} \times P (\text{pulse number}) = P/\text{rev}$$

◎ When a quick response is required, please set up the acceleration/deceleration time for operating the ac drive to the minimum value.

×	F154	Pulse command direction setup	-1~1		1
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■ **-1 : B leads A**— The motor operates in REV direction.

■ **0 : Single-phase Pulse Command**— Pulse frequency command is for phase A while operating direction command is for phase B.

■ **1 : A leads B**— The motor operates in FWD direction.

◎ After the completion of confirming the start direction by A-leading, B-leading, then a smooth control of forward/backward rotation direction command is achievable.



R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F155	Pulse Command multiplying factor	0.010~10.000	χ	1.000

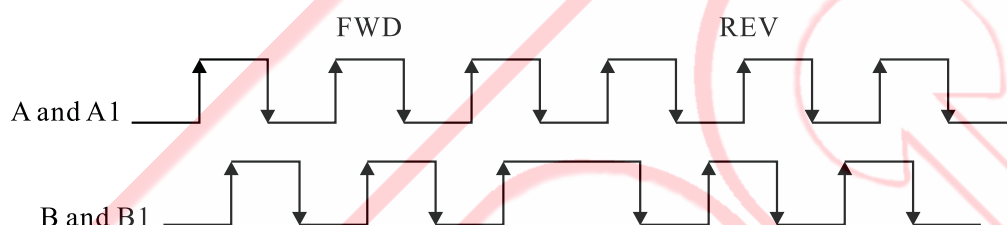
◎ Preset multiplying factor and adaptation with Encoder (PG) allows precise linked operation by ratio.

※ F148~F153 Relates to the encoder setup group, an encoder speed feedback card interface board provided with two sets of control interface to perform high precision speed control must be installed.

## PG-AB2 input mode setup

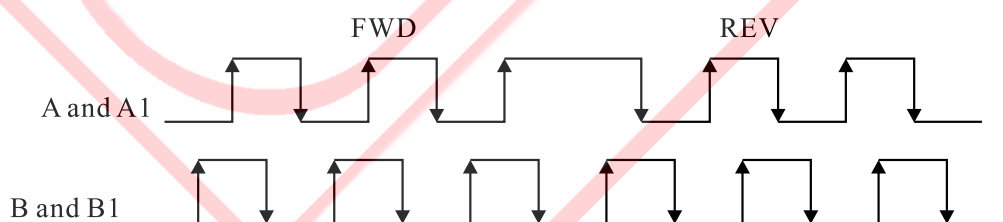
### ★ F150 Programmer (PG) input direction = 1:A leads B

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



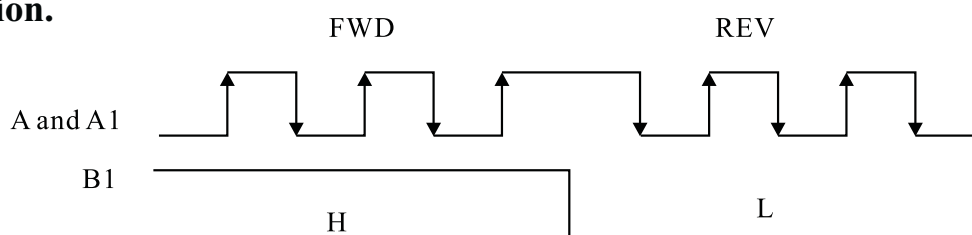
### ★ F150 Programmer (PG) input direction = -1:B leads A

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

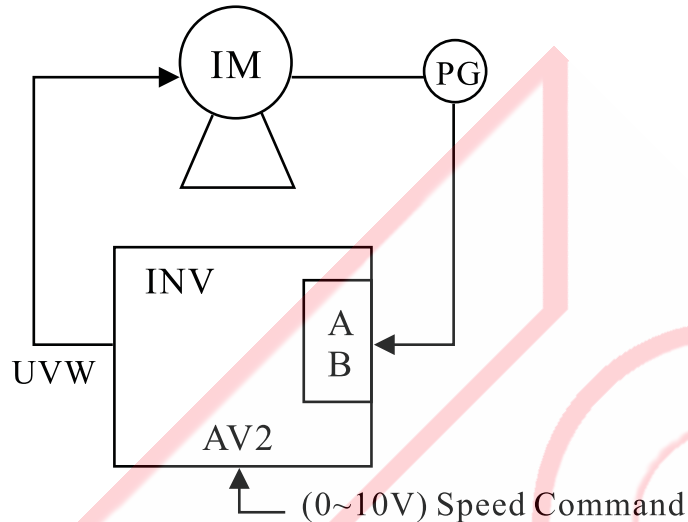


### ★ F150 Programmer (PG) input direction = 0:Single phase feedback/command

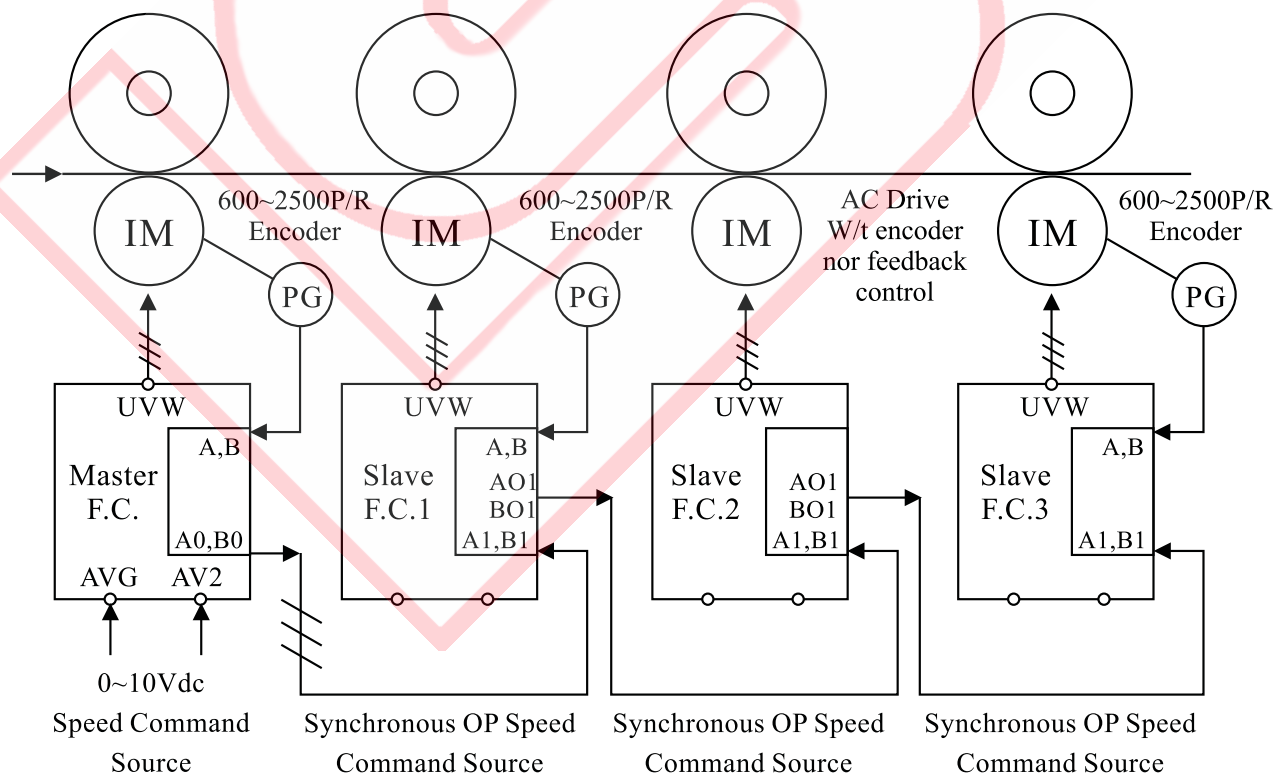
- Phase A is a pulse train
- A1 is a pulse train input by frequency speed command, phase B1 is for direction while symbol L is for backward rotation and H for forward rotation.



- ※ **Encoder (PG)**—Relates to the master encoder to perform speed feedback.  
Encoder mounted to the motor is connected to the interface board of Encoder (PG) to perform speed feedback, and speed error compensation so as to achieve high precision speed control.



- ※ **Pulse Frequency Command**— By taking the feedback Encoder pulse to perform a synchronous magnification as the speed command source with master encoder (PG) further equipped is able to perform a synchronous & serial operation or proportional linking movement for multiple units at a precise speed.



### Application Example: Universal Digital Synchronizer System Operation in Series

## Motor Electric Parameters

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F156	Stator Resistance	500~32767	Pu:Q17	10000
×	F157	Rotor Resistance	500~32767	Pu:Q17	8000
×	F158	Stator Inductance	3250~32767	Pu:Q12	9000
×	F159	Mutual Inductance	3250~32767	Pu:Q12	8750
×	F160	No-load current (%)	12.50~99.00	0.01%	40.00

※ This parameter group can be automatically set by F147 Control Mode- Electrical Parameter Auto-tuning Function. Modification of the setting by user is not required.

If the auto-tuning fails, manually enter the Parameters F156, F157, F158, F159 and F160. Obtains the five parameters from the Motor manufacturer, respectively Rs: Stator Resistance, Rr: Rotor Resistance, Ls: Stator Inductance, and Lm: Mutual Inductance, No-load current.

**EXAMPLE :** Motor manufacturer provides the parameters :

$R_s=0.3\Omega$   $R_r=0.303\Omega$   $L_s=L_r=0.0477H$   $L_m=0.0456H$

Motor Ratings: 220 V, 14 A, 60 Hz, No-load current 4.2A

Computation is as follow :

$$V_{base} = 220\sqrt{2}/\sqrt{3} = 179.63 \text{ (volt)}$$

$$I_{base} = 14\sqrt{2} = 19.8 \text{ (A)}$$

$$\omega_{base} = 2\pi \cdot 60 = 377 \text{ (rad/s)}$$

$$R_{base} = V_{base}/I_{base} = 9.07 (\Omega)$$

$$L_{base} = R_{base}/\omega_{base} = 0.02406 (H)$$

$$\bar{R}_s = \frac{R_s}{R_{base}} * 2^{17} = 0.0331 * 2^{17} = 4338..... (F156)$$

$$\bar{R}_r = \frac{R_r}{R_{base}} * 2^{17} = 0.0334 * 2^{17} = 4378 ..... (F157)$$

$$\bar{L}_s = \bar{L}_r = \frac{L_s}{L_{base}} * 2^{12} = 1.9825 * 2^{12} = 8120..... (F158)$$

$$\bar{L}_m = \frac{L_m}{L_{base}} * 2^{12} = 1.8953 * 2^{12} = 7763..... (F159)$$

$$\begin{aligned} \text{No-load current (\%)} &= (\text{motor no-load current} / \text{motor rated current}) \times 100 \\ &= (4.2A / 14A) \times 100 = 30(\%).....(F160) \end{aligned}$$

**Note:** In the calculation,  $2^{12}$  and  $2^{17}$  are constants in format Q and shall not be changed. ( $2^{12} = 4096$ ,  $2^{17} = 131072$ )

×	F161	Mechanical Constant(Rotor Inertia)	0~30000	Q16	1500
---	------	------------------------------------	---------	-----	------

◎ To determine the rotor inertia of the motor. (Motor rotor inertia calibration must be when F147 : 5 Closed Loop Flux Vector Control is used).

## Flux Estimation Tester

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F162	Magnetic Flux Estimator Bandwidth (LPF)	1.0~20.0	Hz	3.0

- ◆ A smaller set value will lead to a higher low-speed torque, a smaller speed error that makes the speed easy to be unstable.

A higher set value will lead to a smaller low-speed torque, a bigger speed error that makes the speed stable.

- ※ Suitable for F147 = **6 : Sensorless Flux Vector Control** mode.

×	F163	Speed Estimator Bandwidth (LPF)	1.0~20.0	Hz	4.0
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- ◆ A small set value will make the speed response slow and smooth at steady state.

A big set value will make the speed response quick and unsmooth at steady state.

- ※ Suitable for F147 = **4 : Sensorless V/F Scalar Control** or **6 : Sensorless Flux Vector Control** mode.

○	F164	Slip Compensation Gain	10~200	%	100
---	------	------------------------	--------	---	-----

- ◆ If the load to motor increases, the motor reduces its speed resulting in greater motor speed difference. The function of slip compensation gain is to overcome the speed slip due to load change of the motor so as to maintain a constant speed.

- ※ Suitable for F147 = **4 : Sensorless V/F Scalar Control** or **6 : Sensorless Flux Vector Control** mode

- ◆ The rated slip of motor can be computed from the following formula according to the numerical values in the motor nameplate:

Synchronous motor rotating speed =  $60\text{Hz}(4\text{P}) \times 30 = 1800\text{rpm}$

Motor rated rotating speed = 1730rpm

Slip of rotating speed =  $1800 - 1730 = 70\text{rpm}$

- ※ LS800 Series default rated slip frequency is 3Hz

Slip Compensation =  $\text{F164} \times 3\text{Hz}$

**Example** : Slip Compensation =  $88\% \times 3\text{Hz} = 2.64\text{Hz}$

- ※ F147 = 6 : Sensorless flux vector control

Slip Compensation = Motor electric parameters (F156~F160)  $\times$  F164

## Speed PI Controller (ASR)

- ※ PI control: PI control is a combination of proportional control (P) and integral control (I) that can make an offset to thereof controlled set point according to the error value and time-derived variation.

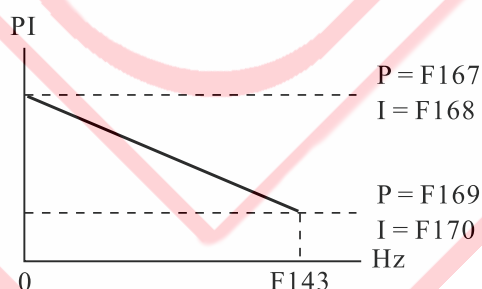
R	Parameter	Description	Range	Unit	Ex-factory Setting
○	F165	Scalar Speed Control P Gain	2~100	%	20
○	F166	Scalar Speed Control I Gain	0.0~100.0	%	50.0

- ◎ The scalar speed PI control is to provide operation compensation for (F147) Control Mode = 3: Closed Loop V/F scalar Control operation.

○	F167	Low-speed Sensorless Speed Control P Gain	2~100	%	50
○	F168	Low-speed Sensorless Speed Control I Gain	0.0~100.0	%	50.0
○	F169	High-speed Sensorless Speed Control P Gain	2~100	%	30
○	F170	High-speed Sensorless Speed Control I Gain	0.0~100.0	%	30.0

- ◆ PI speed control: PI control is to make a response that control the speed according to the speed deviation and time-elapsd variation through the combination of (P) proportional control and (I) integral control.
- ◆ Suitable for the control mode of F147 = 5 : Close-loop vector control and 6 : Sensorless vector control.

**Caution :** The abovementioned parameter modulation is the PI-modulating parameter for speed. It directly affects the dynamic response speed and control precision of system. Under general condition, the user has no need to alter the ex-factory values.



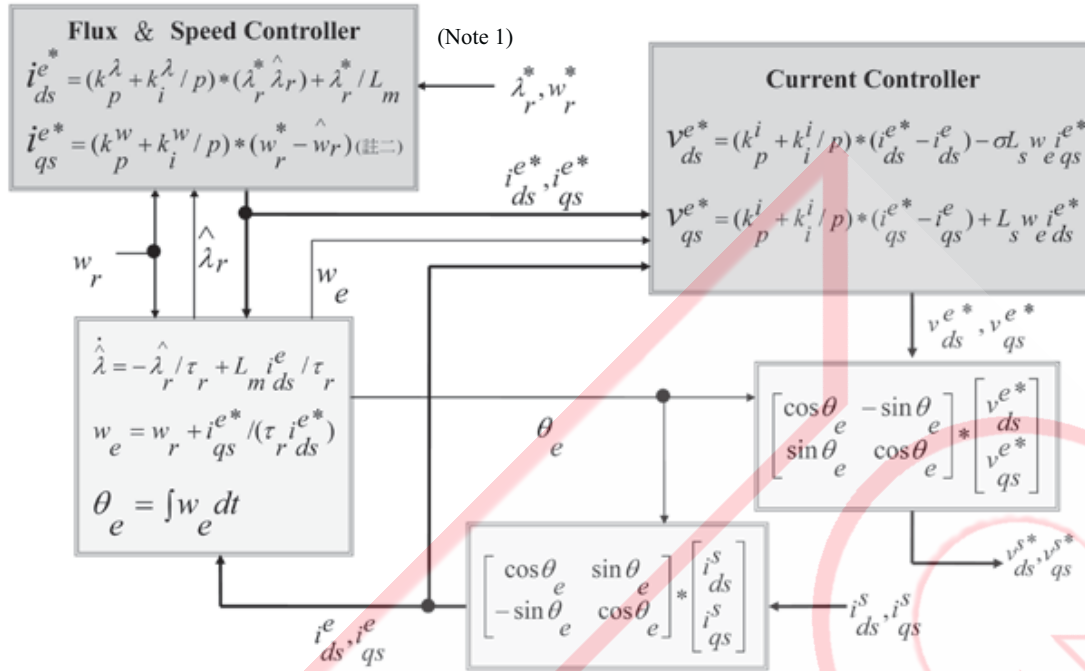
※ Please be cautious to the reaction from system simultaneously when modulating the parameters F167~F170.

### ※ Prompt:

- (1) When you are using a motor with a high-efficiency, high-torque or a lower base frequency, a smaller set value of P gain shall be set to F167 and F169; otherwise , a bigger set value shall be used instead.
- (2) If system needs a shorter acceleration/deceleration time, please set the F92 stall protection function to 0 together with an additional mounting of brake unit, or consider upgrading the capacity of frequency inverter for one level higher.
- (3) PI parameters for speed control are closely related to the loading inertia and acceleration/deceleration time of motor system. The user can make adjustment based on the ex-factory PI parameters to go with different requirements of load characteristic in order to satisfy all kinds of need for different situation.



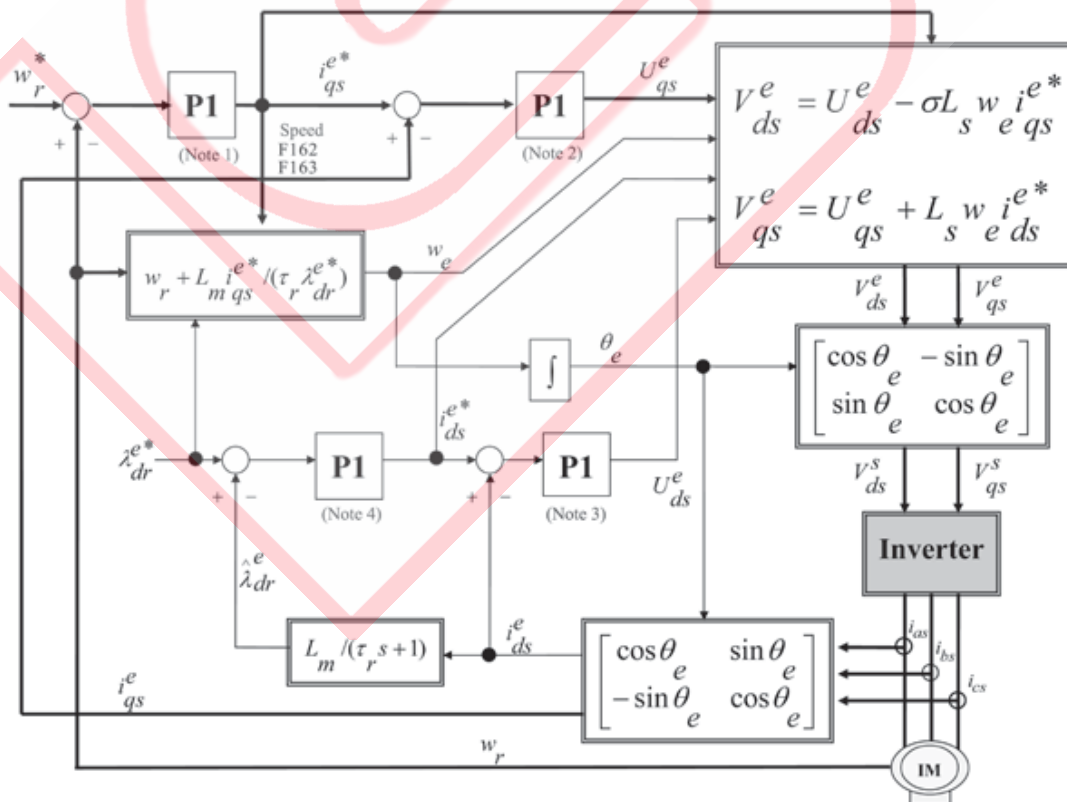
## Magnetic Filed Oriented Control Block Chart



Note 1 : The formula to solve magnetic field current is resident in the software and prevents from any alternation.

Note 2 : The formula to solve speed PI is adjusted by F167 and F168.

## PI Speed Control Parameters Mathematical Calculation Chart



Note 1: PI herein will be set by the client, F165~F170.

Notes 2, 3, and 4: All resident in the software that prevent from any alternation.

## V -Description of parameter functions-

R : Parameter is changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F171	Low-speed magnetic-field magnification factor	100.0~180.0	%	140.0
×	F172	Magnetic-field magnification cut-off frequency	0.00~0.60	Pu	0.20

◆ The F171 & F172 Torque compensation cut-off frequency sensor-less vector control mode function for F147= 5 Closed Loop Flux Vector Control and 6 : Sensorless Flux Vector Control is suitable for the equipment that needs high torque at low speed.

◆ Torque compensation is to take the no-load current of motor as the fiducial point while compensation cut-off frequency is to take the rated frequency of motor as the fiducial point.

Note: No-load current is the detected value from the detection & measurement of motor electric parameters.

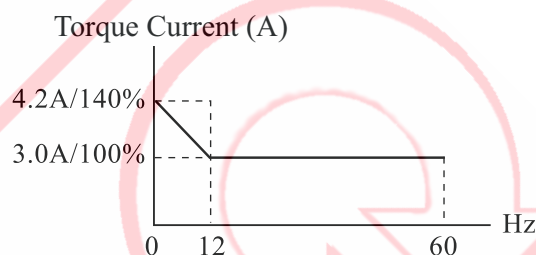
Ex.: Motor no-load current = 3.0A,

motor rated frequency=60Hz,

F171=140%, F172=0.20

Computation formula:  $3.0A \times 140\% = 4.2A$

$60 \text{ Hz} \times 0.20 = 12 \text{ Hz}$



○	F173	Torque Current Limit	0.000~1.250		1.000
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◆ To set the torque current of the maximum load output from the AC drive.

Torque current = AC drive Rated Output Current (rms) x (F173) Torque Current Limit Setting. × 2

Ex.: 400V series 5HP ac drive, rated current 9.0A.

Torque Current Limit =  $9.0 \times 2 \times 1.000 = 18.000$

◆ Torque current limit is provided only for two types of control modes setup operation, F147 = 5 : Closed Loop Flux Vector Control, and 6 : Sensorless Flux Vector Control.

※ **Caution: The ac drive must match with the motor.**

×	F174	Torque Current analog control source selection	0~5		0
---	------	------------------------------------------------	-----	--	---

◆ To set up the option of torque control command input from the following four analog input signals and PID control torque, to take the analog signal 100% to correspond the set value of F173. ( this function is only active under F147 = 5 Closed Loop Flux Vector Control mode, and 6: Sensorless Flux Vector Control.mode, Please refer to F50 ~ F64 for setting the analog parameters. )

■ **0 : Disabled**— The analog torque control is disabled.

■ **1 : Digital Operator Panel AV**— Linear torque control is done by the input signal voltage (DC 0~5V) from the digital operator AV.

■ **2 : AV1**— The torque current set by F148 corresponding to input signal voltage (DC 0 ~ ±10V) from the external terminal AV1 is applied to perform the linear torque control.

- **3 : AV2**— The torque current set by F173 corresponding to input signal voltage (DC0~10V) from the external terminal AV2 is applied to perform the linear torque control.
- **4 : AI**— The torque current set by F173 corresponding to input signal current(4~20mA) or voltage (DC 0~10V) from the external terminal AI is applied to perform the linear torque control.
- **5 : External PID**— To perform torque PID feedback control. (Refer to PID Parameter Group F186-F200).

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F175	Torque Control Mode	0~1		0

- **0 : Torque Current Limit**— To follow the analog signals to perform torque current output limit.

- **0 : Torque Current Command(Over-speed trip)**— To follow the analog signals to perform torque current output control.

×	F176	Torque control over-speed tripping frequency	0.0~400.0	Hz	60.0
---	------	----------------------------------------------	-----------	----	------

- ◆ When using the torque current command control with a load coefficient smaller than the torque current command value, the increase of speed frequency will go up unlimitedly; therefore, if there is a safety concern in this regard, please set an upper limit to F176 Torque Control over-speed tripping frequency so that the ac drive will trip at an error code Err 24 when output limit exceeds this upper limit.

## Zero-speed positioning

×	F177	Closed loop vector control zero-speed positioning	0~2		0
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- **0 : Disabled**
- **1 : Zero-speed positioning**— When enabled this function, the internal control will lock the zero-speed that protect the rotor position of motor from drifting and rotating.
- **2 : Pulse frequency command position tracking**— To take the pulse number as the speed command and position control command; please set relevant parameters to F153 ~ F155 and set the F15 upper-limit frequency to a frequency above 115% of operating command frequency.

○	F178	Zero-speed positioning P gain	2.00~100.00	%	30.00
○	F179	Zero-speed positioning I gain	0.00~100.00	%	20.00

## Abnormality Records

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F180	Latest Abnormality Record	0~60		0
×	F181	Last 1 abnormality Record	0~60		0
×	F182	Last 2 abnormality Records	0~60		0
×	F183	Last 3 abnormality Record	0~60		0
×	F184	No. of auto-reset	0~10		0

- ◆ When taken place an abnormal tripping phenomenon when ac drive is running, F184 will automatically reset to clear the abnormality (Auto-reset is disabled when set to 0); for safety concern if any, please cancel F184 Auto-reset function.
- ◆ The number of time of auto-reset is to be set up by the user; and when the number of abnormality exceeds the established number of time, pressing the RESET pushbutton from the digital operation panel for clearance is required; or set the digital input terminal 2 to: RESET CLEARANCE to reset to zero the number of time of auto-reset.
- ◆ A default time setting to reset the abnormality automatically is 6 seconds; for equipment with a larger mechanical inertia, please refer to F6 functions to enable a time-delay for activating the operation.
- ◆ For an abnormality taken place at standby state F xx.xx, F184 will not reset automatically, pressing RESET pushbutton for clearing the reset is required.
- ◆ When taken place an abnormality when operation control source is set to F4: 0 Digital operation panel, F184 will automatically reset and restart the operation.
- ◆ When taken place an abnormality when operation control source is set to F4: 1 Digital input terminal, F184 will automatically reset and operate under the current control mode.

×	F185	Abnormality Records Cleared	0~1		0
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○ Clear the Alarm trips stored in the memory.

■ **0 : Not Cleared.**

■ **1: Cleared.**

Err Code	Description of Alarm Report
Err 0	Digital operation panel communication failure
Err(U,A) 1	Over voltage (Err U1) or current (Err A1)in standby statu (Hardware detection protection)
Err(U,A) 2	Over voltage (Err U2) or current (Err A2)during acceleration (Hardware detection protection)
Err(U,A) 3	Over voltage (Err U3) or current (Err A3)during deceleration (Hardware detection protection)
Err(U,A) 4	Over voltage (Err U4) or current (Err A4)during speed regulation (Hardware detection protection)
Err 5	Heat sink overheated

R : Parameter is changeable  
during operation (○)

## –Description of parameter functions– V

Err Code	Description of Alarm Report
Err 6	Dc Bus over voltage
Err 7	Dc Bus low voltage
Err 8	Electronic thermal relay action (Motor overload)
Err 9	AC Drive voltage not matched to the motor voltage
Err 10	Software detected overload current protection
Err 11	AC Drive rated current range not matched to motor current
Err 12	Loss of output U-phase or U-phase C.T failure
Err 13	Loss of output V-phase or V-phase C.T failure
Err 14	Loss of output W-phase or W-phase C.T failure
Err 15	Reserved
Err 16	Encoder direction opposite to the phase sequence on the output side
Err 17	Encoder signal abnormalit
Err 18	Parameter detection failure
Err 19	Position-tracking error greater then 40 turns
Err 20	Overload (150%,60 sec)
Err 21	PG off-line detection
Err 22	Break wire detected analog signals AI
Err 23	Absence of speed feedback affecting performance of closed loop control
Err 24	Torque control overrides the F176 overspeed setting
Err 25	EEPROM parameter read back out of range
Err 26	Digital operation panel storage parameter write failure
Err 27	DSP storage parameter locked and preventing modification.
Err 28	Operator panel storage parameter locked and preventing modification
Err 29	External input abnormality
Err 30	3-phase current amplitude difference too big
Err 31	Current leakage or abnormal 3-phase current sum
Err 32	PUF fuse burnt out
Err 33	Power failure or too low mains input phase voltage
Err 35	Error in automatic operation time setup
Err 36	Digital input terminal setup repeated.
Err 15 、 Err 34 、 Err 37~Err 60    Are signals reserved for failure.	



## External PID

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F186	PI Target Value Input Options	0~4		0

- **0 : PID Disabled** — PID control not activated.
- **1 : PID Stop Setting Zero-in** — In PID control, the final PID control value is not memorised.
- **2 : PID Stop Setting Reserved** — In PID control, the final PID control value is memorised when the of operation command stops; when the operation command is reactivated, the memorised PID value acts as the initial PID value for control.
- **3 : DI enabled (PID Stop Setting Zero-in)** — With PID control activated by the multi-function input terminal, the final PID control value is not memorised when the operation command stops.
- **4 : DI enabled (PID Stop Setting Reserved)** — With PID control activated by the multi-function input terminal, the final PID control value is memorised when the operation command stops; when the operation command is reactivated, the memorised PID value acts as the initial value of PID for control.

×	F187	PI Target Value Input Options	0~8		0
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◎ Input terminal is selected to function as the PID setpoint frequency command.

Setting	Function	Description of Function	
0	PI initial value setup	PI setpoint command % value is directly set up by Parameter (F190).	
1	AV1 Input	<ul style="list-style-type: none"> <li>External analog frequency command input terminal sets the setpoint value.</li> <li>Gain of analog frequency command is adjusted by Parameter F52~F66</li> </ul>	
2	AV2 Input		
3	AI Input		
4	Pulse Frequency Command Value	<ul style="list-style-type: none"> <li>Input of external setpoint value of pulse signal (option card PG- AB2) frequency command is set up by Parameters F148~F155.</li> </ul>	
5	Encoder (PG) feedback Value		
6	RAMP output	<ul style="list-style-type: none"> <li>S curve Output (Acceleration/Deceleration time curvature)</li> </ul>	
7	Total output current	$\hat{I}$	$\text{Total } \hat{I} = \sqrt{i\theta^2 + iJ^2}$ $i\theta = \text{Excitation current}$ $iJ = \text{Torque current}$
8	Torque current	$\eta$	

R : Parameter is changeable  
during operation (○)

## –Description of parameter functions– V

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F188	PI Feedback Input Options	0~8		0

◎ Input terminal is selected to function as the PID feedback detection source

Setting	Function	Description of Function	
0	PI initial value setup	PI setpoint command % value is directly set up by Parameter (F190).	
1	AV1 Input	<ul style="list-style-type: none"><li>External analog frequency command input terminal sets the setpoint value.</li><li>Gain of analog frequency command is adjusted by Parameter F52~F66</li></ul>	
2	AV2 Input		
3	AI Input		
4	Pulse Frequency Command Value	<ul style="list-style-type: none"><li>Input of external setpoint value of pulse signal (option card PG- AB2) frequency command is set up by Parameters F148~F155.</li></ul>	
5	Encoder (PG) feedback Value		
6	RAMP output	<ul style="list-style-type: none"><li>S curve Output (Acceleration/Deceleration time curvature)</li></ul>	
7	Total output current	$\hat{I}$	Total $\hat{I}=\sqrt{i\varnothing^2+iJ^2}$ $i\varnothing$ = Excitation current $iJ$ = Torque current
8	Torque current	$\eta$	

×	F189	D Input Options	0~8		0
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◎ Input terminal is selected to function as the Derivative feedback input.

Setting	Function	Description of Function	
0	PI Error	Error resulted from the PI setpoint and measured value sets the Derivative feedback input.	
1	AV1 Input	<ul style="list-style-type: none"><li>External analog frequency command input terminal sets the setpoint value.</li><li>Gain of analog frequency command is adjusted by Parameter F52~F66</li></ul>	
2	AV2 Input		
3	AI Input		
4	Pulse Frequency Command Value	<ul style="list-style-type: none"><li>Input of external setpoint value of pulse signal (option card PG- AB2) frequency command is set up by Parameters F148~F155.</li></ul>	
5	Encoder (PG) feedback Value		
6	RAMP output	<ul style="list-style-type: none"><li>S curve Output (Acceleration/Deceleration time curvature)</li></ul>	
7	Total output current	$\hat{I}$	Total $\hat{I}=\sqrt{i\varnothing^2 + iJ^2}$ $i\varnothing$ = Excitation current $iJ$ = Torque current
8	Torque current	$\eta$	

※ **ATTENTION !** The feedback input type of F188 and F189 shall not be the same type used for the setpoint input of F187.

## V -Description of parameter functions-

R : Parameter is changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory Setting
○	F190	PI Initial Value Setup	0.00~100.00	%	50.00

- ◎ This parameter sets up a fixed PI controller setpoint value or feedback value; however, both the setpoint source and the feedback source can not be set up with this function at the same time.

○	F191	D input filtration time setup	0.05~10.00	Sec	0.20
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- ◎ Derivative input is connected to a low pass filter to filter high frequency noise with the time constant  $\tau = F191/2.3$

○	F192	PID Output Limit	0.00~100.00	%	100.00
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- ◎ This parameter is to be used for PID control with % as the unit of output limit, and the upper limit of PID control is 100%, the highest output frequency.

○	F193	Unit 1 Kp Gain	2.00~300.00	%	100.00
○	F194	Unit 1 Ki_H Gain	0.0~3000.0	%	400.0
○	F195	Unit 1 Ki_L Gain	0.0~3000.0	%	200.0
○	F196	Unit 1 Kd Gain	0.0~3000.0	%	20.0
○	F197	Unit 2 1Kp Gain	2.00~300.00	%	100.00
○	F198	Unit 2 Ki_H Gain	0.0~3000.0	%	5.0
○	F199	Unit 2 Ki_L Gain	0.0~3000.0	%	5.0
○	F200	Unit 2 Kd Gain	0.0~3000.0	%	5.0

**Kp Control:** The operation gain amounts to the proportional change of output. The response gets faster when a higher gain is entered, however, excessively large gain generates output instability. The response gets slower when a smaller gain is entered. Note: The gain of the KP control should not be entered as 0.

**Ki Control:** The operation gain amounts to integral change of output; the effective response is achieved by having the feedback value to be same as setpoint value. The response is faster when a higher integral gain is entered; however, excessive large gain will generate output instability.

**Kd Control:** The operation gain amounts to the rate of output changes; This gives a faster response to any sudden change. The output change will decay faster when a higher differential gain is entered; however, excessively large gain will generate output instability.

- (1) There are two units of PID parameter settings available to perform switched operation control by using the digital multi-function terminal inputs.

◎ The conversion between PID controller setpoint and feedback values is described as follows:

The speed command value set by F52~F66, the input analog voltage or current is divided by (F15) speed upper limit to give the % value.

**For Example :** F57 = 10% , F58 = 100% , F15 = 100.0Hz

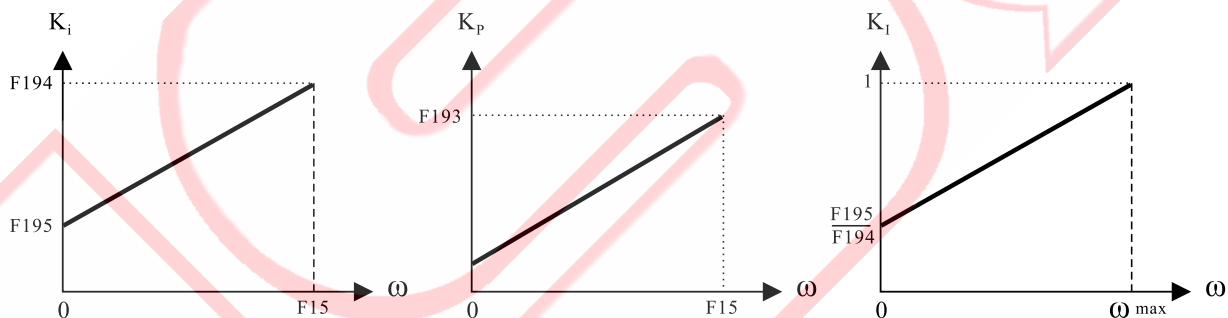
(F187 or F188) = 2 : AV2

voltage % =  $100 \times \{ (2/10) \times (60/100 \times 100) + (60/100 \times 10) \} / F15 = 18\%$

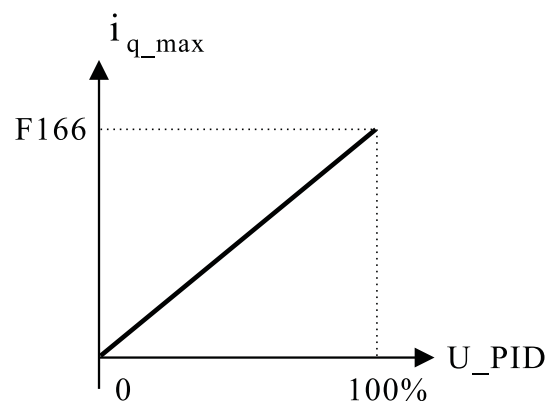
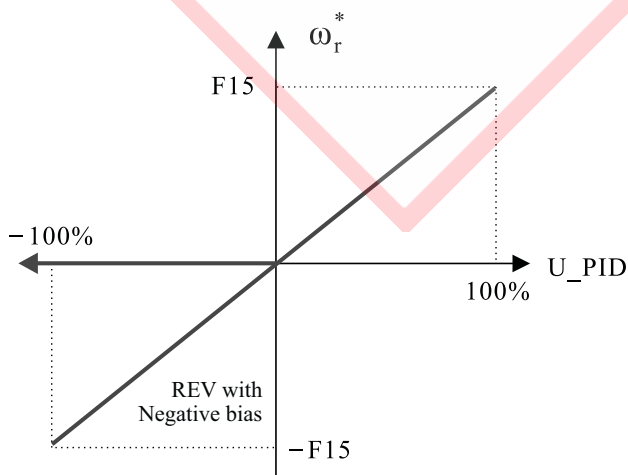
4~6 : % =  $100 \times (\text{feedback speed/speed upper limit})$

7~8 : % =  $100 \times (\text{current/current when the current detector outputs 5V})$

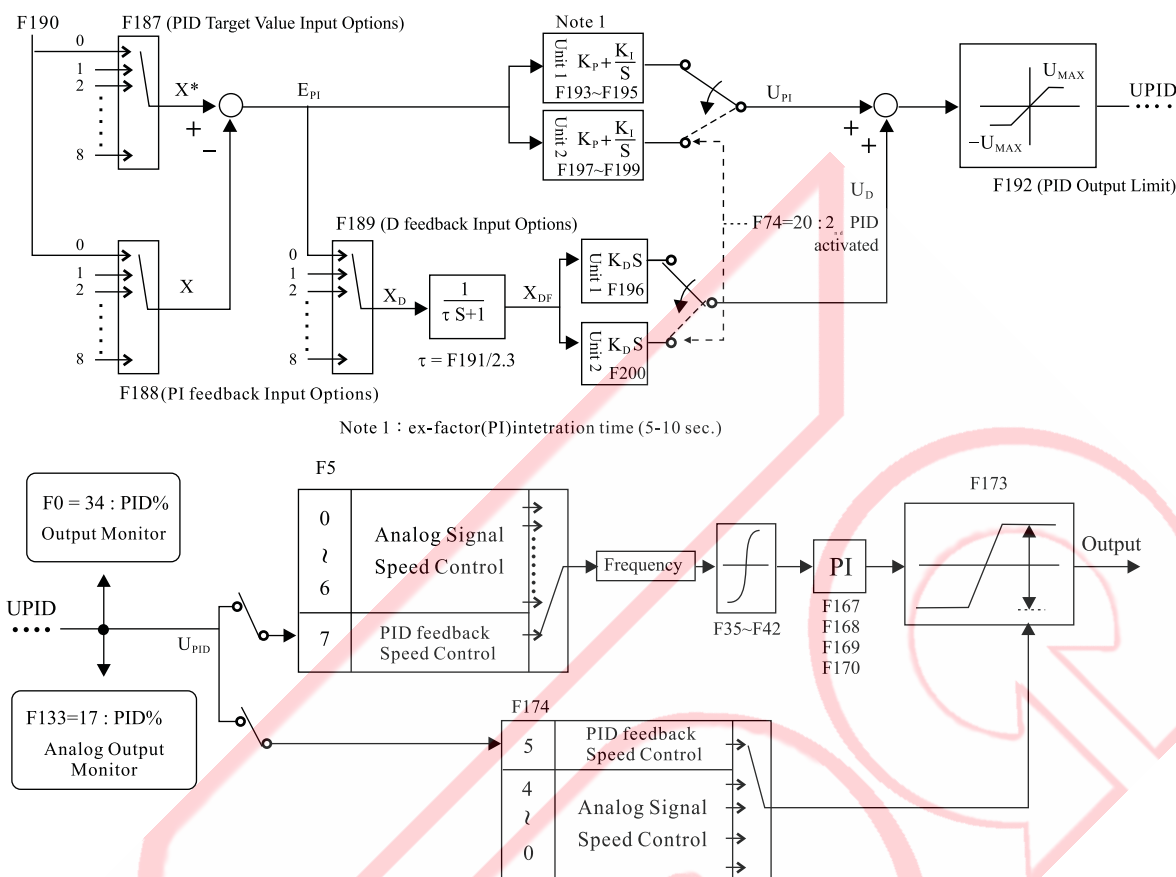
- (2) Ki gains (Ki\_L and Ki\_H) at the zero-speed and the speed upper limit can be respectively set up. The settings will change proportionately according to the respective speed command changes. ( $Ki\_L \leq Ki\_H$ )
- (3) Kp gain setting corresponds to (F15) speed upper limit. Kp gain is automatically adjusted within the range of the speed upper limit according to change of multiplication of Ki gain.
- (4) If the setting for the Ki\_L is the same as that given to Ki\_H, then both Kp gain and Ki gain will not vary according to the speed.



- (5) Kd gain will not change according to speed command
- (6) When PID output acts as the speed command, 100% = F15 (speed upper limit).
- (7) When the PID output acts as the torque current limit, 100% = F173 (Limit current).



## PID Control Block Chart :



## Special parameter setup

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F201	Set the minimum working pressure	1.0~20.0	%	2.0

■ An application parameter relevant to the Parameter F5 : Speed command source and 8 : AV2 + external PID control mode.

(1) Unless otherwise the pressure mode at minimum pressure is enabled at PID command value  $<$  Parameter F201, and AV2  $<$  0.5 %, it is under general control mode.

(2) Under the general control mode :

(A) If PID command value  $<$  Parameter F201, and AV2  $\geq$  0.5 %, then it is in general control mode.

(B) When PID command value  $\geq$  Parameter F201 :

(a) Under general control mode :

If PID feedback value  $<$  PID command value, then it stays at general control mode.

If PID feedback value  $\geq$  PID command value, then it enters into PID control mode.

(b) Under PID control mode :

If PID command value  $\geq$  Parameter F201, then it stays at PID control mode.

If PID command value  $<$  Parameter F201, then it ends the PID control mode.



## No.2.31 Special-Purpose

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F202	Longest outage duration allowable	0~5000	ms	20

- ◆ If the power outage time is less than the allowable set value of time, it will follow the cycle of sequence to restart machine; otherwise, it will trip directly and display Err7 (DC voltage too low). During the low-voltage period, PWM output will be turned off and Lu warning will be displayed at the same time.

※ **Current vector control mode is not suitable for the function to follow the cycle of sequence to restart machine after power restoration from power outage.**

### Communication setup

×	F203	AC Drive Comm. Address	1~255		1
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- ◆ The address range of the ac drive communication falls between 1 ~ 255, representing the address of the ac drive in the communication network. The remote controller (PC or PLC) must be given remote control of the communication address set for each ac drive. (Note 1)

**Note1:** No AC drive shall have the same communication address within the same communication network.

×	F204	PC Transmission Rate	0~4		2
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2400 Bps transmits  $2400 / 8 = 300$  bytes per second.

The type of transmission cable and its length affect the transmission rate. In the case of longer cable being used, the cable with slower transmission rate is preferred to compensate for a higher transmission quality and stability. If faster response speed is expected from the ac drive, adjust for higher transmission rate or adjust(F206) ac drive response time.

**0 : 2400      1 : 4800      2 : 9600      3 : 19200      4 : 38400**

×	F205	PC Communication Data Format	0~3		0
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- 0 : 8,N,1 RTU ( 1 start bit + 8 data bits + 1 stop bit )
- 1 : 8,E,1 RTU ( 1 start bit + 8 data bits + 1 Even bit + 1 stop bit )
- 2 : 8,0,1 RTU ( 1 start bit + 8 data bits + 1 Odd bit + 1 stop bit )
- 3 : 8,N,2 RTU ( 1 start bit + 8 data bits + 2 stop bits )

×	F206	Response time of frequency inverter	3~50	ms	5
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※ The response time of the ac drive is the delay time between the time the ac drive receives command signal from the remote controller and the time the it sends its response signal. The time between the response time of the remote controller from one transmitted package to the next may vary, If the response time of the acdrive is too short and not matching to the response time of the remote controller, the response signal may get overlapped with the command signal in the communication network. Therefore, the response time for the ac drive must be set to that of the remote controller.

×	F207	Receive Failure Response	0~7		0
---	------	--------------------------	-----	--	---

- |                                  |                                                                  |
|----------------------------------|------------------------------------------------------------------|
| ■ <b>0 : Normal Receiving</b>    | ■ <b>4: Packet-receiving time exceeds 0.2 second</b>             |
| ■ <b>1 : Function Code Error</b> | ■ <b>5: Informally alter the parameters during the operation</b> |
| ■ <b>2 : CRCL Error</b>          | ■ <b>6 : Parametric value out of range</b>                       |
| ■ <b>3 : CRCH Error</b>          | ■ <b>7 : Parameter code error</b>                                |

## II. Use instruction of computer communication software

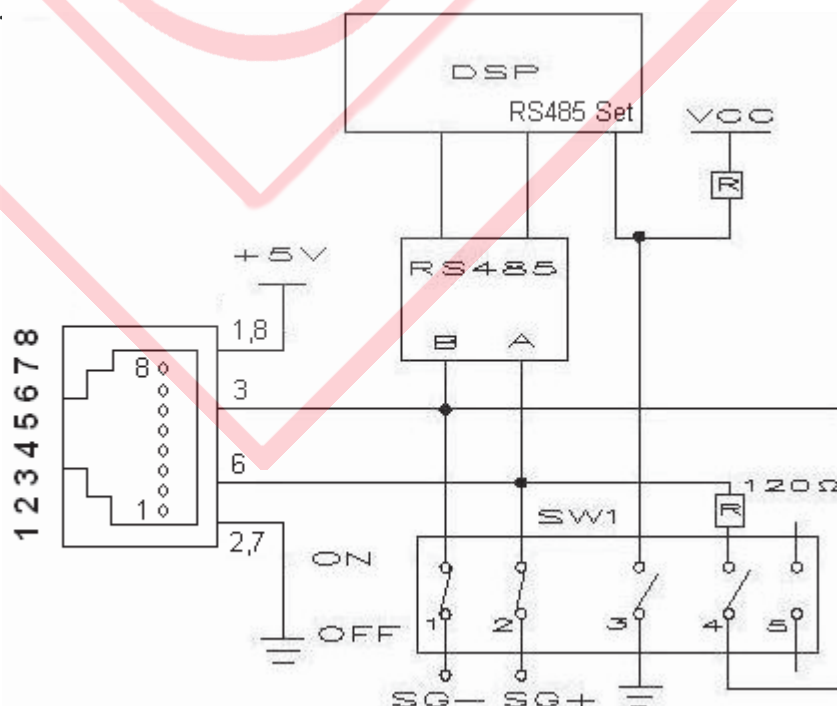
### Setup of communication parameters for ac drive and switch changeover method of hardware

(The digital operation panel is required to perform the following setups)

1. When applying the computer software for communication, the communication parameters (F203 ~ F206) shall be established first by digital operation panel.
2. Setup of parameters: F203: communication address of ac drive, F204: PC transmission rate, F205: communication data format, F206: response time of ac drive, etc. Please select the required communication rate and data format corresponding to the PC in order to access a normal linking for communication.
3. After finishing the setup of parameters for software, please disengage the digital operation panel from ac drive, and set the 1st, 2nd and 3rd pins ON from the SW1 in the motherboard of ac drive. (Please refer to P2-10 in Application Manual).

### Connection of hardware

1. For PC serial communication ports (COM.PORT), route it to RS485 device with a RS232, and then connect the signal line to the SG+ and SG-, two terminals at the terminal block of AC drive.
2. For PC Universal Serial Bus, route the USB to the RS485 signal converter, and then connect the signal line to the SG+ and SG-, two terminals at the terminal block of AC drive.



- Set SW1 Pin3-ON for RS485 MODBUS communication format and pin3-OFF for RS485 digital operation panel format.
- Pin4 of SW1 is a terminal resistance for RS485 communication (120R).

## MODBUS Communication

### LS800 series:

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

※ The RS-485 is the internally exclusive communication format for digital operation panel(Note 1); and a different communication format shall be applied to the external (SG-、SG+) MODBUS communication monitoring(Note 2); do not connect them at the same time for operation; only single format is allowed to be enabled.

Note 1: The internally used signals are signals for digital operation panel to perform the operation and control.

Note 2: The externally used signals are signals to perform the external monitoring that are input from the signal terminal SG-, SG+ of RS485 Modbus to the terminal block; the sources are PLC and Computer, etc.

Please refer to P2-10 for description of relevant setup.

### ◆ Communication procedures between RS485 MODBUS and PLC

- (1) When selected the RS485 communication method to carry out the monitoring and control of ac drive, for the first thing, the digital operation panel shall be taken to establish the parameters of communication mode (F203 ~ F207).

F203 : Communication address of ac drive (1~255)

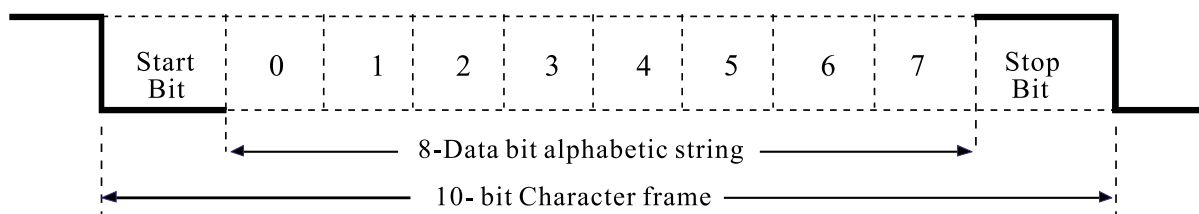
**Caution :** The legal communication addresses are ranging from 1 to 255; if the communication address is set to 0, it means to perform a broadcasting to all motor actuator. Under such a mode, the motor actuator will not respond any message to the master device.

F204 : PC transfer rate (0~4)

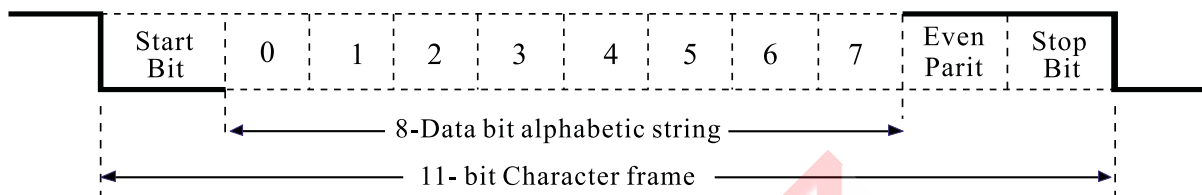
0 : 2400、1 : 4800、2 : 9600、3 : 19200、4 : 38400

F205 : Communication data format (0~3)

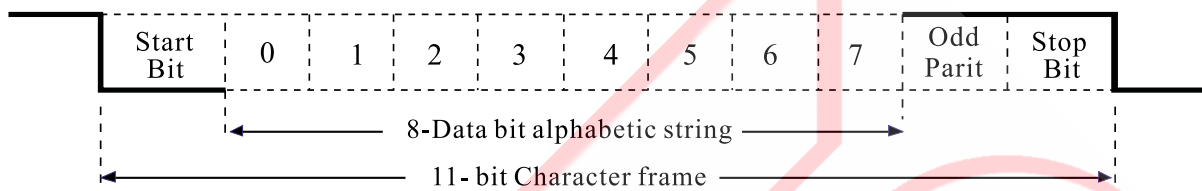
0 : (8, N, 1) RTU (1 Start bit + 8 data bits + 1 stop bit)



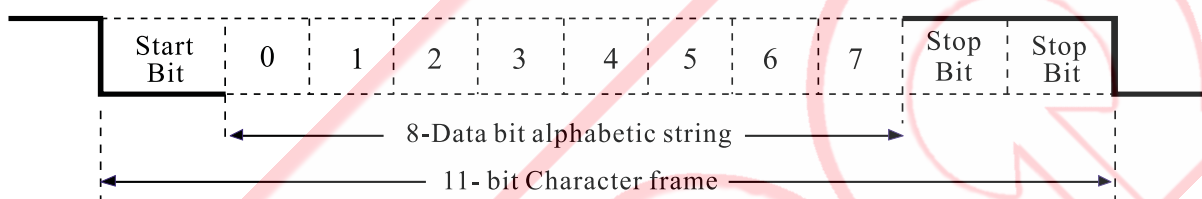
1 : (8 , E , 1) RTU ( 1 Start bit + 8 data bits + 1 Even bit + 1 stop bit )



2 : (8 , 0 , 1) RTU ( 1 Start bit + 8 data bits + 1 Odd bit + 1 stop bit )



3 : (8 , N , 2) RTU ( 1 Start bit + 8 data bits + 2 stop bit )



## F206: Responding time of ac drive (3~50ms)

- (1) When taking the RS485 MODBUS communication to control the ac drive is desired, please set up the F4-Operation control source to 0 : Digital operation and the F5-Frequency command source to 1: Digital operation. The rest of mode setups are for operation-monitoring functions. (Digital operation panel is configured in digital data format).
- (2) Please disengage the digital operation panel and the ac drive; and set the SW1 functional dip switch NO.3 (OFF) from the motherboard for internal communication and set NO.1 (ON), NO.2 (ON), NO.3 (ON) for external communication.
- (3) When communication has no response, just read the receiving failure code (F207) to find out the causes.

- |                                         |                                                                          |
|-----------------------------------------|--------------------------------------------------------------------------|
| ■ <b><u>0 : Receiving normal</u></b>    | ■ <b><u>4 : Packet-receiving time exceeds 0.2 second</u></b>             |
| ■ <b><u>1 : Function code error</u></b> | ■ <b><u>5 : Informally alter the parameters during the operation</u></b> |
| ■ <b><u>2 : CRCL error</u></b>          | ■ <b><u>6 : Set Parameter value out of range</u></b>                     |
| ■ <b><u>3 : CRCH error</u></b>          | ■ <b><u>7 : Parameter code error</u></b>                                 |

- (4) Communication data structure (the data contents are 16-bit numbered format)
  - i. Keep the no-input-signal state  $\geq 10\text{ms}$
  - ii. communication address
  - iii. functional code
  - iv. Parameter code Content (H)
  - v. Parameter code Content (L)
  - vi. Set value Content (H)
  - vii. Set value Content (L)
  - viii. Check code(CRCL)
  - ix. Check code (CRCH)
  - x. Keep the no-input-signal state  $\geq 10\text{ms}$

### (5) Function code :

03H : To read the parameters set to and displayed by ac drive

06H : To write in the operation parameters of ac drive and set up parameters

08H : Loop detection

#### 1. To read the parameters set to AC drive (D2=03H, D3=00H)

A. PC calls :	B. ac drive responds :
D1: Communication address (00~FFh)	D1: Communication address (00~FFh)
D2: function code (03h)	D2: function code (03h)
D3: # th set parameter (H) (00h)	D2: Number of byte for parameter content 2*(0n)
D4: # th set parameter (L) (0~D2h)	D3: Content of set parameter 1(H) (00~FFh)
D5: Number of data entry (H) (00)	D4: Content of set parameter 1(L) (00~FFh)
D6: Number of data entry (L) (0nh)	.....
D7: CRCL	.....
D8: CRCH	Dm-3: Content of set parameter n(H) (00~FFh)
	Dm-2: Content of set parameter n(L) (00~FFh)
	Dm-1: CRCL
	Dm: CRCH
※Number of data entry <u>n</u> = 1~12	※ <u>m</u> = 5 + 2 * n

**Ex. : To read the set values of parameters from the ac drive (F17 Note 1, F18)**

**Responding data : F17=60.00Hz 、F18=5.00Hz Note 2**

※ Note 1 : F17=0011h , Number of data entry: 2 entries

Note 2 : Responding data will be displayed without decimal points, so  
60.00Hz=6000=1770h , 5.00Hz=500=01F4h

Calling commands at PC side are as follows:		Responding data from ac drive are as follows:	
Communication address	01h	Communication address	01h
function code	03h	function code	03h
17th set parameter (H)	00h	Number of data entry	04h
17th set parameter (L)	11h	Contents of F17 parameter (H)	17h
Number of data entry (H)	00h	Contents of F17 parameter (L)	70h
Number of data entry (L)	02h	Contents of F17 parameter (H)	01h
		Contents of F17 parameter (L)	F4h
CRCL	64h	CRCL	FEh
CRCH	0Eh	CRCH	4Bh



## 2.To the parameters displayed by AC drive (D2=03H, D3=21H)

<b>A. PC calls :</b> D1: Communication address (00~FFh) D2: function code (03h) D3: #th displayed parameter (H) (21h) D4: #th displayed parameter (L) (00~25h) D5: Number of data entry (H) (00) D6: Number of data entry (L) (0nh) D7: CRCL D8: CRCH		<b>B. ac drive responds :</b> D1: Communication address (00~FFh) D2: function code (03h) D2: Number of byte for parameter content 2*(0n) D3: content of displayed parameter 1(H) (00~FFh) D4: content of displayed parameter 1(L) (00~FFh) ..... ..... Dm-3: content of displayed parameter n(H) (00~FFh) Dm-2: content of displayed parameter n(L) (00~FFh) Dm-1: CRCL Dm: CRCH	
<b>※ Number of data entry <u>n</u> =1 ~ 12</b>		<b>※ <u>m</u> = 5 + 2 * n</b>	
2100h : Frequency Command	2101h : Output Frequency	2102h : Output current (rms)	2103h : Output voltage(rms)
2104h : PG feedback rpm	2105h : Pulse frequency command	2106h : Sensorless Vector Output Speed	2107h : Output power supply frequenc
2108h : unitless	2109h : Slip Frequency	210ah : Vdc(V)	210bh : Excitation voltage
210ch : Torque voltage	210dh : Excitation Current command	210eh : Torque current command	210fh : Excitation Current
2110h : Torque current	2111h : Output Power	2112h : True Power	2113h : Reactive Power
2114h : Temperature (C)	2115h : Count value	2116h : Digital input status	2117h : Relay and DO status
2118h : AV(%);	2119h : AV1(%)	211ah : AV2(%)	211bh : AI(%)
211ch : Vdc_0V	211dh : Cycle No. & Multi-stage No.	211eh : K_Vdc	211fh : Phase U current (rms)
2120h : Phase V current (rms)	2121h : Phase W current (rms)	2122h : PID(%)	2123h : ERR
2124h : Software version	2125h : Position-tracking error		
2116h: <u>Di8 Di7 Di6 Di5 Di4 Di3 Di2 Di1</u> ; 2117h: <u>BK Do1 Do2 Do3 Relay1 Relay2</u> ; 211dh: <u># # # Cycle. # # piece</u>			

**Ex. : To read the indicating values from the operation of ac drive (2101h, Note 1, output frequency) (Responding data : 60.00 Hz Note 2)**

※Note 1 : 2101h=8449, Number of data entry: 1 entries

Note 2 : Responding data will be displayed without decimal points,  
so 60.00Hz=6000=1770h

R : Parameter is changeable during operation (○)

## -Description of parameter functions- V

Calling commands at PC side are as follows:		Responding data from ac drive are as follows:	
Communication address	01h	Communication address	01h
Function code	03h	function code	03h
Read the indicating parameter (H)	21h	Number of data entry	02h
Read the indicating parameter (L)	01h	Operation-indicating value (H)	17h
Number of data entry (H)	00h	Operation-indicating value (L)	70h
Number of data entry (L)	01h	.....	
CRCL	DFh	CRCL	B6h
CRCH	F6h	CRCH	50h

Response-display parameters :	Data format in expression	Response-display parameters :	Data format in expression
0 : Frequency command (F)	xxx.x(Hz) or xxxxx(Rpm)	19 : Reactive Power (%)	xxx.X
1 : Output Frequency (H)	xxx.x(Hz) or xxxxx(Rpm)	20 : Temperature ( °C )	xxx
2 : Output current (A)	xxx.X	21 : Count value	xxxxx
3 : Output voltage (E)	xxx.X	22 : Digital input status	Di8 Di7 Di6 Di5 Di4 Di3 Di2 Di1
4 : PG feedback rpm (n)	xxx.x(Hz) or xxxxx(Rpm)	23 : Digital output status	BK Do1 Do2 Do3 Relay1 Relay2
5 : Pulse frequency command	xxx.x(Hz) or xxxxx(Rpm)	24 : Digital operation AV (%)	xxx.X
6 : Sensorless Vector Output Speed	xxx.x(Hz) or xxxxx(Rpm)	25 : AV1(%)	xxx.X
7 : Output power supply frequency	xxx.x(Hz) or xxxxx(Rpm)	26 : AV2(%)	xxx.X
8 : unitless	xxxx.X	27 : AI(%)	xxx.X
9 : Slip Frequency	xxx.x(Hz) or xxxxx(Rpm)	28 : Vdc_0	xxxx
10 : Vdc(V)	xxx	29 : Cycle No. & multi-stage No.	# # # #Cycle. # #speed
11 : Excitation voltage	xxx.X	30 : K_Vdc	xxxx
12 : Torque voltage	xxx.X	31 : Phase U current (rms)	xxx.X
13 : Excitation Current command	xxx.X	32 : Phase V current (rms)	xxx.X
14 : Torque current command	xxx.X	33 : Phase W current (rms)	xxx.X
15 : Excitation Current	xxx.X	34 : PID(%)	xxxx
16 : Torque current	xxx.X	36 : Software version	x.XX
17 : Output Power (%)	xxx.X	37 : Position-tracking error	xx
18 : True Power (%)	xxx.X	35, 38~40 : Reserved	

## 3.To write in the operation parameters of AC drive (D2=06H, D3=20H)

<b>A. PC calls:</b> D1: Communication address (0~FEh) D2: function code (06h) D3: #th operating parameter (H) (20h) D4: #th operating parameter (L) (00~00h) D5: Write-in content of parameter (H) (00~FFh) D6: Write-in content of parameter (L) (00~FFh) D7: CRCL D8: CRCH	<b>B. AC drive responds:</b> D1: Communication address (00~FFh) D2: function code (06h) D3: #th operating parameter (H) (20h) D4: #th operating parameter (L) (00~D1h) D5: Write-in content of parameter (H) (00~FFh) D6: Write-in content of parameter (L) (00~FFh) D7: CRCL D8: CRCH
2000h(Operation control ) : 0: Stop 1: FWD 2 :REV 3: Inching FWD 4:Inching REV 5: Failure reset	

## 4.To write in the set parameters of ac drive (D2=06H, D3=00H)

<b>A. PC calls:</b> D1: Communication address (00~FFh) D2: function code (06h) D3: #th set parameter (H) (00h) D4: #th set parameter(L) (00~D2h) D5: Write-in content of parameter (H) (00~FFh) D6: Write-in content of parameter (L) (00~FFh) D7: CRCL D8: CRCH	<b>B. AC drive responds:</b> D1: Communication address (00~FFh) D2: function code (06h) D3: #th set parameter (H) (00h) D4: #th set parameter(L) (00~D2h) D5: Write-in content of parameter(H) (00~FFh) D6: Write-in content of parameter(L) (00~FFh) D7: CRCL D8: CRCH
Only the speed command setups can be changeable during operation: F17~ F25.	

**Ex. : ① Writing to enable the AC drive to perform setup in 50.00Hz**

**② Writing to enable the AC drive to perform the running command 2000h: 1 FWD running**

※ Note 1 : F17=0011h, 50.00Hz=5000=1388h

Note 2 : Running command=2000h=8192, FWD rotation=0001h

Calling commands at PC side are as follows:	① 50HZ	② FWD running	Responding data from ac drive are as follows:	① 50HZ	② FWD running
Communication address	01h	01h	Communication address	01h	01h
Function code	06h	06h	Function code	06h	06h
17th set parameter (H)	00h	20h	17th set parameter (H)	00h	20h
17th set parameter (L)	11h	00h	17th set parameter (L)	11h	00h
Data content (H)	13h	00h	Content of set Data (H)	13h	00h
Data content (L)	88h	01h	Content of set Data (L)	88h	01h
CRCL	24h	43h	CRCL	24h	43h
CRCH	99h	CAh	CRCH	99h	CAh

## 5. Loop detection (D2=08H)

08H : Loop detection	
<b>A. PC calls</b> D1: Communication address (00~FFh) D2: function code (08h) D3: Test content of parameter (1) (00~FFh) D4: Test content of parameter (2) (00~FFh) D5: Test content of parameter (3) (00~FFh) D6: Test content of parameter (4) (00~FFh) D7: CRCL D8: CRCH	<b>B. ac drive responds:</b> D1: Communication address (00~FFh) D2: function code (08h) D3: Test content of parameter (1) (00~FFh) D4: Test content of parameter (2) (00~FFh) D5: Test content of parameter (3) (00~FFh) D6: Test content of parameter (4) (00~FFh) D7: CRCL D8: CRCH

### Ex. : Loop testing commands

Calling commands at PC side are as follows:		Responding data from ac drive are as follows:	
Communication address	01h	Communication address	01h
function code	08h	function code	08h
Test content of parameter (1)	01h	Test content of parameter (1)	01h
Test content of parameter (2)	02h	Test content of parameter (2)	02h
Test content of parameter (3)	03h	Test content of parameter (3)	03h
Test content of parameter (4)	04h	Test content of parameter (4)	04h
CRCL	41h	CRCL	41h
CRCH	04h	CRCH	04h

#### CRC production steps :

1. CRC = 0FFFFh
2. CRC = (CRC) XOR (DATA1)
3. Determine if CRC's BIT0 is 1 ?  
Yes : CRC = (CRC >>1 ) XOR (0A001h)  
No : CRC = CRC >> 1  
※ >>1 : right-shift for one digit, input 0 to higher bits.
4. Again, repeat the step 3 for 7 times (that is, the step 3 shall be executed 8 times in total)
5. Download the data of next entry DATA2
6. Repeat steps 2~4
7. Repeat steps 5 and 6 until all the data have been executed.

## Storage, Recalling Parameters

R	Parameter	Description	Range	Unit	Ex-factory Setting
×	F208	Recall Parameter	0~2		0

■ **0 : Not Recalled.**

■ **1 : Recall Ex-factory Setup** — Recall the ex-factory setting (F129, F130, F141~F146, F156~F161 are not affected).

■ **2: Recall Parameter Settings Saved in Digital Operation Panel** — Recall the parameter settings saved in the digital operator.

×	F209	Copy & save the parameter in digital operation panel	0~1		0
---	------	------------------------------------------------------	-----	--	---

■ **0 : Not Saved.**

■ **1 : Saved in Digital Operation panel** — to save the modified parameter settings into the digital operator.

※ **ATTENTION 1** — Each digital operator is provided with an EEPROM to maintain records without any externally power supply. The memory capacity for each EEPROM covers to all parameter settings of one unit of ac drive, and may be used to save another set of parameter settings from another ac drive, or acts as the backup for storage and parameter duplication. The duplication of the parameter settings may be done through Parameter F208: (2) Recall Parameter Settings Saved in Digital Operator. The recalled parameter settings from the digital operator is recalled to the RAM of the DSP; and then saved

※ **ATTENTION 2** — Parameter duplication function is only applicable to duplicate the parameters from multiple ac drives under the conditions they are of the same voltage grade, capacity and same control mode.

×	F210	Lock up EEPROM Parameters	0~1		0
---	------	---------------------------	-----	--	---

■ **0 : Save modified** — to modified all parameter settings into the EEPROM.

■ **1 : Lock up Parameters** — This function is able to lock most of the contents of parameters; the contents are unchangeable and for display only.

※ **Parameters F0, F17 are exempted from this restriction of locking the functional parameters.**



# VI

## PROTECTION & TROUBLESHOOTING

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

# VI – Protection & Troubleshooting–

## Abnormality Diagnosis

◆ This Chapter describes the display of abnormality found with the ac drive and coping measures, as well as the troubleshooting in case of any abnormality found with the motor.

< Table > Abnormality Display & Coping Measures

Display	Description	Cause	Coping Measures
Err 1	Over voltage (U1) or current (A1) in standby status	<ul style="list-style-type: none"> <li>Excessively high voltage at input(R. S.T) source resulting in that the voltage on the DC side is over the voltage detected level.</li> <li>Possible shortage between phases or shortage to the grounding of the output cable.</li> </ul>	<ul style="list-style-type: none"> <li>Drop the voltage to fall within the range of power source specification.</li> <li>Check the output cable and remove any shortage when confirmed.</li> </ul>
Err 2	Over voltage (U2) or current (A2) in acceleration	<ul style="list-style-type: none"> <li>If the activation is done while the motor is idling (that could easily lead to over voltage or over current)</li> <li>If acceleration time too short (that easily leads to over current).</li> <li>Electrical leakage caused by bad motor insulation</li> </ul>	<ul style="list-style-type: none"> <li>Set F6=2: DC Brake, then leave it to be started by activation frequency.</li> <li>Allow longer acceleration time. Check &amp; repair the motor or replace it with new one</li> </ul>
Err 3	Over voltage (U3) or current (A3) in deceleration	<ul style="list-style-type: none"> <li>If deceleration time too short (that easily leads to over voltage or over current).</li> </ul>	<ul style="list-style-type: none"> <li>Allow longer deceleration time (set the deceleration time that meets <math>GD^2</math>)</li> </ul>
Err 4	Over voltage (U4) or current (A4) in speed regulation	<ul style="list-style-type: none"> <li>If the motor is drawn by external force.</li> <li>If load undergoes drastic change.</li> </ul>	<ul style="list-style-type: none"> <li>Improve system to expel external source.</li> <li>Change the load to be smoother.</li> </ul>
Err 5	Heat sink overheated	<ul style="list-style-type: none"> <li>If temperature of heat sink of the ac drive is over the F100 setting.</li> <li>If cooling fans operate normality</li> <li>If ambient temperature gets too high</li> </ul>	<ul style="list-style-type: none"> <li>Check F100 setting</li> <li>Replace the cooling fan.</li> <li>Increase air ventilation volume.</li> </ul>
Err 6	DC Bus over voltage	<ul style="list-style-type: none"> <li>If input source (R.S.T) voltage higher than DC protection level (AC in<math>\times</math> 1.414<math>\times</math>130%) or F129 setting error.</li> <li>Short deceleration time, and large regenerated source from motor</li> <li>Over Voltage protection point (O.V) : 200V : 400Vdc 400V : 800Vdc</li> </ul>	<ul style="list-style-type: none"> <li>Reduce source voltage</li> <li>Check F129 setting.</li> <li>Extend deceleration time or connect to the brake resistance(or brake unit).</li> </ul>
Err 7	DC Bus low voltage	<ul style="list-style-type: none"> <li>Transient power interruption resulting in voltage stages below DC protection level .(AC in<math>\times</math>1.414<math>\times</math>70%)</li> <li>Phase insufficiency in input power or loosening wiring terminal.</li> <li>Input power supply voltage variation is to large</li> <li>Parameter F129 setting error</li> <li>Low-voltage protection point (L.V) 200V : 180Vdc 400V : 380Vdc</li> </ul>	<ul style="list-style-type: none"> <li>Check to identify the cause and improve power source quality.</li> </ul>

## -Protection & Troubleshooting- VI

< Table > Abnormality Display & Coping Measures

Display	Description	Cause	Coping Measures
Err 8	Electronic thermal relay action (Motor overload)	<ul style="list-style-type: none"> <li>Motor load current is greater than the built-in electronic thermo-sensitive setting(F95,F96 and F142)</li> </ul>	<ul style="list-style-type: none"> <li>Improve the load to motor and check for correct parameters (F95, F96 and F142).</li> <li>Slightly increase the F95 thermal relay initiation of position.</li> </ul>
Err 9	AC drive voltage not match the motor voltage	<ul style="list-style-type: none"> <li>F141 motor rated voltage not be less than 1.5X of the input voltage of the ac drive. (F129)</li> </ul>	<ul style="list-style-type: none"> <li>Change the motor voltage grade and check parameters F129, F141.</li> </ul>
Err 10	Software-detected overload current protection	<ul style="list-style-type: none"> <li>Peak amperage of U.V.W on the output side of the driver greater than 2.8X of the rated amperage.</li> <li>If acceleration time too short</li> <li>If impact amperage for operation gets too large</li> </ul>	<ul style="list-style-type: none"> <li>Check for normal operation of motor &amp; mechanical system</li> <li>Check the setting of acceleration time parameter</li> <li>Replace with a driver of larger capacity</li> </ul>
Err 11	AC drive rated current range not match motor current	<ul style="list-style-type: none"> <li>F142 motor rated current not be less than 9X of the rated current of the ac drive.</li> </ul>	<ul style="list-style-type: none"> <li>Change motor capacity, and check the setting of parameter F142 )(small motor capacity prevents control and protection.)</li> </ul>
Err 12	Loss of output U-phase or U-phase C.T failure	<ul style="list-style-type: none"> <li>Phase wire of U.V.W on output side of the ac drive and motor wiring not secured or open</li> <li>failure to internal current sensor (C.T)</li> </ul>	<ul style="list-style-type: none"> <li>Check the wiring loops before restoration of power.</li> <li>Return to the genuine maker of service.</li> </ul>
Err 13	Loss of output V-phase or V-phase C.T failure		
Err 14	Loss of output W-phase or W-phase C.T failure		
Err 16	Encoder direction opposite to the phase sequence on the output side	<ul style="list-style-type: none"> <li>PG revolution direction is opposite to that of the motor operation</li> </ul>	<ul style="list-style-type: none"> <li>Switch between PG Phase A and B or change the settings of Parameter F150.</li> </ul>
Err 17	Encoder signal (PG) abnormality	<ul style="list-style-type: none"> <li>PG wiring error</li> <li>PG pulse number (F149) setting error</li> <li>Wrong power supply to PG</li> </ul>	<ul style="list-style-type: none"> <li>Check the PG wiring.</li> <li>Check the parameter settings.</li> <li>Supply correct power source</li> </ul>
Err 18	Parameter detection failure	<ul style="list-style-type: none"> <li>Motor electric parameter auto-tuning failure °</li> </ul>	<ul style="list-style-type: none"> <li>Check for correct settings of Parameters F141~F146</li> <li>Manually operate motor data and input results into motor electric parameter group (F156~F160). Refer to P5-43</li> </ul>
Err 19	Position-tracking error greater than 40 turns	<ul style="list-style-type: none"> <li>Too big rpm deviation or overload</li> <li>Maybe acceleration / deceleration time too short</li> </ul>	<ul style="list-style-type: none"> <li>Lighten the motor load, verify the mechanical system.</li> <li>Extend the acceleration/ deceleration time.</li> </ul>

## VI – Protection & Troubleshooting–

< Table > Abnormality Display & Coping Measures

Display	Description	Cause	Coping Measures
Err 20	Overload (150%,60 Sec.)	<ul style="list-style-type: none"> <li>• Short-circuit or grounding taken place at output side of ac drive (Contacted or grounded due to motor burnt out, aged insulation, broken wires, etc.)</li> <li>• Ac drive loaded a current in excess of rated current by 150% for 60 seconds.</li> <li>• Applied a special motor, or a motor in excess of the maximum suitable capacity.</li> <li>• Output side of ac drive is override by the on-off of solenoid valve.</li> </ul>	<ul style="list-style-type: none"> <li>• Check the cause, take remedy actions and restore power.</li> </ul>
Err 21	PG off-line detection	<ul style="list-style-type: none"> <li>• Broken wire of PG wiring.</li> </ul>	<ul style="list-style-type: none"> <li>• Fix and inspect the wire-broken place</li> </ul>
Err 22	Break wire detected analog signals AI	<ul style="list-style-type: none"> <li>• AI input current signals break</li> <li>• Whether application parameter F65 set an error (setting 1).</li> </ul>	<ul style="list-style-type: none"> <li>• Check the wiring circuit</li> <li>• Check the parameter F65</li> </ul>
Err 23	Absence of speed feedback affecting performance of closed loop control	<ul style="list-style-type: none"> <li>• Absence of setting up parameter F148 speed feedback at 1: Encoder PG.</li> </ul>	<ul style="list-style-type: none"> <li>• Set up Parameter F148</li> </ul>
Err 24	Torque control over upper limit of speed	<ul style="list-style-type: none"> <li>• Overshooting occurred</li> <li>• Command speed too high</li> <li>• Inappropriate F176 set value</li> </ul>	<ul style="list-style-type: none"> <li>• Readjust the gain</li> <li>• Recheck the commanding circuit and commanding gain</li> <li>• Confirm F176 set value</li> </ul>
Err 25	EEPROM parameter read back out of range	<ul style="list-style-type: none"> <li>• Failure in EEPROM, no data available, storage incomplete, or parameter setting out of range.</li> </ul>	<ul style="list-style-type: none"> <li>• Use the function of Parameter F208=1: Recall Ex-factory setting before setting up the motor nameplate parameter group, or check one by one the parameter settings for any challenge of the range.</li> <li>• If the step aforesaid fails, return it to genuine maker for service.</li> </ul>
Err 26	Digital Operation panel storage parameter write failure	<ul style="list-style-type: none"> <li>• Operator extension too long or subject to noise interference.</li> <li>• Operator memory failure.</li> </ul>	<ul style="list-style-type: none"> <li>• Improve wiring quality and length.</li> <li>• Replace the operator &amp; run the test again.</li> </ul>
Err 27	DSP storage parameter locked and preventing modification	<ul style="list-style-type: none"> <li>• Parameter storage is restricted to prevent from saving new data.</li> </ul>	<ul style="list-style-type: none"> <li>• If required, save the new parameter, and set Parameter F210=0: Save Allowed.</li> </ul>
Err 28	Operator panel storage parameter locked and preventing modification	<ul style="list-style-type: none"> <li>• The parameter storage of the digital operator has been restricted</li> </ul>	<ul style="list-style-type: none"> <li>• Select Parameter F210=0: Save Allowed</li> </ul>

**< Table > Abnormality Display & Coping Measures**

Display	Description	Cause	Coping Measures
Err 29	External input abnormality	<ul style="list-style-type: none"> <li>External abnormality signals are inputted from the multi-function input terminal (Di3~Di8).</li> </ul>	<ul style="list-style-type: none"> <li>Remove the cause of external abnormality.</li> </ul>
Err 31	Current leakage or abnormal 3-phase current sum	<ul style="list-style-type: none"> <li>Poor wiring or poor motor insulation.</li> </ul>	<ul style="list-style-type: none"> <li>Check the output (U.V.W)wiring and insulation for damage.</li> <li>Check if the setting for Parameter F98 is too small.</li> </ul>
Err 32	PUF fuse burnt	<ul style="list-style-type: none"> <li>Inverter output to motor by a wire short or motor leakage,caused damage to the fuse.</li> </ul>	<ul style="list-style-type: none"> <li>Check the cause and take coping measures before replacing the ac drive.</li> </ul>
Err 33	Power failure or too low mains input phase voltage	<ul style="list-style-type: none"> <li>Poor conduction of the breaker or EMI contact.</li> <li>Loosening input power wiring terminal</li> <li>Drastic changes in the input power voltage</li> </ul>	<ul style="list-style-type: none"> <li>Check the cause and take coping measures before restoring the power.</li> </ul>
Err 35	Error in automatic operation time setup.	<ul style="list-style-type: none"> <li>All the automatic operation for 16 stages of speed are set at 0 (there is no operation time to be executed).</li> </ul>	<ul style="list-style-type: none"> <li>Check the settings of Parameters F105~F120.</li> </ul>
Err 36	Digital input terminal setup repeated.	<ul style="list-style-type: none"> <li>The same function is given repeated set by the multi-function input terminal Di3~Di8 (with the exception of 0: Disabled).</li> </ul>	<ul style="list-style-type: none"> <li>Check the settings of Parameters F69~F74.</li> </ul>



# VI – Protection & Troubleshooting–

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## Most Frequently Used Troubleshooting



INHIBIT

(Troubleshooting listed below can only be done by qualified technician or dedicated keeper of this machine. The manufacturer of this machine will not be liable for any failure of this machine due to failure to observe this statement.)

### The motor just won't run?

**Symptom :** The motor fails to operate

---

**§ Check to see if the source has been delivered to the R.S.T source terminals?**

- Turn on the power source
- Disconnect the power supply and re-energize it.

**§ Check to see if there is the voltage output from output terminals U.V.W?**

- Confirm the power source.
- Follow the operation procedure to operate it.

**§ Check to see if the motor shaft is deadlocked?**

- Ease off the load to the motor
- Replace the motor
- Check the mechanical construction

**§ Wrong wiring ?**

- Examine and repair the wiring loops.

**§ Protection functions enabled ?**

- Verify the displayed content in monitor.

**§ Incorrect setting to the operation keyboard ?**

- Reconfirm the operation procedure

### AC drive trips when starting the motor?

**Symptom:** An error code Err2 appears when starting or accelerating the motor (it may be caused by the enabled protection function of over-current, or a momentary output current in excess of 200% of rated current, or a damaged IGBT module).

**§ If the torque is insufficient upon activation of heavy load?**

→ Change the setting of torque compensation

**§ If the acceleration time is too short to match the GD<sup>2</sup> of the load?**

→ Extend the acceleration time

**§ Starting frequency too low?**

→ Increase the starting frequency

**§ Protection function enabled?**

→ Confirm what is displayed on the monitor.

**§ AC drive started when motor is idling?**

→ To set the function of reactivation in the course of idling.

**§ Incorrect setting to operation keyboard? electric leakage due to defective motor insulation?**

→ Reconfirm

→ Replace with a good motor, or remove the output wires before feeding to activate; if trip insists Err2, it indicates failure of the ac drive; if not, the failure of the motor.

### The ac drive trips when the motor is decelerating?

**Symptom:** Err 6 displays in the course of deceleration (over voltage protection function operates).

**§ The integral brake loop inside the ac drive failed to absorb the regenerative energy from motor during a sharp deceleration when the GD<sub>2</sub> of motor driven load is too big**

**\* Once the rejuvenated energy is greater than 400V(Series 200~240V) or 800V (Series 380~480V), the over voltage protection immediately functions.**

→ Extend the deceleration time.

→ Install a DC brake resistance (optional) of a grade not greater than 15HP exclusively for external use.

→ If the DC brake resistance is of a grade of 20HP or larger, an external brake unit and resistance must be provided.( Allowed option built-in brake unit.)

### Stationary operation trip ?

---

#### ◆ Err 7 appears during operation.

##### § Insufficient voltage of power source?

- Review the capacity of power supply equipment and find out the cause to the low voltage; such as , check if the contacts of no-fuse-breaker or magnetic switch are in good condition

#### ◆ Err 6 appears during operation.

##### § Load and motor or source voltage is to blame?

##### § If any poor motor insulation leading to leakage?

- Install a DC brake resistance (optional) exclusively for external use.
- Remove the output wire before feeding the electricity and activating; if Err6 displays, it indicates that the ac drive fails ; if Err 6 display disappears, it indicates leakage from the motor, replace the motor.

# **VII**

## **TEST, INSPECTION & MAINTENANCE**

◆ Test, Inspection, & Maintenance.....	7-1
----------------------------------------	-----

### TEST, INSPECTION, & MAINTENANCE



CAUTION

#### Cautions:

- A maintenance professional shall confirm the current status of power supply switch in person. In order to ensure the safety of operation, strictly keep the power switch from the reach of irrelevant personnel with an identification label hung on the switch.
- Within a short period of time right after disconnection the power supply, there will be DC high voltage remained at the electrolytic capacitor of large capacity in the internal rectification loop of the ac drive. For this reason, please make sure to see if the (CHARGE) light is off before performing the substrate inspection

#### Highlights of Periodical Maintenance

##### ○ External terminals, components, and screws:

Is there any loosening screw and connector? → If yes, install or tighten up.

##### ○ Cooling Fans:

Is there any abnormal sound or vibration? → If yes, replace or clean up.

##### ○ Capacitor and parts:

Is there any discoloration, carbonization or odor ? → If yes, return to the factory to replace the capacitor or the component of the inverter.

##### ○ Heat sink fins, Circuit board:

Any dust built up or attached with Conductive chips, oil stain? → If yes, use air gun to clear with dry air. (Never use any cleanser at own discretion.)

#### Daily Inspection Items

- Motor follows the preset actions to run? Any faulty sound or vibration during operation?
- If the cooling fans installed below the inverter operates normally? Any sign of abnormal temperature rise?
- Check the output current detected by the monitor to see if it falls out of the normal range?
- If the ambient temperature maintains normal? The installation environment is normal?

※ Please truly follow the check items listed in this manual to conduct them item by item to ensure this product is always maintained at a normal state for a long time



CAUTION

The ac drive is comprised of many types of components, it depends on those parts and components for the ac drive to maintain and provide its expected functions. However, electronic parts usually are consumption items depending on the work environment and the use patter of the individual operator. To maintain long-term normal operation, it is recommended to conductor periodical inspection and replacement as required.



# VIII

## Selecting Brake Resistance & Brake Unit

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

## VIII – Selecting Brake Resistance & Brake Unit –

### Selecting the Brake Resistance Capacity



WARNING

The temperature surrounding of the brake resistance will rise after the continuous discharging by brake resistance to expose the objects in the vicinity. Therefore, always keep those objects at least 2M away from the brake resistance. Sufficient ventilation or additional fans shall be provided at where the brake resistance is installed.

Ac drive						Specification			
Voltage	Applicable motor		Equivalent resistance specification W / $\Omega$	Brake Torque (10%ED) %	Equivalent Min. resistance ( $\Omega$ )	Brake Resistance (module)	Brake Resistance / SET	Externally Provided Unit Specification	Brake Unit / SET
	HP	KW							
200V	0.5	0.4	150W/150 $\Omega$	225	75 $\Omega$			Included	
	1	0.75	150W/150 $\Omega$	150	75 $\Omega$				
	2	1.5	300W/100 $\Omega$	125	39 $\Omega$				
	3	2.2	500W/60 $\Omega$	140	30 $\Omega$				
	5	3.7	800W/40 $\Omega$	125	27 $\Omega$				
	7.5	5.5	1200W/25 $\Omega$	135	18 $\Omega$	DR1K5W-24	1		
	10	7.5	1500W/20 $\Omega$	125	10 $\Omega$	DR1K5W-20	1		
	15	11	2200W/13.6 $\Omega$	125	10 $\Omega$	DR3K1W-12	1		
	20 $\triangle$	15	3000W/10 $\Omega$	125	6.6 $\Omega$	DR3K1W-10	1	LSBR-2015B	1
	25 $\triangle$	18.5	3700W/8 $\Omega$	125	6.6 $\Omega$	DR4K6W-8	1	LSBR-2022B	1
	30 $\triangle$	22	4400W/6.8 $\Omega$	125	3.3 $\Omega$	DR4K6W-6.6	1	LSBR-2022B	1
	40 $\triangle$	30	6000W/5 $\Omega$	125	3.3 $\Omega$	DR6K2W-5	1	LSBR-2015B	2
	50 $\triangle$	37	7400W/4 $\Omega$	125	3.3 $\Omega$	DR4K6W-8	2	LSBR-2022B	2
	60 $\triangle$	45	9000W/3.3 $\Omega$	125	2.5 $\Omega$	DR4K6W-6.6	2	LSBR-2022B	2
	75 $\triangle$	55	11000W/2.7 $\Omega$	125	2.5 $\Omega$	DR6K2W-5	2	LSBR-2022B	3
	100	75	15000W/2 $\Omega$	125		DR6K2W-6	3	LSBR-2022B	4
	125	90	18000W/1.6 $\Omega$	125		DR6K2W-5	3	LSBR-2022B	4 or 5
	150	110	22000W/1.3 $\Omega$	125		DR6K2W-5	4	LSBR-2022B	5

$\triangle$  : An additional brake circuit can be fitted into the ac drive when placing the purchase order.

## – Selecting Brake Resistance & Brake Unit – VIII

Ac drive						Specification			
Voltage	Applicable motor		Equivalent resistance specification W / $\Omega$	Brake Torque (10%ED) %	ivalent Min. resistance ( $\Omega$ )	Brake Resistance (module)	Brake Resistance / SET	Externally Provided Unit Specification	Brake Unit / SET
	HP	KW							
400V	1	0.75	150W/300 $\Omega$	200	150 $\Omega$			Included	
	2	1.5	300W/300 $\Omega$	155	150 $\Omega$				
	3	2.2	500W/150 $\Omega$	175	72 $\Omega$				
	5	3.7	800W/100 $\Omega$	170	72 $\Omega$				
	7.5	5.5	1200W/80 $\Omega$	155	40 $\Omega$	DR1K5W-80	1		
	10	7.5	1500W/60 $\Omega$	155	40 $\Omega$	DR1K5W-60	1		
	15	11	2200W/50 $\Omega$	135	40 $\Omega$	DR3K1W-48	1		
	20 $\triangle$	15	3000W/40 $\Omega$	125	20 $\Omega$	DR3K1W-40	1	LSBR-4015B	1
	25 $\triangle$	18.5	3700W/32 $\Omega$	125	20 $\Omega$	DR4K6W-30	1	LSBR-4030B	1
	30 $\triangle$	22	4400W/27.2 $\Omega$	125	20 $\Omega$	DR4K6W-30	1	LSBR-4030B	1
	40 $\triangle$	30	6000W/20 $\Omega$	125	14.3 $\Omega$	DR6K2W-20	1	LSBR-4030B	1
	50 $\triangle$	37	7400W/16 $\Omega$	125	14.3 $\Omega$	DR4K6W-30	2	LSBR-4030B	2
	60 $\triangle$	45	9000W/13.3 $\Omega$	125	10 $\Omega$	DR4K6W-6.6	2	LSBR-4030B	2
	75 $\triangle$	55	11000W/10 $\Omega$	125	6.6 $\Omega$	DR6K2W-20	2	LSBR-4030B	2
	100	75	15000W/8 $\Omega$	125	6.6 $\Omega$	DR6K2W-24	3	LSBR-4030B	3
	125	90	18000W/6.6 $\Omega$	125		DR6K2W-20	3	LSBR-4030B	3
	150	110	22000W/5.4 $\Omega$	125		DR6K2W-20	4	LSBR-4030B	4
	175	132	26400W/4.5 $\Omega$	125		DR6K2W-20	4	LSBR-4030B	5
	200	160	32000W/3.7 $\Omega$	125		DR6K2W-20	5	LSBR-4030B	6
	250	185	37000W/3.2 $\Omega$	125		DR6K2W-20	6	LSBR-4030B	7
	300	220	44000W/2.7 $\Omega$	125		DR6K2W-20	8	LSBR-4030B	8
	400	300	60000W/2 $\Omega$	125		DR6K2W-20	10	LSBR-4030B	10
	500	375	75000W/1.6 $\Omega$	125		DR6K2W-24	13	LSBR-4030B	13
$\triangle$ : An additional brake circuit can be fitted into the ac drive when placing the purchase order.									

# VIII – Selecting Brake Resistance & Brake Unit –

## Selection of brake Resistance

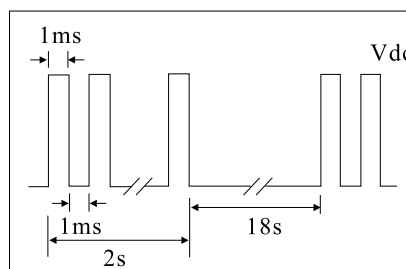
## ◆ DR brake resistance specifications

Model No.		Model	Connection
DR1K5W-R			R1.R2 wire gauge above 3.5mm
R	16Ω	Figure A	
	20Ω		
	24Ω		
	40Ω		
DR3K1W-R			R1.R2 wire gauge above 5.5mm
R	8Ω	Figure B	
	10Ω		
	12Ω		
	20Ω		
	32Ω	Figure B	
	40Ω		
	48Ω		
	60Ω		
DR4K6W-R			R1.R2 wire gauge above 5.5mm
R	5.3Ω	Figure B	
	6.6Ω		
	8Ω		
	13.3Ω		
	12Ω		
	15Ω		
	18Ω		
	30Ω		
DR6K2W-R			R1.R2 wire gauge above 8.0mm
R	4Ω	Figure C	
	5Ω		
	6Ω		
	10Ω		
	16Ω	Figure C	
	20Ω		
	24Ω		
	40Ω		

## ◆ Description of model number

DR 3K1W - 10  
 Brake resistance module \_\_\_\_\_  
 Rated power \_\_\_\_\_  
 Resistance \_\_\_\_\_

## Resistance cyclic curve



## Resistance power condition

1. Duty/Cycle : 1ms/2ms
2. Brake time : 2S
3. Rest time : 18S

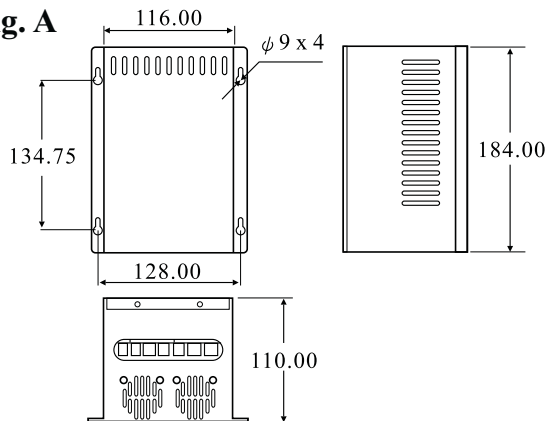
Effective Duty (ED%)

$$ED\% = \frac{2S}{20S} \times 100\% = 10\%$$

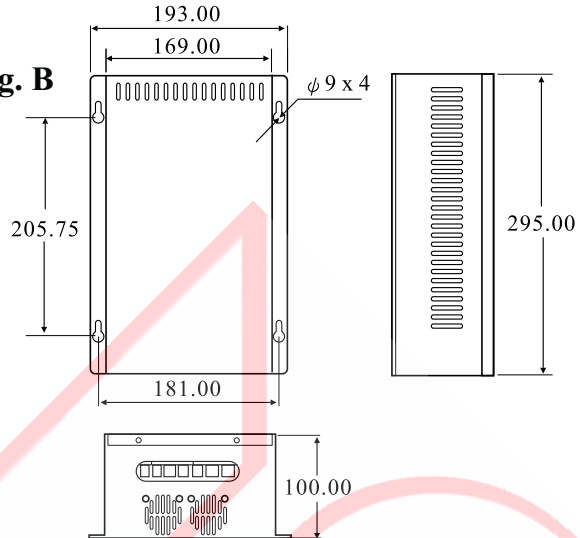
# – Selecting Brake Resistance & Brake Unit – VIII

## ◆ Dimension of machine box

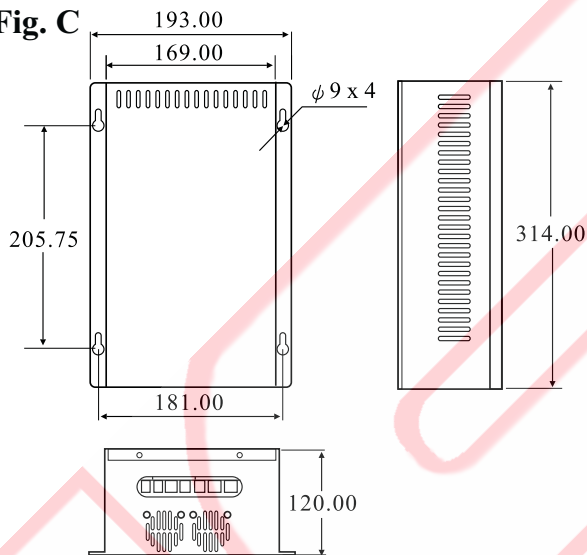
**Fig. A**



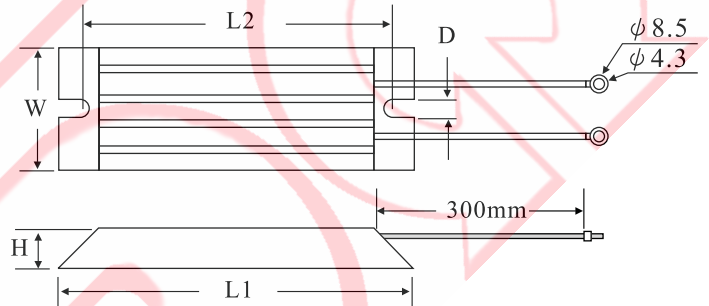
**Fig. B**



**Fig. C**



**Fig. D**



Model No	Dimensions (mm) ±3%					Resistance range (Ω)	Model No	Dimensions (mm) ±3%					Resistance range (Ω)
	L1	L2	H	D	W			L1	L2	H	D	W	
SDR80W	140	125	20	5.2	40	0.1~10K	SDR300W	215	200	30	5.2	60	0.5~30K
SDR100W	165	150	20	5.2	40	0.1~10K	SDR400W	265	250	30	5.2	60	0.5~30K
SDR120W	190	175	20	5.2	40	0.15~15K	SDR500W	335	320	30	5.2	60	0.5~30K
SDR150W	215	200	20	5.2	40	0.15~15K	SDR600W	335	320	30	5.2	60	1~50K
SDR200W	165	150	30	5.2	60	0.3~20K	SDR800W	400	385	40	5.2	80	1~50K

## ★ NOTE :

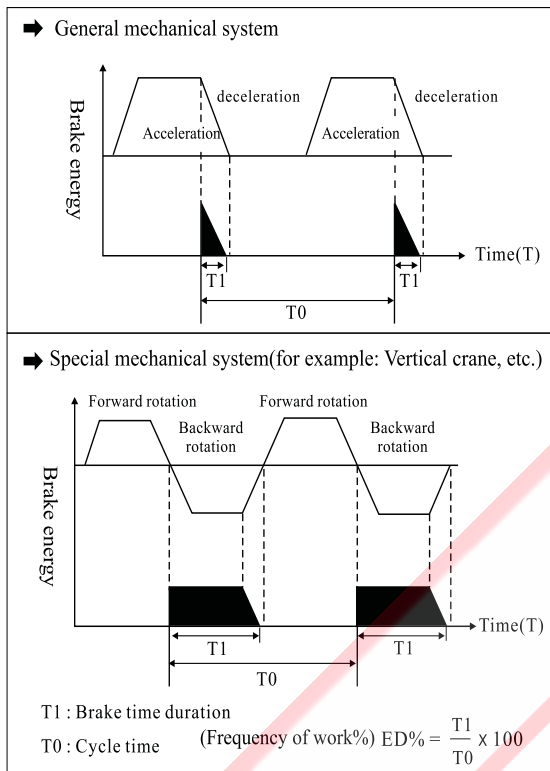
(Resistance can be set up according to the requirements)

1. Please select the resistance (ohms), watts and the frequency of application (ED%) specified by the Company.
2. A precaution toward the safety and inflammability around the peripheral environment shall be made when installing the brake resistance.
3. For an application with more than two sets of brake unit, please pay attention to the equivalent resistance after installing these brake units in parallel connection that shall not be lower than the equivalent minimum resistance of each brake units. When using the brake unit is desired, please peruse the operation instruction of brake unit and connect the wirings accordingly.



# VIII – Selecting Brake Resistance & Brake Unit –

## Braking resistor-watt and resistance values of the calculation



Brake torque	Resistance value	200V~230V	380V~460V
125%	R	150/Motor KW	600/Motor KW
130%	R	143.75/Motor KW	575/Motor KW
135%	R	137.5/Motor KW	550/Motor KW
140%	R	131.25/Motor KW	525/Motor KW
150%	R	118.75/Motor KW	475/Motor KW
160%	R	106.25/Motor KW	425/Motor KW
170%	R	93.75/Motor KW	375/Motor KW
180%	R	81.25/Motor KW	325/Motor KW

Example : 380V / 100HP / 75KW (brake torque 125% , 10%ED)

### Long Braking

Resistance power (W) = ( Motor ) 75000W × 20% = 15000(W)

Resistance value (R) = 600 / 75KW = 8Ω

### ★Caution:

- 1 : The smaller the resistance, the bigger the brake torque; and the higher current flowing through the brake unit
- 2 : Do not let the working current of brake unit exceed there of allowable maximum current, otherwise the device will be damaged.

## ◆ Method of calculation for resistance power (10% ED) :

### ◎ Brake-characterized resistance power

#### 1. General load :

Resistance power (W) = Motor (W) × 10%

#### 2. Frequently brake cycle T0 (Less than 5 times per minute) :

Resistance power (W) = Motor (W) × 15%

#### 3. Long-time brake T1 (Less than 4 seconds per time) :

Resistance power (W) = Motor (W) × 20%

#### 4. Long-time brake with bigger inertia T1(Less than 10 seconds per time) :

Resistance power (W) = Motor (W) × (More than 40%)

### ★ Note :

- 1 : When connecting multiple units of brake resistance, it is recommended that brake resistances should be connected in series; when required a parallel connection, the brake resistance value, wire diameter, and wire length shall be consistent; so that the current can be evenly shunted to effectively protect the service life of every unit of brake resistance. After being serially or parallel connected for use, the resistance of each unit shall be consistent, and be cautious to the final sum of .
- 2 : After being serially or parallel connected for use, the resistance of each unit shall be consistent, and be cautious to the final sum of resistance.

# IX APPENDIX

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

# Appendix A – Standard specifications–

## 200V series specifications

Model No. LS800-2□□□		0K4	0K7	1K5	2K2	4K0	5K5	7K5	011	015	018	022	030	037	045	055	075	090	110
Applicable motor power (KW)		0.4	0.75	1.5	2.2	4.0	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110
Applicable motor power (HP)		0.5	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150
Output	Rated output capacity (KVA)	1.4	1.9	2.8	4.7	6.6	9.5	12.9	19	25	31	38	49	62	72	87	114	133	173
	Continuous rated current (A)	3.7	5	7.5	12.5	17.5	25	34	50	68	82	100	130	165	190	230	300	350	455
	Max. output voltage (V)	3-phase corresponding input voltage																	
	Output frequency range (Hz)	0.0~400.0Hz																	
	Carrier frequency (Hz)	16KHZ					12KHZ			10KHZ			8KHZ			6KHZ		5KHZ	3KHZ
Power supply	Input voltage, frequency	3-phase power supply 200V~240V 50/60HZ																	
	Tolerance for voltage fluctuation of power supply	±10% (180V~264V)																	
	Tolerance for frequency fluctuation of power supply	±8% (47HZ~64.8HZ)																	
Cooling fan		Forced fan																	

## 400V series specifications

Model No. LS800-4□□□		0K7	1K5	2K2	4K0	5K5	7K5	011	015	018	022	030	037	045	055	075	090	110	132	160	185	220	300	375
Applicable motor power (KW)		0.75	1.5	2.2	4.0	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160	185	220	300	375
Applicable motor power (HP)		1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150	175	200	250	300	400	500
Output	Rated output capacity (KVA)	2.8	3.8	5.7	7.6	10.6	13.3	19	28	32	38	51	62	76	99	125	152	175	209	228	266	346	438	544
	Continuous rated current (A)	3.7	5	7.5	10	14	17.5	25	38	43	50	68	82	100	130	165	200	230	275	300	350	455	550	683
	Max. output voltage (V)	3-phase corresponding input voltage																						
	Output frequency range (Hz)	0.0～400.0Hz																						
	Carrier frequency (Hz)	16KHZ				12KHZ			10KHZ			8KHZ			6KHZ		5KHZ		4KHZ		3KHZ		2KHZ	
Power supply	Input voltage, frequency	3-phase power supply 380V～480V 50/60Hz																						
	Tolerance for voltage fluctuation of power supply	±10%(342V～506V)																						
	Tolerance for frequency fluctuation of power supply	±8%(47HZ～64.8HZ)																						
Cooling fan		Forced fan																						

# –Standard specifications– Appendix A

## Common characteristics

Control	Control method	Sine wave SVPWM, 2-phase or 3-phase modulation, switching frequency 1K~16KHZ adjustable, five control modes—V/F、V/F + closed loop、V/F sensorless、Flux vector control + closed loop、Flux vector sensorless.
	Max. output frequency	0.0~400.0Hz
	Frequency precision (temperature fluctuation)	Digital signal : $\pm 0.1\%$ (-10°C ~ +40°C) , Analog signal : $\pm 0.1\%$ (25°C $\pm$ 10°C)
	Precision for frequency setup	Digital signal : 0.1Hz(0.0~400.00Hz) , Analog signal : 0.1/60.0Hz
	Precision for speed regulation	Voltage sensor-less vector : $> 10\text{Hz} : \pm 1.0\%$ , V/F : $\pm 3.0\% \sim 5.0\%$
	Acceleration / deceleration time	0.0~30000(seconds), acceleration/deceleration can be governed by 4 types of adjustment respectively and portioned out into 16 stages of speed for application.
	Control functions	40 display functions, 8 rpm command sources, Torque Limit, zero-speed vector control, variable and constant torque control, selection of sink and source, upper & lower frequency setup, AVR function, S-curve, multiplexing input, output terminal control, 16 preset stages for speed regulation, hopping frequency, Auto-Tuning, detection & measurement of static and dynamic motor parameters, , slip compensation, Torque compensation, dual PID functions, DC brake at on/off, multi-stage operation functions, RS485/Modbus communication, automatic operation function, energy-saving operation.
	Signal for frequency setup	DC 0 ~ $\pm 10\text{V}$ , DC 0 ~ +10V , 4 ~ 20mA
	Brake torque	20% approximately, 125% with brake controller mounted.
	Control functions	Digital operation panel, speed regulation, sensor-less flux control, PID control, multi-stage speed control, etc.
Protection functions	Motor protection	Integral electronic thermal relay protections.
	Over-current protection	Will trip at over-current protection to enable a free run of motor when exceeding the 200% rated current
	Overload ability of ac drive	Motor rated output current exceeds the 150%, cumulative time 1 minutes free running stop.
	Over-voltage protection	Over-voltage level: $V_{dc} > 400\text{V}(200\text{V} \sim 240\text{Vclass}) / V_{dc} > 800\text{V}(380\text{V} \sim 480\text{Vclass})$
	Low-voltage protection	Low-voltage level: $V_{dc} < 180\text{V}(200\text{V} \sim 240\text{Vclass}) / V_{dc} < 380\text{V}(380\text{V} \sim 480\text{Vclass})$
	Power supply protection	Under phase protection for input power supply (equipped for ac drive with a power above 5.5KW), under phase protection for output (equipped for ac drive with a power above 0.4KW)
	Superheating heat radiation fins	Thermal coupler protection 85°C $\pm$ 5°C
	Stall protection	To protect the device from stall during acceleration/deceleration and operation.
	Grounding protection	To protect electronic circuits.
	Charging indication	Charging indicator will be turned “ON” when the DC voltage of main circuit is over 50V.
	Place used	Indoor places free of corrosion or dusts.
Environment conditions	Ambient temperature	-10°C ~ +45°C (Lock wall-mounting model), -10°C ~ +50°C (open model) free of freezing condition
	Storage temperature (Note 1)	-20°C ~ +60°C
	Humidity	Below 95%RH (no condensation condition)
	Vibration	20Hz $\leq$ 1G, 20 ~ 50Hz 0.2G
※ Note 1 : A too high storage temperature may damage the capacitor of main circuit.		

# Appendix B – Ex-factory set values–

## 200V Series

Horsepower	KW	20K4	20K7	21K5	22K2	24K0	25K5	27K5	2011	2015
	HP	0.5	1	2	3	5	7.5	10	15	20
F126		0.040	0.040	0.030	0.030	0.025	0.025	0.020	0.020	0.015
F128		5000	5000	5000	5000	5000	5000	5000	5000	5000
F129		220 V	220 V	220 V	220 V	220 V	220 V	220 V	220 V	220 V
Motor's rated parameters	F141	220 V	220 V	220 V	220 V	220 V	220 V	220 V	220 V	220 V
	F142	2.0 A	3.5 A	6.0 A	8.2 A	15 A	20 A	27 A	38 A	50 A
	F143	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz
	F144	1680	1710	1710	1720	1720	1740	1740	1755	1755
	F145	0.5 HP	1.0 HP	2.0 HP	3.0 HP	5.0 HP	7.5 HP	10 HP	15 HP	20 HP
	F146	4P	4P	4P	4P	4P	4P	4P	4P	4P

Horsepower	KW	2018	2022	2030	2037	2045	2055	2075	2090	2110
	HP	25	30	40	50	60	75	100	125	150
F126		0.015	0.010	0.010	0.008	0.008	0.006	0.006	0.003	0.003
F128		5000	5000	5000	5000	5000	3000	3000	3000	2000
F129		220 V	220 V	220 V	220 V	220 V	220 V	220 V	220 V	220 V
Motor's rated parameters	F141	220 V	220 V	220 V	220 V	220 V	220 V	220 V	220 V	220 V
	F142	62 A	75 A	97 A	128 A	150 A	187 A	235 A	300 A	355 A
	F143	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz
	F144	1760	1760	1760	1775	1775	1780	1780	1780	1780
	F145	25 HP	30 HP	40 HP	50 HP	60 HP	75 HP	100 HP	125 HP	150 HP
	F146	4P	4P	4P	4P	4P	4P	4P	4P	4P



## – Ex-factory set values – Appendix B

### 400V Series

Horsepower	KW	40K7	41K5	42K2	44K0	45K5	47K5	4011	4015	4018	4022	4030
	HP	1	2	3	5	7.5	10	15	20	25	30	40
F126		0.040	0.030	0.030	0.025	0.025	0.020	0.020	0.015	0.015	0.010	0.010
F128		5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
F129		380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V
Motor's rated parameters	F141	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V
	F142	1.9 A	3.7 A	5.3 A	8.2 A	12 A	15 A	22 A	28 A	36 A	44 A	58 A
	F143	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz
	F144	1710	1710	1720	1720	1740	1740	1755	1755	1760	1760	1760
	F145	1.0 HP	2.0 HP	3.0 HP	5.0 HP	7.5 HP	10 HP	15 HP	20 HP	25 HP	30 HP	40 HP
	F146	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P

Horsepower	KW	4037	4045	4055	4075	4090	4110	4132	4160	4185	4220	保留
	HP	50	60	75	100	125	150	175	200	250	300	
F126		0.008	0.008	0.006	0.006	0.003	0.003	0.003	0.003	0.003	0.003	保留
F128		5000	5000	4000	4000	3000	3000	3000	3000	2000	2000	
F129		380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	
Motor's rated parameters	F141	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	
	F142	72 A	84 A	108 A	135 A	165 A	210 A	260 A	290 A	340 A	385 A	
	F143	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	
	F144	1775	1775	1780	1780	1780	1780	1780	1780	1780	1780	
	F145	50 HP	60 HP	75 HP	100 HP	125 HP	150 HP	175 HP	200 HP	250 HP	300 HP	
	F146	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P	

$R : (\bigcirc)$  denotes that performing to set up the function is permitted during operation.

1	R	Parameter	Description	Range	Unit	Ex-factory Setting	Page No.	
<b>Operation status display setup</b>	○	F0	Operation panel display selection	0~40		1	P5-1	
	0 : Frequency command (F)    10 : Vdc (V)    20 : Temperature (°C)    30 : K_Vdc 1 : Output frequency (H)    11 : Excitation voltage    21 : Counts Value    31 : Phase U current (rms) 2 : Output current (A)    12 : Torque voltage    22 : Digital input status    32 : Phase V current (rms) 3 : Output voltage (E)    13 : Excitation current    23 : Digital output status    33 : Phase W current (rms) 4 : PG feedback speed rpm (n)    command    24 : Digital operation panel    34 : PID(%) 5 : Pulse frequency command    14 : Torque current command    AV(%)    35 : Reserved 6 : Vector Estimated RPM    15 : Excitation current    25 : AV1(%)    36 : Software version 7 : Output power supply frequency    16 : Torque current    26 : AV2(%)    37 : Position-tracking error 8 : Unitless    17 : Output power (%)    27 : AI(%)    38 ~ 40 : Reserved 9 : Slipping frequency    18 : True power(%)    28 : Vdc_0V 19 : virtual power (%)    29 : Cycle & Multiple stage							
	○	F1	LPF filtration time display	0~15		6	P5-3	
	○	F2	Speed display unit	0~1		0		
	0 : Frequency (Hz)                      1 : rpm (Rpm)							
	○	F3	Unitless display of fold of multiplication (Max multiplying display value=3276.7)	0.001~10.000		1.000	P5-3	
	<b>Operation control parameters</b>	×	F4	Operation control source	0~1		0	P5-3
		0 : Digital operation panel                      1 : Digital input terminal						
×		F5	Frequency command source	0~8		1	P5-3	
0 : Digital operation panel (F17)    3 : AV2 input (+10V)    6 : Pulse frequency command 1 : Operation panel AV input (V.R)    4 : AI input (20mA or +10V)    7 : External PID 2 : AV1 input (±10V)    5 : AV2+AI    8 : External PID or AV2								
×		F6	Start Mode	0~2		0	P5-5	
0 : Started on by start frequency    1 : Flying Re-start activation    2 : DC Brake before Starting by Activation Frequency								
×		F7	Stop Mode	0~2		1	P5-6	
0 : Coast to Stop    1: Dynamic Stop    2 : Dynamic DC stop								
×		F8	Brake Time before Activation	0.0~120.0	Second	5.0	P5-6	
×		F9	Current of Brake before Activation	0.00~1.00	Pu	0.20		
×		F10	Stop brake time	0.0~120.0	Second	5.0	P5-7	
×		F11	Stop brake current	0.00~1.00	Pu	0.20		
×	F12	(V/F) Stop brake beginning frequency	0.0~60.0	Hz	0.0			
※ This setup is effective only to V/F mode setup, brake-to-stop by vector control can be activated provided that the speed has been decelerated to zero speed.								

# –Parameter Setup Schedule–Appendix C

R : (○) denotes that performing to set up the function is permitted during operation.

2	R	Parameter	Description	Range	Unit	Ex-factory Setting	Page No.	
Speed limit	×	F13	Rotating Direction Control	0~3		1	P5-7	
	0 : Either FWD or REV.    1: FWD only    2 : REV only    3 : REV only with negative bias							
	×	F14	Lower Limit Frequency (※F14≤F15)	0.0~400.0	Hz	0.0	P5-8	
	×	F15	Upper Limit Frequency (※F14≤F15)	0.0~400.0	Hz	60.0		
×	F16	Activation Frequency	0.0~30.0	Hz	0.0			
Multi-stage speed command setup	○	F17	Master speed	0.0~400.0	Hz	5.0	P5-9	
	○	F18	Stage 1 speed	0.0~400.0	Hz	5.0		
	○	F19	Stage 2 speed	0.0~400.0	Hz	10.0		
	○	F20	Stage 3 speed	0.0~400.0	Hz	15.0		
	○	F21	Stage 4 speed	0.0~400.0	Hz	20.0		
	○	F22	Stage 5 speed	0.0~400.0	Hz	30.0		
	○	F23	Stage 6 speed	0.0~400.0	Hz	40.0		
	○	F24	Stage 7 speed	0.0~400.0	Hz	50.0		
	○	F25	Stage 8 speed	0.0~400.0	Hz	0.0		
	○	F26	Stage 9speed	0.0~400.0	Hz	0.0		
	○	F27	Stage 10 speed	0.0~400.0	Hz	0.0		
	○	F28	Stage 11 speed	0.0~400.0	Hz	0.0		
	○	F29	Stage 12 speed	0.0~400.0	Hz	0.0		
	○	F30	Stage 13 speed	0.0~400.0	Hz	0.0		
	○	F31	Stage 14 speed	0.0~400.0	Hz	0.0		
	○	F32	Stage 15 speed	0.0~400.0	Hz	0.0		
	○	F33	Inching speed	0.0~400.0	Hz	5.0		
	(※ F14 ≤ Set value ≤ F15)							
	Acceleration and deceleration time	×	F34	Acceleration/deceleration time unit	0~2		1	P5-10
0 : 0.01 second    1 : 0.1 second    2 : 1 second								
○		F35	Master Speed,Stage 4,Stage 8,Stage 12, Acceleration time 0	0.0~30000	Second	10.0	P5-10	
○		F36	Master Speed,Stage 4,Stage 8,Stage 12, Deceleration time 0	0.0~30000	Second	10.0		
○		F37	Stage 1,Stage 5,Stage 9,Stage 13, Acceleration time 1	0.0~30000	Second	10.0		
○		F38	Stage 1,Stage 5,Stage 9,Stage 13, Deceleration time 1	0.0~30000	Second	10.0		
○		F39	Stage 2,Stage 6,Stage 10,Stage 14 , Acceleration time 2	0.0~30000	Second	10.0		

# Appendix C –Parameter Setup Schedule–

R : (○) denotes that performing to set up the function is permitted during operation.

3	R	Parameter	Description	Range	Unit	Ex-factory Setting	Page No.
Acceleration and deceleration time	○	F40	Stage 2,Stage 6,Stage 10,Stage 14 , Deceleration time 2	0.0~30000	Sec.	10.0	P5-10
	○	F41	Stage 3,Stage 7,Stage 11,Stage 15, Acceleration time 3	0.0~30000	Sec.	10.0	
	○	F42	Stage 3,Stage 7,Stage 11,Stage 15 , Deceleration time 3	0.0~30000	Sec.	10.0	
	○	F43	Inching acceleration time	0.0~30000	Sec.	5.0	
	○	F44	Inching deceleration time	0.0~30000	Sec.	5.0	
	×	F45	Multi-stage acceleration/ deceleration time allotment	0~2		0	P5-11
	0 : All Internal Allotment ; 1: Half Internal Allotment and another Half External Terminals; 2 : All External Terminals						
	×	F46	S-curve time when starting the acceleration	0.00~3.00	Sec.	0.00	P5-11
	×	F47	S-curve time when finishing the acceleration	0.00~3.00	Sec.	0.00	
	×	F48	S-curve time when starting the deceleration	0.00~3.00	Sec.	0.00	
×	F49	S-curve time when finishing the deceleration	0.00~3.00	Sec.	0.00		
Analog frequency commands	○	F50	AV : 0V input bias %	-300.00~300.00	%	0.00	P5-12
	○	F51	AV : 5V input gain %	-300.00~300.00	%	100.00	
	○	F52	AV1 : -10V input bias %	-300.00~300.00	%	-100.00	P5-13
	○	F53	AV1 : 10V input gain %	-300.00~300.00	%	100.00	
	○	F54	AV1 : Dead Band Voltage (Dead Band)	0.00~85.00	%	0.00	
	○	F55	AV1 : Zero-point output gain	0.00~50.00	%	0.00	
	○	F56	AV1 : Maximal output limit	10.00~100.00	%	100.00	
	○	F57	AV2 : 0V input bias %	-300.00~300.00	%	0.00	P5-15
	○	F58	AV2 : 10V input gain %	-300.00~300.00	%	100.00	
	○	F59	AV2 : Dead Band Voltage (Dead Band)	0.00~85.00	%	0.00	
	○	F60	AV2 : Zero-point output gain	0.00~50.00	%	0.00	
	○	F61	AV2 : Maximal output limit	10.00~100.00	%	100.00	
	○	F62	AI : 4mA (or 0V) input bias %	-300.00~300.00	%	0.00	
	○	F63	AI : 20mA (or 10V) input gain %	-300.00~300.00	%	100.00	
	○	F64	AI : Dead band voltage (Dead Band)	0.00~85.00	%	0.00	
	○	F65	AI : Signal Input mode	0~1	%	0	
	0 : 4~20mA ; 1 : 0~10V ;						
	○	F66	AI : signal Interrupts detection (F5 = 4)	0~3	%	0	
	0 : Not detected 1 : Slow down to zero Hz after stopping 2 : Coast to stop 3 : Maintain the frequency of operation before break						
		×	F67	Digital Terminal Scan Cycle	1~5000	0.2ms	

# -Parameter Setup Schedule-Appendix C

R : (○) denotes that performing to set up the function is permitted during operation.

4	R	Parameter	Description		Range	Unit	Ex-factory Setting	Page No.
Digital input	×	F68	Di1,Di2 setup		0~1		0	P5-18
	0:Di1(FWD/STOP), Di2(REV/STOP)      1:Di1(RUN/STOP), Di2(FWD/REV)							
	×	F69	Di3 setup	※Settings for multi-function input terminals should never be repeated except	0~24		2	P5-19
	×	F70	Di4 setup		0~24		4	
	×	F71	Di5 setup		0~24		5	
	×	F72	Di6 setup		0~24		6	
	×	F73	Di7 setup		0~24		9	
	×	F74	Di8 setup		0~24		18	
	0 : Disabled 1 : 3-wire control 2 : Input in Case of External Abnormality (NO) 3 : Input in Case of External Abnormality (NC) 4 : RESET 5 : Multi-stage speed command 1 6 : Multi-stage speed command 2 7 : Multi-stage speed command 3 8 : Multi-stage speed command 4 9 : Inching Operation 10 : Acceleration/Deceleration Time Command 1 11 : Acceleration/Deceleration Time Command 2 12 : Master Speed Increase 13 : Master Speed Decrease 14 : Automatic Operation 15 : Auto Operation Suspended 16 : Counter Signal Input 17 : Counter Zero-in 18 : Coast to stop 19 : Auto saving Operation 20 : Second Unit PID 21 : Di enables PID 22 : Di enables AV2 23 : Di enables AI 24 : Zero servo							
	Digital output	×	F75	Relay1 setup		0~12		1
×		F76	DO1 setup		0~12		11	
×		F77	DO2 setup		0~12		6	
×		F78	DO3 setup		0~12		7	
×		F79	Relay2 setup		0~12		3	
0 : Disabled 1 : Output in Case of Abnormality (NO) 2 : Output in Case of Abnormality (NC) 3 : In Operation 4 : Frequency Attained 1 5 : Frequency Attained 2 6 : Consistent Frequency 7 : Overload Warning 8 : Overload Timing Forecast 9 : Counter Cycle is Up 10 : Comparator Counting is Up 11 : Zero-Speed Detected 12 : Timer function output								
×		F80	Frequency Consistent Width		0.0~10.0	Hz	1.0	P5-23
×		F81	Frequency Attained 1		0.0~400.0	Hz	60.0	
×		F82	Frequency Attained 2		0.0~400.0	Hz	60.0	
×		F83	Magnetic Stagnation Width Attained		0.0~10.0	Hz	1.0	
Frequency skip	×	F84	Counting Cycle		0~30000	P	1000	P5-24
	×	F85	Comparative Counting		0~30000	P	500	
	×	F86	ON-Delay time counting		0.00~60.00	Sec.	0.00	
	×	F87	OFF-Delay time counting		0.00~60.00	Sec.	0.00	
	×	F88	Frequency skip 1		0.0~400.0	Hz	0.0	P5-25
	×	F89	Frequency skip 2		0.0~400.0	Hz	0.0	
	×	F90	Frequency skip 3		0.0~400.0	Hz	0.0	
	×	F91	Frequency Skip Width		0.0~10.0	Hz	0.0	



# Appendix C –Parameter Setup Schedule–

R : (○) denotes that performing to set up the function is permitted during operation.

5	R	Parameter	Description	Range	Unit	Ex-factory Setting	Page No.
Motor protection setup	○	F92	Stalling Protection setup	0~31		3	P5-25
		bit0 : Protection function F93      bit1 : Protection function F94      bit2 : Protection function F96 bit3 : Inhibit inertia at motor start      bit4 : Automatic Voltage Regulation (AVR)					
	×	F93	Deceleration stalling voltage setup	1.00~1.25		1.20	P5-27
	×	F94	Acceleration Stalling Current Setup	0.50~2.50	Pu	1.50	
	×	F95	Start Thermal relays the current setting of position	0.80~1.30	Sec.	1.00	
	×	F96	Current level of electronic thermal relay	1.00~2.50	Pu	1.50	
	×	F97	Acting time of electronic thermal relay	0.1~120.0	Sec.	60.0	
	×	F98	V / F output current limit	0.20~1.45		1.30	P5-28
	×	F99	Leaking current, 3-phase current, and abnormal level setup	0.001~0.500	Pu	0.250	
	×	F100	Over Temp Protection Setup	60.00~95.00	°C	88.00	
	×	F101	Fan Activating Temp. Setup	40.00~60.00	°C	45.00	P5-29
	×	F102	Brake discharging level	1.12~1.40	Pu	1.20	
Automatic operation functions	×	F103	Automatic Operation Mode	0~4		0	
		0 : Disabled    1 : Reciprocal mode    2 : Cyclic mode    3 : Master speed after reciprocal mode 4 : Master speed after cyclic mode					
	×	F104	Number of Cycles	1~1000	Cycle	1	P5-30
	×	F105	Time of automatic operation mode at master speed	-30000~30000	Sec.	5	
	×	F106	Time of automatic operation mode at stage 1	-30000~30000	Sec.	0	
	×	F107	Time of automatic operation mode at stage 2	-30000~30000	Sec.	0	
	×	F108	Time of automatic operation mode at stage 3	-30000~30000	Sec.	0	
	×	F109	Time of automatic operation mode at stage 4	-30000~30000	Sec.	0	
	×	F110	Time of automatic operation mode at stage 5	-30000~30000	Sec.	0	
	×	F111	Time of automatic operation mode at stage 6	-30000~30000	Sec.	0	
	×	F112	Time of automatic operation mode at stage 7	-30000~30000	Sec.	0	
	×	F113	Time of automatic operation mode at stage 8	-30000~30000	Sec.	0	
	×	F114	Time of automatic operation mode at stage 9	-30000~30000	Sec.	0	
	×	F115	Time of automatic operation mode at stage 10	-30000~30000	Sec.	0	
	×	F116	Time of automatic operation mode at stage 11	-30000~30000	Sec.	0	
	×	F117	Time of automatic operation mode at stage 12	-30000~30000	Sec.	0	
	×	F118	Time of automatic operation mode at stage 13	-30000~30000	Sec.	0	
	×	F119	Time of automatic operation mode at stage 14	-30000~30000	Sec.	0	
	×	F120	Time of automatic operation mode at stage 15	-30000~30000	Sec.	0	
	×	F121	Maximum Output Voltage (U,V,W)	0.50~1.00	Pu	1.00	P5-31
	×	F122	Maximal Voltage Frequency	0.50~2.00	Pu	1.00	



## -Parameter Setup Schedule-Appendix C

$R : (O)$  denotes that performing to set up the function is permitted during operation.

[illegible]

$R : (\bigcirc)$  denotes that performing to set up the function is permitted during operation.

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7	R	Parameter	Description	Range	Unit	Ex-factory Setting	Page No.
FM1 waveform output	LS800 NO.2.32 Special-Purpose						
	×	F131	Longest outage duration allowable	0~5000	ms	20	P5-36
	×	F132	Terminal-actuating setup for failure reset and after power restoration	0~1		0	
	0 : Direct Start                      1 : Return the Start Command Terminal (Di)						
	×	F133	FM 1 Output Mode	0~2		0	P5-36
	0 : 0~10V                      1 : ±10V                      2 : 4~20mA						
	○	F134	FM1 Multifunctional output setup	0~21		1	P5-36
	0 : No Output                      5 : Power supply source frequency                      10 : Output Current                      16 : Reactive power 1 : Motor output speed                      11 : Excitation Current Command                      17 : PID % output 2 : PG feedback speed                      6 : Slip Frequency                      12 : Torque current command                      18 : Keypad operate signal AV 3 : Pulse frequency command                      7 : Output Voltage                      13 : Excitation current                      19 : AV1 4 : Sensor-less vector output speed                      8 : Excitation voltage                      14 : Torque Current                      20 : AV2 						

# -Parameter Setup Schedule-Appendix C

R : (○) denotes that performing to set up the function is permitted during operation.

8	R	Parameter	Description	Range	Unit	Ex-factory Setting	Page No.
Encoder setup	×	F149	Encoder (PG) pulse	600~2500	P/rev	1024	P5-40
	×	F150	Encoder (PG) direction	-1~1		1	
	-1 : B leads A                      0 : Single Phase command                      1 : A leads B						
	○	F151	Encoder (PG) feedback speed/filtration time	0.0~100.0	ms	2.0	P5-40
	×	F152	PG off-line detection time	0.00~10.00	Sec.	3.00	
	×	F153	Pulse command	600~2500	P/rev	1024	
	×	F154	Pulse command direction setup	-1~1		1	
	-1 : B leads A                      0 : Single Phase Feedback                      1 : A leads B						
	×	F155	Pulse-command multiplying factor	0.010~10.000	×	1.000	P5-41
	Motor electric parameters	×	F156	Stator Resistance	500~32767		10000
×		F157	Rotor Resistance	500~32767		8000	
×		F158	Stator Induction	3250~32767		9000	
×		F159	Mutual Induction	3250~32767		8750	
×		F160	No-load current (%)	12.50~99.00	%	40.00	
×		F161	Mechanical Constant (rotor inertia)	0~30000		1500	
Estimator	×	F162	Magnetic Flux Estimator Bandwidth	1.0~20.0	Hz	3.0	P5-44
	×	F163	Speed Estimator Bandwidth	1.0~20.0	Hz	4.0	
	○	F164	Slip compensation Gain	10~200	%	100	
Speed PI control parameters (ASR)	○	F165	Scalar Speed Control P Gain	2~100	%	20	P5-45
	○	F166	Scalar Speed Control I Gain	0.0~100.0	%	50.0	
	○	F167	Low-speed Sensorless Speed Control P Gain	2~100	%	50	
	○	F168	Low-speed Sensorless Speed Control I Gain	0.0~100.0	%	50.0	
	○	F169	High-speed Sensorless Speed Control P Gain	2~100	%	30	
	○	F170	High-speed Sensorless Speed Control I Gain	0.0~100.0	%	30.0	
	×	F171	Low-speed magnetic-field magnification factor	100.0~180.0	%	140.0	P5-47
	×	F172	Magnetic-field magnification cut-off frequency	0.00~0.60	Pu	0.20	
	○	F173	Torque current Limit	0.000~1.250		1.000	
	×	F174	Torque Current Analog control source selection	0~5		0	
	0 : Disabled                      2 : AV1                      4 : AI 1 : Digital operation panel AV                      3 : AV2                      5 : External PID						
	×	F175	Torque control mode	0~1		0	P5-48
	0 : Torque current limit                      1 : Torque current command (over-speed tripping)						
	×	F176	Torque control over-speed tripping frequency	0.0~400.0	Hz	60.0	P5-48

# Appendix C –Parameter Setup Schedule–

R : (○) denotes that performing to set up the function is permitted during operation.

9	R	Parameter	Description	Range	Unit	Ex-factory Setting	Page No.
Zero-speed positioning	×	F177	Close-loop vector control zero-speed positioning	0~2		0	P5-48
	0 : Disabled 1 : Zero-speed positioning 2 : Pulse-wave frequency command position tracking						
	○	F178	Zero-speed positioning P gain	2.00~100.00	%	30.00	P5-48
○	F179	Zero-speed positioning I gain	0.00~100.00	%	20.00		
Abnormality records	×	F180	Latest Abnormality Record	0~60		0	P5-49
	×	F181	Last Abnormality Record	0~60		0	
	×	F182	Last 2 Abnormality Records	0~60		0	
	×	F183	Last 3 Abnormality Records	0~60		0	
	Err 0 : Digital operation panel communication failure			Err 21 : PG off-line detection			
	Err 1 : Over voltage(U1) or current(A1) in standby status			Err 22 : Break wire detected analog signals AI			
	Err 2 : Over voltage(U2) or current(A2) in acceleration			Err 23 : Absence of speed feedback affecting performance of closed loop control			
	Err 3 : Over voltage(U3) or current(A3) in deceleration			Err 24 : Torque control over upper limit of speed			
	Err 4 : Over voltage(U4) or current(A4) in speed regulation			Err 25 : EEPROM parameter read back out of range			
	Err 5 : Heat sink overheated			Err 26 : Digital operation panel storage parameter write failure			
	Err 6 : Dc Bus over voltage			Err 27 : DSP storage parameter locked & preventing modification			
	Err 7 : Dc Bus low voltage			Err 28 : Operation panel storage parameter locked & preventing modification			
	Err 8 : Electronic thermal relay action (Motor overload)			Err 29 : External input abnormality			
	Err 9 : AC Drive voltage not match the motor voltage			Err 30 : 3-phase current amplitude difference too big			
	Err 10 : Software-detected overload current protection			Err 31 : Current leakage or abnormal 3-phase current sum			
	Err 11 : AC Drive rated current range not match motor current			Err 32 : PUF fuse blown			
Err 12 : Loss of output U-phase or U-phase C.T failure			Err 33 : Power failure or too low mains input phase voltage				
Err 13 : Loss of output V-phase or V-phase C.T failure			Err 34 : Reserved				
Err 14 : Loss of output W-phase or W-phase C.T failure			Err 35 : Error in automatic operation time setup				
Err 15 : Reserved			Err 36 : Digital input terminal setup repeated				
Err 16 : Encoder direction opposite to the phase sequence on the output side			Err 37~60 : Reserved				
Err 17 : Encoder signal abnormality							
Err 18 : Parameter detection failure							
Err 19 : Position-tracking error greater then 40 turns							
Err 20 : Overload (150%, 60 seconds)							
	×	F184	No. of auto-reset	0~10		0	P5-49
	×	F185	Abnormality Records Cleared	0~1		0	
0 : Not Cleared. 1 : Cleared.							
External PID control	×	F186	PID mode	0~4		0	P5-51
	0 : PID Disabled 2 : PID Stop Setting Reserved 4 : DI enabled (PID Stop Setting Reserved) 1 : PID Stop Setting Zero-in 3 : DI enabled (PID Stop Setting Zero-in)						
	×	F187	PI Target Value Input Options	0~8		0	P5-51
	0 : PI initial value setup 3 : AI input 6 : RAMP output 1 : AV1 input 4 : Pulse Frequency command value 7 : Total output current 2 : AV2 input 5 : Encoder (PG) feedback value 8 : Torque current						

# -Parameter Setup Schedule-Appendix C

R : (○) denotes that performing to set up the function is permitted during operation.

10	R	Parameter	Description	Range	Unit	Ex-factory Setting	Page No.
External PID control	×	F188	PI Feedback point Options	0~8		0	P5-52
	0 : PI initial value setup      3 : AI input      6 : RAMP output 1 : AV1 input      4 : Pulse Frequency command value      7 : Total output current 2 : AV2 input      5 : Encoder (PG) feedback value      8 : Torque current						
	×	F189	D input options	0~8		0	P5-52
	0 : PI error      3 : AI input      6 : RAMP output 1 : AV1 input      4 : Pulse Frequency command value      7 : Total output current 2 : AV2 input      5 : Encoder (PG) feedback value      8 : Torque current						
	○	F190	PI Initial Value Setup	0.00~100.00	%	50.00	P5-53
	○	F191	D Input Filtration Time Setup	0.05~10.00	Sec.	0.20	
	○	F192	PID Output Limit	0.00~100.00	%	100.00	
	○	F193	Unit 1 Kp Gain	2.00~300.00	%	100.000	
	○	F194	Unit 1 Ki_H Gain	0.0~3000.0	%	400.0	
	○	F195	Unit 1 Ki_L Gain	0.0~3000.0	%	200.0	
	○	F196	Unit 1 Kd Gain	0.0~3000.0	%	20.0	
	○	F197	Unit 2 Kp Gain	2.00~300.00	%	100.00	
	○	F198	Unit 2 Ki_H Gain	0.0~3000.0	%	5.0	
	○	F199	Unit 2 Ki_L Gain	0.0~3000.0	%	5.0	
	○	F200	Unit 2 Kd Gain	0.0~3000.0	%	5.0	
	×	F201	Set the minimum working pressure	1.0~20.0	%	2.0	P5-55
	×	F202	Longest outage duration allowable(NO.2.31 Version)	0~5000	ms	0	P5-56
	×	F202	Reserved (NO.2.32 Version)	-32767~32767		0	
	×	F203	Ac Drive Communication Address	1~255		1	
PC communication	×	F204	PC transmission rate	0~4		2	
	0 : 2400      1 : 4800      2 : 9600      3 : 19200      4 : 38400						
	×	F205	Data Communication Data Format	0~3		0	P5-56
	0 : 8,N,1 RTU ( 1 start bit + 8 data bits + 1 stop bit ) 1 : 8,E,1 RTU ( 1 start bit + 8 data bits + 1 Even bit + 1 stop bit ) 2 : 8,0,1 RTU ( 1 start bit + 8 data bits + 1 Odd bit + 1 stop bit ) 3 : 8,N,2 RTU ( 1 start bit + 8 data bits + 2 stop bits )						
	×	F206	Communication responded time	3~50	ms	5	P5-56
	×	F207	Receive Failure Response	0~7		0	P5-57
	0 : Normal Receiving      3 : CRCH error      6 : Parametric value out of range 1 : Function Code error      4 : Packet Receiving Time Over 0.2 Seconds      7 : Parameter code error 2 : CRCL error      5 : Changing Parameter Not Permitted during Operation						

# Appendix C –Parameter Setup Schedule–

R : (○) denotes that performing to set up the function is permitted during operation.

11	R	Parameter	Description	Range	Unit	Ex-factory Setting	Page No.
Storage, recall parameters	×	F208	Recall Parameter	0~2		0	P5-65
		0 : Not Recalled                      2 : Recall Parameters Saved in Digital operation panel 1 : Recall Ex-factory Setup					
	×	F209	Copy & save the parameter in digital operation panel	0~1		0	P5-65
		0 : Not Saved                      1 : Saved in Digital operation panel					
	×	F210	Lock up EEPROM Parameters	0~1		0	P5-65
		0 : Save modified                      1 : Lock up Parameters					
	×	F211	Reserved 1	-32767~32767		0	
	×	F212	Reserved 2	-32767~32767		0	





## Appendix D –Err Display–

Err Code	Description of Alarm Report
Err 0	Digital operation panel communication failure
Err(U,A) 1	Over voltage (Err U1) or current (Err A1)in standby status
Err(U,A) 2	Over voltage (Err U2) or current (Err A2)during acceleration
Err(U,A) 3	Over voltage (Err U3) or current (Err A3)during deceleration
Err(U,A) 4	Over voltage (Err U4) or current (Err A4)during speed regulation
Err 5	Heat sink overheated
Err 6	DC Bus over voltage
Err 7	DC Bus low voltage
Err 8	Electronic thermal relay enabled ( Motor Overload )
Err 9	AC Drive voltage not match to the motor voltage
Err 10	Software detected overload current protection
Err 11	AC Drive rated current range not match motor current
Err 12	Loss of output U-phase or U-phase C.T failure
Err 13	Loss of output V-phase or V-phase C.T failure
Err 14	Loss of output W-phase or W-phase C.T failure
Err 16	Encoder direction opposite to the phase sequence on the output side
Err 17	Encoder signal abnormality
Err 18	Parameter detection failure
Err 19	Position-tracking error greater than 40 turns

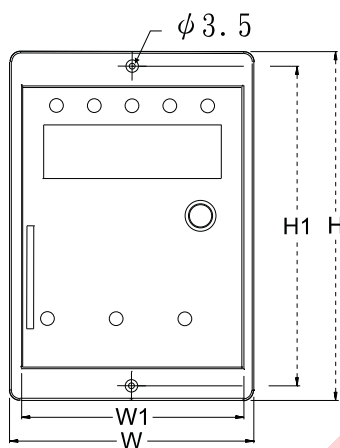
## -Err Display- D Appendix

Err Code	Description of Alarm Report
Err 20	Overload (150%,60 Sec.)
Err 21	PG off-line detection
Err 22	Break wire detected analog signals AI
Err 23	Absence of speed feedback affecting performance of closed loop control
Err 24	Torque control over upper limit of speed
Err 25	EEPROM parameter read back out of range
Err 26	Digital operation panel storage parameter write failure
Err 27	DSP storage parameter locked and preventing modification.
Err 28	Operation panel storage parameter locked and preventing modification
Err 29	External input abnormality
Err 30	3-phase current amplitude difference too big
Err 31	Current leakage or abnormal 3-phase current sum
Err 32	PUF fuse blown
Err 33	Power failure or too low mains input phase voltage
Err 35	Error in automatic operation time setup.
Err 36	Digital input terminal setup repeated.
<b>Err 15 、 Err 34 、 Err 37~Err 60 Are signals reserved for failure.</b>	

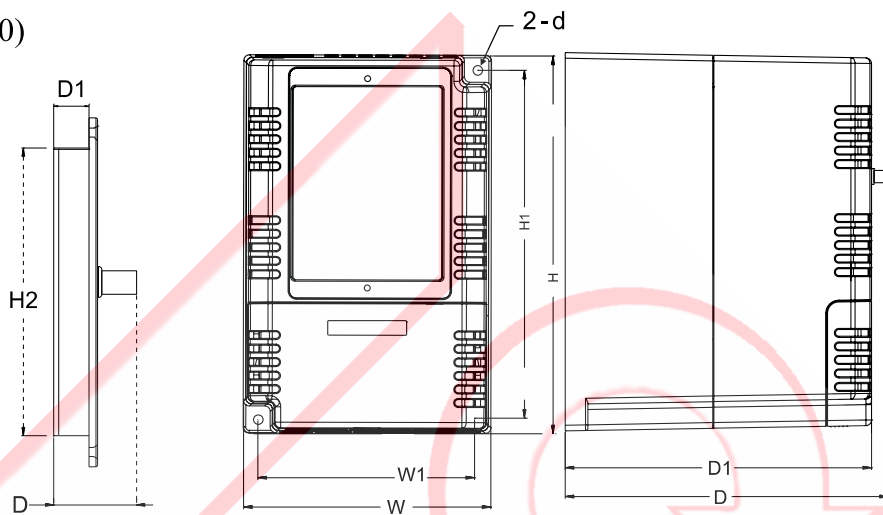
# Appendix E – Dimensional drawing of mechanism– Roughing-in dimensions and mounting dimensions

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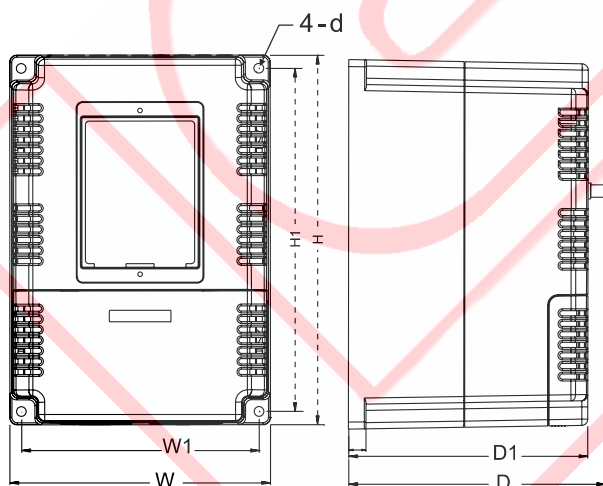
Digital operator (KP-AD20)



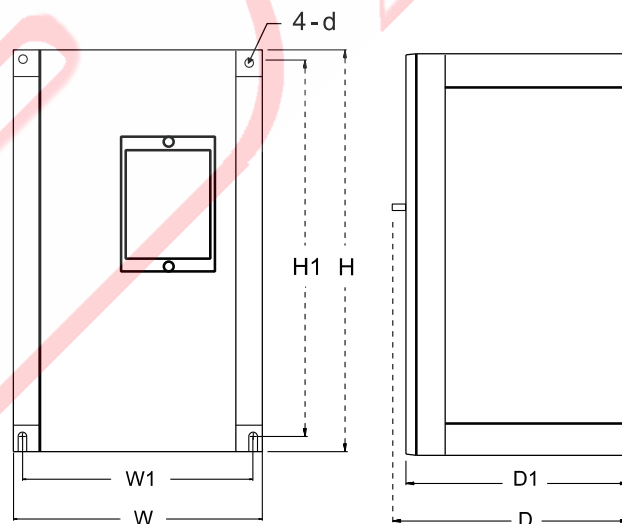
( Figure A )



( Figure B )



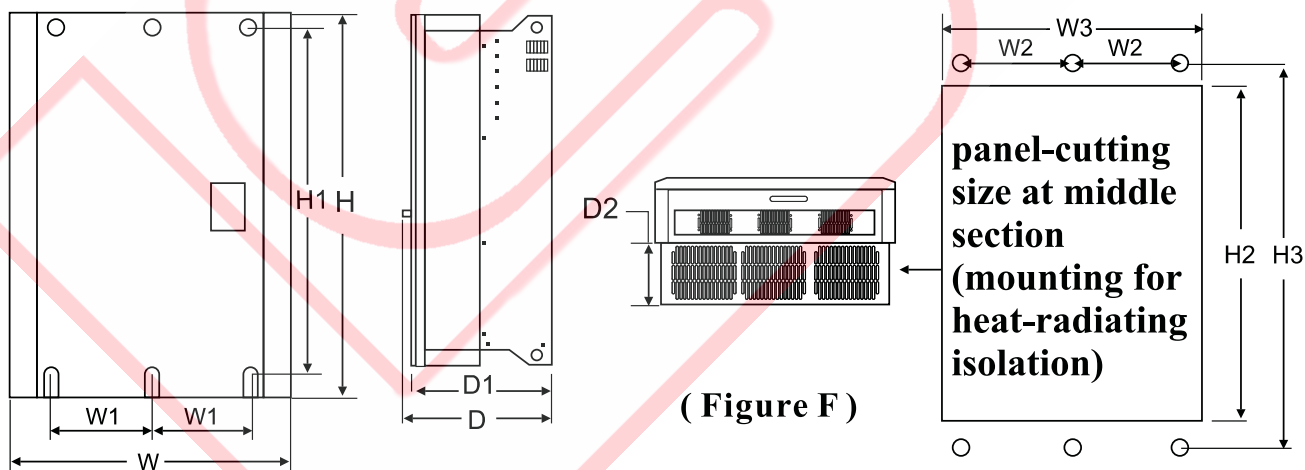
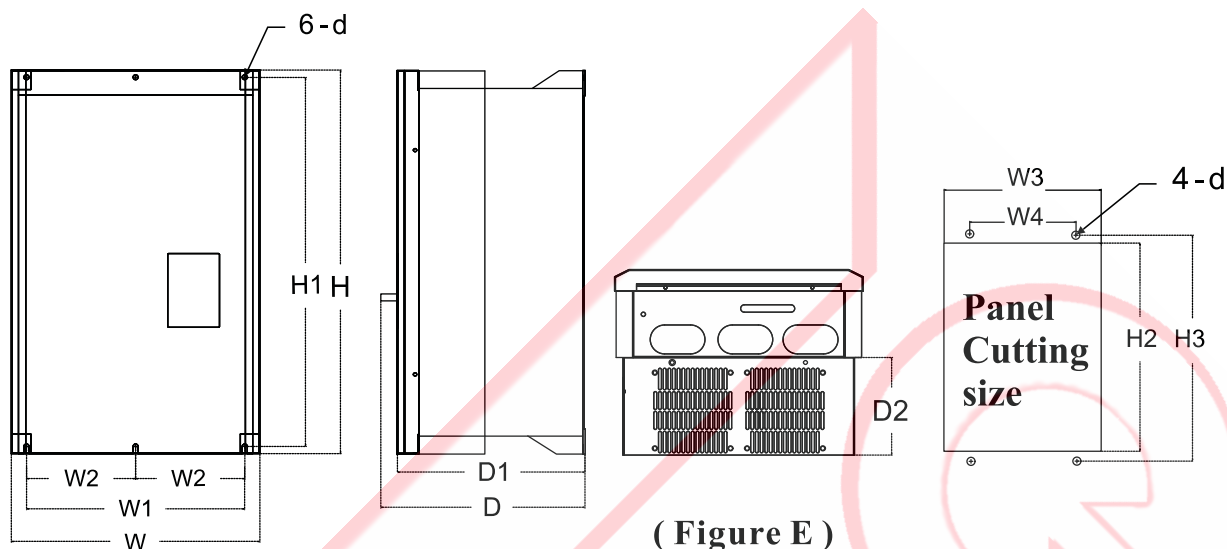
( Figure C )



( Figure D )

# -Dimensional drawing of mechanism- EAppendix

## Roughing-in dimensions and mounting dimensions



※ Dimensions shown in the figures above are for reference only.  
Please refer to the latest catalogue for the updated dimensions.  
We reserve the right to change the dimensions without notice.

# Appendix E – Dimensional drawing of mechanism – Roughing-in dimensions and mounting dimensions

## 200V class series

Applicable motor capacity	Roughing- in dimensions (mm)			Constant dimensions (mm)				$\psi$	Holing, constant dimensions (mm)					Drawing No.
(HP)／(KW)	W	H	D	W1	W2	H1	D1	d	W3	W4	H2	H3	D2	
KP-AD 20	70.9	102	25.8	—	—	93	15.8	3.5	65.3	—	84.5	—	—	A
0.5 / 0.4	114	172	146	101	—	159	136	5.3	—	—	—	—	—	B
1 / 0.75														
2 / 1.5														
3 / 2.2	152	214	146	137.5	—	200	136	5.3	—	—	—	—	—	C
5 / 3.7														
7.5 / 5.5	188	300	180	170	—	283	170	7	—	—	—	—	—	D
10 / 7.5														
15 / 11														
20 / 15	250	458	227	218	—	401	217	7	242	170	445	460	112	E
25 / 18														
30 / 22														
40 / 30	345	563	272	305	152.5	515	262	7	330	212	546	568	140	
50 / 37														
60 / 45														
75 / 55	604	770	322	262.4	220	749.5	312	7	582	—	745	770	158	
100 / 75														
125 / 90														
150 / 110														



# –Dimensional drawing of mechanism– EAppendix

## Roughing-in dimensions and mounting dimensions

### 400V class series

Applicable motor capacity (HP)/(KW)	Roughing-in dimensions (mm)			Constant dimensions (mm)				$\psi$	Holing, constant dimensions (mm)					Drawing No.
	W	H	D	W1	W2	H1	D1	d	W3	W4	H2	H3	D2	
KP-AD 20	70.9	102	25.8	—	—	93	15.8	3.5	65.3	—	84.5	—	—	A
0.5 / 0.4	114	172	146	101	—	159	136	5.3	—	—	—	—	—	B
1 / 0.75														
2 / 1.5														
3 / 2.2	152	214	146	137.5	—	200	136	5.3	—	—	—	—	—	C
5 / 3.7														
7.5 / 5.5	188	300	180	170	—	283	170	7	—	—	—	—	—	D
10 / 7.5														
15 / 11														
20 / 15	250	458	227	218	—	401	217	7	242	170	445	460	112	E
25 / 18														
30 / 22														
40 / 30														
50 / 37														
60 / 45	345	563	272	305	152.5	515	262	7	330	212	546	568	140	
75 / 55														
100 / 75														
125 / 90														
150 / 110	604	770	322	262.4	220	749.5	312	7	582	—	745	770	158	F
175 / 132														
200 / 160														
250 / 185														
300 / 220														
400 / 320														
500 / 375														

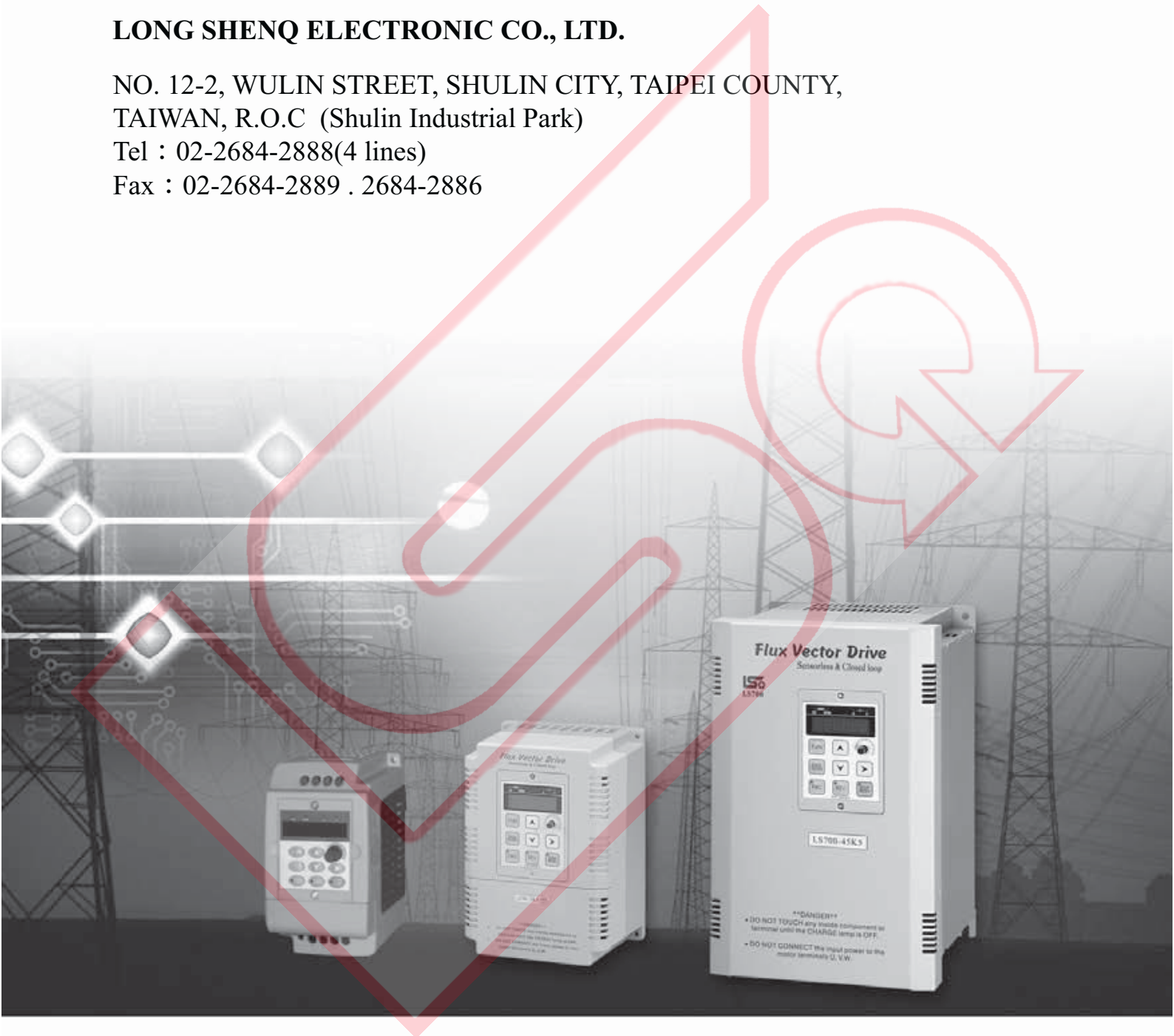


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