

– DESCRIPTION OF PARAMETER FUNCTIONS – V

Encoder Setup

- **6: Sensorless Flux 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.

PROMPT: The application of 6: Sensorless Flux Vector Control Mode must fall with the high speed [approximately 90%~120% of the motor rated speed] where speed precision is the essence. Set up the following Parameter groups upon completing the electric parameter calibration:

1. F101 = 0.80~0.90

2. F108 = 6K~8K[Carrier Frequency]

F127	Speed Feedback	0, 1	1	0
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- **0: No Feedback** – Speed feedback disabled.
- **1: Encoder 1** – to perform speed feedback control to the master controller.

F128	Encoder 1 Output	600~2500 P/rev	1 P/rev	1024
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- ◎ Set the correct number of pulses per revolution to enable precise speed control.

F129	Encoder 1 Direction	-1, 0, 1	1	1
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- **0: Single Phase Feedback** – Single-phase feedback allows only one-direction operation
- **-1: B leads A** – the motor operates in REV direction.
- **1: A leads B** – the motor operates in FWD direction.

F130	Encoder 2 Output	600~2500 P/rev	1 P/rev	1024
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- ◎ Encoder 2 is the slave encoder of speed feedback command to perform precise speed follow-up operation.
- ◎ Whenever fast response is required, the acceleration or deceleration time of the ac drive in follow-up operation must be set at its minimum.

F131	Encoder 2 Direction	-1, 0, 1	1	1
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- **0: Single Phase Feedback** – Single-phase feedback allows only one-direction operation
- **-1: B Leads A** – Motor operates in REV direction.
- **1: A Leads B** – Motor operates in FWD direction.
- ◎ Confirmation of the initial direction by A or B allows smooth FWD, REV and follow-up operation.

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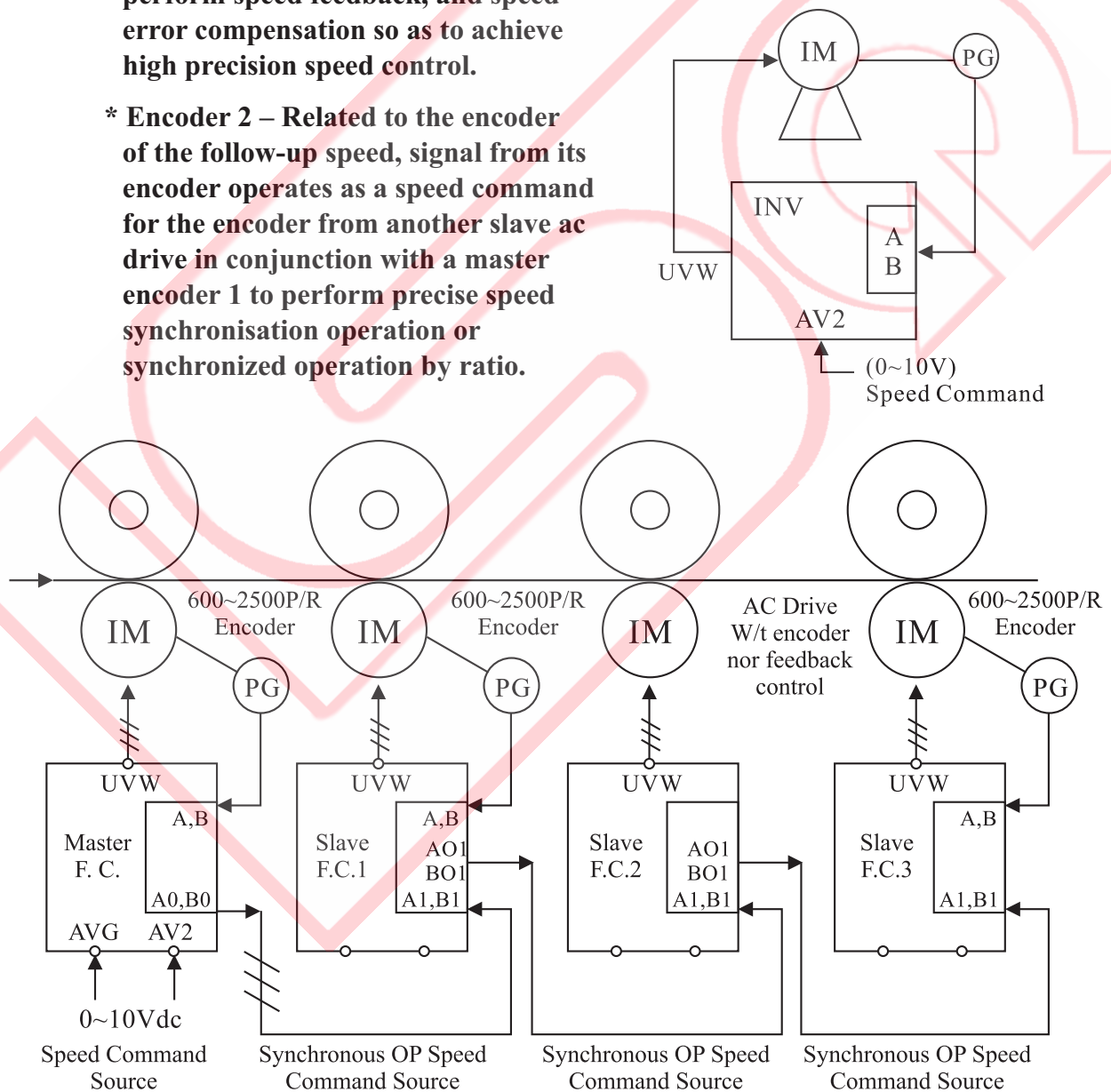
Parameter	Description	Range	Unit	Ex-factory Setting
F132	Encoder 2 Multiplying Factor	0.01~7.50X	0.01X	1.00

◎ Preset multiplying factor and adaptation with **Encoder 1** allows precise linked operation by ratio.

* **F127~F132: 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**

* **Encoder 1 – Relates to the master encoder to perform speed feedback. Encoder mounted to the motor is connected to the interface board of **Encoder 1** to perform speed feedback, and speed error compensation so as to achieve high precision speed control.**

* **Encoder 2 – Related to the encoder of the follow-up speed, signal from its encoder operates as a speed command for the encoder from another slave ac drive in conjunction with a master encoder 1 to perform precise speed synchronisation operation or synchronized operation by ratio.**



Application Example: Universal Digital Synchronizer System Operation in Series

– DESCRIPTION OF PARAMETER FUNCTIONS – V

MOTOR Electric Parameters

Parameter	Description	Range	Unit	Ex-factory Setting
F133	Stator Resistance	6500~32767	1	20000
F134	Rotor Resistance	6500~32767	1	16000
F135	Stator Inductance	6500~32767	1	18000
F136	Mutual Inductance	6500~32767	1	17500
F137	Rated Rotor Resistance	-32767~32767	1	16000

*** This parameter group can be automatically set by F126 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 F133, F134, F135 and F136. Obtains the four parameters from the Motor manufacturer, respectively Rs: Stator Resistance, Rr: Rotor Resistance, Ls: Stator Inductance, and Lm: Mutual Inductance.

EXAMPLE: motor manufacturer provides the parameters : Rs=0.3Ω Rr=0.303Ω
Ls=Lr=0.0477H Lm=0.0456H
Motor Ratings: 220 V, 14 A, 60 Hz

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

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

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

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

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

$$\bar{R}_s = \frac{R_s}{R_{base}} * 2^{18} = 0.0331 * 2^{18} = 8677.....(F133)$$

$$\bar{R}_r = \frac{R_r}{R_{base}} * 2^{18} = 0.0334 * 2^{18} = 8755.....(F134)$$

$$\bar{L}_s = \bar{L}_r = \frac{L_s}{L_{base}} * 2^{13} = 1.9825 * 2^{13} = 16240.....(F135)$$

$$\bar{L}_m = \frac{L_m}{L_{base}} * 2^{13} = 1.8953 * 2^{13} = 15526.....(F136)$$

Note: In the calculation, 2¹³ and 2¹⁸ are constants in format Q and shall not be changed. (2¹³=8192, and 2¹⁸=262144)

V – DESCRIPTION OF PARAMETER FUNCTIONS –

Estimation Tester & Speed PI Control Parameters

Parameter	Description	Range	Unit	Ex-factory Setting
F138	Motor Inertia	0~30000	1	1500

- ◎ To determine the rotor inertia of the motor. (Motor rotor inertia calibration must be when F126:5 Closed Loop Flux Vector Control is used).

F139	Magnetic Flux Bandwidth	4.0~10.00HZ	0.1HZ	4.0
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F140	Speed Bandwidth	1.0~6.0HZ	0.1HZ	4.0
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F141	Slip Compensation Gain	10~200%	1%	88
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- ◎ 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.

F142	Scalar Speed Control P Gain	0~100%	1%	30
F143	Scalar Speed Control I Gain	0~100.0%	0.1%	20.0

- ◎ The scalar speed PI control is to provide operation compensation for (F126) Control Mode – 3: Closed Loop V/F vector Control operation.

F144	Vector Speed Control P Gain	0~100%	1%	40
F145	Vector Speed Control I Gain	0~100.0%	0.1%	20.0

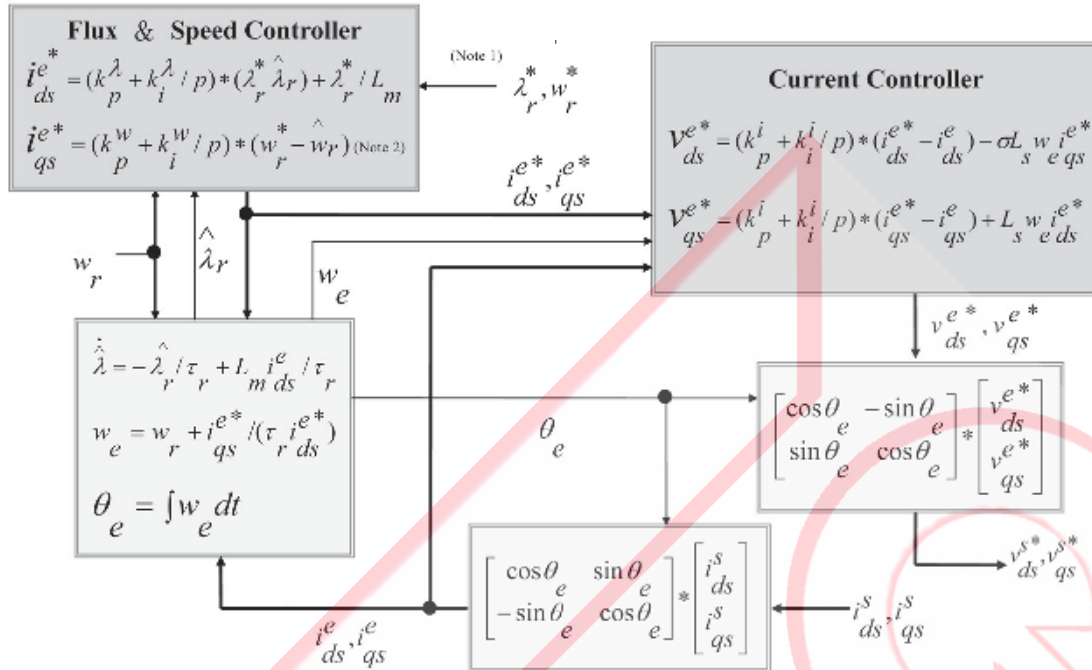
- ◎ The vector speed PI control is to provide operation compensation for (F126) Control Mode – 5: Closed Loop Flux Vector Control operation.

F146	Sensorless Speed Control P Gain	0~100%	1%	30
F147	Sensorless Speed Control I Gain	0~100.0%	0.1%	15.0

- ◎ Sensorless speed PI control is to provide compensation for (F126) Control Mode – 6: Sensorless Flux Vector Control operation.
- ◎ PI Control: PI control is the combination of (P) Proportional Control and (I) Integral Control to make the compensation of its control variables depending on the magnitude of its variation , and the changes in time.

– DESCRIPTION OF PARAMETER FUNCTIONS – V

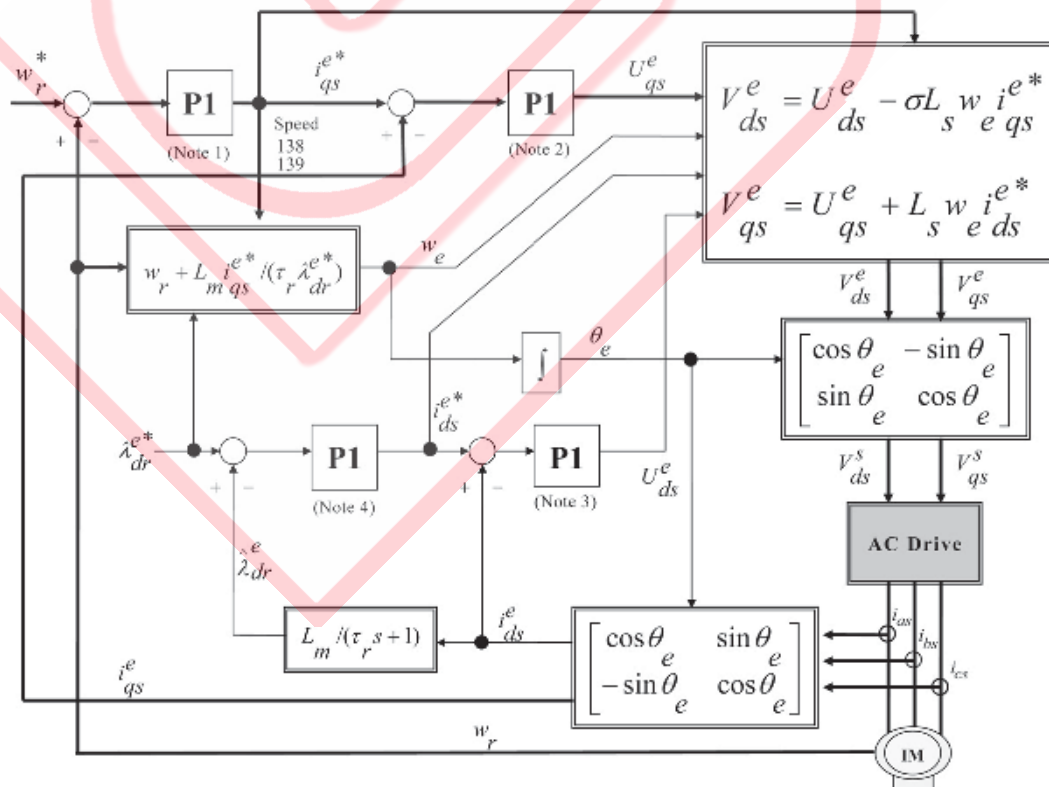
Magnetic Field Oriented Control Block Chart



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 F144 and F145.

PI Speed Control Parameters Mathematical Calculation Chart



Note 1: PI herein will be set by the client, F142~F147.

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

V – DESCRIPTION OF PARAMETER FUNCTIONS –

Abnormaility Record

Parameter	Description	Range	Unit	Ex-factory Setting
F148	Torque Current Limit	0~1.250	0.001	1.000

- ◎ To set the torque current of the maximum load output from the ac drive.
Torque current = Ac drive Rated Output Current (rms) × (F148) Torque Current Limit Setting.
- ◎ Torque current limit is provided only for two types of (F126) control modes setup operation, (1) F126=5: Closed Loop Flux Vector Control, and (2) F126=6: Sensorless Flux Vector Control. The other control modes do not have torque control function.

F149	Torque Current Input Option	0~5	1	0
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- ◎ To set up the option of torque control command input from the following four analog input signals and PID control torque (this function is only active under F126:5 Closed Loop Flux Vector Control mode).
 - **0: Disabled** – the analog torque control is disabled.
 - **1: Digital Operator AV** – Linear torque control is done by the input signal voltage (DC0~5V) from the digital operator AV.
 - **2: AV1** – The torque current set by F148 corresponding to input signal voltage (DC0~±10V) from the external terminal AV1 is applied to perform the linear torque control.
 - **3: AV2** – The torque current set by F148 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 F148 corresponding to input signal current (0~20mA) or voltage (DC0~10V) from the external terminal AI is applied to perform the linear torque control.
 - **5: PID Control** – to perform torque PID feedback control. (Refer to PID Parameter Group F157-F171).

F150	Current Alarm Record	0~40	1	0
F151	Last 1 st Alarm Record	0~40	1	0
F152	Last 2nd Alarm Records	0~40	1	0
F153	Last 3rd Alarm Record	0~40	1	0
F154	Last 4th Alarm Record	0~40	1	0
F155	Last 5th Alarm Records	0~40	1	0
F156	Alarm Records Cleared	0,1	1	0

- ◎ Clear the Alarm trips stored in the memory.
 - **0: Not Cleared.**
 - **1: Cleared.**

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Err Code	Description of Alarm Report
Err0	Digital operator communication failure
Err 1	Over voltage or current in standby status
Err 2	Over voltage or current during acceleration
Err 3	Over voltage or current during deceleration
Err 4	Over voltage or current during speed regulation
Err 5	Heat sink overheated
Err 6	Dc Bus over voltage
Err 7	Dc Bus low voltage
Err 8	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	Pump low current detected
Err 16	Encoder direction opposite to the phase sequence on the output side
Err 17	Encoder signal abnormality
Err 18	Parameter detection failure
Err 23	Absence of speed feedback affecting performance of closed loop control
Err 25	EEPROM parameter read back out of range
Err 26	Digital operator storage parameter write failure
Err 27	DSP storage parameter locked and preventing modification.
Err 28	Operator storage parameter locked and preventing modification
Err 29	External input abnormality
Err 30	unbalanced three-phase output current.
Err 31	Leakage current outputted
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 19, Err 20, Err 21, Err 22, Err 24, Err 34 Are signals reserved for failure.	

V – DESCRIPTION OF PARAMETER FUNCTIONS –

External PID

Parameter	Description	Range	Unit	Ex-factory Setting
F157	PID Mode	0~4	1	0

- **0: PID Disabled** – PID control not activated.
- **1: PID Stop Setting Not-Memorised** – In PID control, the final PID control value is not memorised.
- **2: PID Stop Setting Memorised** – 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 Not-Memorised)** – 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 Memorised)** – 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.

F158	PI Setpoint Input Options	0~8	1	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 (F161).	
1	AV1 input	<ul style="list-style-type: none">● External analog frequency command input terminal sets the setpoint value.● Gain of analog frequency command is adjusted by Parameters F43~F57.	
2	Av2 input		
3	AI input		
4	Encoder 2 feedback value	<ul style="list-style-type: none">● Input of external setpoint value of pulse signal (option card PG-AB2) frequency command is set up by Parameters F128~F132.	
5	Encoder 1 feedback value		
6	RAMP output	● S curve Output (Acceleration/Deceleration time curvature)	
7	Total output current	\hat{i}	<div>Total $\hat{i} = \sqrt{i\vartheta^2 + iJ^2}$<div>$i\vartheta$ = Excitation current iJ = Torque current</div></div>
8	Torque current	η	

F159	PI Feedback Input Options	0~8	1	0
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◎ Input terminal is selected to function as the PID feedback detection source.

– DESCRIPTION OF PARAMETER FUNCTIONS – V

Setting	Function	Description of Function		
0	PI initial value setup	PI setpoint command % value is directly set up by Parameter (F161).		
1	AV1 input	<ul style="list-style-type: none"> External analog frequency command input terminal sets the PI setpoint value. Gain of analog frequency command is adjusted by Parameters F43~F57. 		
2	Av2 input			
3	AI input			
4	Encoder 2 feedback value	<ul style="list-style-type: none"> External of input setpoint value of pulse signal (option card PG-AB2) frequency command is set up by Parameters F128~F132. 		
5	Encoder 1 feedback value			
6	RAMP output	<ul style="list-style-type: none"> S curve Output (Acceleration/Deceleration time curvature) 		
7	Total output current	\hat{i}	$\text{Total } \hat{i} = \sqrt{i\theta^2 + iJ^2}$ <div style="display: flex; justify-content: space-between; font-size: small;"> $i\theta$ = Excitation current iJ = Torque current </div>	
8	Torque current	η		

F160	Derivative Feedback Input Options	0~8	1	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"> External analog frequency command input terminal sets the derivative input value. Gain of analog frequency command is adjusted by Parameters F43~F57. 		
2	Av2 input			
3	AI input			
4	Encoder 2 feedback value	<ul style="list-style-type: none"> Input of external setpoint value of pulse signal (option card PG-AB2) frequency command is set up by Parameters F128~F132. 		
5	Encoder 1 feedback value			
6	RAMP output	<ul style="list-style-type: none"> S curve Output (Acceleration/Deceleration time curvature) 		
7	Total output current	\hat{i}	$\text{Total } \hat{i} = \sqrt{i\theta^2 + iJ^2}$ <div style="display: flex; justify-content: space-between; font-size: small;"> $i\theta$ = Excitation current iJ = Torque current </div>	
8	Torque current	η		

*** ATTENTION ! The feedback input type of F159 and F160 shall not be the same type used for the setpoint input of F158.**

F161	PI Initial Value Setup	0.00~100.00	%	50.00
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⊙ 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.

V – DESCRIPTION OF PARAMETER FUNCTIONS –

Parameter	Description	Range	Unit	Ex-factory Setting
F162	Derivative Filter Time Setup	0.05~10.00	Sec	0.20

- ◎ Derivative input is connected to a low pass filter to filter high frequency noise with the time constant $\tau = F162/2.3$.

F163	PID Output Limit	0.00~100.00	%	100.00
F164	PID Loop 1 Kp Gain	0.00~300.00	%	100.00
F165	PID Loop 1 Ki_H Gain	0.0~3000.0	%	400.0
F166	PID Loop 1 Ki_L Gain	0.0~3000.0	%	200.0
F167	PID Loop 1 Kd Gain	0.0~3000.0	%	200.0
F168	PID Loop 2 Kp Gain	0.00~300.00	%	100.00
F169	PID Loop 2 Ki_H Gain	0.0~3000.0	%	5.0
F170	PID Loop 2 Ki_L Gain	0.0~3000.0	%	5.0
F171	PID Loop 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 F43~F57, the input analog voltage or current is divided by (F15) speed upper limit to give the % value.

For Example: F48=10%, F49=100%, F15=100.0Hz, AV2=2 voltage

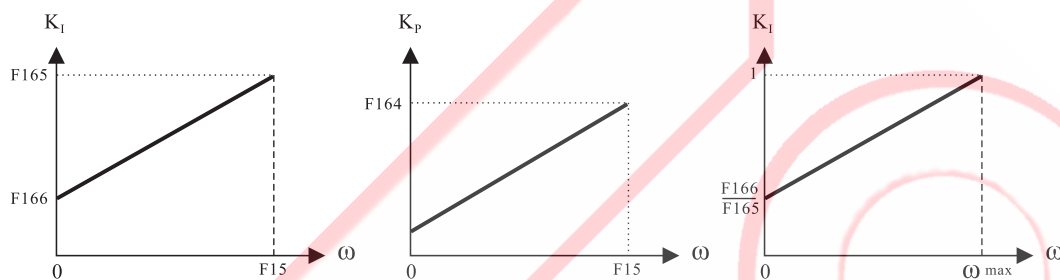
$$\% = 100 * \{ (2/10) * (60/100 * 100) + (60/100 * 10) \} / F15 = 18\%$$

4~6: % = 100 × (feedback speed/speed upper limit)

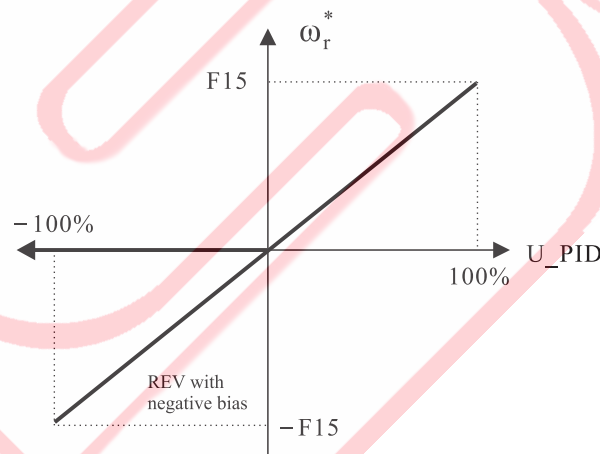
7~8: % = 100 × (current/current when the current detector outputs 5V)

– DESCRIPTION OF PARAMETER FUNCTIONS – V

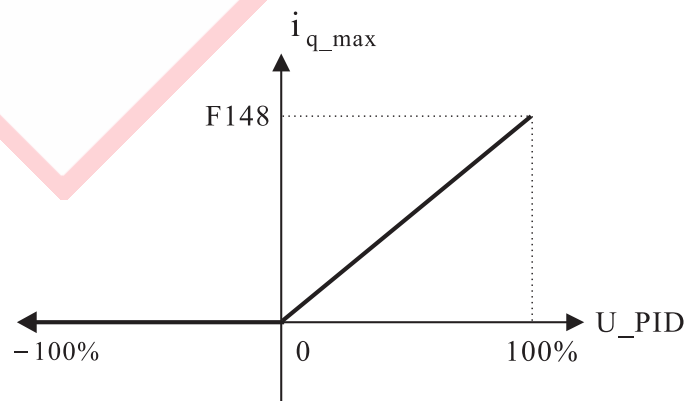
- (2) KI gains (KI_L and KI_H) at the zero-speed and the speed upper limit can be respectively set up. The settings will change proportionately according to the respective speed command changes. * ($KI_L \leq KI_H$).
- (3) KP gain setting corresponds to (F15) speed upper limit. KP gain is automatically 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).

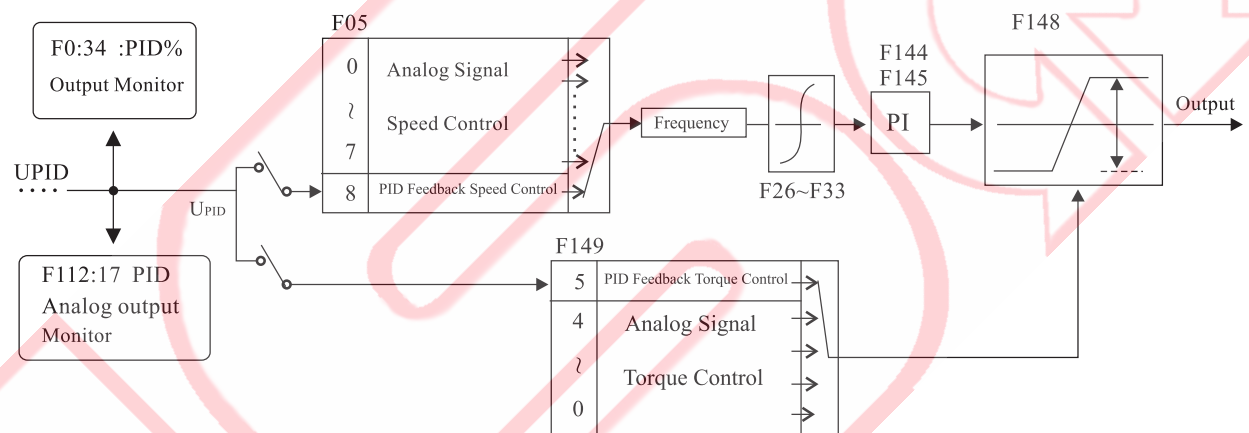
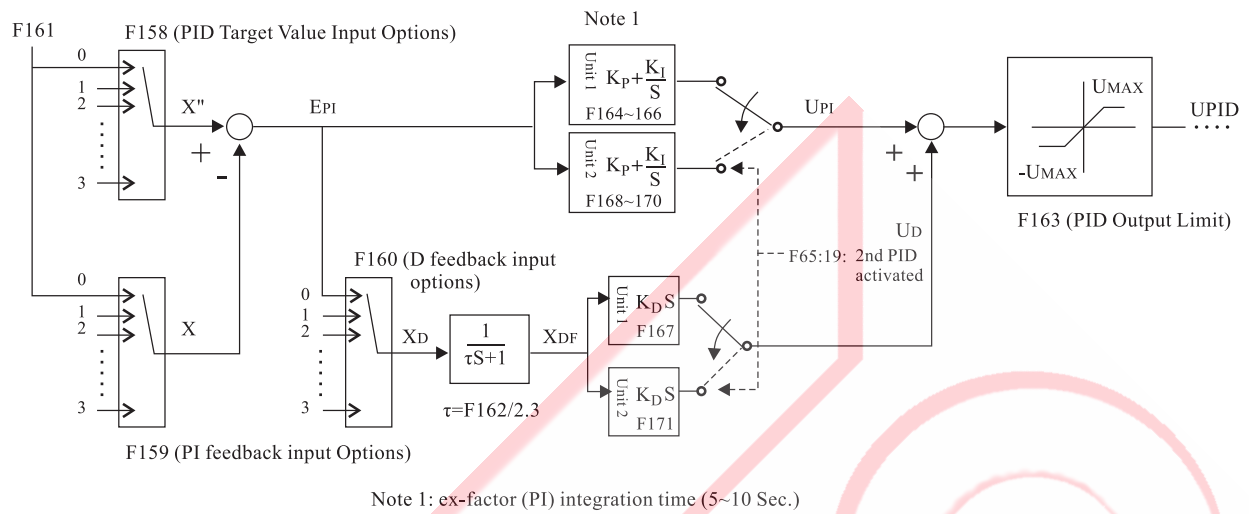


- (7) When the PID output acts as the torque current limit, 100% = F148 (Limit current)



V – DESCRIPTION OF PARAMETER FUNCTIONS –

PIDControl Block Chart:



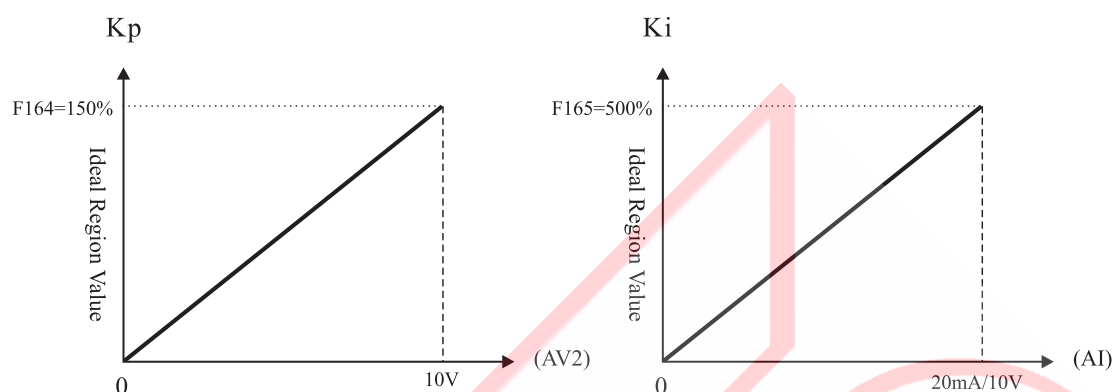
F172	Kp Analog Adjustment	0~4		0
F173	Ki Analog Adjustment	0~4		0

- 0:No adjustment
- 1:Operator AV Input
- 2:AV1 Input
- 3:AV2 Input
- 4:AI Input

- ◎ Control of gains of K_p and K_i may be done by selecting the input control from those four analogy input ends. For charactreistics of analog signals, please refer to Parameters F41~F57.
- ◎ In K_p and K_i controls for analog operation, a set of ideal $K_p(164)$ and $K_i(165)$ operation region values must be first set so that the operation of analog signals can be done in a regional range with better response.

- DESCRIPTION OF PARAMETER FUNCTIONS - V

PC Communication



- When an ideal value may be availed by applying analog operation to adjust Kp and Ki values, the ideal value may be solved and directly inputted into Parameters F164 and F165 (or into the second unit setup of Kp/F168 and Ki/F169).

For example: F164 is set for 150% ; and F165, 500%, the analog Kp value is adjusted to 45% ; and Ki, 60%.

Ideal Real Kp Value = $150\% \times 45\% = 67.5\%$F164

Ideal Real Ki Value = $500\% \times 60\% = 300\%$F165

- Both ideal real Kp and Ki values are directly inputted into F164 and F165 while shutting off Kp and Ki adjustment parameters F172 and F173.

F174	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.

F175	Transmission Rate	0~3		2
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0 : 2400

1 : 4800

2 : 9600

3 : 19200

- 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 (F177) ac drive response time.

V – DESCRIPTION OF PARAMETER FUNCTIONS –

Standstill Positioning

Parameter	Description	Range	Unit	Ex-factory Setting
F176	Communication Data Format	0~2		0

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,O,1 RTU(1 start bit + 8 data bits + 1 Odd bit + 1 stop bit)

F177	AC Drive Response Time	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.

F178	Receive Failure Response	0~5		0
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- ◎ To determine if the failure response signal should be sent in case of any error after the inspection operation of the command signal received by the ac drive.

0: Normal Receiving

1: Function Error Code

2: CRCL Error

3: CRCH Error

4: Packet Receiving Time Over 0.2 Seconds

5: Changing Parameter Not Permitted during Operation

F179	Standstill Positioning	0, 1		0
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■ **0: Disabled**

■ **1: Activated** – When this functions is activated, the internal control may be applied to lock the rotor of the motor at zero-speed to prevent it from any movement drift. When the speed command setting is 0 and the motor speed reaches zero-speed, the zero-speed positioning control and PI gain are activated to lock the rotor in place. To perform this function, the drive should be in closed loop flux vector control mode (F126 = 5).

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Pump Functions

Parameter	Description	Range	Unit	Ex-factory Setting
F180	Positioning P Gain	0~100.00	%	30.00
F181	Positioning I Gain	0~100.00	%	20.00
F182	Constant Water Pumping Function Activated	0~1		0

■ **0: Disabled**

■ **1: Activated** – To activate the constant water pumping PID control, stand-by operation, and protection functions of detecting water pumping at low power without water.

F183	Sleep Detected Time	0~12000	Sec	15
F184	Sleep Error	0.00~10.00	%	5.00
F185	Wake-up Error	0.0~100.0	%	10.0

- ◎ If after the water pump starts to operate, the feedback value is consistent with the target (command) value and the feedback signal becomes constant instead of a small pulse feedback signal (indicating that the water pressure is stabilized), setting (F188) for sleep error is activated for detection according to the following conditions:

Detection Conditions

- (1) When the water pressure error is $>$ (F184) sleep error setting, the water valve will not be shut off and PID constant pressure control operation continues.
- (2) When the water pressure is $<$ (F184) sleep error setting, the water valve has been shut off and the (F183) sleep countdown timer is activated. PID control enters into sleep mode once when countdown is completed.

Note: Both settings of (F184) Sleep Error and (F185) Wake-up Error are set as a percentage of the target value; and the Wake-up Error setting must be greater than the Sleep Error setting.

Example: Target Value of Water Pressure=2 kg/cm², Sleep Error=5%(0.1kg/cm²) and Wake-up Error = 10% (0.2 kg/cm²)

- ◎ When the water pressure is greater than the constant signal at 1.9 kg/cm², the (F183) Sleep Detected Time is activated. The PID control is waking up to control the operation when the pressure value is smaller than 1.8 kg/cm² upon entering into the sleep mode or already in the sleep mode.

V – DESCRIPTION OF PARAMETER FUNCTIONS –

16 Preset Speeds

Parameter	Description	Range	Unit	Ex-factory Setting
F186	Standby Operation Detected Time	0~12000	Sec	900
F187	Standby Operation Time	0~12000	Sec	60
F188	Standby Operation Frequency	0.0~400.0	Hz	0.0

- ◎ When PID control enters into sleep mode, (F186) Standby Operation Detected Time is activated to detect the countdown timer. Once the counting value reaches 0, (F188) Standby Operation Frequency and (F187) Standby Operation Time are activated to repeat cycling the standby operation mode until upon entering into Wake-up mode.

► When the standby operation mode is not desired, set (F188) Standby Operation Frequency at 0.0 Hz.

F189	Low Power Detected Level	0.0~100.0	%	10.0
F190	Low Power Detected Time	0~12000	Sec	60
F191	Low Power Detected Restoration Time	0~12000	Sec	3000

- ◎ When the protection mechanism of water pumping at low power without water is activated, the detection of insufficient water pressure or the absence of water on the primary side is executed according to the setting of (F189) Low Power Detected Valve and PID water pressure feedback value. Upon the detected time is out, the ac drive stops operating and enters into (F191) Low Power Detected Restoration Time (test will be activated once again after the expiry of the downtime).

- ◎ (F189) Low Power Detected Level) is set as a percentage of (F124) HP Rated P (e.g., 1HP = 746W). If after the water pump starts to operate and the real power % is smaller than that of (F189) Low Power Detected Level, the protection mechanism of protection is activated. The output real power percentage may be monitored in Parameter F0=18 Real Power (%).

F192	Stage 8 Speed	0~400.0	Hz	0
F193	Stage 9 Speed	0~400.0	Hz	0
F194	Stage 10 Speed	0~400.0	Hz	0
F195	Stage 11 Speed	0~400.0	Hz	0
F196	Stage 12 Speed	0~400.0	Hz	0
F197	Stage 13 Speed	0~400.0	Hz	0
F198	Stage 14 Speed	0~400.0	Hz	0
F199	Stage 15 Speed	0~400.0	Hz	0

*** Attention: From the 8th speed to the 16th speed, there are no autoprogrammable (like PLC) function, which can only be control by terminal or internal program.**

– DESCRIPTION OF PARAMETER FUNCTIONS – V

Storing/Recalling Parameters

Parameter	Description	Range	Unit	Ex-factory Setting
F206	Recall Parameter	0~3		0

- **0: Not Recalled.**
 - **1: Recall Ex-factory Setup** – Recall the ex-factory setting (F109.F120~F125 are not affected).
 - **2: Recall Parameters Saved in DSP** – Recall the data of parameter group saved in the EEPROM of the DSP.
 - **3: Recall Parameter Settings Saved in Digital Operator** – Recall the parameter settings saved in the digital operator.
- * If parameter settings have to be provided for two different manufacturing processes on the same unit of machine, apply F206=2, with one set of saved parameter settings and F206=3 with another set of saved parameter settings and recall them to the RAM as needed.**

F207	Save Current Parameters	0~2	1	0
------	-------------------------	-----	---	---

- **0: Not Saved.**
 - **1: Saved to DSP** – Save the modified parameter settings into the EEPROM of the DSP.
- * Attention: Any changing of parameter setting will be saved only in the RAM of DSP which will not reserve the changing after power off. Hence, please have to reset the parameter. 1: save to EEPROM of DSP.**
- **2: Saved to Digital Operator** – to save the modified parameter settings into the digital operator.
- * ATTENTION1– 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 F206: (3) 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 the same to F207=1: You must save to DSP to complete the permanent data storage.**
- * 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.**

V – DESCRIPTION OF PARAMETER FUNCTIONS –

Parameter	Description	Range	Unit	Ex-factory Setting
F208	Lock up EEPROM Parameters	0~3	1	0

- **0: Save Allowed** – to save all parameter settings into the EEPROM.
- **1: Lock up Parameters Stored in DSP** –Any modified parameter setting is not allowed to be stored in DSP's EEPROM.
- **2: Lock up Parameters Stored in Digital Operator** –Any modified parameter setting is not allowed to be stored in the digital operator's EEPROM.
- **3: Lock up Parameters Stored in DSP and Digital Operator** – Any modified parameter setting is not allowed to be stored in both the DSP or the EEPROM of the digital operator.

*** When the EEPROM is restricted from data storage, all the parameter settings are registered in the RAM of the DSP. When Power Off, all the parameter settings in the RAM are immediately lost.**

VI

PROTECTION & TROUBLESHOOTING

- ◆ Abnormality Diagnosis6-1
- ◆ 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.

Abnormality Display & Coping Measures

Display	Description	Cause	Coping Measures
Err 1	Over voltage or over current in standby status	<ul style="list-style-type: none">Excessively high voltage at input (R.S.T) source resulting in that the voltage on the DC side is over the voltage detected level.Possible shortage between phases or shortage to the grounding of the output cable.	<ul style="list-style-type: none">Drop the voltage to fall within the range of power source specification.Check the output cable and remove any shortage when confirmed.
Err 2	Over voltage or over current in Acceleration	<ul style="list-style-type: none">If the activation is done while the motor is idling (that could easily lead to over voltage or over current)If acceleration time too short (that easily leads to over current).	<ul style="list-style-type: none">Set F6=2: DC Brake, then leave it to be started by activation frequency.Allow longer acceleration time.
Err 3	Over voltage or current in deceleration	<ul style="list-style-type: none">If deceleration time too short (that easily leads to over voltage or over current).	<ul style="list-style-type: none">Allow longer deceleration time (set the deceleration time that meets GD^2)
Err 4	Over voltage or current in speed regulation	<ul style="list-style-type: none">if the motor is drawn by external force.If load undergoes drastic change.	<ul style="list-style-type: none">Improve system to expel external source.Change the load to be smoother.
Err 5	Heat sink overheated	<ul style="list-style-type: none">If temperature of heat sink of the ac drive is over the F87 setting.If cooling fans operate normalityIf ambient temperature gets too high	<ul style="list-style-type: none">Check F87 setting.Replace the cooling fan.Increase air ventilation volume.
Err 6	Dc Bus over voltage	<ul style="list-style-type: none">If input source (R.S.T) voltage higher than DC protection level (F109 setting $\times 1.414 \times 130\%$) or F109 setting error.Short deceleration time, and large regenerated source from motor	<ul style="list-style-type: none">Reduce source voltage.Check F109 setting.Extend deceleration time or connect to the brake resistance (or brake unit).
Err 7	Dc Bus low voltage	<ul style="list-style-type: none">Transient power interruption resulting in voltage stages below DC protection level (F109 setting $\times 1.414 \times 70\%$)Phase insufficiency in input power or loosening wiring terminalWild changes to the input power voltageParameter F109 setting error	<ul style="list-style-type: none">Check to identify the cause and improve power source quality.

– PROTECTION & TROUBLESHOOTING – VI

Abnormality Display & Coping Measures

Display	Description	Cause	Coping Measures
Err 8	Motor overload	<ul style="list-style-type: none"> • Motor load current is greater than the built-in electronic thermo-sensitive setting (F84, F85) • V/F set F101: maximal output voltage and F102: maximal voltage frequency gets too high or too low • F106 torque compensation setting too high 	<ul style="list-style-type: none"> • Improve the load to motor and check for correct parameters (F84, F85). • Check settings of Parameters (F101, F102) of V/F characteristics. • Check the settings.
Err 9	AC drive voltage not match the motor voltage	<ul style="list-style-type: none"> • F120 motor rated voltage not be less than 1.2X of the input voltage of the ac drive. 	<ul style="list-style-type: none"> • Change the motor voltage grade and check parameters F109, F120.
Err 10	Over-current detected via software & inspection	<ul style="list-style-type: none"> • Peak amperage of U.V.W on the output side of the driver greater than 2.8X of the rated amperage. • If acceleration time too short • If impact amperage for operation gets too large 	<ul style="list-style-type: none"> • Check for normal operation of motor & mechanical system • Check the setting of acceleration time parameter • Replace with a driver of larger capacity
Err 11	AC drive rated current range not match motor current	<ul style="list-style-type: none"> • F121 motor rated current not be less than 9X of the rated current of the ac drive. 	<ul style="list-style-type: none"> • Change motor capacity, and check the setting of parameter F121)(small motor capacity prevents control and protection.)
Err 12	U-phase output side off or C.T failure	<ul style="list-style-type: none"> • Phase wire of U.V.W on output side of the ac drive and motor wiring not secured or open. • failure to internal current sensor (C.T) 	<ul style="list-style-type: none"> • Check the wiring loops before restoration of power. • Return to the genuine maker for service.
Err 13	V-phase output side off or C.T failure		
Err 14	W-phase output side off or C.T failure		
Err 15	Absence of water in pump, lower power detected	<ul style="list-style-type: none"> • Check for normal water supply at the inlet of pump. • Check for normal setting in the pump function parameter area. • Check settings of Parameters F189 and F190. 	<ul style="list-style-type: none"> • Correct the water inlet failure and re-start. • Check again the setting of pump function parameter
Err 16	Encoder direction opposite to the phase sequence on the output side	<ul style="list-style-type: none"> • PG revolution direction is opposite to that of the motor operation 	<ul style="list-style-type: none"> • Switch between PG Phase A and B or change the settings of Parameter F129.
Err 17	Encoder signal abnormality	<ul style="list-style-type: none"> • PG wiring error or disconnected • PG pulse number (F128) setting error 	<ul style="list-style-type: none"> • Check the PG wiring. • Check the parameter settings.
Err 18	Auto-tuning failure	<ul style="list-style-type: none"> • Motor electric parameter auto-tuning failure 	<ul style="list-style-type: none"> • Check for correct settings of Parameters F120~F125. • Manually operate motor data and input results into motor electric parameter group (F133~F137). Refer to P5-36.

VI – PROTECTION & TROUBLESHOOTING –

Abnormality Display & Coping Measures

Display	Description	Cause	Coping Measures
Err 23	Absence of speed feedback preventing performance of closed loop control	<ul style="list-style-type: none"> Absence of setting up parameter F127: speed feedback at 1: Encoder 1. 	<ul style="list-style-type: none"> Set up Parameter F127.
Err 25	EEPROM parameter read back out of range	<ul style="list-style-type: none"> Failure in EEPROM, no data available, storage incomplete, or parameter setting out of range. 	<ul style="list-style-type: none"> Use the function of Parameter F206=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. If the step aforesaid fails, return it to genuine maker for service.
Err 26	Operator storage parameter write-in failure	<ul style="list-style-type: none"> Operator extension too long or subject to noise interference. Operator memory failure. 	<ul style="list-style-type: none"> Improve wiring quality and length. Replace the operator & run the test again.
Err 27	DSP storage parameter locked and preventing modification.	<ul style="list-style-type: none"> Parameter storage is restricted to prevent from saving new data. 	<ul style="list-style-type: none"> If required, save the new parameter, and set Parameter F208=0: Save Allowed.
Err 28	Operator storage parameter locked and preventing modification	<ul style="list-style-type: none"> The parameter storage of the digital operator has been restricted. 	<ul style="list-style-type: none"> Select Parameter F208=0: Save Allowed.
Err 29	External input abnormality	<ul style="list-style-type: none"> External abnormality signals are inputted from the multi-function input terminal (Di3~Di8). 	<ul style="list-style-type: none"> Remove the cause of external abnormality.
Err 30 Err 31	Unbalanced three-phase output current. Leakage current abnormality	<ul style="list-style-type: none"> Poor wiring or poor motor insulation. 	<ul style="list-style-type: none"> Check the output (U.V.W) wiring and insulation for damage. Check if the setting for Parameter F86 is too small.
Err 32	PUF fuse burnt out	<ul style="list-style-type: none"> Damaged IGBT module due to shortage or grounding on the output side of the ac drive. 	<ul style="list-style-type: none"> Check the cause and take coping measures before replacing the ac drive.
Err 33	PF input source phase insufficiency or too low	<ul style="list-style-type: none"> Poor conduction of the breaker or EM contact. Loosening input power wiring terminal Drastic changes in the input power voltage 	<ul style="list-style-type: none"> Check the cause and take coping measures before restoring the power.

– PROTECTION & TROUBLESHOOTING – VI

Abnormality Display & Coping Measures

Display	Description	Cause	Coping Measures
Err 35	Error in automatic operation time setup.	<ul style="list-style-type: none">• All the automatic operation for 8 stages of speed are set at 0 (there is no operation time to be executed).	<ul style="list-style-type: none">• Check the settings of Parameters F93~F100
Err 36	Digital input terminal setup repeated.	<ul style="list-style-type: none">• The same function is given repeated set by the multi-function input terminal Di3~Di8 (with the exception of 0: Disabled).	<ul style="list-style-type: none">• Check the settings of Parameters F60~F65

VI – PROTECTION & TROUBLESHOOTING –

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
- ☞ Kill the power source and turn it on.

✓ 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

✓ Check to see if the motor shaft is deadlocked?

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

✓ If the setting of the frequency command gets too small?

- ☞ Change the command setting to be greater than the F16 activation frequency command of the minimum output frequency.

✓ If there is any error in the wiring?

- ☞ Check and repair for any error in wiring loops

✓ If the protection mechanism works?

- ☞ Confirm what is displayed on the monitor.

✓ If the operation keypad properly set up?

- ☞ Reconfirm the operation procedure

– PROTECTION & TROUBLESHOOTING – VI

✗ **The ac drive trips when the motor is activated?**

Symptom: the message of Err2 displays when the motor is activated or in course of acceleration (possible a transient output exceeds 200% of the rated current when the over current protection function operates, or the IGBT module is damaged).

=====

- ✓ **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^2 of the load?**
 - ☞ Extend the acceleration time.
- ✓ **If the activation frequency is too low?**
 - ☞ Increase the activation frequency.
- ✓ **If the protection mechanism works?**
 - ☞ Confirm what is displayed on the monitor.
- ✓ **The ac drive is activated while the motor is idling?**
 - ☞ To set the function of reactivation in the course of idling.
- ✓ **If the operation keyboard properly set up? Any leakage due to poor insulation of the motor?**
 - ☞ 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).

=====

- ✓ **When the GD^2 of the load driven by the motor gets too large, the auxiliary brake loop built in the ac drive fails to effectively absorb the rejuvenated energy from the motor in acute deceleration?**
 - * **Once the rejuvenated energy is greater than 400V(Series 200~240V) or 800V (Series 380~460V), the over voltage protection immediately functions.**
 - ☞ Extend the deceleration time.
 - ☞ Install a DC brake resistance (optional) of a grade not greater than 10HP exclusively for external use.
 - ☞ If the DC brake resistance is of a grade of 15HP or larger, an external brake unit and resistance must be provided.

VI – PROTECTION & TROUBLESHOOTING –

✕ Tripping off during the static operation?



◆ Err 7 displays during operation.

✓ Insufficient voltage of power source?

- ☞ Review the capacity of the power source, and check cause(s) leading to insufficient voltage, e.g., if the contact of the no-fuse of the EM switch operates in normal condition.

◆ Err 6 displays 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

VII – TEST, INSPECTION & MAINTENANCE –

TEST, INSPECTION & MAINTENANCE



CAUTION

While providing maintenance and inspection:

- Confirm the current status of the power switch. For safety concerns, do not permit anyone else approaching the power switch where should be marked as such.
- Care shall be taken that DC high voltage still accumulates in the large capacity electrolytic capacitor on the rectification loop in the ac drive even in a short while after the power is off. Therefore, always check and make sure that the indicator of [CHARGE] is off before conducting the inspection of the substrates.

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 ac drive.

• 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

- If motor operates as preset? Any abnormal sound or vibration during operation?
- If the cooling fans installed below the ac drive 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? If the installation environment is normal?

*** Check the items listed in the manual one by one to ensure that this product always maintains normal operation status for extended service life.**



CAUTION

Whereas 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 pattern of the individual operator. To maintain long-term normal operation, it is recommended to conduct periodical inspection and replacement as required.

VIII

Selecting Brake Resistance & Brake Unit

- ◆ Selecting Brake Resistance &
Extra Brake Unit 8-1

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	Model	Capacity	Ohm (min.)	Wattage (min.)	Quantity	Brake Torque	Externally Provided Unit Specification
200V	LS800	0.75	150	120	1	130	Built-in brake circuit
		1.50	100	200	1	130	
		2.20	60	250	1	120	
		3.70	40	300	1	120	
		5.50	25	1000	1	150	
		7.50	20	2000	1	150	
		11.00	13.6	2400	1	125	LSBR-2015B
		15.00	10.0	3000	1	125	LSBR-2015B
		18.50	8.0	4800	1	125	LSBR-2022B
		22.00	6.8	4800	1	125	LSBR-2022B
		30.00	10	3000	2	125	LSBR-2015B
		37.00	10	3000	2	100	LSBR-2015B
		45.00	6.8	4800	2	120	LSBR-2022B
		55.00	6.8	4800	2	100	LSBR-2022B
400V	LS800	0.75	300	200	1	200	Built-in brake circuit
		1.50	300	200	1	200	
		2.20	150	300	1	130	
		3.70	100	500	1	130	
		5.50	80	800	1	150	
		7.50	60	1000	1	150	
		11.00	50	1040	1	135	LSBR-4015B
		15.00	40	1560	1	125	LSBR-4015B
		18.50	32	4800	1	125	LSBR-4030B
		22.00	27.2	4800	1	125	LSBR-4030B
		30.00	20	6000	1	125	LSBR-4030B
		37.00	32	4800	2	125	LSBR-4030B
		45.00	20	6000	2	135	LSBR-4030B
		55.00	20	6000	2	135	LSBR-4030B

IX APPENDIX

- ◆ **A. Parameter Setup Schedule9-1**
- ◆ **B. Err Display9-9**
- ◆ **C. Drawing of Mechanism Appearance ..9-10**

IX APPENDIX A – PARAMETER SETUP SCHEDULE–

1	Parameter Code	Description	Range	Unit	Ex-factory Setting	R/W	Page No.				
OPERATION STATUS DISPLAY SETUP	F 0	Operator display variables selections	0~36	1	1		P5-1				
	0: Speed Command 10: Excitation Voltage 20: Temperature (°C) 29: Cycles & Multi-Stage Number 1: Output Motor Speed 11: Torque Voltage 21: Counts 2: Encoder Speed 1 12: Output Current (rms) 22: Digital Input Status 30: Reserved 3: Encoder Speed 2 13: Excitation Current Comm. 23: Digital Output Status 31: Phase U Current (rms) 4: Sensorless vector Speed 14: Torque Current Comm. 24: Digital Operator AV(%) 32: Phase V Current (rms) 5: Output Frequency 15: Excitation Current 25: AV1 (%) 33: Phase W Current (rms) 6: Output process Speed 16: Torque Current 26: AV 2(%) 34: PID (%) 7: Slipping Frequency 17: Output Power(%) 27: AI (mA) % 35~1023: Reserved 8: Vdc (V) 18: Output True Power (%) 28: Vdc_0 36: LS800 Version 9: Output Voltage (rms) 19: Output Reactive Power(%)										
	F 1	Speed display unit	0~1	1	0		P5-2				
	0: Frequency (Hz) 1: Speed.										
	F 2	Display multiplying factor for process speed display (maximal display value without unit at 3276.7)	0.001~10.000	0.001	1.000		P5-2				
F 3	Operator display update constant	0~15	1	2							
OPERATION CONTROL PARAMETER	F 4	Operation control source	0~1	1	0						
	0: PB Operator 1: Digital Input Terminal										
	F 5	Speed Command	0~8	1	2		P5-3				
	0 : PB Operator 3 : VA1 Input (±10V) 6 : AV2+AI 1 : Digital Input Terminal 4 : AV2 Input (+10V) 7 : Encoder 2; 2 : (Operator) AV input (5) V 5 : AI Input (20mA) 8 : External PID										
	F 6	Activation Method	0~2	1	0		P5-5				
	0 : Started by Activation Frequency; 1 : Follower Activation; 2 : DC Brake before Starting by Activation Frequency										
	F 7	Stop Mode	0~2	1	1		P5-5				
	0 : Coas to Stop 1: Dynamic Stop 2 : DC Brake										
	F 8	Brake Time before Activation	0~30.0	0.1Sec	5.0		P5-6				
	F 9	Voltage of Brake before Activation	0~20.0	0.001Pu	.050						
	F10	Stop Brake Time	0~30.0	0.1Sec	5.0						
	F11	Stop Brake Voltage	0~.200	0.001Pu	.050						
	F12	Stop Brake Starting Frequency	0~20.0	0.1Hz	0						
	SPEED LIMIT	F13	Revolving Direction Limit	0~3	1	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)	0~400.0	0.1Hz	0		P5-7				
F15		Upper Limit Frequency(F15 ≥ F14)	0~400.0	0.1Hz	60.0						
F16		Activation Frequency	0~30.0	0.1Hz	1		P5-8				
MULTI-STAGE SPEED COMMAND SETUP	Preset Speeds Terminal →	Inching Command	Multi-stage Command 3	Multi-stage Command 2	Multi-stage Command 1						
	F17	Master	OFF	OFF	OFF	OFF	0~400.0	0.1Hz	60.0		P5-9
	F18	Stage1	OFF	OFF	OFF	ON	0~400.0	0.1Hz	5.0		
	F19	Stage2	OFF	OFF	ON	OFF	0~400.0	0.1Hz	10.0		
	F20	Stage3	OFF	OFF	ON	ON	0~400.0	0.1Hz	15.0		
	F21	Stage4	OFF	ON	OFF	OFF	0~400.0	0.1Hz	20.0		
	F22	Stage5	OFF	ON	OFF	ON	0~400.0	0.1Hz	30.0		
	F23	Stage6	OFF	ON	ON	OFF	0~400.0	0.1Hz	40.0		
	F24	Stage7	OFF	ON	ON	ON	0~400.0	0.1Hz	50.0		
	F25	Inching	ON	X	X	X	0~400.0	0.1Hz	5.0		
(* F14 ≤ setting ≤ F15)											

- PARAMETER SETUP SCHEDULE- APPENDIX A IX

2	Parameter Code	Description			Range	Unit	Ex-factory Setting	R/W	Page No.
ACCELERATION/DECELERATION TIME		F40-0: Internal Time Allotment		Multi-stage Speed					
	F26	Acceleration time 1		Mater/ 8 speed	Stage 4/ 12 speed	.1~1200.0	0.1Sec	10.0	P5-9
	F27	Deceleration time 1				.1~1200.0	0.1Sec	10.0	
	F28	Acceleration time 2		Stage 1/ 9 speed	Stage 5/ 13 speed	.1~1200.0	0.1Sec	10.0	
	F29	Deceleration time 2				.1~1200.0	0.1Sec	10.0	
	F30	Acceleration time 3		Stage 2/ 10 speed	Stage 6/ 14 speed	.1~1200.0	0.1Sec	10.0	
	F31	Deceleration time 3				.1~1200.0	0.1Sec	10.0	
	F32	Acceleration time 4		Stage 3/ 11 speed	Stage 7/ 15 speed	.1~1200.0	0.1Sec	10.0	
	F33	Deceleration time 4				.1~1200.0	0.1Sec	10.0	
	F34	Inching Acceleration Time				.1~1200.0	0.1Sec	5.0	P5-10
	F35	Inching Deceleration Time				.1~1200.0	0.1Sec	5.0	
	F36	Acceleration curvature				0~100	1 %	0	
	F37	Acceleration curves intersection point				0~100	1 %	50	
	F38	Deceleration curvature				0~100	1 %	0	P5-11
	F39	Deceleration curves intersection point				0~100	1 %	50	
	F40	Multi-stage acceleration/deceleration time allotment				0~2	1	0	
	0 : All Internal Allotment 1: Half Internal Allotment and another Half External Terminals; 2 : External Terminals								
ANALOG FREQUENCY COMMAND	F41	Operator Analog AV:0V bias Ratio				-300.0~300.0	%	0.0	P5-12
	F42	Operator Analog AV:5V Gain Ratio				-300.0~300.0	%	100.0	
	F43	Analog Voltage AV1:-10V Gain Ratio				-300.0~300.0	%	-100.0	P5-13
	F44	Analog Voltage AV1:10V Gain Ratio				-300.0~300.0	%	100.0	
	F45	Analog Voltage AV1 Sensorless Voltage				0~50.0	%	0.0	
	F46	Analog Voltage AV1 Zero-point Output Gain				0~50.0	%	0.0	
	F47	Analog Voltage AV Maximum Output Limit				10.0~100.0	%	100.0	
	F48	Analog Voltage AV2:0 Bias Ratio				-300.0~300.0	%	0.0	P5-15
	F49	Analog Voltage AV2:10V Gain Ratio				-300.0~300.0	%	100.0	
	F50	Analog Voltage AV2 Sensorless Voltage				0.0~50.0	%	0.0	
	F51	Analog Voltage AV2 Zero-point Output Gain				0.0~50.0	%	0.0	
	F52	Analog Voltage AV2 Maximum Output Limit				10.0~100.0	%	100.0	
	F53	AI: 0mA (or 0V) Bias Ratio				-300.0~300.0	%	0.0	
	F54	AI: 20mA (or 0V) Gain Ratio				-300.0~300.0	%	100.0	
	F55	AI Sensorless Voltage				0.0~50.0	%	0.0	
	F56	AI Zero-point Output Gain				0.0~50.0	%	0.0	
	F57	Analog Current AI, Maximum Output Limit				10.0~100.0	%	100.0	

IX APPENDIX A – PARAMETER SETUP SCHEDULE–

3	Parameter Code	Description	Range	Unit	Ex-factory Setting	R/W	Page No.
MULTI-FUNCTION INPUT TERMINALS	F58	Digital Terminal Scan Cycle	1~5000	1=0.2ms	10x0.2ms=2ms		P5-17
	F59	DI1, DI 2 Setup	0~1		0		P5-18
	0: DI1(FWD/STOP), DI2(REV/STOP) 1: DI1(RUN/STOP), DI2(FWD/REV)						
	F60	DI3 Setup	Settings for multi-function input terminals should never be repeated with the exception of the setting of 0: Disabled.	0~21	1	2	P5-18
	F61	DI4 Setup		0~21	1	4	
	F62	DI5 Setup		0~21	1	5	
	F63	DI6 Setup		0~21	1	6	
	F64	DI7 Setup		0~21	1	9	
	F65	DI8 Setup		0~21	1	18	
	0: Disabled 1: 3-way 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: Free-run 19: Save Energy Operation 20: Second Unit PID 21: Enabling PID						
MULTI-FUNCTION OUTPUT TERMINALS	F66	Relay1 Setup	0~11	1	1		P5-21
	F67	DO1 Setup	0~11	1	11		
	F68	DO2 Setup	0~11	1	6		
	F69	DO3 Setup	0~11	1	7		
	F70	Relay2 Setup	0~11	1	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: OL Timing Forecast 9: Counter Cycle is Up 10: Comparator Counting is Up 11: Zero-Speed Detected						
	F71	Frequency Consistent Width	0~10.0	0.1Hz	1.0		P5-22
	F72	Frequency Attained 1	0~400.0	0.1Hz	60.0		
	F73	Frequency Attained 2	0~400.0	0.1Hz	60.0		
	F74	Magnetic Stagnation Width Attained	0~10.0	0.1Hz	1.0		
FREQUENCY SKIP	F75	Counting Cycle	0~30000	1P	1000		P5-23
	F76	Comparative Counting	0~30000	1P	500		
	F77	Frequency Skip 1	0~400.0	0.1Hz	0.0		
	F78	Frequency Skip 2	0~400.0	0.1Hz	0.0		
	F79	Frequency Skip 3	0~400.0	0.1Hz	0.0		
PROTECTION SETUP	F80	Frequency Skip Width	0~10.0	0.1Hz	0.0		P5-24
	F81	Stall Prevention	0~1	1	0		
	0: Not Activated 1: Activation						
	F82	Stalling voltage Setup	1.00~1.25	0.01	1.10		P5-24
	F83	Stalling Current Setup	0.50~2.50	0.01Pu	1.50		
	F84	Overload Current Lever	1.00~2.50	0.01Pu	1.50		P5-25
	F85	Overload time Allowance	0.1~120.0	0.1Sec	60.0		
	F86	Leakage current outputted or unbalanced 3-phase output current	0.001~0.500	0.001Pu	0.100		
	F87	Over Temp Protection Setup	60.00~95.00	0.01℃	85.00		
F88	Fans Activating Temp. Setup	30.00~45.00	0.01℃	40.00			

- PARAMETER SETUP SCHEDULE- APPENDIX A IX

4	Parameter Code	Description	Range	Unit	Ex-factory Setting	R/W	Page No.
PROTECTION SETUP	F89	Automatic Voltage Regulation (AVR)	0~1	1	0		P5-25
		0: Disabled 1: Activation					
	F90	Dynamic Braking Activated	0~1	1	0		P5-26
		0: Disabled 1: Activation					
AUTOMATIC OPERATION FUNCTION	F91	Automatic Operation	0~1	1	0		P5-26
		0: Disabled 1: Reciprocal Fashion 2: Cyclic Fashion 3: Mater Speed after Reciprocation 4: Mater Speed after Circulating					
	F92	Number of Cycles	1~2000	1	1		P5-27
	F93	Stage 1 Time & Direction	-30000~30000	1Sec	10		
	F94	Stage 2 Time & Direction	-30000~30000	1Sec	10		
	F95	Stage 3 Time & Direction	-30000~30000	1Sec	10		
	F96	Stage 4 Time& Direction	-30000~30000	1Sec	10		
	F97	Stage 5 Time & Direction	-30000~30000	1Sec	10		
	F98	Stage 6 Time & Direction	-30000~30000	1Sec	10		
	F99	Stage 7 Time& Direction	-30000~30000	1Sec	10		
	F100	Stage 8 Time & Direction	-30000~30000	1Sec	10		
MAGNETIC FLUX SETUP	F101	Maximum Output Voltage (U.V. W)	.50~1.00	0.01Pu	0.90		P5-28
	F102	V/F Maximal Voltage Frequency	.50~2.00	0.01Pu	1.00		
	F103	V/F Curve Option	-10~5	1	0		
	F104	Save Energy Control Mode	0~2	1	0		P5-29
		0 : Normal Mode 1: Save Energy Control Mode 2: External Terminal Control					
	F105	V/F Torque Compensation Mode	0~2	1	1		P5-29
		0 : Disabled 1: Setup Compensation Activated 2 : Automatic torque compensation					
	F106	V/F Torque Compensation Setting	0~200	0.001PU	0.020		P5-29
AC DRIVE PARAMETER	F107	PWM Modulation Method	1~2	1	1		P5-30
		1 : 3-Phase SVPWM Modulation 2 : 2-Phase SVPWM Modulation					
	F108	PWM Switching Frequency	2000~16000	1Hz	5000		P5-30
	F109	RST Input Voltage (rms)	180~500VAC	1VAC	220, 380, 440		P5-31
METER 1 WAVEFORM OUTPUT		(* F109 setting must satisfy: $F109 \leq 1.2 \times F120$)					
	F110	METER 1 Output format	0~1	1	0		P5-31
		0: PWM Modulation Output 1: Pulse Frequency Output					
	F111	Pulse Frequency Multiplying Factor 1	1~36	1	1		P5-31
	F112	PWM1 Output Mode Options	0~17	1	1		
		0: Output ineffective 5: Source Frequency 10: Output Current 15: True Power 1: Motor Speed 6: Slip Frequency 11: Excitation Current Command 16: Reactive Power 2: Feedback Speed 1 7: Output Voltage 12: Torque Current Command 17: PID % value Output 3: Feedback Speed 2 8: Excitation Voltage 13: Excitation Current 4: Estimated Speed 9: Torque Voltage 14: Torque Current					
	F113	PWM1 Display Variable Multiplying Factor/10V	.50~8.00	0.01Pu	1.00		P5-32
	F114	PWM1 Display Variable Polarity Setup	0~1	1	0		
		(*PWM1 Output Voltage Signal < 5Vdc, motor engages in REV operation) 0: Without Polarity 1: With Polarity→ (*PWM1 Output Voltage Signal = 5Vdc, motor stops) (*PWM1 Output Voltage Signal > 5Vdc, motor engages in FWD operation)					

IX APPENDIX A – PARAMETER SETUP SCHEDULE–

5	Parameter Code	Description	Rang	Unit	Ex-factory Setting	R/W	Page No.
METER 2	F115	METER 2 Output Format	0~1	1	0		P5-32
	0: PWM Modulation Output 1: Pulse Frequency Output						
	F116	Pulse Frequency Multiplying Factor 2	0~36	1	1		P5-32
	F117	PWM2 Output Mode Options	0~17	1	10		
	* Mode selection same as that for F112						
	F118	PWM2 Display Variable Multiplying Factor/10V	.50~8.00	0.01Pu	1.00		P5-32
	F119	PWM2 display Variable Polarity Setup	0~1		0		
0: No Polarity 1: With Polarity (same as that of Parameter F114)							
MOTOR NAMEPLATE	F120	Rated Voltage (rms)	180~500	1V	N		P5-32
	F121	Rated Current (rms)	1.5~130.0	0.1A	N		
	(* F121 setting must satisfy: $F121 > AC \text{ Drive Rated current} \div 9$)						
	F122	Rated Frequency	50.0~70.0	0.1Hz	N		P5-32
	F123	Rated Speed	0~4200	1rpm	N		P5-33
	F124	HP	.5~50.0	0.1Hp	N		
	F125	Number of Poles	2~12	2 Pole	N		
Note: N= Ex-factory setting varies depending on the drive and motor capacity							
CONTROL MODE	F126	Control Mode Setup	0~6	1	2		P5-33
	0: Electric Parameter Detection; 4: Sensorless V/F vector Control 1: Mechanical Parameter Detection 5: Closed Loop Flux Vector Control 2: Open Loop V/F vector Control; 6: Sensorless Flux Vector Control 3: Closed Loop V/F vector Control						
ENCODER SETUP	F127	Speed Feedback	0~1	1	0		P5-34
	0: No Feedback 1: Encoder 1						
	F128	Encoder 1 Pitch No./Revolution	600~2500	1P/rev	1024		P5-34
	F129	Encoder 1 Direction	-1~1	1	1		
	-1: B leads A 0: Single Phase Feedback 1: A leads B						
	F130	Encoder 2 Pitch No./Revolution	600~2500	1P/rev	1024		P5-34
	F131	Encoder 2 Direction	-1~1	1	1		
-1: B Leads A 0: Single Phase Feedback 1: A Leads B							
MOTOR ELECTRIC PARAMETER	F132	Encoder 2 Multiplying Factor	0.01~7.50	0.01X	1.00		P5-34
	F133	Stator Resistance	6500~32767	1	20000		P5-36
	F134	Rotor Resistance	6500~32767	1	16000		
	F135	Stator Self-Induction	6500~32767	1	18000		
	F136	Mutual Induction	6500~32767	1	17500		
	F137	Rated Rotor Resistance	-32767~32767	1	16000		
Estimator	F138	Mechanical Constant	0~30000	1	1500		P5-37
	F139	Magnetic Flux Estimator Bandwidth	4.0~10.0	0.1Hz	4.0		
	F140	Speed Estimator Bandwidth	1.0~6.0	0.1Hz	4.0		
	F141	Slip Correction Gain	10~200	1%	88		

- PARAMETER SETUP SCHEDULE- APPENDIX A IX

6	Parameter Code	Description	Rang	Unit	Ex-factory Setting	R/W	Page No.
SPEED PI CONTROL PARAMETER	F142	V/F vector Speed Control P Gain	0~100	1%	30		P5-37
	F143	V/F vector Speed Control I Gain	0~100.0	0.1%	20.0		
	F144	Flux Vector Speed Control P Gain	0~100	1%	40		
	F145	Flux Vector Speed Control I Gain	0~100.0	0.1%	20.0		
	F146	Sensorless Speed Control P Gain	0~100	1%	30		
	F147	Sensorless Speed Control I Gain	0~100.0	0.1%	15.0		
	F148	Torque Current Limit	0~1.250	0.001	1.000		P5-39
	Minimum {5×F121, F148×AC Drive Rated current}						
	F149	Torque Current Analog Limit	0~5	1	0		P5-39
	0: Disabled 1: Digital Operator AV 2: AV1 3: AV2 4: AI 5: PID Control						
ABNORMALITY RECORDS	F150	Latest Abnormality Record	0~256	1	0		P5-39
	F151	Last Abnormality Record	0~256	1	0		
	F152	Last 2 Abnormality Records	0~256	1	0		
	F153	Last 3 Abnormality Records	0~256	1	0		
	F154	Last 4 Abnormality Records	0~256	1	0		
	F155	Last 5 Abnormality Records	0~256	1	0		
	Err 0 : Digital operator communication failure Err 20 : Reserved Err 1 : Over voltage or current in standby status Err 21 : Reserved Err 2 : Over voltage or current in acceleration Err 22 : Reserved Err 3 : Over voltage or current in deceleration Err 23 : Failure to perform closed loop control due Err 4 : Over voltage or current in speed regulation to no speed feedback Err 5 : Heat sink overheated Err 24 : Reserved Err 6 : Dc Bus over voltage Err 25 : EEPROM parameter read back out of range Err 7 : Dc Bus low voltage Err 26 : Digital operator storage parameter write in Err 8 : Overload failure Err 9 : AC Drive voltage not match the motor voltage Err 27 : DSP storage parameter locked & preventing Err 10 : Software detection overload current protection modification. Err 11 : AC Drive rated current range not match motor Err 28 : Operator storage parameter locked & current preventing modification Err 12 : U-phase output side off or C.T failure Err 29 : External input abnormality Err 13 : V-phase output side off or C.T failure Err 30 : Unbalanced 3-phase output current Err 14 : W-phase output side off or C.T failure Err 31 : Leakage current outputted Err 15 : Pump low current detected Err 32 : PUF fuse burnt out Err 16 : Encoder direction opposite to the phase Err 33 : PF input source phase insufficiency or too low sequence on the output side Err 34 : Reserved Err 17 : Encoder signal abnormality Err 35 : Error in automatic operation time setup. Err 18 : Auto-tuning failure Err 36 : Digital input terminal setup repeated. Err 19 : Reserved Err 37~256 : Reserved						
	F156	Abnormality Records Cleared	0~1	1	0		P5-39
	0: Not Cleared. 1: Cleared.						

IX APPENDIX A – PARAMETER SETUP SCHEDULE–

7	Parameter Code	Description	Rang	Unit	Ex-factory Setting	R/W	Page No.
EXTERNAL PID CONTROL	F157	PID Mode	0~4		0		P5-41
	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)						
	F158	PI Target Value Input Options	0~8		0		P5-41
	0: PI zero point setup 3: AI input 6: RAMP output 1: AV1 input 4: Encoder 2 feedback value 7: Total output current 2: AV2 input 5: Encoder 1 feedback value 8: Torque current						
	F159	PI Feedback Input Options	0~8		0		P5-41
	0: PI zero point setup 3: AI input 6: RAMP output 1: AV1 input 4: Encoder 2 feedback value 7: Total output current 2: AV2 input 5: Encoder 1 feedback value 8: Torque current						
	F160	D Feedback Input Options	0~8		0		P5-42
	0: PI error 3: AI input; 6: RAMP output; 1: AV1 input 4: Encoder 2 feedback value; 7: Total output current; 2: AV2 input 5: Encoder 1 feedback value; 8: Torque current						
	F161	PI Zero-point Setup	0.00~100.00	%	50.00		P5-42
	F162	D Input Filtration Time Setup	0.05~10.00	Sec	0.20		P5-43
	F163	PID Output Limit	0.00~100.00	%	100.00		
	F164	Unit 1 Kp Gain	0.00~300.00	%	100.00		
	F165	Unit 1 Ki_H Gain	0.0~3000.00	%	400.0		
	F166	Unit 1 Ki_L Gain	0.0~3000.00	%	200.0		
	F167	Unit 1 Kd Gain	0.0~3000.00	%	20.0		
	F168	Unit 2 Kp Gain	0.00~300.00	%	100.00		
	F169	Unit 2Ki_H Gain	0.0~3000.00	%	5.0		
	F170	Unit 2Ki_L Gain	0.0~3000.00	%	5.0		
	F171	Unit 2Kd Gain	0.0~3000.00	%	5.0		P5-45
	F172	Kp Analog Adjustment	0~4		0		
	F173	Ki Analog Adjustment	0~4		0		
	0: No adjustment to be made 1: Operator AV Input 2: AV1 Input 3: AV2 Input 4: AI Input						
PC COMMUNICATION	F174	Drive Com. Address	1~255		1		P5-46
	F175	PC Transmission Rate	0~3		0		
	0 : 2400 1 : 4800 2 : 9600 3 : 19200						
	F176	PC Comme Data Format	0~2		0		P5-47
	0:8,N,1 RTU (1start bit + 8 data bits + 1 stop bit) 1:8,E,1 RTU (1start bit + 8 data bits + 1 Even bit + 1 stop bit) 2:8,O,1 RTU (1start bit + 8 data bits + 1 Odd bit + 1 stop bit)						
	F177	Drive Response Time	3~50	ms	5		P5-47
	F178	Receive Failure Response	0~1		0		
	0: Normal Receiving 2: CRCL Error 4: Packet Receiving Time Over 0.2 Seconds 1: Function Error Code 3: CRCH Error 5: Changing Parameter Not Permitted during Operation						
STANDSTILL POSITIONING	F179	Stand still position	0~1		0		P5-47
	0: Disabled 1:Activated						
	F180	Positioning P Gain	0~100.00	%	30.00		P5-48
	F181	Positioning I Gain	0~100.00	%	20.00		

- PARAMETER SETUP SCHEDULE- APPENDIX A IX

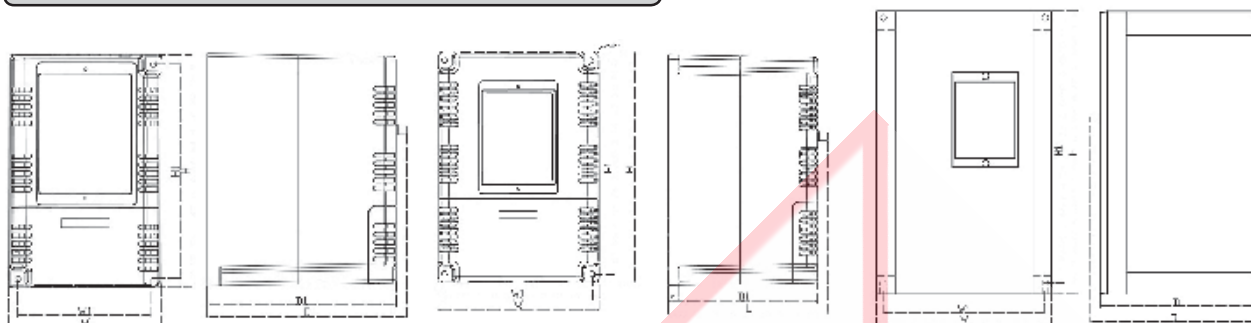
8	Parameter Code	Description	Rang	Unit	Ex-factory Setting	R/W	Page No.
WATER PUMP FUNCTIONS	F182	Constant Water Pumping Function Activated	0~1		0		P5-48
	0: Disabled 1: Activated						
	F183	Sleep Detected Time	0~12000	Sec	15		P5-48
	F184	Sleep Error	0.0~10.0	%	5.0		
	F185	Wake-up Error	0.0~100.0	%	10.0		
	F186	Standby Operation Detected Time	0~12000	Sec	900		
	F187	Standby Operation Time	0~12000	Sec	60		
	F188	Standby Operation Frequency	0.0~400.0	Hz	0.0		
	F189	Low Current Detected Level	0.0~100.0	%	10		
	F190	Low Current Detected Time	0~12000	Sec	60		
	F191	Low Power Detected Restoration Time	0~12000	Sec	3000		
16 PRESET SPEEDS	F192	Stage 8 Speed	0~400.0	Hz	0		P5-49
	F193	Stage 9 Speed	0~400.0	Hz	0		
	F194	Stage 10 Speed	0~400.0	Hz	0		
	F195	Stage 11 Speed	0~400.0	Hz	0		
	F196	Stage 12 Speed	0~400.0	Hz	0		
	F197	Stage 13 Speed	0~400.0	Hz	0		
	F198	Stage 14 Speed	0~400.0	Hz	0		
	F199	Stage 15 Speed	0~400.0	Hz	0		
STORAGE, RECALL PARAMETERS	F206	Recall Parameter	0~3	Hz	0		P5-50
	0: Not Recalled. 2: Recall Parameters Saved in DSP 1: Recall Ex-factory Setup 3: Recall Parameter Settings Saved in Digital Operator						
	F207	Save Current Parameters	0~2		0		P5-50
	0: Not Saved 1: Saved to DSP 2: Saved in Digital operate keypad						
	F208	Lock up EEPROM Parameters	0~3		0		P5-51
	0: Save Allowed; 2: Lock up Parameters Stored in Digital Operator; 1: Lock up Parameters Stored in DSP 3: Lock up Parameters Stored in DSP and Digital Operator						
	F209	Ex-factor Decryption Code Input 1	-32767~32767		0		
	F210	Ex-factor Decryption Code Input 2	-32767~32767		0		

IX APPENDIX B – ERR DISPLAY –

Err Code	Description of Alarm Report
Err0	Digital operator communication failure
Err 1	Over voltage or current in standby status
Err 2	Over voltage or current during acceleration
Err 3	Over voltage or current during deceleration
Err 4	Over voltage or current during speed regulation
Err 5	Heat sink overheated
Err 6	Dc Bus over voltage
Err 7	Dc Bus low voltage
Err 8	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	Pump low current detected
Err 16	Encoder direction opposite to the phase sequence on the output side
Err 17	Encoder signal abnormality
Err 18	Parameter detection failure
Err 23	Absence of speed feedback affecting performance of closed loop control
Err 25	EEPROM parameter read back out of range
Err 26	Digital operator storage parameter write failure
Err 27	DSP storage parameter locked and preventing modification.
Err 28	Operator storage parameter locked and preventing modification
Err 29	External input abnormality
Err 30	unbalanced three-phase output current.
Err 31	Leakage current outputted
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 19 , Err 20 , Err 21 , Err 22 , Err 24 , Err 34 Are signals reserved for failure.	

- Drawings of Mechanism Appearance- APPENDIX C IX

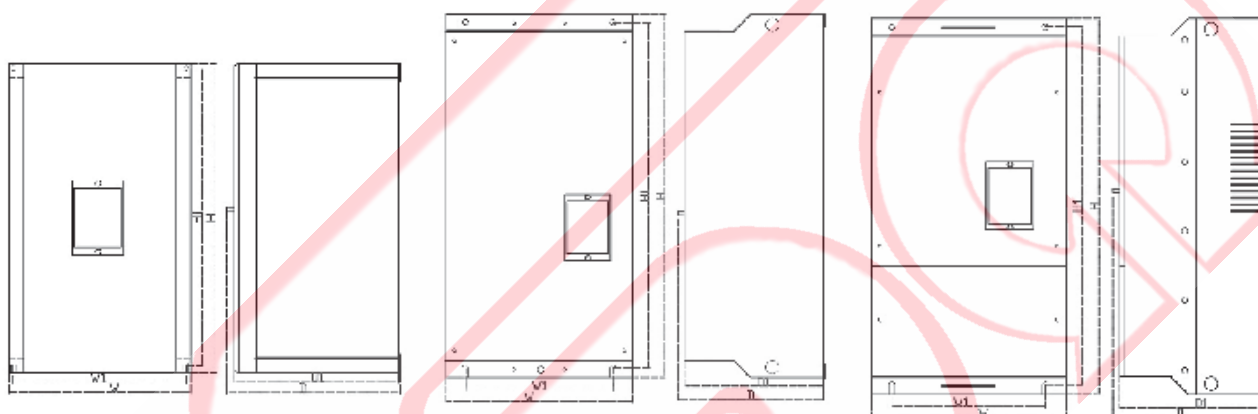
Dimension of Enclosure



(Fig. A)

(Fig. B)

(Fig. C)



(Fig. D)

(Fig. E)

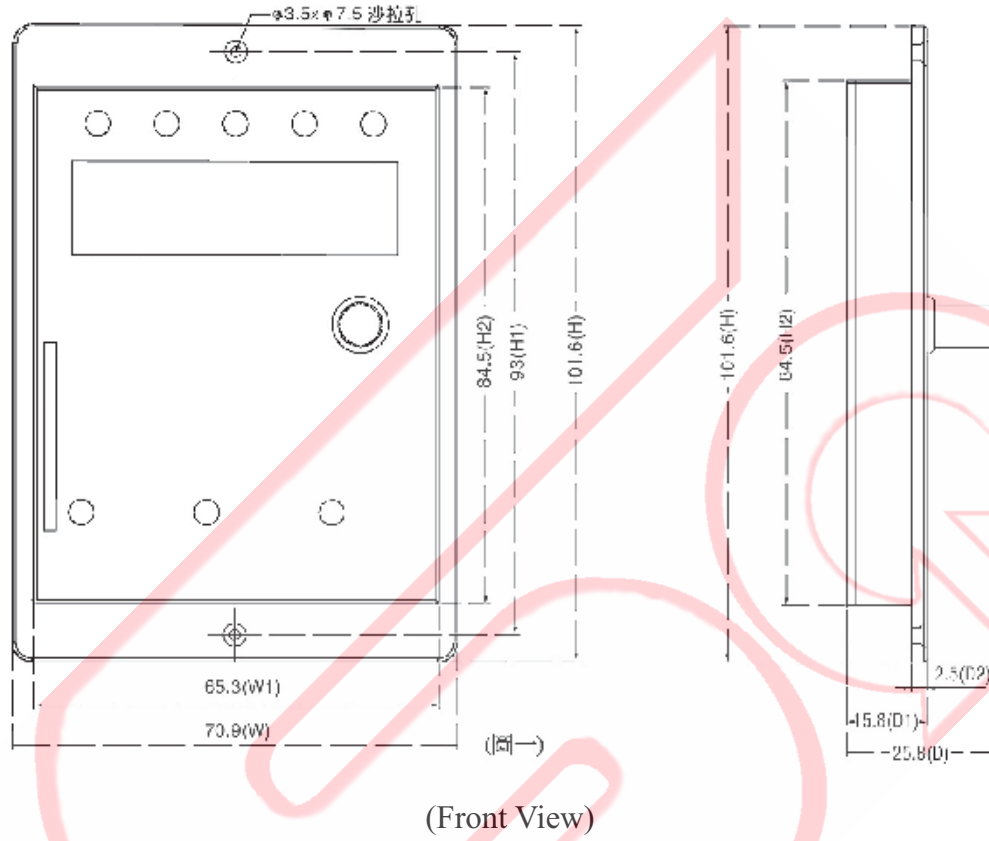
(Fig. F)

Voltage Grade	Maximum Applicable Motor Capacity (KW)	Dimension/Unit: (mm)						
		W	W1	H	H1	D	D1	Appearance
220V / 400V	0.4	114.2	101	172.1	159	146	136	A
	0.75							
	1.5							
	2.2	A / B (2 Types of Casing Specification)						
	3.7	152	137.5	214	200	146.4	136.4	B
	5.5	188	170	300	282	180	170	C
	7.5							
	11							
	15, 18.5, 22	250	226	420	405	226	216	D
	30~37	290	236	562	535	220	210	E
	45~75	356	236	670	645	285	275	F

* Mechanism dimension given in this page is only for reference purpose, and the manufacturer may make any change without further notice. Please refer to the dimension given on the updated catalogue for the corresponding product.

IX APPENDIX C – Drawings of Mechanism Appearance –

Dimension of Keypad (Handset for Communication)







Version 1.0, March 01, 2006

800 Model AC DRIVE

Application Manual

Sensorless & Closed Loop



Version No. 2.20

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










The edition changes the NO.2.20 version explanation

The edition changes the NO.2.20 version explanation

In order to make the function more convenient customer use also to increase many new functions, thus the change edition was the NO.2.20 version changes the project as follows :

Introduction of function keys :

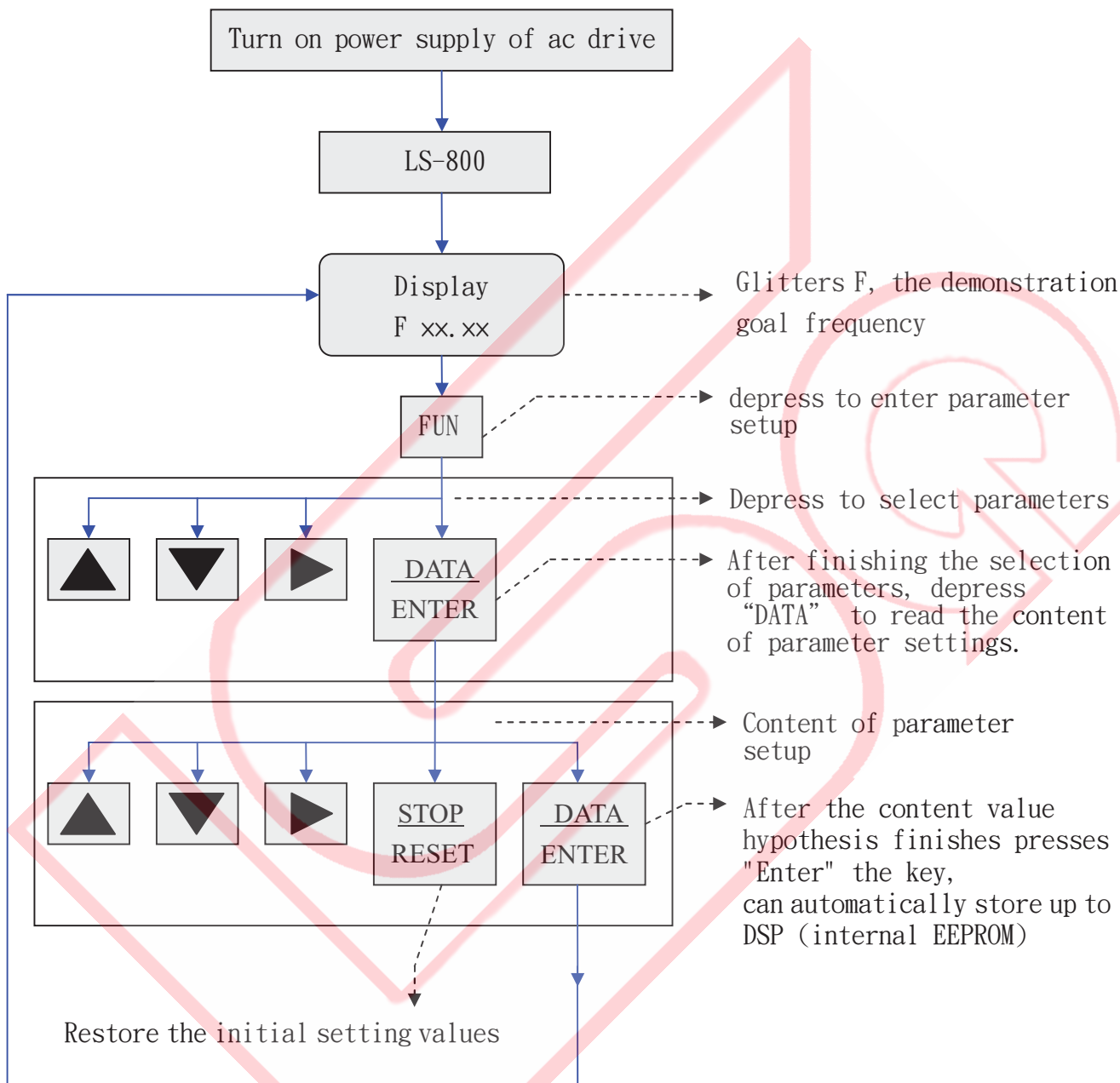
NO.2.20 version

Classification	Pushbutton	Summary description of function
Control/ parameter key		Depress to enter into Parameter Function Mode.
		To read and write parameter settings. With to the material confirms reads in, and automatic storage to DSP (internal EEPROM).
Shift/ increase, decrease keys		To move the position of flashing cursor rightward to select the place for data entry. * When revolution, right lateral key for circulation demonstration. → F : Hypothesis frequency → H : Reference frequency ← n : Encoder speed ← E : Output voltage ← A : Output current
		Depress to make an increment of numerical values for parametric encoding and setting values, etc. Under operation control mode with F5: rpm command source=0, proceed the frequency setup from digital operation panel.
		Depress to make an decrement of numerical values for parametric encoding and setting values, etc. In the revolution may enter F0, surveillance of each kind of demonstration project.
Operation Command keys		To execute an operation command in forward revolution and illuminate the LED indicator. To serve as a function key to execute stop running command when execution of forward revolution is disabled due to limitation of rotational direction.
		To execute an operation command in reversal revolution and illuminate the LED indicator. To serve as a function key to execute stop running command when execution of reversal revolution is disabled due to limitation of rotational direction.
		To execute the STOP running command. To reset the failure when encountered a failure; depress of this key in parameter setup mode will restore the original setting values.
RPM command		F5 : RPM control for operation panel Ai (V.R.) when RPM command source =1.

Parameter setup mode

NO.2.20 version

Flow process of parameter setup mode

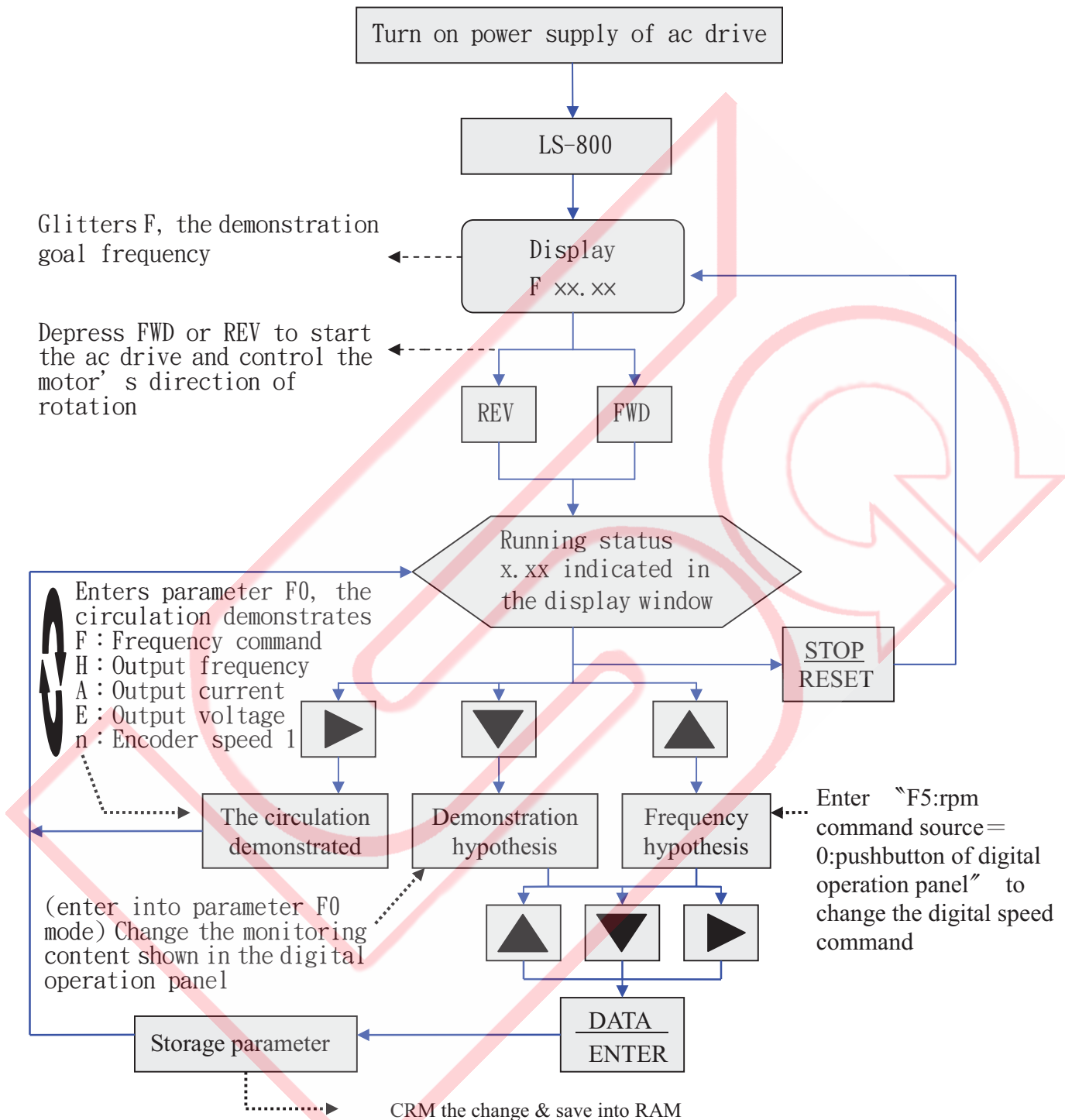


- Note 1 : Make sure to save each and all parameter setting that have been confirmed and complied with the purpose as demanded in the commissioning into the built-in EEPROM by selecting F207(save current parameter)=1 : Save to DSP(built-in EEPROM) to prevent loss of the parameter setting.
- Note 2 :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

Control mode

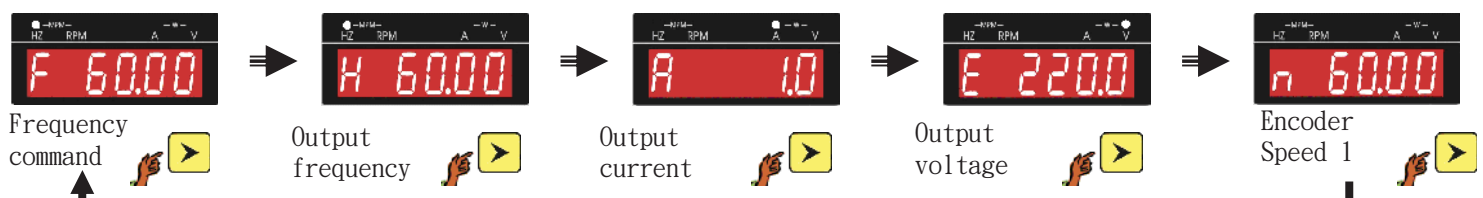
NO. 2.20 version

Flowchart of control mode for digital operation panel





Quick & cyclic display functions during operation

Each press of key from digital operation panel is able to cyclically display the function in the following order : Frequency command→Output frequency→Output current→Output voltage→Encoder speed 1.



Fast Operation Control Mode

Parameter Function	Operation Procedure	Ex-factory Setting	Page No.
F4 : Operation Control Source			
0 : PB Operator	Press [FWD] once F xx xx displays  * During commissioning, watch for the revolving direction of the motor. *	0	P5-2
1 : Digital Input Terminal	Terminal Di1 /ON → FWD (indicator ON) operation → OFF/Stop		P5-2 P5-16
F5 : RPM Command Source			
0 : Digital operation pane	Frequency changing mode is accessing the  key during the operating state	2	P5-3
1 : Operator AV Input (5V)	To perform RPM control from the potentiometer (V.R.) on the operator.		P5-3
2 : AV 1Input (±10V)	To perform RPM control by entering 0 ~ ± 10V from analog AV1 terminal.		P5-3
3 : AV2 Input (±10V)	To perform RPM control by entering 0 ~ ± 10V from analog AV2 terminal.		P5-3
4 : AI Input (20mA)	To perform RPM control by entering 0 ~ 20mA from analog AV1 terminal.		P5-3
5 : AV2+AI	With analog AV2 and AI terminals, addition and subtraction operation can be provided for both analog signals at the same time to perform revolving speed control.		P5-3
6 : Encoder 2	Additional PG-AB2 speed control card must be installed to connect to terminals A1 and B1 with digital pulse signals to perform revolving speed control.		P5-4
7 : PID	To execute the external analog signals for PID feedback control.		P5-4

Automatic Modulation

⚙ Automatic Modulation Elements

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



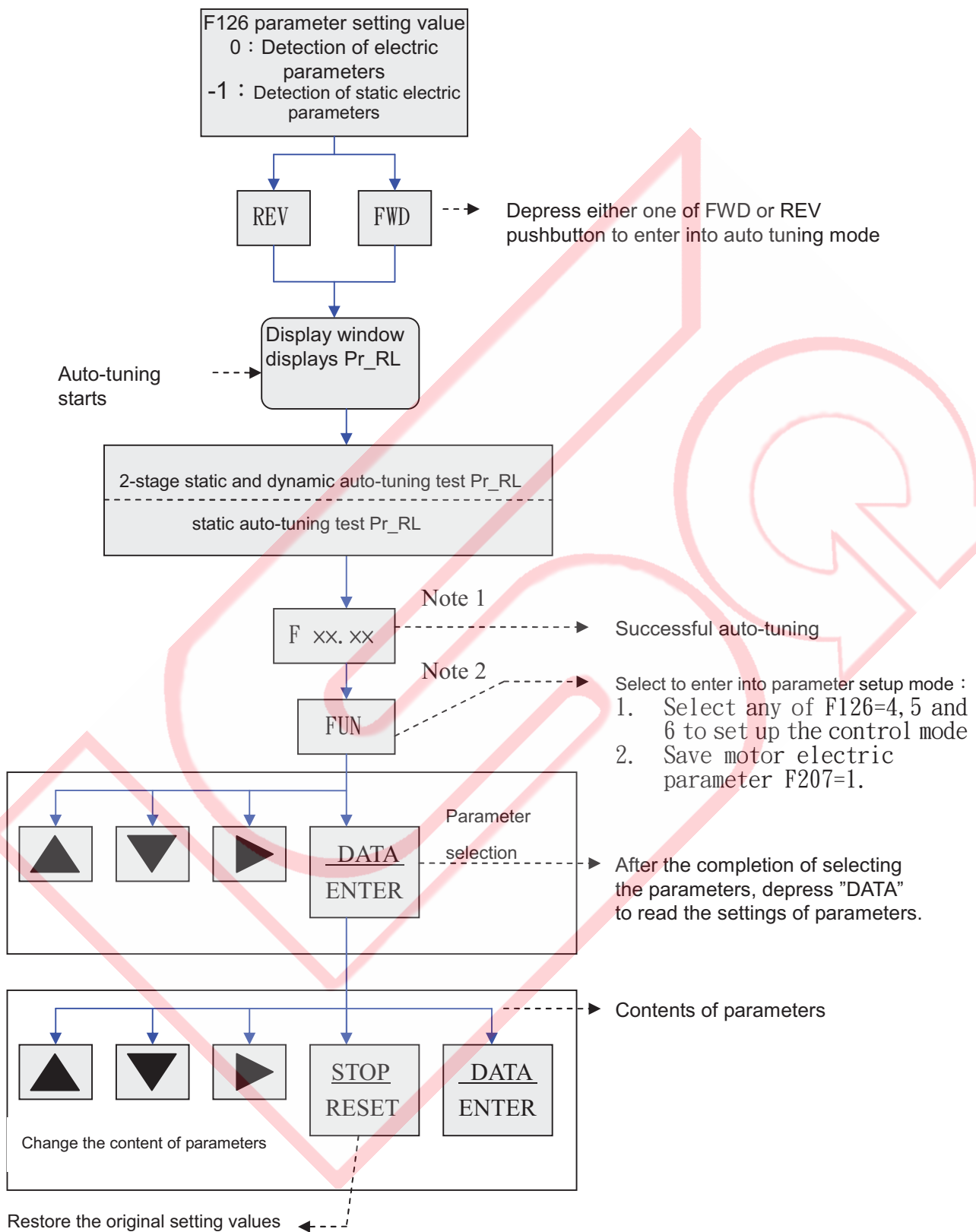
Upon performing the automatic modulation, **the motor must be separated from the machine**, and confirm that there is no exposure to danger even the motor is running.

⚙ Parameter Automatic Modulation

- ◆ ④ **Parametric tuning (F126) -1: Detection of static electric parameters**: This function is designed for those machinery equipments coupled with heavy duty that fails the detection of dynamic parameters; however, it shall be used in association with the setup of parameter F97 (motor's no-load current %) so that the motor's electric parameter group (F133~F137) can be detected in full while the accuracy in this regard is lower than the 0: Electric parameter detection.

- 1、Set up the control mode (F126) at 0: Electric Parameter Detection to perform the parameter automatic modulation.
- 2、Press [ENTER] for the inverter to display Pr-RL to start outputting DC to the motor for providing Stage 1 static mode parameter modulation in advance, and Stage 2 dynamic parameter modulation for the revolution type of the motor.
- 3、If the automatic modulation has been successfully executed, the inverter will automatically set up the electric characteristics of the motor and save them into corresponding parameters F133~F137.
- 4、If F126=5 (Closed Loop Vector Control) Mode is required, perform the F126=1 (Machinery Parameter Detection) automatic modulation. The setting of the parameter modulation will affect the response of the vector speed (PI) control. During the automatic modulation, the inverter displays Pr-Jm; the dynamic parameter modulation of the revolution type of the motor will be performed, and the modulation setting will be saved into Parameter F138. (Refer to Prompt 2.)
- 5、Modify the control mode (F126) to 4: Sensorless Scalar Control, 5: Closed Loop Vector Control, or 6: Sensorless Vector Control.
- 6、Save electric parameters into F207=1: Save to DSP (EEPROM) to avoid losing the electric parameters after power off.

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



Note 1 : Detection of electric parameters is completed.

Note 2 : Set up the relevant operation control mode from F126

Operation Status Monitor Setup

R : Parameter changeable during operation (○)

R	Parameter code	Descriptions	Setting range	Unit	Ex-factory set value
○	FO	Operator display variables selections	0~40	1	1

Ⓢ Seven-stage display and LED indicators on the operator may be applied to monitor a total of 40 operation status settings of the **drive**.

Setting	Function	Description of Function	Related Parameter
0	RPM Command (F)	RPM command setting	F5
1	Reference RPM (H)	Monitor output rpm reference value.	
2	Output Current (A)	Display the total drive motor load amperage from output of drive (U.V.W)	
3	Output Voltage (E)	Display the output (U.V.W) voltage (rms) of the drive .	
4	Feedback RPM 1	Display the real rpm of the motor feedback to Encoder.	F128
5	Feedback RPM 2	Display the product of Encoder 2 feedback rpm and F132 multiplying power.	F130・F132
6	Estimated RPM	Monitor estimated sensorless vector control rpm.	F126=6
7	Output Frequency source	Monitor the output frequency after compensation.	F126=3.4.5.6
8	Without Unit	Display linear speed, feeding speed...etc. (with maximal display value at 3276.7).	F2,F123
9	Slip Frequency	Monitor the slip F due to load when the motor is on load	F126=3.4.5.6
10	Vdc (V)	Display DC voltage on the capacitor	
11	Excitation Voltage	The excitation voltage in vector control mode	
12	Toque Voltage	The torque voltage in vector control mode	
13	Excitation Current Command	The command value of excitation current in vector control mode	
14	Torque Current Command	The command value of torque current in vector control mode	
15	Excitation Current	Real excitation amperage	
16	Torque Current	Real torque amperage	
17	Output Power	Total output power $P=IV$	
18	True Power	Total apparent power $P=VI \cos \phi$	
19	Reactive Power	Reactive power $P=VI \sin \phi$	
20	Temperature	Display the temperature reading of the internal heat sink	F87
21	Counts	Already provided with a built-in summary counter to display counts.	F75
22	Digital Input Status	To monitor digital input and outer terminals control for real-time display of ON or OFF status (for status monitor, refer to P3-5).	F59~F65
23	Digital Output Status		F66~F70
24	Digital Operator AV (V)	<ul style="list-style-type: none"> Monitor the analog input voltage % as displayed Monitor noise voltage generated by the wiring; the voltage may be used to set up the bias voltage for avoiding unnecessary noise interference. 	F5=1
25	AV1 (V)		F5=2
26	AV2 (V)		F5=3
27	AI (mA)		F5=4

Setting	Function	Description of Function	Related Parameter
28	Vdc_0	With POWER ON, the initial Vdc of the DC bus on capacitor	
29	Cycles & Multiple Stages	Related to the cycles of automatic operation. and the number of stage of operation currently executed	F92~F100
30	K_Vdc	Reserved	30
31	Phase U current (rms)	Display drive motor load amperage of Phase U output of the drive	31
32	Phase V current (rms)	Display drive motor load amperage of Phase V output of the drive	32
33	Phase W current (rms)	Display drive motor load amperage of Phase W output of the drive	33
34	PID (%)	Display PID control output in %	34
35	Reserved	Reserved	
36	Software version	To display the version number of software	
37	Position error tracking		

R	Parameter code	Descriptions	Setting range	Unit	Ex-factory set value
○	F5	Frequency command source	0~8		1

✖ This parameter relates to the **speed** command source of the ac **drive**.
The following eight options of rpm command source are available for selection, depending on the demands of the configuration of the control system.

✖ Once the inching speed function setup becomes effective, its control priority is over the following eight rpm command sources while permitting adaptation of any type of rpm command source for alternative control.

▣ **0 : PB Operator** — Control is set up by keys [Increase] and [Decrease] from the PB Operator, or by functions 11: Master Speed Increase, and 12: Master Speed Decrease Control of the multi-function digital input terminals.

▣ **1 : (Operator) AV input (5V)** — Control by potentiometer (V.R) signals CD0~5V from the operator.

▣ **2 : AV1 Input (±10V)** — Control by analog voltage signal DC0~±10V inputted from analog input terminal AV1. °

▣ **3 : AV2 Input (+10V)** — Control by analog voltage signal DC0~+10V inputted from analog input terminal AV2.

▣ **4 : AI Input (20mA)** — Control by analog current signal DC0~20mA (or DC0~+10V to be adjusted with SW1~5) inputted from analog input terminal AV1.

▣ **5 : AV2+AI** — Control by addition operation of two input values of analog voltage and analog current (or voltage) signals inputted from both analog input terminals AV2 and AI; or addition and subtraction operation control is done by an ideal negative bias set up by the parameter while performing synchronous linking analog compensation control for multiple units.

✖ For example : (1) Parameter F15=60HZ(upper limit), AV2 of F49=100%, F48=0V(with a bias of 0%).

✖ (2) AI of F54=50%, F53=-50%(with a bias of 50%). See Fig. 2 for the curve.

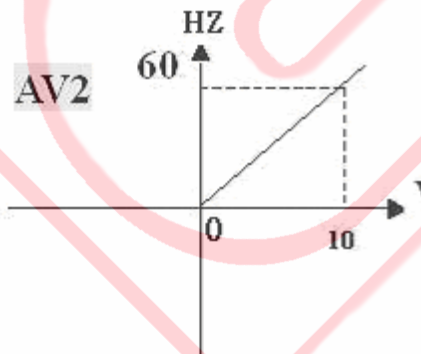


Fig 1

Performing Calculation of Addition and Subtraction (Note 1)

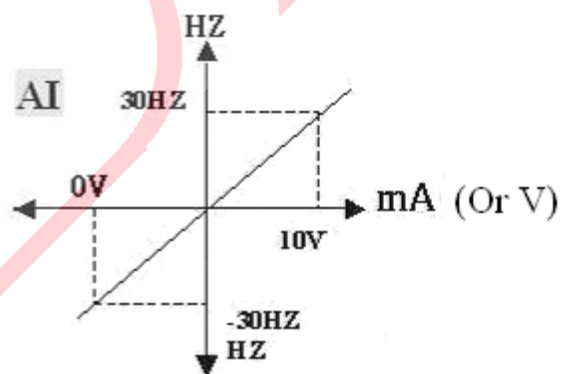
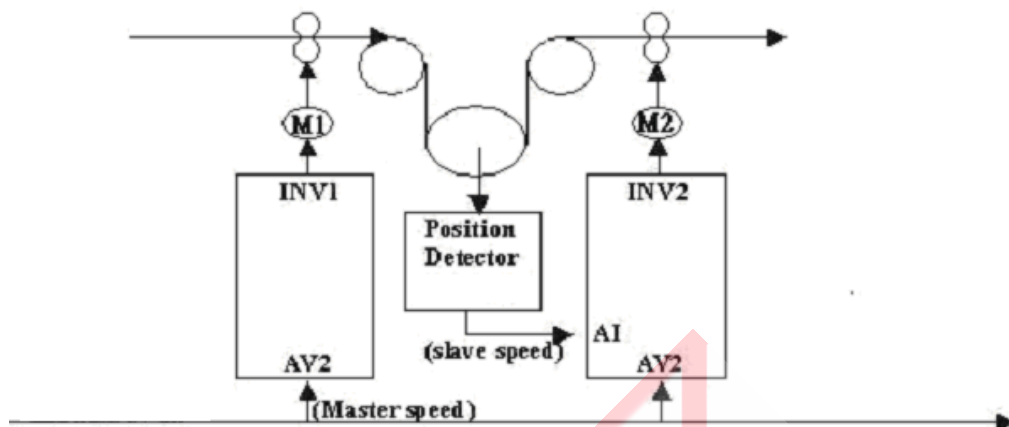


Fig 2

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

✖ **Fig. 3:** AV2 of INV2 is the source of the master speed to exercise addition/subtraction operation on AI signals. Wherein, AI is the auxiliary compensation input. The sum of both values is not be greater than the upper limit of F15 frequency and the difference between both is less than 0HZ, the downtime status exists. Refer to the setup method illustrated in Figs. 1 and 2 for the setting of the parameter.



(Fig 3)

6: Encoder 2 — Relates to the control interface for the rpm command source of the digital pulse signal. An additional encoder speed feedback card must be installed to provide follow-up operation control with the primary motor controller (synchronous operation control by ratio).

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

7 : External PID — To perform external analog signals PID feedback control. [Select parameter setup PID target value and PID feedback value source terminals, and PID parameter group F157~F171.]

R	Parameter code	Descriptions	Setting range	Unit	Ex-factory set value
x	F8	Braking duration before start	0.0~120.0	Second	5.0

◆ This parameter is to set up time duration of DC dynamic braking enabled when ac drive is started, ac drive will start its running only after the entered time duration elapsed. An entry of minimum value "0" to the duration will disable the braking function.

x	F9	Braking current before start	0.00~100.00	%	30.0
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◆ This parameter is to set the percentage of the DC brake voltage output before the operation of the ac drive. A minimum set value, i.e., "0", will deny the output brake energy, and will be regarded as a control to trigger a delay for the start of operation. F6 setting shall govern the time span of delay.

x	F10	Stopping & brake voltage time	0.0~120.0	Second	0.0
x	F11	Stopping & brake voltage	0.00~100.00	%	30.0

✱ Do not enter a minimum value "0" to set up the stopping & brake time and the stopping & brake voltage; an entry of "0" will leave the time and brake energy inactive.

		Range	Unit	Ex-factory Setting
x	F66	Relay1 Setup		0
x	F67	DO1 Setup	1	11
x	F68	DO2 Setup		6
x	F69	DO3 Setup		7
x	F70	Relay2 Setup		3

@No specific sequence is specified Setup for the function of these six terminals. Upon selecting the function, read first the description and related requirements of the function.

12: Timer Output function — When the frequency changer starts revolves, after F204 time delay time, corresponds the multi-ability out-port (Timer function output) contacts can close, this function essential matches F6 the direct-current brake function, the direct-current brake energy size may depend on the demand to establish.

Protection Setup¹

R	Parameter code	Descriptions	Setting range	Unit	Ex-factory set value
x	F81	Stall protection setup	0~7		7

bit0 : Protection function F82 — To enable the function for stalling voltage protection during deceleration.

bit1 : Protection function F83 — To enable the function for stalling current protection during acceleration.

bit2 : Protection function F84 — To enable the function electronic thermal relay.

※ Digital increment table

Set values	F84 $2^2 = 4$	F83 $2^1 = 2$	F82 $2^0 = 1$	Set values	F84 $2^2 = 4$	F83 $2^1 = 2$	F82 $2^0 = 1$
0	x	x	x	4	○	x	x
1	x	x	○	5	○	x	○
2	x	○	x	6	○	○	x
3	x	○	○	7	○	○	○

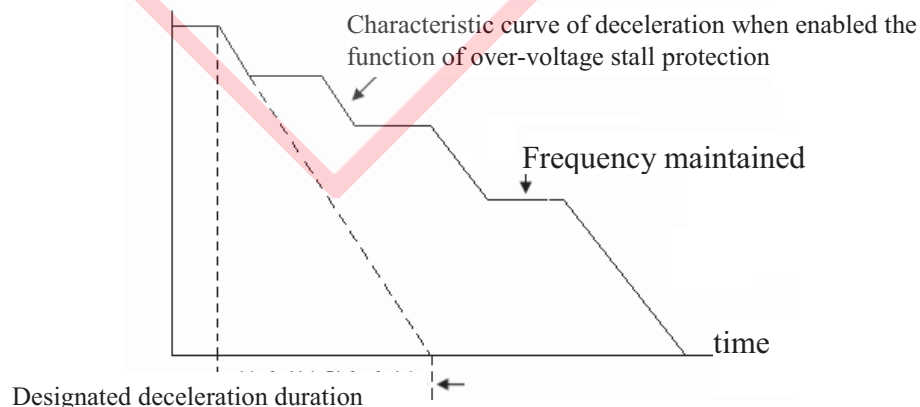
※ ○: protection function enabled, x: protection function disabled, no protection function when set value is 0.

x	F82	Setup for stalling voltage during deceleration	1.00~1.25		1.10
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◆ As a result from the inertia of motor load when the ac drive is executing the deceleration; the motor will regenerate energy into the interior of ac drive to heighten the voltage at DC bus. Therefore, the ac drive will stop decelerating (output frequency paused from decreasing) once a voltage at DC bus detected higher than the set value and resume its executing the deceleration provided that the voltage at DC bus falls below the set value.

※Note: Stall voltage level = F109 (220V) x 1.414 x 1.10 (ex-factory value)

Output frequency,



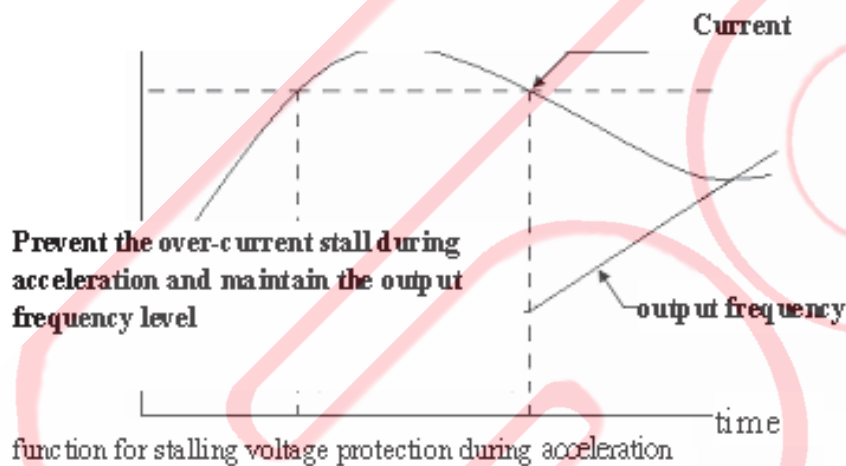
R	Parameter code	Descriptions	Setting range	Unit	Ex-factory set value
×	F83	Setup for stalling current during acceleration	0.50~2.50	Pu	1.50

When performing the acceleration or operation, the ac drive will stop accelerating (output frequency is paused from increasing) due to a too-fast acceleration or too-big motor load that leads to a quick rise of output current from ac drive to exceed the set value of stalling current level; ac drive will resume its acceleration provided that the current is lower than the set value.

- ◆ stalling current level during acceleration= (F121) motor rated current × (F83) stalling current percentage

Example : stalling current level = $4A \times 1.70 = 6.8A$

F83 setup for stalling current during acceleration



×	F84	Current level of electronic thermal relay	1.00~2.50	PU	1.50
×	F85	Acting duration of electronic thermal relay	0.1~120.0	Second	60.0

- ◆ When the rated capacity of ac drive is higher than motor's rated capacity, please input the motor's rated capacity into the parameters F120~F125 to avoid burning out the motor.
- ◆ This parameter provides a function of electronic thermal relay to protect the motor from overheating. This kind of protective characteristic has taken the protection against the low cooling ability encountered when motor is running at low speed into consideration.
- ◆ When the continuously loading current output from the ac drive exceeds the set value of (F121) motor rated current, the timer for acting duration of electronic thermal relay will be actuated.

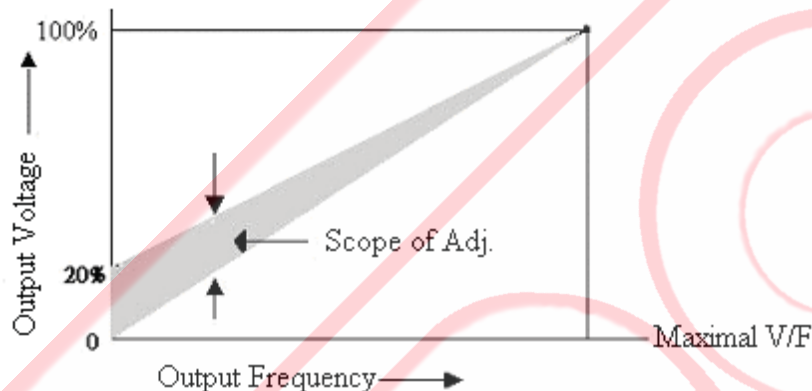
※ $\int (I^2_{A(pu)} - 1) dt \geq (I^2_{OL} - 1) \times T_{OL}$, **overload is overtime.**

R	Parameter code	Descriptions	Setting range	Unit	Ex-factory set value
○	F105	Oscillation-inhibit gain	0.0~100.0	%	15.0

- ◆ When operating in some frequency bandwidth, the electric machine will produce current oscillation; then adjustment of this parametric set value can effectively correct this condition. The current oscillating bandwidth for a motor with higher horsepower will appear at a lower frequency bandwidth; therefore, it is advised to duly increase the set value. However, an excessive setting may easily produce an over-excited current, please make a suitable adjustment.

○	F106	V/F torque Compensation Setting	0.000~0.100	Pu	0.020
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- Ⓢ V/F linear curve theories are borrowed to provide means for proper promotion of the 0Hz corresponding output voltage so to improve insufficient torque of the motor as demonstrated in the lower rpm area.



- Ⓢ Excessive promotion will render the motor overload current, and further leading to the activation of functions (F82~F85) of limiting output current. Therefore, while confirming the status of output current displayed under F0=12, make the adjustment at the same for the optimal setting.
- Ⓢ Unless otherwise specified, 3Hz is sufficient to activate the motor to run in the V/F control mode.

×	F126	Control mode setup	-1~6		1
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- 📖 -1: Static electric parameter detection – This function is to be used for some machinery equipment that has been coupled with a heavy-duty yet cannot be performed the dynamic parameter detection; however, the F137 value (motor's no-load current %) must be accurately set; thus the motor's electric parameter group (F133~F136) can be fully detected with an accuracy lower than the 0: Electric parameter detection.

- 📖 0 : electric parameter detection – This function is to be enabled to perform the automatic tuning function for static and dynamic parameters that can measure the electric characteristics of motor automatically and enter the motor's parameters into the electric parameter group F133 ~ F137.

(Dynamic parameter tuning: When motor is performed a FWD revolution command to run at a frequency above 40HZ for one minute approximately, the inspection & testing of parameters at no-load or at a current below the motor's rated current for the coupled machine can be performed.)

※Note: Display Pr RL(Detecting function)

NO.2.20 version

R : **Parameter changeable during operation (○)**

R	Parameter code	Descriptions	Setting range	Unit	Ex-factory set value
×	F139	Magnetic Flux Estimator Bandwidth	1.0~20.0	Hz	3.0

- ◆ The setting value hour, the low speed torque is big, the rate error is quite small, the speed easy to produce not stably.
When the setting value is big, the low speed torque is small, the rate error is quite big, the speed is quite stable.

×	F140	Speed Estimator Bandwidth	1.0~20.0	Hz	6.0
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- ◆ The setting value hour, the velocity response is slow, when stable state is steady.
When the setting value is big, the velocity response is quick, when stable state is not steady.

×	F150	Torque Control Mode	0~1	Pu	0
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 Torque current limit.

 Torque current order.

×	F182	The torque control overspeed jumps machine the frequency	0.0~400.0	Hz	60.0
×	F183	PG broken line examination time	0.01~10.00	秒	3.00

- ◆ May establish the F182 torque control overspeed to jump machine the upper-frequency limit, when the torque control surpasses this upper limit, the frequency changer can jump Err 24.
- ◆ The PG broken line examination time can (F183), whether examine the Encoder wiring broken line perhaps not meet.

×	F201	Low-speed offset gain	100.0~180.0	%	140.0
×	F202	Torque offset cut-off frequency	0.00~0.60	Pu	0.20

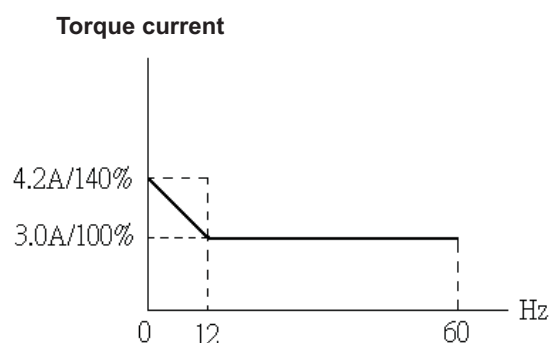
- ◆ F201 and F202 are functions in sensorless flux vector control mode and suitable for the equipments with low rpm and high torque.
- ◆ Torque offset is to take motor's no-load current as the base point while offset cut-off frequency is to take motor's rated frequency as the base point.

Note: The no-load current is the detected value for detecting motor's electric parameters.

Ex : motor's no-load current = 3.0A 、 motor's rated frequency = 60Hz ; F201 = 140% 、 F202 = 0.20

calculation formula : $3.0 \times 140\% = 4.2A$,

$60Hz \times 0.20 = 12Hz$



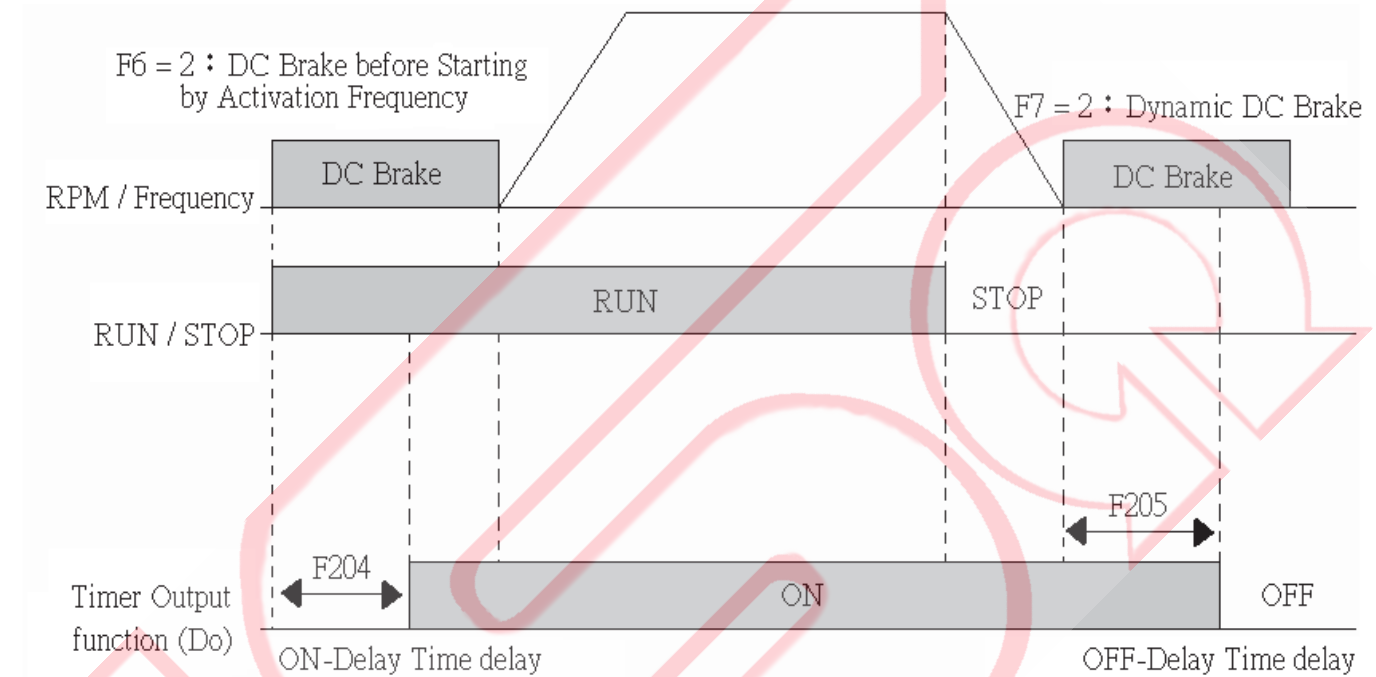
NO.2.20 version

R : **Parameter changeable during operation (○)**

R	Parameter code	Descriptions	Setting range	Unit	Ex-factory set value
×	F203	The encoder 1 gives the velocity filtering time	1.0~20.0	HZ	3.0

◆ The motor and the Encoder pulse wave will produce some miscellaneous news, may use this function filtration.

○	F204	ON-Delay Time delay	0.00~60.00	Second	0.00
○	F205	OFF-Delay Time delay	0.00~60.00	Second	0.00



200V series specifications

Model No.LS800-2□□□		0K2	0K4	0K7	1K5	2K2	4K0	5K5	7K5	011	015	018	022	030	037	045	055	075	090	110
Applicable motor power (K W)		0.2	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)		0.25	0.5	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150
Output	Rated output capacity (K V A)	0.6	1.2	1.7	2.7	3.8	6.4	9.5	12.5	17.5	23	29	34	45	57	68	82	114	133	162
	Continuous rated current (A)	1.6	3.2	4.5	7.0	10	17	25	33	46	62	76	90	120	150	180	215	300	350	425
	Max. output voltage (V)	3-phase corresponding input voltage																		
	Output frequency range (H z)	0.00～400.00Hz																		
	Carrier frequency (H z)	16K-HZ					12K-HZ				10K-HZ			8K-HZ			6K-HZ		5K-HZ	3K-HZ
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	±5%(47HZ～63HZ)																		
Cooling fan		Forced fan																		

400V series specifications

Model No.LS700-4□□□		0K7	1K5	2K2	4K0	5K5	7K5	011	015	018	022	030	037	045	055	075	090	110	132	160	185	220
Applicable motor power (K W)		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
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
Output	Rated output capacity (K V A)	2.4	3.4	5.3	6.8	9.5	13	19	24	30	34	47	57	70	87	110	144	164	210	228	265	340
	Continuous rated current (A)	3.2	4.5	7.0	9.0	12.5	17	25	32	40	46	62	75	92	115	150	180	216	275	300	350	450
	Max. output voltage (V)	3-phase corresponding input voltage																				
	Output frequency range (H z)	0.00~400.00Hz																				
	Carrier frequency (H z)	16K-HZ			12K-HZ			10K-HZ			8K-HZ			6K-HZ			5K-HZ			4K-HZ		3K-HZ
Power supply	Input voltage, frequency	3-phase 380V~480V 50/60HZ																				
	Tolerance for voltage fluctuation of power supply	±10%(342V~528V)																				
	Tolerance for frequency fluctuation of power supply	±5%(47HZ~63HZ)																				
Cooling fa		Forced fan																				

Flux Vector Model LS800 Series

■ Model Instructions

LS800 – 22K2

AC DRIVE Model
NumberPower : 2.2KW
2 : input 200V~240V
4 : input 380V~460V

■ STANDARD SPECIFICATIONS

200V Series	LS800 Model	20K7	21K5	22K2	24K0	25K5	27K5	2011	2015	2018	2022	2030	2037	2045	2055	2075	2090	2110
	Max.Motor(kw) Rated	0.75	1.5	2.2	4.0	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110
	Output Capacity(KVA) of Drive	1.7	2.8	4.2	6.0	9.1	12.2	17.5	23	29	34.7	44	55	67	82	110	140	160
	Rated Current(A) of Drive	4.5	7.5	11	16	24	33	46	61	76	90	115	145	175	215	300	350	450

400V Series	LS800 Model	40K7	41K5	42K2	44K0	45K5	47K5	4011	4015	4018	4022	4030	4037	4045	4055	4075	4090	4110	4132	4160	4185	4220
	Max.Motor(kw) Rated	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
	Output Capacity(KVA) of Drive	2.0	3.2	4.2	7.0	9.5	13	18	23.5	29	33	46	53	68	84	110	150	170	210	230	260	340
	Rated Current(A) of Drive	3.2	4.5	7.0	9.0	12	17	23	30	38	43	58	70	85	110	150	190	216	275	300	350	450

Item		220V Rating	400V Rating
Power source	Input Voltage, frequency	Three phase 220/208/220V 50/60Hz, 230V 60Hz	Three phase 380/400/415/440/460V 50/60Hz
	Allow Voltage Variance	+10%, -15%	
	Allow Frequency Variance	±5%	
	Max. Output Voltage	Three phase 220/208/220/230V corresponds to input voltage	Three phase 380/400/415/440/460V corresponds to input voltage
	Rated Output Frequency	Setting Max. Range 0.1Hz ~ 400Hz	
Control Characteristics	Control Model	Sine wave SVPWM two or three phase modulated switch frequency 2K ~ 16KHz adjustable, choose one of 5 control modes: V/f, V/f + closed loop, V/f sensorless, flux vector control + closed loop, and flux vector sensorless	
	Starting Torque	150% / speed zero (150% / 1Hz without PG card)	
	Range of Speed Control	1:1000 with PG card, 1:100 without PG card	
	Precision of Speed Control	±0.02% (±0.2% without PG card)	
	Torque Control	Four quadrant control, zero speed vector positioning control, variable and constant current torque control	
	Control Function	36 Indications, 8 command sources of rotation speed, speed searching, torque limits, zero speed vector control, variable and constant current torque control, sink and source option, multi-work input and output terminal control, 16 preset speeds control, option card, jump frequency, AVR, Auto-tuning dynamic motor parameters, S curve, slip compensation, torque compensation, upper and lower frequency setting, DC brake in start/stop, double PID function, power saving operation, intelligent water pump function setting, RS485/ Modbus communication.	
	Frequency Precision (Temperature Variation)	Digital signal: ±0.1% (-10°C ~ +40°C)	Analog signal: ±0.1% (25°C ~ ±10°C)
	Frequency Setting Resolution	Digital signal: 0.1Hz (0.1 ~ 400Hz) Analog signal : 0.1Hz/60Hz * (11bit + symbol)	
	Frequency Output Resolution	0.1Hz	
	Overload Limited	Rated current 150%, 1 Min.	
	Analog Rated Setting Signal	DC 0 ~ ±10V, 0 ~ 10V, 0 ~ 20 mA (499Ω, with PG card for impulse input control)	
	Time for Speed Acc/Dec	0.1 sec ~ 1200 sec, 4 adjustments are individually distributed to 16 speeds	
	Torque for Braking	About 20%, up to 125% with braking controller	
Protection Function	Motor Protection	Integral electrical thermo protection	
	Instantaneous Over Current	When over 200% rated current and skip current protection, motor stops	
	Overload	About 150% rated output current, motor stops after 1 Min.	
	Over Voltage	DC voltage in main circuit about 400V, motor stops	DC voltage in main circuit about 800V, motor stops
	Low Voltage	DC voltage in main circuit below 180V, motor stops	DC voltage in main circuit below 380V, motor stops
	Power Protection	Input (equipped above 5.5KW), output phase lag protection (equipped above 0.4KW)	
	Instantaneous Power Break Compensation	Factory setting: Instantaneous power break, motor stops in 15 ms	
	Ventilation Over-heat	Protected, by thermo-switch, can be read and monitored	
	Stall Prevention	In speed Acc/Dec, stall prevention during operation	
	Ground Protection	Electrical circuit protection	
Environment	Charging Indicating	DC voltage in main circuit over 50V, charging light is "on"	
	Location	Indoor, no corrosive and free from dust	
	Ambient Temp.	-10 ~ +40°C (closed and wall mounted type), -10 ~ +45°C (open type), no freezing	
	Storage Temp. (*2)	-20 ~ +60°C	
	Vibration	1G below 20Hz, 0.2G during 20 ~ 50Hz	

(Note 1) Max. applicable capacity of motor is based on 4-pole motor. (Note 2) If storage temperature is too high, it might destroy the capacitor in main circuit.

(Note 3) Large capacity under development, please contact us.

200V Series

KW	20K 4	20K 7	21K 5	22K 2	24K 0	25K 5	27K 5	2011	2015
HP	0.5	1	2	3	5	7.5	10	15	20
F106	0.040	0.040	0.030	0.030	0.025	0.025	0.020	0.020	0.015
F108	5000	5000	5000	5000	5000	5000	5000	5000	5000
F109	220 v	220 v	220 v	220 v	220 v	220 v	220 v	220 v	220 v
F120	220 v	220 v	220 v	220 v	220 v	220 v	220 v	220 v	220 v
F121	2.0 A	3.5 A	6.0 A	8.2 A	15 A	20 A	27 A	38 A	50 A
F122	60 H z	60 H z	60 H z	60 H z	60 H z	60 H z	60 H z	60 H z	60 H z
F123	1680	1710	1710	1720	1720	1740	1740	1755	1755
F124	0.5 HP	1.0 HP	2.0 HP	3.0 HP	5.0 HP	7.5 HP	10 HP	15 HP	20 HP
F125	4P	4P	4P	4P	4P	4P	4P	4P	4P

KW	2018	2022	2030	2037	2045	2055	2075	2090	2110
HP	25	30	40	50	60	75	100	125	150
F106	0.015	0.010	0.010	0.008	0.008	0.006	0.006	0.003	0.003
F108	5000	5000	5000	5000	5000	3000	3000	3000	2000
F109	220 v	220 v	220 v	220 v	220 v	220 v	220 v	220 v	220 v
F120	220 v	220 v	220 v	220 v	220 v	220 v	220 v	220 v	220 v
F121	62 A	75 A	97 A	128 A	150 A	187 A	235 A	300 A	355 A
F122	60 H z	60 H z	60 H z	60 H z	60 H z	60 H z	60 H z	60 H z	60 H z
F123	1760	1760	1760	1775	1775	1780	1780	1780	1780
F124	25 HP	30 HP	40 HP	50 HP	60 HP	75 HP	100 HP	125 HP	150 HP
F125	4P	4P	4P	4P	4P	4P	4P	4P	4P

400V Series

KW	40K 7	41K 5	42K 2	44K 0	45K 5	47K 5	4011	4015	4018	4022	4030
HP	1	2	3	5	7.5	10	15	20	25	30	40
F106	0.040	0.030	0.030	0.025	0.025	0.020	0.020	0.015	0.015	0.010	0.010
F108	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
F109	380 v	380 v	380 v	380 v	380 v	380 v	380 v	380 v	380 v	380 v	380 v
F120	380 v	380 v	380 v	380 v	380 v	380 v	380 v	380 v	380 v	380 v	380 v
F121	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
F122	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz
F123	1710	1710	1720	1720	1740	1740	1755	1755	1760	1760	1760
F124	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
F125	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P

KW	4037	4045	4055	4075	4090	4110	4132	4160	4185	4220	Reserve
HP	50	60	75	100	125	150	175	200	250	300	
F106	0.008	0.008	0.006	0.006	0.003	0.003	0.003	0.003	0.003	0.003	
F108	5000	5000	4000	4000	3000	3000	3000	3000	2000	2000	
F109	380 v	380 v	380 v	380 v	380 v	380 v	380 v	380 v	380 v	380 v	
F120	380 v	380 v	380 v	380 v	380 v	380 v	380 v	380 v	380 v	380 v	
F121	72 A	84 A	108 A	135 A	165 A	210 A	260 A	290 A	340 A	385 A	Reserve
F122	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	
F123	1775	1775	1780	1780	1780	1780	1780	1780	1780	1780	
F124	50 HP	60 HP	75 HP	100 HP	125 HP	150 HP	175 HP	200 HP	250 HP	300 HP	
F125	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P	