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SV-iV5 User Manual

2.2~37kW(200VAC) / 2.2~500 kW (400VAC) / 5.5~500kW(400VDC)

Safety Instructions

- Read this manual carefully before installing, wiring, operating, servicing or inspecting this equipment.
- Keep this manual within easy reach for quick reference.

LSIS

This User's Manual is aimed at.....

Describing specification, installation, operation, function, and maintenance of SV-iV5 series inverter provided for the users who are familiar with and having basic experience in the inverter.

Be sure to understand function, performance, installation, and operation of the product by reading through this User's Manual completely prior to your use of SV-iV5 series inverter that you have purchased. In addition, you are required to have this User's Manual properly delivered to the end-user and maintenance manager.

■ Option Module Guide

The following Option Module Guides will be provided when you purchase the applicable Option Module. In addition, if you access our homepage http://www.lsis.biz/ [Customer Support] - [Download Data Room], you can download it in PDF file.

- IV5 EL (Elevator) I/O Option Module Guide (Korean)
- IV5 SYNC Option Module Guide (Korean)
- IV5 SIN/COS Encoder Card Option Module Guide (Korean)
- IP5A/IV5 RS-485 & Modbus-RTU Option Module Guide (Korean)
- IS5/IP5A/IV5 Profibus-DP Card Option Module Guide (Korean)
- IS5/IP5A/IV5 DeviceNet Card Option Module Guide (Korean)
- IP5A/IV5 CC-Link Card Option Module Guide (Korean)

Safety Instructions

To prevent injury and property damage, follow these instructions. Incorrect operation due to ignoring instructions will cause harm or damage.

The seriousness of which is indicated by the following symbols.

Symbol		Meaning
	Warning	**This symbol indicates the possibility of death or serious injury.**
	Caution	**This symbol indicates the possibility of injury or damage to property.**

Remark

- Even if the instructions are indicated as 'Caution', it can cause a serious result according to the kind of operation and the environment.

The meaning of each symbol in this manual and on your equipment is as follows.

Symbol	Meaning
	This is the safety alert symbol. **Read and follow instructions carefully to avoid dangerous situation.**
	This symbol alerts the user to the presence of "dangerous voltage" inside the product that might cause harm or electric shock.

After reading this manual, keep it in the place that the user always can contact easily.

This manual should be given to the person who actually uses the products and is responsible for their maintenance.

WARNING

- **Do not remove the cover while power is applied or the unit is in operation.**
  Otherwise, electric shock could occur.
- **Do not run the inverter with the front cover removed.**
  Otherwise, you may get an electric shock due to high voltage terminals or charged capacitor exposure.
- **Do not remove the cover except for periodic inspections or wiring, even if the input power is not applied.**
  Otherwise, you may access the charged circuits and get an electric shock.
- **Wiring and periodic inspections should be performed at least 10 minutes**

WARNING

after disconnecting the input power and after checking the DC link voltage is discharged with a meter (below DC 30V).

Otherwise, you may get an electric shock.

- **Operate the switches with dry hands.**

  Otherwise, you may get an electric shock.

- **Do not use the cable when its insulating tube is damaged.**

  Otherwise, you may get an electric shock.

- **Do not subject the cables to scratches, excessive stress, heavy loads or pinching.**

  Otherwise, you may get an electric shock.

⚠ CAUTION

- **Install the inverter on a non-flammable surface. Do not place flammable material nearby.**

  Otherwise, fire could occur.

- **Disconnect immediately the input power if the inverter gets damaged.**

  Otherwise, it could result in a secondary accident and fire.

- **After the input power is applied or removed, the inverter will remain hot for a couple of minutes.**

  Otherwise, you may get bodily injuries such as skin-burn or damage.

- **Do not apply power to a damaged inverter or to an inverter with parts missing even if the installation is complete.**

  Otherwise, electric shock could occur.

- **Do not allow lint, paper, wood chips, dust, metallic chips or other foreign matter into the drive.**

  Otherwise, fire or accident could occur.

Caution for Use

■ Transportation and Installation

- Be sure to carry inverter in a proper way suitable for its weight, or it may result in damage to inverter.
- Be sure to use heat-treated wooden crate when you adopt wooden packaging for the product.
- Do not pile up inverters above allowable limit.
- Be sure to install the inverter as directed in this instruction manual.
- Do not turn off the power supply to the damaged inverter.
- Do not open the front cover while carrying the inverter.
- Do not place the heavy material on the inverter.
- The direction of installation should be observed properly as criterions specified in this manual show.
- Make sure that you should not put screw, metal material, water, oil and the inflammable something else.
- Keep in mind that inverter is very vulnerable to drop from the mid air and strong shock.
- Don't let the inverter exposed to rain, snow, fog, dust, etc.
- Do not cover, nor block, the ventilating system having cooling fan. It may cause the inverter overheated.
- Be sure to check the power is off when installing the inverter.
- To prevent the risk of fire or electric shock, keep the connected wire in a sound condition. Use the wire that meets the standard in a recommended length.
- Be sure to ground the inverter. (Under 10 Ω to 200V class, Under 100 Ω to 400V class)

- Be certain to use the inverter under the following conditions.

Environment	Description
Ambient Temperature	- 10 ~ 40 ℃ (Non-frozen) (Less than 80% load is recommended at 50℃.)
Ambient Humidity	Below 90% RH (Dewdrop should not be formed)
Storage Temperature	-20 ~ 65℃
Ambient Condition	Free of corrosive gas, inflammable gas, oil sludge and dust, etc
Altitude/Vibration	Below 1000m above sea level, Below 5.9m/sec² (=0.6g)
Ambient Air Pressure	70 ~ 106 kPa

■ Wiring

⚠ Caution

- **A professional installer should have done the wiring and checking.**

- Do wiring after installing the inverter body.
- Do not connect phase-leading capacitors, surge filter, radio noise filter to the output of inverter.
- Output terminals (terminals named U, V, W respectively) should be connected in a proper phase sequence.
- Make sure that there is not any short circuit terminal, wrong wiring. It may cause spurious operation or failure.
- Refrain from using a cable other than the cable shielded when you connect control circuit wiring.
- Adopt the shielded wire only when wiring the control circuit. It may cause the failure of inverter in its operation. Use the twisted pair shield wire for the ground terminal of the inverter.

⚠ Warning

- **To prevent an electric shock, be sure to check if MCCB and MC are switched OFF before wiring**

  Otherwise, it may cause an electric shock.

■ Adjustment before starting trial operation

- Do not supply the excessive range of voltage displayed in the user manual to the each terminal. It may cause damage to the inverter.
- Current hunting can be occurred in the low speed territory during testing. It occurs where the capacity is above 110kW with no-load and the axis is not connected. The current hunting has a gap according to the motor characteristic. It will be disappeared when the load is connected and it is not the indication of abnormal condition.
  If the hunting is occurred seriously, please stop the testing and operates with the load.
- Be sure to check relevant parameters for the application before starting trial operation.

■ How to Use

- Be sure not to approach the machine when retry function is selected. The machine may start working suddenly.
- Stop key on the keypad should be set to be in use. For safety, additional emergency stop circuit should be required.
- Inverter restarts if alarm condition is cleared while FX/RX signal is on. Therefore, be sure to operate the alarm reset switch after checking if FX / RX signal is off.
- Never modify the inverter for inappropriate use.
- When a magnetic contactor is installed on the power source, do not frequently start or stop using this magnetic contactor. It may cause the failure of inverter.

- Noise filter should be used for the minimization of troubles by electro-magnetic noise. Electronic equipments close to the inverter should be protected against the damage caused by troubles.
- Be sure to install the AC reactor at the input of inverter in case of input voltage unbalance. Otherwise, generator or phase-leading capacitors may be destroyed by the harmonic current from inverter.
- If 400V class motor is used with the inverter, insulation-enforced motor should be used or countermeasures against the suppression of micro-surge voltage generated by the inverter should be carried out.
  Otherwise, micro-surge voltage is generated across input terminal for the motor and this voltage lowers allowable insulation break-down voltage and then, may cause the destruction of the motor.
- Be sure to set the parameters once more, in case of initialization of parameters, all values of parameters is set to values of factory setting.
- High speed operation can be set easily, therefore be sure to check the performance of motor or machine before changing parameter value.
- DC braking function cannot produce a zero-servo torque. If required, additional equipment should be installed.
- When inverter trip or emergency stop (BX) occurs without keypad connected, LED on the control board will blink by the interval of 0.5 sec. But LED will blink by 1 sec when keypad is connected. This function displays which trip will be occurred according to the connection of keypad.
- Do not change wiring, nor disconnect connector or option card during the operation of inverter.
- Do not disconnect the motor wiring while the voltage of inverter is output. Mishandling may cause damage to the inverter.
- Be sure to handle the inverter and option care in the order recommended in the Electro Static Discharge (ESD) Countermeasure. Mishandling may lead to damage to the circuit on the PCB caused by ESD.

■ Countermeasure against malfunction troubles

- If inverter is damaged and then gets into uncontrollable situation, the machine may lead to the dangerous situation, therefore to avoid this situation, be sure to install the additional equipments such as brake.

■ Maintenance, inspection and parts replacement

- Do not perform the megger (insulation resistance check) test on the control board.
- Please refer to intervals for parts replacement on Chapter 8.

■ Disposal

- Handle the inverter as an industrial waste when disposing of it.
- Our inverter contains the raw material of value that can be recycled from the aspect of energy and resource preservation. All the package materials and metal parts are recyclable. Plastics are also recyclable, but may be burnt under the controllable environment depending on the local regulation.

■ General Instruction

- The drawing in this user manual is represented the details of the inner inverter, so, the drawing is described without cover part and circuit breaker. But, cover and circuit breaker should be mounted before the operation following to the instruction of user manual.
- Turn off the power of inverter when the inverter is not used.

■ Cleaning

- Be sure to operate the inverter under a clean condition.
- When cleaning the inverter, be sure to check the inverter is off. Start cleaning it with all the plugs connected with the inverter socket removed.
- Never clean the inverter using wet cloth or water. Wipe the stained area softly using the cloth completely wet with a neutral detergent or ethanol.
- Never use the solution such as acetone, benzene, toluene, alcohol, etc. They may cause the coating on the surface of the inverter to peel off. In addition, do not clean LCD display, etc. using detergent or alcohol.

■ Storage

Be sure to keep the inverter under the following conditions if you don't use it for a long period of time.

- Make sure that you satisfy the recommended storage environment. (See page v.)
- If the storage period exceeds 3 months, be sure to keep it at the ambient temperature of -10 ~ +30˚C to prevent 『Deterioration by Temperature』 of electrolytic condenser.
- Be sure to keep it in a proper package to prevent moisture, etc. Put the desiccant (Silica Gel), etc., in the package so that the relative humidity in the package can be maintained at 70% or less.
- When it is exposed to moisture or dust (mounted on the 『System』 or 『Control Panel』, etc. installed at the construction site), remove it and then keep it under the environmental condition specified in the page v.

⚠ Caution

- **If the inverter has been left long with electric current not charged, the nature of electrolytic condenser can be deteriorated. So be sure to have it plugged in for 30 ~ 60 minutes once a year. Do not perform wiring and operation of the output side (secondary side).**

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Chapter 1 - Introduction

This instruction manual is designed for **LS STARVERT-iV5 series Vector Control Inverters**, which have excellent characteristics in speed and torque control with pulse encoder mounted on the shaft of 3 phase induction motor, and covers installation, maintenance, wiring and operation for these inverters.

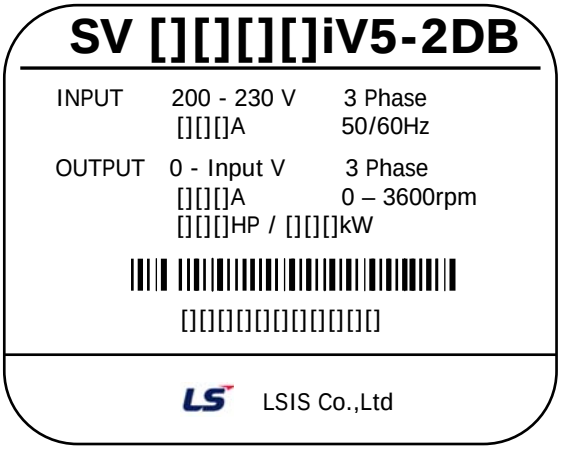
1.1 Key Features

- Current Controlled Vector Control Inverter with Speed Sensor using IGBT as Power Semiconductor Device.
- Tension/Torque Control and Wide Variety of Process Control
- Process PI Control, Draw Control, Droop Control, Synchronous Control, WEB Control etc.
- Auto-tuning of Motor Parameters for Precise Speed/Torque Control: Rotational/Standstill mode
- Encoder error (H/W and S/W) Detection Function
- Auxiliary Battery Function and Emgergent Operation by Battery Operation
- Various Option for Communication and Application
- Inverter Application

Application	Applicable Machine/System	Features
Process Control	● Steel Strip ● Paper Mill ● Textile ● Film ● Coater ● Printing Machine	Tension Control Wide Range of Speed Control
Hoisting Control	● Lifts (Elevators) ● Parking ● Stacker Crane ● Crane ● Hoist	High Speed Operation High Starting Torque Positioning Wide Range of Speed Control
Machine Control	● Machine Tool ● Wire Drawing ● Extruder	High Speed Operation High Starting Torque Positioning
Others	● Conveyor ● Industrial Washing Machine	High Speed Operation Positioning

1.2 Inverter Nameplate and Model

1.2.1 Inverter nameplate (Example)



- Input Power Source Specifications
- Rated Capacity
- Output Power Source Specifications
- Running Freq. / Rated Output Current
- Output Capacity
- Bar Code
- Serial Code

1.2.2 Inverter Model Name

SV [][][][] iV5 – 2 DB (MD) (380V) (ENC)

- **LS STARVERT Series**
- **Max. Applicable Motor**

  022 : 2.2kW ~ 5000 : 500kW
- **iV5 Series**
- **Input Voltage**

  2 : 200V Class (200 ~ 230V) ,

  4 : 400V Class (380 ~ 480V)
- **Built-in DB Circuit**

  DB : Built-in DB Circuit (DB Resistors Integrated)

  Blank : No Built-in DB Circuit (Use external DB Unit)
- **MD : Mold Type (2.2~22kW)**

  DC : DC Power Input

  (Electrical specification of MD type is based on specifications of 5.5~2.2kW except for the specification of exterior and its size.)
- **Input Voltage**

  (380V) : 380V Input Voltage – 30~220kW(400V)

  Blank : Below 22kW (200V/400V) 280~500kW(400V)
- **ENCODER TYPE**

  - Blank : 5V Line Drive, 15V Open Collector

  - 24V ENC : 24V Line Drive/Open Collector

Chapter 2 - Specification

2.1 Standard Specification

2.1.1 200V Class (AC power input type)

SV[][][]iV5-2(DB)		022	037	055	075	110	150	185	220	300	370
Max. applicable motor output Note1)	[HP]	3	5	7.5	10	15	20	25	30	40	50
	[kW]	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37
Output	Capacity [kVA](Note2)	4.5	6.1	9.1	12.2	17.5	22.5	28.2	33.1	46	55
	Rated current [A]	12	16	24	32	46	59	74	88	122	146
	Speed	0 ~ 3600(rpm)									
	Voltage	0 ~ 200V (230V(Note3))									
Input	Voltage	3ϕ 200 ~ 230V(-10% ~ +10%)									
	Frequency	50 ~ 60Hz(±5%)									
Inverter weight [kg(lbs)]		6 (13)	6 (13)	14 (30)	14 (30)	27.5 (60)	27.5 (60)	28 (61)	28 (61)	42 (93)	42 (93)

2.1.2 400V Class (AC power input type)

SV[][][][]iV5-4(DB)		022	037	055	075	110	150	185	220	300	370	450
Max. applicable motor output Note1)	[HP]	3	5	7.5	10	15	20	25	30	40	50	60
	[kW]	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45
Output	Capacity [kVA](Note2)	4.5	6.1	9.1	12.2	18.3	22.9	29.7	34.3	46	57	70
	Rated Current [A]	6	8	12	16	24	30	39	45	61	75	91
	Speed	0 ~ 3600(rpm)										
	Voltage	0 ~ 380V (480(Note3))										
Inverter weight [kg(lbs)]		6 (13)	6 (13)	14 (30)	14 (30)	27 (59)	28 (61)	28 (61)	28 (61)	42 (93)	42 (93)	63 (139)
Input	Voltage	3ϕ 380 ~ 480V(-10% ~ +10%)(Note4)										
	Frequency	50 ~ 60 Hz (±5%)										

SV[][][][]iV5-4(DB)		550	750	900	1100	1320	1600	2200	2800	3150	3750	5000
Max. applicable motor output Note1)	[HP]	75	100	120	150	175	215	300	373	420	500	666
	[kW]	55	75	90	110	132	160	220	280	315	375	500
Output	Capacity [kVA](Note2)	85	116	140	170	200	250	329	416	468	557	732
	Rated Current [A]	110	152	183	223	264	325	432	546	614	731	960
	Speed	0 ~ 3600(rpm)										
	Voltage	380 ~ 480V(Note3)										
Inverter weight [kg(lbs)]		63 (139)	68 (150)	98 (216)	98 (216)	122 (269)	122 (269)	175 (386)	243 (536)	380 (838)	380 (838)	476 (1050)
Input	Voltage	3ϕ 380 ~ 480V(-10% ~ +10%)(Note4)										
	Frequency	50 ~ 60 Hz (±5%)										

※ The electrical specifications of the MD type (2.2~22kW Class) are the same as the above.
(In case of 2.2 and 3.7 KW products, refer to the weight in above table.)

SV[][][]iV5-2/4DB(MD)	055	075	110	150	185	220
Inverter weight [kg(lbs)]	7.7(16.9)	7.7(16.9)	13.7(30.2)	13.7(30.2)	20.3(44.7)	20.3(44.7)

2.1.3 400V Class (DC power input type)

SV[][][]iV5-4DC		055	075	110	150	185	220	300	370	450	550
Max. applicable motor output Note1)	[HP]	7.5	10	15	20	25	30	40	50	60	75
	[kW]	5.5	7.5	11	15	18.5	22	30	37	45	55
Output	Capacity [kVA](Note2)	9.1	12.2	18.3	22.9	29.7	34.3	46	57	70	85
	Rated Current [A]	12	16	24	30	39	45	61	75	91	110
	Speed	0 ~ 3600(rpm)									
	Voltage	0 ~ 380V (480V(note3))									
Input rated voltage		DC 540 ~ 680V(+10%)(note5)									
Inverter weight [kg (lbs)]		12 (26)	12 (26)	24 (53)	24.5 (54)	25 (55)	25 (55)	38.5 (84)	38.5 (84)	50 (110)	50 (110)

SV[][][]iV5-4DC		750	900	1100	1320	1600	2200	2800	3150	3750	5000
Max. applicable motor output Note1)	[HP]	100	120	150	175	215	300	373	420	500	666
	[kW]	75	90	110	132	160	220	280	315	375	500
Output	Capacity [kVA] Note2)	116	140	170	200	250	329	416	468	557	732
	Rated Current [A]	152	183	223	264	325	432	546	614	731	960
	Speed	0 ~ 3600(rpm)									
	Voltage	0 ~ 380V (480V(note3))									
Input rated voltage		DC 540 ~ 680V(+10%) note5)									
Inverter weight [kg (lbs)]		55 (121)	79 (174)	79 (174)	98.5 (217)	98.5 (217)	154.5 (340)	206 (454)	343 (756)	343 (756)	466 (1028)

Note)

1. It represents the output capacity of maximum applicable motor in case 4 poles of motor is used. (200V is based on 220V and 400V is based on 440V.)
2. Rated capacity (= √ 3*V*I) is calculated based on 220V for 200V class, 440V for 400V class.
3. Maximum output voltage cannot be generated above specified input voltage.
4. Derate the rated current by 10% when the input voltage is in the range above 480V.
5. Rated current is derated by 10 % above 680 VDC of input voltage.

2.2 Common Specification

Items			Detailed Specification
Inverter type			Voltage source inverter using IGBT
Control	Control method		● Field oriented vector control inverter with speed sensor attached
	Speed control accuracy		● Analog setting: ± 0.01%(25 ± 10℃) of max. Speed (1,800 rpm) ● Digital setting: ± 0.01%(0 ~ 40℃) of max. Speed (1,800 rpm)
	Speed setting resolution		● Analog setting: ± 0.1% of maximum Speed ● Digital setting: 0.1 rpm
	Cut-off frequency of ASR		50Hz
	Torque control accuracy		3%
	Overload Capacity		CT: 150%/1Min
	Accel/ Decel	Time setting	0.00 ~ 6000.0 sec (Time unit can be set)
		Combination	4 Combinations of acceleration/Deceleration Time
		Pattern	Linear, S-Curve
Braking	Braking method		Dynamic braking using external resistors
	Braking torque		150%
	Braking resistor		External braking resistor should be provided.
Input	Speed settings		● Digital setting via keypad ● Multi-step speed setting by input terminal selection ● Analog input settings of –10~10V or 4~20mA ● Remote setting by option card
	Analog input		● 3 channels (AI1, AI2, AI3*, (AI4,AI5: Extended I/O)) ● -10→10V, 10→10V, 0→10V, 10→0V,0→20mA, 20→0mA, (*AI3(AI5:Extended I/O): Motor NTC/PTC selectable) ● Selectable among 15 different user-defined functions ● AI3, AI5(Motor NTC):only available with LG-OTIS motors.
	Contact input		● FX, RX, BX, RST, P1 ~ P7 ● Selectable among 42 different user-defined input functions
Output	Analog output		● 2 channels (AO1, AO2) ● -10V → 10V, 10 → -10V, 0 → 10V, 10 → 0V output ● Selectable among 41 different user-defined functions
	Contact output		● 2 channels (1A-1B, 2A-2B) ● Fault alarm relay: 1 channel (30A-30C, 30B-30C)
	Open Collector		1 Channel (OC1/EG)
Protection			Overcurrent, Overvoltage, Low voltage, Inverter overheat, Inverter thermal sensor malfunction, Motor overheat, Motor thermal sensor malfunction, Overspeed, Instantaneous IGBT gate block (BX), Fuse blown open, External Trip, Pulse encoder malfunction, Electronic thermal function, Inverter overload, Ground fault current, IGBT short, Communication error, FAN power error
Environment	Installation condition		Indoor, Free of Corrosive gas and Direct sunlight (Pollution Degree 2)
	Ambient temperature		-10 ~ 40°C (Non-frozen condition)
	Humidity		Below RH 90% (Dewdrop should not be formed)

Items		Detailed Specification
	Cooling method	Forced ventilation by cooling fan
	IP Type	IP00: 2.2 ~ 22 kW (MD), 30 ~ 500 kW IP20: 5.5 ~ 22 kW (Press)
	Altitude, Vibration	Below 1000m above sea level, Below 5.9m/s^2 (=0.6G)

Chapter 3 – Installation and Wiring

This chapter describes general items for the installation and wiring of an inverter and includes instruction for wiring to power terminal and control one and caution in case of wiring, and also explains the function of each terminal for both power and control.

Be sure to check mechanical and electrical installation environment before you start the inverter. Read through the checking list below. Be sure to read through the Caution for Safety on this User's Manual prior to the operation of inverter.

Checking List

- Mechanical Installation Checking List
  - Be sure to check the surrounding environment is allowed for operation. (Read through the 'Caution on Installation')
  - Inverter is a heat-generating device. Be sure to sufficiently secure the surrounding space to prevent thermal saturation phenomenon.
  - Be sure to check air is circulated in a normal condition.
  - Be sure to check motor and drive system are ready to start.

- Electrical Installation Checking List
  - Make sure that the protective grounding is properly done.
  - Replace the condenser with new one if it lasted longer than two years.
  - Set the input voltage to the nominal input voltage of the inverter.
  - Check if the input voltage connected with R, S, T and then fasten them tightly using an accurate torque wrench.
  - Check if input power fuse and circuit breaker are properly installed.
  - Install the motor cable away from the other cable.
  - Check if the ext. input/output is properly connected.
  - Check if the input voltage is properly connected with the output terminal of inverter.

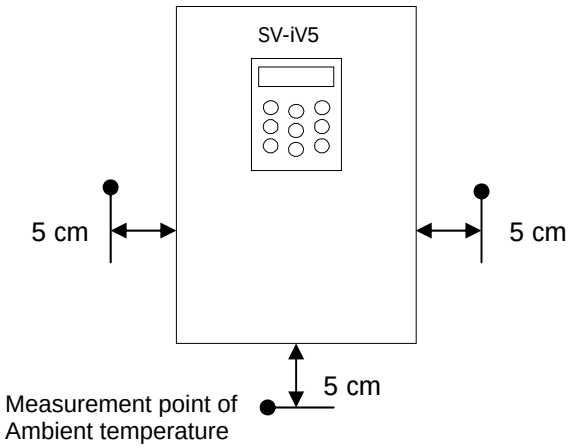
3.1 Caution on Installation

3.1.1 Do not install the inverter in a location where excessive vibration is present.

Be cautious when installing on presses or moving equipment.

3.1.2 Caution on ambient temperature

Ambient temperature greatly affects inverter lifetime, therefore be sure to keep the ambient temperature of installation location at –10 to 40℃.



3.1.3 Install the inverter on the uninflammable material. The inverter operates at high-temperature.

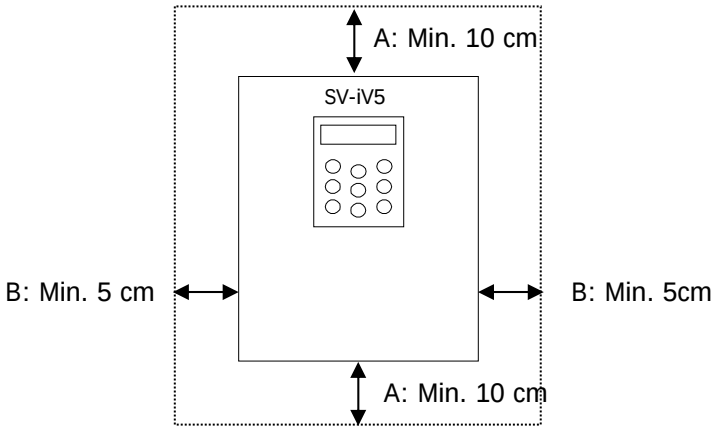
3.1.4 Avoid a humid and hot location.

3.1.5 Install the inverter in a location free of oil mist and dust.

Totally enclosed panel can be used to protect the inverter against that materials.

Cooling air must be clean, free from corrosive materials and electrically conductive dust.

3.1.6 Secure the installation space enough to protect the inverter against the overheating.



At least the room that 30 cm from upper and lower of inverter and 20 cm from left and right of inverter is required for installing more than 30 kW products.

3.1.7 Special care should be taken in case the inverter is to be installed in the panel.

In case more than 2 inverters are to be installed or ventilation fan is to be installed in the panel, make sure that inverter and ventilation fan is properly installed. If they are poorly installed, it causes the increase of an ambient temperature and less effective ventilation. Therefore, be sure to keep the ambient temperature of inverter below the allowable temperature.

3.1.8 Install the inverter tightly not to get loose using proper sized bolt or screw.

3.2 Basic Wiring

Do the wiring of inverter and then check the wiring of main circuit and control circuit before starting it. Read through the checking list as below.

Checking List

Is the inverter supplied in the form as ordered?

- Are the type and numbers of peripherals (Resistance, DC reactor, Noise filter, etc.) supplied as ordered?
- Is the type of option supplied as supplied?

Place of the inverter to be installed and how to install it

- Is the inverter installed on a right place in a right way?

Power voltage, Output voltage

- Is power voltage within the range of inverter input voltage specified?
- Does the rated output comply with the inverter output specification?
- Is the rating done properly?

Main Circuit Wiring

- Is the power input using the circuit breaker?
- Is the rating of the circuit breaker done properly?
- Is the power wiring input properly to the inverter input terminal? [If the input power is connected with the input terminal (U, V, W) it may cause damage to the inverter]
- Is the motor wiring connected with the inverter output terminal in a proper phase sequence? (Otherwise, the motor will be rotated adversely.)
- Is 600V vinyl insulation wire adopted for the power and motor wires?
- Is the main circuit wire in a proper size?
- Is the ground line installed in a proper way?
- Are the screws of the main circuit terminal and the ground terminal fastened tightly?
- In the event several motors are operated with one inverter, does each motor have a overload protecting circuit?
- In the event it adopts braking resistance or braking resistance unit, is an electronic contactor installed at the inverter power side so as to isolate the inverter from the power by protecting the resistance from overload?
- Isn't power condenser, surge killer, or radio noise filter connected with the output side?

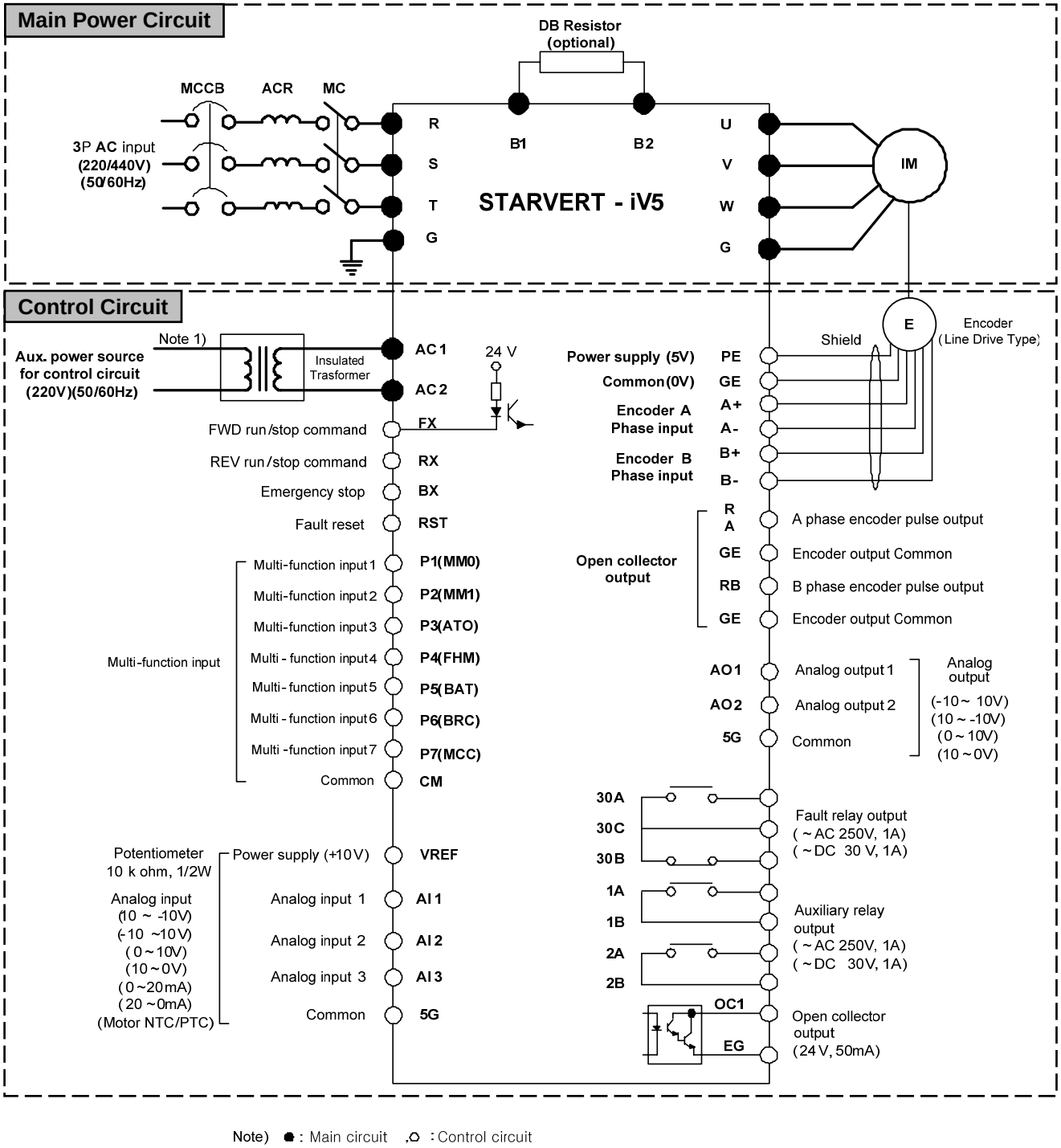
Control Circuit Wiring

- Is a twisted pair shielded wire adopted for the inverter control circuit wiring?
- Is the covered wire with shield connected with the ground terminal?
- In the event it is operated in 3-Wire sequence, is the control circuit wiring done after the parameter of multi-function contact input terminal is modified?
- Is the wiring of the optional devices done properly?
- Aren't there any wiring mis-connected?
- Are the inverter control circuit terminal screws fastened tightly?
- Aren't there any wire fragments or screw left?
- Doesn't the remaining wire connected with the terminal contact the terminals nearby?
- Is the control circuit wiring isolated from the main circuit wiring in the duct or control panel?
- Doesn't the length of wiring exceed 300m ? (In the case of the produce of 3.7kW or less, the entire length of wiring should be 100m or less)
- Doesn't the wiring of safety input exceed 30m?

■ **AC Power Input Type:**

SV022, 037, 055, 075, 110, 150, 185, 220iV5-2(DB)

SV022, 037, 055, 075, 110, 150, 185, 220iV5-4(DB)



Note) ● : Main circuit ,○ : Control circuit

※ 5G: Encoder power source common terminal for SV022/037iV5

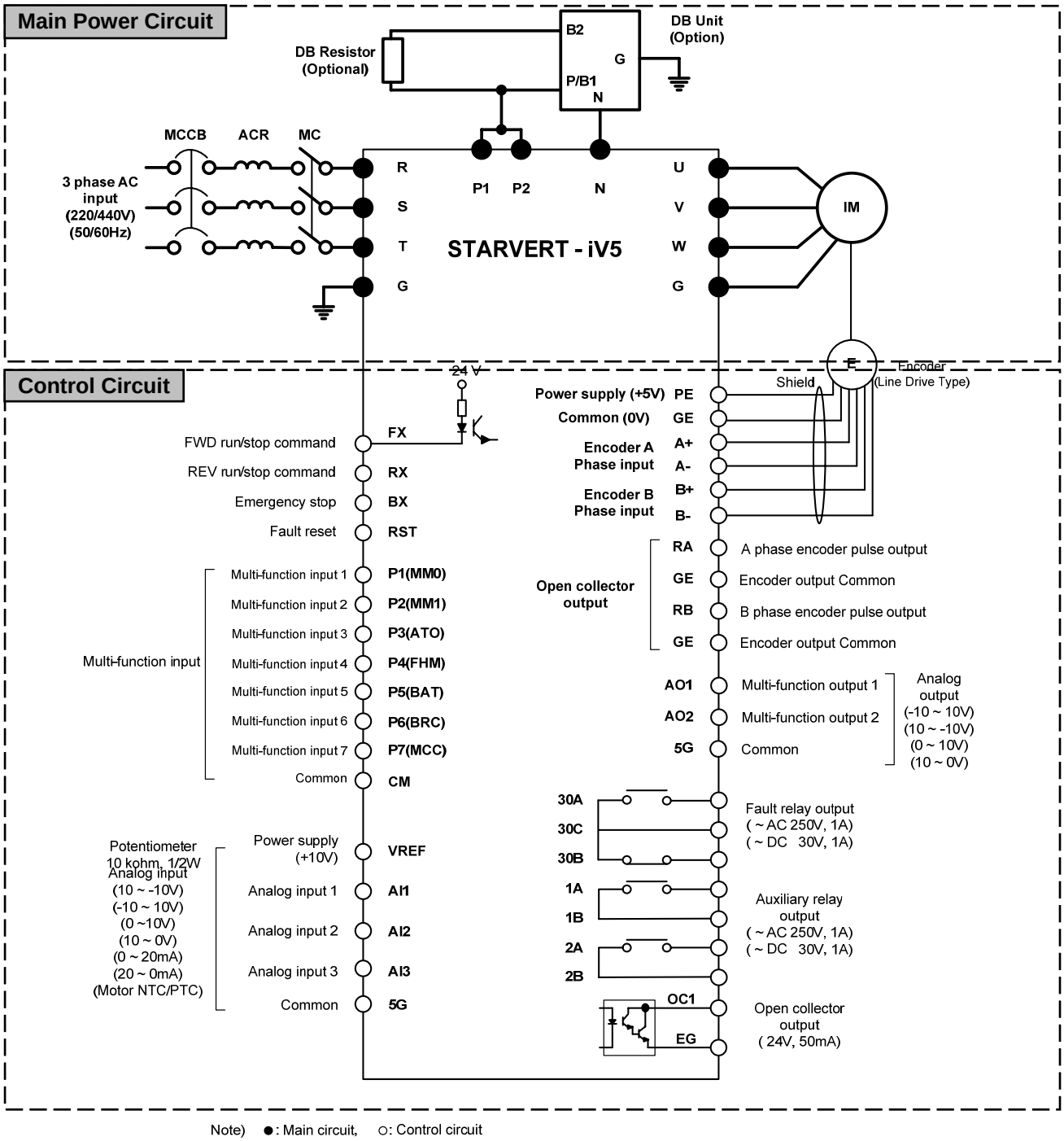
Note 1) It is used when inverter control circuit is energized from auxiliary power source (220 VAC) separated from main power supply. Use insulated transformer to separate from main power supply. (Transformer capacity: Above 100VA recommended)

■ **AC Power Input Type**

SV300, 370iV5-2

SV300, 370, 450, 550, 750, 900, 1100, 1320, 1600, 2200, 2800, 3150, 3750iV5-4

Note: AC Fans for 300~2200iV5-4 series should be changed the input power source of transformer 1st tap corresponding with that of inverter. (Factory default is 380VAC)



Note) ●: Main circuit, ○: Control circuit

※ SIO terminal indication for SV2800~3750iV5: PE → PENT, GE → G24X

Note 1) It is used when inverter control circuit is energized from auxiliary power source (220 VAC) without main power supply. Use insulated transformer to separate from main power supply. (Transformer capacity: above 100VA recommended)

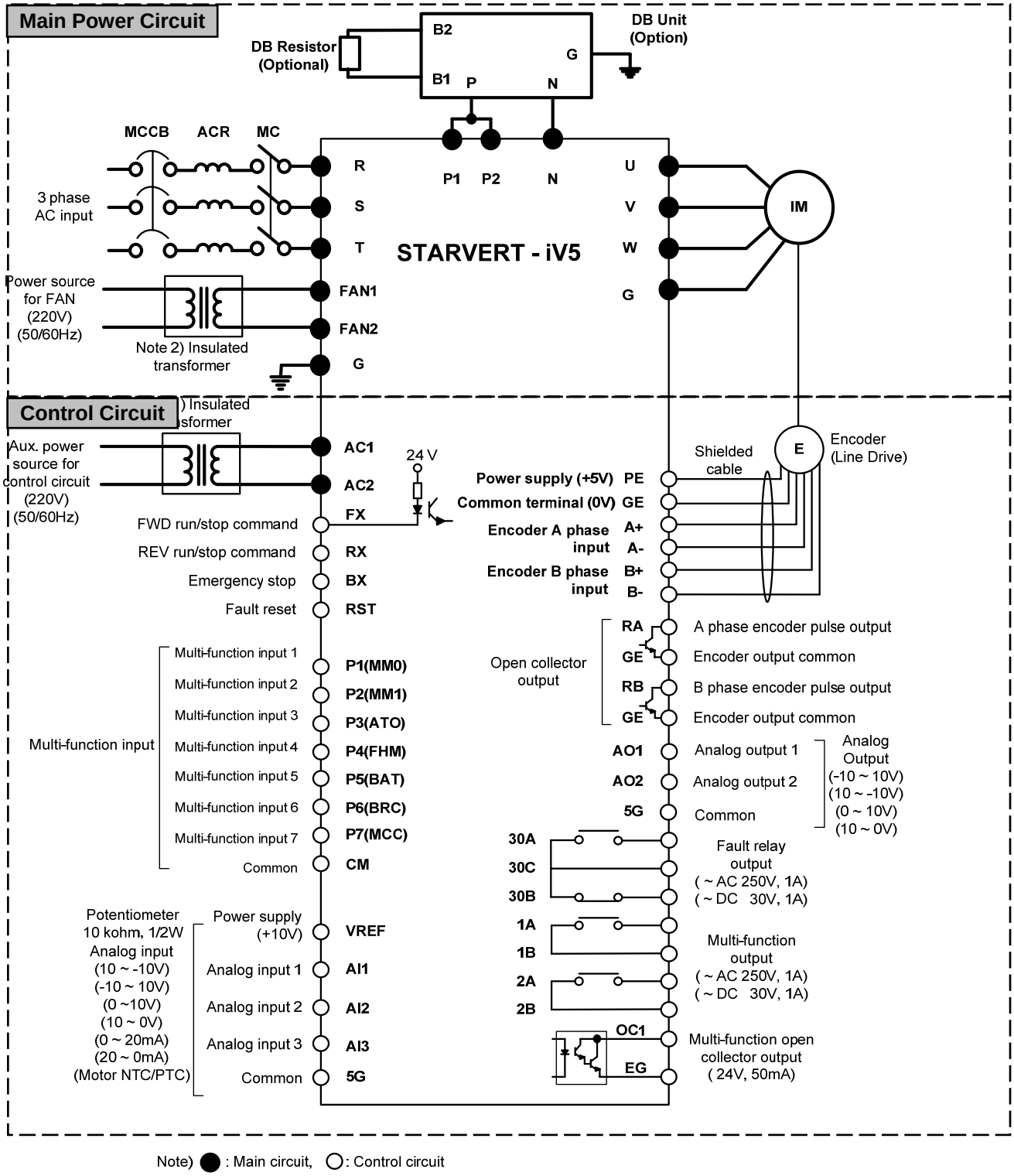
■ **AC Input Type**

SV5000iV5-4

Note: AC220V (50/60 Hz) must be supplied to FAN1 and FAN2 because 500kW-4 type of inverter has a AC fan of 220V internally. If not use AC220V power, the inverter is not operated because of 'FAN PWR' until the trip is released after inputting of AC220V. The order of power supply is described as below.

(The order of power on: 220VAC for fan → Main power source of 3-phase AC input → Run stop)

The order of power off: Run stop → Main power source of 3-phase AC input → 220VAC for fan)



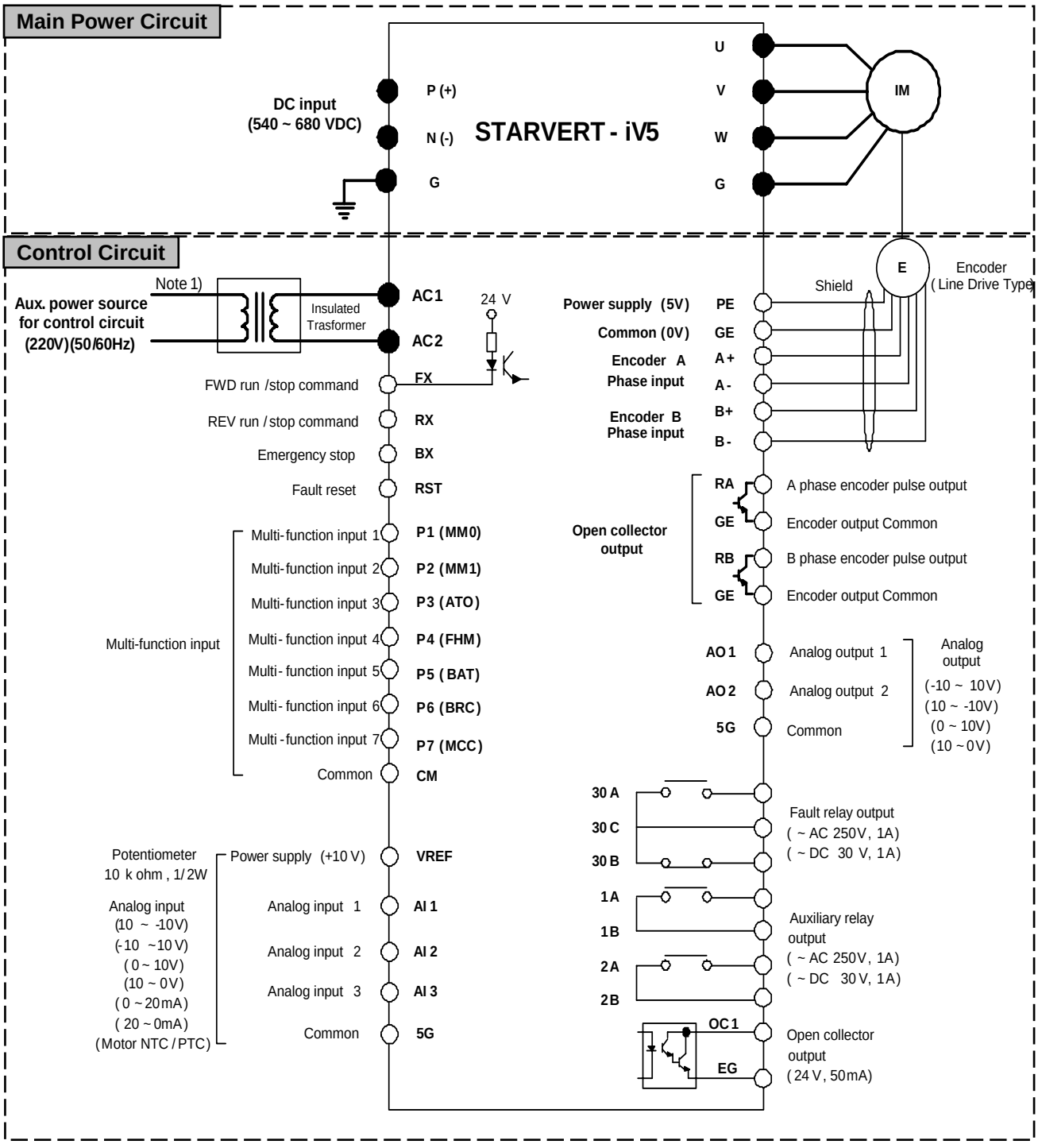
Note) ● : Main circuit, ○ : Control circuit

Note 1) It is used when inverter control circuit is energized from auxiliary power source (220 VAC) without main power supply. Use insulated transformer to separate from main power supply. (Transformer capacity: above 100VA recommended)

Note 2) The power of 220 VAC is muset be supplied bacause it is for the operation of internal cooling fan. Use insulated transformer to separate from main power supply. (Transformer capacity: above 500VA recommended)

■ **DC Power Input Type:**

SV055, 075, 110, 150, 185, 220, 2800, 3150, 3700iV5-4DC



Note) ●: Main circuit ,○ : Control circuit

※ SIO terminal indication for SV2800~3750iV5: PE → PENT, GE → G24X

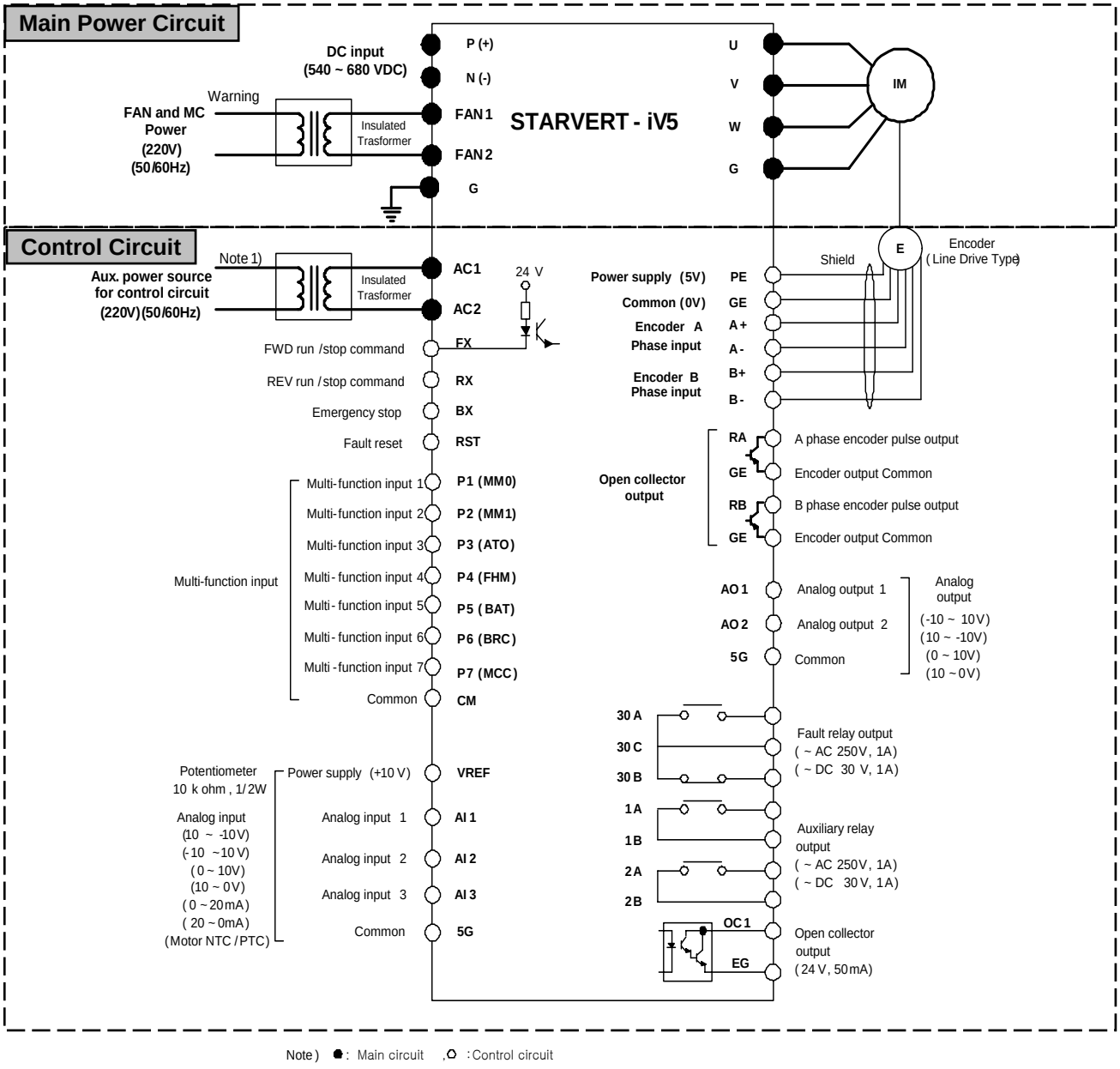
Note 1) It is used when inverter control circuit is energized from auxiliary power source (220 VAC) without main power supply. Use insulated transformer to separate from main power supply. (Transformer capacity: above 100VA recommended)

■ **DC Power Input Type:**

SV300, 370, 450, 550, 750, 900, 1100, 1320, 1600, 2200, 5000iV5-4DC

⚠Warning) It must be energized AC220V (50/60Hz) to terminal of FAN1 and FAN2 because 30 ~ 500 kW-4DC series have a cooling fan for AC power drive and MC. If not, Trip (30~160kW: "FAN/MC PWR", 220kW: "FAN PWR") will be occurred. The inverter is not operated unless trip is released after AC220V inputs. The recommended order of power input and cutoff is as shown below.

(The order of power On: 220VAC → P(+)/N(-) → Run, The opder of power Off: Stop → P(+)/N(-) → 220VAC)



Note) ●: Main circuit ,○ :Control circuit

Note 1) It is used when inverter control circuit is energized from auxiliary power source (220 VAC) without main power supply. Use insulated transformer to separate from main power supply. (Transformer capacity: above 100VA recommended)

Note 2) The power of 220VAC is must be supplied for the operation of internal cooling fan and/or Magnetic contactor.
Use insulated transformer to separate from main power supply. (30 ~ 160 kW: for the operation of FAN and MC, 220/500kW: for the operation of FAN)(Transformer capacity: above 30~75kW(100VA), 90~160kW(150VA), 220/500kW(500VA) recommended)

3.3 Power Circuit Terminal

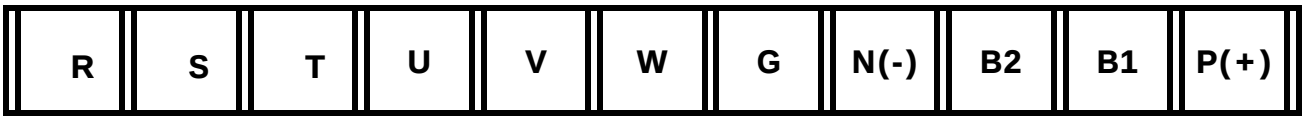
3.3.1 Power circuit terminal arrangement

(1) AC power input type

⚠ CAUTION

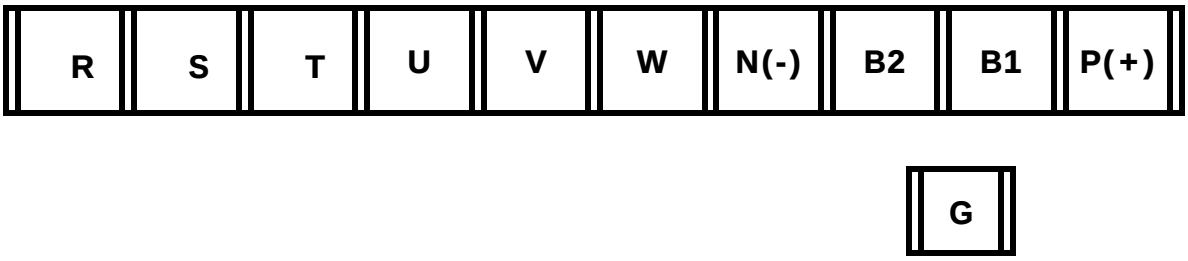
Be sure that "N" is not Neutral Line but DCN(-) and P is DCP(+)

■ **SV022, 037, 055, 075, 110, 150, 185, 220iV5-2(DB)**
SV022, 037, 055, 075, 110, 150, 185, 220iV5-4(DB)

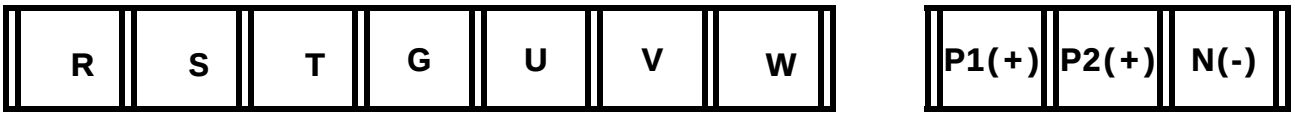


■ **SV110, 150, 185, 220iV5-2(DB)(MD)**
SV110, 150, 185, 220iV5-4(DB)(MD)

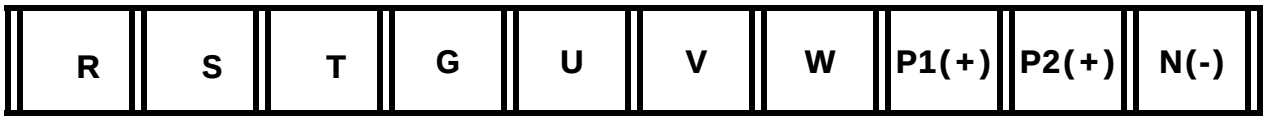
*(MD) : Mold Type



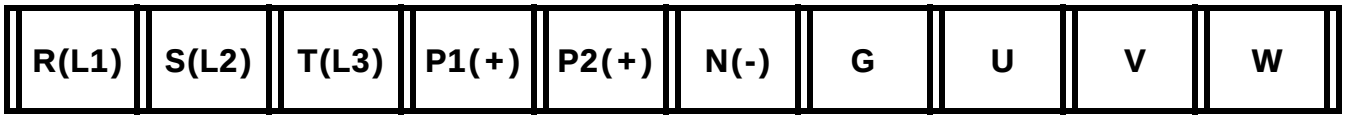
■ **SV300, 370iV5-2**
SV300, 370, 450, 550, 750iV5-4



■ **SV900, 1100, 1320, 1600, 2200iV5-4**

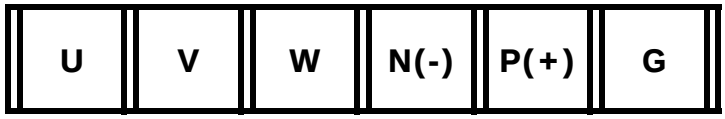


■ **SV2800, 3150, 3750, 5000iV5-4**

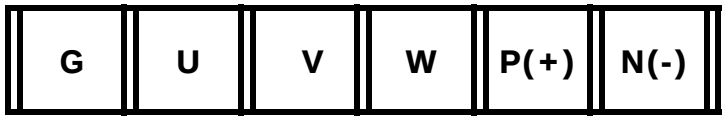


(2) DC power input type

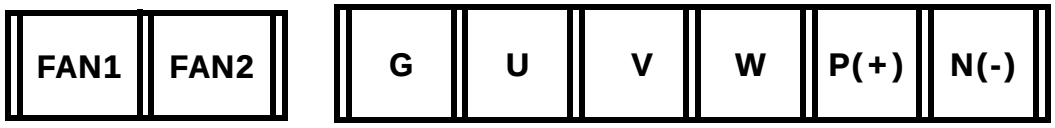
■ **SV055, 075iV5-4DC**



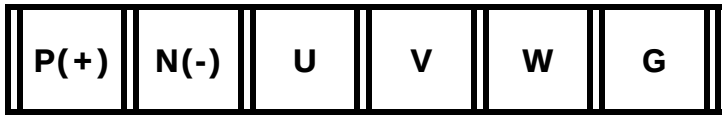
■ **SV110, 150, 185, 220iV5-4DC**



■ **SV300, 370,450,550,750,900,1100,1320,1600,2200iV5-4DC**



■ **SV2800, 3150, 3750, 5000iV5-4DC**



3.3.2 Power circuit terminal description

(1) AC power input type

Name	Function	Description
R, S, T	3 Phase input power supply	Connected to 3 phase input power supply
U, V, W	Inverter Output	Connected to 3 phase induction motor
G	Grounding	Used for inverter frame earth
B1, B2	Braking Resistor	Connected to braking resistor
P1(+), P2(+)	DC Reator and DB Unit	Used for DC Reactor, DB Unit and DC link common connection

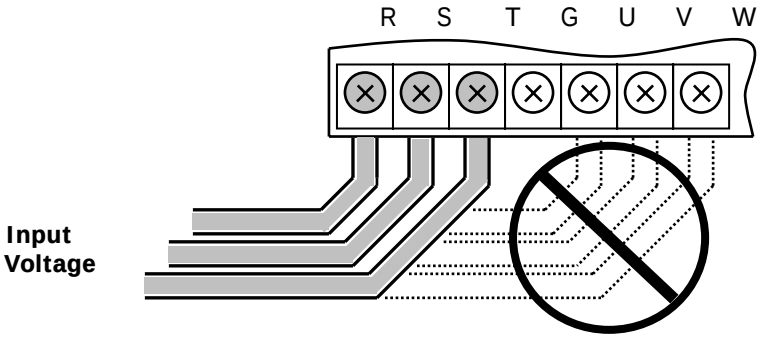
Name	Function	Description
P(+)	DC Link common	DC link common connection
N(-)	DB Unit	Used for DB Unit and DC link common connection

(2) DC power input type

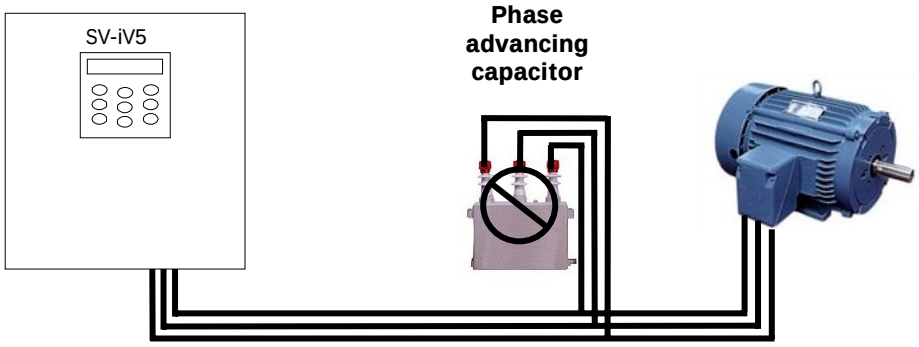
Name	Function	Description
P(+), N(-)	DC input power	Connected to DC input power source Connected from DC power suupy (PWM converter) within max. 30m
U, V, W	Inverter Output	Connected to 3-phase induction motor
G	Grounding	Used for inverter frame earth
FAN1, FAN2	Internal cooling fan and MC drive power source	Connected to single-phase 220V AC power source

3.3.3 Cautions to be required for wiring to power circuit terminal

① Connect terminals (R, S and T) to 3 phase input power supply after checking inverter nameplate attached on the inverter. Never connect terminals (U, V and W) to 3 phase input power supply. It results in lethal damage to the inverter.



② Never connect the phase advancing capacitor to the inverter output. If already installed, remove the phase advancing capacitor clearly.



③ Cable between inverter output and motor should be less than 30m long. If cable gets long, surge voltage appears across motor terminals depending on the cable parameters. Especially, in 400V class motor case, insulation withstanding voltage may be decreased. Use an insulation-enforced motor when 400V class motor is used.

Distance between inverter and motor	Up to 50m	Up to 100m	Over 100m
Permitted Carrier Frequency	Below 10kHz	Below 5kHz	Below 2.5kHz

(In case of below 3.7 kW, use the cable of output within 100 m)

④ Crimp terminal with insulation cap should be used for the input power supply and the motor.
⑤ After finishing wiring, be certain to remove all the wire or cable scraps inside the inverter.
⑥ Use the shield cable or twist-paired wire for control circuit terminal. Do not put them into the same wiring duct for the power terminal.
⑦ When wiring is changed after operating the inverter, be sure to check LCD window on the keypad or charge lamp is turned off. Capacitors inside inverter are charged with high voltage and it may result in lethal injury.
⑧ Below 22kW inverter, B1 and B2 on the power terminal should not be connected to anything else other than DB resistors.

3.3.4 Main power circuit wire sizes and grounding wire size

① Main Power Circuit Wire Sizes

If wiring for the main power terminal is not performed properly, it may cause severe damage to inverter or lethal injury to inverter operator. **Be sure to use 600V, 75℃ copper wire.**

Inverter Capacity		Wire Size (Cabling standards of IEC 60227-3 or UL508C)			
		mm2		AWG or kcmil	
		R, S, T	U, V, W	R, S, T	U, V, W
200V	2.2 kW	2.5	2.5	12	12
	3.7 kW	4	4	10	10
	5.5 kW	6	6	8	8
	7.5 kW	10	10	6	6
	11 kW	16	16	4	4
	15 kW	25	25	3	3
	18.5 kW	35	35	2	2
	22 kW	35	35	2	2
	30 kW	50	50	1/0	1/0
	37 kW	70	70	2/0	2/0
400V	2.2/3.7 kW	2.5	2.5	12	12
	5.5 kW	4	4	10	10
	7.5 kW	4	4	10	10
	11 kW	6	6	8	8
	15 kW	10	10	6	6
	18.5 kW	16	16	4	4
	22 kW	16	16	4	4

Inverter Capacity		Wire Size (Cabling standards of IEC 60227-3 or UL508C)			
		mm2		AWG or kcmil	
		R, S, T	U, V, W	R, S, T	U, V, W
	30 kW	35	25	3	3
	37 kW	25	25	2	2
	45 kW	50	35	2	2
	55 kW	50	50	1	1
	75 kW	70	70	2/0	2/0
	90 kW	120	120	4/0	4/0
	110 kW	150	150	300	300
	132 kW	185	185	350	350
	160 kW	240	240	500	500
	220 kW	400	400	800	800
	280 kW	2 X 240	2 X 240	2 X 500	2 X 500
	315 kW	2 X 240	2 X 240	2 X 500	2 X 500
	375 kW	2 X 300	2 X 300	2 X 600	2 X 600
	500 kW	2 x 400	2 x 400	2 x 800	2 x 800

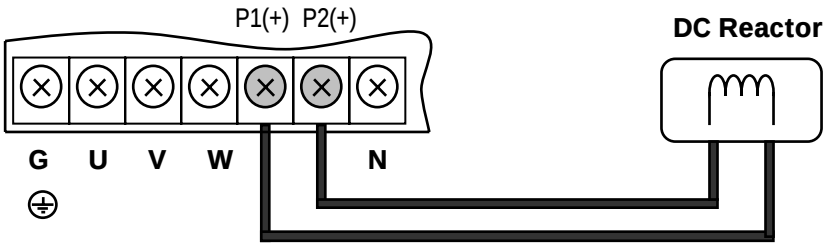
1) Apply the rated torque to terminal screws. Loose screws can cause of short circuit or malfunction. Tighting the screws too much can damage the terminals and cause a short circuit or malfunction.

② Grounding Wire Size and Caution to be taken

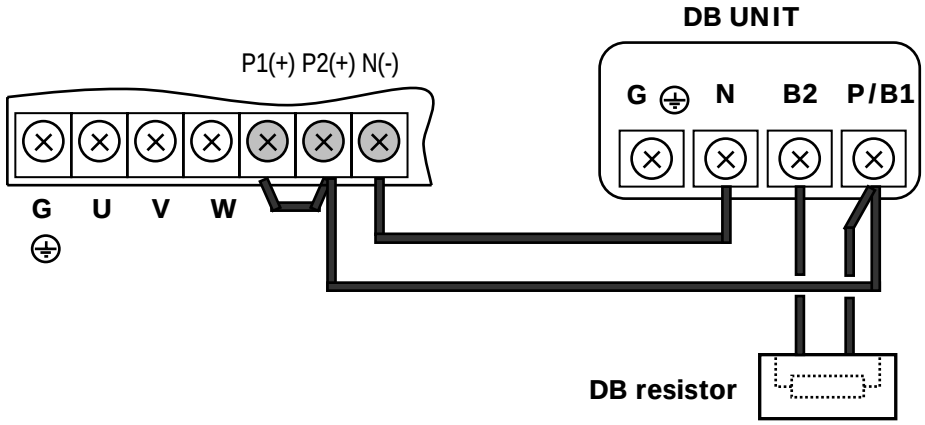
- Be sure to ground the motor and the inverter to prevent electric shock injury. (200V class: ground impedance 100Ω, 400V class: ground impedance 10Ω)
- Connect the inverter ground to the ground terminal exclusively used for the inverter. Do not use the case of inverter of sash screw for ground.
- It is strongly recommended that as thick a grounding wire as possible be used and wire be short.

Motor Capacity	Ground wire size(mm^2)	
	200V Class	400V Class
2.2 ~ 3.7 kW	4	2.5
5.5 ~ 7.5 kW	6	4
11 ~ 15 kW	16	10
18.5 ~ 22 kW	25	16
30 ~ 37 kW	25	16
45 ~ 75 kW	-	25
90 ~ 132 kW	-	35
160 ~ 220 kW	-	95
280 ~ 315 kW	-	185
375 ~ 500 kW	-	240

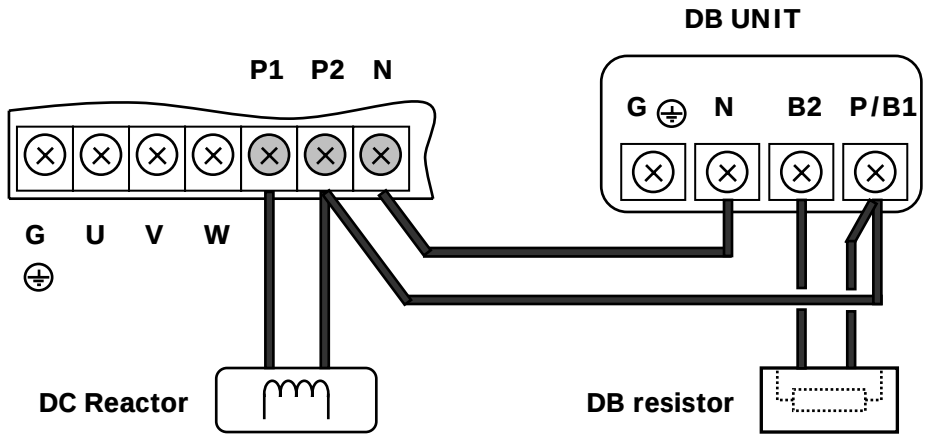
3.3.5 Wiring DC Reactor (Option) (AC power input: 30kW and higher)



3.3.6 Wiring DB Unit (Option) (AC power input: 30kW and higher)



3.3.7 Wiring guide when using both of DC reactor (Option) and DB Unit(option) (30kW and higher) (AC power input: 30kW and higher)



3.4 Control Board and Terminal

3.4.1 Control board Jumper description

- **Control board Jumper description according to S/W version**

Set jumper of control board as following, if it is not set rightly, it may result in misworking

(S/W version can be verified in display group of Function code list.)

1) Before S/W V2.00 (V1.XX ~ V1.93)

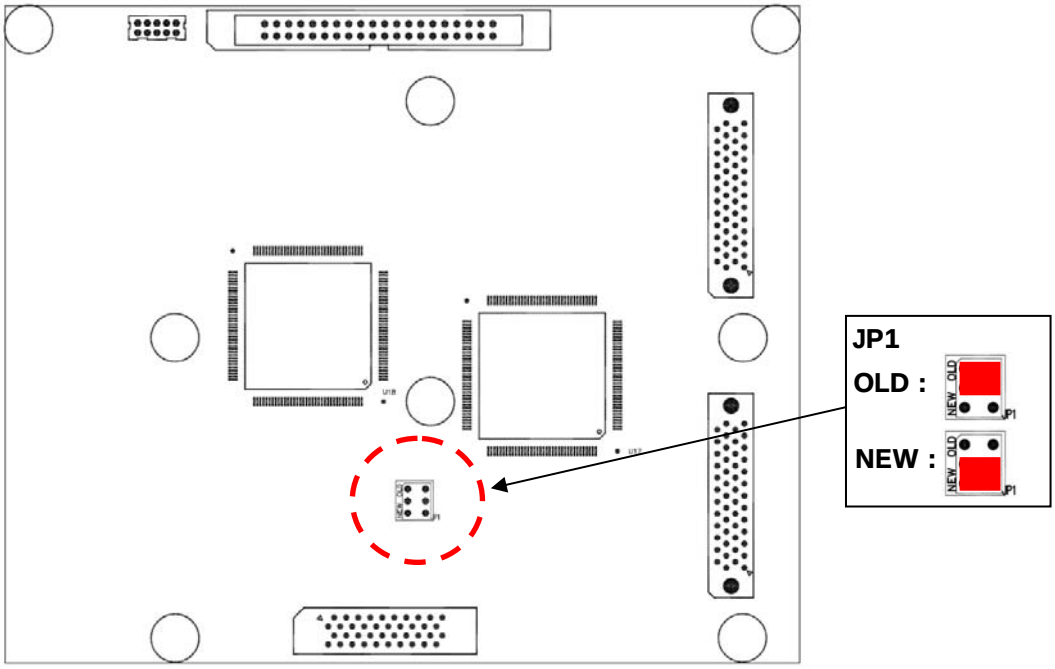
Set JP1 to **OLD** in Control board

2) After S/W V2.00 (V2.00 ~)

Set JP1 to **NEW** in Control board.(Factory default)

Note) The products which released after 2007 are being set up to “NEW”

- **iV5 Control Board (5.5 ~ 375kW Class)**

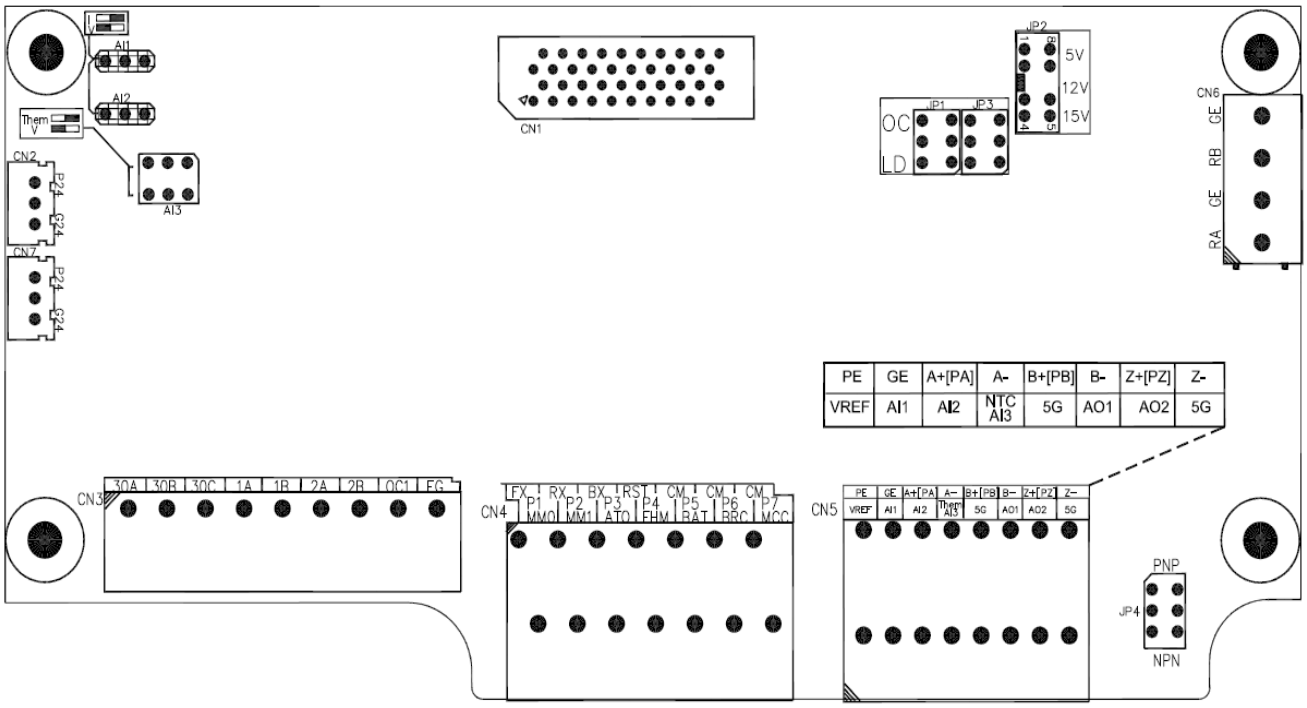


◈ The control board for 2.2/3.7 kW is configured same as above figure.

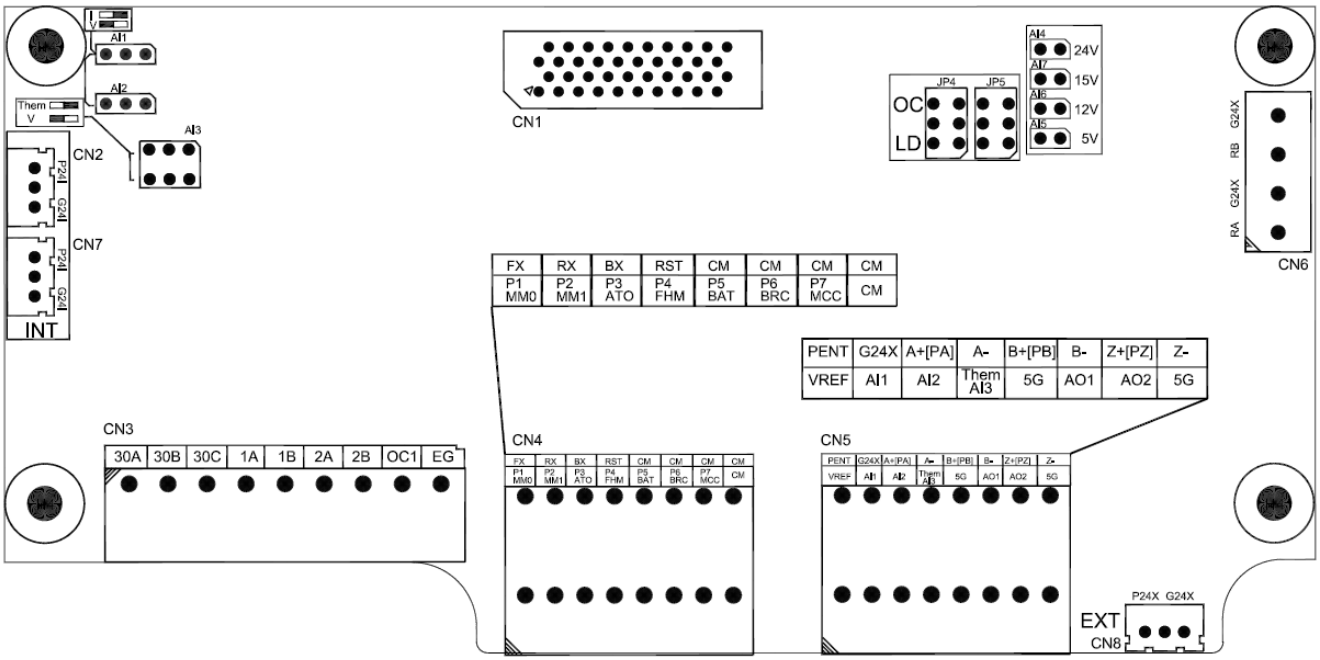
(The difference is that the external size is reduced and the connector for option installation is the one.)

3.4.2 Control circuit terminal arrangement

■ **SV022 ~ 2200/5000iV5**



■ **SV2800 ~ 3750iV5**



3.4.3 Control circuit terminal function description

Item	Name	Function	Description
Contact Input	FX	Forward Run /Stop Command	● Forward/Reverse RUN Command is ON when closed to CM in NPN input mode. ● Motor stops when FX/RX is ON or OFF at the same time.
	RX	Reverse Run/Stop Command	
	BX	Emergency Stop	● ON when closed to CM in NPN input mode, Free-run to Stop and deceleration to stop. It does not trigger fault alarm signal.
	RST	Fault Reset	Resets when fault condition is cancelled.
	P1(MM0)	Multi-function input contact	● 1 function can be selected among 42 different functions as shown below. (Multi-step speed 1 / 2 / 3, Jog, MOP Up / Down / Save / Clear, Analog Hold, Main Drive, 2nd function, Accel./Decel. Time selection, 3 Wire RUN, External trip (B contact), Power failure prevention, Reverse rotation prevention, Process PI Disable, Timer input, Soft start cancel, ASR P/PI Gain switch-over, ASR P/PI switch-over, Flux command value switch-over, Pre-excitation, Speed/Torque control, Torque limit ON/Off, Torque bias ON/Off, Battery operation On/Off, Low voltage trip detection prevention)
	P2(MM1)		
	P3(AT0)		
	P4(FHM)		
	P5(BAT)		
	P6(BRC)		
	P7(MCC)		
	CM	COMMON	● In NPN input mode, it turns On when each contact is closed to CM terminal. ● In PNP input mode, it turns On when each contact is closed to external 24V input.
Analog Input	VREF	Power supply for analog setting	● Reference voltage by variable resistor (+ 10V) : 10kΩ
	AI1	Voltage/ Current Signal Input	● Voltage input (-10→10V, 10→-10V, 0→10V, 10→0V) current input (0→20mA, 20→0mA), Motor NTC/PTC are selectable via Multi-function Analog input. ● Jumper setting in Voltage Input: **Jumper set as default)** ➔ AI1, AI2: Jumper set on left side, AI3: Switch set on left (“V”) side ● Jumper setting in Current Input ➔ AI1, AI2: Jumper set on right side ● S/W setting in motor NTC (Higen motor)/PTC input ➔ AI3: switch set on right (“Them”) side. ● Selectable 15 functions as following: (Speed, Process PID controller, Process PI controller feedback, Draw, Torque, Magnetic flux, Torque bias, Torque limit, Motor NTC/PTC...)
	AI2		
	AI3/Them	Voltage input Motor NTC/PTC Input	
	5G	COMMON	● COMMON terminal for Analog input
Encoder Input	PE	P/S (Power supply) for Pulse Encoder[1)]	+5V Line Drive Power
	GE		0V
	A+	Encoder A-phase signal	● A, B signal for Line Drive Type Encoder. ● Set the JP2 switch at “P5” on I/O PCB and set the JP4 switch to “LD” for the use of Line Drive. **※ Jumper set as default**
	A-		
	B+	Encoder B-phase signal	
	B-		
	PE	P/S for Open Collector Note1)	+15V Open Collector Power
	GE		0V
	PA	Encoder A-phase signal	● A, B signal for Complementary or Open Collector Type Encoder. ● Set the JP2 switch at “P15” on I/O PCB and set the JP4 switch to “OC” for the use of Open Collector.
	PB	Encoder B-phase signal	

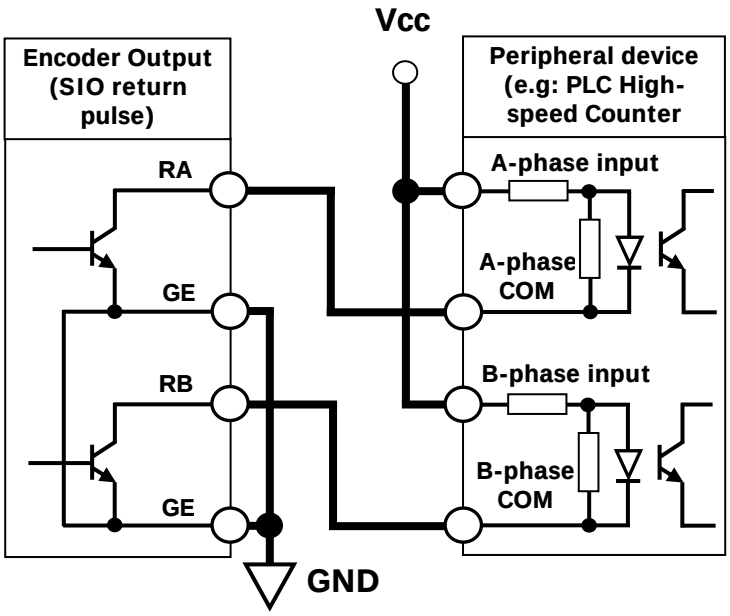
Item	Name	Function	Description
	Z+(PZ)	Encoder Z-phase signal	**Caution) The usages of Z-phase signal are as follows and its functions will be available soon.** ● Use for Z-phase pulse provided encoders. ● Z+ and Z- signals are used for Line Drive type, so set the JP5 switch to "LD". ● PZ signal is used for Open Collector type, so set the JP5 switch to "OC".
	Z-		
Encoder Output	RA	Encoder signal output : A-phase	Encoder A, B phase signal output – Open Collector Type Note4
	GE	Output Common	
	RB	Encoder signal output : B-phase	
	GE	Output Common	
Analog Output	AO1	Analog Output 1	● -10V → 10V, 10 → -10V, 0 → 10V, 10 → 0V output ● Selectable among 41 functions (Analog input value, Pre Ramp Reference, Post ramp reference, ASR Input Reference, Motor Rotating Speed, Speed Deviation, ASR Output, Torque bias, Positive Trq Limit, Negative Trq Limit, Regeneration Trq Limit, Torque Reference, Torque current ref., Torque current, Flux reference, Flux Current ref. , Flux Current, ACR output of axis Q, ACR output of axis D, Voltage reference of axis D, Voltage reference of axis Q, Output current, Output voltage, Output power, DC LINK voltage, Process PI reference, Process PI Feedback, Process PI output, Motor temperature, Motor temperature, Inverter temperature, Inverter i2t)
	AO2	Analog Output 2	
	5G	COMMON	● COMMON terminal for Analog Output
Relay output	1A	Multi-function relay output 1 (A Contact)	● Selectable among the following 21 functions; (Inverter ready, Zero speed detection, Seed detection, Speed detection (ABS), Speed arrival, Timer out, Low voltage alarm, run, regenerating, Motor overheat warning, Inverter overhear warning, Speed agree, Touque detection, Torque limit detection, Overload warning, Stop, Steady run, Brake output, WEB brake, UP to speed, False core)
	1B		
	2A	Multi-function relay output 2 (A Contact)	
	2B		
	OC1	Open Collector Ouput	
	EG		
	30A	Fault alarm A contact	● Outputs when fault occurs. ● Deactivated in BX condition.
	30B	Fault alarm B contact	
	30C	COMMON	● COMMON for A, B
Switch	JP1	Encoder Input-pulse Type	LD (Line Drive) / OC (Open Collector or Complementary)
	JP2[Note3)]	Encoder Power Supply	DC +5V / +12V / +15V selectable usages
	JP4[Note4)]	PNP/NPN Input mode	PNP/NPN contact input mode selection

Note 1) Wire Encoder power source according to series I/O board as below:
SV022~2200iV5 Class: PE: "+" , GE: "－"
SV2800~3750iV5 Class: PENT: "+", G24X: "－"

Note 2) I/O board of SV2800~3750iV5 Class is classified into 2 types: 24V and 5/12/15V Encoder power
Encoder power is set by PIN(AI4(24V), AI5(5V), AI6(12V), AI7(15V))

Note 3) NPN/PNP input mode selection are not supported for SV2800~3750 iV5 series' I/O board.

Note 4) Example wiring of Encoder output



Warning

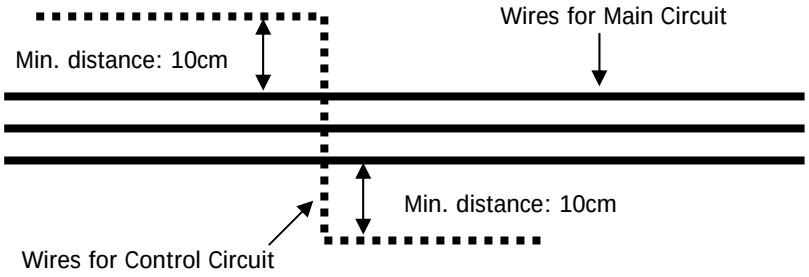
Wiring must be considered with input circuit . Because encoder output is open collector type. The figure is shown the wiring when inverter is connected with High-speed counter of LSIS PLC.

- **Additional Functions of Extended I/O(EXTN _ I/O) Control board terminal**

Item	Name	Function	Description
Analog Input	AI1	Voltage Input Current Input	● Extended I/O(EXTN_I/O) board is added analog input AI4, AI5. ● How to use terminal Pin: - Voltage Input : AI1, AI2,AI3, AI4, AI5 - Current Input : AI1, AI2, AI3, AI4 - Motro NTC/PTC input : AI5 Note) Jumper setting and functions are explained at I/O control terminal description.
	AI2		
	AI3		
	AI4		
	AI5/Them	Voltage Input Motor NTC/PTC Input	
	5G	COMMON	COMMON terminal for Analog Input

3.4.4 Wiring the control circuit terminal

① Shield wire or vinyl insulated wire are highly recommended to be used for the control circuit terminal.
② Be sure to use twisted shield wire if wiring distance gets too long.
③ Wire should be at least as thick as 0.2 ~ 0.8 mm^2 (18 ~ 26 AWG).
④ Screwing torque limit should be kept under 5.2 lb-in.
⑤ Maximum interrupting capacity of auxiliary contact 1, 2 and 3 is of AC 250V/1A, DC 30V/1A.
⑥ Maximum interrupting capacity of fault alarm relay A, B contact is of AC 250V/1A, DC 30V/1A.
⑦ Open collector output 1, 2, 3 and encoder output can be used below maximum of 24V/100mA.
⑧ Wires for the control circuit terminal should be separated from ones for the power circuit terminal, if possible and in case wires for both control circuit terminal and the power circuit one cross each other, they should be crossed at right angles (90°).



3.4.5 Caution on wiring pulse encoder

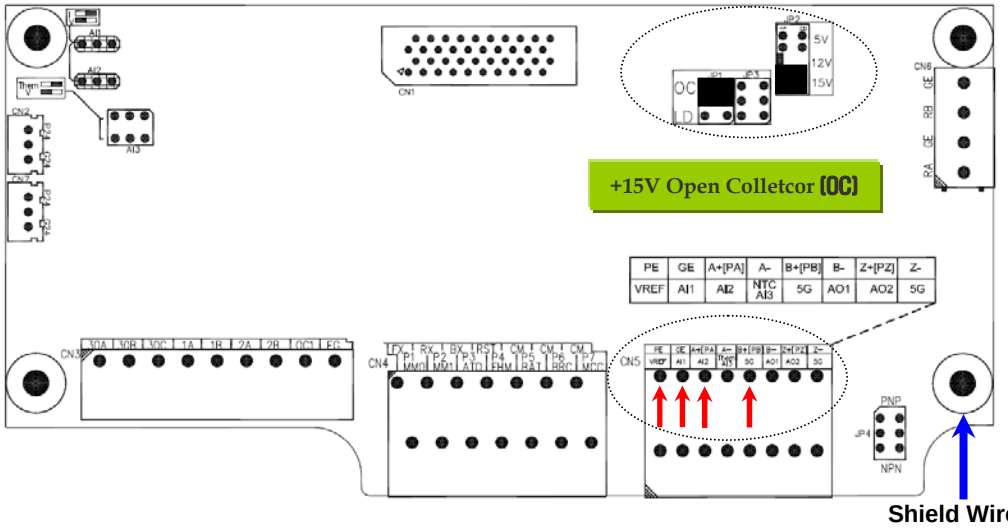
1) Check-up of the coupling and alignment of motor shaft and encoder shaft

① Be sure to mount the pulse encoder at the location where it rotates with same speed as the motor does. (e.g. on the opposite shaft of load side of motor, on the opposite shaft of motor at traction machine)
② In case there is speed slip between the motor shaft and encoder shaft, the motor may not start or it causes mechanical vibration.
③ Poor alignment of motor and encoder shaft results in torque ripple and causes mechanical vibration which has the same frequency as the motor speed at the constant speed region.

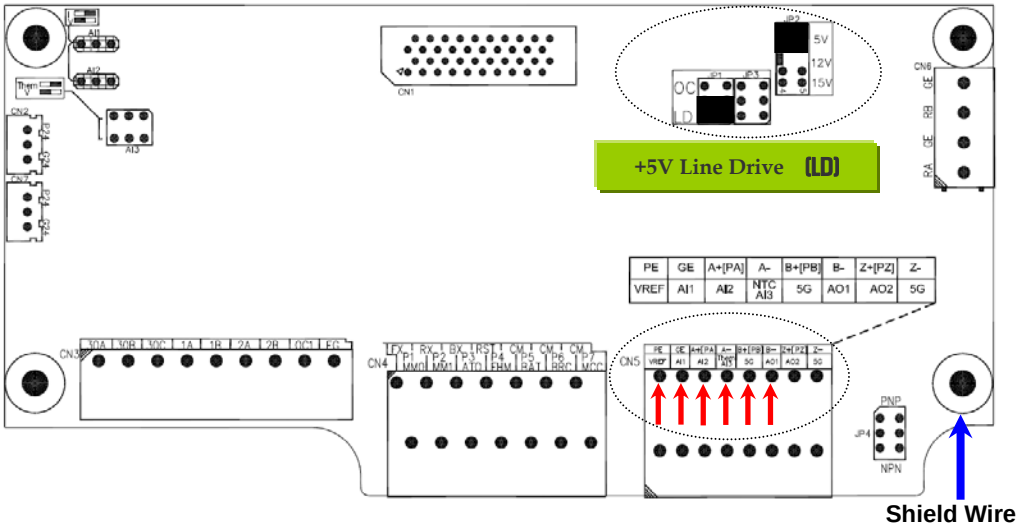
2) Wiring the pulse encoder

① Be sure to **use twist paired shield wire** and **ground shield wire to screw for earth on the I/O PCB**.
② Signal wires should be separated from the power lines, if possible. Electromagnetic noise may affect the pulse encoder output signals.

3.4.6 Encodder wiring and switch setting method (+15V Complementary / Open Collector Type)



3.4.7 Encoder wiring and switch setting method (+5V Line Drive) ※ Jumper set as default

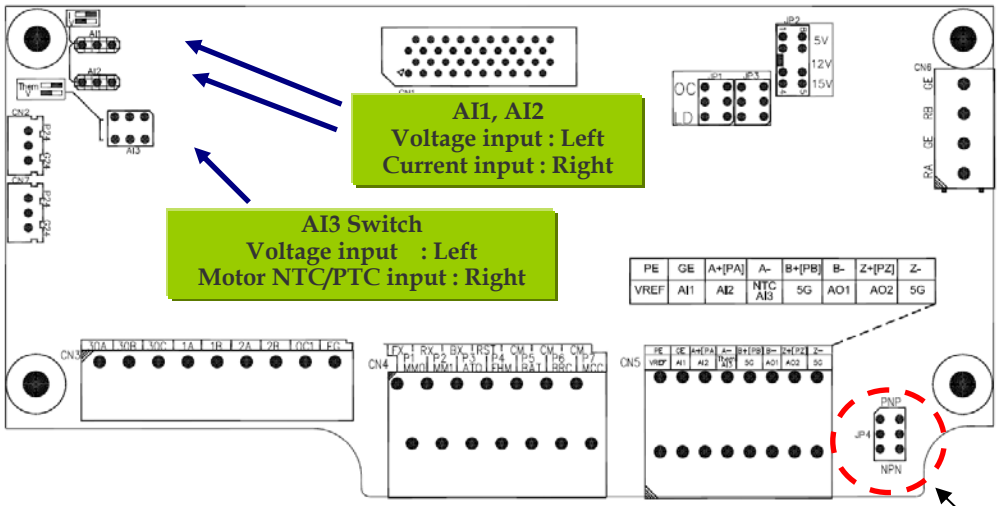


⚠ CAUTION

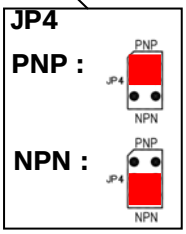
- NEVER change the switch setting for Encoder Type during inverter run. Otherwise, it may cause inverter trip, adversely affecting the entire system.
  Therefore, verify the switch is correctly set before operation.

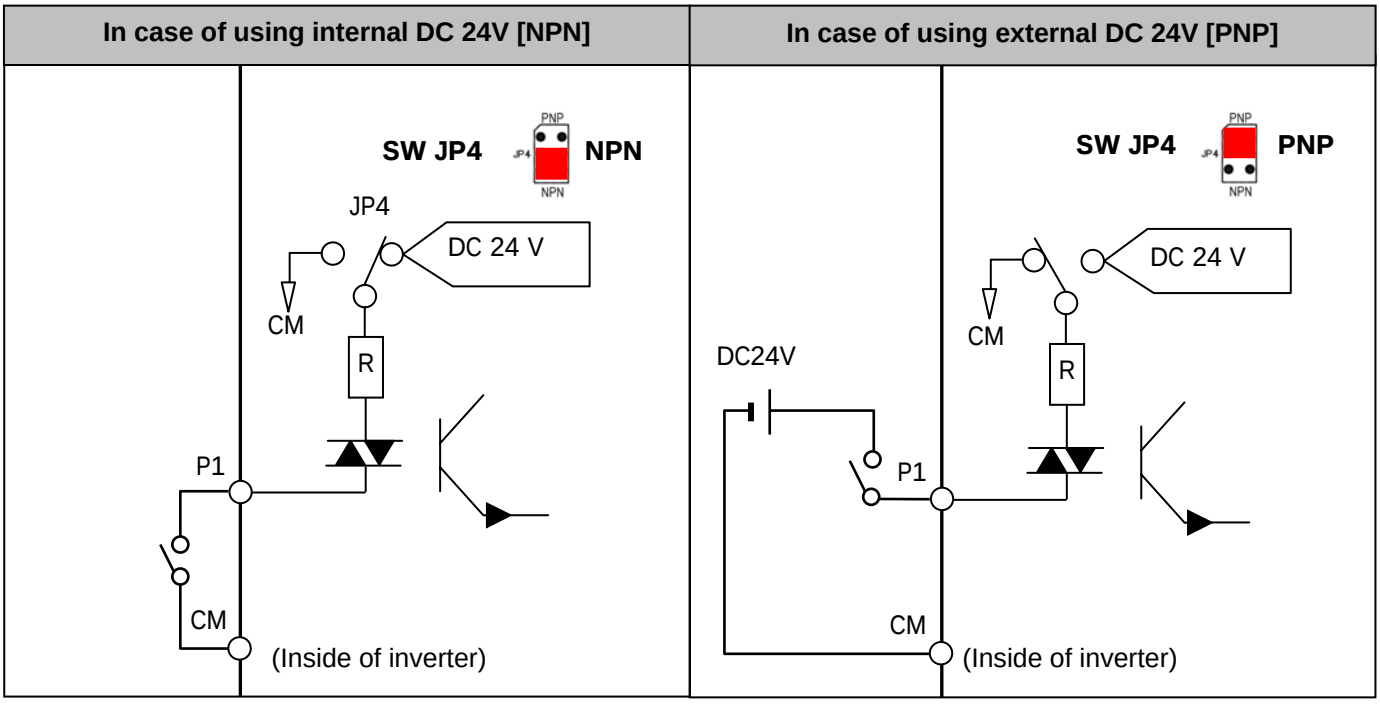
3.4.8 Analog input jumper setting (Voltage/Current/Motor NTC/PTC Input) and PNP/NPN input mode switch setting

※ **Jumper set as default : Voltage Input (Left)**



※ **Factory Default Jumper Setting: NPN (down side)**





- **Guaranteed PNP type input voltage (external DC 24V): On voltage (DC 19~25.2 V)/ Off voltage (DC 7V or less)**

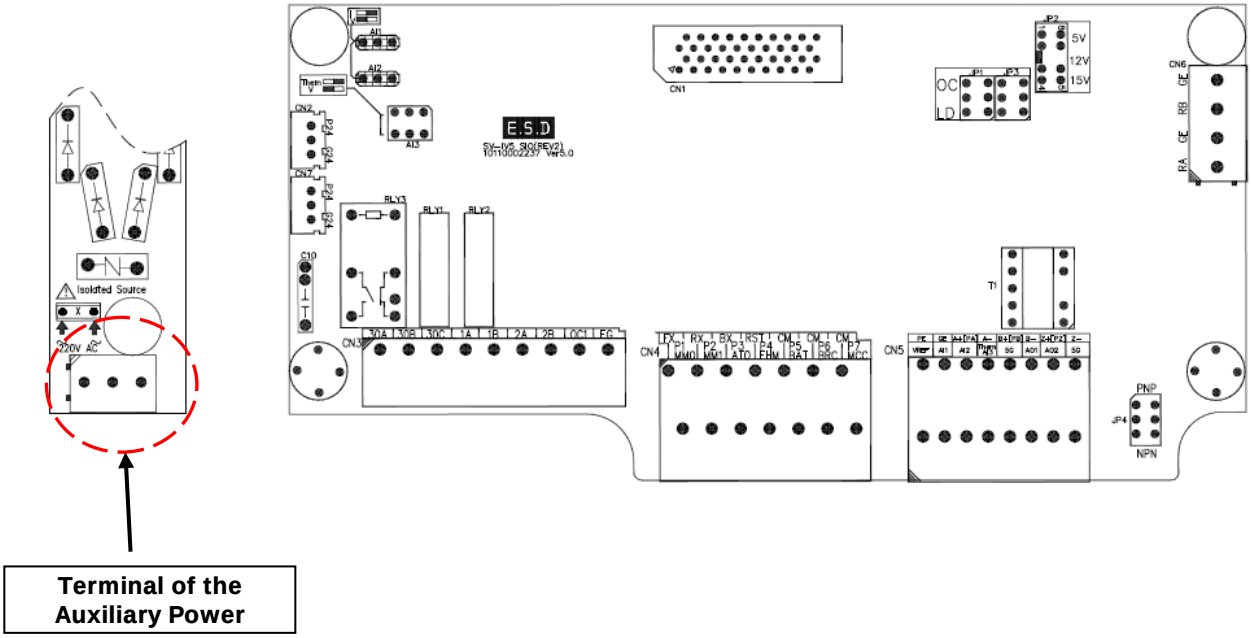
⚠ CAUTION

- NEVER change the jumper setting during inverter run. Otherwise, it may cause inverter trip, adversely affecting the entire system.
- Motor NTC input for Analog Input 3 (AI3) is ONLY available when OTIS Motor is connected.
  If user use a motor other than Higen motor with different NTC(PTC) specification and use this function, it will lead to motor overheat and damage to the motor.
- Do not change the setting of PNP/NPN input switch during inverter operation. It can influence to the system since contact input is changed. Set the switch correctly before inverter operation.

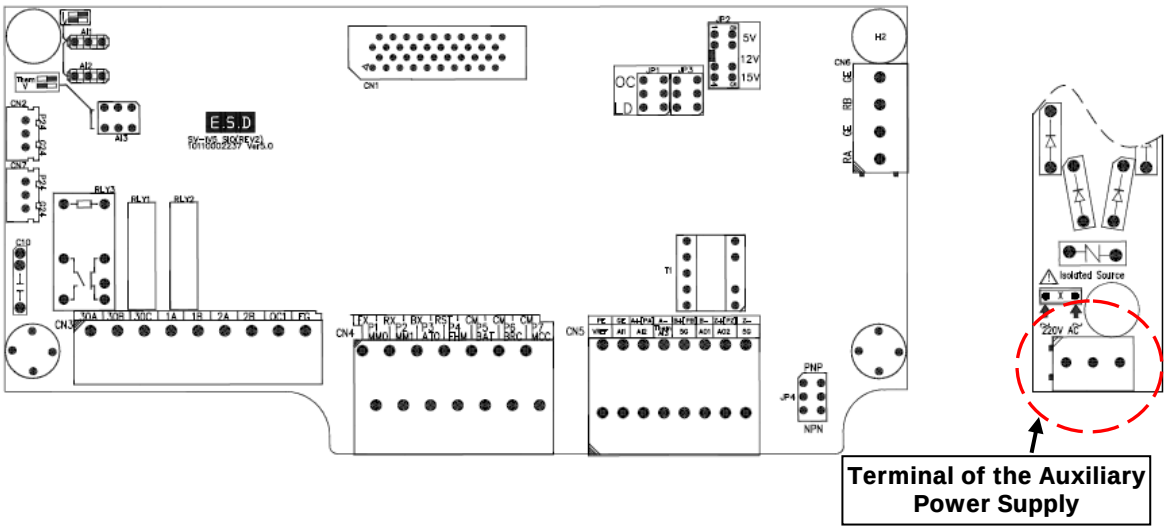
3.5 Terminal of the Auxiliary Power Supply

3.5.1 The position of the terminal

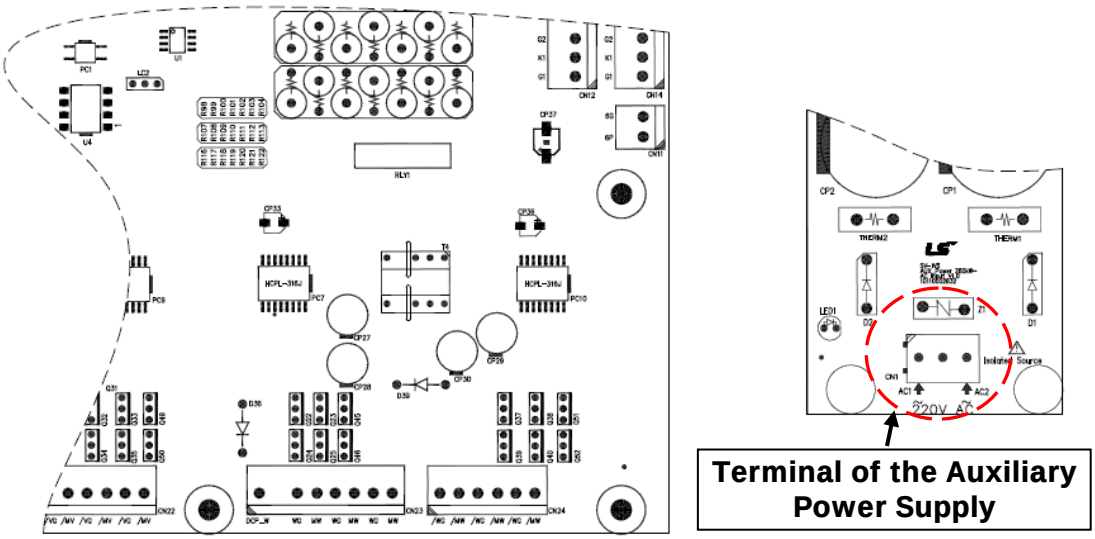
■ **SV055 ~ 220iV5(Press) (for AC/DC products)**



■ SV900 ~ 2200iV5(Press) (for AC/DC products)



■ SV2800 ~ 5000iV5(Press) (for AC/DC products)



3.5.2 Function description of auxiliary terminal block

Symbol	Terminal Name	Terminal Description	Input Power
AC1, AC2	Auxiliary power input	Inputs single-phase AC input source	220V (-10 ~ +10%), 50/60Hz

3.5.3 Wiring and Precaution of auxiliary terminal block

① Connect the auxiliary power supply through insulated transformer separated with main power supply.

② User polyvinyl chloride insulated wire for auxiliary power cable.

③ User the cable above 0.5mm^2 (20 AWG).

Chapter 4 - Trial Operation

4.1 Keypad Operation

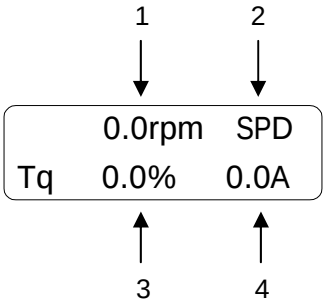
LCD Keypad can display up to 32 alphanumeric characters and monitor or set parameter values to operate the inverter and the motor properly. As follows are keypad view and explanation on each key/LED on the keypad.

<Keypad View>

Items	Name	Function	Description
Key	MODE	Mode	Enables to move to the other groups (Initial Screen →DIO → PAR → FUN...) and go to the first code in the same group.
	PROG	Program	Enables to modify setting values.
	ENT	Enter	Enables to move to the other groups (Initial Screen ← DIO ← PAR ← FUN...) **and** save the changed setting values.
	▲(Up)	Up	Moves to the next code or increments setting values.
	▼(Down)	Down	Moves to the next code or decrements setting values.
	SHIFT/ESC	Shift/ESC	Acts as Shift key in a setting mode and as ESC key in other mode.
	REV	Reverse RUN	Reverse RUN command is enabled.
	STOP/RESET	Stop/Reset	Stop key during inverter operation. Resets fault when inverter returns to normal after fault has occurred.
	FWD	Forward RUN	Forward RUN command is enabled.
LED	(REV)	Reverse RUN	Lit when motor is in reverse revolution. Blinks on acceleration/deceleration, lit in a constant speed
	(STOP/RESET)	Stop/Reset	Lit when the motor stops. Blinks when fault has occurred.
	(FWD)	Forward RUN	Lit when motor is in forward revolution. Blinks on acceleration/deceleration, lit in a constant speed

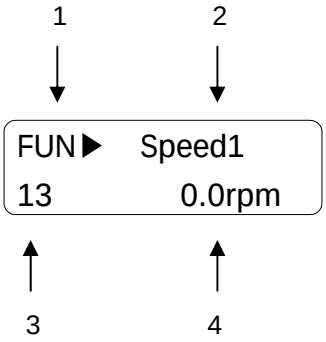
4.2 Keypad LCD Display

4.2.1 LCD Start-up display



No.	Function	Description
1	Motor speed	Real motor speed in RPM (Revolution Per Minute)
2	Motor control Mode	SPD: Speed control mode TRQ: Torque control mode WEB: WEB control mode BX: Emergency stop BAT : Battery-operated mode
3	Generating torque	Displays % ratio to the rated torque of a motor.
4	Output current	Inverter output current in RMS

4.2.2 Group display



No.	Function	Description
1	Parameter group	Displays the name of each parameter group. There are DIS, DIO, PAR, FUN, CON, AIO, USR and 2nd group.
2	Code name	Displays a code name to be set.
3	Code Number	Displays a code name to be set.
4	Code data and unit	Displays a code data and a code unit to be set.

4.3 Setting of Parameter Values

In case inverter is to be in use using a keypad, proper parameter values can be set depending on the load and operation condition. For more detailed information, refer to Chapter 6.

First, move on to the code in a group where is intended to change parameter value. cursor (■) blinks by pressing [**PROG**] key. Parameter value can be set using (SHIFT/ESC)], [▲(Up)] and [▼(Down)] keys and then can be saved by entering [ENT] key.

Note) In some cases, data will not be changed for the following two reasons.

* Some data cannot be changed during inverter operation.
* Parameter data lock function is set. (PAR_04 [Parameter Lock] is enabled)

Example) In case the 1st acceleration time is to be changed from 10(sec) to 15(sec), it can be set as shown below.

0.0rpm SPD Tq 0.0% 0.0A	Initial Display
FUN▶ Jump code 00 1	Move to FUN Group by using [MODE] Key
FUN▶ Jump code 00 40	Press [PROG] Key → Enter 40 by [(SHIFT/ESC)], [▲(Up)], [▼(Down)] Key →[ENT]
FUN▶ Acc Time-1 40 10.00 sec	Acc time 1 is settable.
FUN▶ Acc Time-1 40 ■10.00 sec	Press [PROG] Key. Setting Mode(Cursor(■) appears and blinks)
FUN▶ Acc Time-1 40 1**0**.00 sec	Move the Cursor(■) to the position to be changed using [(SHIFT/ESC)] key.
FUN▶ Acc Time-1 40 1**5**.00 sec	Set the data using [▲(Up)], [▼(Down)]
FUN▶ Acc Time-1 40 15.00 sec	Save the changed data by pressing [ENT] key. (Cursor disappears.)

4.4 Data Groups

SV-iV5 series inverters use LCD keypad for user's convenience. Data groups are divided into 12 groups for easy access depending on the inverter application.

Name	LCD keypad (on the upper left)	Description
Display group	DIS	Motor speed, Motor control mode, Generating torque, Output current, User selection display, Process PID output/reference/feed-back value, Fault display, User group display setting and so on.
Digital I/O group	DIO	Digital input parameters, Digital output parameters and so on.
Parameter group	PAR	Parameter initialization, Parameter read / write / lock /password, Motor related constants, Auto-tuning and so on.
Function group	FUN	Operating frequency, Operation mode, Stop mode, Acceleration /deceleration time and pattern, Carrier frequency, Electronic thermal selection and so on.
Control group	CON	Control mode, ASR PI gain, Process PID gain, Draw control setting, Droop control related constants, Torque control related constants, V/F control related constants and so on.
Exterior group	EXT[1)]	It is displayed when Communication option board is installed. Communication setting parameter and so on.
Analog I/O group	AIO	Analog Input or Output Parameter and so on.
User group	USR	User macro function, macro function save, macro function recall
2nd function group	2nd	2nd motor control mode, 2nd motor accel./decel.time, 2nd motor parameters and so on.
Elevator group	E/L[1)]	It is displayed when EL_I/O option board is installed, Elevator operation function setting parameter and so on.
Synchronous group	SYNC[1)]	It is displayed when SYNC_I/O option board is installed. Synchronous operation function setting parameter and so on.
WEB group	WEB	Diameter and Tension control setting parameter while WEB control.

It is a basic group to display as a Group name.

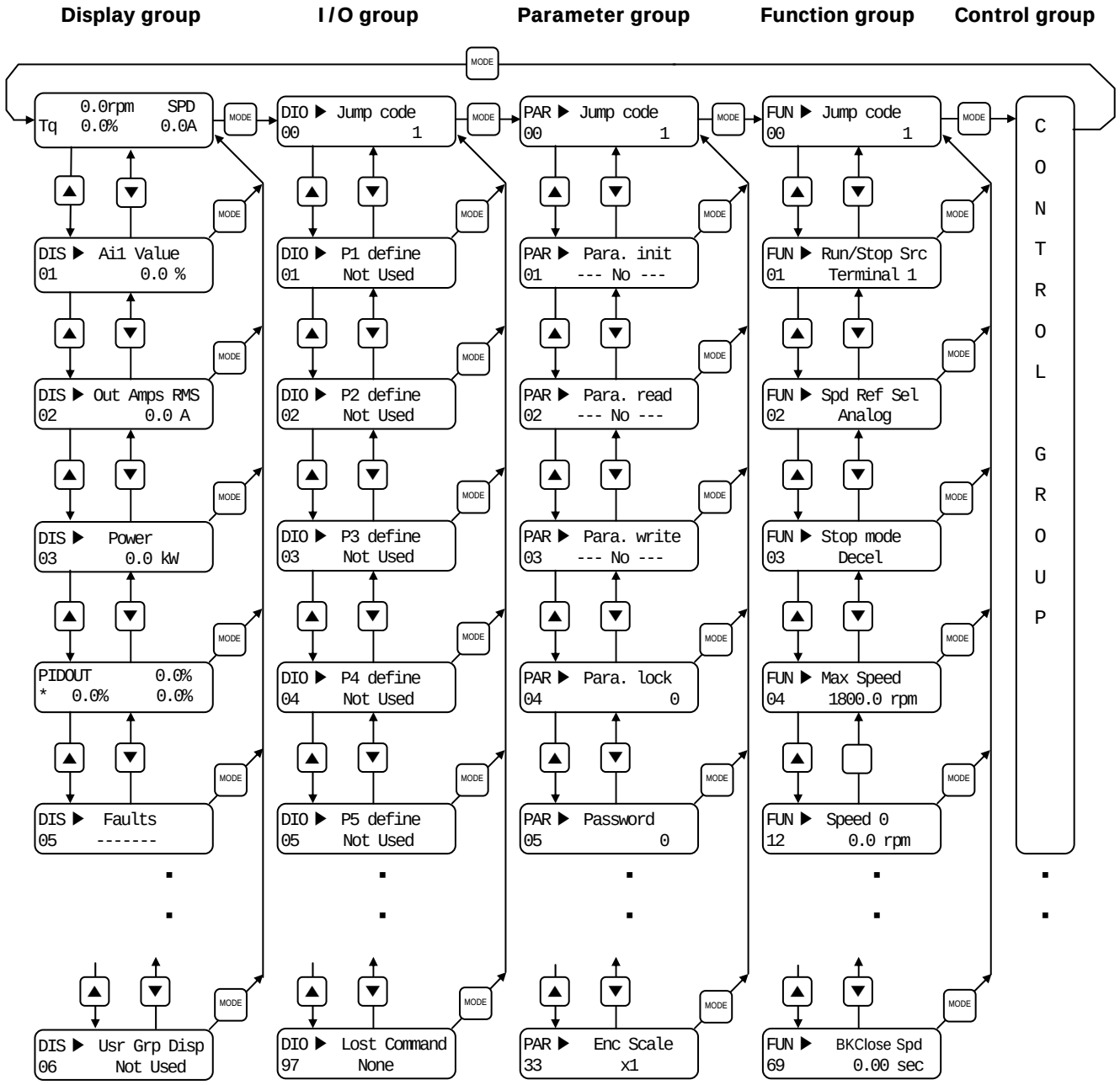
1) It is displayed when option board is installed, Refer to the option manual for more details

Refer to Chapter 6. Function Description for more details.

Refer to the description of Chap. 7 for more information about WEB group.

- **Group transfer in the keypad**

For transfer to another group, [MODE] key is used and ▲(Up), ▼(Down) key is used to move up and down in the same group.



- User group and 2nd group are omitted.
- In these group transfers, User Group, 2nd Group, AIO Group and WEB Group are omitted.

4.5 Auto-Tuning

Parameters such as stator resistance (R_s), stator leakage inductance (sL), flux current (IF), rotor time constant (τ_r) and stator self-inductance (Ls) are indispensable for obtaining an excellent control performance in the vector control and are automatically measured and set using auto-tuning function.

■ SV-iV5 features two types of Auto-tuning: 1) Rotational Auto Tuning
2) Standstill Auto Tuning

4.5.1 Motor & encoder parameter setting for auto-tuning

The Motor capacity, Basic speed, Rating voltage, Pole number, Efficiency, Rating slip and Rating current on the nameplate of the motor and the pulse number of encoder should be set before operation.

LCD Display	Description
PAR▶ Motor select 07 kW	● Enter the motor capacity. ● Basic capacity is same with Inverter capacity ● Enter directly in the PAR_08 after selecting “User Define” if there is no Motor capacity.
PAR▶ UserMotorSel 08 kW	● Enter the motor capacity directly at PAR_08 incase that select “User Define” at PAR_07
PAR▶ Enc Pulse 10 [][][]	● Set the pulse numbers per revolution of pulse encoder coupled to the motor shaft.
PAR▶ Base Speed 17 rpm	● Set the motor base speed. Note) It is not rating current of name plate. Base Speed = 120 X Base Frequency/ Pole number
PAR▶ Rated Volt 18 V	● Set the rated voltage of the motor. (Voltage value on the name plate)
PAR▶ Pole number 19 []	● Set the number of poles of the motor.
PAR▶ Efficiency 20 %	● Set the efficiency of the motor. If you cannot find the efficiency in name plate, Do not set the Efficiency.
PAR▶ Rated-Slip 21 rpm	● Set the rated slip speed of the motor. (Rated slip=synchronous speed–rated speed)
PAR▶ Rated-Curr 22 A	● Set the rated current of the motor.

4.5.2 Rotational auto-tuning

1) Precautions

⚠ CAUTION

Be sure to remove the load connected to the motor shaft before performing rotational auto-tuning. Otherwise, it may lead to damage to the motor or bodily injury. DB resistor should be installed because the inverter repeats abrupt Accel/Decel many times to find the motor constant (Tr) during tuning.

2) Rotational Auto-tuning procedure

LCD Display	Description	Tuning Time
PAR ▶ AutoTuneType 23 Rotational	Set it to **" Rotational ".**	-
PAR ▶ Auto tuning 24 ALL1	Auto-tuning starts when it is set to " **ALL1 ".**	-
PAR ▶ Auto tuning 24 Enc Testing	Checks whether the encoder wiring is properly done and an encoder works well by rotating the motor at 1500 rpm in forward direction.	30 ~ 35(Sec)
PAR ▶ Auto tuning 24 Rs Tuning	Stator resistance (Rs) is measured without rotating the motor.	10 ~ 20(Sec)
PAR ▶ Auto tuning 24 sL Tuning	The leakage inductance (sL) of the motor is measured without rotating the motor.	5 ~ 20(Sec)
PAR ▶ Auto tuning 24 IF Tuning	The flux current (IF) is measured by rotating the motor at 1500 rpm.	30 ~ 60(Sec)
PAR ▶ Auto tuning 24 Ls Tuning	Stator self-inductance (Ls) is measured by rotating the motor at 1500 rpm.	50 ~ 60(Sec)
PAR ▶ Auto tuning 24 Tr Tuning	Accel/Decel is performed repeatedly to find motor constant (Tr) so that DB Resistor should be connected before starting tuning. Otherwise, "Over Voltage " trip will occur.	20 ~ 60(Sec)

PAR ▶ Auto tuning 24 None PAR ▶ Auto tuning 24 [][] Error	When auto-tuning is complete successfully, “None” is displayed. If error occurs during auto-tuning, “[][] Error” is displayed. In this case, **verify motor parameters and encoder setting is done properly** and redo the auto-tuning. If the problem persists, contact LS representative.	**Total** **3 ~ 5 (Min.) is required**

- FWD/REV LED on keypad will blink during Auto-tuning.
- If setting PAR_24 (Auto tuning) to “ ALL2 ”, all procedure is same as “ALL1” except Encoder Testing will be skipped.
- Motor constants of each can be selected and separately tuned.

(Encoder Test, Rs Tuning, Lsigma, Flux Curr, Ls Tuning, Tr Tuning)

- If encoder phase (A, B) or inverter output wiring is switched during Auto-tuning, “ Enc AB Chgd ” message will be displayed. In this case, changing PAR_11 (Enc Dir Set) setting from “ A Phase Lead ” to “ B Phase Lead ” (or oppositely) will erase the need for changing the wiring.

4.5.3 Standstill auto tuning

1) Precaution

Be sure to lock the motor shaft using magnetic brake.

2) StandStill Type Auto-tuning procedure

LCD Display	Description	Tuning Time
PAR ▶ AutoTuneType 23 Standstill	Set the auto-tuning type to "**Standstill**".	-
PAR ▶ Auto tuning 24 ALL1	Auto-tuning starts if **ALL1** is set.	-
PAR ▶ Auto tuning 24 Rs Tuning	Stator resistance (R_s) is measured without rotating the motor.	20-30 Sec
PAR ▶ Auto tuning 24 sL Tuning	The leakage inductance (sL) of the motor is measured without rotating the motor.	90-150 Sec
PAR ▶ Auto tuning 24 If/Tr/Ls Tuning	Flux current (IF), rotor time constant (T_r) and stator self-inductance (Ls) is measured simultaneously without rotating the motor.	40-70 Sec
PAR ▶ Auto tuning 24 None PAR ▶ Auto tuning 24 [][] Error	When auto-tuning is complete successfully, "None" is displayed. If error occurs during auto-tuning, "[][] Error" is displayed. In this case, verify motor parameters and encoder setting is done properly and redo the auto-tuning. If the problem persists, contact LS representative.	Total: 3-5 minutes

- FWD/REV LED on keypad will blink during Auto-tuning.
- Motor constants of each can be selected and separately tuned.

(Rs Tuning, Lsigma, Flux Curr, Ls Tuning, Tr Tuning)

4.6 Pulse Encoder Check

4.6.1 The definition of forward rotation

Forward rotation is of counter-clockwise from the side view of motor shaft.

Motor

4.6.2 Forward rotation check

Be sure to check if positive(+) speed is displayed when inverter power is on and rotates the motor in the forward direction.

```
  +[][].[]rpm  SPD
Tq      %      A
```

4.6.3 Reverse rotation check

Be sure to check if negative(-) speed is displayed when inverter power is on and rotates the motor in the reverse direction.

```
  -[][].[]rpm  SPD
Tq      %      A
```

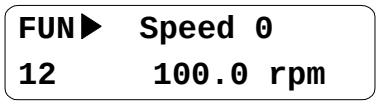
- If speed is displayed 0.0 rpm or unchanged or speed polarity is reversed, check if wiring for the pulse encoder is properly done.
- In case the motor shaft cannot be rotated with hands, refer to next chapter.

4.7 Operation by Keypad

4.7.1 Parameter setting for keypad operation to rotate the motor at 100 rpm

① RUN/STOP command setting by keypad

② Operating speed reference setting by keypad

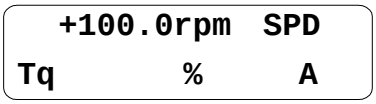


③ Operating speed setting

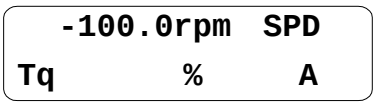
4.7.2 Forward / Reverse Run (FWD / REV)

① Low speed operation

- Check if motor speed is +100 rpm in the start-up LCD screen after pressing [FWD] key.



- Check if motor speed is –100 rpm in the start-up LCD screen after pressing [REV] key.



- The following table describes the cases of abnormal rotation due to the incorrect wiring of encoder and/or motor.

Command	Rotating direction	Speed display	Torque display	Wiring Status	
FX	Forward	+100.0(rpm)	Below +10%	Normal	
RX	Reverse	-100.0(rpm)	Below -10%		
FX	Forward	-10 ~ -40(rpm)	150%(Torque Limit)	Encoder wiring reversed	Abnormal
RX	Reverse	10 ~ 40(rpm)	-150%(Torque Limit)		
FX	Reverse	-10 ~ -40(rpm)	150%(Torque Limit)	Phase V and W wiring reversed	
RX	Forward	10 ~ 40(rpm)	-150%(Torque Limit)		
FX	Reverse	+100.0(rpm)	Below +10%	Encoder and Motor all reversed	
RX	Forward	-100.0(rpm)	Below -10%		

- If A and B phase are reversed, be sure to replace A with B phase wire after checking the pulse encoder wiring. Or user does not need to change wiring if PAR_11(Enc Dir Set) setting value is changed from “A Phase Lead” to “B Phase Lead”.
- If Motor wires are reversed, be sure to replace V with W phase wire after checking the motor output wiring.
- Torque display is on the basis of the no load operation.

② High Speed Operation

Change the value of FUN_12 to 1000.0(rpm) and Check the display LCD by pressing [FWD], [REV] keys shown below.

- When pressing [FWD] key;

```
    +1000.0rpm   SPD
Tq        %        A
```

- When pressing [REV] key;

```
    -1000.0rpm   SPD
Tq        %        A
```

4.8 Operation by Control Terminal

4.8.1 Parameter setting

```
FUN▶ Run/Stop Src
01       Terminal 1
```

① Setting RUN/STOP command by terminal

```
FUN▶ Spd Ref Sel
02        Analog
```

② Setting Speed reference by Analog

```
FUN▶ Max Speed
04        1800.0 rpm
```

③ Setting Max. motor speed

```
AIO▶ Ai1 Define
01    Speed Ref
```

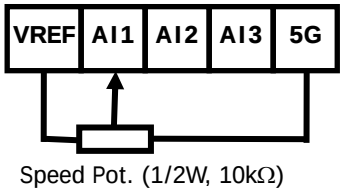
④ Ai1(Analog input terminal) define

```
AIO▶ Ai1 Source
02
```

⑤ Ai1(Analog input terminal) Source define : Select
(-10->10V, 10->-10V, 0->10V,10->0V, 0->20mA, 20->0mA)

4.8.2 Wiring example when issuing speed reference using speed potentiometer on AI1 terminal

Connect the potentiometer to VREF, AI1 and 5G as shown below.



..... Control Terminal

Speed Pot. (1/2W, 10kΩ)

4.8.3 Adjusting Ai1 Gain and Bias (example of analog input Ai1 setting)

① Out Y2(Gain) Adjustment of Analog input

- Apply 10V or 20mA between AI1 ~ 5G (for setting by potentiometer, adjust it to Max).
- Adjust the other multi analog input terminals in same manner.

Key Handling	Loader Display	Description
	AIO▶ Ai1 Out Y2 06 100.00 %	Initial LCD display
PROG	AIO▶Ai1 98.00 % 06 Gain 100.00 %	Pressing [PROG] key, shows in upper side the percent of input to output and in low side the gain value be set presently.
▲	AIO▶Ai1 100.00 % 06 Gain 102.00 %	If you try to adjust the gain to show 100.00%, Press [▲(Up)] key repeatedly and set to be 102.00%.
ENT	AIO▶ Ai1 Out Y2 06 102.00 %	After adjusting Gain, if you enter [ENT] key, the adjusted gain value is saved.

② Out Y1(Bias) Adjustment of Analog input

- Apply 0V or 0mA between AI1 ~ 5G (for setting by potentiometer, adjust it to Min).
- Adjust the other multi analog input terminals in same manner.

Key Handling	Loader Display	Description
	AIO▶ Ai1 Out Y1 04 0.00 %	Initial LCD display
PROG	AIO▶Ai1 0.18 % 04 Bias 0.00 %	Pressing [PROG] key, shows in upper side the percent of input to output and in low side the Bias value be set presently.
▲	AIO▶Ai1 0.00 % 04 Bias 0.18 %	If you try to adjust the Bias to show 0.00%, Press [▲(Up)] key repeatedly and set to be 0.00%.
ENT	AIO▶ Ai1 Out Y1 04 0.18 %	After adjusting Bias, if you enter [ENT] key, the adjusted Bias value is saved.

4.8.4 FX / RX operation

1) FX Operation (Forward Run Command by Control Terminal)

① Apply 0V between AI1 and 5G (for setting by potentiometer, adjust it to Min).

② Check the motor speed display in display group shows "+0.0rpm" after connecting the terminals FX and CM.

③ Increase AI1 voltage little by little and check the speed is increasing (for setting by potentiometer, turn the pot to max. smoothly).

④ To stop the motor, disconnect the FX and CM terminal.

2) RX Operation (Reverse Run Command by Control Terminal)

① Apply 0V between AI1 and 5G (for setting by potentiometer, adjust it to Min).

② Check the motor speed display in display group shows "-0.0rpm" after connecting the terminals RX and CM. Increase AI1 voltage little by little and check the speed is increasing (for setting by potentiometer, turn the pot to max. smoothly).

③ To stop the motor, disconnect the RX and CM terminal.

3) The cases of abnormal rotation due to the wrong wiring of encoder and/or motor during low speed (about 100rpm) operation by control terminal.

Command	Rotating direction	Speed display	Torque display	Wiring Status	
FX	Forward	+100.0(rpm)	Below +10%	Normal	
RX	Reverse	-100.0(rpm)	Below -10%		
FX	Forward	-10 ~ -40(rpm)	150%(Torque Limit)	Encoder wiring reversed	Abnormal
RX	Reverse	10 ~ 40(rpm)	-150%(Torque Limit)		
FX	Reverse	-10 ~ -40(rpm)	150%(Torque Limit)	Phase V and W wiring reversed	
RX	Forward	10 ~ 40(rpm)	-150%(Torque Limit)		
FX	Reverse	+100.0(rpm)	Below +10%	Encoder and Motor all reversed	
RX	Forward	-100.0(rpm)	Below -10%		

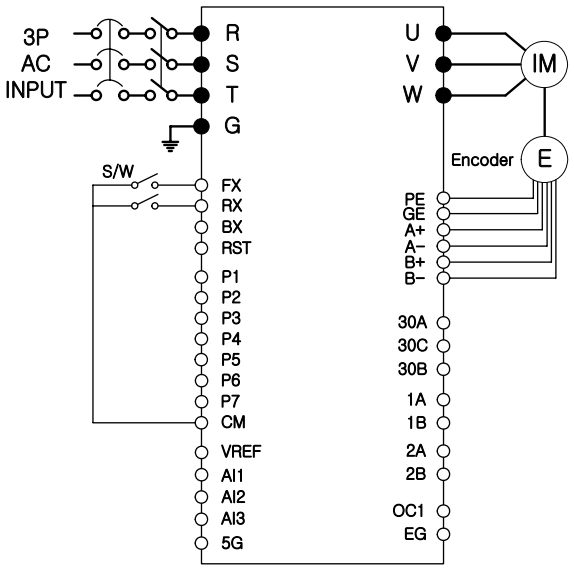
- If A and B phase are reversed, be sure to replace A with B phase wire after checking the pulse encoder wiring.
- If motor wires are reversed, be sure to replace V with W phase wire after checking the motor output wiring.
- It does not need to change wiring if user changes the setting value of PAR_11(Enc Dir Set) from "A Phase Lead" to "B Phase Lead".
- Torque display is on the basis of the no load operation.

Operation Example (1)	Speed Setting via Keypad + Run/Stop via Terminal (FX/RX)

[Operation condition]

-. Control mode : Speed control
-. Ref. Speed : 1500[rpm] setting via keypad
-. Accel/Decel time : Accel - 10[sec], Decel - 20[sec]
-. Run/Stop Src : Run/Stop via FX/RX terminal, Control terminal: NPN mode

[Wiring]



[Related Function Code]

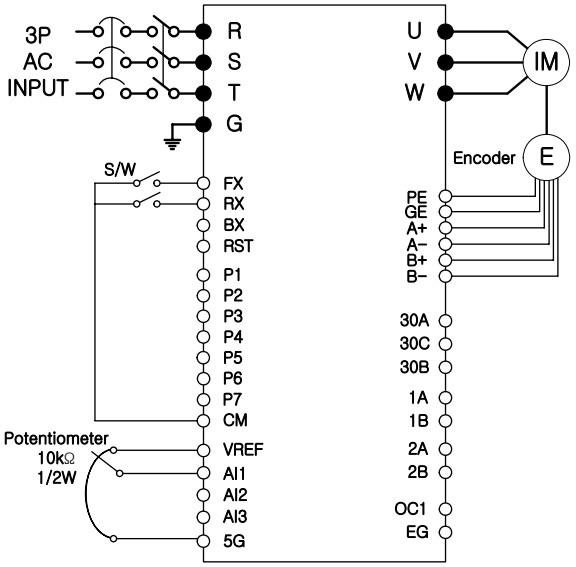
Step	Parameter setting	Code	Description
1	RUN/STOP source select	FUN_01	Set it to 0 “Terminal 1”.
2	Speed setting method	FUN_02	Set it to 1 “Keypad1”.
3	Ref. Speed Setting	FUN_12	Set speed command 1500[rpm] via Keypad.
4	Accel/Decel time	FUN_40 FUN_41	Set Accel time to 10 [sec] in FUN_40. Set Decel time to 20 [sec] in FUN_41.
5	Terminal FX	-	Motor starts to rotate in Forward direction at 1500[rpm] with Accel time 10 [sec] when FX terminal is turned ON. Motor decelerates to stop with Decel time 20[sec] when FX terminal is turned OFF.
6	Terminal RX	-	When RX terminal is turned ON motor starts to rotate in Reverse direction at 1500[rpm] with Accel time 10 [sec]. When it is OFF, motor decelerates to stop with Decel time 20 [sec].

Operation Example (2)	Analog Voltage Input(AI1) + Run/Stop via Terminal (FX/RX)

[Operation condition]

-. Control mode : Speed control
-. Ref. Speed : 1500[rpm] analog input via AI1(Potentiometer)
-. Accel/Decel time : Accel - 10[sec], Decel - 20[sec]
-. Run/Stop Src : Run/Stop via FX/RX terminal, Control terminal: NPN mode

[Wiring]



[Related Function Code]

Step	Parameter setting	Code	Description
1	RUN/STOP source select	FUN_01	Set it to 0 “Terminal 1”.
2	Speed setting method	FUN_02	Set it to 0 “Analog”.
3	Analog Input 1 Definition	AIO_01	Set it to 1 “Speed Ref”.
4	Analog Input 1 Input Method Definition	AIO_02	Set it to 2 “0 → 10V”.
5	Ref. Speed Setting	DIS_01	Set speed command 1500[rpm] via AI1(Potentionmeter) in DIS_01 PreRamp Ref.
6	Accel/Decel time	FUN_40 FUN_41	Set Accel time to 10 [sec] in FUN_40. Set Decel time to 20 [sec] in FUN_41.
7	Terminal FX	-	Motor starts to rotate in Forward direction at 1500[rpm] with Accel time 10 [sec] when FX terminal is turned ON. Motor decelerates to stop with Decel time 20[sec] when FX terminal is turned OFF.
8	Terminal RX	-	When RX terminal is turned ON motor starts to rotate in Reverse direction at 1500[rpm] with Accel time 10 [sec]. When it is OFF, motor decelerates to stop with Decel time 20 [sec].

Chapter 5 - Function Code Table

5.1. Display Group (DIS_[][])

* " – " mark of communication adrress indicates communication exclusion.
* Setting during Inverter operation (Yes : possible, No : impossible)

CODE NO.	Comm. Addr	CODE NAME	LCD DISPLAY	SETTING DATA			Adjustment During Run 1)	PAGE
				RANGE	UNIT	DEFAULT		
DIS_00	-	Motor Speed/Control Mode Output Torque/Output Current	0.0rpm SPD Tq 0.0% 0.0A	-	-	-	-	
DIS_01	-	User Display 1	Ai1 Value		%	PreRamp Ref	Yes	6-1
			Ai2 Value		%			
			Ai3 Value		%			
			Ai4 Value1)		%			
			Ai5 Value 1)		%			
			PreRamp Ref		rpm			
			PostRamp Ref		rpm			
			ASR Inp Ref		rpm			
			Output Freq		rpm			
			Motor Speed		rpm			
			Speed Dev		rpm			
			ASR Out		%			
			Torque Bias		%			
			PosTrq Limit		%			
			NegTrq Limit		- %			
			RegTrq Limit		%			
			Torque Ref		%			
			IqeRef		A			
			Iqe		A			
			Flux Ref		%			
			Ide Ref		A			
			Ide		A			
			ACR_Q Out		V			
			ACR_D Out		V			
			VdeRef		V			
			VqeRef		V			
			Out Amps RMS		A			
			Out Volt RMS		V			
			Power		kW			
			DC Bus Volt		V			
			Proc PI Ref		%			
			Proc PI F/B		%			
			Proc PI Out		%			
			MotTemp NTC		deg			
			MotTemp PTC		deg			
			Inv Temp		deg			
			Inv i2t		%			
			MP Output		%			
			Ctrl Mode		-			
			S/W Version		-			
			Run Time		-			
			Terminal In		-			
			Terminal Out		-			
			Run Status		-			
			Diameter 2)		%			
			Line SPD CMD 2)		%			
			Reel SPD 2)		%			
DIS_02	-	User Display 2	Refer to DIS_01		-	DC Bus Volt	Yes	
DIS_03	-	User Display 3	Refer to DIS_01		-	Terminal In	Yes	
DIS_04	-	Process PID Output Ref / FB	PIDOut 0.0% *xx.x% 0.0%	-	-	-	-	6-3
DIS_05	-	Faulty Display	Faults	-	-	-		
DIS_06	7106	User Group Display Setting	Usr Grp Disp	0 (Not Used) 1 (Dis+User Grp) 2 (Display ALL)	-	0 (Not Used)	Yes	6-4

1) It is effective only when you use Extended I/O (EXTN_I/O).

2) It is displayed on WEB control Mode.

5.2 Digital DIO Group (DIO_[][])

CODE NO.	Comm. Addr	CODE NAME	LCD DISPLAY	SETTING DATA			Adjustment During Run	PAGE
				RANGE	UNIT	DEFAULT		
DIO_00	-	Jump for quick view	Jump Code	1 ~ 97	-	-	Yes	6-5
DIO_01	7201	Multi-function input terminal P1 definition	P1 define	0 (Not Used) 1 (Speed-L) 2 (Speed-M) 3 (Speed-H) 4 (Jog Speed) 5 (MOP Up) 6 (MOP Down) 7 (MOP Clear) 8 (MOP Save) 9 (Analog Hold) 10 (Main Drive) 11 (2nd Func) 12 (Xcel-L) 13 (Xcel-H) 14 (3-Wire) 15 (Ext Trip-B) 16 (Prohibit FWD) 17 (Prohibit REV) 18 (Proc PID Dis) 19 (Timer Input) 20 (SoftStrtCncl) 21 (ASR Gain Sel) 22 (ASR P/PI Sel) 23 (Flux Ref Sel) 24 (PreExcite) 25 (Spd/Trq Sel) 26 (Use Max Trq) 27 (Use Trq Bias) 30 (Battery Run) Note2) 41 (LVT Disable) 42 (Dia Hold) Note1) 43 (Dia Preset) Note 1) 44 (CoreSize-L) Note 1) 45 (CoreSize-H) Note 1) 46 (TensionDisable) Note 1) 47 (PI Gain Sel) Note 1) 48 (PID ITerm Clr) Note 1) 49 (Taper Disable) Note 1) 50 (Stall Enable) Note 1) 51 (Boost Enable) Note 1) 52 (Quick Stop) Note 1) 53 (Jog Web) Note 1) 54 (Under Wind) Note 1) 55 (Unwinder) Note 1)	-	0 (Not Used)	No	
DIO_02	7202	Multi-function input terminal P2 definition	P2 define	Refer to DIO_1	-	0 (Not Used)	No	
DIO_03	7203	Multi-function input terminal P3 definition	P3 define		-	0 (Not Used)	No	
DIO_04	7204	Multi-function input terminal P4 definition	P4 define		-	0 (Not Used)	No	
DIO_05	7205	Multi-function input terminal P5 definition	P5 define		-	0 (Not Used)	No	
DIO_06	7206	Multi-function input terminal P6 definition	P6 define		-	0 (Not Used)	No	
DIO_07	7207	Multi-function input terminal P7 definition	P7 define		-	0 (Not Used)	No	
DIO_08	-	Negative function of multi-function input terminal	Neg Func. In	0000000 ~ 1111111	bit	0000000	No	6-17
DIO_09	7209	Multi-function Input LPF time constant	Terminal LPF	0 ~ 2000	-	5	Yes	
DIO_10	-	Negative function of multi-function auxiliary output terminal	Neg Func. Out	00000 ~ 11111	bit	00000	No	6-17

1) It is displayed on WEB control Mode.
2) It is for only 5.5~22kW/2/4 products.

CODE NO.	Comm. Addr	CODE NAME	LCD DISPLAY	SETTING DATA			Adjustment During Run	PAGE
				RANGE	UNIT	DEFAULT		
DIO_41	7229	Definition of multi-function Auxiliary output (AX1)	AX1 Define	0 (Not Used) 1 (INV Ready) 2 (Zero Spd Det) 3 (Spd Det.) 4 (Spd Det(ABS)) 5 (Spd Arrival) 6 (Timer Out) 7 (LV Warn) 8 (Run) 9 (Regenerating) 10 (Mot OH Warn) 11 (Inv OH Warn) 12 (Spd Agree) 13 (Trq Det.) 14 (Trq Lmt Det.) 15 (OverLoad) 16 (Stop) 17 (MC on/off) 18 (Steady) 19 (Brake Output) 23 (WEB Break)[1)] 24 (Up To Spd)[1)] 25 (False Core)[1)]	-	0 (Not Used)	Yes	6-17
DIO_42	722A	Definition of multi-function Auxiliary output (AX2)	AX2 Define	Same as DIO_41	-	0 (Not Used)	Yes	
DIO_43	722B	Definition of multi-function Auxiliary output (OC1)	OC1 Define	Same as DIO_41	-	0 (Not Used)	Yes	
DIO_46	722E	Fault relay mode selection (A, B, C)	Relay Mode	000 ~ 111	bit	011	Yes	6-23
DIO_47	722F	Zero speed detection level	ZSD Level	0.0 ~ 480.0	rpm	10.0	Yes	6-18
DIO_48	7230	Zero speed detection band	ZSD Band	0.1 ~ 10.0	%	0.5	Yes	
DIO_49	7231	Speed detection level	SD Level	-3600 ~ 3600	rpm	0	Yes	6-18
DIO_50	7232	Speed detection band	SD Band	0.1 ~ 10.0	%	0.5	Yes	
DIO_51	7233	Speed arrival band	SA Band	0.1 ~ 10.0	%	0.5	Yes	6-19
DIO_52	7234	Speed deviation band	SEQ Band	0.1 ~ 10.0	%	0.5	Yes	
DIO_53	7235	Torque detection level	TD Level	0.0 ~ 250.0	%	0.0	Yes	6-21
DIO_54	7236	Torque detection band	TD Band	0.1 ~ 10.0	%	0.5	Yes	
DIO_55	7237	Timer On delay time	TimerOn Dly	0.1 ~ 3600.0	sec	0.1	Yes	6-20
DIO_56	7238	Timer Off delay time	TimerOff Dly	0.1 ~ 3600.0	sec	0.1	Yes	
DIO_57	7239	Overload warning level	OL Level	30 ~ 250	%	150	Yes	6-21
DIO_58	723A	Overload warning time	OL Time	0 ~ 30	sec	10	Yes	
DIO_59	723B	Overload trip selection	OLT Select	0 (No) 1 (Yes)		1 (Yes)	Yes	6-23
DIO_60	723C	Overload trip level	OLT Level	30 ~ 250	%	180	Yes	
DIO_61	723D	Overload trip time	OLT Time	0 ~ 60	sec	60	Yes	
DIO_62	723E	Inverter overheat warning temp.	IH Warn Temp	50 ~ 85	deg	75	Yes	6-21
DIO_63	723F	Inverter overheat warning band	IH Warn Band	0 ~ 10	deg	5	Yes	
DIO_64	7240	Motor overheat warning temp.	MH Warn Temp	75 ~ 130	deg	120	Yes	6-20
DIO_65	7241	Motor overheat warning band	MH Warn Band	0 ~ 10	deg	5	Yes	
DIO_66	7242	Delayed time of MC On	MC Timer On	100~50000	msec	1000	No	6-22
DIO_67	7243	Delayed time of MC Onff	MC Timer Off	100~50000	msec	1000	No	
DIO_97	7261	How to Run at Lost command	Lost Command	0 (None) 1 (FreeRun) 2 (Stop)	-	0 (None)	No	6-24

1) Displayed WEB Control mode setting.

5.3 Parameter group (PAR_[][])

CODE NO.	Comm. Addr	CODE NAME	LCD DISPLAY	SETTING DATA			Adjustment During Run	PAGE
				RANGE	UNIT	DEFAULT		
PAR_00	-	Jump for quick view	Jump Code	1 ~ 33	-	-	Yes	
PAR_01	7301	Initialize parameters	Para. init	0 (No) 1 (All Groups) 2 (DIS) 3 (DIO) 4 (PAR) 5 (FUN) 6 (CON) 7 (EXT) 8 (AIO) 9 (USR) 10 (2ND) 11 (E/L) 12 (SYN) 13 (WEB)		0 (No)	No	6-25
PAR_02	-	Read parameters	Para. read	No / Yes		No	No	
PAR_03	-	Write parameters	Para. write	No / Yes		No	No	
PAR_04	-	Parameter write protection	Para. lock	0 ~ 255		0	Yes	6-26
PAR_05	-	Password	Password	0 ~ 9999		0	Yes	
PAR_07	7307	Motor capacity selection	Motor select	0 (2.2) 1 (3.7) 2 (5.5) 3 (7.5) 4 (11.0) 5 (15.0) 6 (18.5) 7 (22.0) 8 (30.0) 9 (37.0) 10 (45.0) 11 (55.0) 12 (75.0) 13 (90.0) 14 (110.0) 15 (132.0) 16 (160.0) 17 (220.0) 18 (280.0) 19 (315.0) 20 (375.0) 21 (500.0) 22 (800.0) 23 (User Define) [1]	kW	-	No	6-27
PAR_08	7308	Motor cap. selection of USER	UserMotorSel	1.5 ~ 800.0	kW	5.5	No	
PAR_09	7309	Motor cooling type	Cooling Mtd	0 (Self-cool) 1 (Forced-cool)	-	1 (Forced-cool)	Yes	6-45
PAR_10	730A	Pulse no. of encoder	Enc Pulse	360 ~ 4096	-	1024	No	6-28
PAR_11	730B	Encoder direction setting	Enc Dir Set	0 (A Phase Lead) 1 (B Phase Lead)	-	0 (A Phase Lead)	No	6-26
PAR_12	730C	Encoder error check enable	Enc Err Chk	0 (No) 1 (Yes)	-	1 (Yes)	No	6-28
PAR_13	730D	Encoder LPF time constant	Enc LPF	0 ~ 100	ms	1	Yes	
PAR_14	730E	Encoder error detection time	EncFaultTime	0.00 ~ 10.00	sec	0.00	No	
PAR_15	730F	encoder error reference speed	EncFaultPerc	0.0 ~ 50.0	%	25.0	No	
PAR_17	7311	Motor base speed	Base Speed	100.0 ~ 3600.0	rpm	1800.0	No	6-30
PAR_18	7312	Motor rated voltage	Rated Volt	120 ~ 560	V		No	
PAR_19	7313	Motor number of poles	Pole number	2 ~ 12		4	Yes	
PAR_20	7314	Motor efficiency	Efficiency	70.0 ~ 100.0	%		Yes	
PAR_21	7315	Motor rated slip	Rated-Slip	10 ~ 2000.0	rpm		Yes	
PAR_22	7316	Motor rated current	Rated-Curr	1.0 ~ 750.0	A		Yes	6-31
PAR_23	7317	Auto tuning type selection	AutoTuneType	0 (Rotational) 1 (Standstill)		0 (Rotational)	No	6-31,33
PAR_24	-	Auto tuning range setting [2]	Auto Tuning	None ALL1/ALL2 Encoder Test Rs Tuning Lsigma Flux Curr Ls Tuning Tr Tuning	-	None	No	6-31, 6-33
PAR_25	7319	Tuning Torque	Tune Torque	10.0 ~ 100.0	%	70	Yes	
PAR_26	731A	Motor flux current	Flux-Curr	70 % to 0.0 ~ PAR_22	A		Yes	6-35
PAR_27	731B	Motor time constant	Tr	30 ~ 3000	ms		Yes	
PAR_28	731C	Leakage inductance	Ls	0.00 ~ 500.00	mH		Yes	
PAR_29	731D	Leakage coefficient	Lsigma	0.00 ~ 100.00	mH		Yes	
PAR_30	731E	Stator resistance	Rs	0.000 ~ 5.000	ohm		Yes	
PAR_33	7321	Encoder pulse multiplication [3]	Enc Scale	x1 / x16 / x32 / x64	-	x 1	No	-

1) When PAR_07 (Motor select) is set to "User Define", PAR_08 (UserMotorSel) will be displayed.

2) If PAR_23 (AutoTuneType) is set to "Standstill", the order of display in PAR_24 (Auto Tuning) will be None→ ALL1→ Rs Tuning→

Lsigma→ If/Tr/Ls Tune.

3) **Caution: PAR_33 (Enc Scale) Code is necessary only in the case of installation of SIN/COS Encoder option board, Don't modify the default value "X1" when not using SIN/COS Encoder board. If you modify the value, the normal operation isn't possible. For any extra information in detail, refer to the option dedicated manual.**

5.4. Function group (FUN_[][])

CODE NO.	Comm. Addr	CODE NAME	LCD DISPLAY	SETTING DATA			Adjustment During Run	PAGE
				RANGE	UNIT	DEFAULT		
FUN_00	-	Jump for quick view	Jump code	1 ~ 69	-	-	Yes	6-37
FUN_01	7401	RUN/STOP command source selection	Run/Stop Src	0 (Terminal 1) 1 (Terminal 2) 2 (Keypad) 3 (Option)	-	0 (Terminal 1)	No	
FUN_02	7402	Speed setting source selection	Spd Ref Sel	0 (Analog) 1 (Keypad1) 2 (Keypad2) 3 (Option) 6 (Line SPD Ref) 1) 7 (Line SPD Opt) 1)	-	1 (Keypad1)	No	6-38
FUN_03	7403	Stop mode selection	Stop mode	0 (Decel) 1 (Free-run)	-	0 (Decel)	No	
FUN_04	7404	Max. motor speed	Max Speed	400.0 ~ 3600.0	rpm	1800.0	No	
FUN_12	740C	Multi-step speed 0	Speed 0	0.0~Max Speed	rpm	0.0	Yes	6-38
FUN_13	740D	Multi-step speed 1	Speed 1	0.0~Max Speed	rpm	0.0	Yes	
FUN_14	740E	Multi-step speed 2	Speed 2	0.0~Max Speed	rpm	0.0	Yes	
FUN_15	740F	Multi-step speed 3	Speed 3	0.0~Max Speed	rpm	0.0	Yes	
FUN_16	7410	Multi-step speed 4	Speed 4	0.0~Max Speed	rpm	0.0	Yes	
FUN_17	7411	Multi-step speed 5	Speed 5	0.0~Max Speed	rpm	0.0	Yes	
FUN_18	7412	Multi-step speed 6	Speed 6	0.0~Max Speed	rpm	0.0	Yes	
FUN_19	7413	Multi-step speed 7	Speed 7	0.0~Max Speed	rpm	0.0	Yes	
FUN_20	7414	JOG speed	Jog Speed	0.0~Max Speed	rpm	100.0	Yes	
FUN_21	7415	Dwell Speed	Dwell Speed	0.0~Max Speed	rpm	100.0	No	6-39
FUN_22	7416	Dwell Time	Dwell Time	0.00 ~ 100.00	sec	0.00	No	
FUN_33	7421	Acc./Dec. reference Speed	Acc/Dec Ref	0 (Max Speed) 1 (Ref Speed)	-	0 (Max Speed)	No	6-40
FUN_36	7424	S ratio 1 in acceleration start	Acc S Start	0.0 ~ 50.0	%	0.0	No	6-41
FUN_37	7425	S ratio 2 in acceleration end	Acc S End	0.0 ~ 50.0	%	0.0	No	
FUN_38	7426	S ratio 1 in deceleration start	Dec S Start	0.0 ~ 50.0	%	0.0	No	
FUN_39	7427	S ratio 2 in deceleration end	Dec S End	0.0 ~ 50.0	%	0.0	No	
FUN_40	7428	Acceleration time 1	Acc Time-1	0.00 ~ 6000.0	sec	2.00 Note 2)	Yes	6-39
FUN_41	7429	Deceleration time 1	Dec Time-1	0.00 ~ 6000.0	sec	2.00 Note 2)	Yes	
FUN_42	742A	Acceleration time 2	Acc Time-2	0.00 ~ 6000.0	sec	3.00 Note 2)	Yes	
FUN_43	742B	Deceleration time 2	Dec Time-2	0.00 ~ 6000.0	sec	3.00 Note 2)	Yes	
FUN_44	742C	Acceleration time 3	Acc Time-3	0.00 ~ 6000.0	sec	4.00 Note 2)	Yes	
FUN_45	742D	Deceleration time 3	Dec Time-3	0.00 ~ 6000.0	sec	4.00 Note 2)	Yes	
FUN_46	742E	Acceleration time 4	Acc Time-4	0.00 ~ 6000.0	sec	5.00 Note 2)	Yes	
FUN_47	742F	Deceleration time 4	Dec Time-4	0.00 ~ 6000.0	sec	5.00 Note 2)	Yes	
FUN_48	7430	Deceleration time selection for zero speed	Use 0 Dec T	0 (No) 1 (Yes)		0 (No)	Yes	6-43
FUN_49	7431	Deceleration time for zero speed	0 Dec Time	0.00 ~ 6000.0	sec	0.00	Yes	
FUN_51	7433	Deceleration time for emergency stop	BX Time	0.0 ~ 6000.0	sec	0.0	Yes	6-44
FUN_52	7434	Pre-excitation time	PreExct Time	0 ~ 10000	ms	0	No	
FUN_53	7435	Hold Time	Hold Time	100 ~ 10000	ms	1000	No	
FUN_54	7436	Electronic thermal selection	ETH Select	0 (No) 1 (Yes)	-	0 (No)	Yes	6-45

1) **Displayed when setting WEB Control Mode.**

2) **A default value of a time of acceleration and deceleration is different from the setting capacity of inverter.**

Code No.	Comm. Addr	CODE NAME	LCD DISPLAY	SETTING DATA			Adjustment During Run	PAGE
				RANGE	UNIT	DEFAULT		
FUN_55	7437	Electronic thermal level for 1 minute	ETH 1 min	FUN_56 ~ 200	%	150	Yes	6-45
FUN_56	7438	Electronic thermal level for continuous	ETH Cont	50 ~ FUN_55 (up to 150%)	%	100	Yes	
FUN_57	7439	Switching frequency select	PWM Freq	2.5 ~ 10.0	kHz	Different according to the capacity of inverter	No	6-46
FUN_58	743A	Power on Run selection	Power-on Run	0 (No) 1 (Yes)	-	0 (No)	Yes	6-47
FUN_59	743B	Restart after fault reset	RST Restart	0 (No) 1 (Yes)	-	0 (No)	Yes	6-48
FUN_60	743C	Number of auto restart try	Retry Number	0 ~ 10	-	0	Yes	6-49
FUN_61	743D	Delay time before Auto restart	Retry Delay	0.0 ~ 60.0	sec	1.0	Yes	
FUN_62	743E	Wait time for Restart upon Stop	Restart Time	0.00 ~ 10.00	sec	0.00	No	6-50
FUN_63	743F	Overspeed Detection Level	OverSpdLevel	100.0 ~ 130.0	%	120.0	No	
FUN_64	7440	Overspeed Detection Time	OverSpd Time	0.00 ~ 2.00	sec	0.00	No	
FUN_65	7441	Brake Open Time [1]	BKOpen Time	0.00 ~ 30.00	sec	0.00	No	6-51
FUN_66	7442	Brake Open Speed [1]	BKOpen Spd	0.0 ~ 500.0	rpm	0.0	No	
FUN_67	7443	Brake Open Current [1]	Release Curr	0.0 ~ 150.0	%	20.0	No	
FUN_68	7444	Brake Close Time [1]	BKClose Time	0.00 ~ 30.00	sec	0.00	No	
FUN_69	7445	Brake Close Speed [1]	BKClose Spd	0.0 ~ 500.0	rpm	0.0	No	
FUN_70	7446	Speed in battery-operated mode [2]	Batt. Speed	2.5 ~ 200.0	rpm	50.0	No	6-53
FUN_71	7447	Battery input voltage Note 2)	Batt. Volt	12 ~ PAR_18	V	48	No	

1) Displayed when setting the definition of multi-aux output terminal (DIO_41~DIO_43) as “Brake Output”.

2) It can set for only 5.5 ~ 22 kW/2/4 products in case ‘Battery Run’ of multi-function input terminal (P1 ~ P&) is turned On.

5.5. Control group (CON_[][])

Code No.	Comm. Addr	Code Name	LCD DISPLAY	Setting Data			Adj. During Run	PAGE
				Range	Unit	Default		
CON_00	-	Jump for quick view	Jump Code	1 ~ 49	-	-	Yes	6-55
CON_01	7501	Control mode setting	Control Mode	1 (Speed) 2 (Torque)	-	1 (Speed)	No	
CON_02	-	Application mode setting	Application	General Vect Elevator [1] Synchro [2] WEB Control	-	General Vect	No	
CON_03	7503	ASR P Gain 1	ASR P Gain1	0.1 ~ 200.0	%	50.0	Yes	6-56
CON_04	7504	ASR I Gain 1	ASR I Gain1	0 ~ 50000	ms	300	Yes	
CON_05	7505	ASR LPF time constant 1	ASR LPF1	0 ~ 20000	ms	0	Yes	
CON_06	7506	ASR P Gain 2	ASR P Gain2	0.1 ~ 200.0	%	5.0	Yes	
CON_07	7507	ASR I Gain 2	ASR I Gain2	0 ~ 50000	ms	3000	Yes	
CON_08	7508	ASR LPF time constant 2	ASR LPF2	0 ~ 20000	ms	0	Yes	
CON_09	7509	Ramp time for ASR gain switch-over	ASR RAMP	10 ~ 10000	ms	1000	Yes	6-57
CON_10	750A	Target Speed after ASR gain switch-over	ASR TarSpd	0.0 ~ 3600.0	rpm	0.0	No	
CON_11	750B	Process PID reference (keypad)	Proc PID Ref	-100.0 ~ 100.0	%	0.0	Yes	6-58
CON_13	750D	Process PID P gain	Proc PID Kp	0.0 ~ 999.9	%	0.0	Yes	6-59
CON_14	750E	Process PID I gain	Proc PID Ki	0.0 ~ 100.0	%	0.0	Yes	
CON_15	750F	Process PID D gain	PROC PID Kd	0.0 ~ 100.0	%	0.0	Yes	
CON_16	7510	Process PID Positive limit	Proc Pos Lmt	-100.0 ~ 100.0	%	100	Yes	
CON_17	7511	Process PID Negative limit	Proc Neg Lmt	-100.0 ~ 100.0	%	100	Yes	
CON_18	7512	Process PID output LPF time constant	Proc Out LPF	0 ~ 500	ms	0	Yes	
CON_19	7513	Process PID output gain	Proc OutGain	-250.0 ~ 250.0	%	0.0	Yes	
CON_20	7514	Process PID output Enable	Proc PID Enb	0 (Disable) 1 (Enable) 2 (Terminal)	-	0 (Disable)	No	-
CON_21	7515	Proces PID Hold Time	PIDHoldTime	0 ~ 10000	ms	5000	No	6-59
CON_22	7516	Draw quantity	Draw %	-100.0 ~ 100.0	%	0.0	Yes	6-61
CON_23	7517	Droop quantity	Droop %	0.0 ~ 100.0	%	0.0	Yes	6-62
CON_24	7518	Low speed limit of Droop control	Droop MinSpd	0.0 ~ 3600.0	rpm	0.0	Yes	
CON_25	7519	Starting torque of Droop control	Droop MinTrq	0.0 ~ 100.0	%	0.0	Yes	
CON_26	751A	Torque reference source selection	Trq Ref Src	0 (None) 1 (Analog) 2 (Keypad) 3 (Option)	-	0 (None)	No	6-64
CON_27	751B	Torque Reference(keypad)	Torque Ref	-180.0 ~ 180.0	%	0.0	Yes	
CON_28	751C	Torque limit source selection	Trq Lmt Src	0 (Kpd Kpd Kpd) 1 (Kpd Kpd Ax) 2 (Kpd Ax Kpd) 3 (Kpd Ax Ax) 4 (Ax Kpd Kpd) 5 (Ax Kpd Ax) 6 (Ax Ax Kpd) 7 (Ax Ax Ax) 8 (Opt Opt Opt)	-	0 (Kpd Kpd Kpd)	No	6-66
CON_29	751D	Torque limit in forward run	Pos Trq Lmt	0.0 ~ 250.0	%	150.0	Yes	6-65
CON_30	751E	Torque limit in reverse run	Neg Trq Lmt	0.0 ~ 250.0	%	150.0	Yes	
CON_31	751F	Torque limit in regeneration	Reg Trq Lmt	0.0 ~ 250.0	%	150.0	Yes	
CON_32	7520	Torque Bias source selection	Trq Bias Src	0 (None) 1 (Analog) 2 (Keypad) 3 (Option)		0 (None)	No	6-65
CON_33	7521	Torque Bias quantity	Trq Bias	-150.0 ~ 150.0	%	0.0	Yes	
CON_34	7522	Torque bias feedforward	Trq Bias FF	-150.0 ~ 150.0	%	0.0	Yes	6-65
CON_35	7523	Torque Balance quantity	Trq Balance	0.0 ~ 100.0	%	50.0	Yes	
CON_49	7531	Speed search setting	Speed Search	0000 ~ 1111 (bit setting)	-	0100	No	6-68

1) Displayed only when the E/L_IO board is installed.

2) Displayed only when the SYNC_IO board is installed.

5.6. User group (USR_[][])

Code No.	Comm. Addr	Code Name	LCD DISPLAY	Setting Data			Adjustment During Run	PAGE
				Range	Unit	Default		
USR_00	-	Select Code number	Jump Code	1 ~ 67	-	-	Yes	6-69
USR_01	-	Initialize to the initial value adequate to the application	Macro Init	User Define E/L	-	User Define	No	
USR_02	-	User data save	User Save	No / Yes	-	No	No	
USR_03	-	Recall saved User Data.	User Recall	No / Yes	-	No	No	
USR_04	-	User Group Data	User Grp	-	-	-	No	

5.7. Second motor function (2nd_[][])

CODE NO.	Comm. Addr	CODE NAME	LCD DISPLAY	SETTING DATA			Adjustment During Run	PAGE
				RANGE	UNIT	DEFAULT		
2nd_00	-	Jump for quick view	Jump Code	1 ~ 33	-	-	Yes	6-71
2nd_01	7801	2nd motor Control mode setting	2nd Ctl Mode	1 (Speed) 2 (Torque)	-	1 (Speed)	No	
2nd_02	7802	Max. speed of 2nd motor	2nd Max Spd	400.0 ~ 3600.0	rpm	1800.0	No	
2nd_04	7804	Multi-step speed 0 of 2nd motor	2nd Spd 0	0.0 ~ 2nd_02	rpm	0.0	Yes	
2nd_05	7805	2nd motor S ratio 1 in acceleration start	2nd Acc S St	0.0 ~ 50.0	%	0.0	No	6-72
2nd_06	7806	2nd motor S ratio 2 in acceleration end	2nd Acc S Ed	0.0 ~ 50.0	%	0.0	No	
2nd_07	7807	2nd motor S ratio 1 in deceleration start	2nd Dec S St	0.0 ~ 50.0	%	0.0	No	
2nd_08	7808	2nd motor S ratio 2 in deceleration end	2nd Dec S Ed	0.0 ~ 50.0	%	0.0	No	
2nd_09	7809	acceleration time of 2nd motor	2nd Acc time	0.00 ~ 6000.0	sec	10.00	Yes	
2nd_10	780A	deceleration time of 2nd motor	2nd Dec time	0.00 ~ 6000.0	sec	10.00	Yes	
2nd_11	780B	cooling method of 2nd motor	2nd Cool Mtd	0 (Self-cool) 1 (Forced-cool)	-	0 (Self-cool)	Yes	
2nd_12	780C	Encoder pulse no. of 2nd motor	2nd Enc #	360 ~ 4096	-	1024	No	
2nd_13	780D	Encoder direction setting df 2nd motor	2nd Enc Dir	0 (A Phase Lead) 1 (B Phase Lead)	-	0 (A Phase Lead)	No	
2nd_14	780E	Encoder error check enable of 2nd motor	2nd Enc chk	0 (No) 1 (Yes)	-	1 (Yes)	No	
2nd_15	780F	Encoder LPF time constant of 2nd motor	2nd Enc LPF	0 ~ 100	ms	1	Yes	
2nd_17	7811	Base speed of 2nd motor	2nd BaseSpd	300.0 ~ 3600.0	rpm	1800.0	No	
2nd_18	7812	Rated voltage of 2nd motor	2nd R-Volt	120 ~ 560	V	-	No	
2nd_19	7813	2nd motor number of poles	2nd Pole #	2 ~ 12	-	4	No	
2nd_20	7814	Efficiency of 2nd motor	2nd Mot Eff.	70 ~ 100	%	-	Yes	
2nd_21	7815	Rated slip of 2nd motor	2nd R-Slip	10 ~ 250	rpm	-	Yes	
2nd_22	7816	Rated current of 2nd motor	2nd R-Curr	1.0 ~ 450.0	A	-	Yes	
2nd_23	7817	Flux current of 2nd motor	2nd Flx Cur	0.0 ~ 70% of 2nd_22	A	-	Yes	
2nd_24	7818	Rotor time constant of 2nd motor	2nd Mot Tr	30 ~ 3000	ms	-	Yes	
2nd_25	7819	Leakage inductance of 2nd motor	2nd Mot Ls	0.00 ~ 500.00	mH	-	Yes	
2nd_26	781A	Leakage coefficient of 2nd motor	2nd Mot sLs	0.00 ~ 100.00	mH	-	Yes	
2nd_27	781B	Stator resistance Of 2nd motor	2nd Mot Rs	0.000 ~ 5.000	ohm	-	Yes	
2nd_32	7820	Electronic thermal level for 1 minute of 2nd motor	2nd ETH 1min	100 ~ 150	%	150	Yes	
2nd_33	7821	Electronic thermal continuous level of 2nd motor	2nd ETH cont	50 ~ 150	%	100	Yes	

5.8. Analog AIO Group (AIO_[][])

Code No.	Comm. Addr	Code Name	LCD DISPLAY	Setting Data			Adjustment During Run	PAGE
				Range	Unit	Default		
AIO_00	-	Select code number	Jump Code	1 ~ 83	-	-	Yes	
AIO_01	7701	Multi-function Analog input Ai1 definition	Ai1 Define	0 (Not Used) 1 (Speed Ref) 2 (Proc PID Ref) 3 (Proc PID F/B) 4 (Draw Ref) 5 (Torque Ref) 6 (Flux Ref) 7 (Torque Bias) 8 (Torque Limit) 9 (Line SPD Ref) 1) 10 (Tension Ref) 1) 11 (Dancer Ref) 1) 12 (Taper Ref) 1) 13 (Tension F/B) 1) 14 (Diameter) 1) 15 (Diam Preset) 1)	-	0 (Not Used)	No	
AIO_02	7702	Multi-function Analog input Ai1 Source definition	Ai1 Source	00 (-10 → 10V) 01 (10 → -10V) 02 (0 → 10V) 03 (10 → 0V) 04 (0 → 20mA) 05 (20 → 0mA)	-	0 (-10 → 10V)	No	
AIO_03	7703	Multi-function Analog input Ai1 Minimum Voltage	Ai1 In X1	0.00 ~ Ai1 In X2	%	0.00	Yes	6-74
AIO_04	7704	Multi-function Analog input Ai1 Minimum Voltage Bias	Ai1 Out Y1	-10.00 ~ Ai1 Out Y2	%	0.00	Yes	
AIO_05	7705	Multi-function Analog input Ai1 Maximum Voltage	Ai1 In X2	0.00 ~ 100.00	%	100.00	Yes	
AIO_06	7706	Multi-function Analog input Ai1 Maximum Voltage Gain	Ai1 Out Y2	0.00 ~ 250.00	%	100.00	Yes	
AIO_07	7707	Multi-function Analog input Ai1 -Minimum Voltage	Ai1 -In X1	Ai1 -In X2 ~ 0.00	%	0.00	Yes	
AIO_08	7708	Multi-function Analog input Ai1 -Minimum Voltage Bias	Ai1 -Out Y1	Ai1 -Out Y2 ~ 10.00	%	10.00	Yes	
AIO_09	7709	Multi-function Analog input Ai1-Maximum Voltage	Ai1 -In X2	-100.00 ~ 0.00	%	-100.00	Yes	
AIO_10	770A	Multi-function Analog input Ai1-Maximum Voltage Gain	Ai1 -Out Y2	-250.00 ~ 0.00	%	-100.00	Yes	
AIO_11	770B	Ai1 input LPF time constant	Ai1 LPF	0 ~ 2000	ms	-	-	
AIO_12	770C	Multi-function Analog input Ai1 command loss Criterion select	Ai1 Wbroken	0 (None) 1 (Half of x1) 2 (Below x1)	-	0 (None)	No	6-77

1) Displayed only when WEB mode setting.

Code No.	Comm. Addr	Code Name	LCD DISPLAY	Setting Data			Adjustment During Run	PAGE
				Range	Unit	Default		
AIO_13	770D	Multi-function Analog input Ai2 Definition	Ai2 Define	Refer to AIO_01~12				6-74
AIO_14	770E	Multi-function Analog input Ai2 Source definition	Ai2 Source					
AIO_15	770F	Multi-function Analog input Ai2 Minimum Voltage	Ai2 In X1					
AIO_16	7710	Multi-function Analog input Ai1 Minimum Voltage Bias	Ai2 Out Y1					
AIO_17	7711	Multi-function Analog input Ai2 Maximum Voltage	Ai2 In X2					
AIO_18	7712	Multi-function Analog input Ai2 Maximum Voltage Gain	Ai2 Out Y2					
AIO_19	7713	Multi-function Analog input Ai2 -Minimum Voltage	Ai2 -In X1					
AIO_20	7714	Multi-function Analog input Ai2 -Minimum Voltage Bias	Ai2 -Out Y1					
AIO_21	7715	Multi-function Analog input Ai2 -Maximum Voltage	Ai2 -In X2					
AIO_22	7716	Multi-function Analog input Ai2 -Maximum Voltage Gain	Ai2 -Out Y2					
AIO_23	7717	Ai2 input LPF time constant	Ai2 LPF					
AIO_24	7718	Multi-function Analog input Ai2 loss command Criterion select	Ai2 Wbroken					
AIO_25	7719	Multi-function Analog input Ai3 Definition	Ai3 Define	Refer to AIO_01 ∫ Possible to select NTC/PTC motor 16 (Use Mot NTC) 17 (Use Mot PTC)		0 (Not Used)		No
AIO_26	771A	Multi-function Analog input Ai3 Source Definition	Ai3 Source	0 (-10 → 10V) 1 (10 → -10V) 2 (0 → 10V) 3 (10 → 0V)	-	0 (-10 → 10V)		No
AIO_27	771B	Multi-function Analog input Ai3 Minimum Voltage	Ai3 In X1	Refer to AIO_03~12				
AIO_28	771C	Multi-function Analog input Ai3 Minimum Voltage Bias	Ai3 Out Y1					
AIO_29	771D	Multi-function Analog input Ai3 Maximum Voltage	Ai3 In X2					
AIO_30	771E	Multi-function Analog input Ai3 Maximum Voltage Gain	Ai3 Out Y2					
AIO_31	771F	Multi-function Analog input Ai3 -Minimum Voltage	Ai3 -In X1					
AIO_32	7720	Multi-function Analog input Ai3 –Minimum Voltage Bias	Ai3 -Out Y1					
AIO_33	7721	Multi-function Analog input Ai3 -Maximum Voltage	Ai3 -In X2					

Code No.	Comm. Addr	Code Name	LCD DISPLAY	Setting Data			Adjustment During Run	PAGE
				Range	Unit	Default		
AIO_34	7722	Multi-function Analog input Ai3 -Maximum Voltage Gain	Ai3 -Out Y2	Refer to AIO_01~12				6-74
AIO_35	7723	Ai3 input LPF time constant	Ai3 LPF					
AIO_36	7724	Multi-function Analog input Command loss criterion select	Ai3 Wbroken					
AIO_37	7725	Multi-function Analog input Ai4 Definition 1)	Ai4 Define					
AIO_38	7726	Multi-function Analog input Ai4 Source Definition 1)	Ai4 Source					
AIO_39	7727	Multi-function Analog input Ai4 Minimum Voltage 1)	Ai4 In X1					
AIO_40	7728	Multi-function Analog input Ai4 Minimum Voltage Bias 1)	Ai4 Out Y1					
AIO_41	7729	Multi-function Analog input Ai4 Maximum Voltage 1)	Ai4 In X2					
AIO_42	772A	Multi-function Analog input Ai4 Maximum Voltage Gain 1)	Ai4 Out Y2					
AIO_43	772B	Multi-function Analog input Ai4 -Minimum Voltage 1)	Ai4 -In X1					
AIO_44	772C	Multi-function Analog input Ai4 -Minimum Voltage Bias 1)	Ai4 -Out Y1					
AIO_45	772D	Multi-function Analog input Ai4 -Maximum Voltage 1)	Ai4 -In X2					
AIO_46	772E	Multi-function Analog input Ai4 -Maximum Voltage Gain 1)	Ai4 -Out Y2					
AIO_47	772F	Ai4 output LPF time constant1)	Ai4 LPF					
AIO_48	7730	Multi-function Analog input Ai4 command loss criterion select1)	Ai4 Wbroken					
AIO_49	7731	Multi-function Analog input Ai5 Definition 1)	Ai5 Define	Refer to AIO_01 ∫ When using EXTN_I/O motor NTC/PTC function is available at Ai5 16 (Use Mot NTC) 17 (Use Mot PTC)		0 (Not Used)	No	
AIO_50	7732	Multi-function Analog input Ai5 Source Definition 1)	Ai5 Source	0 (-10 → 10V) 1 (10 → -10V) 2 (0 → 10V) 3 (10 → 0V)	-	0 (-10 → 10V)	No	

1) It only comes under using EXTN_I/O.

Code No.	Comm. Addr	Code Name	LCD DISPLAY	Setting Data			Adjustment During Run	PAGE
				Range	Unit	Default		
AIO_51	7733	Multi-function Analog input Ai5 Minimum Voltage 1)	Ai5 In X1	Refer to AIO_03~12				6-74
AIO_52	7734	Multi-function Analog input Ai4 Minimum Voltage Bias 1)	Ai5 Out Y1					
AIO_53	7735	Multi-function Analog input Ai5 Maximum Voltage 1)	Ai5 In X2					
AIO_54	7736	Multi-function Analog input Ai5 Maximum Voltage Gain 1)	Ai5 Out Y2					
AIO_55	7737	Multi-function Analog input Ai5 -Minimum Voltage 1)	Ai5 -In X1					
AIO_56	7738	Multi-function Analog input Ai5 -Minimum Voltage Bias 1)	Ai5 -Out Y1					
AIO_57	7739	Multi-function Analog input Ai5 -Maximum Voltage 1)	Ai5 -In X2					
AIO_58	773A	Multi-function Analog input Ai5 -Maximum Voltage Gain 1)	Ai5 -Out Y2					
AIO_59	773B	Ai5 input LPF time constant1)	Ai5 LPF					
AIO_60	773C	Multi-function Analog input Ai5 command loss criterion select1)	Ai5 Wbroken					
AIO_73	7749	Multi-function Analog input command loss time	Time out	0.1 ~ 120.0	sec	1.0	No	6-78
AIO_74	774A	Multi-function analog Output AO1 Definition	AO1 Define	0 (Not Used) 1 (Ai1 Value) 2 (Ai2 Value) 3 (Ai3 Value) 4 (Ai4 Value) 1) 5 (Ai5 Value) 1) 7 (PreRamp Ref) 8 (PostRamp Ref) 9 (ASR Inp Ref) 11 (Motor Speed) 12 (Speed Dev) 13 (ASR Out) 14 Torque Bias 15 (PosTrq Limit) 16 (NegTrq Limit) 17 (RegTrq Limit) 18 (Torque Ref) 19 (IqeRef) 20 (Iqe) 21 (Flux Ref) 22 (IdeRef) 23 (Ide) 24 (ACR_Q Out) 25 (ACR_D Out) 26 (VdeRef) 27 (VqeRef) 28(Out Amps RMS) 29 (Out Volt RMS) 30 (Power) 31 (DC Bus Volt) 32 (Proc PI Ref)	-	0 (Not Used)	No	

1) It only comes under using EXTN_I/O.

Code No.	Comm. Addr	Code Name	LCD DISPLAY	Setting Data			Adjustment During Run	PAGE
				Range	Unit	Default		
AIO_74	774A	Multi-function Analog Output AO1 Definition	AO1 Define	33 (PROC PI F/B) 34 (Proc PI Out) 35 (Line Speed) 1) 36 (Tension Out) 1) 37 (Diameter) 1) 38 (MotNTC Temp) 39 (MotPTC Temp) 40 (Inv Temp) 41 (Inv i2t)	-	0 (Not Used)	No	6-78
AIO_75	774B	Multi-function Analog Output AO1 Source Definition	AO1 Source	0 (-10 → 10V) 1 (10 → -10V) 2 (0 → 10V) 3 (10 → 0V)	-	0 (-10 → 10V)	No	
AIO_76	774C	Multi-function Analog Output AO1 Bias	AO1 Bias	-100.0 ~ AIO_77	%	0.0	No	
AIO_77	774D	Multi-function Analog Output AO1 Gain	AO1 Gain	0.0 ~ 500.0	%	100.0	No	
AIO_78	774E	Multi-function Analog Output AO1 absolute value setting	AO1 ABS	0 (No) 1 (Yes)	-	0 (No)	No	
AIO_79	774F	Multi-function Analog Output AO2 Definition	AO2 Define	Refer to AIO_74~78				
AIO_80	7750	Multi-function Analog Output AO2 Source Definition	AO2 Source					
AIO_81	7751	Multi-function Analog Output AO2 Bias	AO2 Bias					
AIO_82	7752	Multi-function Analog Output AO2 Gain	AO2 Gain					
AIO_83	7753	Multi-function Analog Output AO1 absolute value setting	AO2 ABS					

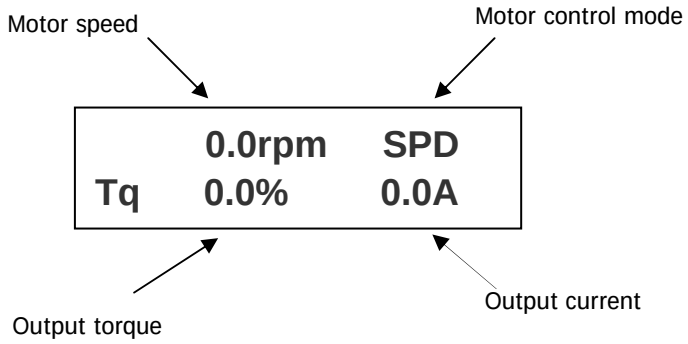
1) Displayed only when WEB mode setting.

Chapter 6 – Function Description

6.1 Display Group (DIS_[][])

6.1.1 DIS_00 (Motor control status monitoring)

Displayed when Power ON.



Code	Parameter name	Unit	Description
DIS_00	Motor speed	rpm	Actual motor rotating speed displayed in rpm.
	Motor control mode		SPD : Speed control mode TRQ : Torque control mode WEB : WEB control mode BX : Emergency stop display BAT : Battery-operated mode
	Output torque	%	100% = Rated torque of motor
	Inverter output current	A	Inverter actual output current displayed

6.1.2 DIS_01 ~ 03 (User display 1, 2, 3)

Select one of the followings each to be displayed in DIS_01, 02 and 03.

Factory default: **DIS_01= " PreRamp Ref "**, **DIS_02= "DC Bus Volt"**, **DIS_03= " Terminal In "**

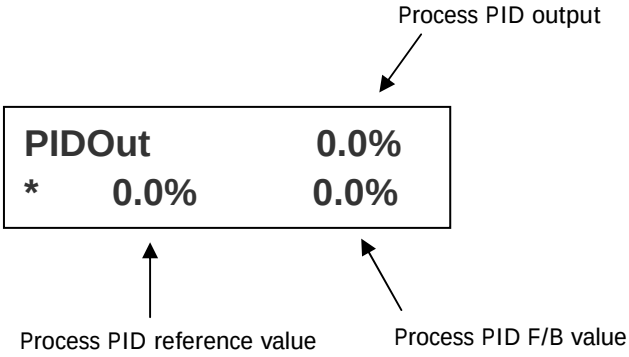
Code	Parameter name	LCD display	Unit	Description
DIS_01 ~ DIS_03	Ai1 Value ~ Ai3 Value *1	Ai1 Value ~ Ai3 Value	%	Displayed as the percentage of multi-function analog input value (10V / 100%, 20mA / 100%)
	Pre Ramp Reference	PreRamp Ref	rpm	Speed reference before ramping
	Post ramp reference	PostRamp Ref	rpm	Speed reference after ramping
	ASR Input Reference	ASR Inp Ref	rpm	Final speed reference input value to ASR (Automatic Speed Regulator) displayed (Draw and Droop included)
	Motor Rotating Speed	Motor Speed	rpm	Actual motor rotating speed
	Speed Deviation	Speed Dev	rpm	Deviation between speed ref and actual rotating speed
	ASR Output	ASR Out	%	ASR output to rated torque
	Torque bias	Torque Bias	%	Torque bias to rated torque
	Positive Trq Limit	Pos Trq Limit	%	Positive torque limit to rated torque
	Negative Trq Limit	Neg Trq Limit	%	Negative torque limit to rated torque

<table>
<tr><th>Code</th><th>Parameter name</th><th>LCD display</th><th>Unit</th><th>Description</th></tr>
<tr><td rowspan="30">DIS_01
~
DIS_03</td><td>Regeneration Trq Limit</td><td>Reg Trq Limit</td><td>%</td><td>Regeneration torque limit to rated torque</td></tr>
<tr><td>Torque Reference</td><td>Torque Ref</td><td>%</td><td>Torque reference to rated torque</td></tr>
<tr><td>Torque current ref.</td><td>IqeRef</td><td>%</td><td>Torque current reference to rated torque current</td></tr>
<tr><td>Torque current</td><td>Iqe</td><td>%</td><td>Actual torque current to rated torque current</td></tr>
<tr><td>Flux reference</td><td>Flux Ref</td><td>%</td><td>Flux reference to the rated flux</td></tr>
<tr><td>Flux Current ref.</td><td>IdeRef</td><td>%</td><td>Flux current reference to rated flux current</td></tr>
<tr><td>Flux Current</td><td>Ide</td><td>%</td><td>Actual flux current to rated flux current</td></tr>
<tr><td>ACR output of axis Q</td><td>ACR_Q Out</td><td>V</td><td>ACR output value of axis Q</td></tr>
<tr><td>ACR output of axis D</td><td>ACR_D Out</td><td>V</td><td>ACR output value of axis D</td></tr>
<tr><td>Voltage reference of axis D</td><td>VdeRef</td><td>V</td><td>Voltage reference value of axis D</td></tr>
<tr><td>Voltage reference of axis Q</td><td>VqeRef</td><td>V</td><td>Voltage reference value of Q axis Q</td></tr>
<tr><td>Output current</td><td>Out Amps RMS</td><td>A</td><td>Inverter output current (rms)</td></tr>
<tr><td>Output voltage</td><td>Out Volt RMS</td><td>V</td><td>Inverter output voltage (rms)</td></tr>
<tr><td>Output power</td><td>Power</td><td>kW</td><td>Motor output power</td></tr>
<tr><td>DC LINK voltage</td><td>DC Bus Volt</td><td>V</td><td>Inverter DC link voltage</td></tr>
<tr><td>Process PI reference</td><td>Proc PI Ref</td><td>%</td><td>Reference value of Process PID routine</td></tr>
<tr><td>Process PI Feedback</td><td>Proc PI F/B</td><td>%</td><td>Feedback value of Process PID routine</td></tr>
<tr><td>Process PI output</td><td>Proc PI Out</td><td>%</td><td>Output value of Process PID routine</td></tr>
<tr><td>Motor temperature NTC</td><td>Mot Temp NTC</td><td>deg</td><td>Temp displayed when mot temp sensor is NTC. 25℃ displayed when temp sensor is not provided with the motor.</td></tr>
<tr><td>Motor temperature PTC</td><td>Mot Temp PTC</td><td>deg</td><td>Temp displayed when mot temp sensor is PTC. 25℃ displayed when temp sensor is not provided with the motor.</td></tr>
<tr><td>Inverter temperature</td><td>Inv Temp</td><td>deg</td><td>Inverter Heatsink temp displayed</td></tr>
<tr><td>Inverter i2t</td><td>Inv i^2t</td><td>%</td><td>Inverter overload capability displayed. In the case Overload capability is 150% for 1 min, i^2t becomes 100% when 150% of rated current is flowing for 1 min.</td></tr>
<tr><td>MOP output</td><td>MP Output</td><td>%</td><td>Set value displayed when operation is done by potentiometer on terminal input.</td></tr>
<tr><td>Control mode</td><td>Ctrl Mode</td><td></td><td>Selected control mode displayed</td></tr>
<tr><td>Software version</td><td>S/W Version</td><td></td><td>S/W version displayed</td></tr>
<tr><td>Running time</td><td>Run Time</td><td></td><td>Inverter running time displayed after Power On</td></tr>
<tr><td>Input terminal status</td><td>Terminal In</td><td></td><td>ON/OFF status of Input terminal displayed
(0: OFF, 1: ON)
<table>
<tr><th></th><th>FX</th><th>RX</th><th>BX</th><th>P1</th><th>P2</th><th>P3</th><th>P4</th><th>P5</th><th>P6</th><th>P7</th></tr>
<tr><td>0 : OFF
1 : ON</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td></tr>
</table></td></tr>
<tr><td>Output terminal status</td><td>Terminal Out</td><td></td><td>ON/OFF status of open collector output, fault relay and contact output.
(0: OFF, 1: ON)
<table>
<tr><th></th><th>AX1</th><th>AX2</th><th>OC1</th><th>NC</th><th>NC</th><th>30A (30B)</th></tr>
<tr><td>0 : OFF
1 : ON</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0</td><td>0</td><td>0/1</td></tr>
</table></td></tr>
<tr><td>Running status</td><td>Run Status</td><td></td><td>Operating status displayed</td></tr>
</table>

*1) In the case of using EXTN_I/O, it will be displayed up to Ai5.

6.1.3 DIS_04 (Process PID controller)

Information on Output, reference, F/B values of Process PID controller is displayed in this code.



6.1.4 DIS_05 (Fault display)

Current fault status, previous two faults, the number of faults occurred and faults information reset are available using [SHIFT/ESC] key in DIS_05.

Code	LCD display	Parameter name	Description
DIS_05	Faults	Current Trip displayed	"**-------"** displayed when normal. Trip information given when tripped.
	Last Fault1	2nd fault displayed	Refer to Chapter 9. Troubleshooting.
	Last Fault2	1st fault displayed	
	Fault Count	Total number of faults	The number of total faults in memory from the initialization until now is displayed.
	Fault Clear	Reset	Clear the faults and initialize to "0".

Faults information, speed reference before fault occurs, speed F/B value, output frequency/ current/ Voltage, torque current reference & actual value, DC Link voltage, input terminal status, output terminal status, Run status, running time can be monitored using [PROG], [▲(Up)] / [▼(Down)] keys. Pressing [ENT] key will return to top. To enter the fault info into memory as [Last Fault 1], press [RESET] key. Refer to [Chapter 9 troubleshooting and maintenance] for more details.

No	Trip information	LCD display	No	Trip information	LCD display
1	Overcurrent in Phase U	OC–U	15	Overload trip	Over Load
2	Overcurrent in Phase V	OC–V	16	External trip B	Ext-B Trip
3	Overcurrent in Phase W	OC–W	17	Communication Error	COM Error
4	Fuse Open	Fuse Open	18	Inverter overload	Inv OLT
5	Overvoltage	Over Voltage	19	Motor overheat	MotOver Heat
6	IGBT short in phase U	Arm Short–U	20	Inverter thermal open	InvThem OP
7	IGBT short in phase V	Arm Short–V	21	Motor thermal error	MotThem Err
8	IGBT short in phase W	Arm Short–W	22	Motor over speed	Over Speed
9	IGBTshot in pahse DB *1)	Arm Short–DB	23	H/W Error	HW-Diag
10	Encorder Error	Encoder Err	24	Inverter over heat *2)	OHD Open
11	Low voltage	Low Voltage	25	FAN faulty *2)	FAN LOCK
12	Ground fault	Ground Fault	26	Failure of power for encoder supply *2)	Enc Power
13	Inverter Overheat	InvOver Heat	27	Power failure of AC FAN and M/C *3)	FAN/MC PWR
14	Electronic thermal	E-Thermal	28	Power failure AC FAN *4)	FAN PWR

※ **Note :**

When multiple faults occur at the same time, the MOST CRITICAL fault will be displayed and the rest of others can be inferred from the value using [PROG], [▲(Up)] / [▼(Down)] keys .

*1) Applicable only to SV110~220iV5.

*2) Applicable only to SV2800~5000iV5.

*3) Applicable only to SV300~1600iV5-4DC.

*4) Applicable only to SV2200iV5-4DC, SV5000iV5-4 and SV5000iV5-4DC.

6.1.5 DIS_06(User group display selection)

User can make “User group” by collecting frequently used codes. In DIS_06, user can set whether User group is displayed or not in three selections.

Code	LCD display	Parameter name	Description	
DIS_06	Usr Grp Disp	User group display selection	Not Used	User group not displayed
			Dis+Usr Grp	Only Display + User group displayed. The rest of groups are not displayed. If you want to display the rest, move to other group in Jump code or change the selection.
			Display ALL	Display all groups including User group. But, 2nd group is displayed only when 2nd group is defined. EXT group is displayed when Option board is installed.

6.2 DIO Group (DIO_[][])

6.2.1 Jump code (DIO_00)

In I/O_00, jumping directly to any parameter code can be accomplished by entering the desired code number.

(Example) Moving to I/O_05

Press [PROG] and set to 5 using [SHIFT/ESC] / [▲(Up)] / [▼(Down)] and press [ENT] key to move to I/O_05. If the desired code cannot be set, the closest code will be displayed.

```
DIO▶     P5 define
05       Not Used
```

Jumping other code is available using [▲(Up)] / [▼(Down)] keys.

6.2.2 Multi-function input terminal

1) DIO_01 ~ DIO_07 (Multi-function input terminal P1 ~ P7 define)

It defines Multi-function input terminals. SV-iV5 has 7 dedicated terminals (P1 ~ P7) for the setting of parameters below. However, the multiple terminals cannot be selected for the same function and if so, the invalid terminal definition is displayed as “Not Used”. And the selected function cannot be adjusted while running.

No	Set value	Description	No	Set value	Description
1	Speed-L	Multi-step speed-Low	16	Prohibit FWD	Forward Run prevention
2	Speed-M	Multi-step speed-Middle	17	Prohibit REV	Reverse Run prevention
3	Speed-H	Multi-step speed-High	18	Proc PID Dis	PID operation disabled
4	Jog Speed	Jog speed	19	Timer Input	Timer ON
5	MOP Up	MOP UP operation	20	SoftStrtCncl	Cancel Soft start
6	MOP Down	MOP Down operation	21	ASR Gain Sel	Switch ASR gain
7	MOP Clear	MOP Speed Clear (Reset)	22	ASR P/PI Sel	Switch ASR P/PI
8	MOP Save	MOP Speed Save	23	Flux Ref Sel	Switch Flux reference
9	Analog Hold	Analog speed ref. Hold	24	PreExcite	Pre-excitation
10	Main Drive	Exchange between Option and Inverter	25	Spd/Trq Sel	Speed/Torque control select
11	2nd Func	The 2nd function	26	Use Max Trq	Torque limit ON/OFF
12	Xcel-L	Multi-accel/decel-Low	27	Use Trq Bias	Torque bias ON/OFF
13	Xcel-H	Multi-accel/decel-High	28	Battery Run	Selection of battery-operated
14	3-Wire	3 Wire	29	LVT Diable	Detection of Low voltage trip disabled
15	Ext Trip-B	External trip B contact			

1.1) Speed-L

1.2) Speed-M

1.3) Speed-H

1.4) JOG operation

By defining P1 ~ P4 as “Speed-L”, “Speed-M”, “Speed-H” and “Jog Speed”, the selected references in FUN goup 12 ~ 20 (Multi-step speed 0 ~ 7 and Jog speed) become active as speed reference.

(Example) To define Multi-function input terminals P1, P2, P3 as Speed-L, Speed-M, Speed-H and P4 as Jog Speed;

Code	LCD display	Description	Setting range	Unit	Set value
DIO_01	P1 define	Multi-function input terminal P1 define			Speed-L
DIO_02	P2 define	Multi-function input terminal P1 define			Speed-M
DIO_03	P3 define	Multi-function input terminal P3 define			Speed-H
DIO _04	P4 define	Multi-function input terminal P4 define			Jog Speed

When multi-step speed 0 (FUN_12: Speed 0) is selected (P1, P2, P3 = OFF), speed reference is input by the method set in FUN_02 (Analog, keypad 1/2, option). If the jog (FUN_20) is active, inverter operates with jog frequency regardless of other terminal signal input.

P1	P2	P3	P4	Set Vaule
OFF	OFF	OFF	OFF	FUN_02: keypad→ FUN_12(Speed 0)
ON	OFF	OFF	OFF	FUN_13(Speed 1)
OFF	**ON**	OFF	OFF	FUN_14(Speed 2)
ON	**ON**	OFF	OFF	FUN_15(Speed 3)
OFF	OFF	**ON**	OFF	FUN_16(Speed 4)
ON	OFF	**ON**	OFF	FUN_17(Speed 5)
OFF	**ON**	**ON**	OFF	FUN_18(Speed 6)
ON	**ON**	**ON**	OFF	FUN_19(Speed 7)
X	X	X	**ON**	FUN_20(Jog Speed)

1.5) MOP (Motor operated potentiometer) Up

1.6) MOP Down

1.7) MOP Clear

1.8) MOP Save

When multi-function input terminals P1 ~ P7 is set to “MOP Up”, “MOP Down”, inverter performs Accel/Decel Constant Run according to the terminal input. Generally, MOP function is used to adjust the speed simply with terminal ON/OFF. When MOP UP/Down is selected, inverter ignores FUN_02 setting, and performs MOP operation. To cancel it, change the defined terminal to “Not Used”. If this function is selected with “Main Drive” function, operating reference is done by MOP and the rest will be defined by “Main Drive” function. Max speed limit is FUN_04(Max Speed).

If “MOP Save” is entered during MOP operation, the current speed reference value is saved as ”MOP Data” and

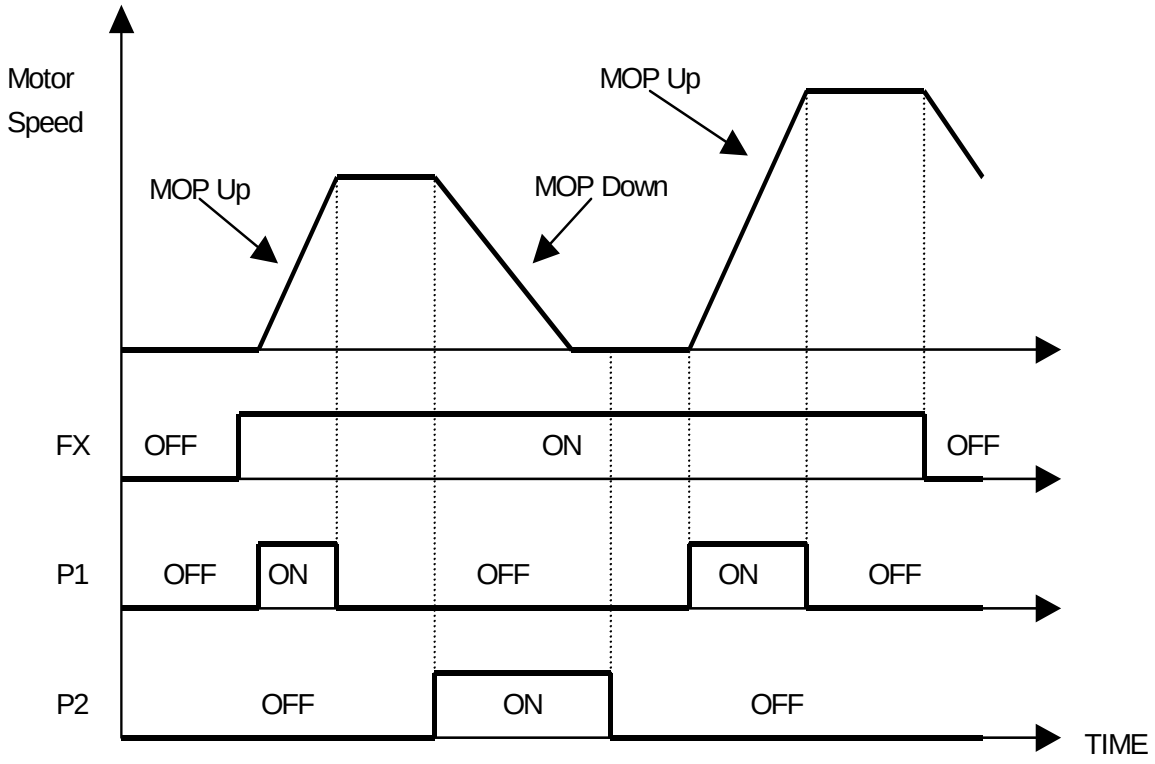
retained. When the MOP operation resumes, the retained value will be used as speed reference.

"MOP Clear" resets the MOP Data value to "0". It is used to change the saved value.

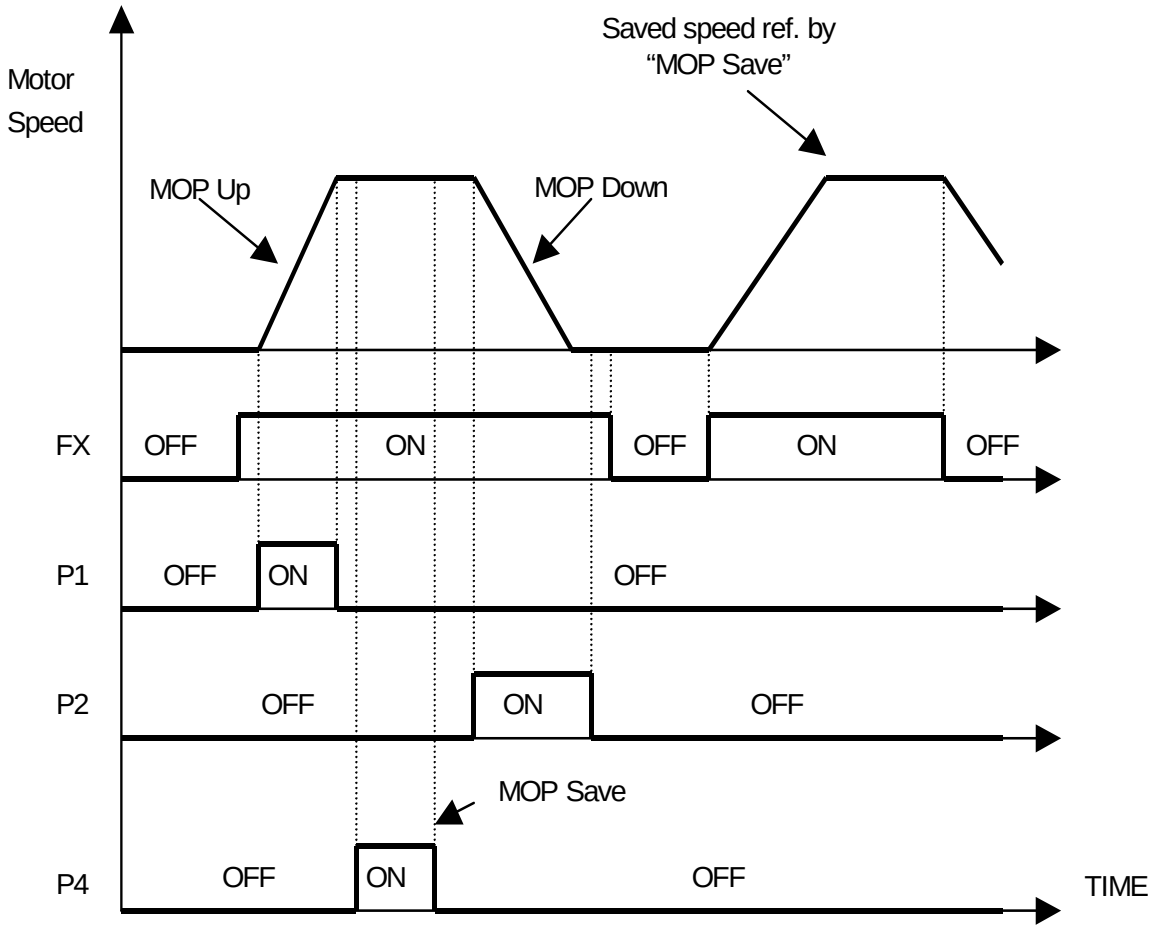
(Example) MOP function setting and operation method is as follows;

Code	LCD display	Description	Setting range	Unit	Set value
DIO_01	P1 define	Multi-function input terminal P1 define			MOP Up
DIO_02	P2 define	Multi-function input terminal P1 define			MOP Down
DIO_03	P3 define	Multi-function input terminal P3 define			MOP Clear
DIO_04	P4 define	Multi-function input terminal P4 define			MOP Save

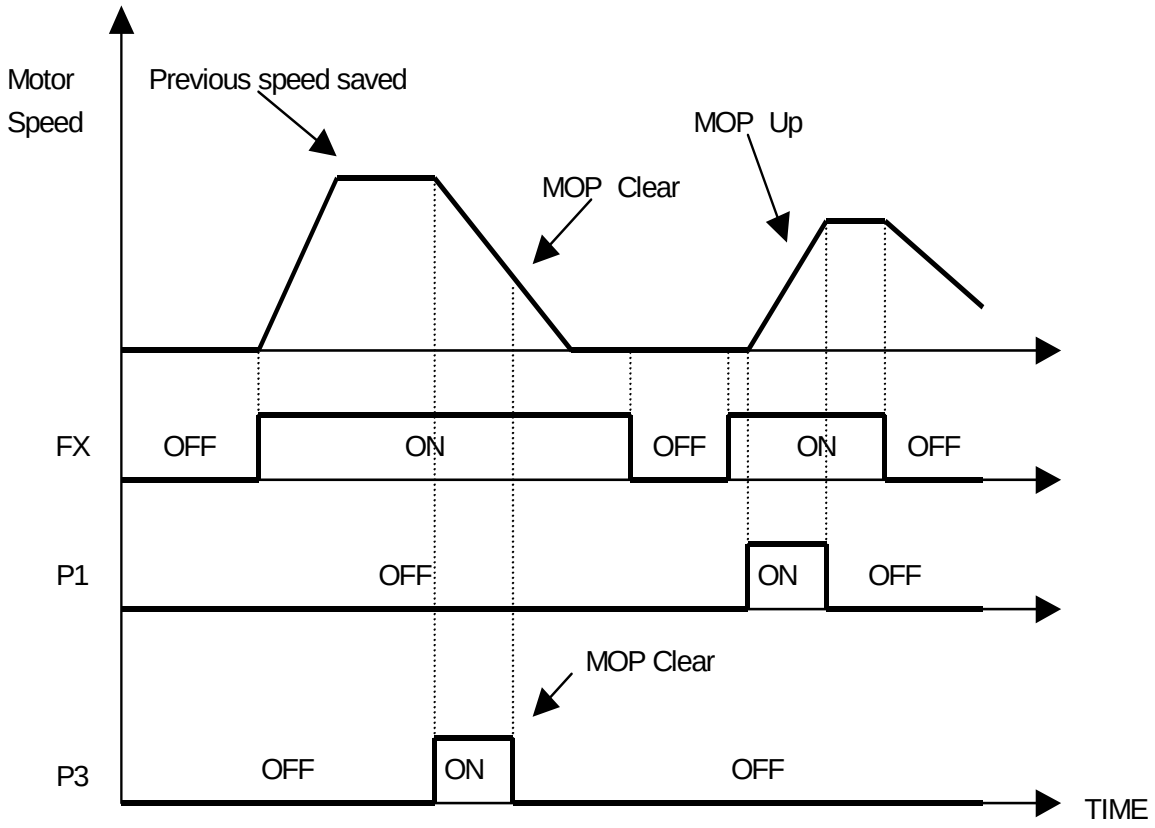
(MOP Up/Down example 1) This is used only if terminal ON/OFF is required for speed control.



(MOP Save example 2) In case terminal input assigned to MOP Save function is ON, operation speed at that instant is memorized and operates at the saved speed when operation resumes.

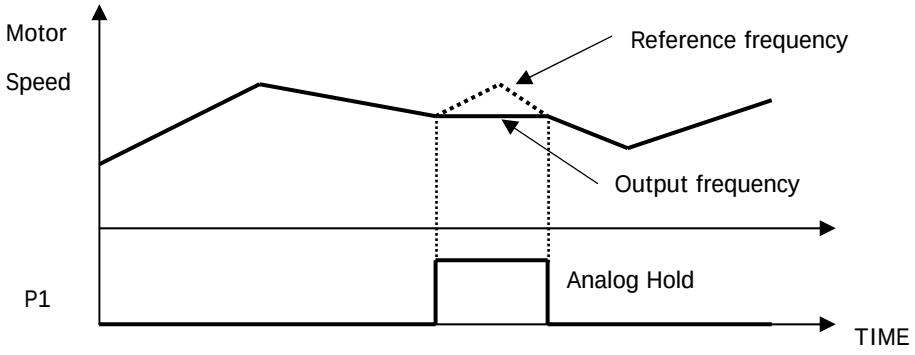


(MOP Clear setting example 3) To clear the saved speed by MOP Save function, use “MOP Clear ON/OFF”. If MOP Clear is ON during running, the inverter decelerates its speed to zero speed. If MOP is ON during stop, this function resets the speed reference to “0”.



1.9) Analog Hold

When FUN_02 is set to “analog” and one of the selected terminal set to “Analog Hold” is ON, inverter fixes its output frequency, regardless of the frequency reference change. The changed frequency reference is applied when the terminal is OFF. This function is useful when a system requires constant speed after acceleration.



1.10) Main Drive

Each inverter linked to system can be controlled separately. When this terminal is turned On, changing operating speed reference, operating method, and torque limit is done via only Keypad without changing the user-setting parameter value.

When 'Main Drive' terminal is turned On, Main Drive operation is available as shown below condition.

- Inverter during stop: It is applied immediately.
- Inverter during operation: It is applied after stop.

The parameter value of FUN_01 Run/Stop Src, FUN_02 Spd Ref Sel, CON_28 Trq Lmt Src related with Operating speed reference, Operating method, and Torque limit is not applied when 'Main Drive' terminal is turned On even though parameter is changed via keypad or communication. It is applied when the terminal is turned Off during stop.

The parameter value of CON_01 Control Mode is operated same as above parameter described.

The setting of Operating speed reference, Operating method and Torque limit is set as shown below.

Function	"Main Drive" ON	"Main Drive" OFF	Applied point of time
Operating method	Keypad mode	Parameter value of FUN_01 Run/Stop Src	After inverter stop
Operating Speed reference	Keypad1 mode	Parameter value of FUN_02 Spd Ref Sel	
Torque Limit	Kpd Kpd Kpd mode	Parameter value of CON_28 Trq Lmt Src	
Control Mode	Speed mode	Parameter value of CON_01 Control Mode	

1.11) 2nd Func (the 2nd function setting)

The iV5 inverter has the capability to control 2 motors independently. A second motor may be active by selecting one terminal for this function and turn it ON. 2nd function is not displayed if the terminal is not defined for this or the defined terminal is OFF.

※ Cross reference table for **1st function and& 2nd function**

Parameter	2nd function		1st function	
Acceleration time	2nd_09	2nd Acc time	FUN_40	Acc. Time 1
Deceleration time	2nd_10	2nd Dec time	FUN_41	Dec. time 1
Encoder-related parameter	2nd_12 ~ 2nd_14		PAR_11 ~ PAR_15	
Motor constants	2nd_15 ~ 2nd_26		PAR_16 ~ PAR 30	
Electronic thermal level for 1 min	2nd_32	2nd ETH 1min	FUN_55	ETH 1min
Electronic thermal level for continous	2nd_33	2nd ETH Cont	FUN_56	ETH Cont

※ **Note : 1st & 2nd function switch-over should be selected when the motor is stopped.**

If selected during RUN, 2nd function is not active until motor stop.

1.12) XCEL-L

1.13) XCEL-H

Refer to FUN_40 ~ 47 (Accel/ Decel time 1, 2, 3, 4).

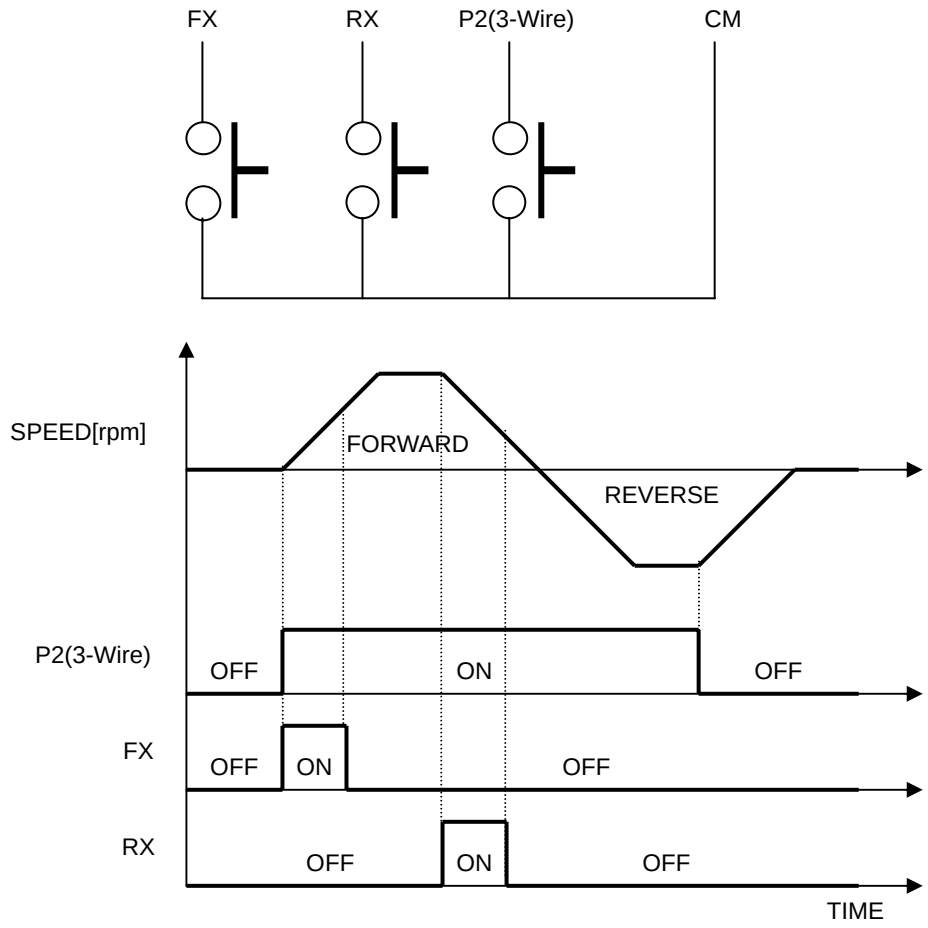
(The factory default value is different from the capacity of inverter.)

Code	LCD display	Description	Unit	Factory default value			
				2.2~37 kW	45~75 kW	90~220 kW	280~500 kW
FUN_40	Acc Time-1	Acceleration time 1	sec	2.00	10.00	20.00	30.00
FUN_41	Dec Time-1	Deceleration time 1	sec	2.00	10.00	20.00	30.00
FUN_42	Acc Time-2	Acceleration time 2	sec	3.00	12.00	24.00	35.00
FUN_43	Dec Time-2	Deceleration time 2	sec	3.00	12.00	24.00	35.00
FUN_44	Acc Time-3	Acceleration time 3	sec	4.00	14.00	28.00	40.00
FUN_45	Dec Time-3	Deceleration time 3	sec	4.00	14.00	28.00	40.00
FUN_46	Acc Time-4	Acceleration time 4	sec	5.00	16.00	32.00	45.00
FUN_47	Dec Time-4	Deceleration time 4	sec	5.00	16.00	32.00	45.00

1.14) 3-Wire operation

When FX or RX terminal is turned ON and turned OFF, the terminal is maintained ON using this parameter.

(Operating method when P2 is set to 3-Wire)



[3 Wire operation]

1.15) Ext Trip-B (External trip signal input by b contact)

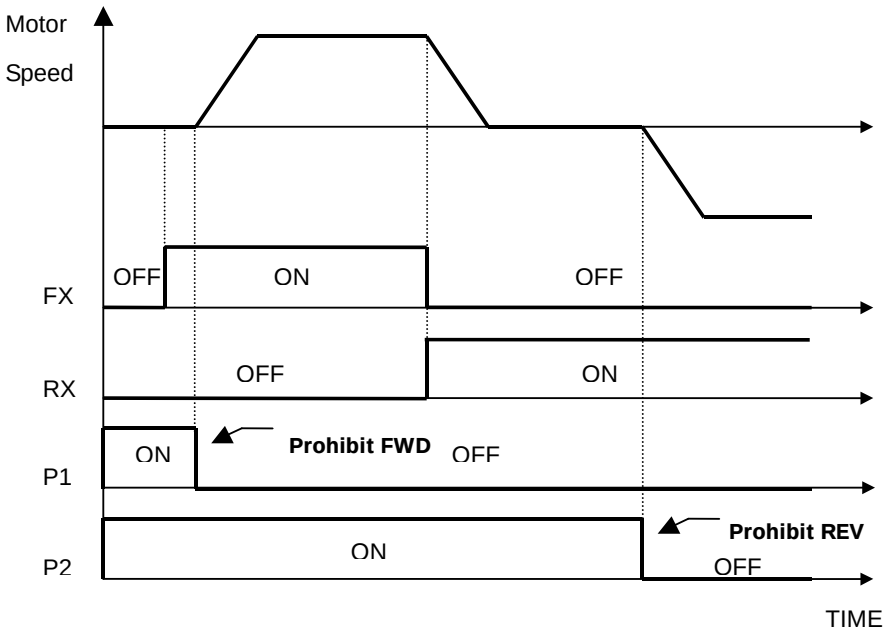
If the terminal set to this function is off, the inverter disables the gating of IGBT and then the motor freely rotates to a stop. The message written as “External Trip Signal B contact” appears on the LCD screen and STOP LED is blinking in the keypad. This signal can be used as an external latch trip.

1.16) Prohibit FWD (Prohibition of forward rotation)

1.17) Prohibit REV (Prohibition of reverse rotation)

If Prohibit FWD or Prohibit REV is set, it prohibits forward or reverse rotation, respectively. If Prohibit FWD is used, speed command becomes 0 when it has positive value. Similarly, If Prohibit REV is used, speed command becomes 0 when it has negative value.

(Example) When multi-function input terminal P1 is set to “prohibit FWD” and P2 to “prohibit REV” the following diagram will be shown.



1.18) Proc PID Dis (Process PID disabled)

This function is used to disable the Process PID controller. If Proc PID Enb at the CON_20 is ON and also this terminal is ON, the output of Process PID controller becomes zero. Otherwise, Process PID controller generates its output depending on the controller operation. ‘Proc PID Enb’ at CON_20 determines whether this function is used or not. The setting for this code is as follows.

Code	LCD display	Description	Setting range	Unit	Factory setting
CON_20	Proc PID Enb	Proc PID contoller Enable/Disable	Disable Enable Terminal		Disable

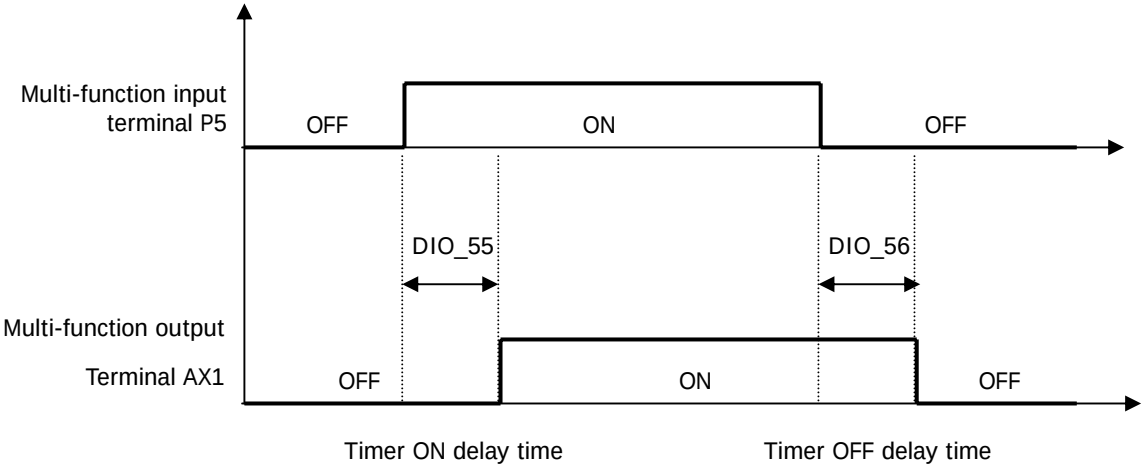
‘Disable’ at CON_20 blocks the output of Process PID controller and ‘Enable’ at CON_20 enables the Process PID controller. If ‘Terminal’ is set, the multi-function terminal set to ‘Proc PID Dis’ determines whether the output of Process PID controller is enabled or not. To prevent the saturation of Process PID controller, Process PID controller is enabled only if the multi-function input terminal is set to ‘Proc PID Dis’ and its terminal input is OFF and operation command is ‘ON’. Process PID controller does not work if operation command is not ON or ‘Process PID Disable’ is not set. Truth table is as follows.

CON_20	Proc PID Dis	Operating reference	
	Multi-function input signal	ON	OFF
Terminal	ON	Disable	Disable
	OFF	Enable	Disable
Enable		Enable	Disable
Disable		Disable	Disable

1.19) Timer input

The multi-function input terminals P1~P7 can generate the timer output based on the timer ON delay time at I/O_55 and timer Off delay time at I/O_56. The following example is the case where I/O_05 is set to timer input and the multi-function output terminal AX1 at I/O_41 is set to 'Timer Out'.

Code	LCD display	Description	Setting range	Unit	Setting value
DIO_05	P5 Define	Multi-function input terminal P5 Define			Timer Input
DIO_41	AX1 Define	Multi-function output terminal AX1 Define			Timer Out
DIO_55	TimerOn Dly	Timer On Delay Time	0.1 ~ 3600.0	sec	
DIO_56	TimerOff Dly	Timer Off Delay Time	0.1 ~ 3600.0	sec	



1.20) SoftStartCncl (Soft Start Cancel)

Soft start cancel is used when the shortest acceleration/deceleration time is required without using the existing accel/decel time. In this case, real acceleration/deceleration time depends on the load condition and response characteristic of speed controller. The following table shows what kind of acceleration/deceleration time is used when P1, P2 and P3 are used for the transfer of accel/decel time or soft start cancel function is enabled.

(Example) Programming P3 as SoftStrtCncl

P1 (Xcel-L)	P2 (Xcel-H)	P3 (SoftStartCncl)	Accel/Decel time
OFF	OFF	OFF	Accel/Decel 1
ON	OFF	OFF	Accel/Decel 2
OFF	ON	OFF	Accel/Decel 3
ON	ON	OFF	Accel/Decel 4
X	X	ON	The shortest Accel./Decel.

1.21) ASR Gain Sel (Switch automatic seed regulator PI gain)

Using 'ASR Gain Sel' function, one of the two P and I gains can be selected for PI speed controller (ASR).

(Example) Programming P5 as ASR PI Gain

Code	LCD display	Description	Setting range	Unit	Setting value
DIO_05	P5 define	Multi-function input terminal P5 Define			ASR Gain Sel
CON_03	ASR P Gain1	ASR (Automatic Speed Regulator) P Gain 1	0.0 ~ 200.0	%	P5 : OFF
CON_04	ASR I Gain1	ASR I Gain 1	0 ~ 50000	ms	
CON_05	ASR LPF1	ASR LPF time constant 1	0 ~ 20000	ms	
CON_06	ASR P Gain2	ASR P Gain 2	0.0 ~ 200.0	%	P5 : ON
CON_07	ASR I Gain2	ASR I Gain 2	0 ~ 50000	ms	
CON_08	ASR LPF2	ASR LPF time constant 2	0 ~ 20000	ms	

1.22) ASR P/PI Sel (ASR P/PI Transfer)

The ASR could be P controller or PI controller by MFi programmed as ASR P/PI Sel. When the ASR Gain is switched to each other, the effective P gain could be changed gradually with the time ASR Ramp CON_09 in order to prevent the shock in the machine because of the quick change of P gain.

(Programming Example) Programming P6 as ASR P/PI Sel.

Code	LCD display	Description	Setting range	Unit	Factory setting
DIO_05	P5 define	Multi-function input terminal P5 Define			ASR P/PI Sel

1.23) Flux Ref Sel (Flux reference selection)

If the flux reference selection is ON, flux reference is set to the value which analog voltage (-10 ~ 10V) is converted to % ratio of the rated flux.

1.24) PreExcite (Pre-excitation)

This function enables the motor to build up the flux by flowing the magnetizing current into it before run command is ON so that speed control characteristic can be improved at the time of the acceleration of the motor.

1.25) Spd/Trq Sel (Speed/Torque Control Transfer)

Speed and torque control can be switched using this function. This terminal input overrides the input from the keypad. Control mode can be switched only during stop state. Despite multi-function terminal input during running, the control mode can be switched only after stopping.

1.26) Use Max Torque (Maximum Torque Enable)

If this input is ON, the torque limit value of the speed controller is fixed to its maximum value. On the contrary, when this input turns off, the value defined at CON_29 ~ CON_31 applies to torque limit value. This function disables the inverter continous operation.

If this function is used continously, it may lead to damage to the motor and inverter. Take caution when using this function.

1.27) Use Trq Bias (Torque Bias enable)

If one of the multi-function terminals (P1 ~ P7) is selected as “Use Trq Bias”, torque bias value is fed into the inverter following the input signal. Besides, if “Use Trq Bias” is not set, and ‘Keypad’ is set at CON_32, torque bias value set at CON_33 is fed into the inverter. And, if “Analog” is set at CON_32 (Trq Bias Src), and the input is selected as “Torque Bias”, the torque bias value is fed into the inverter. Therefore, in order not to use the torque bias value, ‘None’ should be set at CON_32 or one of the multi-function terminals (P1 ~ P7) should be selected as “Use Trq Bias” and then be kept the terminal Open.

1.28) Battery Run (Selection of battery-operated mode)

When main power is not able to use by simultaneous power failure at elevator application, motor can be operated temporarily with battery power.

This function is available from 5.5 to 22kW/-2/4 products. Refer to ‘6.4.14 Battery Run speed and input voltage setting’ for details of Battery Run.

1.29) LVT Disable (Detection of Low voltage trip disabled)

It detects the hardware fault except for low voltage trip through operating the control board with only auxiliary power source before inputting of main power source. If inverter has the only low voltage trip, a fault contact is not closed. Run command is not inputted before inputting of main power source eventhough inverter has not hardware fault. The auxiliary output terminal of multi-function is not closed eventhough it sets as ‘INV Ready’.

FAN fault detection supported at 280 ~ 375 kW products among hardware fault can be detected in case the power is inputted so it will not be detected before the inputting of main power source. ‘LVT Disable’ function with inputting auxiliary power source operates as shown below at each condition (‘INV Ready’ ouput, FAN fault detection and H/W fault detection etc.)

“LVT Disable”	Main power source	‘INV Ready’ output	FAN fault detection	H/W fault detection except for Low voltage and FAN fault
ON	Before input	OFF	Not availblae	Available
	After input	ON	Available	

2) DIO_08 (Reversal of Multi-function input terminal)

Multi-function input terminal is based on the 'A' contact operation. If a specific terminal should be changed to 'B' contact operation, the relevant terminal setting should be set from '0' to '1', Once the relevant terminal is set to '1', the terminal operates on the basis of 'B' contact and it is effective before it is changed to '0'. But, in case of the external trip 'B' contact, it is changed to 'A' contact operation. Terminals are displayed in the order of P1, P2, P3, P4, P5, P6 and P7 from the beginning.

(P1 ~ P7: A contact)

DIO ▶ Neg Function
08 0000000

(P1, P6: B contact)

DIO ▶ Neg Function
08 1000010

3) DIO_09 (Low pass filter time constant for the terminals)

This setting affects the response speed of the control circuit terminals (FX, RX, BX, P1 ~ P7, RST). It is greatly effective when electro-magnetic noise signal is present in the input signal. The larger the time constant becomes, the slower response speed becomes. Response speed is approximately proportional to the setting value times 2.5 [m sec].

6.2.3 Multi-function digital output terminal

1) DIO_10 Inversion of Multi-function aux contact output (Relay output, Open collector output)

Factory default settinf of Multi-function Relay outputs is A contact. To change it to B contact, set it to "1".

See the below for setting example: (terminal layout is AX1, AX2, OC1, NC, NC from left.)

(Setting example)

(AX1 ~ OC1: A contact)

DIO ▶ Neg Func.Out
10 00000

(AX1, OC1: B contact)

DIO ▶ Neg Func.Out
10 10100

2) DIO_41 ~ 43 (Multi-function aux contact output (AX1 ~ AX2) and Open collector (OC1) output setting)

Multi-function digital output terminal serves as one of the functions listed in the table below. Multi-function aux contact is activated when the selected function is ON.

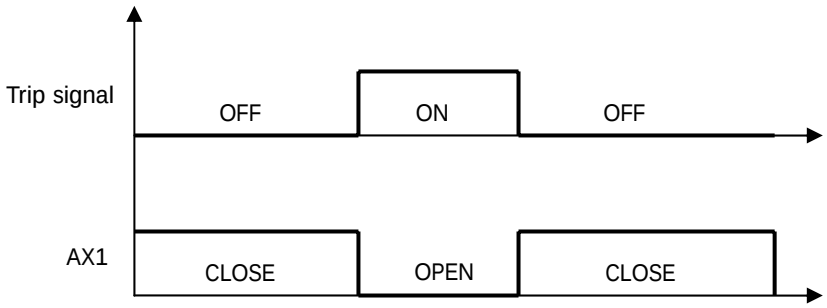
No	Set value	No	Set value	No	Set value
1	Not Used	9	Run	17	Stop
2	INV Ready	10	Regenerating	18	Steady
3	Zero Spd Det	11	Mot OH Warn	19	Brake Output
4	Spd Det.	12	INV OH Warn		
5	Spd Det (ABS)	13	Speed Agree		
6	Spd Arrival	14	Trq Det.		
7	Timer Out	15	Trq Lmt Det.		
8	LV Warn	16	OverLoad		

2.1) Not used

It is set unless multi-function output is not used as any function listed above.

2.2) INV ready

INV Ready becomes ON when inverter is ready to operate normally. If trip signal occurs, INV Ready is left OPEN immediately as shown in the figure below.

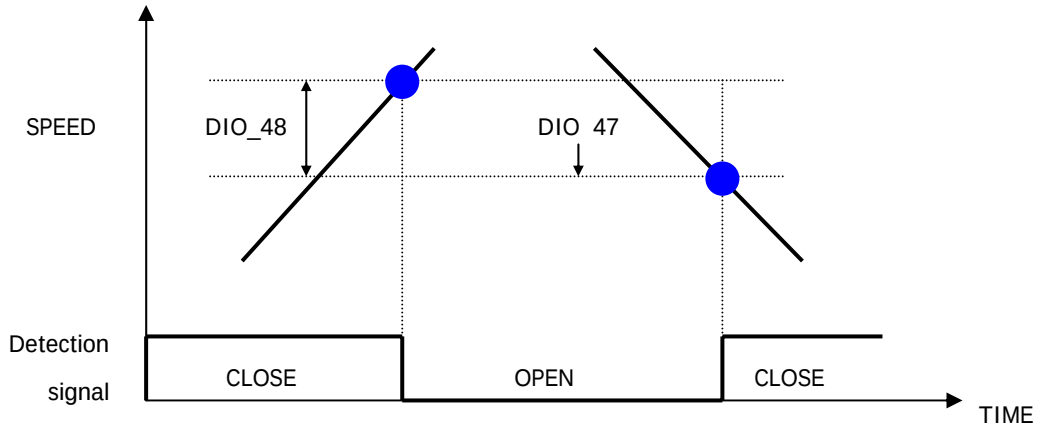


2.3) Zero Spd Det

Detects zero speed of motor. See the figure below.

Code	Display	Description	Range	Unit	Default
DIO_47	ZSD Level	Zero Speed Detect Level	0.0 ~ 480.0	rpm	10
DIO_48	ZSD Band	ZSD hysteresis band	0.1 ~ 10.0	%	0.5

- DIO_48(ZSD Band) is set as the percentage of FUN_04 Max motor speed.



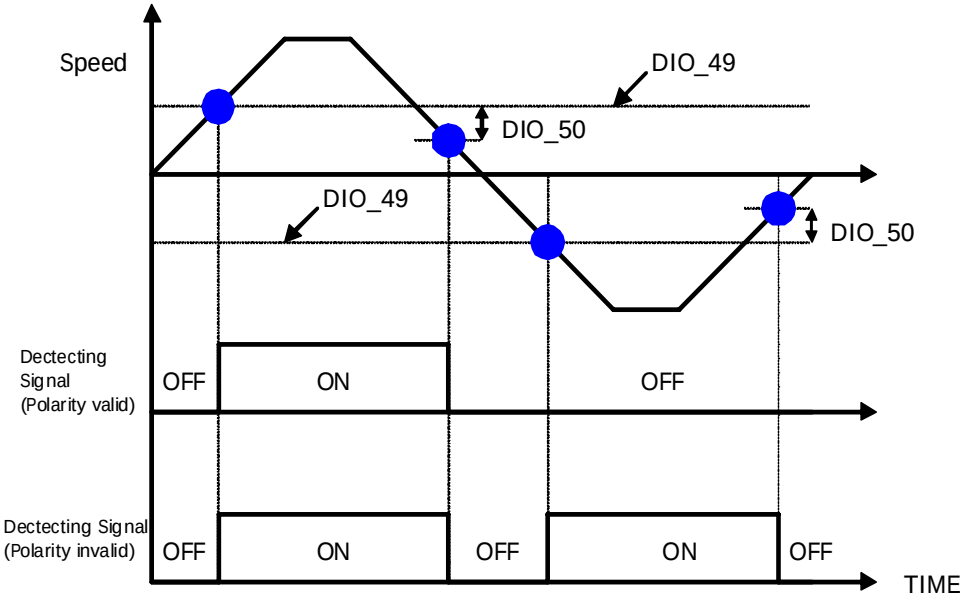
2.4) Spd Det. – Polarity valid

2.5) Spd Det.(ABS) – Polarity invalid

This is ON when the real motor speed reaches the arbitrary speed. The polarity of detecting speed is valid for Spd Det. But, the polarity is invalid for Spd Det(ABS).

Code	Display	Description	Range	Unit	Default
DIO_49	SD Level	Speed Detect Level	-3600 ~ 3600	rpm	0
DIO_50	SD Band	Speed Hysterisis Band	0.1 ~ 10.0	%	0.5

- DIO_49(SD Band) is set as the percentage of FUN_04 Max motor speed.



2.6) Spd arrival

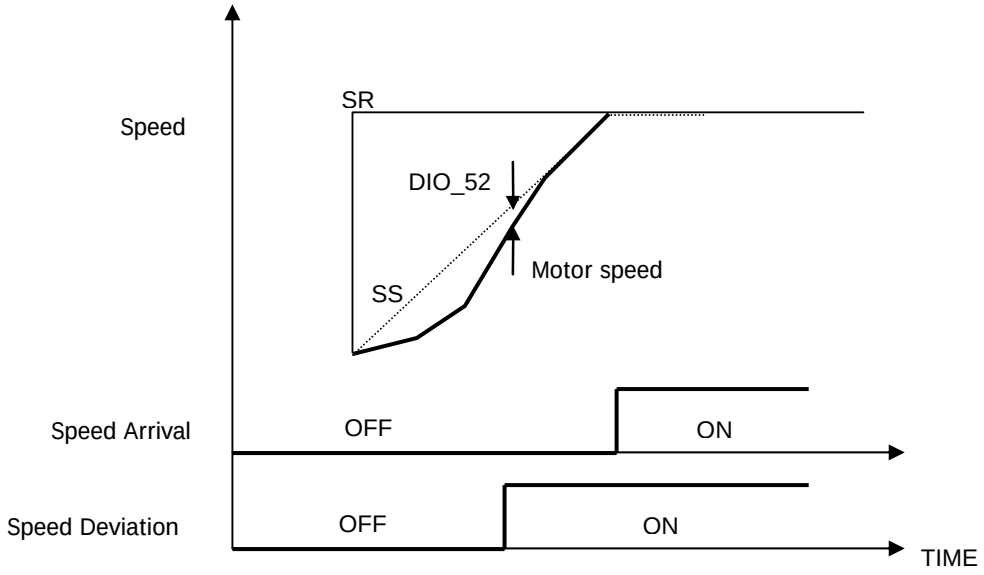
It detects whether the motor reaches the set speed band.

Code	Display	Description	Range	Unit	Default
DIO _51	SA Band	SA hysterisis band	0.1~10.0	%	0.5

2.7) Spd agree

This is ON when the motor speed becomes equal to the set speed.

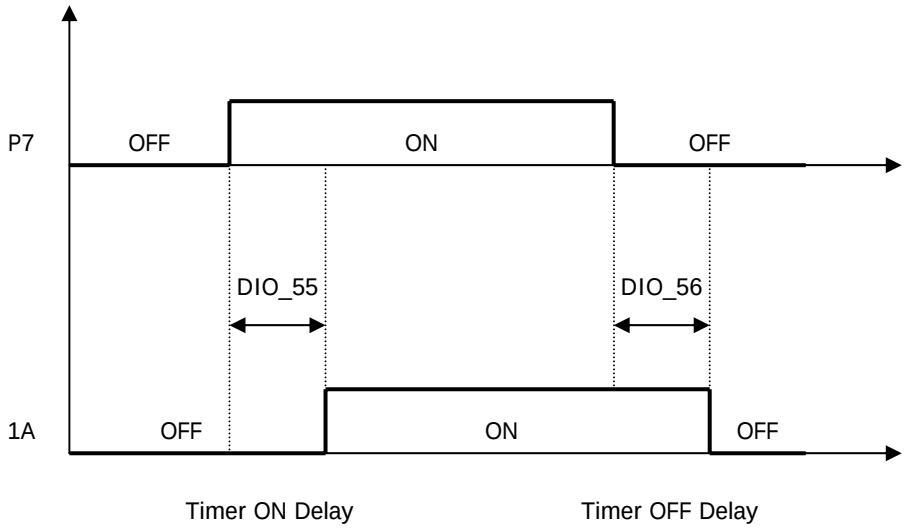
Code	Display	Description	Range	Unit	Default
DIO_52	SEQ Band	SEQ hysterisis band	0.1 ~ 10.0	%	0.5



2.8) Timer out

Timer Out acts as an output signal to the timer input signal defined in the one of the multi-function input terminals P1~P7 and it uses the set values of Timer On delay time at I/O_55 and of Timer Off delay time at I/O_56. The example of code setting is shown in the table below when I/O_07 is set to Timer Input and I/O_41 is set to Timer Output.

Code	Display	Description	Range	Unit	Default
DIO_07	P7 define	Definition of P7			Timer Input
DIO_41	AX1 Define	Definition of multi-function output terminal relay output 1 (1A, 1B)			Timer Out
DIO_55	TimerOn Dly	Timer ON delay	0.1 ~ 3600.0	sec	0.1
DIO_56	TimerOff Dly	Timer OFF delay	0.1 ~ 3600.0	sec	0.1



2.9) LV

LV is enabled when the DC link voltage of the inverter is less than the detecting level of low voltage alarm.

2.10) Run

It is ON when the inverter is running.

2.11) Regenerating

It is ON when the motor is regenerating.

2.12) Mot OH Warn (Motor Overheat Warning)

Using NTC or PTC signal built in the motor, Motor Overheat is ON when the temperature inside the motor is higher than the overheat alarm level. This signal is only for an alarm, not for the inverter trip.

※In the case of ExTTN_I/O it corresponds to Ai5 Ai3 Define[AIO_25] is set to “Use Mot NTC” or “Use Mot PTC”.

Code	Display	Description	Range	Unit	Default
DIO_64	MH Warn Temp	Motor overheat detect	75 ~ 130	°C	120
DIO_65	MH Warn Band	MH hysterisis band	0 ~ 10	°C	5

2.13) Inv OH Warn (Inverter Overheat Warning)

Inverter Overheat is ON, when the heatsink inside the inverter is higher than the overheat alarm level. This signal is only for an alarm, not for the inverter trip.

Code	Display	Description	Range	Unit	Default
DIO_62	IH Warn Temp	Inverter Overheat Detection Temperature	50 ~ 85	°C	75
DIO_63	IH Warn Band	Inverter Overheat Detection Bandwidth	0 ~ 10	°C	5

2.14) Trq Det.

Trq Det is ON when the torque output of ASR reaches the setting torque level.

Code	Display	Description	Range	Unit	Default
DIO_53	TD level	Torque Detect Level	0.0 ~ 250.0	%	0.0
DIO_54	TD Band	TD hysterisis band	0.1 ~ 10.0	%	0.5

2.15) Trq Lmt Det

Trq Lmt Det is ON when the output of ASR (Torque reference) is saturated so that its limit value is generated.

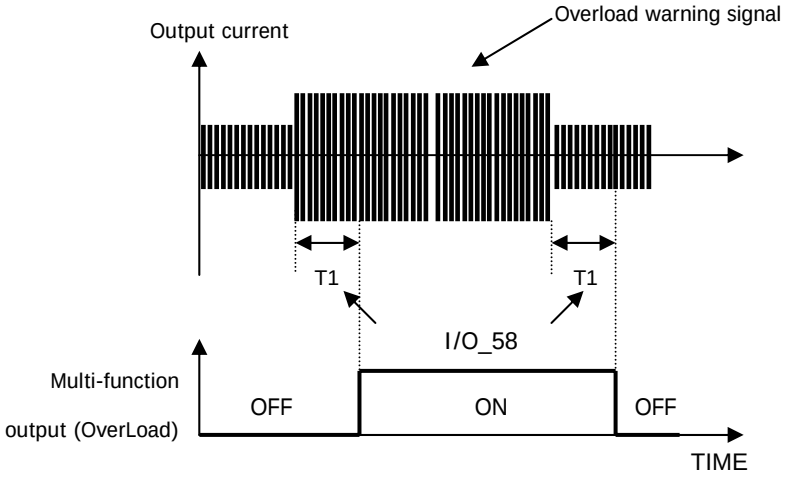
2.16) OverLoad

Overload is ON when the inverter output current is higher than the overload alarm level. (On the basis of the rated current of the motor) Refer to the following values of overload alarm level (DIO_57) and overload alarm time (DIO_58).

- **DIO_57: [Overload warning level], DIO_58 [Overload warning time]**

If the inverter output current keeps flowing more than overload alarm level (DIO_57) and longer than overload alarm time (DIO_58), alarm signal is triggered. The overload signal is canceled when the inverter output current flows less than overload alarm level (DIO_57) and longer than overload alarm time (DIO_58) has passed.

Overload alarm signal can be generated by the multi-function outputs (1A-1B, 2A-2B, OC1-EG). “OL” should be set in the DIO_41, 42 and 43 [Multi-function auxiliary terminal output setting] to use this function. Even if overload occurs, its alarm signal is generated through the multi-function output terminal and the inverter keeps running.



Code	Display	Description	Range	Unit	Default
DIO_57	OL level	Overload warning level	30 ~ 250	%	150
DIO_58	OL time	Overload warning time	0 ~ 30	sec	10

- Note: The set value of overload alarm level is of percentage(%) to the rated current of the motor.

2.17) Stop

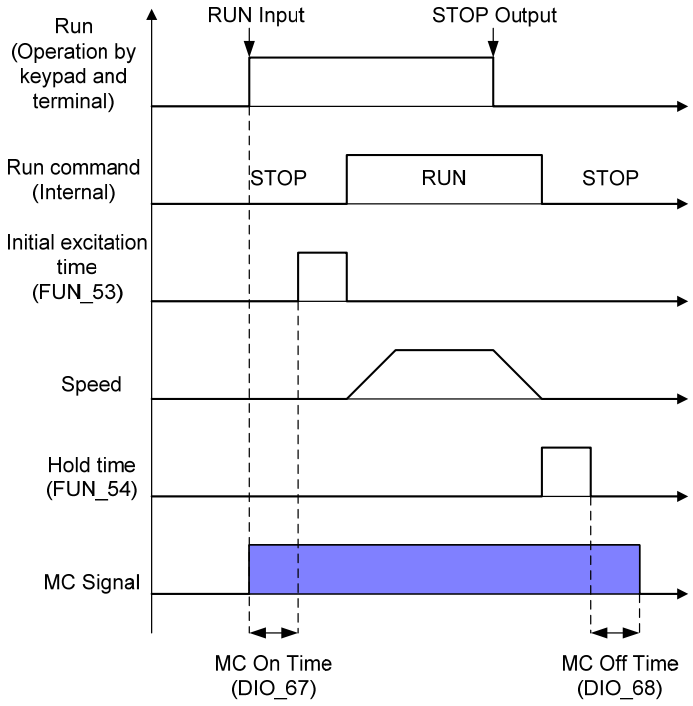
'Stop' is ON when the inverter keeps stopping.

2.18) MC on/Off

This function control the operation of magnetic contactor (MC) when MS is mounted on the inverter output at the application, elevator, etc. It is the multiple functional output signal that it turns on/off the contact of MC before a current is outputted from inverter at start.

LED of FWD and REV on keypad flikers during the time of MC on/off. If MC on/off is not set at multi-function output, operation will be same as the setting of MC on/off time = 0.

Code	Display	Description	Range	Unit	Default
DIO_66	MC Timer On	Delayed time of MC On	100~50000	msec	1000
DIO_67	MC Timer Off	Delayed time of MC Off	100~50000	msec	1000

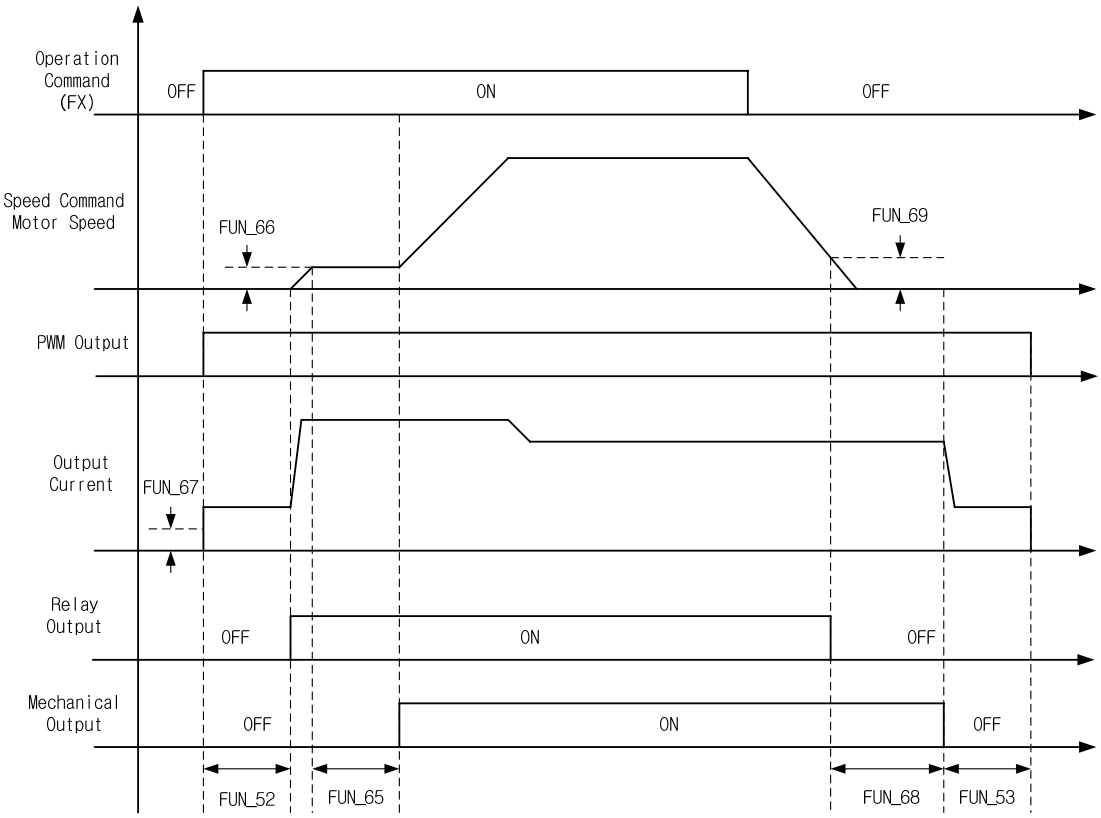


2.19) Steady

This is ON when the inverter is running at the constant speed.

2.20) Brake output

Output the signal of opening or closing of brake.



Code	Display	Decription	Range	Unit	Default
FUN_65	BKOpen Time	Brake opening time	0.00 ~ 30.00	sec	0.00
FUN_66	BKOpen Spd	Brake opening speed	0.0 ~ 500.0	rpm	0.0
FUN_67	Release Curr	Brake opening current	0.0 ~ 150.0	%	20.0
FUN_68	BKClose Time	Brake closing time	0.00 ~ 30.00	sec	0.00
FUN_69	BKClose Spd	Brake closing speed	0.0 ~ 500.0	rpm	0.0

Note : Brake opening current value is set as a percentage of the motor magnetic current.

3) DIO_46 (Fault output relay (30A, 30B, 30C))

This function can be used when the inverter fault signal is generated through the relay contact. the fault alarm is triggered differently by setting the bits related to the low voltage trip, inverter trip and the number of retry.

Code	Display	Description	Range	Unit	Default
DIO_46	Relay mode	Relay mode	000 ~ 111	-	011

Code	Bit 2 (Number of Auto retry)	Bit 1 (Inverter trip)	Bit 0 (LV trip)
DIO_46	0/1	0/1	0/1

Bit	Setting	Description
Bit 0 (LV)	0	Deactivated at Low Voltage Trip
	1	Activated at Low Voltage Trip
Bit 1 (Trip)	0	Deactivated at any fault
	1	Activated at any fault except Low Voltage Trip
Bit 2 (Retry)	0	Deactivated at the auto retry attempt
	1	Activated at the number of auto retry attempt

4) DIO_59 ~ 61 (Overload trip enable, level, time)

If the inverter output current higher than the overload limit level is kept for the overload limit time, the inverter blocks the gating of IGBTs and issues the trip message.

Code	Display	Description	Range	Unit	Default
DIO_59	OLT select	Overload trip enable	Yes/No	-	Yes
DIO_60	OLT level	Overload trip level	30 ~ 250	%	180
DIO_61	OLT time	Overload trip time	0 ~ 60	sec	60

- Note: DIO_60 is set as the percentage of Motor rated current.

5) DIO_97(Operation method when losing command)

You can choose the operation method when multi-function analog input signal satisfying the criteria for the signal loss of analog input and the condition of multi-function analog input signal loss judging time. Refer to analog I/O Group for the criteria for the multi-function analog input signal loss and the judging time of signal loss.

Code	Display	Function Name / Range	Unit	Description
DIO_97	Lost Command	None	-	Continuing the operation when losing command
		Free-run	-	Free-run stop when losing command
		Stop	-	Decelerating stop when losing command

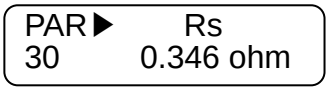
6.3 Parameter Group (PAR_[][])

6.3.1 Jump code (PAR_00)

PAR_00, jumping directly to any parameter code can be accomplished.

(Example) Moving to PAR_30

Press [PROG] and set to 30 using [SHIFT/ESC] / [▲(Up)] / [▼(Down)] and press [ENT] key. If the desired code cannot be set (void), the nearest code will be displayed.



Use [▲(Up)] / [▼(Down)] to move to other codes.

6.3.2 Parameter group function

1) PAR_01 (Parameter initialize)

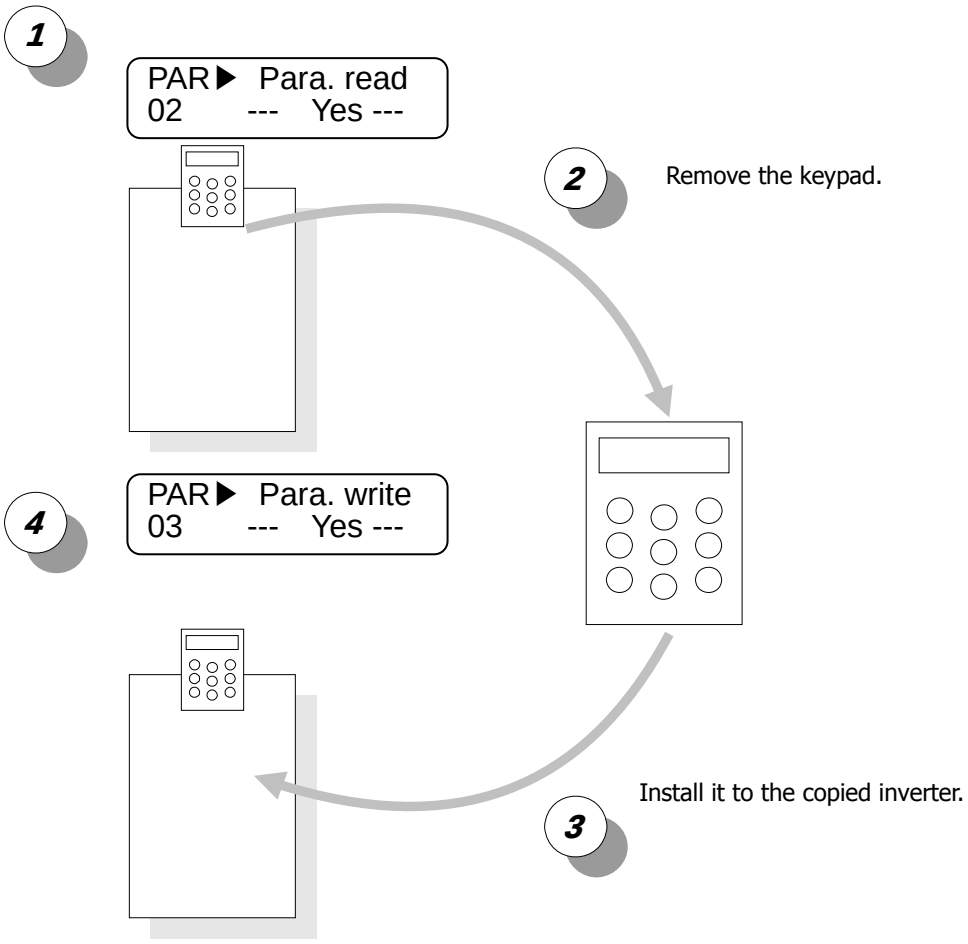
This is used to initialize all parameters or each group back to the factory defaults. After performing this, be sure to check **PAR_07 (Motor Select) is properly set**.

Code	LCD display	Description	Setting range	Unit	Factory setting
PAR_01	Para. init	Initialize parameters as factory defaults	No All Groups DIS DIO PAR FUN CON EXT AIO USR 2ND E/L SYN WEB		No

2) PAR_02 ~ 03 (All Parameter Read/Write)

Parameters setting can be copied to other inverters using keypad. To do this, set **PAR_02** 'Parameter Read' to "Yes" to upload the parameter setting from the inverter. Take the keypad out and install it to the copied inverter and set **PAR_03** 'Parameter Write' to "Yes" to download the function parameters.

Code	LCD display	Description	Setting range	Unit	Factory setting
PAR_02	Para. Read	All Paramter Read	No/Yes		No
PAR_03	Para. Write	All Paramter Write	No/Yes		No



3) PAR_04 (Parameter Lock)

Set it to "12" to disable "paramter change".

Code	LCD display	Description	Setting range	Unit	Factory setting
PAR_04	Para. Lock	Parameter lock	0 ~ 255		0

4) PAR_05 (Password)

When user put any four-digit number except "0" and cycle the power, only Display groupd will appear. Press [Mode] key and PAR_05 "Password" will be directed. If the right password is entered, all other groups can be accessed and adjustable. To clear the password, set it to "0". When you forget the password, enter "5052". It is the master password and it resets the password to "0".

Code	LCD display	Description	Setting range	Unit	Factory setting
PAR_05	Password	Password	0 ~ 9999		0

6.3.3 Motor parameters setting

1) PAR_07(Motor rating setting)

2) PAR_08(Motor cap. selection of user)

Select the motor rating. Its factory default value is the same as inverter capacity. If this is set, motor parameters are automatically set. These are designed to fit for LG-OTIS vector motor. When other makers' motor is used, program the motor parameters properly. When using a motor having a rating not specified in this code, select "**User Define**". Then, PAR_08 will be displayed. Enter motor rating in this code. Then, enter motor parameters in the name plate and perform Auto-tuning to gain proper parameters before use.

Code	LCD display	Description	Setting range	Unit	Factory setting
PAR_07	Motor select	Motor rating select	2.2 ~ 800.0 User Define	kW	Same as inverter rating
PAR_08	UserMotorSel	Motor cap. Selection of User	1.5 ~ 800.0	kW	5.5

3) PAR_09 (Motor cooling method)

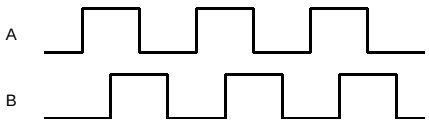
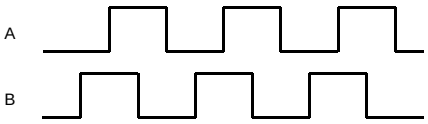
Select the cooling method of the motor to use. 'Motor cooling method' is used to check if the motor is currently overloaded or not. The self-cooled motor should be set to 'Self-Cool' and the forced cooled motor to 'Forced-Cool'.

Code	LCD display	Description	Setting range	Unit	Factory setting
PAR_09	Cooling Mtd	Motor Cooling method	Forced-cool Self-cool		Forced-cool

4) Encoder parameters (PAR_10 ~ 13: Pulse number of encoder, direction, error detection, LPF)

Enter the pulse number of encoder mounted on the motor shaft at the **PAR_10 (the pulse number of encoder).** If **PAR_12**(**Encoder error check enable)** is set to '**Yes**', Encoder error signal is detected and then triggers fault alarm in the case of the wire cut or the miswiring. But, **for open collector type encoder, it is unable to detect the encoder error, therefore PAR_12 should be set to 'No'.** In case the wiring for encoder (A, B phase) or inverter output (U, V, W) is changed, '**Enc AB Chgd**' message is shown during the auto-tuning operation. In this case, **PAR_11 (Enc Dir Set)** can be changed without changing the wiring of pulse encoder. If encoder signal is mixed with electromagnetic noise signal, encoder signal may be less affected by the electromagnetic noise signal by adjusting **PAR_13** (**Encoder LPF Time Constant)**.

Code	LCD display	Description	Setting range	Factory setting
PAR_11	Enc Dir Set	Encoder direction setting	A Phase Lead/B Phase Lead	A Phase Lead

Setting	Description	Encoder pulse (In FWD RUN)
A Phase Lead	A phase leads in FWD rotation. B phase leads in REV rotation.	
B Phase Lead	B phase leads in FWD rotation. A phase leads in REV rotation.	

If you set "Enc Err Chk" of PAR_12 to "Yes", when there is disconnection or misconnection of encoder, encoder error is detected and show the encoder abnormity sign. In the case of open collector method of encoder, it isn't possible to detect encoder error. So set PAR-12 to "No".

Improper setting of encoder parameters may deteriorate accurate speed control and lead to "overcurrent" or "overvoltage" trips. Refer to chapter 9 "Troubleshooting".

Code	LCD display	Description	Setting range	Unit	Factory setting
PAR_10	Enc Pulse	Number of encoder pulse	360 ~ 4096		1024
PAR_12	Enc Err Chk	Encoder error check	Yes No		Yes
PAR_13	Enc LPF	Encoder LPF time constant	0 ~ 100	ms	1

6.3.4 Encoder S/W error detection (PAR_14 ~ 15: Encoder error detection time, encoder error reference speed)

To achieve correct motor speed detection and control using encoder, proper wiring of encoder and motor should be preceded. If operation is continued with faulty wiring of Encoder/Motor, overcurrent flows to the motor, damaging the motor. Therefore, encoder should have functions to detect encoder input error and wrong wiring.

SV-iV5 can monitor encoder H/W error by setting PAR_12 to "Yes" and it monitors encoder pulse signal input status to detect H/W faults such as encoder disconnection error. However, wrong wiring error cannot be detected with this function. In this case, perform "Rotational Auto-tuning". Set PAR_23 (AutoTuneType) to "Rotational" and perform Encoder Test. Then wiring problem can be detected by applying voltage and checking speed detection level while motor is running.

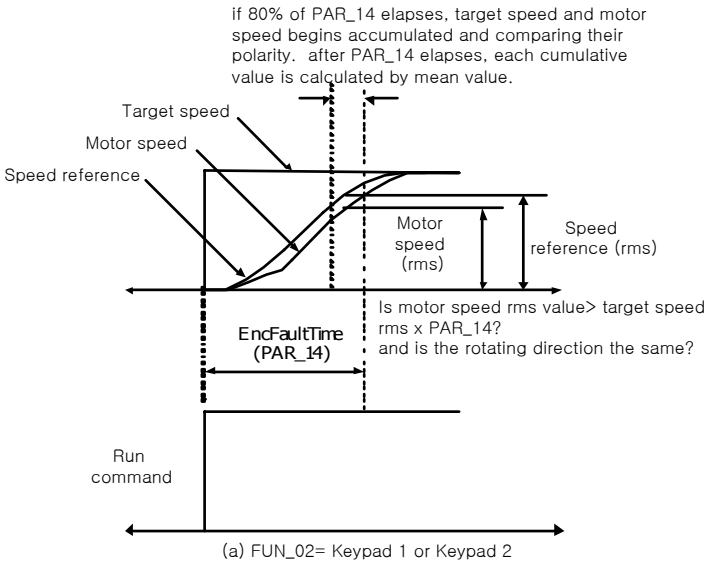
There are some loads (ex. Elevator) performing Encoder Test described above is difficult. To solve this fault, iV5 adopts the following functions to detect S/W faults.

Code	LCD display	Description	Setting range	Unit	Factory setting
PAR_14	EncFaultTime	Encoder error detection time	0.00 ~ 10.00	sec	0.00
PAR_15	EncFaultPerc	Encoder error reference speed	0.0 ~ 50.0	%	25.0
PAR_21	Rated-Slip	Motor rated slip	10 ~ 250	rpm	

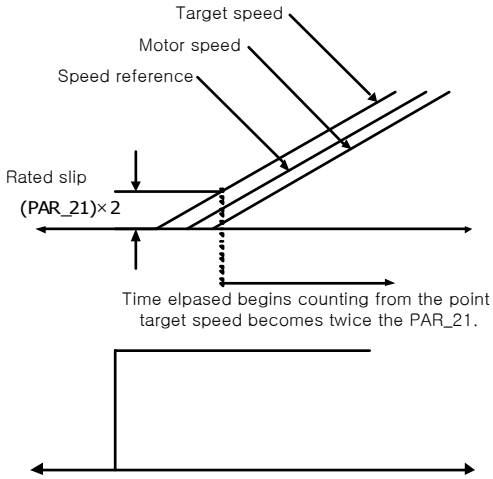
When encoder/motor wiring is reversed, motor cannot perform acceleration due to overcurrent. Encoder S/W error detection is adopted to detect the errors such as wrong wiring and incorrect pulse input during normal operation, not during Auto-tuning. Inverter determines encoder error if motor speed is not accelerated proportional to operating time and target speed after PAR_14 EncFaultTime elapses and polarity does not match.

To activate S/W error detection function, set CON_01 = Speed, Auto Tuning is not selected and set EncFaultTime except 0. If run command is removed before "EncFaultTime" elapses or acceleration is turned to deceleration due to target speed change, inverter cannot detect encoder S/W error. Inverter determines encoder S/W error by comparing motor speed and Target speed XEncFaultPerc while operation status is acceleration after EncFaultTime elapses.

Encoder S/W error detection is performed only once after operation starts and activates when target speed becomes twice the rated slip. For example, when target speed is 500(rpm) and rated slip is 40(rpm), the detection active level is 80(rpm).



(a) FUN_02= Keypad 1 or Keypad 2



(b) FUN_02= Analog or Up/Down Operation

6.3.5 Auto-tuning

The motor parameters for the Vector Control are autotuned by Starvert-iV5. The stator resistance, Stator Inductance, Leakage Inductance and Rotor time constant are found and saved. User can select the type of Auto-tuning in Rotational or Standstill mode.

1) Motor and encoder parameters setting for auto-tuning

The following paramters should be set according to motor nameplate to find motor parameters correctly.

Code	LCD display	Description	Setting range	Unit	Factory setting
PAR_07	Motor Select	Motor capacity selection	2.2 ~ 800.0 User Define		
PAR_08	UserMotorSel	Motor cap. selection of USER	1.5 ~ 800.0		5.5
PAR_10	Enc Pulse	Pulse no. of encoder	360 ~ 4096		1024
PAR_17	Base Speed	Motor base speed	100.0 ~ 3600.0	rpm	1800.0
PAR_18	Rated Volt	Motor rated voltage	120 ~ 560	V	220 or 440
PAR_19	Pole Number	Motor number of poles	2 ~ 12		4
PAR_20	Efficiency	Motor efficiency	0.0 ~ 100.0	%	
PAR_21	Rated-Slip	Motor rated slip	10 ~ 250	rpm	
PAR_22	Rated-Curr	Motor rated current	1.0 ~ 2000.0	A	

PAR_17 "Motor base speed" is the frequency inverter outputs its rated voltage. It is to be set within the range of Motor Max speed. **Set motor speed and rated voltage according to motor rating.** When standard motor is used, 60Hz (1800rpm) is the normal rating. The base speed of motor is $rpm = \frac{120 \times \text{Base Frequency}}{\text{Pole Number}}$

In the case of standard moto, $1800rpm = \frac{120 \times 60Hz}{4}$

PAR_18 "Motor rated voltage"

For 200V class inverters, factory default is 220(V) and for 400V class is 440(V). When input voltage is 380(V), change it to 380V. This value is input to Voltage controller and used to prevent voltage saturation. It should be set correctly because it affects Flux current value during Auto-tuning.

PAR_20 "Motor efficiency" should be entered for (PAR_23[AutoTuneType] : StandStill), not needed for (PAR_23 [AutoTuneType] : Rotational).

PAR_21 "Motor rated slip"

It is calculated by Motor speed – Motor nameplate rated speed. For example, Motor speed is 1800(rpm) with 1740(rpm) rated speed. Then, Motor rated slip would be 60(rpm).

2) Rotational auto-tuning

2.1) Precaution

⚠ CAUTION

Be sure to remove the load connected to the motor shaft before performing rotational auto-tuning. Otherwise, it may lead to damage to the motor or bodily injury. DB resistor should be installed because the inverter repeats abrupt Accel/Decel many times to find the motor constant (Tr) during tuning.

2.2) Parameter setting

Code	LCD display	Description	Setting range	Unit	Factory setting
PAR_23	AutoTuneType	Auto tuning type selection	Rotational StandStill		**Rotational**
PAR_24	Auto Tuning	Auto tuning range setting	None ALL1 ALL2 Encoder Test Rs Tuning Lsigma Flux Curr Ls Tuning Tr Tuning		None
PAR_25	Tune Torque	Tuning Torque	10.0 ~ 100.0	%	70

There are 8 types of auto-tuning selection for Rotational mode.

- ALL2: Rs→ Lsigma→ Flux Current→ Ls→ Tr
- ALL1: Encoder test →Perform ALL2

Rs, Lsigma, Flux Current, Ls, Tr: Perform each parameter seperately. Tr follows Rs, Ls auto-tuning to find exact value. To save tuning time, increase PAR_25 "Tuning torque for Auto-tuning" when load inertia is high during Tr tuning. FWD/REV LED is blinking during auto-tuning.

Auto-tuning type	Description
None	No Operation
ALL1	Rs, Lσ, I Flux, Ls, Tr are tuned continuously after Encoder test
ALL2	Rs, Lσ, I Flux, Ls, Tr are tuned continuously except Encoder Test
Encoder Test	Encoder Test Only The motor is rotating at 1500 rpm in forward direction and the encoder wiring status is checked.
Rs Tuning	Rs tuning Only. The stator resistance is tuned at standstill.
Lsigma	Lsigma tuning Only. The Leakage Inductance is tuned at standstill.
Flux Curr	Flux current Only. The motor is rotating at 1500 rpm and finds Flux current.
Ls Tuning	Ls Only. The motor is rotating at 1500 rpm and finds Rotor Inductance.
Tr Tuning	Tr Only The motor is ramping UP and DOWN continuously. But tuning time can vary. It should be autotuned after Rs, Lσ, and Ls.

2.3) Rotational auto-tuning procedure

LCD display	Description	Tuning time
PAR ▶ AutoTuneType 23 Rotational	Set it to **" Rotational ".**	-
PAR ▶ Auto tuning 24 ALL1	Auto-tuning starts when it is set to " **ALL1 ".**	-
PAR ▶ Auto tuning 24 Enc Testing	Checks whether the encoder wiring is properly done and an encoder works well by rotating the motor at base speed in forward direction.	30~35(Sec)
PAR ▶ Auto tuning 24 Rs Tuning	Stator resistance (Rs) is measured without rotating the motor.	10~20(Sec)
PAR ▶ Auto tuning 24 sL Tuning	The leakage inductance (sL) of the motor is measured without rotating the motor.	5 ~ 20(Sec)
PAR ▶ Auto tuning 24 IF Tuning	The flux current (IF) is measured by rotating the motor at base speed.	30~60(Sec)
PAR ▶ Auto tuning 24 Ls Tuning	Stator self-inductance (Ls) is measured by rotating the motor at base speed.	50~60(Sec)
PAR ▶ Auto tuning 24 Tr Tuning	Accel/Decel is performed repeatedly to find motor constant (Tr) so that DB Resistor should be connected before starting tuning. Otherwise, "Over Voltage " trip will occur.	20~60(Sec)
PAR ▶ Auto tuning 24 None PAR ▶ Auto tuning 24 [][] Error	When auto-tuning is complete successfully, "None" is displayed. If error occurs during auto-tuning, "[][] Error" is displayed. In this case, verify motor parameters and encoder setting is done properly and redo the auto-tuning. If the problem persists, contact LS representative.	**Total: 3 ~ 5 (Min.)**

3) Standstill auto tuning

3.1) Precaution

Be sure to lock the motor shaft using magnetic brake to find motor parameters correctly.

3.2) Parameter setting

	LCD display	Description	Setting range	Unit	Factory setting
PAR_23	**AutoTuneType**	Auto tuning type selection	Rotational StandStill		**StandStill**
PAR_24	Auto Tuning	Auto tuning range setting	None ALL1 Rs Tuning Lsigma If/Tr/Ls Tune		None

There are 4 modes for Standstill auto-tuning.

ALL1: Rs→ Lsigma→ If→ Ls→Tr

Rs Tuning, Lsigma, If/Tr/Ls Tune: Perform each parameter seperately.

Auto-tuning type	Description
None	No Operation
ALL1	Rs, Lσ, If/Tr/Ls are tuned continuously except Encoder Test
Rs Tuning	Rs tuning Only. The stator resistance is tuned at standstill.
Lsigma	Lσ, tuning Only. The Leakage Inductance is tuned at standstill.
If/Tr/Ls Tune	Finds If/Tr/Ls by applying DC current pulse.

- **FWD/REV LEDs are blinking during auto-tuning.**

3.3) StandStill type auto-tuning procedure

LCD Display	Description	Tuning Time
PAR ▶ AutoTuneType 23 StandStill	Set the auto-tuning type to "**Standstill**".	-
PAR ▶ Auto tuning 24 ALL1	Auto-tuning starts if **ALL1** is set.	-
PAR ▶ Auto tuning 24 Rs Tuning	Stator resistance (Rs) is measured without rotating the motor.	20-30 Sec
PAR ▶ Auto tuning 24 sL Tuning	The leakage inductance (sL) of the motor is measured without rotating the motor.	90-150 Sec
PAR ▶ Auto tuning 24 If/Tr/Ls Tuning	Flux current (IF), rotor time constant (τ r) and stator self-inductance (Ls) is measured simultaneously without rotating the motor.	40-70 Sec
PAR ▶ Auto tuning 24 None PAR ▶ Auto tuning 24 [][] Error	When auto-tuning is complete successfully, "None" is displayed. If error occurs during auto-tuning, "[][] Error" is displayed. In this case, verify motor parameters and encoder setting is done properly and redo the auto-tuning. If the problem persists, contact LS representative.	**Total: 3-5 minutes**

4) Motor parameters

The following parameters are found during Auto-tuning.

Motor parameters described below are entered based on LG-OTIS vector motor.

Code	LCD display	Description	Setting range	Unit	Factory setting
PAR_26	Flux-Curr	Motor flux current	0.0 ~ 70% of motor rated current	A	
PAR_27	Tr	Rotor time constant	30 ~ 3000	ms	
PAR_28	Ls	Leakage inductance	0.00 ~ 500.00	mH	
PAR_29	Lsigma	Leakage coefficient	0.00 ~ 100.00	mH	
PAR_30	Rs	Stator resistance	0.000 ~ 5.000	ohm	

Additional functions are as follows;

- User can stop tuning during tuning using [STOP] key.
- In case Encoder test is failed, inverter does not conduct Rs tuning and displays "Encoder Err".
  If this happens, press [Reset] key and retry Encoder test.
- Tr Tuning result can be slightly different for times. Perform it couple of times.

5) Auto tuning error message

LCD Display	Description and Solution
PAR ▶ Auto tuning 24 Enc Error	Displayed when phase loss of A or B occurs and/or error between reference speed and encoder feedback speed exceeds motor rated slip. Check whether wiring of encoder power (PE, GE) and A/B phase is conducted correctly.
PAR ▶ Auto tuning 24 Enc AB Chgd	Displayed in case of reverse wiring of phase A/B or U, V, W. Wire the U, V, W in a correct order or change the encoder direction setting to "B Phase Lead" in PAR_11.
PAR ▶ Auto tuning 24 Rs Error	Displayed when RS value is greater than 5[Ω] or less than 0.002[Ω]. Check for wiring of inverter and motor and motor damage. It may occur when motor rating is much lower than that of inverter.
PAR ▶ Auto tuning 24 sL Error	Displayed when sL is higher than 100[mH]. Check for wiring of inverter and motor and motor damage.
PAR ▶ Auto tuning 24 IF Error	Displayed when motor rpm exceeds 1650 rpm (1800 rpm rated motor) during flux current calculation or flux current is not measured for a long time. Check for wiring of inverter and motor and number of motor phase.
PAR ▶ Auto tuning 24 Ls Error	Displayed when motor rpm exceeds 1650 rpm (1800 rpm rated motor) during Ls calculation or Ls is not measured for a long time. Check for wiring of inverter and motor and number of motor phase.
PAR ▶ Auto tuning 24 PAR 27 DOWN	Displayed when initial set value of PAR_27 is set too high. Repeat the calculation after lowering 30% to initial value.
PAR ▶ Auto tuning 24 PAR 27 UP	Displayed when initial set value of PAR_27 is set too low. Repeat the calculation after increasing 30% to initial value.

6.4 Function group (FUN_[][])

6.4.1 Jump code (FUN_00)

Jumping directly to any parameter code can be accomplished using FUN_00 [Jump code].

Press [PROG] key first and set 2 using [▲(Up)], [▼(Down)], [SHITF/ESC] and press [ENT] key to jump to FUN_02. If the desired code cannot be accessed or void, it automatically jumps to closest code.

After jumping, it is available to jump to other codes using [▲(Up)], [▼(Down)].

6.4.2 Operating method select

1) FUN_01(RUN/STOP source select)

There are four methods for issuing RUN/STOP command of the motor.

- Terminal 1/ Terminal 2: Digital input of the FX/RX terminal
- Keypad: [FWD], [REV], [STOP] key on the keypad
- Option: using Option card. (Factory setting: Terminal 1)

Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_01	Run/Stop Src	RUN/STOP source select	Terminal 1 Terminal 2 Keypad Option		Terminal 1

Difference between Terminal 1 and Terminal 2 setting

Run/Stop source select	Terminal ON/OFF		FWD/REV select
Terminal 1	FX	ON	FWD run command
		OFF	Stop command
	RX	ON	REV run command
		OFF	Stop command
Terminal 2	FX	ON	Run command
		OFF	Stop command
	RX	ON	REV rotation
		OFF	FWD rotation

For Analog speed setting, applying (+) Voltage marks FWD Run command and (-) voltage REV Run command.

Analog speed setting range	FX / FWD / Option FWD	RX / REV / Option REV
0 ~ +10 V	Forward direction	Reverse direction
-10 ~ 0 V	Reverse direction	Forward direction

2) FUN_02 (Speed setting method)

There are four methods to set operating speed.

- Keypad 1/Keypad 2: Digital setting via keypad
- Analog: speed setting via analog input terminal define
- Option: speed setting via option card

To change speed reference in Keypad 1 method, change the value in FUN_12 Speed 0 using [▲(Up)], [▼(Down)] key and press [ENT] key to enter the value into memory. However, in Keypad 2, the changed value is reflected real-time without pressing [ENT] key.

Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_02	Spd Ref Src	Speed setting method	Analog Keypad 1 Keypad 2 Option		Keypad 1

3) FUN_03 (Stop method)

This determines the stop mode of the motor. If this is set to 'Decel' and then stop command is ON, the motor decelerates to a stop within the deceleration time set at FUN_39 (Deceleration Time 1). But, if the motor does not stop within the deceleration time, it is freely rotating after the deceleration time. If this is set to 'Free-run' and then stop command is ON, the motor freely rotates immediately.

Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_03	Stop Mode	Stop method	Decel Free-run		Decel

6.4.3 Motor max speed setting

Maximum value of the speed command to the motor is set to the sum of setting speed, reference speed in Draw control , reference speed in Process PID control and reference speed in Droop control. In this case, final speed command output is limited to the maximum speed command to the motor.

Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_04	Max Speed	Max. motor speed	400.0 ~ 3600.0	rpm	1800.0

6.4.4 Multi-step speed and Dwell speed setting methods

1) FUN_12 ~ 19(Multi-step speed 0 ~ 7)

2) FUN_20(JOG speed command)

If the multi-function terminal is selected as a multi-step speed setting or jog operation, the speed command is determined by the combination of multi-function terminals P1 to P7 and jog speed command.

Multi-speed command by the combination of P1, P2 and P3 is generated as follows. In case multi-step speed 0 is selected (P1, P2 and P3 all are OFF), One of the speed commands from the keypad, analog voltage input and option board is fed into the inverter. In case P4 is ON, it ignores the speed command selection by other terminals and jog

operation command has a priority. In this case, the motor is operated at the speed of FUN_20 (Jog speed command).

P1	P2	P3	P4	Setting speed
OFF	OFF	OFF	OFF	Speed command source is selected at FUN_02. (One of analog inputs, FUN_12 and Option board)
ON	OFF	OFF	OFF	FUN_13
OFF	ON	OFF	OFF	FUN_14
ON	ON	OFF	OFF	FUN_15
OFF	OFF	ON	OFF	FUN_16
ON	OFF	ON	OFF	FUN_17
OFF	ON	ON	OFF	FUN_18
ON	ON	ON	OFF	FUN_19
X	X	X	ON	FUN_20 (JOG speed command)

The values of the multi-step speed command are shown below.

Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_12	Speed 0	Multi-step speed 0	0.0 ~ FUN_04	rpm	0.0
FUN_13	Speed 1	Multi-step speed 1	0.0 ~ FUN_04	rpm	0.0
FUN_14	Speed 2	Multi-step speed 2	0.0 ~ FUN_04	rpm	0.0
FUN_15	Speed 3	Multi-step speed 3	0.0 ~ FUN_04	rpm	0.0
FUN_16	Speed 4	Multi-step speed 4	0.0 ~ FUN_04	rpm	0.0
FUN_17	Speed 5	Multi-step speed 5	0.0 ~ FUN_04	rpm	0.0
FUN_18	Speed 6	Multi-step speed 6	0.0 ~ FUN_04	rpm	0.0
FUN_19	Speed 7	Multi-step speed 7	0.0 ~ FUN_04	rpm	0.0
FUN_20	Jog Speed	JOG speed	0.0 ~ FUN_04	rpm	100.0

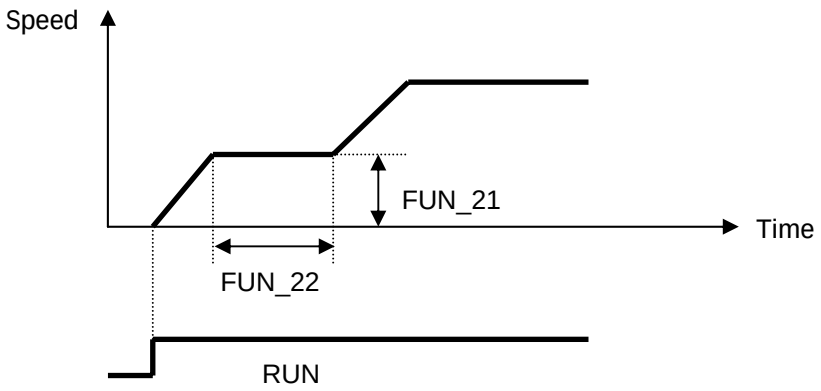
- FUN_04: Max. motor speed

3) FUN_21(Dwell Speed), FUN_22(Dwell Time)

Acceleration is instantly stopped and restarted before driving a heavy load such as hoists when selected.

Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_21	Dwell Speed	Dwell Speed	0.0 ~ FUN_04	rpm	100.0
FUN_22	Dwell Time	Dwell Time	0.00 ~ 100.00	sec	0.00

- FUN_04: Maximum motor speed
- disabled when FUN_22 is set to “0”.

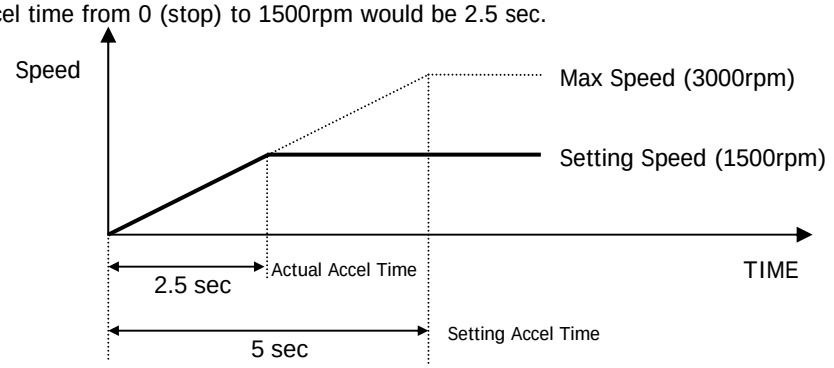


6.4.5 Accel/Decel pattern and time selection

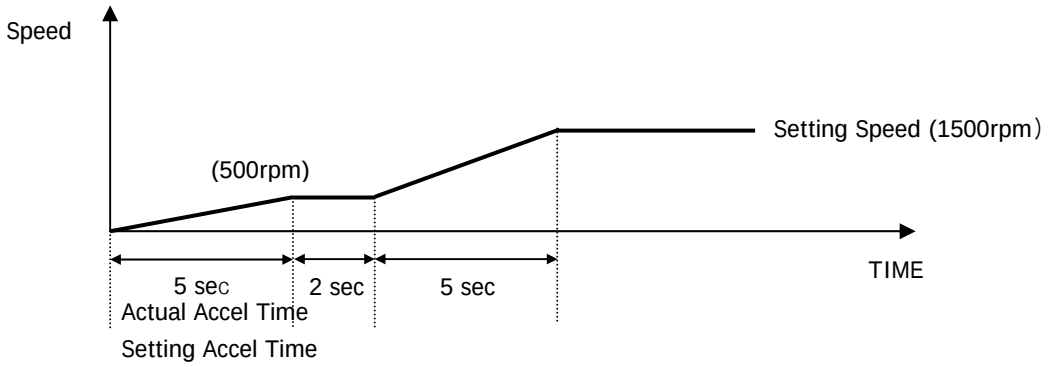
1) FUN_33 (Accel/Decel reference speed)

Acceleration time, deceleration time and BX time is set on the basis of the value at **FUN_33(Accel./decel. reference speed)**, which is 'Max speed'or 'Ref speed'.

Setting example 1 if FUN_33= "Max Speed", Max motor speed= 3000rpm and Operating speed= 1500rpm, Accel time= 5 sec, accel time from 0 (stop) to 1500rpm would be 2.5 sec.



Setting example 2 If FUN_33 is set to 'Ref Speed' and speed command and acceleration time is set to 1500rpm and 5 seconds, respectively, it takes 5 seconds to accelerate from the standstill to 1500rpm.



2) FUN_40 ~ 47(Accel/Decel time 1 ~ 4)

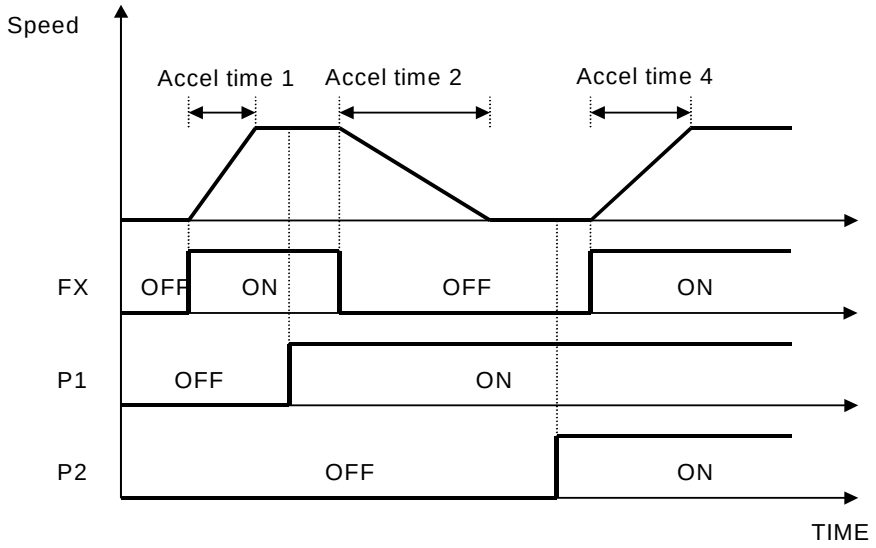
Accel/Decel time 1-4 can be set in SV-iV5 as shown below.

(The factory default value is different from the capacity of inverter.)

Code	LCD display	Description	Setting range	Unit	Factory default value			
					2.2~37kW	45~75kW	90~220kW	280~500kW
FUN_40	Acc Time-1	Acceleration time 1	0.00 ~ 6000.0	sec	2.00	10.00	20.00	30.00
FUN_41	Dec Time-1	Deceleration time 1	0.00 ~ 6000.0	sec	2.00	10.00	20.00	30.00
FUN_42	Acc Time-2	Acceleration time 2	0.00 ~ 6000.0	sec	3.00	12.00	24.00	35.00
FUN_43	Dec Time-2	Deceleration time 2	0.00 ~ 6000.0	sec	3.00	12.00	24.00	35.00
FUN_44	Acc Time-3	Acceleration time 3	0.00 ~ 6000.0	sec	4.00	14.00	28.00	40.00
FUN_45	Dec Time-3	Deceleration time 3	0.00 ~ 6000.0	sec	4.00	14.00	28.00	40.00
FUN_46	Acc Time-4	Acceleration time 4	0.00 ~ 6000.0	sec	5.00	16.00	32.00	45.00
FUN_47	Dec Time-4	Deceleration time 4	0.00 ~ 6000.0	sec	5.00	16.00	32.00	45.00

(Example) Programming P1, P2 as Xcel-L and Xcel-H

Code	LCD display	Description	Setting range	Unit	Factory setting
DIO_01	P1 define	Definition of P1 input			Xcel – L
DIO_02	P2 define	Definition of P2 input			Xcel – H



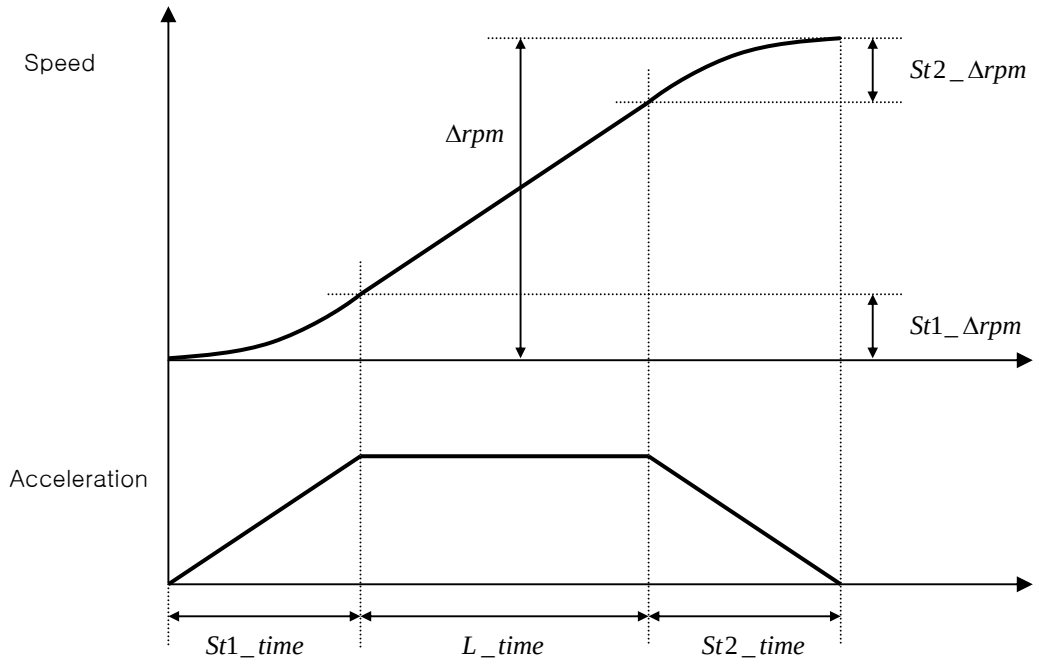
P1 (Xcel-L)	P2 (Xcel-H)	P3 (SoftStartCncl)	Accel/Decel time
OFF	OFF	OFF	Accel/Decel 1
ON	OFF	OFF	Accel/Decel 2
OFF	ON	OFF	Accel/Decel 3
ON	ON	OFF	Accel/Decel 4
X	X	ON	Max Accel/Decel

3) FUN_36 ~ 39(S curve ratio during Accel/Decel 1 ~ 2)

The ramping pattern of the Linear and S Curve could be used by setting the parameters below. S Curve pattern is used to control the acceleration of the machine as linear to minimize the shock at the start. The parameters, FUN_36 ~ 39 determine the rate of S Curve pattern as in the figure below. FUN_36, 37 are applied in the acceleration and FUN_38, 39 in the deceleration.

Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_36	Acc S Start	Curve ratio at the beginning of acceleration	0.0 ~ 50.0	%	0.0
FUN_37	Acc S End	Curve ratio at the end of acceleration	0.0 ~ 50.0	%	0.0
FUN_38	Dec S Start	Curve ratio at the beginning of deceleration	0.0 ~ 50.0	%	0.0
FUN_39	Dec S End	Curve ratio at the end of deceleration	0.0 ~ 50.0	%	0.0

- **Programming example of S curve pattern**



- **Basic equation**

*St1_time = AccTime * (FUN_36 / 50.0%)*

*St2_time = AccTime * (FUN_37 / 50.0%)*

*St1_⊿rpm = St1_time * (MaxSpeed / AccTime) * 0.5*

*St2_⊿rpm = St2_time * (MaxSpeed / AccTime) * 0.5*

- **Calculation 1**

$\Delta rpm \geq St1_\Delta rpm + St2_\Delta rpm$

Δrpm = The difference between the current speed and the target speed

$L_time = (\Delta rpm - St1_\Delta rpm - St2_\Delta rpm) * (AccTime / MaxSpeed)$

***Effective Acceleration Time* = $St1_time + L_time + St2_time$**

- **Calculation 2**

$\Delta rpm < St1_\Delta rpm + St2_\Delta rpm$

$St1'_time = \sqrt{\{ [\Delta rpm * AccTime^2 * St1_time^2] / [25 * MaxSpeed * (St1_time + St2_time)] \}}$

$St2'_time = \sqrt{\{ [\Delta rpm * AccTime^2 * St2_time^2] / [25 * MaxSpeed * (St1_time + St2_time)] \}}$

Effective Acceleration Time = $St1'_time + St2'_time$

Δrpm: Speed difference
MaxSpeed : Maximum speed (FUN_04)
AccTime : Set acceleration time (FUN_40, 42, 44, 46)
$St1_\Delta rpm$: Acc S Start ST (%) of FUN_36 at the time of acceleration,
Dec S End ST (%) of FUN_39 at the time of deceleration
$St2_\Delta rpm$: Acc S End ST (%) of FUN_37 at the time of acceleration,
Dec S Start ST (%) of FUN_38 at the time of deceleration
St1_time: The time when St1_Δrpm is formed.
St2_time: The time when St2_Δrpm is formed.

4) FUN_48 (Deceleration time for zero speed selection)

5) FUN_49 (Zero speed deceleration time)

This is the time when the motor decelerates from the arbitrary speed to 0 rpm in speed. This is valid only when FUN_48 is set to 'Yes'. If 'No' is set, the set deceleration time is applied.

Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_48	Use 0 Dec T	Deceleration time selection for zero speed	No/Yes		No
FUN_49	0 Dec Time	Deceleration time for zero speed	0.00~6000.0	sec	0.00

6) FUN_51(Decel time when BX is ON)

When the motor should be stopped immediately in case of emergency, BX on the control circuit terminal can be used. When BX is ON, the motor decelerates to a stop within 'Emergency deceleration time' set at FUN_51. But, if the motor does not stop within the deceleration time, it rotates freely after the deceleration time. If the motor is intended to stop at the instant BX is ON, FUN_51 is set to '0'.

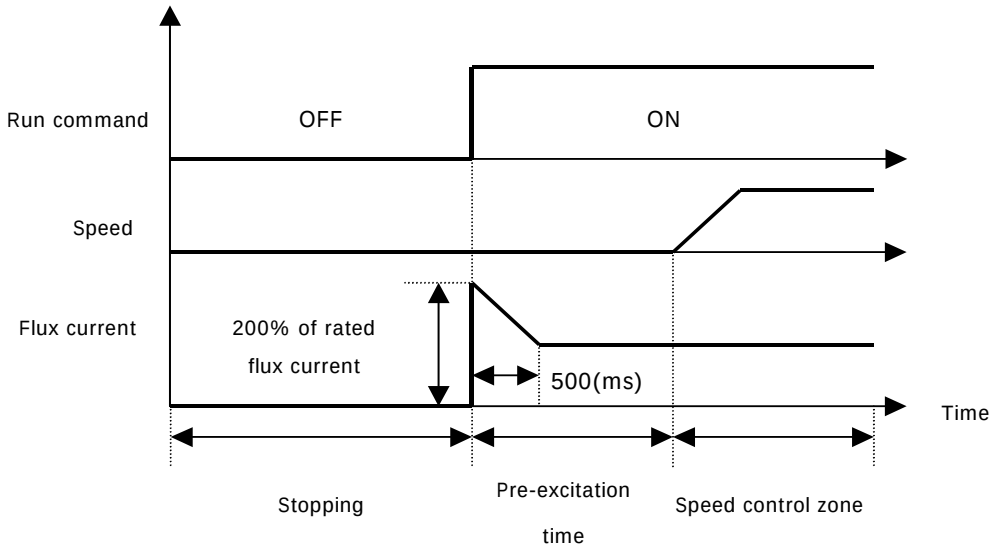
Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_51	BX Time	Deceleration time for emergency stop	0.0 ~ 6000.0	sec	0.0

7) FUN_52 (Pre-excitation)

FUN_52 (Motor Pre-excitation Time) can be used for the flux build-up in the induction motor to obtain the best control characteristic. FWD and REV LED blink concurrently during the time of pre-excitation.

- **FUN_52 is activated only when FUN_02(Spd Ref Sel) is set to Keypad1 or Keypad2.**

Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_52	PreExct Time	Pre-excitation time	0 ~ 10000	ms	0



8) FUN_53(Hold Time)

The motor maintains the zero speed for 'Motor Hold Time' after the motor decelerates to a stop.

Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_53	Hold Time	Motor Hold Time	100 ~ 10000	ms	1000

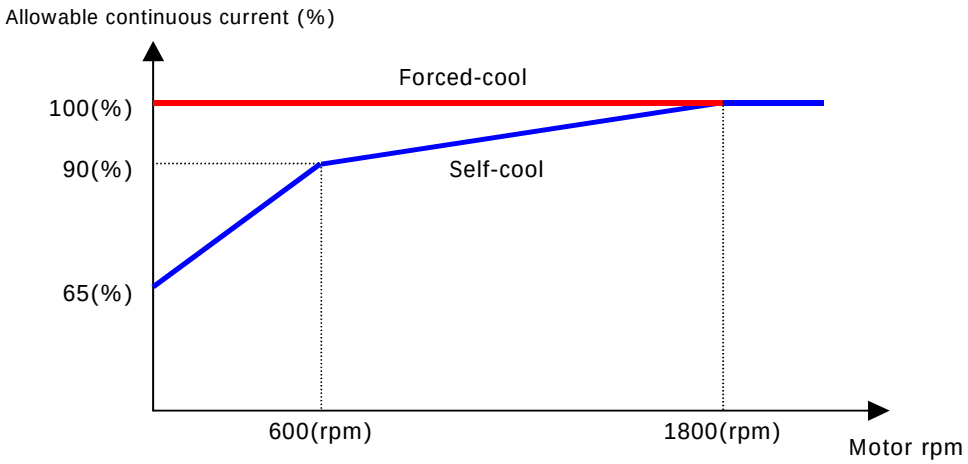
6.4.6 Electronic thermal (motor I^2T) selection

These functions are required when the motor should be protected against the overheat without installing the thermal relay between the inverter and the motor. If electronic thermal protection is ON, the inverter blocks the IGBT gating signals and issues the trip message.

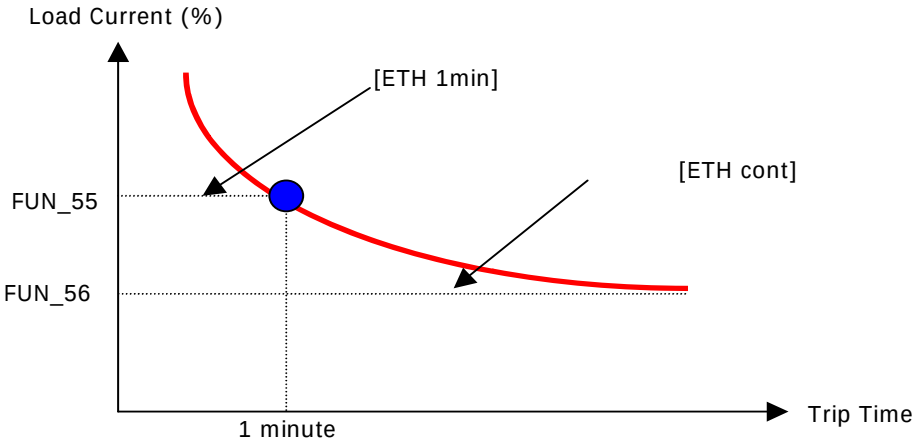
Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_54	ETH Select	Electronic thermal selection	No Yes		No
FUN_55	ETH 1 Min	Electronic thermal level for 1 minute	FUN_56 ~ 200	%	150
FUN_56	ETH Cont	Electronic thermal level for continuous	50 ~ FUN_55 (up to 150%)	%	100
PAR_09	Cooling Mtd	Motor cooling method	Self-cool Forced-cool		Forced-cool

Electronic thermal protection level is set in % based on the **'Motor rated current'** at PAR_22. **'1 min.level of electronic thermal'** at FUN_55 is the current level which should be referred to when the motor is operated for a minute and the motor is estimated to be overheated. **'Continuous level of electronic thermal'** at FUN_56 is the current level which should be referred to when the motor is operated continuously and the motor is estimated to be in thermal equilibrium. Continuous level is set to the motor rated current (100%) and should be less than **'1 min.level of electronic thermal'** at FUN_55. PAR_09 'Cooling type' should be set correctly to ensure the proper electronic thermal protection.

- **Self-cool** : This should be set when cooling fan mounted on the motor shaft is used for cooling. The cooling performance is greatly reduced when the motor is operated at the low speed. Compared to high speed region, the motor is rapidly overheated at the low speed region even if the same current flows into it. So like the graph below, according to frequency, the allowable continous current value of **'Continuous level of electronic thermal'** of FUN_56 is reduced and electronic thermal function starts operating.
- **Forced-cool** : This should be set when the cooling fan is powered by the separate power supply. **'Continuous level of electronic thermal'** at FUN_56, which is allowable continuous current is applied, regadless of the operating frequency.



[The characteristic of allowable continuous current with respect to 4 pole, 60Hz motor]



[Motor i2t Characteristic Curve]

- The motor protection is possible by calculating and accumulating I^2t even in load variation and frequent run/stop.

6.4.7 Inverter switching frequency select

1) FUN_57 (Inverter switching frequency select)

This parameter affects the audible sound of the motor, noise emission from the inverter, inverter termperature, and leakage current. If the ambient temperature where the inverter is installed is high or other equipment may be affected by potential inverter noise, set this value lower. (setting range: 2.5 ~ 10.0 kHz).

Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_57	PWM Freq	Switching frequency select		kHz	

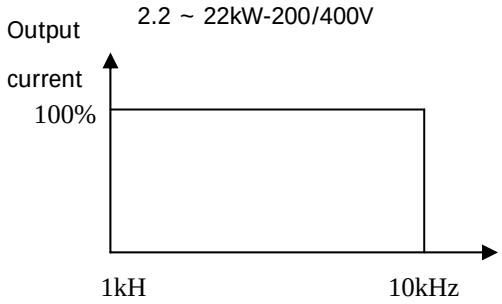
2) Setting range and factory setting of switching frequency

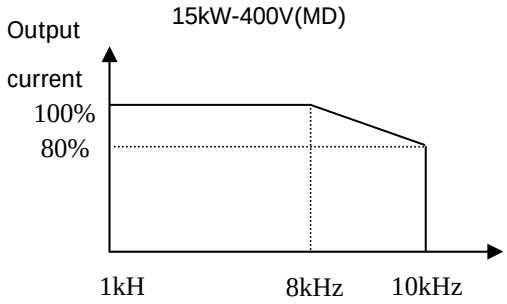
Voltage	Inverter capacity (kW)	Setting range (kHz)	Factory setting (kHz)
200V	2.2 ~ 22(kW)	2.5 ~ 10(kHz)	10(kHz)
	30/37(kW)	2.5 ~ 7(kHz)	5(kHz)
400V	2.2 ~ 22(kW)	2.5 ~ 10(kHz)	8(kHz)
	30 ~ 75(kW)	2.5 ~ 7(kHz)	5(kHz)
	90 ~ 132(kW)	2.5 ~ 5(kHz)	4(kHz)
	160/220(kW)	2.5 ~ 4(kHz)	4(kHz)
	280 ~ 500 (kW)	2(kHz)	2(kHz)

- **Continuous Operation Derating Information**

15kW-400V(MD) class model among 5.5 ~ 22kW-200/400V class MD type models applies the following load rating.

① Rated load classified by the switching frequency





② The above graph is only applied when the inverter is operated in the allowable temperature. Pay attention to the air cooling when the inverter is installed in a panel box, and the inside temperature should be within an allowable temperature range.

③ This derating curve is based on inverter current rating when rated motor is connected.

6.4.8 Power ON start selection (FUN_58)

In case 'No' is set, the inverter can be operated only if the terminal should be 'On' again after it is 'Off' once. In case 'Yes' is set, the inverter starts to run at the instant the power is supplied to the inverter if FX terminal input is 'On' or RX terminal input is 'On'. If the inverter starts to run while the motor is freely rotating, first, the motor decelerates to a stop and restart.

Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_58	Power-on Run	Power on start selection	Yes No		No

⚠ CAUTION

Particular attention should be directed to this function due to potential hazard as motor starts to run suddenly upon applying AC input power.

6.4.9 Restart after fault reset (FUN_59)

In case 'No' is set, the inverter can be operated only if the terminal should be 'On' again after it is 'Off' once. In case 'Yes' is set, the inverter starts to run at the instant the inverter fault is cleared if FX terminal input is 'On' or RX terminal input is 'On'. At the time of the inverter trip, the motor start to coast to a stop because the inverter blocks the IGBT gating signals. If the inverter starts to run while the motor is freely rotating, first, the motor decelerates to a stop and restart. If set CON_49 [Speed search] to bit 1 from previous bit 2, operation begin by speed search function when fault is reset.

Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_59	RST Restart	Restart after fault reset	Yes No		No

CAUTION

Take caution for this function. When FUN_59 is set, motor runs immediately upon fault is reset.

6.4.10 Restart after fault reset

1) FUN_60 (number of auto restart try)

2) FUN_61 (delay time before auto restart)

This function prevents the permanet stop of the inverter due to the trip. The inverter automatically resets the fault and restarts and continues to run after the fault occurs if the number of automatic restart is set and the inveter operation is possible.

Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_60	Retry Number	Number of auto restart try	0 ~ 10		0
FUN_61	Retry Delay	Delay time before Auto restart	0.0 ~ 60.0	sec	1.0

In case the inverter trip occurs, the inverter restarts by **'The number of automatic restart'** at FUN_60. In case of the inverter trip, the inverter resets the fault automatically and waits for '**Delay time before automatic restart'** at FUN_61 and restarts. The inverter will not restart any more, blocks the IGBT gating signals and issues the trip message if the inverter trip occurs more than **'The number of automatic restart'** at FUN_60. For example, if inverter starts sucessfully by 'automatic restart' (and trip doesn't occur any more), 'the number of automatic restart' doesn't add. If it fails (trip occurs again) 1 is added based on the previous accumulated number. That is, the number is added continuously without the initialization.

The conditions for the initialization of 'the number of automatic restart'.

- The number automatic restart accumulated so far is initailized by turning the inverter power ON/OFF
- If the number of automatic restart reaches to the set value at FUN_60, the automatic restart won't be conducted any more. Then push the reset key in loader forcefully for clearing trip so that the number of automatic restart will be initialized again and be increased from the beginnning.

⚠ CAUTION

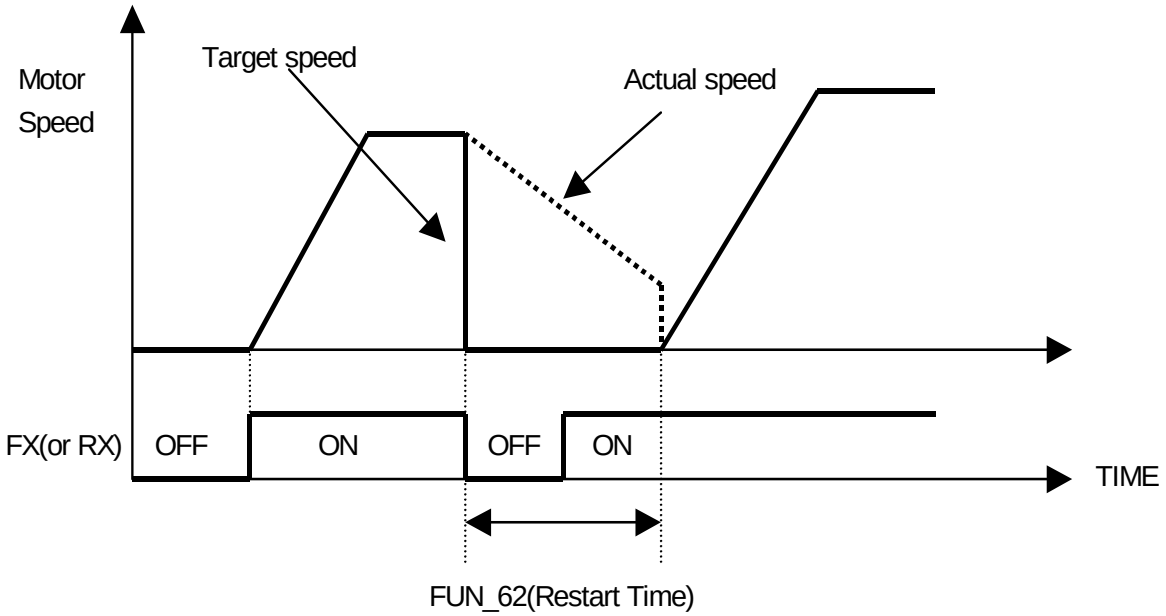
- Particular attention should be directed to this function as the inverter clears the fault automatically and motor suddenly restarts when trip occurs.
- Auto restart function is disabled when the following trips occur.
  - ① BX (Emergency stop)
  - ② Low Voltage
  - ③ Arm Short-U (V, W, DB)
  - ④ Fuse Open
  - ⑤ Ext Trip-B (External trip B)
  - ⑥ InvOver Heat (inverter overheated)
  - ⑦ MotOver Heat (Motor overheated)
  - ⑧ Encoder Err (Encoder error)
  - ⑨ Over Load (Overload trip)
  - ⑩ E-Thermal (Electronic thermal protection)
  - ⑪ FAN/MC PWR, FAN PWR (AC FAN and M/C power source fault)
- If trip does occur in 30 sec after restart, inverter adds the number of restart by one automatically and this cannot exceed setting value.

6.4.11 Wait time for restart upon stop

- Only active when FUN_03 is set to 'Free-run' and operating method is 'Terminal'.

Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_62	Restart Time	Wait time for Restart upon Stop	0.00 ~ 10.00	sec	0.00
FUN_03	Stop mode	Stop method	Decel **Free-run**		Decel

Even though restart command is input after stopping the operation, inverter does not run until FUN_62 setting time elapses.



6.4.12 Overspeed error detection

- Inverter detects error if motor rpm exceeds its limit. User can set the detection level and time of overspeed.

Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_63	OverSpdLevel	Overspeed Detection Level	100.0 ~ 130.0	%	120.0
FUN_64	OverSpd Time	Overspeed Detection Time	0.00 ~ 2.00	sec	0.00

- FUN_63 is based on 100% of FUN_04(Max Speed).
- When motor speed exceeds FUN_63 (Overspeed Detection Level) and FUN_64(Overspeed Detection Time) elapses, overspeed error detection is activated.
- If FUN_64 is set to 0.00(sec) and motor rpm exceeds FUN_63, inverter immediately detects overspeed error.

6.4.13 Brake opening and closing setting

1) FUN_65(Brake opening time)

2) FUN_66(Brake opening speed)

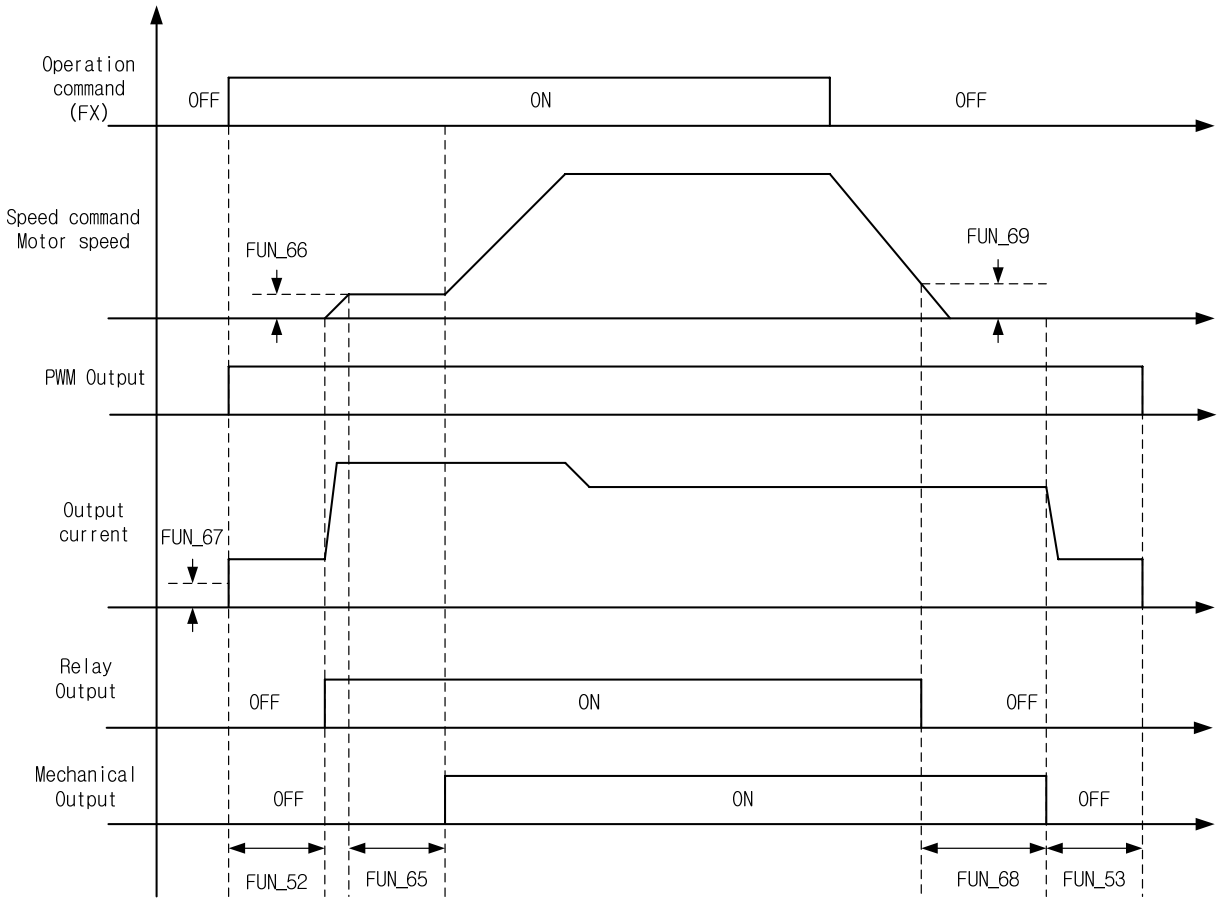
3) FUN_67(Brake opening current)

4) FUN_68(Brake closing time)

5) FUN_69(Brake closing speed)

- It only operates when multi-aux ouput terminal(DIO_41 ~ DIO_43)is set to Brake Output.
  The motor brake is not opened during motor' Auto-tuning, so be sure to open the brake forcedly when you do the rotating type motor's Auto tuning.
- About Brake opening time, Multi-aux output terminal becomes on after passing initial excitation time of motor and it operates with the brake opening speed during set time.
- About Brake opening speed, Multi-aux output terminal becomes on after passing initial excitation time of motor and it operates with the set speed during brake opening time.
- Brake openig current value is set as the percentage of magnetic current of motor. The brake openig signal operates only after ocurring more output current than set value.
- Brake closing time means the set time after multi-aux output terminal is off below the brake closing speed. Set more high brake closing time value than decelerating time between brake closing speed and 0.
- At the brake closing speed, multi-aux ouput teminal becomes off.
- If Backlash phenomenon occurs when the motor is stopping, increase the brake closing set value more and more until the Backlash phenomenon isn't occurs anymore. At the same time, adjust also the brake closing time set value.

Code	Display	Description	Range	Unit	Default
FUN_65	BKOpen Time	Brake opening time	0.00 ~ 30.00	sec	0.00
FUN_66	BKOpen Spd	Brake opening speed	0.0 ~ 500.0	rpm	0.0
FUN_67	Release Curr	Brake opening current	0.0 ~ 150.0	%	20.0
FUN_68	BKClose Time	Brake closing time	0.00 ~ 30.00	sec	0.00
FUN_69	BKClose Spd	Brake closing speed	0.0 ~ 500.0	rpm	0.0

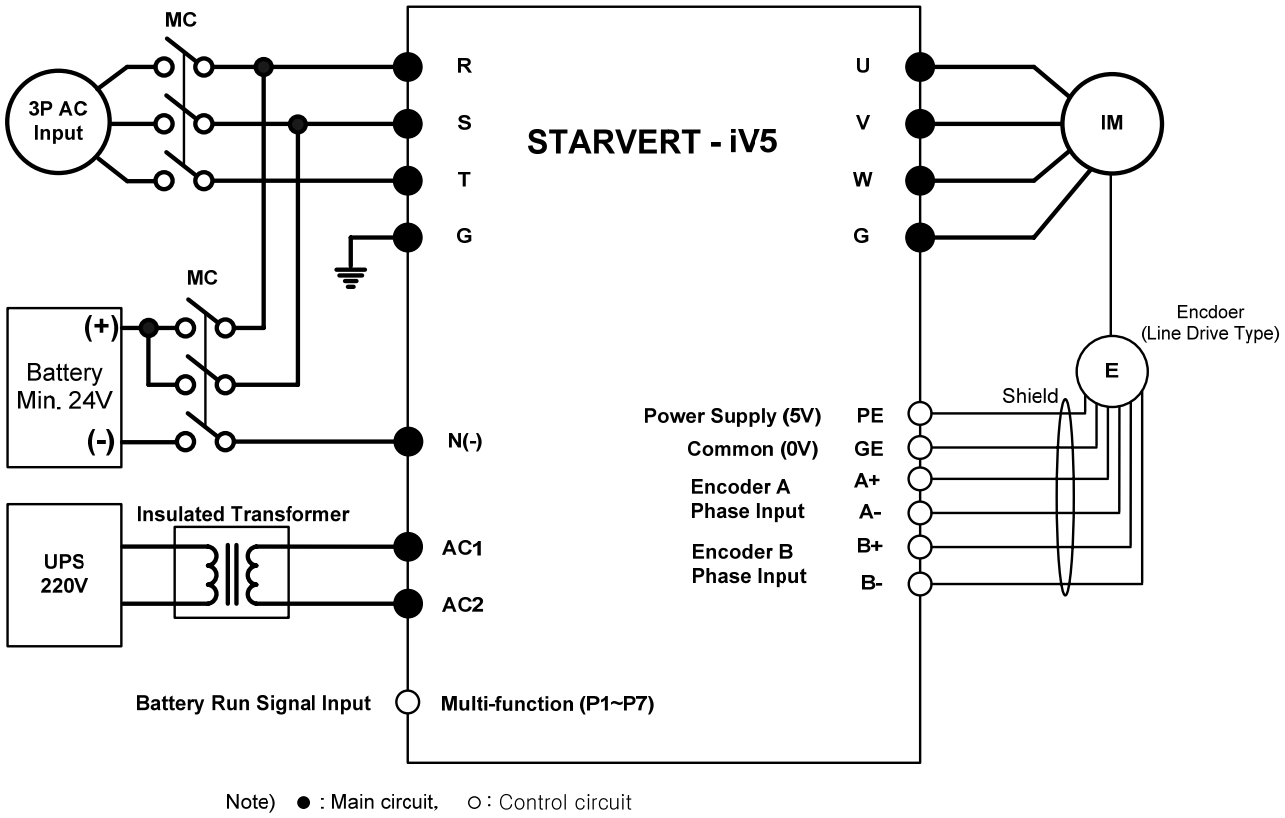

Operation command (FX)
OFF
ON
OFF
Speed command Motor speed
FUN_66
FUN_69
PWM Output
Output current
FUN_67
Relay Output
OFF
ON
OFF
Mechanical Output
OFF
ON
OFF
FUN_52
FUN_65
FUN_68
FUN_53

6.4.14 Battery-operated (Battery Run) speed and Input voltage setting

Battery-operated function operates the motor with external battery at elevator application field when main power is not energized by instantaneous power failure etc.. (it is for 5.5 ~ 22 kW-2/4 products.)

Code	LCD display	Description	Setting range	Unit	Factory setting
FUN_70	Batt. Speed	Battery-operated speed	2.5 ~ 200.0	rpm	50.0
FUN_71	Batt. Volt	Battery input voltage	12 ~ PAR_18	V	48

- FUN-70, 71 code are displayed in case 'Battery Run' of multi-function input DIO_01~07 is turned On.
- FUN_70 sets the operation speed during emergency operation.
- FUN_71 sets the battery voltage used.
- In emergency, battery-operated is activated when the signal is given to terminal which 'Battery Run' function of DIO group is turned On. After it is activated, it is operated with speed set in FUN_70 and level of low voltage trip is changed lower automatically.
- To return to normal mode, release the signal from 'Battery Run' mode of multi-function input turned On.
- Additional wiring for battery-operated mode is as shown below.
  -. Connect the 2 terminals among main circuit input terminal R, S, T to battery positive through MC (Magnetic Contactor).
  -. Connect N (-) terminal of main circuit to battery negative.
  -. Input UPS auxiliary power supply 220V to AC1 and AC2.



Note) ● : Main circuit, ○ : Control circuit

- Features of battery-operated function

  -.In battery-operated mode, LED on the right side of the loader for current operation mode and 'BAT' are displayed by turns.

  -.In case multi-function output sets to 'INV Ready', it turns off during battery-operated mode.

  -. After battery power is energized to inverter, inverter will start 2 seconds later after the time for releasing the low voltage trip and raising the internal voltage.

  -.If voltage is falling less than about 53% of FUN_71 set value, it sets down as low voltage trip so it is detected a trip.

  -.To return to main power, main power must be energized after releasing the magnetic contactor and signal from the battery and then low voltage trip is detected.

  -.Operation speed (FUN_71) must be determined according to battery voltage (FUN_70), base speed (PAR_17) and motor rated voltage (PAR_18). Please operate the inverter with low speed by battery capacity.

6.5 Control Group (CON_[][])

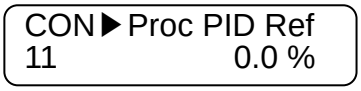
6.5.1 Jump code (CON_00)

Jumping directly to any parameter code can be accomplished using CON_00 [Jump code].

Example Jumping to **CON_11**

Press [PROG] key first and set 11 using [▲(Up)], [▼(Down)], [SHITF/ESC] and press [ENT] key to jump to CON_11.

If the desired code cannot be accessed or void, it automatically jumps to closest code.



After jumping, it is available to jump to other codes using [▲(Up)], [▼(Down)].

6.5.2 Control mode select (CON_01)

In the motor control mode, there are **speed** and **torque** control modes based on the vector control. The speed sensor such as the pulse encoder is required if speed control ('**Speed**') and torque control ('**Torque**') are to be used.

Code	LCD display	Description	Setting range	Unit	Factory setting
CON_01	Control Mode	Control mode selection	Speed Torque		Speed

6.5.3 Application mode (CON_02)

General vector mode or Elevator mode can be selected in CON_02.

Code	LCD display	Description	Setting range	Unit	Factory setting
CON_02	Application	Application mode setting	General Vect Elevator *1) Synchro*2) WEB Control		General Vect

*1) Only displayed with Elevator option board (EL_IO) installed.

*2) Only displayed with Synchonization option board (SYNC_IO) installed.

6.5.4 Automatic speed regulator: ASR

1) CON_05(ASR LPF Time Constant 1)

2) CON_08(ASR LPF Time Constant 2)

One of the two PI gains of ASR can be selected depending on the status of the multi-function terminal input set as the 'ASR Gain Selection'. That is, if the multi-function terminal input is 'Off', 1-numbered gain and LPF time constant is selected. On the contrary, if this input is 'On', 2-numbered gain and LPF time constant are selected.

(Example) Programming P4 as ASR PI Gain

Code	LCD display	Description	Setting range	Unit	Set value
DIO_04	P4 define	Multi-function input terminal P4 definition			ASR Gain Sel

The two sets of Lowpass Filter are as follow:

Code	LCD display	Description	Setting range	Unit	Factory setting
CON_05	ASR LPF1	ASR LPF time constant 1	0 ~ 20000	ms	0
CON_08	ASR LPF2	ASR LPF time constant 2	0 ~ 20000	ms	0

3) CON_03 ~ 04(ASR PI Gain 1)

4) CON_06 ~ 07(ASR PI Gain 2)

One of 2 sets of PI gain can be selected by "ASR Gain Sel" in Multi-function input terminal.

Code	LCD display	Description	Setting range	Unit	Factory setting
CON_03	ASR P Gain1	ASR P Gain 1	0.0 ~ 200.0	%	50.0
CON_04	ASR I Gain1	ASR I Gain 1	0 ~ 50000	ms	300
CON_06	ASR P Gain2	ASR P Gain 2	0.0 ~ 200.0	%	5.0
CON_07	ASR I Gain2	ASR I Gain 2	0 ~ 50000	ms	3000

5) CON_09 (Ramp time for ASR gain Transfer)

6) CON_10 (Motor Speed at the time of ASR Gain Transfer)

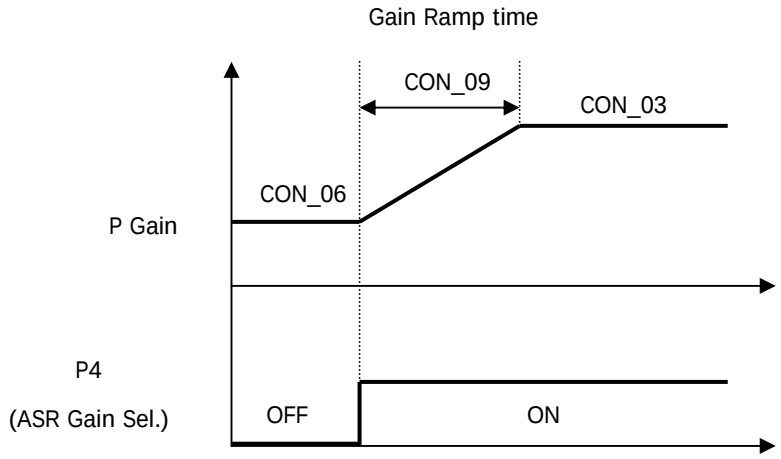
ASR PI controller can be transferred to P controller depending on the status of the multi-function terminal input set as '**ASR P/PI transfer**'.

Example When P6 is set to ASR P/PI transfer:

Code	LCD display	Description	Setting range	Unit	Factory setting
DIO_06	P6 define	Multi-function input terminal P6 definition			ASR P/PI Sel

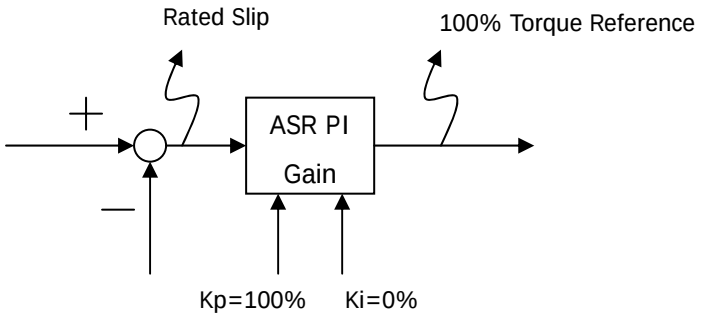
To avoid the shock to the control system due to the rapid change P and I gain in case of ASR gain transfer, if the multi-function terminal input set to '**ASR Gain Sel**' is 'On', the transferred P gain changes gradually for the time set at CON_09. P gain 2 is transferred to P gain 1 at the higher speed than the value set at CON_10. This happens when the multi-function terminal input set to 'ASR Gain Sel' is 'On', not 'Off"

Code	LCD display	Description	Setting range	Unit	Factory setting
CON_09	ASR Ramp	Ramp time for ASR gain switch-over	10 ~ 10000	ms	1000
CON_10	ASR TarSpd	Target Speed after ASR gain switch-over	0.0 ~ 3600.0	rpm	0.0



- **How to set the P and I gain of the ASR (Automatic Speed Regulator)**

The P gain(%) of ASR becomes equal to the torque reference(%) when the speed difference between the speed command and the real speed fed back to the ASR is identical to the rated slip. The I gain is the time to be taken to accumulate the torque reference from 0 to 100%. That is, The output of ASR becomes equal to the 100% of the torque reference when P gain is set to 100% and the speed difference is equal to the rated slip. Speed response characteristic may be better, but the control system may be unstable when P gain is increased or I gain is decreased. On the contrary, Speed response characteristic may be degraded if P gain is decreased or I gain is increased.



6.5.5 Process PID control

Process PID controller is added ouside the speed control loop and a wide variety of process control can be implemented without using the stand-alone PID controller outside the speed control loop or PLC. '**Process PID Enb**' at CON_20 determines whether Process PID controller is enabled or not. '**Process PID Enb**' at CON_20 can be set as follows.

(Example) programming CON_20 "Process PID Enable/Disable"

CON_20 (Proc PID Enb)	RUN/STOP command	
	ON	OFF
Disable	Disable	Disable
Enable	**Enable**	Disable
Terminal	Depending on terminal definition	Disable

If '**Process PID Enb**' at CON_20 is set to 'Terminal', Process PID controller is enabled using 'Proc PID Dis', which is the one of the functions of the multi-function terminal input. To avoid the saturation of the process PID controller, process PI controller is enabled only when the multi-function terminal is set to 'Proc PID Dis' and the terminal is 'OFF' and the run command is 'ON'.

Multi-function input terminal defined as "Proc PID Dis"		RUN/STOP command	
Input signal		ON	OFF
Defined	ON	Disable	Disable
	OFF	**Enable**	Disable
Not defined		Disable	Disable

The command to Process PID controller uses the digital value (CON_10) set using the keypad or the analog value ('Process PID F/B') which is the one of the multi-function analog output. The setting range of Process PID digital input at CON_11 is from –100 to100% and the setting range of analog input command is from –10 to 10V.

Code	LCD display	Description	Setting range	Unit	Factory setting
CON_11	Proc PID Ref	Process PID Reference Source (Keypad)	-100.0 ~ 100.0	%	0.0

The definition of P gain and I gain in the Process PID controller is as follows. If P gain is 100% and I gain is 0% and the input error of the Process PID controller (CON_11 + Proc PID Ref - Proc PID F/B) is 100%, the output of Process PID controller is 100%. If I gain is 10% and P gain is 0 and the input error is 100%, it takes the output of the Process PI controller 1 second to be accumulated up to 100%. The higher I gain becomes, the faster the response becomes reducing the accumulated time. Finally, the output of Process PID controller (%) multiplied by the maximum motor speed (FUN_04) is added to the total speed command.

Code	LCD display	Description	Setting range	Unit	Factory setting
CON_13	Proc PID Kp	Process PID P gain	0.0 ~ 999.9	%	0.0
CON_14	Proc PID Ki	Process PID I gain	0.0 ~ 100.0	%	0.0
CON_15	Proc PID Kd	Process PID D gain	0.0 ~ 100.0	%	0.0

To prevent the Process PID controller from being saturated by the malfunction of the Process PID controller, the output of the Process PID controller can be limited to the positive or negative value, separately from the main speed controller.

Code	LCD display	Description	Setting range	Unit	Factory setting
CON_16	Proc Pos Lmt	Process PID positive limit	-100 ~ 100	%	100
CON_17	Proc Neg Lmt	Process PID negative limit	-100 ~ 100	%	100

Low pass filter at the output of the Process PID controller can be used. In this case, filter output is multplied by the output gain and fed to the speed command.

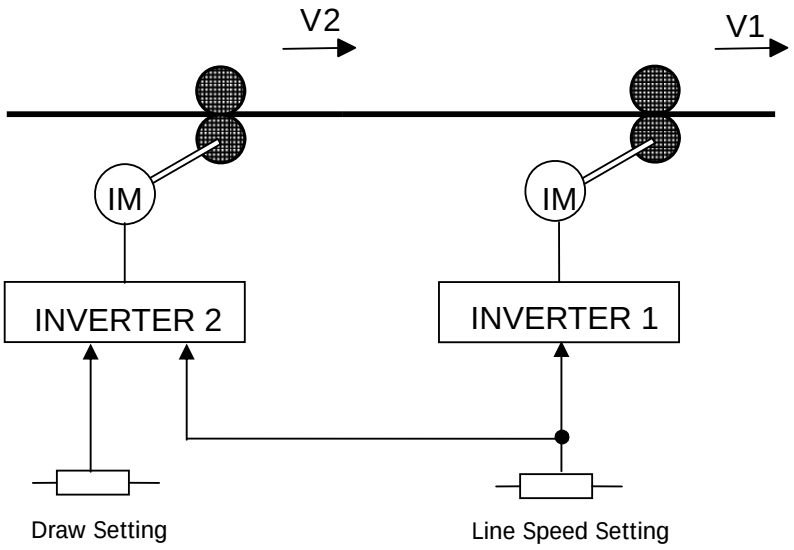
Code	LCD display	Description	Setting range	Unit	Factory setting
CON_18	Proc Out LPF	Process PID output LPF time constant	0 ~ 500	ms	0
CON_19	Proc OutGain	Process PID output gain	-250.0 ~ 250.0	%	0.0

If the output error of Process PID exists at stopping, it keeps current motor speed during “PID Hold Time” and then free-runs and stops by stopping friction power. If output error is “0”, motor is stopped regardless of “PID Hold Time“ setting.

Code	LCD display	Description	Setting range	Unit	Factory setting
CON_21	PIDHoldTime	Process PID Hold Time	0 ~ 10000	ms	5000

6.5.6 Draw control

Draw control is a sort of Open Loop tension control. Draw is the ratio of speed difference between one roll and the other. Tension is generated as in the following equation.



$$D = \frac{V1 - V2}{V2}$$

$$T = E \times S \times D = E \times S \times \frac{V1 - V2}{V2}$$

Where,

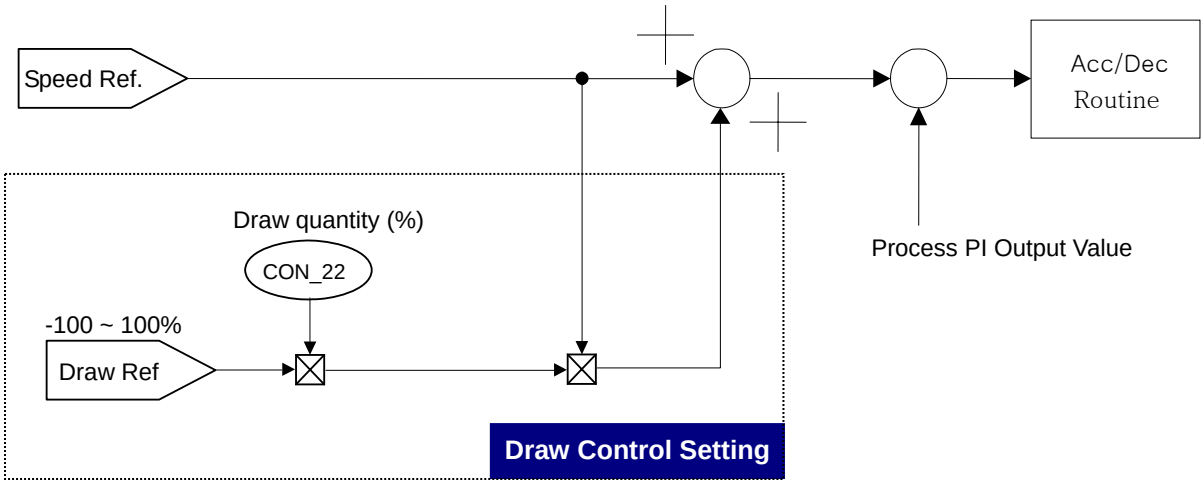
V1, V2: Transfer speed of each roll (m/min)

T: Tension (kg)

E: Elasticity coefficient of processed material (kg/mm2)

S: Sectional area of processed material (mm2)

Draw reference multiplied by draw quantity set at CON_22 is added up to the speed command and the sum acts as the final speed command.



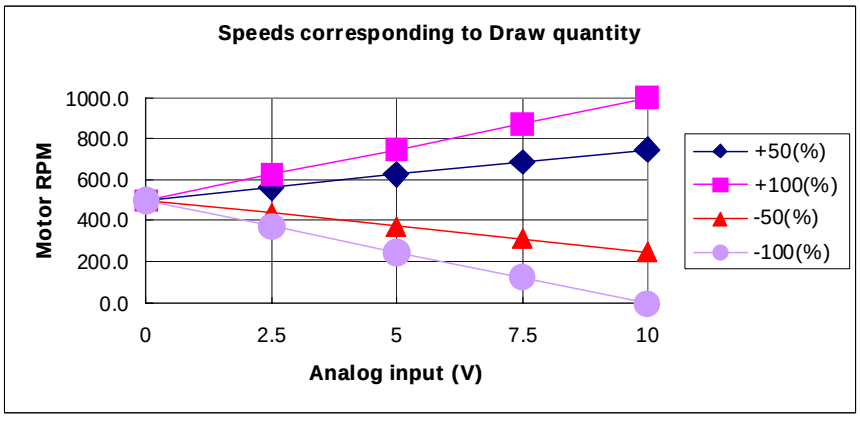
One of the multi-function analog input is set to the draw command ranging from –100% to 100% and the speed command multiplied by Draw quantity is added up to the speed command (Speed Ref) to obtain the final speed command.

Example Programming Ai2 as the Draw Reference

Code	LCD display	Description	Setting range	Unit	Factory setting
AIO_13	Ai2 Define	Multi-function analog input Ai2 definition			Draw Ref
FUN_02	Spd Ref Sel	Speed reference selection			Keypad1
FUN_12	Speed 0	Multi-speed 0	0.0 ~ 3600.0	rpm	500.0
CON_22	Draw %	Draw Quantity	-100.0 ~ 100.0	%	

☞ $\text{Run speed} = \text{Spd Ref value} + \text{Spd Ref value} \times \frac{\text{Draw quantity}(\%)}{100(\%)} \times \frac{\text{Anolog input}(V)}{10(V)}$

☞ Sign of analog input operates by absolute value norm.

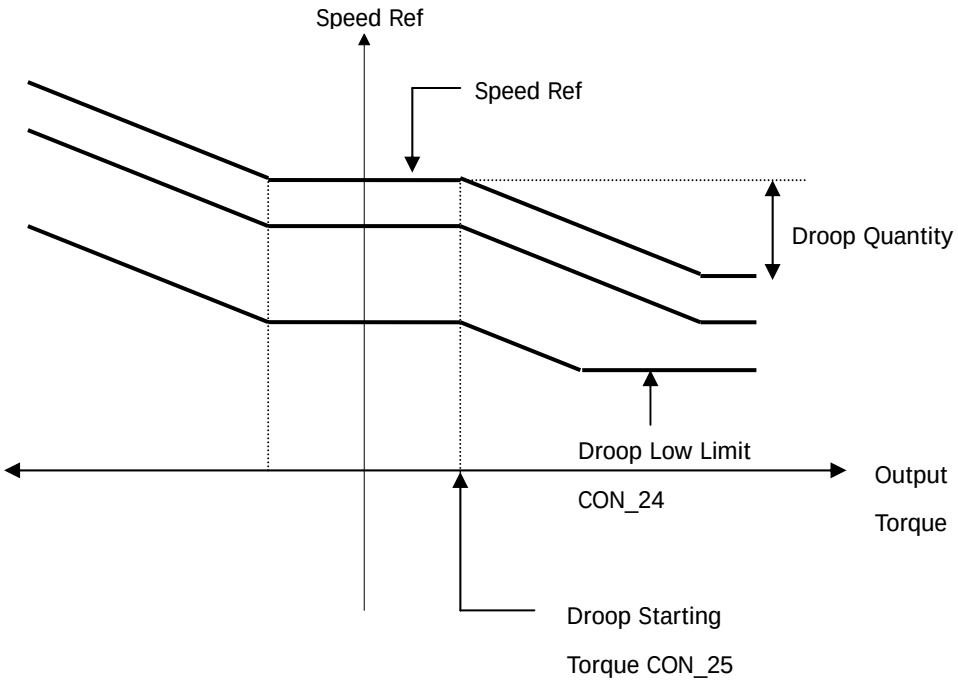


6.5.7 Droop control

Droop control uses the drooping characteristic of the speed with respect to the torque reference. This control method is used to prevent the saturation of the speed controller due to the difference between the speed reference and the real speed when the inverter is used for load balancing of the multiple motors and helper roll, which is the auxiliary device of the main roll. As shown in the figure below, the speed command is adjusted properly depending on the torque reference.

Code	LCD display	Description	Setting range	Unit	Factory setting
CON_23	Droop %	Droop Quantity	0.0 ~ 100.0	%	0.0
CON_24	Droop MinSpd	Low speed limit of Droop control	0.0 ~ 3600.0	rpm	0.0
CON_25	Droop MinTrq	Starting torque of Droop control %	0.0 ~ 100.0	%	0.0

If the torque reference (the output of the speed controller) becomes higher than the set Droop start torque, it reduces the speed command and consequently, decreasing the torque reference. Speed command in the Droop control is as in the following equation.



Droop Control Calculation Example

- **When Torque Ref is Positive:**

Droop Ref speed = (Torque Ref [%] − Droop Starting Torque[%]) * Droop Quantity[%]

The result value becomes positive. Therefore, final speed ref value decreases and it should be,

(Speed Ref – Droop Ref speed) > Droop low limit speed

Droop Ref speed < (Speed Ref – Droop low limit speed)

Therefore, positive limit is "**Speed Ref − Droop Low Limit Speed"**.

- **When Torque Ref is Negative:**

Droop Ref speed = −(Torque Ref [%] − Droop Starting Torque[%]) * Droop Quantity [%]

The result value becomes negative. Therefore, final speed ref value increases and it should be,

(Speed Ref – Droop Ref speed) < Max Motor speed

Droop Ref speed > −(Max Motor speed − Speed Ref)

Therefore, negative limit is "**Max Motor speed − Speed Ref**".

6.5.8 Torque control

One mode among the speed control mode and torque control mode can be set at CON_01('Control Mode'). The default is the speed control mode. Control mode can be selected using the multi-function terminal input set to 'Spd/Trq Sel'. This method has a priority over the one by CON_01.

(Setting example) Programming P6 as Torque control

Code	LCD display	Description	Setting range	Unit	Setting
DIO_06	P6 define	Multi-function input terminal P6 definition			Spd/Trq sel
CON_01	Control Mode	Control mode setting	Speed Torque		Torque

1) CON_26 (Torque Reference Source Selection)

2) CON_27 (Torque Reference Source)

In the speed control mode, the output of the ASR acts as the torque reference. In the torque control mode, the torque reference is set by the analog input signal defined as 'Trq Ref Src' on the control circuit terminal or by the option board and the polarity is reversed if the direction of the speed command is changed. If the analog input is used as the torque reference, the analog input ranging from –10V to 10V is converted to the percentage of the rated torque (-100~100%) to obtain the torque reference, which can set from –250% to 250% by the settings of Gain and Bias.

CON_27 "Torque Ref" defines torque ref. value when torque source is set to Keypad.

Code	LCD display	Description	Setting range	Unit	Factory setting
CON_26	Trq Ref Src	Torque reference source selection	None/Analog Keypad/Option		None
CON_27	Torque Ref	Torque Ref (keypad)	-180.0 ~180.0	%	0.0

3) CON_32 (Torque Bias Source Select)

4) CON_33 (Torque Bias quantity)

The Torque Bias is the feedforward compensation which is added to the Torque Reference. The source of Torque Bias could be selected by the Keypad (CON_32) as one of Multi Function Analog Input and the Option. The Torque Bias is enabled by MFi programmed as UseTrq Bias. The MFI should be ON for enabling the Torque Bias.

The Analog Input [-10~+10V] is converted to [-100~+100%] and this could be expanded up to [-250~+250%] with gain and bias.

Code	LCD display	Description	Setting range	Unit	Factory setting
CON_32	Trq Bias Src	Torque Bias source selection	None Analog Keypad Option		None
CON_33	Trq Bias	Torque Bias quantity	-150.0 ~ 150.0	%	0.0

5) CON_35 (Torque Balance)

In the lift use, the load torque balance can be adjusted to obtain a good riding comfort at start-up using the load cell, which is a sort of an weighing devices installed at the bottom of the lift. CON_35 is adjusted to show 50% after the car weight becomes equal to the weight of counter-weight.

The value displayed when pressing [PROG] key on the keypad is the loadcell voltage input to the inverter. Therefore, adjust the percent using [▲(Up)] / [▼(Down)] to make it to be setpoint of actual load compensation.

Code	LCD display	Description	Setting range	Unit	Factory setting
CON_35	Trq Balance	Torque Balance quantity	0.0 ~ 100.0	%	50.0

6) Torque Bias Enable/Disable

Torque bias is enabled depending on the status of the multi-function terminal input set to 'Torque bias enable'. But, if 'Torque bias enable' is not set and CON_32 is set to 'Keypad', the torque bias command set at CON_32 by the keypad, is fed directly to the torque bias quantity regardless of the status of the terminal. Therefore, In order not to use the torque bias command set at CON_33, CON_32 should be set to 'None' or the multi-function terminal input should be set to 'Torque bias enable' and then the terminal should be left open.

(Example) Programming P5 as Torque Bias EnableTorque Bias

Code	LCD display	Description	Setting range	Unit	Factory setting
DIO_05	P5 define	Multi-function input terminal P5 definition			Use Trq Bias

7) CON_34(Torque Bias F/F)

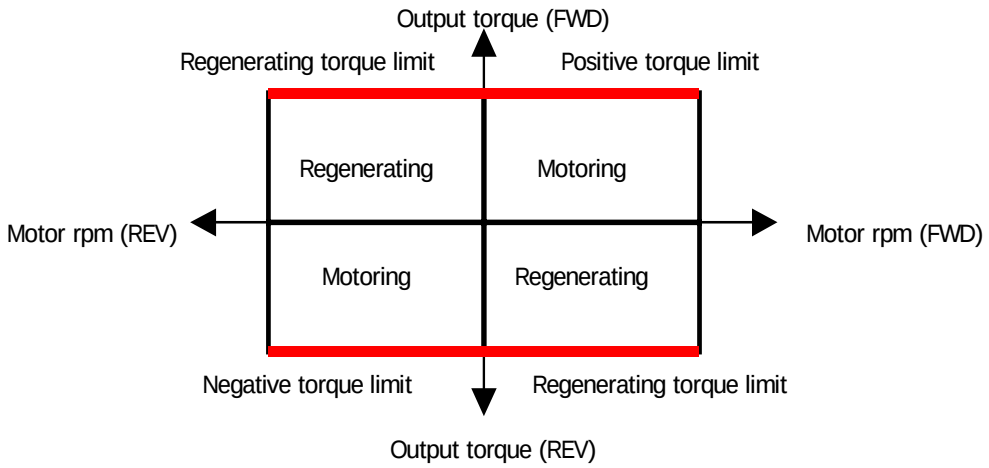
This is the torque bias quantity to compensate for the friction loss, which varies with the rotational direction of the motor and added up to the torque bias quantity.

Code	LCD display	Description	Setting range	Unit	Factory setting
CON_34	Trq Bias FF	Torque compensation for Friction loss	-150.0 ~ 150.0	%	0.0

8) CON_28 ~ 31 (Torque Limit Define, Torque Limit during FWD RUN /REV RUN/Regenerating)

The torque limit can be selected separately depending on the motor control mode such as forward rotation and reverse rotation and regeneration modes. In all modes, the limit values can be set by the function code, the multi-function terminal input and the option board, respectively.

Code	LCD display	Description	Setting range	Unit	Factory setting
CON_28	Trq Lmt Src	Torque Limit Source select			Kpd Kpd Kpd



Torque Limit

Torque Limit value is determined one of the 9 different combinations shown below depending on CON_28 setting.

CON_28 set value	Positive Torque Limit	Negative Torque Limit	Regenerating Torque Limit
Kpd Kpd Kpd	CON_29	CON_30	CON_31
Kpd Kpd Ax	CON_29	CON_30	Vx
Kpd Ax Kpd	CON_29	Vx	CON_31
Kpd Ax Ax	CON_29	Vx	Vx
Ax Kpd Kpd	Vx	CON_30	CON_31
Ax Kpd Ax	Vx	CON_30	Vx
Ax Ax Kpd	Vx	Vx	CON_31
Ax Ax Ax	Vx	Vx	Vx
Opt Opt Opt	Positive Torque Limit of Option	Negative Torque Limit of Option	Regenerating Torque Limit of Option

※ Vx marks the Torque Limit value defined in analog input terminal.

9) Torque Current reference

The torque reference is converted to the torque current reference. The torque current reference is generated from the rated current and magnetizing current of the motor. The initial value of the rated current and magnetizing current of the motor can be set by OTIS vector motor parameter that is chosen at PAR_07

Code	LCD display	Description	Setting range	Unit	Factory setting
PAR_07	Motor Select	Motor capacity selection	2.2 ~ 800.0	kW	
PAR_22	Rated-Curr	Motor rated current	1.0 ~ 2000.0	A	
PAR_26	Flux-Curr	Motor flux current	0.0 ~ 70% of PAR_22	A	

6.5.9 Speed search

This is used to restart the motor during coasting without stopping the motor. The setting for using this function is related to setting of FUN_58 and FUN_59. CON_49 are required for this function. The proper values should be set depending on the inertia moment (GD^2) of the load and the torque of the motor in use.

Code	LCD display	Description	Setting range	Unit	Factory setting
CON_49	Speed Search	Speed search setting	1111		0100
FUN_58	Power-on Run	Power on Run selection	Yes No		No
FUN_59	RST Restart	Restart after fault reset	Yes No		No

CON_49 speed search setting is as follows.

Code	Set value				Description
	Bit4	Bit3	Bit2	Bit1	
CON_49				√	Speed search during Accelerating
			√		Speed search during a Fault Reset restarting
		√			Speed search during Instant Power Failure restarting.
	√				Speed search when FUN_58 Power ON starting is set to “Yes”

(1) Bit 1
0: The motor is normally accelerated without the speed search operation.
1: The speed search operation is enabled at the time of acceleration.
(Automatic restart and FUN_58[Power-on start enable] included)

(2) Bit 2
0: The motor is normally accelerated without the speed search operation after the trip occurs.
1: The speed search is enabled at the time of restart after the trip occurs.
(Automatic restart and FUN_59[Restart enable after fault reset] included)

(3) Bit 3
0: The motor stops when instantaneous power failure occurs. Run command should be turned ON again to restart the operation.
1: The speed search is enabled at the time of restart after the instantaneous power failure occurs.

(4) Bit 4
0: The motor is normally accelerated only when FUN_58 [Power-on start enable] is set to Yes.
1: The speed search operation is enabled at the time of acceleration when FUN_58 [Power-on start enable] is set to Yes.

6.6 User Group (USR_[][])

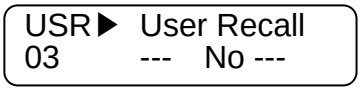
User group can be generated by collecting the frequently-used function codes, and it also can be created by using the existing function codes for the specific application.

6.6.1 Jump code (USR_00)

Jumping directly to any parameter code can be accomplished using USR_00.

(Example) Jumping to USR_03

Press [PROG] key first and set 3 using [▲(Up)], [▼(Down)], [SHITF/ESC] and press [ENT] key to jump to USR_03. If the desired code cannot be accessed or void, it automatically jumps to closest code.



After jumping, it is available to jump to other codes using [▲(Up)], [▼(Down)].

6.6.2 Macro

1) USR _01 (Macro Init)

The initialization of the code type can be defined according to the application the user defines.

Code	LCD display	Description	Setting range	Unit	Factory setting
USR_01	Macro Init	Use Macro Definition	User Define E/L		User Define

2) USR_02(User Save)

This enables the code type and the set value which the user define to be saved into the memory.

3) USR_03(User Recall)

This enables the code type and the set value saved by USR_02('User Save') to be recalled from the memory.

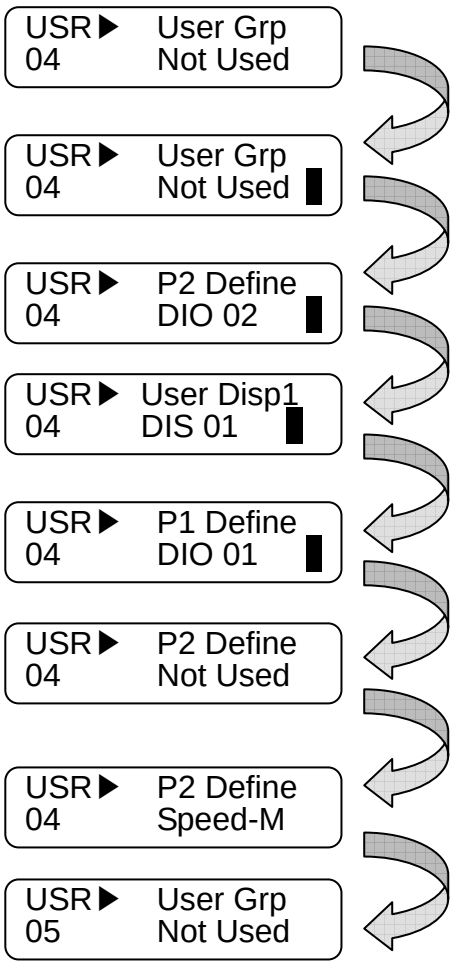
Code	LCD display	Description	Setting range	Unit	Factory setting
USR_02	User Save	User data save selection	No Yes		No
USR_03	User Recall	Recall saved user data	No Yes		No

6.6.3 User code define (USR_04 ~ 67)

It displays the type and value of the user code when [PROG] key is pressed. The code can be set in the same manner as the codes in the other group can be. If the code is 'User Grp' and its set value is 'Not Used', the code can be changed by pressing the [PROG] key once more.

Total 64 user group data can be programmed and saved. To make the unused data invisible, set it to "Not Used".

Chaning User group codes



Press the [PROG] key once.

Pressing the [PROG] key once more and press the [SHIFT/ESC] key to change the group.
(DIS →DIO→PAR→FUN→CON→AIO→2ND→DIS)

Press the [SHIFT/ESC] key once more and the group is changed. (DIS →DIO)

Pressing [▲(Up)] / [▼(Down)] key navigates the codes in the selected group.

Pressing the [ENT] key changes the code.

Press [PROG] key and change the value using [▲(Up)] / [▼(Down)] and then press [ENT] key to save the value into memory.
Use the [▲(Up)] key to move to other codes in the same group.

6.7 2nd Function Group (2nd_[][])

2nd function group is equivalent to the parameter group which includes the data related to the 2nd motor in case single inverter controls 2 motors. One of the multi-function terminal input P1 ~ P7 (DIO_01 ~ DIO_07) should be set to "2nd Func" . The setting ranges and usage of the 2nd motor parameter is basically the same as those of the 1st motor parameters. If the multi-function terminal input enables the 1st motor, the 1st motor parameters become valid. Similiarly, if the multi-function terminal input enables the 2nd motor, the 2nd motor parameters become valid.

6.7.1 Jump code (2nd_00)

You can move on to the code you want to check using 2nd_00.

(Example) If you want to move on to 2nd_02,

After pressing the [PROG] key, set to02 using [SHIFT/ESC] / [▲(Up)] / [▼(Down)] keys and then press the [ENT] key. If the code to jump to is not found, the nearest code number is selected.

```
2nd▶2nd Max Spd
02    1800.0 rpm
```

You can check the other code using [▲(Up)] / [▼(Down)] keys.

6.7.2 2nd motor control mode selection (2nd _01)

In the motor control mode, there are **speed** and **torque** control modes based on the vector control. The speed sensor such as the pulse encoder is required if speed control ('**Speed**') and torque control ('**Torque**') is to be used.

Code No.	LCD display	Function	Setting range	Unit	Factory setting
2nd_01	2nd Ctl Mode	2nd motor control mode selection	Speed Torque		Speed

6.7.3 2nd motor speed setting

1) 2nd_02: The 2nd motor maximum speed

2) 2nd_04: The 2nd digital speed setting

Code No.	LCD display	Function	Setting range	Unit	Factory setting
2nd_02	2nd Max Spd	2nd motor maximum speed	400.0 ~ 3600.0	rpm	1800.0
2nd_04	2nd Spd 0	2nd motor multi-step speed 0	0.0 ~ 3600.0	rpm	0.0

6.7.4 2nd motor parameters related to acceleration and deceleration

Setting range and factory setting value should be referred to FUN_36 to FUN_41.

Code No.	LCD display	Function	Setting range	Unit	Factory setting
2nd_05	2nd Acc S St	2nd motor S ratio 1 in accel. start	0.0 ~ 50.0	%	0.0
2nd_06	2nd Dec S Ed	2nd motor S ratio 2 in accel. end	0.0 ~ 50.0	%	0.0
2nd_07	2nd Dec S St	2nd motor S ratio 1 in decel. start	0.0 ~ 50.0	%	0.0
2nd_08	2nd Dec S Ed	2nd motor S ratio 2 in decel. end	0.0 ~ 50.0	%	0.0
2nd_09	2nd Acc time	2nd motor acceleration time	0.01 ~ 6000.0	sec	10.0
2nd_10	2nd Dec time	2nd motor deceleration time	0.01 ~ 6000.0	sec	10.0

6.7.5 2nd motor parameters related to the pulse encoder

Code No.	LCD display	Function	Setting range	Unit	Factory setting
2nd_12	2nd Enc #	2nd motor encoder pulse number	360 ~ 4096	%	1024
2nd_13	2nd Enc Dir	2nd motor encoder direction set	A Phase Lead B Phase Lead		A Phase Lead
2nd_14	2nd Enc Chk	2nd motor encoder test enable	Yes No		Yes
2nd_15	2nd Enc LPF	2nd motor encoder LPF time constant	00 ~ 100	ms	1

6.7.6 2nd motor parameters

Code No.	LCD display	Function	Setting range	Unit	Factory setting
2nd_17	2nd BaseSpd	2nd motor base speed	300.0 ~ 3600.0	rpm	1800.0
2nd_18	2nd R-Volt	2nd motor rated voltage	120 ~ 560	V	
2nd_19	2nd Pole #	the number of poles of the 2nd motor	2 ~ 12		4
2nd_20	2nd Mot Eff.	2nd Motor Efficiency	70 ~ 100	%	72
2nd_21	2nd R-Slip	2nd motor rated slip	10 ~ 250	rpm	
2nd_23	2nd Flx Cur	2nd motor magnetizing current	0.0~ Inverter rated current	A	
2nd_24	2nd Mot Tr	2nd motor rotor time constant	30 ~ 3000	ms	
2nd_25	2nd Mot Ls	2nd motor stator inductance	0.00 ~ 500.00	mH	
2nd_26	2nd Mot sLs	2nd motor leakage coefficient	0.00 ~ 10.00	mH	
2nd_27	2nd Mot Rs	2nd motor stator resistance	0.000 ~ 5.000	ohm	

6.7.7 2nd motor miscellaneous parameters

Code No.	LCD display	Function	Setting range	Unit	Factory setting
2nd_11	2nd Cool Mtd	2nd motor cooling method	Same as the 1st motor		Self-cool
2nd_32	2nd ETH 1min	2nd motor 1 min. level for electronic thermal protection	Same as the 1st motor		150
2nd_33	2nd ETH Cont	2nd motor continuous level for electronic thermal protection	Same as the 1st motor		100

6.8 Analog AIO Group (AIO_[][])

6.8.1 Jump code (AIO_00)

In AIO_00, jumping directly to any parameter code can be accomplished by entering the desired code number.

(Example) Moving to AIO_13

Press [PROG] and set to 5 using [SHIFT/ESC] / [▲(Up)] / [▼(Down)] and press [ENT] key to move to AIO_13. If the desired code cannot be set, the closest code will be displayed.

AIO▶	Ai2 define
13	Not Used

Jumping other code is available using [▲(Up)] / [▼(Down)] keys.

6.8.2 Multi-function analog input

1) AIO_01 ~ 60 (Multi-function analog input terminal definition, input source, Min. input, Bias, Max. input, Gain, LPF Time constant, criterion of command loss)

3 analog input are assigned for AIO board. Ai3 serves are the Motor NTC/PTC input port and voltage or current signal can be fed into Ai1 and Ai2 by the jumper setting. Analog input on the control circuit terminal can be used as single function among the following 8 functions in the table below (10 functions for Ai3 – including Motor NTC/PTC). Voltage input range is –10 ~ 10V and current input range is 0 ~ 20mA. Any analog input cannot be set as the same function as the other inputs. If 2 analog inputs are set to the same function, last set analog input is changed to "Not Used". When analog input is changed to the other function, previously set value is initialized to 0.

(In the case of EXTN_I/O, 5 analog inputs are possible and Mot NTC/PTC input is possible for Ai5)

Setting value	Definition	Description
Speed Ref	Speed Reference	±10V input is equivalent to ±100% of maximum speed.
Proc PID Ref	Process PID Reference	±10V input is equivalent to ±100% of reference of Process PI controller.
Proc PID F/B	Process PID F/B	±10V input is equivalent to ±100% of reference of Process PI controller.
Draw Ref	Draw Control Reference	±10V input is equivalent to ±100% of reference of Draw controller.
Torque Ref	Torque Reference	±10V input is equivalent to ±100% of rated torque. It can be set up to –250 ~ 250% of rated torque by the gain and bias adjustment.
Flux Ref	Flux Reference	±10V input is equivalent to ±100% of rated flux.
Torque Bias	Torque Bias	±10V input is equivalent to ±100% of rated torque. It can be set up to –250 ~ 250% of rated torque by the gain and bias adjustment.
Torque Limit	Torque Limit	±10V input is equivalent to ±100% of rated torque. It can be set up to –250 ~ 250% of rated torque by the gain and bias adjustment.
Use Mot NTC	Use Motor NTC	Thermal sensor in the motor(NTC) is fed into this terminal. In this case, the motor temperature is displayed and motor overheat alarm and trip signal can be triggered. Caution: This is applied only to LG-OTIS Vector-controlled Motor.
Use Mot PTC	Use Motor PTC	Thermal sensor in the motor(PTC) is fed into this terminal. In this case, the motor temperature is displayed and motor overheat alarm and trip signal can be triggered. Thermal sensor is only applied to PT100 products

Code setting about analog command definition is as follow.

Code	Display	Definition		Unit	Function Description
		Name	Setting range		
AIO_01	Ai1 Define	Definition of Multi function analog input Ai1	Speed Ref Proc PID Ref Proc PID F/B Draw Ref Torque Ref Flux Ref Torque Bias Torque Limit		It defines the type of Multi function analog input Ai1.
AIO_02	Ai1 Source	Definition of input source of Multi function analog input Ai1	-10 → 10V 10 → -10V 0 → 10V 10 → 0V 0 → 20mA 20 → 0mA		It defines input source of Multi function analog input Ai1.
AIO_03	Ai1 In X1	Min. input of Multi function analog input Ai1	0.00 ~ Ai1 In X2	%	It sets Min. value of analog input. Without reference to AIO_02 set value, it is based on 0[V](voltage) or 0[mA](current)
AIO_04	Ai1 Out Y1	Min. input Bias of Multi function analog input Ai1	-10.00 ~ Ai1 Out Y2	%	It defines the set value of AIO_01 responding to analog input value of AIO_03.
AIO_05	Ai1 In X2	Max. input of Multi function analog input Ai1	0.00 ~ 100.00	%	It set Max. input value of analog input value.
AIO_06	Ai1 Out Y2	Max. input gain of Multi function analog input Ai1	0.00 ~ 250.00	%	It defines the set value of AIO_01 responding to analog input value of AIO_05.
AIO_07	Ai1 In -X1	-Min. input of Multi function analog input Ai1	Ai1 In X2 ~ 0.00	%	It sets -Min. value of analog input. Without reference to AIO_02 set value, it is based on 0[V](voltage) or 0[mA](current)
AIO_08	Ai1 Out -Y1	-Min. input Bias of Multi function analog input Ai1	Ai1 Out Y2 ~ 10.00	%	It defines the set value of AIO_01 responding to analog input value of AIO_07.
AIO_09	Ai1 In -X2	-Max. input of Multi function analog input Ai1	-100.00 ~ 0.00	%	It set -Max. input value of analog input value.
AIO_10	Ai1 Out -Y2	-Max. input gain of Multi function analog input Ai1	-250.00 ~ 0.00	%	It defines the set value of AIO_01 responding to analog input value of AIO_09.
AIO_11	Ai1 LPF	Input LFP time constant of Ai1	0 ~ 2000	ms	It sets LPF time constant about analog input
AIO_12	Ai1 Wbroken	Option for criterion of command loss of Multi function analog input	None Half of x1 Below x1		It chooses criterion of command loss of analog input Ai1

AIO_13 ~ AIO_36(Ai2 ~ Ai3) are the same with the analog input 1(Ai1) above. (In the case of EXTN_I/O, same up to AIO_37 ~ AIO_60(Ai4 ~ Ai5). But in the case of Ai3 and Ai5, there is no current input.

AIO_03 Ai1 In X1 displays the analog input voltage or analog min. input current that inverter recognize as % unit.

It means the percentage(%) of max.input voltage 10[V] or max. input current 20[mA]. For example, if you set AIO_03 Ai1 In X1 as 20[%], the voltage becomes 2[V], the current becomes 4[mA]. And if AIO_04 Ai1 Out Y1 is set as 0[%],

the analog input value that is under voltage 2[V], or current 4[mA] that is fed into analog input terminal will not be recognized.

AIO_04 Ai1 Out Y1 sets the min. level of analog input voltage or current that inverter actually recognizes. For example, if you set AIO_03 Ai1 In X1 as 0[%] and set AIO_04 Ai1 Out Y1 as 20[%] and then, you feed into analog input terminal voltage 2[V] or current 4[mA], when the actual analog input voltage or current that inverter recognizes is 0, inverter recognizes as 20[%].

AIO_15 Ai1 In X2 displays the analog input voltage or analog max. input current that inverter recognize as % unit.

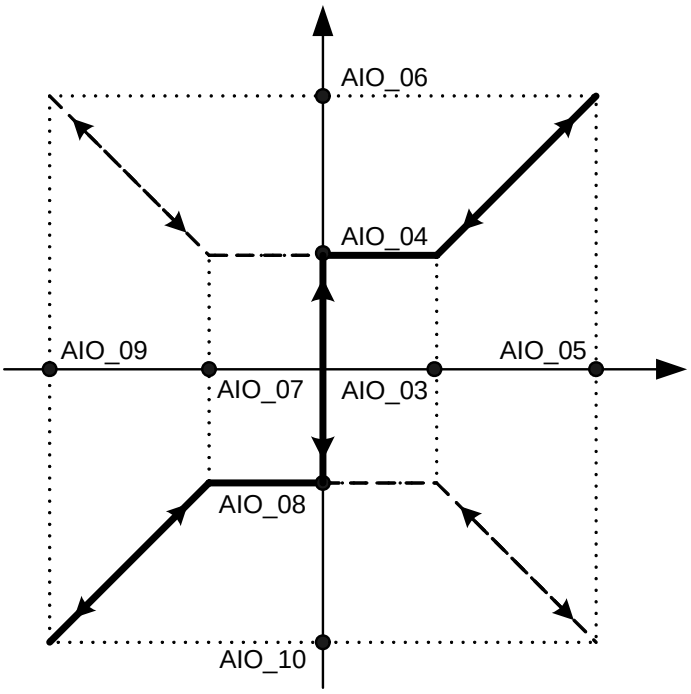
For example, if you set AIO_05 Ai1 In X2 as 50[%], when the actual voltage or current that is fed into analog input terminal is more than 5[V] or 10[mA], inverter recognizes it as max. analog input value.

AIO_06 Ai1 Out Y2 sets the max. level of analog input voltage or current that inverter actually recognizes.

For example, if you set AIO_05 Ai1 In X2 as 100[%] and AIO_06 Ai1 Out Y2 as 50[%], although the voltage 10[V] or the current 20[mA] is actually fed into analog input terminal, inverter recognizes the final analog input value as 50[%].

If you set as above and the rated speed is 1800[rpm], you cannot set more than 900[rpm] although you feed 10[V] into analog input terminal

.



Analog input Mapping diagram

AIO_03 Ai1 In X1 and AIO_05 Ai1 In X2 are for setting the allowed range of voltage of current that is fed into analog input terminal, so generally you can set AIO_03 Ai1 In X1 as 0[%], and AIO_05 Ai1 In X2 as 100[%]. But, the analog input device make happen Chattering around 0[%], you can adjust the set value of AIO_03 Ai1 In X1 up to the level of escaping the Chattering.

When Main Controller recognizes the voltage or current that is fed into analog input terminal, the difference can occur by the detail of I/O devices. . AIO_04 Ai1 Out Y1 and AIO_06 Ai1 Out Y2 are for correcting this error in Main Controller, so they are a kind of Bias and Gain. If the analog input is negative value, you can set AIO_07 ~ AIO_10 as the same as the above.

It is possible for iV5 inverter to input also the upper limit of 2, 4 according to the setting of AIO_02 Ai1 Source, not only

the upper limit of 1, 3 as the analog input Mapping diagram. It is also possible to operate along the dotted line according to the setting of AIO_03 ~ AIO_10.

2) Adjusting Bias: Out Y1 and Gain: Out Y2 by Loader

- AIO_04 Ai1 Out Y1 adjustment

Connect the voltage source or current source between Ai1 ~ 5G, multi-analog terminals of standard I/O devices.

Feed 0[V] or 0[mA] with the AIO_03 In X1 set as 0% and then follow as below.

Key	LCD Display	Description
	AIO▶ Ai1 Out Y1 04 0.00 %	Initial Gain (Factory setting)
PROG	AIO▶Ai1 0.18 % 04 Bias 0.00 %	When pressing the [PROG] key, current output [%] to input value is displayed on the first line and current setting bias on the second line.
▲	AIO▶Ai1 0.00 % 04 Bias 0.18 %	If you want to adjust Bias to be 0.00% at 0V input on the first line, adjust it to be 0.00% using [▲(Up)] key.
ENT	AIO▶ Ai1 Out Y1 04 0.18 %	After setting 0.00% Bias and pressing [ENT] key, it is displayed and the changed value is saved.

- AIO_06 Ai1 Out Y2 adjustment

Connect the voltage source or current source between Ai1 ~ 5G, multi-analog terminals of standard I/O devices.

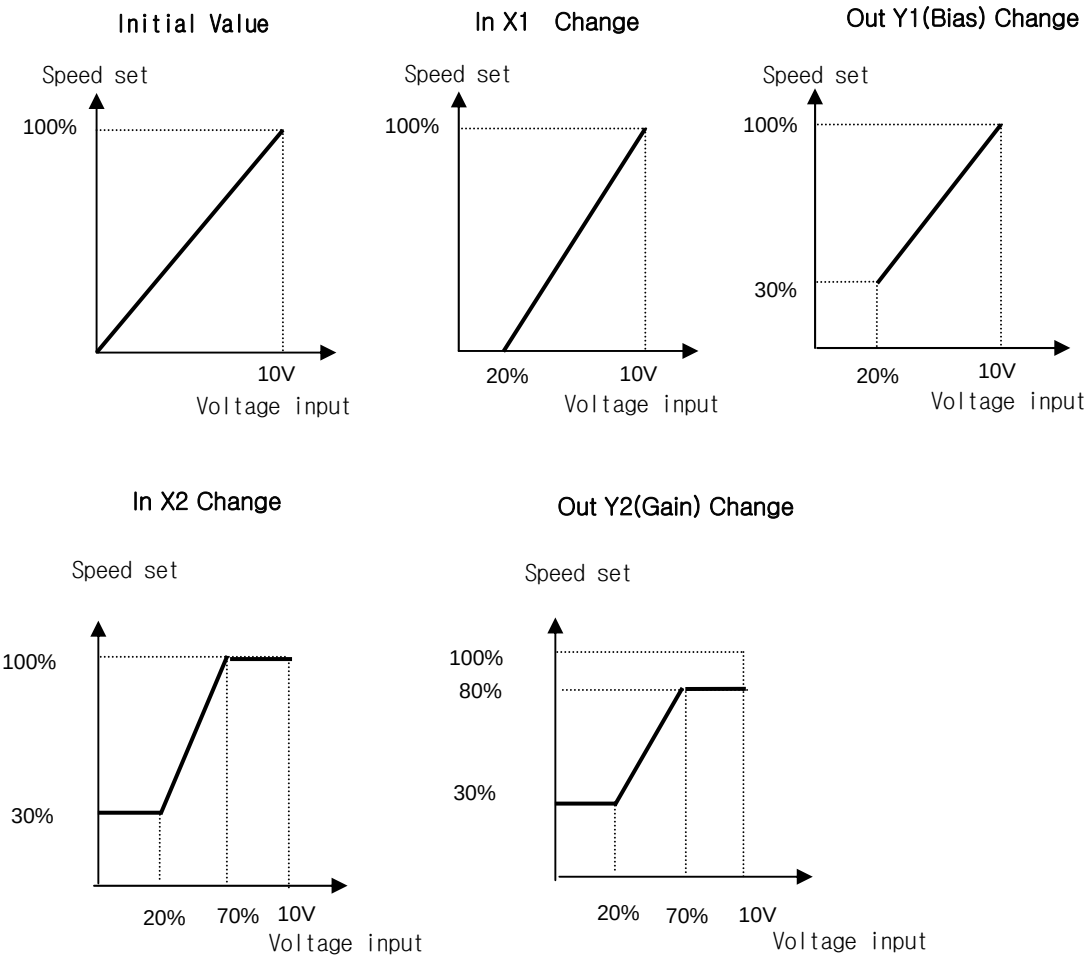
Feed 10[V] or 20[mA] with AIO_05 In X2 set as 100% and then follow as below.

Key	LCD Display	Description
	AIO▶ Ai1 Out Y2 06 100.00 %	Initial Gain (Factory setting)
PROG	AIO▶Ai1 98.00 % 06 Gain 100.00 %	When pressing the [PROG] key, current output [%] to input value is displayed on the first line and current setting gain on the second line.
▲	AIO▶Ai1 100.00 % 06 Gain 102.00 %	If you want to adjust Gain to be 100.00% at 10V input on the first line, adjust gain to be 102.00% using [▲(Up)] key.
ENT	AIO▶ Ai1 Out Y2 06 102.00 %	After setting 102.00% Gain and pressing [ENT] key, it is displayed and the changed gain is saved.

The same procedure is applied to AIO_08 Ai1 –Out Y1 and AIO_10 Ai1 –Out Y2 and also to the other multi-function

analog input

For example about multi-function analog input setting , In X1 : 20%, In X2 : 70%, Out Y1 : 30%, Out Y2 : 80% for the 0 ~ 10V input, analog command changes are as follows.



3) Criterion for command loss of Multi analog input Ai1 (AIO_1)

You can choose criterion for command loss of signal that is fed into multi-function analog input.

Code	Display	Definition		Unit	Function description
		Name	Setting range		
AIO_12	Ai1 Wbroken	Criterion for command loss of Multi analog input Ai1	None		Do not set analog loss
			Half of x1		If the analog input under the 1/2 of set value of AIO_03 Ai1 In X1 is fed , it means analog loss.
			Below x1		If the analog input under set value of AIO_03 Ai1 In X1 is fed , it means analog loss

There are same functions for choosing the criterion of command loss of the other multi-function analog input.

4) Time out for command loss of Multi-function analog input (AIO_73 Time out)

It means the time for judging the loss time of analog input. If the time that is set at AIO_73 Time Out is passed, it can be considered as analog input loss

Code	Display	Definition		Unit	Function description
		Name	Setting range		
AIO_73	Time out	Time for loss of Multi-function analog input	0.1 ~ 120.0	sec	It sets the time for judging command loss when the analog input is keeping from the moment of satisfying the condition set at multi-function analog input loss criterion until the set time.

AIO_73 Time out can be applied 세 AIO_12 Ai1 Wbroken, AIO_24 Ai2 Wbroken, AIO_36 Ai3 Wbroken.

(In the case of I/O(EXTN_I/O, it can also be applied to AIO_48 Ai4 Wbroken, AIO_60 Ai5 Wbroken.)

6.8.3 Analog output

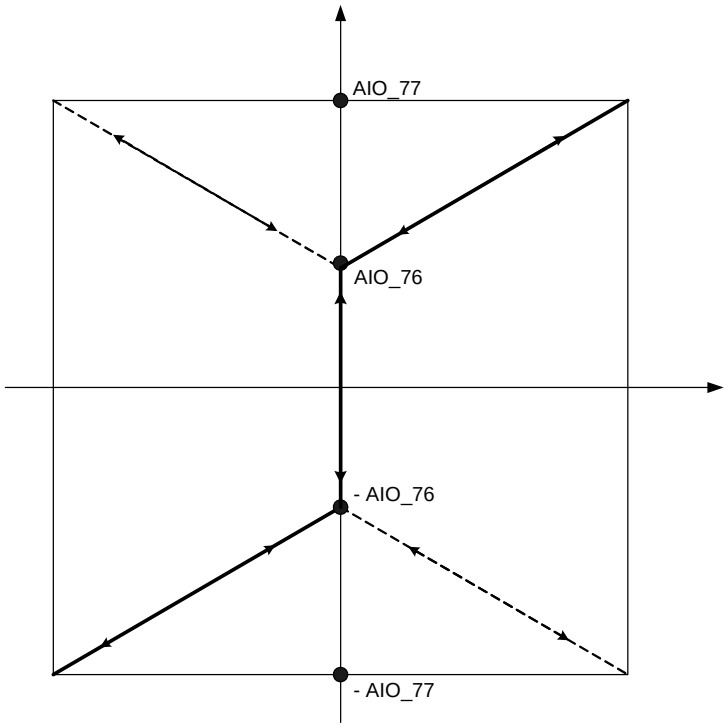
1) AIO_74 ~ 83(description for multi-function analog output terminal, output source , Bias, Gain, setting absolute value)

SV-iV5 offers 2 analog outputs and according to the options of user, you can vary the description for using.

The output rage is -10V ~ +10V and the types are as follows.

Key	Display	Function Definition		Unit	Function Description
		Name	Range		
AIO_74	AO1 Define	Multi-function analog output A01 definition			It describes type of multi-function analog output A01.
AIO_75	AO1 Source	Mullti-function analog output A01 output source definition.	-10 → 10V 10 → -10V 0 → 10V 10 → 0V		It describes source of multi-function analog output A01.
AIO_76	AO1 Bias	Multi-function analog output A01 Bias	-100.0 ~ AIO_77	%	. It describes Bias of multi-function analog output A01.
AIO_77	AO1 Gain	Multi-function analog output A01 Gain	0.0 ~ 500.0	%	It describes Gain of multi-function analog output A01.
AIO_78	AO1 ABS	Multi-function analog output A01 the absolute value setting	No / Yes		It is possible to have positive absolute value of analog output A01.

The other multi-function analog output terminals have same functions. The following pictures is the diagram of Multi-function analog output A01 definition. It can be output as the dotted line according to the setting of A01 Source.



Analog Output Mapping Diagram

2) Adjusting Gain and Bias by Keypad

- AIO_76 AO1 Bias setting

It can be set the Bias value of analog output value. It can occur actual output more than the Bias value.

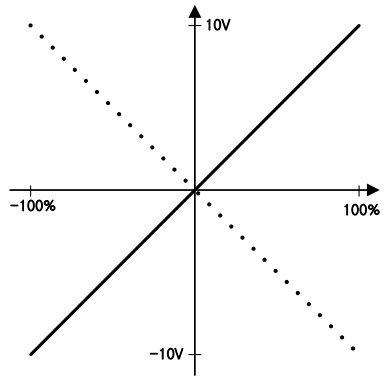
Key	LCD Display	Description
	AIO▶ A01 Bias 76 0.0 %	Initial Gain (Factory setting)
PROG	AIO▶Ao1 0.18 % 76 Bias 0.00 %	When pressing the [PROG] key, current output [%] to input value is displayed on the first line and current setting bias on the second line.
▲	AIO▶Ao1 0.00 % 76 Bias 30.0 %	If you want to adjust Bias so that output is occurs when is more than 30% , adjust it to be 30.0% using [▲(Up)] key.
ENT	I/O▶ A01 Bias 76 30.0%	After adjusting Bias and pressing [ENT] key, it is displayed and the changed value is saved.

- AIO_77 AO1 Gain setting

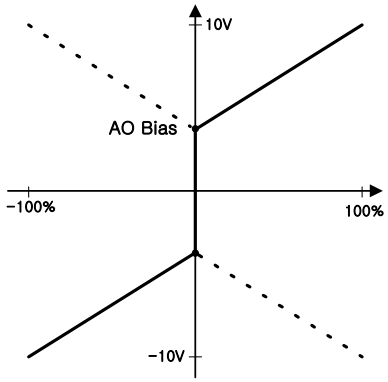
You can set the slope of output so that max. output of analog output can be 10V.

Key	LCD Display	Description
	AIO▶ AO1 Gain 77 100.0 %	Initial Gain (Factory setting)
PROG	AIO▶Ao1 30.0 % 77 Gain 100.0 %	When pressing the [PROG] key, current output [%] to input value is displayed on the first line and current setting gain on the second line.
▲	AIO▶Ao1 30.0 % 77 Gain 200.0 %	If you want to adjust Gain to be 10V output at more than 200% on the first line, adjust gain to be 200.0% using [▲ (Up)] key.
ENT	AIO▶ AO1 Gain 77 200.00 %	After setting 102.00% Gain and pressing [ENT] key, it is displayed and the changed gain is saved.

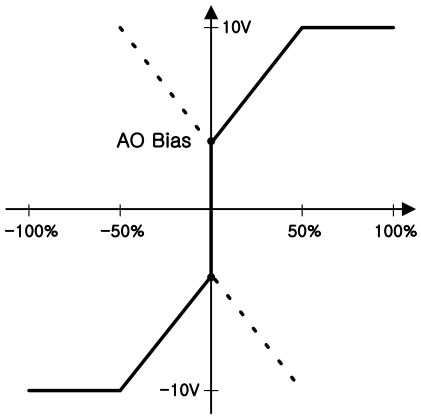
In examples for output setting of multi-function analog output, according to setting of Bias, Gain and the absolute value at -10 ~ 10V input, the output waveform varies as below.



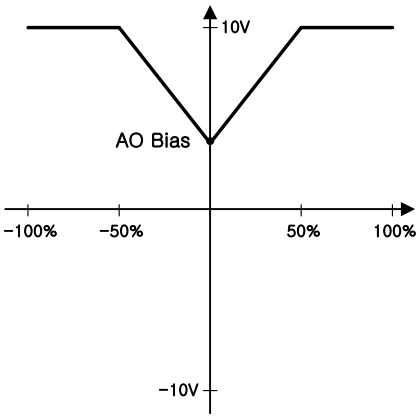
Initail Value (Bias : 0%, Gain : 100%)



Bias 30% setting



Gain 200% setting



Absolute value setting

Multi-function analog output setting types and range are as below

Setting	Description	Output signal level
AiX Value	Analog input value	±10 V: 10V, 20mA
PreRamp Ref	Pre Ramp Reference	±10 V: Max Speed
PostRamp Ref	Post ramp reference	±10 V: Max Speed
ASR Inp Ref	ASR Input Reference	±10 V: Max Speed
Motor Speed	Motor Rotating Speed	±10 V: Max Speed
Speed Dev	Speed Deviation	±10 V: Rated slip * 2
ASR Out	ASR Output	±10 V: 250%
Torque Bias	Torque bias	+6 V: 150%
PosTrq Limit	Positive Trq Limit	10V: 250%
NegTrq Limit	Negative Trq Limit	10V: 250%
RegTrq Limit	Regeneration Trq Limit	10V: 250%
Torque Ref	Torque Reference	±10 V: 250%
IqeRef	Torque current ref.	±10V: 250% of rated torque current
Iqe	Torque current	±10V: 250% of rated torque current
Flux Ref	Flux reference	10V: Flux rating * 2
IdeRef	Flux Current ref.	±10V: Rated flux current * 2
Ide	Flux Current	±10V: Rated flux current * 2
ACR_Q Out	ACR output of axis Q	±10 V: 300/600
ACR_D Out	ACR output of axis D	±10 V: 300/600
VdeRef	Voltage reference of axis D	±10 V: 300/600
VqeRef	Voltage reference of axis Q	±10 V: 300/600
Out Amps RMS	Output current	10 V: Rated current * 2
Out Volt RMS	Output voltage	±10 V : 300/600
Power	Output power	±10 V: Rated output * 2
DC Bus Volt	DC LINK voltage	10 V: 500/1000V
Proc PI Ref	Process PI reference	±10 V: Rating
Proc PI FB	Process PI Feedback	±10 V: Rating
Proc PI Out	Process PI output	±10 V: Rating
Mot NTC Temp	Motor temperature	+10V : 150°C
Mot PTC Temp	Motor temperature	+10V : 150°C
Inv Temp	Inverter temperature	±10 V: 100°C
Inv i2t	Inverter i2t	10 V: 150%

Chapter 7 WEB Control Application

7.1 Change into WEB control mode

LCD loader display is indicated up to 32 digits in English letters and Arabic numerals, allowing you to directly check a variety of settings on screen.

Shown below are the appearance of LCD loader and the functions of each part.

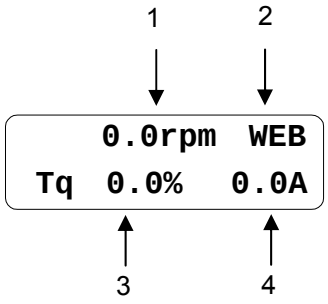
When setting control (CON) group CON_02 (Application) to **"WEB Control",** LCD loader home screen is changed into web control mode as shown in the following figure. For the function of each key of the loader, please refer to 'Loader' in 4.1, Chapter 4.

7.1.1 Method of Changing into Web Control Mode

CON▶Application 02 General Vect	Move to Application Mode of Control (CON) Group
CON▶ Application 02 General Vect ■	Universal Vector Application Mode – Cursor appears (■)
CON▶ Application 02 WEB Control ■	Change into WEB control mode using [▲(Up)] key.
CON▶ Application 02 WEB Control	Set to WEB control mode pressing [ENT] key..

7.2 Loader Display in WEB Control Mode

7.2.1 Home Screen



The status of the screen as above is called "**Home Screen of Display Group**" or "**Home Screen**", and you can return to this home screen by pressing SHIFT/ESC key. Each item on the screen shows the associated information as shown in the table below.

Item No.	Title	Function
1	Motor Speed	Indicate actual rotating speed of the motor in rpm
2	Motor Control Mode	SPD : Speed Control Mode TRQ : Torque Control Mode WEB : WEB control mode BX : Indication of Emergency Stop State
3	Detent Torque	Indicate detent torque occurred against 100% rating output of the motor
4	Inverter Output Current	Indicate effective value for the inverter's actual output current

7. 3 change of Parameter Group

When selecting WEB control application mode WEB Control Group (WEB) is added following the user group.

Name of Group	LCD loader (Left upper corner of LCD)	Major Description
Display Group	DIS	Motor Speed, Motor Control Mode, Detent Torque, Inverter Output Current, User Selection Display, Process PID Output / Ref / Fdb, Current Failure State, User Group Display Setting
Digital I/O Group	DIO	Digital Input Parameter, Digital Output Parameter, etc.
Parameter Group	PAR	Parameter Initialization, Parameter READ / WRITE / LOCK / PASSWORD, Motor-related Constant, Auto-Tuning, etc.
Function Group	FUN	Operation Frequency, Operation Method, Stop Method, Acceleration/Deceleration Time and Pattern, Carrier Frequency, Electronic Thermal Selection, etc.
Control Group	CON	Control Mode, ASR PI Gain, Process PID Gain, Draw Control Setting, Droop Control-Related Constant, Torque Control-Related Constant, etc.
External Group	EXT	Parameter Setting for Communication Option Mode, etc.
Analog I/O Group	AIO	Analog Input- Related Parameter, Analog Output Parameter, etc.
WEB group	WEB	Diameter and tension control setting parameters, etc. at the time of Web Control

- For further details by groups except WEB group, please refer to Function in Chapter 6 of the Main Manual.

7.4 Parameter Setting required for Web Control

To conduct WEB control, be sure to set inverter parameters in following sequence. For further details of the function, please refer to the explanation on WEB group function.

7.4.1 WEB Control Mode Setting (Compulsory)

In order to use exclusively for web control, be sure to set the setting of CON_02 Application to "WEB Control". Upon setting it to **"WEB CONTROL",** Web group is displayed. When set to "General Vect" WEB group is not displayed.

```
CON▶ Application
02   WEB Control
```

7.4.2 Line Speed Command Setting (Option)

iV5 speed command is available by selecting one out of "Analog, Keypad1, Keypad2, Option, Line SPD Ref, Line SPD Opt" in FUN_02 Spd Ref Sel. In order to use it exclusively for WEB CONTROL, be sure to use either "Line SPD Ref" or "Line SPD Opt" selected. At this time, CON_02 Application should be set to "WEB Control", and then you have to select line speed command in FUN_02 Spd Ref Sel. As the line speed command by analog input one of AIO_01 Ai1 Define, AIO_13 Ai2 Define, and AIO_25 Ai3 Define should be set to "Line Spd Ref". "Line SPD Opt" is the line speed command by communication, and therefore you may set this line speed command in the communication common area 0x050D. For further detail of communication, please refer to the communication common area of communication option borad manual.

① Line Speed Command by Analog Input

```
FUN▶ Spd Ref Sel
02   Line SPD Ref
```

```
AIO▶ Ai1 Define
01   Line SPD Ref
```

② Line Speed Command by Communication

```
FUN▶ Spd Ref Sel
02   Line SPD Opt
```

7.4.3 Diameter Hold Function Setting (Option)

If you desire Hold rather than Computation during operation in exclusive using WEB CONTROL, you may use it after setting one of the multi function inputs (DIO_01 ~ DIO_07) to "Dia Hold". In case the multi-function input set is On, the diameter will not be computed any more maintaining the motor speed corresponding with the currently computed diameter only. When the multi-function input is Off, the diameter is computed again.

```
DIO▶ P1 Define
01   Dia Hold
```

7.4.4 Diameter Initialization Function Setting (Compulsory)

When rewound to full diameter or web is completely unwound from the core, core should be replaced. In this case, you need to inform inverter of the core being replaced. A diameter initialization function can be selected out of multi-function input (DIO_01 ~ DIO_07), analog input, and communication. Diameter initialization source can be selected from WEB_03 DiaPresetSrc.

① Diameter initialization by multi-function input

In the diameter initialization by multi-function input, WEB_03 DiaPresetSrc is set to “Keypad”. In this case, one of multi-function inputs (DIO_01 ~ DIO_07) should be set “Dia Preset”. Then the rest of multi-function inputs are set to “Core size-L” and “Core size-H”, and the preset value selected out of four diameter preset values of WEB-04 ~ WEB-07 by the following combination becomes the initial diameter value in accordance with On/Off of the multi-function input terminal where “Dia Preset” is set. The minimum of the initial diameter value is limited by the WEB_10 Min Diameter.

```
WEB▶ DiaPresetSrc
03     Keypad
```

```
DIO▶ P2 Define
02   Dia Preset
```

```
DIO▶ P3 Define
03   CoreSize-L
```

```
DIO▶ P4 Define
04   CoreSize-H
```

P3 ON/OFF	P4 ON/OFF	Applicable Preset Core Value
OFF	OFF	WEB-04 (Diam Preset 1)
ON	OFF	WEB-05 (Diam Preset 2)
OFF	ON	WEB-06 (Diam Preset 3)
ON	ON	WEB-07 (Diam Preset 4)

② Diameter Initialization by Analog

Diameter initialization by analog is conducted by setting WEB_03 DiaPresetSrc to “Analog”. In this case, one of AIO_01 Ai1 Define, AIO_13 Ai2 Define, and AIO_25 Ai3 Define should be set to “Diam Preset”. The minimum of the initial diameter value is limited by WEB_10 Min Diameter.

```
WEB▶ DiaPresetSrc
03     Analog
```

```
DIO▶ P2 Define
18   Dia Preset
```

③ Diameter Initialization by Communication

To conduct the diameter initialization by communication, WEB_03 DiaPresetSrc should be set to “Option”. In this case, command can be set in communication common area 0x0510. For further detail of communication, please refer to communication common area of communication option borad manual.

```
WEB▶ DiaPresetSrc
03     Option
```

7.4.5 Tension Disable Function Setting (Compulsory)

When using it exclusively for WEB CONTROL only, you may conduct tension control using LoadCell or Dancer. In this case, tension control carries out PID control where it is the Tension Disable Function to perform On/Off of the final output of this PID control. With WEB_27 Tension Enb set to “Enable”, if Tension Disable is Off, it outputs the final output of PID control while if Tension Disable is On, it interrupts the final output of PID control. When WEB_27 Tension Enb is set to “Disable”, Tension Disable Function is not applicable. To conduct the setting Tension Disable Function, you may use it by setting one of the multi-function inputs (DIO_01 ~ DIO_07) to “TensionDisable”.

```
DIO▶ P5 define
05 TensionDisable
```

```
WEB▶ Tension Enb
27      Enable
```

WEB_27 should be set to “Enable”

7.4.6 Maximum Motor Speed Setting (Compulsory)

This is the setting of maximum rotating speed of the motor in minimum diameter to maintain the maximum line speed in case of exclusively using WEB CONTROL. This can be done by setting WEB_08 MaxMotor SPD. In case of maximum line speed in 100 [m/m], gear ratio in 5:1, and core diameter in 100 [mm], the motor maximum speed can be calculated in the following formula;

$$\text{Max. Motor Speed [rpm]} = \text{Gear Ratio} \times \frac{\text{Max. Line Speed}}{\text{Core Diameter x } \pi} = 5 \times \frac{100\,[m/m]}{0.1\,[m] \times \pi} = 1591.55\,[rpm]$$

```
WEB▶ MaxMotor SPD
08     1591.5 rpm
```

7.4.7 Minimum Effective Line Speed Setting (Compulsory)

Minimum effective line speed is the minimum value of the line speed command that can compute the diameter. The line speed command at the time of web control should be larger than the minimum effective line speed. If the line speed command is small than this value, diameter computation is not operated. Setting is done in WEB_09 MinLine SPD.

```
WEB▶ MinLine SPD
09          10.0 %
```

7.4.8 Minimum Diameter Setting (Compulsory)

Minimum diameter indicates the diameter of the smallest core in % against the maximum diameter in full diameter. Minimum diameter is used as the minimum limit of diameter computation during operation, and the selected initial core value is restricted by the minimum diameter. Therefore, it should be set equal to or less than the diameter initialized by multi-function input, analog input, or communication. It can be set in WEB_10 Min Diameter.

```
WEB▶ Min Diameter
10          10.0 %
```

7.4.9 Diameter Computation Source Setting (Compulsory)

In WEB CONTROL mode, the diameter determines the motor speed keeping a certain line speed. At this time, as the diameter becomes less, motor rotating speed gets faster, while as the diameter become larger, the motor rotating speed gets slower, keeping a certain line speed. Accordingly, the diameter computation source is the function that decides whether to calculate the diameter computation by inverter internal S/W or to calculate the analog output of the diameter sensor attached to the system through the analog input terminal of the inverter.

① Diameter Computation Source when computing the diameter by inverter S/W

Computation of diameter by inverter S/W is to compute the diameter by the built-in S/W. You may set WEB_14 Diameter Src to “Internal”.

```
WEB▶ Diameter Src
14      Internal
```

② Diameter Computation Source when computing the diameter using diameter sensor

To compute the diameter using diameter sensor, you need, first, to set WEB_14 Diameter Src to “External”, and then one of Analog input AIO_01 Ai1 Define, AIO_13 Ai2 Define, and AIO_25 Ai3 Define to “Diameter”.

```
WEB▶ Diameter Src
14      External
```

```
AIO▶  Ai1 Define
01      Diameter
```

Note) When the diameter computation source is set to “External”, the diameter initialization function doesn’t move.

7.4.10 Rewind/Unwind Function Setting (Compulsory)

Tension control is divided into three (3) method; First, Unwind Function – tension control in such manner as time goes by the diameter of material gets smaller keeping rewinding; Second, tension control of a fixed roll such as Bridle Roll or Nip Roll; Lastly, Wind or Rewind Function – tension control in such manner as time goes by the diameter of material gets larger keeping winding. In case of setting Rewind/Unwind function, please set to "Rewind" when winding the material in WEB_17 Re/Un Wind or when it is Bridle Roll or Nip Roll, while set to "Unwind" when unwinding the material. Motor rotating direction and splicing operation direction is decided depending on the setting of WEB_17 Re/Un Wind.

① When it is Bridle Roll or Nip Roll, or in case of winding the material;

```
WEB▶ Re/Un Wind
17     Rewind
```

② In case of unwinding material

```
WEB▶ Re/Un Wind
17     Unwind
```

7.4.11 Overwind/Underwind Function Setting (Compulsory)

In case of Rewinding or Unwinding, there are two kinds of method depending on the location when winding or unwinding the material; First – Overwinding that is winding or unwinding the material from the upper part, Second – Underwinding that is winding or unwinding the material from the lower part. Roll rotating direction and PID output are decided depending on the setting of inverter operation command, WEB_17 Re/Un Wind, and WEB_18 O/U Wind. Selection of Overwind/Underwind function can be set in WEB_18 O/U Wind.

① In case of winding or unwinding the material from the upper part;

```
WEB▶  O/U Wind
18    Overwind
```

② In case of winding or unwinding the material from the lower part;

```
WEB▶  O/U Wind
18   Underwind
```

Following figure and table shows line speed command, PID output command, splicing command direction **following the setting of Rewind/Unwind** function and **Overwind/Underwind** function. For further detail, please refer to the explanation on WEB group.

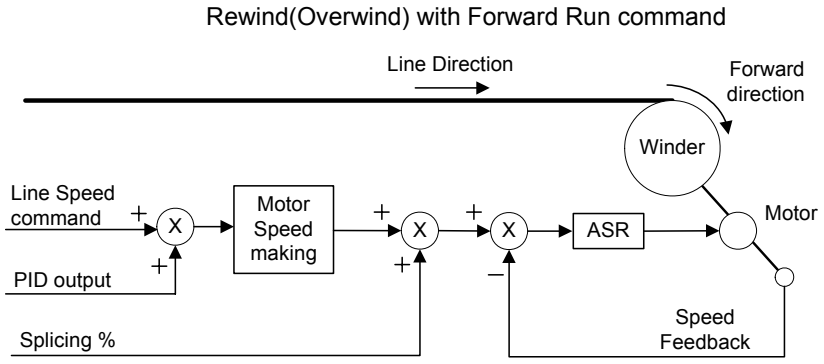


Figure 1. Roll Rotating Direction at the time of Rewind/Overwind Setting, Forward Direction Operation Command

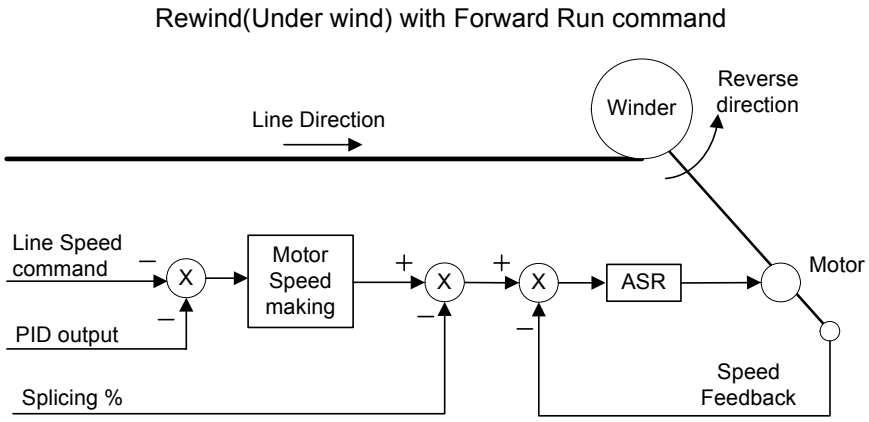


Figure 2. Roll Rotating Direction at the time of Unwind/Overwind Setting, Forward Direction Operation Command

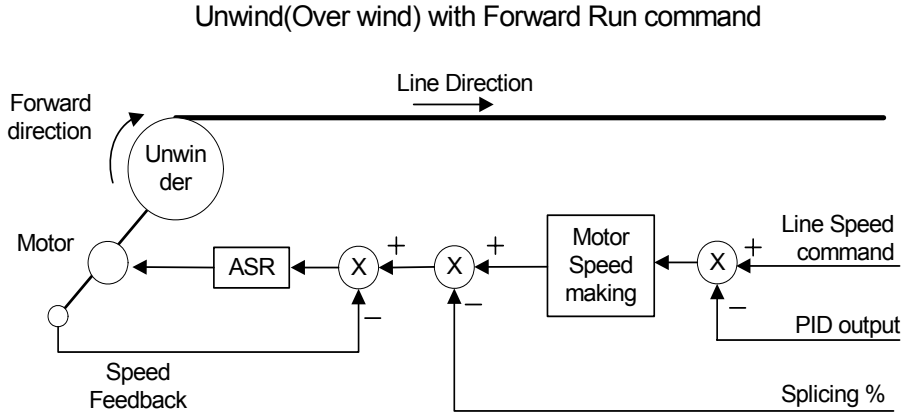


Figure 3. Roll Rotating Direction at the time of Unwind/Overwind Setting, Forward Direction Operation Command

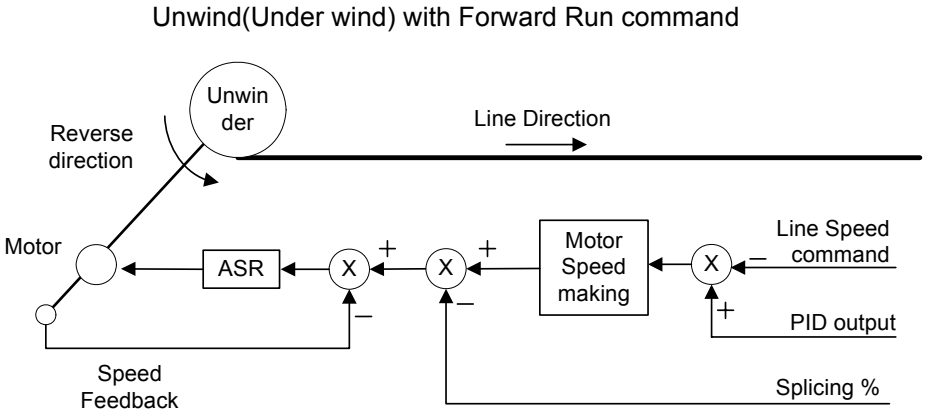


Figure 4. Roll Rotating Direction at the time of Unwind/Overwind Setting, Forward Direction Operation Command

7.4.12 tension Reference input Setting (Compulsory)

In case of using loadcell for tension control sensor, tension reference is used for setting the set point of actual tension. In this case, final tension Reference, the output of set block becomes the reference input of PID control. When not using Taper function, Boost function, and Stall function, tension reference input value becomes the reference input of PID control. Tension reference input setting constitute three methods; by keypad, by analog input, and by communication. The sum of the values from these three method is input, that is the sum of WEB_19 Tension input + Analog input + communication. Furthermore, upper/lower limit is restricted within the range of – 100.0 % ~ 100.0 %. At this time, WEB_28 PIDRef Sel should be set to “Taper Out”. If dancer is used, it means controlling the position of dancer rather than actual tension. Therefore if WEB_28 PIDRef Sel is set to “Dancer Pos”, the value set in tension input reference input is meaningless. If dancer taper function is used where analog output(AIO_74, AIO_79) is set to “Tension Out”, its usage is meaningful. For the dancer position, like in the case of tension reference, the sum of WEB_29 Dancer Pos + Analog input + communication is input

① Tension Reference Input Setting by Keypad (In case of using loadcell)

To conduct tension reference input setting by keypad, you may set WEB_19 Tension Input.

```
WEB▶ TensionInput
19          50.0 %
```

② Tension Reference Input Setting by Analog Input (In case of using loadcell)

To conduct tension reference input setting by analog input, you may set one of Analog input AIO_01 Ai1 Define, AIO_13 Ai2 Define, and AIO_25 Ai3 Define to “Tension Ref”.

```
AIO▶ Ai1 Define
01   Tension Ref
```

③ Tension Reference Input Setting by Communication (In case of using loadcell)

To conduct tension reference input setting by communication, you may use communication common area Address 0x0511. For further detail, please refer to communication common area data.

④ Dancer Position Input Setting by Keypad (In case of using dancer)

To conduct dancer position input setting by Keypad, you may set WEB_28 PIDRef Sel to “Dancer Pos” and then set WEB_29 Dancer Pos.

```
WEB▶ PIDRef Sel
28   Dancer Pos
```

```
WEB▶ Dancer Pos
29       50.0 %
```

⑤ Dancer position input Setting by analog input (In case of using dancer)

To conduct dancer position input setting by analog input, you may set WEB_29 PIDRef Sel to “Dancer Pos”, and then set one of Analog input AIO_01 Ai1 Define, AIO_13 Ai2 Define, and AIO_25 Ai3 Define to “Dancer Ref”.

```
WEB▶ PIDRef Sel
28   Dancer Pos
```

```
AIO▶ Ai1 Define
01   Dancer Ref
```

⑥ Dancer position input Setting by communication (In case of using dancer)

To conduct dancer position input setting by communication, you may set WEB_28 PIDRef Sel to “Dancer Pos” and then use communication common area address 0x0512.. For further detail, please refer to communication common area data.

```
WEB▶ PIDRef Sel
28   Dancer Pos
```

All the functions related with PID control should be set. The relevant function codes are as follows;

-. WEB_30 ProcPID Kp1

-. WEB_32 ProcPID Ki1

-. WEB_42 PIDOGainRe or WEB_43 PIDOGainUn

-. Please operate it with the rest function codes related with PID control set to default. If any change required, please refer to the explanation on WEB group function.

7.4.13 PID Control Feedback Source Setting (Compulsory)

Setting the amount of feedback at the time of PID control can be conducted in two ways; First, PID feedback by analog input, Second, PID feedback by communication. You can set it in WEB_47 PID F/B Src.

① PID Feedback Setting by Analog Input

To conduct PID feedback setting by analog input, first, you may set WEB_47 PID F/B Src to “Analog”, and then set one of Analog input AIO_01 Ai1 Define, AIO_13 Ai2 Define, and AIO_25 Ai3 Define to “Tension F/B”.

```
WEB▶ PID F/B Src
47     Analog
```

```
AIO▶ Ai1 Define
01   Tension F/B
```

② PID Feedback Setting by Communication

To conduct PID feedback setting by communication, first, you may set WEB_47 PID F/B Src to “Option” and then use communication common area Address 0x0513. For further detail, please refer to communication common area data. In case of using PID Feedback for communication, however, its feedback should be done with communication cycle not exceeding 10 [msec]. If communication cycle exceeds 10 [msec], PID feedback setting by communication should not be conducted.

```
WEB▶ PID F/B Src
47     Option
```

7.5 Display Group (DIS_[][])

7.5.1 DIS_01 ~ 03 (User Selection Display 1, 2, and 3)

In the User Selection Display 1, 2, and 3, one of the followings selected can be indicated. Factory default is “PreRamp Ref” for DIS_01, “DC Bus Volt” for DIS_03, and “Terminal In” for DIS_03. If “WEB Control” is selected for CON_02 Application of Control(CON) Group, it displays the following. Please be noted that the displays at the time of WEB CONTROL are summarized only in this data.

Function Code	Loader Display	Name of Function	Unit	Explanation on Function
DIS_01 ~ DIS_03	Diameter	Diameter	%	Displays diameter in % value
	Line SPD CMD	Line Speed Command	%	Display line speed command in % value
	Reel SPD	Roll Speed	%	Display roll rotating speed in % value

7.5.2 Digital Input/Output Group (DIO_[][])

1) DIO_01 ~ DIO_07 (Definition of multi-function input P1~7)

In case of selecting CON_02 Application of Control(CON) Group as “WEB Control”, you may select the following function in addition. For further detail, please refer to the explanation on WEB group function.

<table>
<tr><th>Function Code</th><th>Loader Display</th><th>Name of Function</th><th>Unit</th></tr>
<tr><td rowspan="15">DIO_01
~
DIO_07</td><td>Dia Hold</td><td>Diameter Computation Hold Command</td><td>Select when desiring to hole the diameter computation</td></tr>
<tr><td>Dia Preset</td><td>Diameter Initialization Command</td><td>Select when initializing diameter</td></tr>
<tr><td>CoreSize-L</td><td>Core Select 1 Function</td><td rowspan="2">Select one of WEB_04 ~ WEB_07 by On/Off of the multi-function input terminal at the time of diameter initialization by keypad
<table>
<tr><th>CoreSize-L</th><th>CoreSize-H</th><th>Preset Core Applied</th></tr>
<tr><td>OFF</td><td>OFF</td><td>WEB_04 Diam Preset 1</td></tr>
<tr><td>ON</td><td>OFF</td><td>WEB_05 Diam Preset 2</td></tr>
<tr><td>OFF</td><td>ON</td><td>WEB_06 Diam Preset 3</td></tr>
<tr><td>ON</td><td>ON</td><td>WEB_07 Diam Preset 4</td></tr>
</table></td></tr>
<tr><td>CoreSize-H</td><td>Core Select 2 Function</td></tr>
<tr><td>Tension Disable</td><td>Tension Control Prohibition</td><td>Prohibit the process PID controller output when the set multi-function input terminal is On.</td></tr>
<tr><td>PI Gain Sel</td><td>Process PID Controller PI Gain Transfer</td><td>PI Gain of process PID is transferred from 1 to 2 when the set multi-function input terminal is On. (WEB_30) (WEB_31) (WEB_32) (WEB_33)</td></tr>
<tr><td>PID ITerm Clear</td><td>Accumulated portion of I controller of Process PID controller is initialized</td><td>Accumulated portion of I controller of Process PID controller is initialized when the set multi-function input terminal is On.</td></tr>
<tr><td>Taper Disable</td><td>Taper Function Prohibition</td><td>Stops the taper function when the multi-function input terminal set during operation mode by taper function is On</td></tr>
<tr><td>Stall Enable</td><td>Stall Function Setting</td><td>Stall function operates when the set multi-function input terminal is On.</td></tr>
<tr><td>Boost Enable</td><td>Boost Function Setting</td><td>Boost function operates when the set multi-function input terminal is On</td></tr>
<tr><td>Quick Stop</td><td>Emergency Stop Function Setting</td><td>Inverter stops after the lapse of the time set in WEB_54 when the multi-function input terminal set to stop the inverter operation at emergency is On</td></tr>
<tr><td>Jog Web</td><td>Jog operation function Setting</td><td>Jog operates when the set multi-function input terminal is On. FUN_01 should be set to “Terminal 1”, and Jog operates even if Fx terminal is not On</td></tr>
<tr><td>Under Wind</td><td>Under wind function Setting</td><td>Although the value in WEB_18 is set to “Overwind”, it operates Under wind if the set multi-function input terminal is On.</td></tr>
<tr><td>Unwinder</td><td>Unwinder function Setting</td><td>Although the value in WEB_17 set to “Rewind”, it operates Unwinder if the set multi-function input terminal is On.</td></tr>
</table>

(1) Diameter Hold function :

If the multi-function input terminal set to “Dia Hold” is On, it stops diameter computation and maintains the diameter value. At this time, the diameter hold function operates if one of the following conditions is satisfied.

① Condition of diameter initialization (Except function code initialization) is not satisfied, and the multi-function input terminal set to “Dia Hold” is On

② Condition of diameter initialization (Except function code initialization) is not satisfied, and the multi-function input terminal set to “Quick Stop” is On

③ Condition of diameter initialization (Except function code initialization) is not satisfied, and the multi-function input terminal set to “Quick Stop” is On, and the multi-function input terminal set to “TensionDisable” is On, or WEB_27 Tension Enb is “Disable”

④ Condition of diameter initialization (Except function code initialization) is not satisfied, and the multi-function input terminal set to “Jog Web” is On.

⑤ Condition of diameter initialization (Except function code initialization) is not satisfied, and WEB Break occurs.

(2) Diameter Preset Function :

The multi-function input terminal set to “Dia Preset becomes On, when the diameter preset function operates if one of the following conditions is satisfied.

① The multi-function input terminal set to “Dia Preset becomes On, and the line speed command is less than the set value of WEB_09 MinLine SPD

② The multi-function input terminal set to “Dia Preset becomes On, and the multi-function input terminal set to “TensionDisable” is On.

When initializing the function code in PAR_01 Para. Init, the initialized value of diameter in this case is always initialized with the set value of WEB_04 Diam Preset 1.

(3) Jog operation function :

Jog operates if one of the following conditions is met where the multi-function input terminal set to “Jog Web” becomes On.

① FUN_01 Run/Stop Src is set to “Terminal 1”, and only the multi-function input terminal set to “Jog Web” is On

② FUN_01 Run/Stop Src is set to “Keypad”, and only the multi-function input terminal set to “Jog Web” is On after the FWD button is pressed in keypad

③ When FUN_01 Run/Stop Src is set to “Terminal 1”, the inverter doesn’t operate if both Fx signal and Jog Web signal are On.

2) Multi-function Auxiliary Output Terminal Definition (DIO_41 AX1 Define ~ I/O_43 OC1 Define)

When CON_02 Application of Control (CON) Group is selected as "WEB Control", you can select the following function in addition. For further detail, please refer to WEB group function explanation.

Function Code	Loader Display	Definition of Function		Unit	Explanation of Function
		Name	Setting Range		
DIO_41	AX1 Define	Web Break Detection	WEB Break	%	Detects and outputs the short of Web
		Up to Speed Detection	Up to Spd	%	Detects and outputs the deviation between line speed command and actual line speed
		False Core Detection	False Core	%	Outputs if the diameter is less than the set value in WEB_16

The rest of the multi-function output terminal has the same function. In the standard input/output board, however, AX1 and AX2 are relay output while OC1 is open collector output.

7.5.3 Analog Input/Output Group (AIO_[][])

If you select "WEB Control" at CON_02 Application, you can select following functions more. The function description is simple, so refer to WEB Group function description for more details.

Function Code	Loader Display	Definition of Function		Unit	Explanation of Function
		Name	Setting Range		
AIO_01	Ai1 Define	Line Speed Command	Line SPD Ref	%	The set value of WEB_08 MaxMotor SPD is maximum line speed command 0 ~ 100% where the input is 0 ~ 10V. In case of ±10V input, it recognizes 0 ~ 10V.
		Tension Command	Tension Ref	%	I t means the maximum tension command value is ±10 where the inpu
		Dancer Position Command	Dancer Ref	%	It means dancer command value is ±100% where the input is ±10V
		Taper Command	Taper Ref	%	It means taper command value is ±100% where the input is ±10V
		Tension Feedback	Tension F/B	%	It means the amount of tension feedback is ±100% where the input is ±10V
		Diameter Input	Diameter	%	In case of using the diameter sensor, it means the diameter is ±100% where the input is ±10V
		Diameter Initialization	Diam Preset	%	In case of using diameter initialization by analog input, it means the diameter is ±100% where the input is ±10V
AIO_74	AO1 Define	Final Line Speed Command	Line Speed	%	Outputs the final line speed command that is the sum of line speed command and PID controller output
		Final Tension Command	Tension Out	%	Outputs the final tension command after computing Taper, Boost, and Stall
		Diameter	Diameter	%	Outputs the current diameter

7.5.4 Function Group (FUN_[][])

If CON_02 Application of Control (CON) Group is selected as “WEB Control”, you may select the following function in addition. For further detail, please refer to the explanation on WEB group function.

Function Code	Loader Display	Definition of Function		Unit	Explanation of Function
		Name	Setting Range		
FUN_02	Spd Ref Sel	Speed Setting Method	Line SPD Ref		It is set when conducting line speed command with analog input at the time of Web control.
			Line SPD Opt		It is set when conducting line speed command with communication at the time of Web control..

Note) In case of setting FUN_02 Spd Ref Sel to the other value than “Line SPD Ref” or “Line SPD Opt”, you cannot make exact Web control. Therefore, please set “Line SPD Ref” or “Line SPD Opt” without fail.

7.5.5 Control Group (CON_[][])

CON_02 Application allows you the setting of general vector control mode and WEB control mode. **In case of conducting Web control, please set “WEB Control” without fail**. **Only when setting “WEB Control”, you can confirm all the function and Web group necessary for WEB control in the keypad.**

FunctionCode	Loader Display	Definition of Function		Unit	Explanation of Function
		Name	Setting Range		
CON_02	Application	application control	General Vect		It is set when using the general vector function.
			WEB Control		It is set when using Web control function.

7.6 Function Code of WEB Application Group (WEB_[][])

Code No.	Comm. Addr	Code Name	LCD DISPLAY	Setting Data			Adjustment During Run	PAGE
				Range	Unit	Default		
WEB_00	-	Selection of Function Code	Jump Code	1 ~ 59			Yes	
WEB_01	7C01	Diameter Size Display	Diameter	5.0 ~ 100.0	%	10.0	No	7-18
WEB_02	7C02	Selected Initial Diameter	Current Core (Display Only)	0 (Diam Preset 1) 1 (Diam Preset 2) 2 (Diam Preset 3) 3 (Diam Preset 4) 4 (Analog) 5 (Option)		0 (Diam Preset 1)	No	7-18
WEB_03	7C03	Setting of the Type of Diameter Initialization	DiaPresetSrc	0 (Keypad) 1 (Analog) 2 (Option)		0 (Keypad)	No	7-18
WEB_04	7C04	1st Diameter Initial Value	Diam Preset 1	WEB_10 ~ 100.0	%	10.0	No	7-20
WEB_05	7C05	2nd Diameter Initial Value	Diam Preset 2	WEB_10 ~ 100.0	%	15.0	No	7-20
WEB_06	7C06	3rd Diameter Initial Value	Diam Preset 3	WEB_10 ~ 100.0	%	20.0	No	7-20
WEB_07	7C07	4th Diameter Initial Value	Diam Preset 4	WEB_10 ~ 100.0	%	25.0	No	7-20
WEB_08	7C08	Motor Maximum Rotating Speed with Min. Diameter	MaxMotor SPD	75.0 ~ 3600.0	rpm	300.0	Yes	7-21
WEB_09	7C09	Minimum Effective Line Speed	MinLine SPD	0.0 ~ 100.0	%	5.0	No	7-21
WEB_10	7C0A	Minimum Diameter	Min Diameter	5.0 ~ 100.0	%	10.0	No	7-22
WEB_11	7C0B	Selection of Acceleration/Deceleration Time Setting in case of WEB Control	AccDecWeb	0 (No) / 1 (Yes)		1 (Yes)	No	7-22
WEB_12	7C0C	Acceleration Time in case of WEB Control	Acc TimeWeb	0.00 ~ 6000.0	sec	0.50	Yes	7-22
WEB_13	7C0D	deceleration Time in case of WEB Control	Dec TimeWeb	0.00 ~ 6000.0	sec	0.50	Yes	7-22
WEB_14	7C0E	Setting of the Type of Diameter Computation	Diameter Src	0 (Internal) 1 (Exernal)		0 (Internal)	No	7-22
WEB_15	7C0F	Time Constant of Diameter Computation LPF	Diameter LPF	0.01 ~ 300.00	sec	5.00	Yes	7-23
WEB_16	7C10	False Core Value	False Core	0.0 ~ 50.0	%	5.0	Yes	7-23
WEB_17	7C11	Rewind/Unwind Setting	Re/Un Wind	0 (Rewind) 1 (Unwind)		0 (Rewind)	No	7-23
WEB_18	7C12	Overwind /Underwind Setting	O/U Wind	0 (Overwind) 1 (Underwind)		0 (Overwind)	No	7-24
WEB_19	7C13	Tension Reference Input Setting	TensionInput	-100.0 ~ 100.0	%	0.0	Yes	7-26
WEB_20	7C14	Taper Type Setting	Taper Type	0 (None) 1 (Hyperbolic) 2 (Linear)		0 (None)	No	7-26
WEB_21	7C15	Taper Input Value Setting	Taper Input	-100.0 ~ 100.0	%	0.0	No	7-26
WEB_22	7C16	Boost Type Setting	Boost Type	0 (Proportional) 1 (Fixed)		0 (Proportional)	No	7-27
WEB_23	7C17	Boost Input Value Setting	Boost Input	0.0 ~ 50.0	%	0.0	No	7-27
WEB_24	7C18	Stall Type Setting	Stall Type	0 (Proportional) 1 (Fixed)		0 (Proportional)	No	7-28
WEB_25	7C19	Stall Input Value Setting	Stall Input	0.0 ~ 50.0	%	0.0	No	7-28
WEB_26	7C1A	Ramp Time Setting of Tension Reference Input Value	Tension Ramp	0.00 ~ 600.00	sec	5.00	Yes	7-29
WEB_27	7C1B	Tension Control Enable Setting	Tension Enb	0 (Disable) 1 (Enable)		1 (Enable)	No	7-30
WEB_28	7C1C	PID Reference Type Setting	PIDRef Sel	0 (Dancer Pos) 1 (Taper Out)		1 (Taper Out)	No	7-30
WEB_29	7C1D	Dancer Reference position Setting	Dancer Pos	-100.0 ~ 100.0	%	0.0	Yes	7-31
WEB_30	7C1E	Process PID P1 Gain Setting	ProcPID Kp1	0.0 ~ 999.9	%	10.0	Yes	7-31
WEB_31	7C1F	Process PID P2 Gain Setting	ProcPID Kp2	0.0 ~ 999.9	%	0.0	Yes	7-31
WEB_32	7C20	Process PID I1 Gain Setting	ProcPID Ki1	0.0 ~ 100.0	sec	5.0	Yes	7-31
WEB_33	7C21	Process PID I2 Gain Setting	ProcPID Ki2	0.0 ~ 100.0	sec	0.0	Yes	7-31

Code No.	Comm. Addr	Code Name	LCD DISPLAY	Setting Data			Adjustment During Run	PAGE
				Range	Unit	Default		
WEB_34	7C22	PID Gain Ramp Time Setting	PIDGain RAMP	0.1 ~ 100.0	sec	1.0	Yes	7-32
WEB_35	7C23	Process PID P Gain Profiler Type Setting	P Profiler	0 (Linear) 1 (Square) 2 (Cubed) 3 (Quadratic)		0 (Linear)	No	7-32
WEB_36	7C24	Process PID P Gain Profiler Gain Setting	P Apt Gain	-1.00 ~ 10.00		0.00	No	7-32
WEB_37	7C25	Process PID D Gain Setting	ProcPID Kd	0.0 ~ 100.0	%	0.0	Yes	7-33
WEB_38	7C26	Process PID D Gain LPF	ProcKd LPF	0.0 ~ 100.0	sec	2.0	Yes	7-33
WEB_39	7C27	Process PID Positive Limit	Proc Pos Lmt	-100.0 ~ 100.0	%	100.0	Yes	7-33
WEB_40	7C28	Process PID Negative Limit	Proc Neg Lmt	-100.0 ~ 100.0	%	-100.0	Yes	7-33
WEB_41	7C29	Process PID Output LPF Time Constant	PID Out LPF	0.00 ~ 100.00	sec	1.00	Yes	7-34
WEB_42	7C2A	Rewind-Use Process PID Output Gain	PIDOGainRe	-250.0 ~ 250.0	%	0.0	Yes	7-34
WEB_43	7C2B	Unwind-Use Process PID Output Gain	PIDOGainUn	-250.0 ~ 250.0	%	0.0	Yes	7-34
WEB_44	7C2C	PID Controller Type Setting	PID Type	0 (Proportional) 1 (Fixed)		0 (Proportional)	No	7-34
WEB_45	7C2D	Minimum PID Controller Output Setting	Min FPID	0.0 ~ 50.0	%	10.0	No	7-34
WEB_46	7C2E	Time of Maintenance of PID Controller After Break	PIDHoldTime	0.0 ~ 100.0	sec	5.0	Yes	7-36
WEB_47	7C2F	Process PID Feedback Type Setting	PID F/B Src	0 (Analog) 1 (Option)		0 (Analog)	No	7-36
WEB_48	7C30	WEB Break Detection Function Setting	WB Enable	0 (No) / 1 (Yes)		0 (No)	Yes	7-38
WEB_49	7C31	Setting of Time Delayed until Web Break Detection after Inverter Operation	INV WB Delay	0.1 ~ 600.0	sec	1.0	Yes	7-38
WEB_50	7C32	Time Delayed for WEB Break Detection	WB Delay	0.1 ~ 600.0	sec	1.0	Yes	7-38
WEB_51	7C33	WEB Break Detection Level	WB Level	0.0 ~ 100.0	%	0.0	Yes	7-38
WEB_52	7C34	Up to Speed Judgment Setting	UTS Enable	0 (No) / 1 (Yes)		0 (No)	Yes	7-39
WEB_53	7C35	Up to Speed Level	UTS Level	0.0 ~ 100.0	%	0.0	Yes	7-39
WEB_54	7C36	Quick Stop time Setting	Quick Stop	0.0 ~ 100.0	sec	1.0	Yes	7-39
WEB_55	7C37	Jog Speed Setting	JogSpd Web	0.0 ~ 100.0	%	10.0	Yes	7-40
WEB_56	7C38	Jog Acceleration/Deceleration Time Setting Select	JogTime Sel	0 (No) / 1 (Yes)		1 (Yes)	No	7-40
WEB_57	7C39	Jog Acceleration Time Setting	JogAcc Time	0.00 ~ 6000.0	sec	5.00	Yes	7-40
WEB_58	7C3A	Jog deceleration time Setting	JogDec Time	0.00 ~ 6000.0	sec	5.00	Yes	7-40
WEB_59	7C3B	Splicing Level Setting	Splice Level	0.0 ~ 100.0	%	0.0	Yes	7-40

7.7 WEB Group Function

7.7.1 Jump code(WEB_00)

You may directly jump into the code desired using WEB_00.

(Example) If you want to move to WEB_03;

Press [PROG] key, and then press [SHIFT/ESC] / [▲UP] / [▼DOWN] keys to set 3.

Then you may move to the following mode by pressing [ENT] key.

```
WEB▶ DiaPresetSrc
03      Keypad
```

After jump movement, you can move to the other code using [▲UP] / [▼DOWN] key.

7.7.2 Diameter Display

1) WEB_01 Diameter : Diameter Size Display

It indicates in % value the sizes of the diameter computed by the inverter internal S/W or the diameter of the analog output of the diameter sensor built in the inverter stem input through the analog input terminal.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_01	Diameter	Diameter Size Display	5.0 ~ 100.0	%	10.0

2) WEB_02 Current Core : Display of Initial Diameter Selected

It indicates the initial diameter selected. It is displayed as follow depending on the setting of WEB_03 DiaPresetSrc. First, when set to “Keypad”, depending on the combination of multi-function input (DIO_01 ~ DIO_07) it displays “Diam Preset 1 ~ Diam Preset 4”. Second, when set to “Analog”, it displays “Analog”. Lastly, when set to “Option”, it displays “Option”.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_02	Current Core	Displays initial diameter selected (Display Only)	Diam Preset 1 Diam Preset 2 Diam Preset 3 Diam Preset 4 Analog Option		Diam Preset 1

7.7.3 Diameter Initialization

1) WEB_03 DiaPreset Src : Diameter Initialization Type Setting

The core will be replaced when winding out the material in case of rewinding or when unwinding out the material. In this case, it requires informing the inverter of the core being replaced when winding or unwinding the material again, and then initializing the computed diameter. Core initialization method constitutes the methods by multi-

function input terminal, by analog input terminal , and by communication.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_03	DiaPresetSrc	Diameter Initialization Type Setting	Keypad Analog Option		Keypad

① Initialization of Core by Multi-function Input Terminal

-. Initialization of Core by Multi-function Input Terminal requires setting WEB_03 to “Keypad” first.

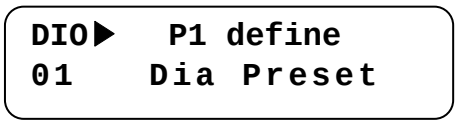
-. Select one of multi-function input terminals (DIO_01 ~ DIO_07), and set it to “Dia Preset”.

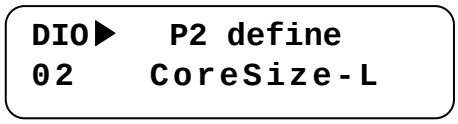
-. Select two of multi-function input terminals (DIO_01 ~ DIO_07), and set them to “CoreSize-L” and “CoreSize-H”.

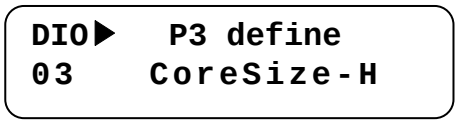
-. Core can be initialized according to On/Off of multi-function input terminal set to “Dia Preset”. The core value initialized becomes, however, one of the initial values set in WEB_04 ~ WEB_07 according to On/Off of the multi-function input terminal set to “CoreSize-L” and “CoreSize-H”.

-. In case of using the core in one kind only, you don’t need to set “CoreSize-L” and “CoreSize-H”. In this case, only WEB_04 Diam Preset 1 is applied to the core.

Example) The initial diameter value when DIO_01, DIO_02, and DIO_03 are set to “Dia Preset”, “CoreSize-L”, and “CoreSize-H” respectively.







P2 ON/OFF	P3 ON/OFF	Preset Core Value Applied
OFF	OFF	WEB_04 Diam Preset 1
ON	OFF	WEB_05 Diam Preset 2
OFF	ON	WEB_06 Diam Preset 3
ON	ON	WEB_07 Diam Preset 4

② Initialization of Core by Analog Input Terminal

-. Initialization of Core by Analog Input Terminal requires setting of WEB_03 to “Analog” first.

-. Select one of multi-function input terminals (DIO_01 ~ DIO_07) and then set it to “Dia Preset”.

-. Select one of analog input terminal definitions (AIO_01, AIO_13, AIO_25), and then set it to “Diam Preset”.

-. You may initialize the diameter according to On/Off of multi-function input terminal set to “Dia Preset”. The diameter value initialized, however, becomes the value of analog input terminal set, and it is restricted to WEB_10 Min Diameter.

Example) Setting DIO_01 and AIO_01 to “Dia Preset” and “Diam Preset” respectively

```
WEB▶   Preset Src
03       Analog
```

```
DIO▶   P1 define
01    Dia Preset
```

```
AIO▶   Ai1 Define
01    Diam Preset
```

③ Initialization of Core by Communication

-. Initialization of Core by Communication requires setting of WEB_03 to “Option” first.

-.Select one of multi-function input terminals (DIO_01 ~ DIO_07), and then set it to “Dia Preset”.

-.You may initialize the diameter according to On/Off of multi-function input terminal set to “Dia Preset”. The diameter value initialized becomes the value of communication set, and is restricted to WEB_10 Min Diameter.

2) WEB_04 Diam Preset 1 : 1st diameter initial value

3) WEB_05 Diam Preset 2 : 2nd diameter initial value

4) WEB_06 Diam Preset 3 : 3rd diameter initial value

5) WEB_07 Diam Preset 4 : 4th diameter initial value

The diameter initialization in tension control (Diam Preset) means empty core at the time of winder operation, while full core at the time of Unwinder operation. In case of initialize the core with multi-function input terminal, it is set with one of WEB_04 Diam Preset 1 ~ WEB_07 Diam Preset 4 according to the WEB_04 Diam Preset 1 ~ WEB_07 Diam Preset 4 set to “CoreSize-L”and “CoreSize-H”. In case all the defined multi-function input terminals are Off or are not set with the multi-function input, the initial value of diameter is set to “Diam Preset 1”. If applying to bridle roll or nip roll instead of general winder and unwidner, you may set all the initial values to 100.0 %. In the core initialization using analog and communication, any initial value of WEB_04 Diam Preset 1 ~ WEB_07 Diam Preset 4 is not applied. The reference of the set value is the diameter initial value expressed in [%] at the time of full diameter.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_04	Diam Preset 1	1st Core initial value	WEB_10 ~ 100.0	%	10.0
WEB_05	Diam Preset 2	2nd Core initial value	WEB_10 ~ 100.0	%	15.0
WEB_06	Diam Preset 3	3rd Core initial value	WEB_10 ~ 100.0	%	20.0
WEB_07	Diam Preset 4	4th Core initial value	WEB_10 ~ 100.0	%	25.0

The condition of diameter initialization is as follow.

③ Multi-function input terminal set to “Dia Preset” is On and the line speed command is less than the set value of WEB_09 MinLine SPD

④ Multi-function input terminal set to “Dia Preset” is On and the multi-function input terminal set to “TensionDisable” is On

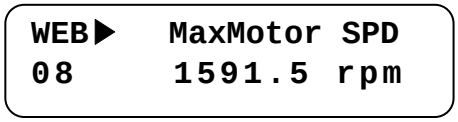
⑤ In case of initializing the function code in PAR_01 Para. Init. In this case, however, the diameter initialization value is always initialized with the set value of WEB_04 Diam Preset 1.

7.7.4 Speed setting when doing WEB controlling

1) WEB_08 MaxMotor SPD : Motor Maximum Rotating Speed in case of Minimum Diameter

This function indicates the motor maximum rotating speed in case of the minimum diameter with the maximum line speed command given. Accordingly, to maintain the exact line speed, it requires setting the exact motor rotating speed in WEB_08 MaxMotor SPD. Setting can be conducted as follow. Assuming maximum line speed in 100[m/m], gear ratio in 5:1, and core diameter in 100[mm], the maximum motor speed set value becomes 1591.5[rpm].

$$\text{Max. motor speed [rpm]} = \text{Gear Ratio} \times \frac{\text{Max. Line Speed}}{\text{Core Diameter x } \pi} = 5 \times \frac{100\,[m/m]}{0.1\,[m] \times \pi} = 1591.55\,[rpm]$$



Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_08	MaxMotor SPD	Motor Maximum Rotating Speed in case of Minimum Diameter	75.0 ~ 3600.0	rpm	300.0

Note) After the installation of the system, be sure to check the motor rotating speed using the gauge when the maximum line speed command is given by the empty core.

2) WEB_09 MinLine SPD : Minimum Effective Line Speed

This function is the function related with diameter computation and diameter initialization. The set value is the minimum value of the line speed command that can compute the diameter, that is expressed in [%] in proportion of maximum line speed (100[%]). At the time of winder operation, the line speed command should be larger than the set value to compute the diameter. If the line speed command is smaller than the set value, the diameter

computation is not conducted. If the line speed command is smaller than the set value, and the multi-function input terminal set to “Dia Preset” is On, the diameter can be initialized. The reference of the set value is the [%] of maximum line speed.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_09	MinLine SPD	Minimum Effective Line Speed	0.0 ~ 100.0	%	5.0

3) WEB_10 Min Diameter : Minimum Diameter

It indicates the diameter of the smallest core [%], which is used as the minimum limit of diameter computation at the time of Taper computation, P Gain Profiler computation, and Unwinder operation, the minimum limit in diameter computation at the time of Unwinder operation, and the minimum limit in the diameter initialization using analog communication, diameter initialization using communication, diameter computation using diameter sensor. In the inverter S/W, if the set value of WEB_10 Min Diameter is larger than the set value of WEB_04 Diam Preset 1 ~ WEB_07 Diam Preset 4, it is limited to the set value of WEB_10 Min Diameter. Therefore, the set value of WEB_10 Min Diameter should be set to the set value equal to or less than that of WEB_04 Diam Preset 1 ~ WEB_07 Diam Preset 4. If applying Bridle Roll or Nip Roll other than general winder and unwinder, the set value of WEB_10 Min Diameter should be set as 100[%].

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_10	Min Diameter	Minimum Diameter	5.0 ~ 100.0	%	10.0

4) WEB_11 AccDecWeb : Selecting Acceleration/Deceleration Time Setting at the time of Web Control

5) WEB_12 Acc TimeWeb : Acceleration Time at the time of Web Control

6) WEB_13 Dec TimeWeb : Deceleration Time at the time of Web Control

When setting WEB_11 AccDecWeb to “No”, WEB_12 Acc TimeWeb and WEB_13 Dec TimeWeb are not displayed on Keypad, but acceleration/deceleration time of FUN_40 Acc Time-1, FUN_41 Dec Time-1is applied at the time of Web control. When set to “Yes”, WEB_12 Acc TimeWeb and WEB_13 Dec TimeWeb are displayed on Keypad, and then the set value of WEB_12 Acc TimeWeb and WEB_13 Dec TimeWeb are applied to the acceleration/deceleration time, and the reference of acceleration/deceleration reference is “Max Speed”.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_11	AccDecWeb	Selecting Acceleration/Deceleration Time Setting at the time of Web Control	No Yes		Yes
WEB_12	Acc TimeWeb	Acceleration Time at the time of Web Control	0.00 ~ 6000.0	sec	0.50
WEB_13	Dec TimeWeb	Deceleration Time at the time of Web Control	0.00 ~ 6000.0	sec	0.50

7.7.5 Diameter Computation

1) WEB_14 Diameter Src : Diameter Computation Type Setting

This function is the function code that determine whether to calculate the diameter computation by inverter internal S/W or to receive the input diameter via the analog output of the diameter sensor attached to the system through the analog input terminal of the inverter. In case of setting WEB_14 Diameter Src to “Internal”, diameter is computed by the inverter internal S/W, while if set to “External”, the diameter is input by the diameter sensor. Accordingly, when set to “External”, the diameter is not computed in the diameter inverter, and furthermore, the diameter preset function doesn’t operate.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_14	Diameter Src	Diameter Computation Type Setting	Internal External		Internal

2) WEB_15 Diameter LPF : Diameter Computation LPF Time Constant

When computing the diameter, to avoid the sudden change in diameter you may set low pass filter(LPF). This set value operates with LPF delay time. In case set the set value in large scale, diameter computation becomes slow, while setting in small scale, diameter computation becomes quicker.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_15	Diameter LPF	Diameter Computation LPF Time Constant	0.01 ~ 300.00	sec	5.00

3) WEB_16 False Core : False Core Value Setting

In case the diameter received by the inverter through the diameter computation S/W inside the inverter or by the system where the diameter sensor is built in is smaller than the set value in the WEB_16 False Core, it is judged as “False Core”. At this time, if one of multi-function output DIO_41 AX1 Define ~ DIO_43 OC1 Define is set to “False Core”, the set multi-function output is On. The reference of the set value is [%] of the diameter.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_16	False Core	False Core Value Setting	0.0 ~ 50.0	%	5.0

7.7.6 Winder setting

1) WEB_17 Re/Un Wind : Rewind/Unwind Setting

There are three methods in general at the time of tension control. First, to control the tension of the fixed roll using Bridle Roll or Nip Roll. Second, to wind the Web as in the Winder in which the diameter of Winder get larger as time goes by. Lastly, to unwind the Web as in the Unwinder in which the diameter of Unwinder gets smaller as time goes by. In this function, you may set to “Rewind” in case of winding the web as in the Winder or control the tension of the fixed roll using Bridle Roll or Nip Roll while set to “Unwind” in case of unwinding the web as in the Unwinder.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_17	Re/Un Wind	Rewind/Unwind Setting	Rewind Unwind		Rewind

2) WEB_18 O/U Wind : Overwind/Underwind Setting

There are two methods in case of winding or unwinding the web with Winder or Unwinder. First, to wind or unwind the web from up to down centered on the roll. Second, to wind or unwind the web from down to up centered on the roll. This function is the code deciding the way of winding or unwinding the web. According to the set value of the function code, the motor rotating direction is decided. The following figure and the table show the direction of line speed command, PID output command, and splicing command according to WEB_17 Re/Un Wind and WEB_18 O/U Wind settings.

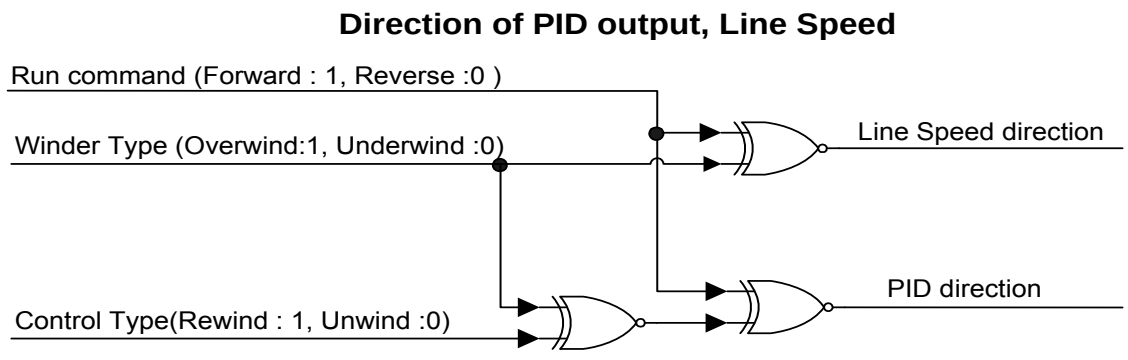
Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_18	O/U Wind	Overwind/Underwind Setting	Overwind Underwind		Overwind

Wind / Type Items	Rewind		Unwind	
	Overwind	Underwind	Overwind	Underwind
Line Speed direction	Positive	Negative	Positive	Negative
PID direction	Positive	Negative	Negative	Positive
Splicing direction	Positive	Negative	Negative	Positive

Table 1. Line Speed, PID and Splicing Direction in case of Forward Direction Command

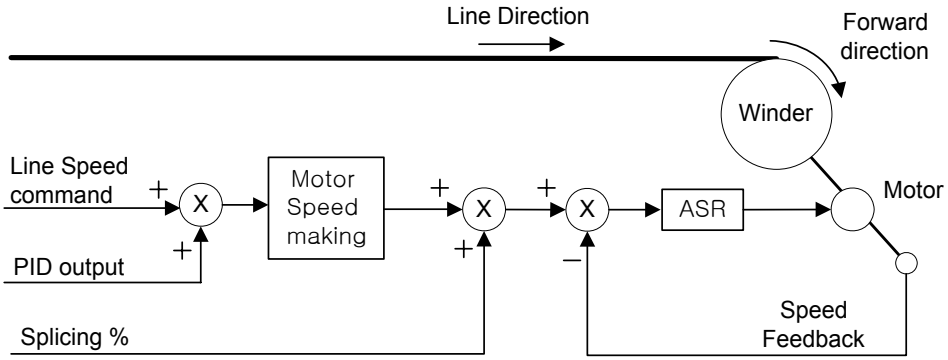
Wind / Type Items	Rewind		Unwind	
	Over wind	Under wind	Over wind	Under wind
Line Speed direction	Negative	Positive	Negative	Positive
PID direction	Negative	Positive	Positive	Negative
Splicing direction	Negative	Positive	Positive	Negative

Table 2. Line Speed, PID and Splicing Direction in case of Reverse Direction Command



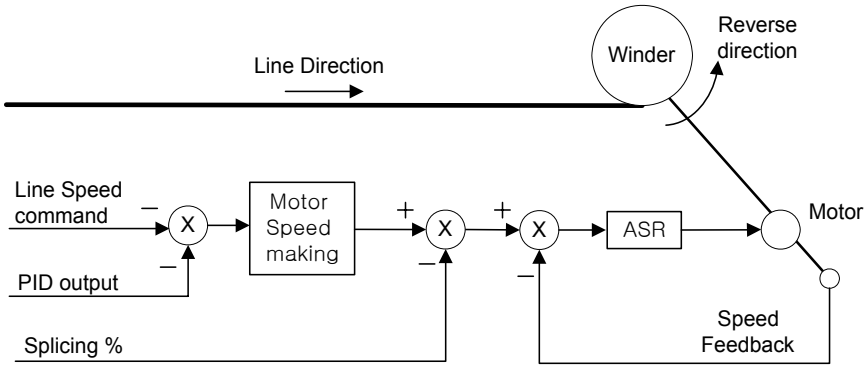
Line Speed, PID direction according to the Command and Function Code

Rewind(Overwind) with Forward Run command



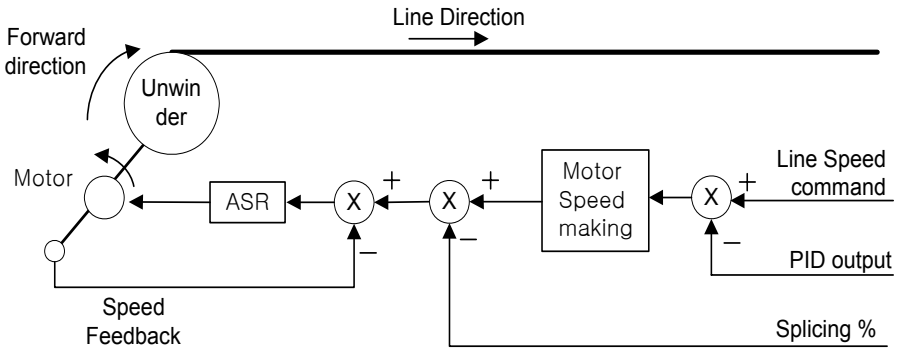
Rewind/Overwind Setting, Roll Rotating Direction in case of Forward Direction Operation

Rewind(Under wind) with Forward Run command



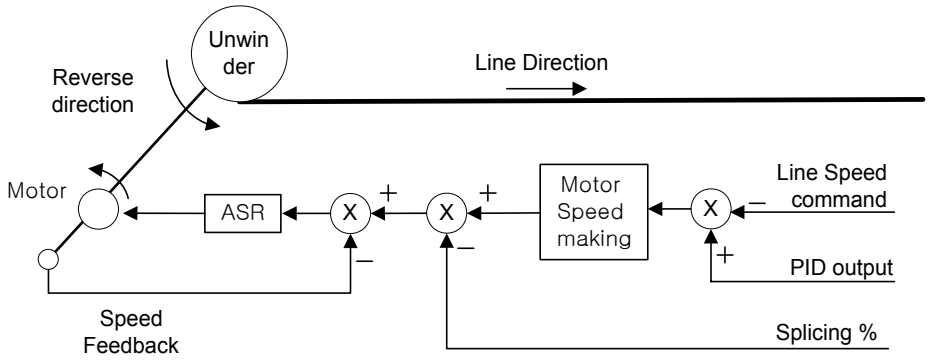
Rewind/Underwind Setting, Roll Rotating Direction in case of Forward Direction Operation

Unwind(Over wind) with Forward Run command



Unwind/Overwind Setting, Roll Rotating Direction in case of Forward Direction Operation

Unwind(Under wind) with Forward Run command



Unwind/Underwind Setting, Roll Rotating Direction in case of Forward Direction Operation

7.7.7 Tension controlling setting

1) WEB_19 Tension Input : tension Reference Input Setting

In case of using loadcell in the tension control you have to set tension reference. If using dancer, you have to set the position reference of dancer. In this case, Taper, Stall and Boost are required according to the system requirement. This function code is the function code where tension reference is set when using the loadcell as the tension control-use sensor. Tension reference is input with the sum of the analog input value at the time of setting WEB_19 Tension Input and analog input (Ai1 ~ Ai3 Define) to “Tension Ref” and the set value of Address 0x0511 in common area. For further detail, please refer to Block Diagram at the time of Web Control. In case of using dancer, this function code plays the role giving the dancer Taper function. In case of setting the set value of WEB_28 PIDRef Sel to “Dancer Pos”, and setting WEB_29 Dancer Pos, WEB_19 Tension Input can be set with the input tension of the dancer. At this time, you may connect with the dancer after setting one of analog output (AIO_74 AO1 Define, AIO_79 AO2 Define) to “Tension Out”.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_19	Tension Input	Tension Reference Input	-100.0 ~ 100.0	%	0.0

2) WEB_20 Taper Type : Taper Type Setting

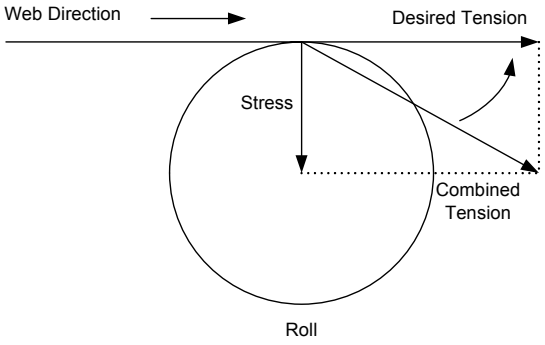
3) WEB_21 Taper Input : Taper Amount Input

In case of Winder, as the diameter gets larger, the tension toward the center direction of the diameter increases. Desired tension is, as shown in the Figure 12, toward the direction of dot line. The tension occurs from the stress, however, and therefore the sum of two vectors work as the total tension. To maintain the tension toward the desired direction, you may use this taper function. There are three methods of using taper function. First; it is not to use taper function, that is tape function is not applicable in case of powering On after setting WEB_20 to “None”, setting WEB_20 to the others than “None” but setting WEB_21 Taper Input to 0.0[%], and setting one of multi-function inputs (DIO_01 ~ DIO_07) to “Taper Disable”. Second; it is to set to “Hyperbolic” when the tension

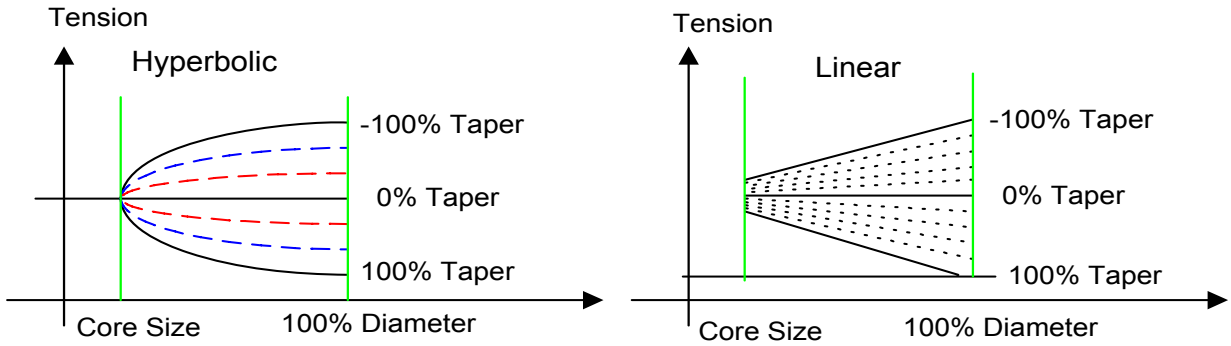
changes showing non-linear behavior depending of the diameter. Third; it is to set to “Linear”, when the tension changes showing linear behavior depending on the diameter.

By inputting the amount of taper, the sum of the set value of WEB_21 Taper Input, the input value of analog input terminal set to Taper Ref”, and the set value of address 0x0514 in the common area is decided as the amount of final taper. In general, the value larger than 0 is input as the taper input, but in specific case, the value less than 0 can be input, which means as the diameter gets larger, the tension becomes larger.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_20	Taper Type	Taper Type	None Hyperbolic Linear		None
WEB_21	Taper Input	Taper Input	-100.0 ~ 100.0	%	0.0



Tension Composition Diagram



Taper Type and Tension according to the Amount of Taper Set

4) WEB_22 Boost Type : Boost Type

5) WEB_23 Boost Input : Boost Input

This function is used when Web is wound with the stronger tension than the preset tension. If WEB_22 Boost Type is set to “Fixed”, the sum of WEB_23 Boost Input set value and the set value of tension becomes the final set value of tension. For example, with the taper function unused, if the set value of tension is 50[%], and WEB_23 Boost Input set value is 20[%], the final set value of tension becomes 70[%]. If WEB_22 Boost Type is set to “Proportional”, the set value of tension multiplying by WEB_23 Boost Input set value is added. For example, with the taper function unused, if the set value of tension 50[%] and WEB_23 Boost Input set value is 20[%], the set

value of final tension becomes 60[%]. In the boost function, the set value of WEB_23 Boost Input is not always 0, but it just operates in case of the multi-function input terminal (DIO_01 ~ DIO_07) set to “Boost Enable” being On.

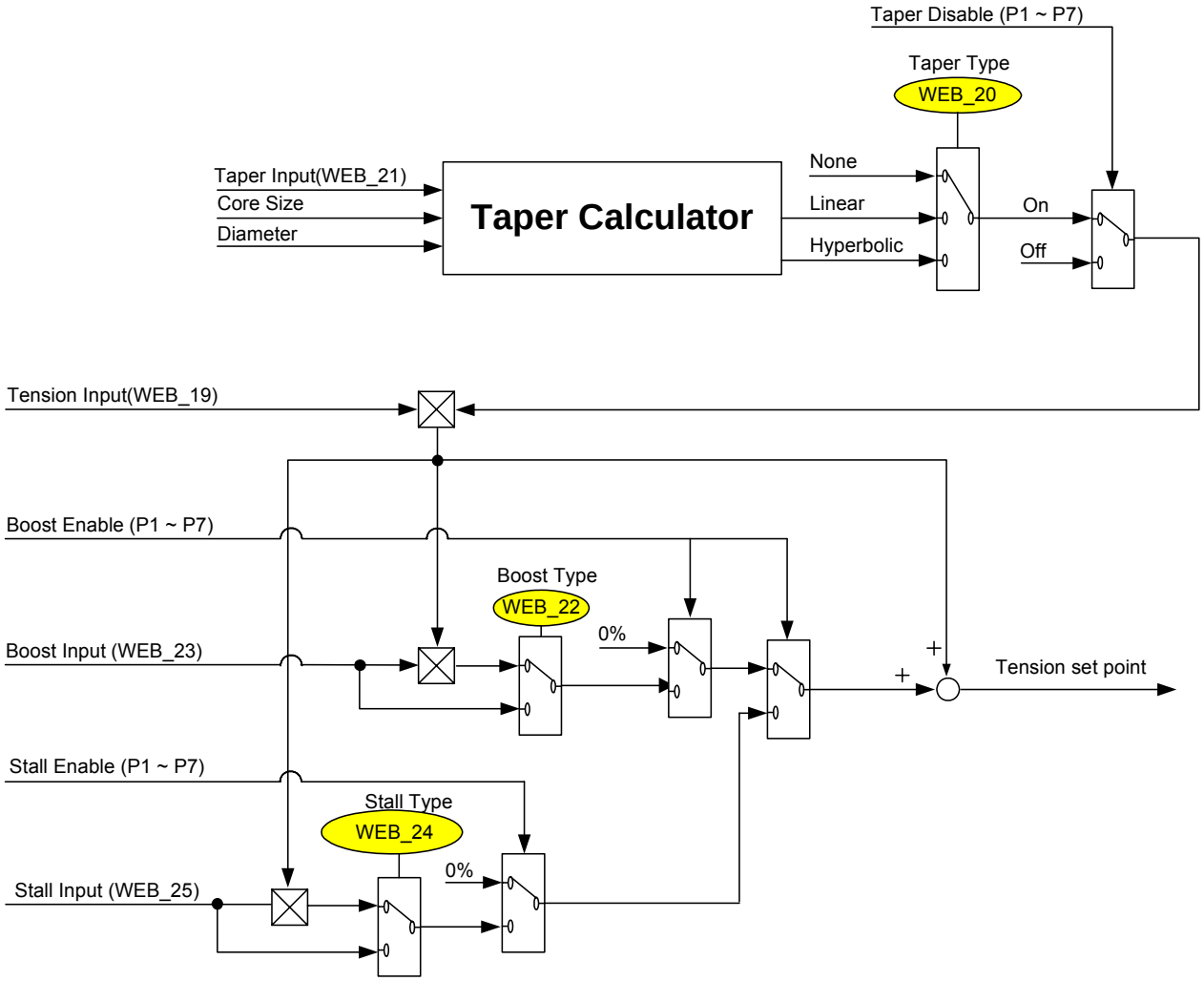
Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_22	Boost Type	Boost Type	Proportional Fixed		Proportional
WEB_23	Boost Input	Boost Input	0.0 ~ 50.0	%	0.0

6) WEB_24 Stall Type : Stall Type

7) WEB_25 Stall Input : Stall Input

This function is used when Web is wound with the weaker tension than the preset tension. In case of setting WEB_24 Stall Type to “Fixed”, the set value of tension less WEB_25 Stall Input set value becomes the set value of final tension. For example, with the taper function unused, if the set value of tension is 50[%], and WEB_24 Stall Input set value is 20[%], the set value of final tension becomes 30[%]. If WEB_24 Stall Type is set to “Proportional”, the set value of tension multiplying by WEB_25 Stall Input set value is subtracted. For example, with the taper function unused, if the set value of tension is 50[%] and WEB_25 Stall Input set value is 20[%], the set value of final tension becomes 40[%]. In the Stall function, the set value of WEB_25 Stall Input is not always 0, but it just operates in case of the multi-function input terminal (DIO_01 ~ DIO_07) set to “Stall Enable” in On.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_24	Stall Type	Stall Type	Proportional Fixed		Proportional
WEB_25	Stall Input	Stall Input	0.0 ~ 50.0	%	0.0

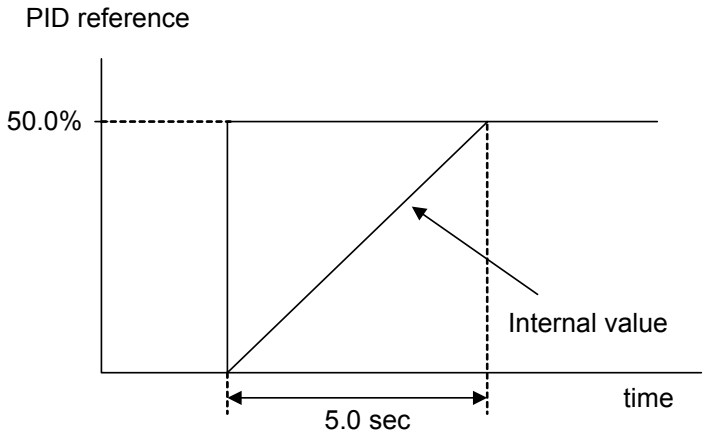


Tension Reference taking Taper, Boost, and Stall into account

8) WEB_26 Tension Ramp : Setting of Ramp in Tension Reference Input

When the machinery starts, Web is in loose state because of lower tension. Therefore the sudden tension command at earlier operation stage may cause unexpected change in tension. To avoid such phenomenon when the command value of loadcell or dancer is applied to the step, the change can be led in smooth manner so that the normal PID controller movement can be carried out by setting the ramp time of the tension input command value. If WEB_26 Tension Ramp is set to 10.0[sec], and the final PID command set to 50[%], the tension command will operate as shown in the Figure 15.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_26	Tension Ramp	Ramp Time of Tension Reference Input	0.00 ~ 600.00	sec	5.00

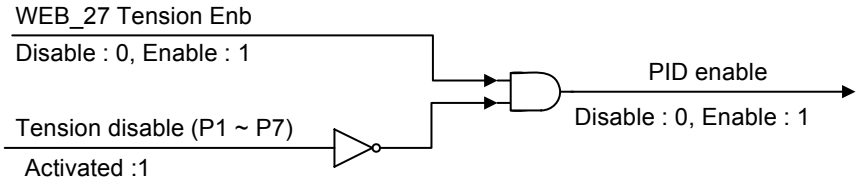


Tension Command where Ramp Time is applied

9) WEB_27 Tension Enb : Setting of Tension Control Enable Function

This is the function of conducting On/Off of the final output of PID controller. If the multi-function input terminal (I/O_01 ~I/O_07) set to "TensionDisable" is Off, and WEB_27 Tension Enb becomes "Enable", PID controller operates. In any other case, PID controller doesn't operates any longer.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_27	Tension Enb	Tension Control Enable Function Setting	Disable Enable		Enable



PID Controller Operation Diagram

7.7.8 WEB PID Control

1) WEB_28 PIDRef Sel : PID Reference Type Setting

When loadcell is used at the time of tension control, PID controller controls actual tension. Accordingly, the reference input of PID controller should be the output of taper computation. Therefore, the set value of WEB_28 PIDRef Sel in the tension control where loadcell is used becomes "Taper Out". If dancer is used, it controls the actual dancer position where the set value of WEB_28 PIDRef Sel is "Dancer Pos", and in this case to carry out the tension control of web, you need to set one of analog outputs (AI/O_74 AO1 Define, AIO_79 AO2 Define) to "Tension Out", and then connect it with dancer. At this time WEB_29 Dancer Pos becomes the reference input of PID controller.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_28	PIDRef Sel	PID Reference Type Setting	Dancer Pos Taper Out		Taper Out

2) WEB_29 Dancer Pos : Dancer Reference Position Setting

To maintain the desired tension, you should set the reference position of dancer. In this case it follows the reference position value of dancer with the deviation between the reference position of dancer set to WEB_29 Dancer Pos and the actual dancer position fed back from outside using PID controller. The reference position of dancer is the sum of the set value of WEB_29 Dancer Pos and "Dancer Ref" set to Analog inputs (AIO_01 Ai1 Define, AIO_13 Ai2 Define, AIO_25 Ai3 Define).

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_29	Dancer Pos	Dancer Reference Position	-100.0 ~ 100.0	%	0.0

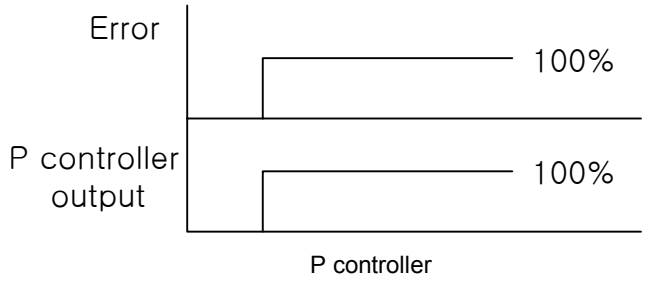
3) WEB_30 ProcPID Kp1 : Process PID Kp1 Gain Setting

4) WEB_31 ProcPID Kp2 : Process PID Kp2 Gain Setting

P Gain means the output of PID controller becomes 100[%] when 100% error is maintained where I Gain is 0. Furthermore, P Gain 50[%] means the output of PID controller becomes 50[%] when 100% error is maintained where I Gain is 0.

When setting multi-function input(DIO_01 ~ DIO_07) to "PI Gain Sel" and then powering it On, P Gain is transferred from WEB_30 ProcPID Kp1 to WEB_31 ProcPID Kp2 during WEB_34 PIDGain RAMP Time. For further detail on gain transfer, please refer to WEB_34 PIDGain RAMP.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_30	ProcPID Kp1	Process PID P1 Gain Setting	0.0 ~ 999.9	%	100.0
WEB_31	ProcPID Kp2	Process PID P2 Gain Setting	0.0 ~ 999.9	%	0.0



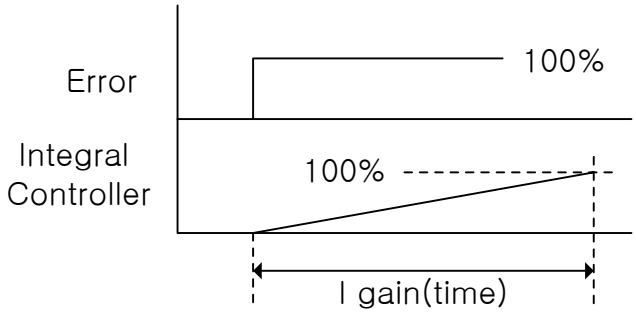
P controller

5) WEB_32 ProcPID Ki1 : Process PID Ki1 Gain Setting

6) WEB_33 ProcPID Ki2 : Process PID Ki2 Gain Setting

I Gain 1[sec] means the time taken for the output to be accumulated up to 100[%] when 100[%] Error is maintained where P Gain is 0. After setting the multi-function input (DIO_01 ~ DIO_07) to "PI Gain Sel" and then powering it On, I Gain is transferred from WEB_32 ProcPID Ki1 to WEB_33 ProcPID Ki2 during the WEB_34 PIDGain RAMP Time. For further detail on gain transfer, please refer to WEB_34 PIDGain RAMP.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_32	ProcPID Ki1	Process PID I1 Gain Setting	0.0 ~ 100.0	sec	5.0
WEB_33	ProcPID Ki2	Process PID I2 Gain Setting	0.0 ~ 100.0	sec	0.0

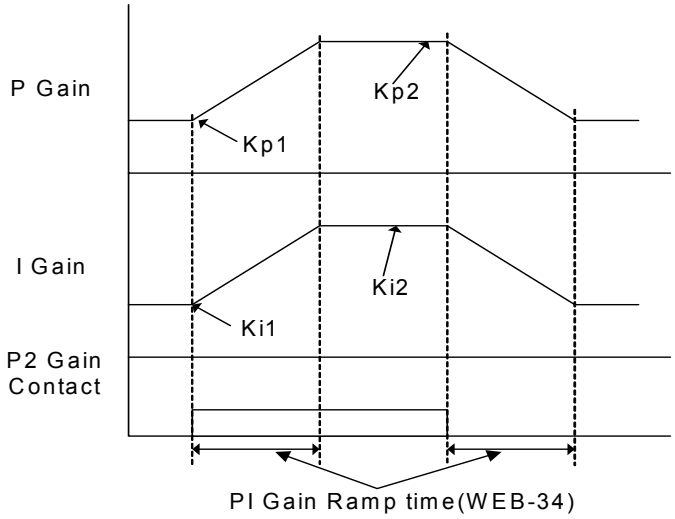


I controller

7) WEB_34 PIDGain RAMP : PID Gain Ramp Time Setting

Sudden change in PI Gain may cause unexpected oscillation. To avoid such phenomenon, you need to carry out setting in slow way for a certain period of time when you transfer gain. This is the function of transferring the gain as shown in the Figure when setting multi-function input(DIO_01 ~ DIO_07) to "PI Gain Sel" and then powering it On.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_34	PIDGain RAMP	PID Gain Ramp Time Setting	0.1 ~ 100.0	sec	1.0



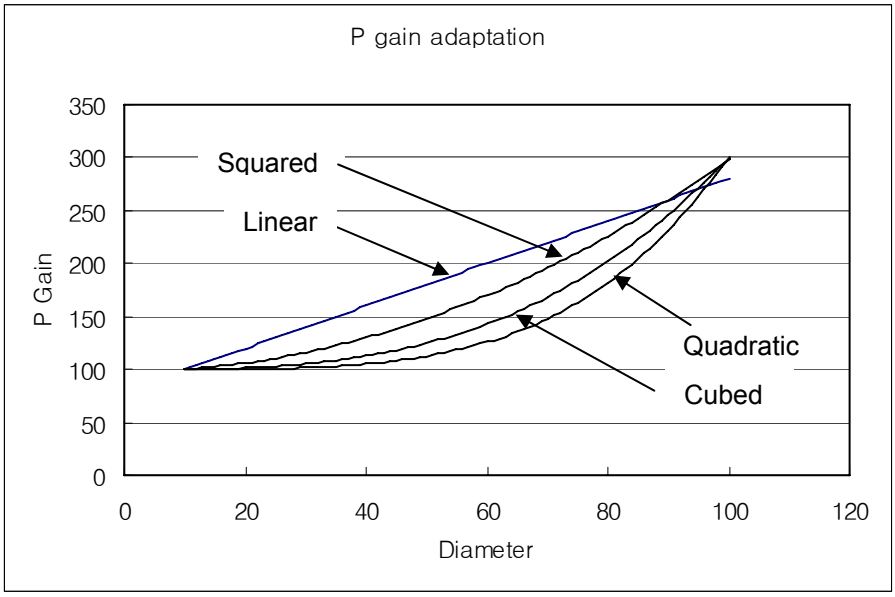
PI Gain Ramp Time

8) WEB_35 P Profiler : Process PID P Gain Profiler Type Setting

9) WEB_36 P Apt Gain : Process PID P Gain Profiler Gain Setting

In case of Winder, the inertia increases as the diameter increases when winding the web. Therefore, P Gain has to change to achieve the same winding performance regardless of the increase of inertia following the increased diameter. There exist four (4) types of profiles; Linear, Square, Cubed, and Quadratic being decided in accordance with the kind of web. WEB_35 P Profiler is the function code that sets the type of P Gain Profiler, while WEB_37 P Apt Gain is the function code that sets the gain applicable to P Gain Profiler. If WEB_36 P Apt Gain is set as 0, Profiler function doesn't operate..

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_35	P Profiler	Process PID P Gain Profiler Type Setting	Linear Square Cubed Quadratic		Linear
WEB_36	P Apt Gain	Process PID P Gain Profiler Gain Setting	-1.00 ~ 10.00		0.00



P Gain applicable where P Gain : 100.0[%], Adaptation Gain : 2.00, Core Size : 10.0[%]

10) WEB_37 ProcPID Kd : Process PID D Gain

11) WEB_38 ProcKd LPF : Process PID D Gain LPF Time Constant

WEB_37 ProcPID Kd and WEB_38 ProcKd LPF constitute D controller of Process PID controller. When the error deviation is 100[%] where WEB_37 ProcPID Kd setting is 100 [%], it means D controller output before going through LPF is 100 [%]. Without LPF, D controller generates outputs when the error changes only. As this characteristic makes the system unstable, LPF is a necessary function in D controller.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_37	ProcPID Kd	Process PID D Gain Setting	0.0 ~ 100.0	%	0.0
WEB_38	ProcKd LPF	Process PID D Gain LPF Time Constant	0.0 ~ 100.0	sec	2.0

12) WEB_39 Proc Pos Lmt : Process PID Positive Limit Setting

13) WEB_40 Proc Neg Lmt : Process PID Negative Limit Setting

WEB_39 Proc Pos Lmt and WEB_40 Proc Neg Lmt are the upper and lower limits of the final output of Process PID controller. WEB_39 Proc Pos Lmt sets the (+) limit of PID controller output value, while WEB_40 Proc Neg Lmt sets (-) limit of PID controller output value. This function expresses the PID controller output in % value. For example, if error is 100[%] and P Gain of PID controller is set as 200[%], the output of PID controller before restricted becomes

200[%]. If the upper limit of PID controller is set as 100[%], however, the final output of PID controller becomes 100[%].

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_39	Proc Pos Lmt	Process PID Positive Limit	-100.0 ~ 100.0	%	100.0
WEB_40	Proc Neg Lmt	Process PID Negative Limit	-100.0 ~ 100.0	%	-100.0

14) WEB_41 PID Out LPF : Process PID output LPF

This function sets LPF time constant against the process PID controller final output value. As the time constant increases, the responsiveness of PID controller output gets slower, but its stability increases.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_41	PID Out LPF	Process PID output LPF	0.00 ~ 100.00	sec	1.00

15) WEB_42 PIDOGainRe : Rewind-use Process PID Output Gain

16) WEB_43 PIDOGainUn : Unwind-use Process PID Output Gain

This function sets the final output gain of Process PID controller. You may set WEB_42 PIDOGainRe in case of winding the web , that is, when setting “Rewind” in WEB_17 Re/Un Wind. On the contrary, you may set WEB_43 in case of unwinding the web, that is when setting “Unwind” in WEB_17 Re/Un Wind. The set value is the [%] value against the maximum line speed command. For example, if you set WEB_44 PID Type to “Fixed” and PID output Gain to 10[%] where the line speed command is 50[%], the final line speed command becomes 60[%]. In case the set value of PID output Gain is (-), PID controller operates in reverse direction. This is useful in the sensor in inverse proportion. For example, if the highest pressure falls under the 0[V] voltage of loadcell and the final pressure falls under 10[V] voltage of loadcell, you may use it by setting PID output Gain as (-) value.

In case of Process PID control, if the line speed command is 0 where PID output is in minus value, the motor may rotate in reverse direction. To avoid this, iV5 is programmed in such manner that it cannot be operated in reverse direction when the PID output is larger than the line speed command in internal S/W.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_42	PIDOGainRe	Rewind-use Process PID Output Gain	-250.0 ~ 250.0	%	0.0
WEB_43	PIDOGainUn	Unwind-use Process PID Output Gain	-250.0 ~ 250.0	%	0.0

17) WEB_44 PID Type : PID Controller Type Setting

18) WEB_45 Min FPID : Minimum PID Output Setting

In this function, there are two (2) types of Process PID controllers. If WEB_44 PID Type is set to “Fixed”, a certain value of PID controller is output regardless of the line speed command. That is, the final line speed command is the sum of line speed command and PID output. For example, if the line speed command is 50[%] and PID output is 10[%], the final line speed command becomes 60[%]. If the line speed command is changed from 50[%]

to 60[%], the final line speed command becomes 70[%].

A. When WEB_44 PID Type is “Fixed”, the final line speed command is;

Final Line Speed Command [%] = Line Speed Command [%] + PID Output [%]

When WEB_44 PID Type is set to “Proportional”, PID output is generated in proportion with the line speed command. That is, the final line speed command is the sum of line speed command and the PID output in proportion with the line speed command. For example, if the speed command is 50[%] and PID output is 10[%], the final line speed command becomes 55[%]. In this case, the line speed command is larger than the set value of WEB_45 Min FPID.

B. When WEB_44 PID Type is “Proportional”, the final line speed command (in case of line speed command > WEB_45 Min FPID) is;

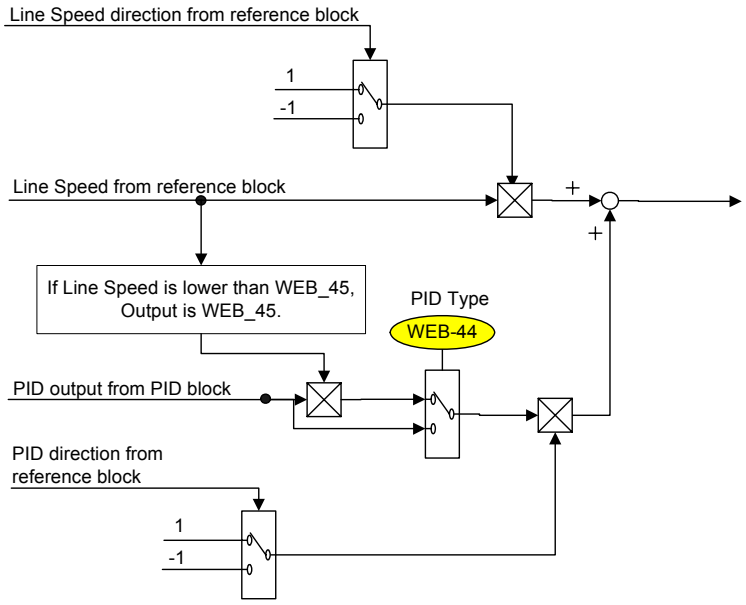
$$\textbf{Final Line Speed Command [\%]} = \textbf{Line Speed Command [\%]} + \frac{\textbf{PID Output [\%] x Line Speed Command [\%]/100}}{100}$$

In case of initial operation, the system should maintain the tension of web starting with initial web tension and 0[%] speed command in possession. In the above formula, if the line speed command is 0[%], the final line speed command becomes 0[%], where the tension of web cannot be maintained. Accordingly, to maintain the tension of web, if the line speed command is less than WEB_45 Min FPID, the final line speed command under the following formula can be applied.

C. When WEB_44 PID Type is “Proportional”, the final line speed command (In case of line speed command < WEB_45 Min FPID) is;

$$\text{Final Line Speed Command}[\%] = \text{Line Speed Command}[\%] + \frac{PID\ \text{Output}\ [\%] \times WEB_45}{100}$$

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_44	PID Type	PID Controller Type Setting	0 (Proportional) 1 (Fixed)		0 (Proportional)
WEB_45	Min FPID	Minimum PID Output Setting	0.0 ~ 50.0	%	10.0



PID Type Block Diagram

19) WEB_46 PIDHoldTime : PID controller Maintenance Time after Hold

In case of Inverter Hold Command, the motor speed is reduced to 0. In case the output deviation of Process PID controller exists, the motor is operated by the deviation of PID output. To avoid this, this is the function where it conducts PID operation for the period of time set to WEB_46 PIDHoldTime, and then the motor carries out free run and stops by the friction force of the system. If the output of Process PID is 0, the motor stops regardless of the time set to WEB_46 PIDHoldTime.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_46	PIDHoldTime	PID Controller Maintenance Time after Hold	0.0 ~ 100.0	sec	5.00

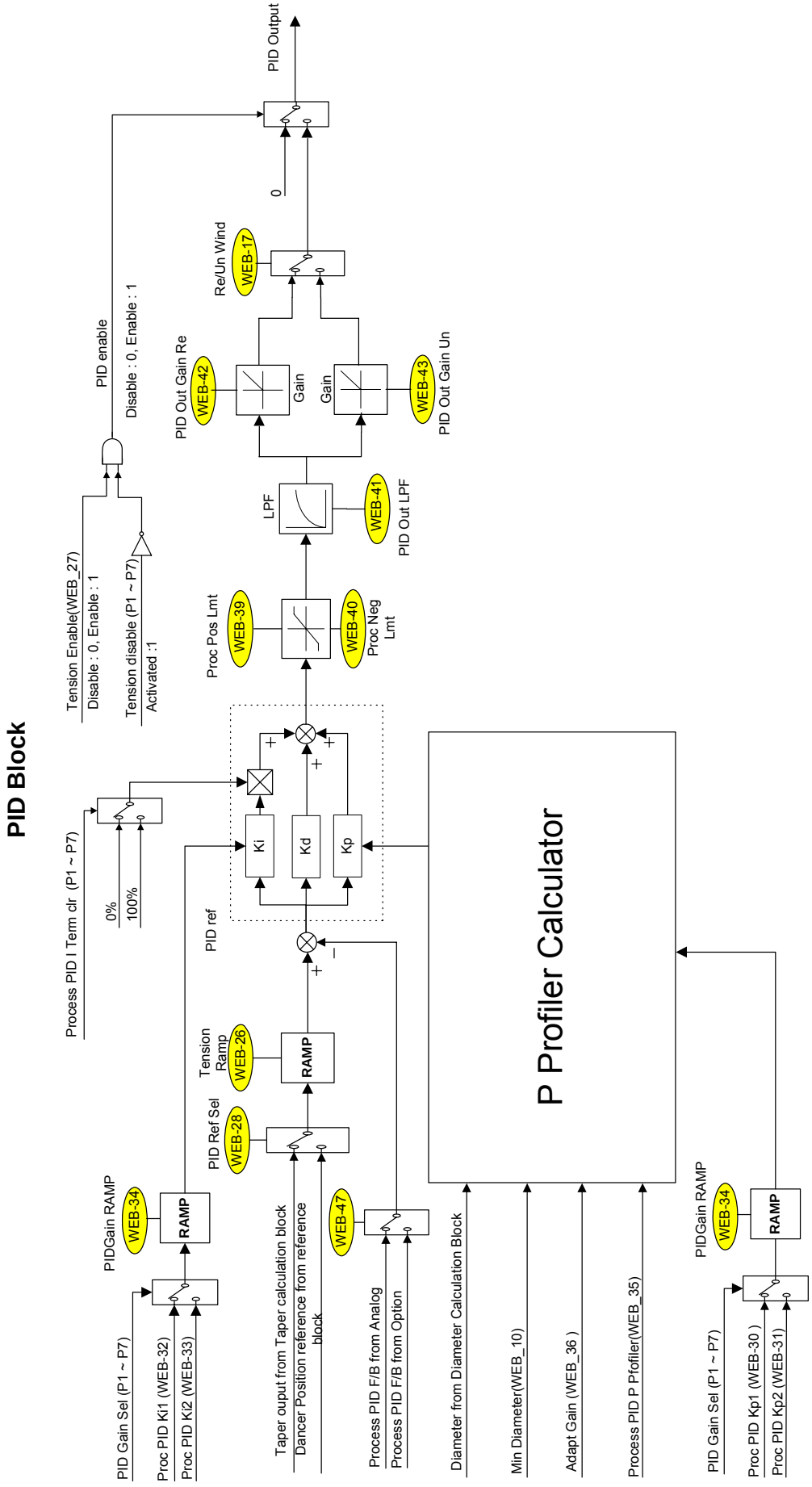
20) WEB_47 PID F/B Src : Process PID Feedback Source Setting

WEB_47 PID F/B Src is the function where the feedback source is set when Process PID controller is used. When set to “Analog”, the definition of analog input terminal (AIO_01, AIO_13, AIO_25) is set to “Tension F/B”, and such amount of feedback is input to the inverter. In this case, the amount of feedback is “0” unless the terminal is defined . In case set to “Option”, it is to input the amount of feedback to inverter through communication. In this case, the amount of feedback is “0” unless such value is input.

In case of setting to “Option”, please conduct communication cycle not exceeding 10[ms].

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_47	PID F/B Src	PID Feedback Source	Analog Option		Analog

PID Block



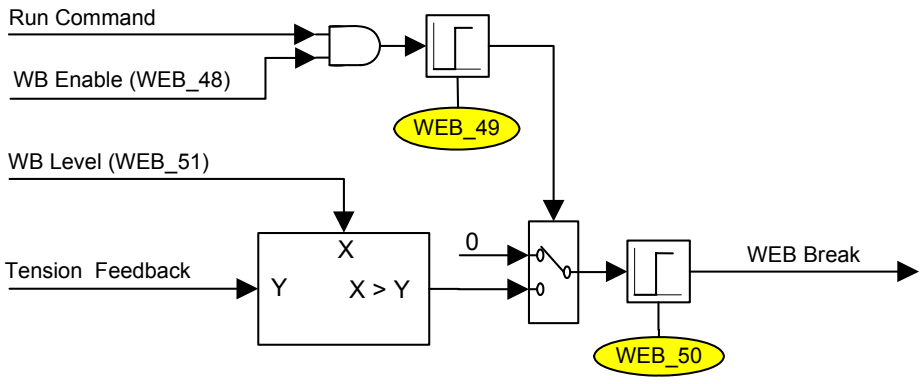
Process PID Block Diagram

7.7.9 WEB Break Setting

1) **WEB_48 WB Enable : WEB Break Detection Function Setting**
2) **WEB_49 INV WB Delay : Setting of Delayed Time until WEB Break Detection after Inverter Operation**
3) **WEB_50 WB Delay : Delayed Time in WEB Break Detection**
4) **WEB_51 WB Level : WEB Break Detection Level**

In the web control mode, the web is broken if it has tension it can bear. In this case, if the system continues the web control without such breakage of the web detected, it may cause more serious accident. Accordingly, the inverter is set so as to force the output of PID controller to be "0" when the web breakage is detected, when the diameter computation is not carried out. Furthermore, if one of multi-function output DIO_41 AX1 Define ~ DIO_43 OC1 Define of the inverter is set to "WEB Break", it lets out the output contact point showing the state of "'breakage". In WEB_48 WB Enable mode, you can set WEB Break Detection function. If it is set to "Yes", please set the multi-function output and conduct its connection so that the higher-level controller can receive the output. In case of WEB_49 INV WB Delay, for a certain period of time from the moment the inverter received the operation command, it has lower value of tension feedback, and accordingly it can be misjudged as web break. This is the function, for such situation, not to detect the web break for a certain period of time set in WEB_49 INV WB Delay since the moment the inverter has started the operation. There exists a number of noises in the actual site, and because of such external factor, the amount of feedback less than the set value can be posted at some moment in WEB_51 WB Level, which can be judged as WEB Break. Therefore, WEB_50 WB Delay sets WEB Break Detection Delayed Time. WEB_51 WB Level is the code to set WEB Break Detection Level where the amount of tension feedback is set in [%] value.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_48	WB Enable	WEB Break Detection Function Setting	No Yes		No
WEB_49	INV WB Delay	Delayed Time until Web Break Detection after Inverter Operation	0.1 ~ 600.0	sec	1.0
WEB_50	WB Delay	Delayed Time in WEB Break Detection	0.1 ~ 600.0	sec	1.0
WEB_51	WB Level	WEB Break Detection Level	0.0 ~ 100.0	%	0.0



WEB Break Block Diagram

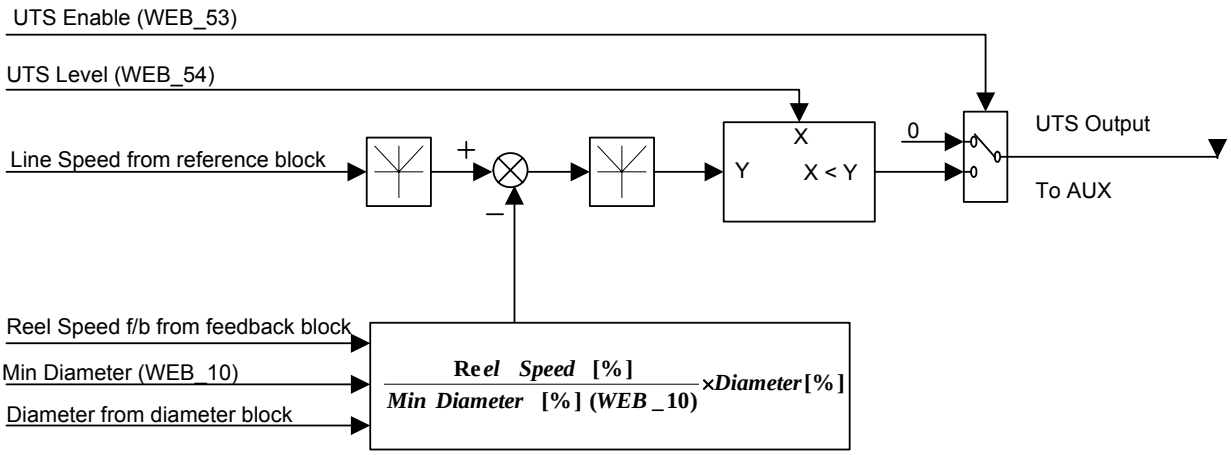
7.7.10 Up to Speed Setting

1) WEB_52 UTS Enable : Up to Speed Judgment Setting

2) WEB_53 UTS Level : Up to Speed Level Setting

When Web control is operates in smooth manner, the line speed command is almost similar to the actual line speed. It is because Process PID controller operates reducing such deviation when there occurs the deviation between line speed command and actual line speed. However, too quick line speed command, problem of the motor or mechanical problem can lead to the discrepancy of the line speed command. This may cause serious problem to the system. WEB_52 UTS Enable and WEB_53 UTS Level are the functions to judge such situations. If the deviation between line speed command and actual line speed is larger than WEB_53 UTS Level, and one of multi-function output DIO_41 AX1 Define ~ DIO_43 OC1 Define is set to "Up to Spd", it can be acknowledged when you let out the output contact point. WEB_53 UTS Level is the [%] value against the line speed command. It has 2[%] Band to avoid chattering. **If the set value of WEB_53 UTS Level is too low, fault operation may happen by the excessive state even near the set level.**

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_52	UTS Enable	Up to Speed Judgment Setting	No Yes		No
WEB_53	UTS Level	Up to Speed Level Setting	0.0 ~ 100.0	%	0.0



. Up to Speed Block Diagram

7.7.11 WEB_54 Quick Stop : Quick Stop Time Setting

It is the function where emergency stop is available when the emergency occurs during sequential operation. If the multi-function input terminal (DIO_01 ~ DIO_07) set to "Quick Stop" is On, it conducts emergency stop maintaining the tension of web for the same deceleration time regardless of the current motor rotating speed, that is, the period of time set to WEB_54 Quick Stop. Even after it completely stopped, the tension of the web is still kept. For example, if the winder roll speed is 170[rpm] and the gear ratio is 10:1, the motor rotating speed is 1700[rpm]. If unwinder

roll speed is 140[rpm] and the gear ratio is 11:1, the motor rotating speed is 1540[rpm]. In this case, if the set value of WEB_54 Quick Stop of such two inverters is 5[sec], it stops after 5[sec] although the rotating speed of two motors are not same where the multi-function input terminal (DIO_01 ~ DIO_07) set to "Quick Stop" is On.

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_54	Quick Stop	Quick Stop Time Setting	0.0 ~ 100.0	sec	1.0

7.7.12 WEB Jog Setting

1) WEB_55 JogSpd Web : Jog Speed Setting

2) WEB_56 JogTime Sel : Jog Acceleration/Deceleration Time Setting Select

3) WEB_57 JogAcc Time : Jog "Acceleration Time Setting

4) WEB_58 JogDec Time : Jog Deceleration Time Setting

If the multi-function input (DIO_01 ~ DIO_07) set to "Jog Web" is On, Process PID controller operates, but doesn't conduct diameter computation. In this case the set value of WEB_55 JogSpd Web is calculated in % of WEB_08 MaxMotor SPD, deciding the motor rotating speed. For example, if the set value of WEB_08 MaxMotor SPD is 300[rpm] and the jog speed set to WEB_55 JogSpd Web is 20[%] where the multi-function input (DIO_01 ~ DIO_07) set to "Jog Web" becomes O, the motor rotating speed is 60[rpm]. In case of jog operation, the jog can set the Acceleration/Deceleration Time instead of the basic Acceleration/Deceleration Time (FUN_40 Acc Time-1, FUN_41 Dec Time-1). When WEB_56 JogTime Sel is set to "No", the basic Acceleration/Deceleration Time is applied during jog operation mode, while when set to "Yes", WEB_57 JogAcc Time and WEB_58 JogDec Time are applied during jog operation mode.

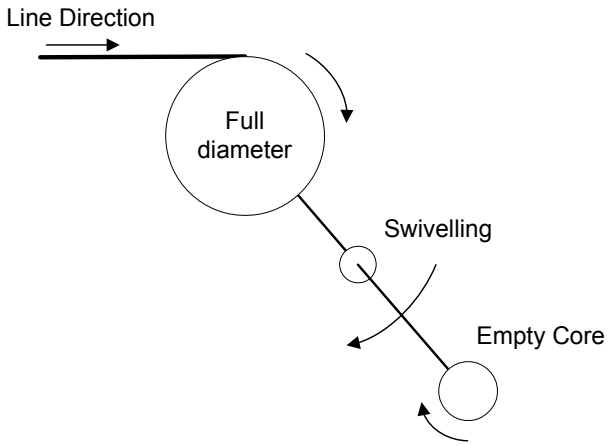
Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_55	JogSpd Web	Jog speed Setting	0.0 ~ 100.0	%	10.0
WEB_56	JogTime Sel	Jog Acceleration/Deceleration Time Setting Select	No Yes		Yes
WEB_57	JogAcc Time	Jog Acceleration Time	0.00 ~ 6000.0	sec	5.00
WEB_58	JogDec Time	Jog Deceleration Time	0.00 ~ 6000.0	sec	5.00

7.7.13 Splicing Level Setting

In the splicing system, the winder core should be replaced without any change in line speed command. When splicing, the process PID controller doesn't operate in the empty core. Therefore, the multi-function input terminal (DIO_01 ~ DIO_07) set to "TensionDisable" should be On. The splicing function doesn't operate during jog operation. In case the web is wound in new core in the winder, sudden load change occurs. Such sudden change in load makes the speed slower, which causes low tension of web, and finally the web becomes drooped. To avoid such phenomenon, you may operate it at higher speed than the line speed command in splicing state. WEB_59 Splice Level is the [%] value for the line speed command. For example, if the line speed command is 50[m/m], and the set value of WEB_59 Splice Level

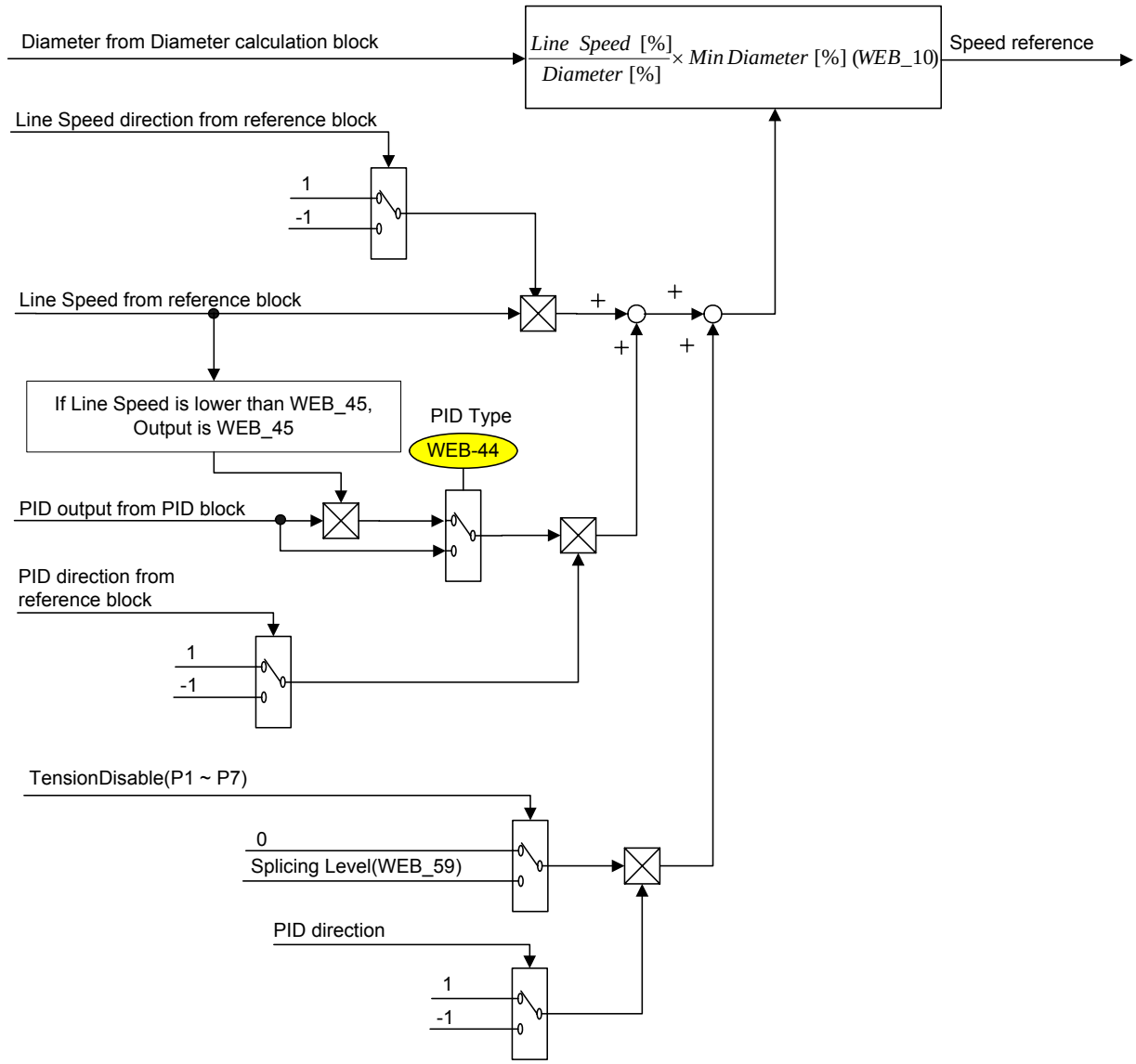
is 10[%], the final line speed command of the empty core at the time of splicing operation becomes 55[m/m].

Function Code	Loader Display	Name of Function	Set Range	Unit	Factory Default
WEB_59	Splice Level	Splicing Level Setting	0.0 ~ 100.0	%	0.0



Splicing Operation Status Diagram

Speed Calculator



Line Speed Command Block Diagram

Chapter 8 –Inspection and Replacement

LS Vector Inverter, STARVERT-iV5, is an industrial electronic product that adopts up-to-date semiconductor device. It may have a failure caused by the ambient environment such as temperature, humidity, vibration, etc. or an excessive use of the component over its duration. It requires a routine checking to prevent such failure in advance.

8.1 Precautions

⚠ CAUTION

- Before starting the maintenance work, the operator must check out the power input of the inverter.
- Large-capacity electrolytic condenser in the power electronic circuit remains charged with power even after the power is off. So be sure to start the maintenance work after you acknowledged the power has been completely discharged using a proper tester.
- Be sure to use a rectifier type volt meter to obtain an accurate voltage when directly measuring the output voltage of inverter. General volt meter or digital volt meter may result in spurious operation or indicate wrong value due to high frequency PWM output voltage of the inverter.

8.2 Checking Points

Electronic product is not intended for a permanent use. When it exceeds the duration even under the normal service environment, the product may have trouble in its operation due to change in the nature of the parts. To prevent such circumstance, it requires a routine and regular checking.

Especially if you use it under the following environment, have it checked with a shorter interval than the regular checking.

- When the temperature is relatively high in the installed place
- When the product is operated with a frequent start and stop
- When the input AC power and load vary seriously
- When it has severe vibration or shock
- When there is corrosive gas, combustible gas, oil sludge, dust, salts, metal powder, etc

⚠ CAUTION

- The failure of the device used in the inverter may not be predicted in advance. The failure of the device may cause the error of input power fuse or the fault trip. If you are suspicious of the failure of device, please contact our sales representative.

8.3 Rountine Checking

Area	Checking points	Description	How to Check	Judgment Criterion	Instrument
Main circuit	Entire system	1) Megger checking (between the main circuit terminal and ground terminal) 2) Isn't any fixed area missing? 3) Isn't there any trace of overheat on each component?	1) Unfasten the connection of inverter, connect R, S, T, U, V, and W terminals, and then measure the gap between this area and the ground terminal using a megger. 2) Fasten the screws. 3) Check it visually	1) To be 5MΩ or more There must be no unusual result from 2) and 3)	DC 500V Class Megger
	Conductor /Wire	1) Isn't there any corrosion on the conductor?2) Isn't there any damage to the wire sheath?	1) Switch the power Off and then turn it with a hand. 2) Fasten it once again.	1) Rotate it softly 2) There must be no unusual record	-
	Terminal block	Isn't it damaged?	Check by eyes.	There must be no unusual record	-
	Flat condenser	Measure the electrostatic capacity	Measure using the capacity meter.	85% or more of the rated capacity	Capacity meter.
	Relay	1) Isn't there any chattering sound? 2) Isn't there any damage to the contact point?	1) Check by ears. 2) Check by eyes.	There must be no unusual record	-

Area	Checking points	Description	How to Check	Judgment Criterion	Instrument
	Resistance	1) Isn't there any damage to the insulation resistance? 2) Check the existence of the clue	1) Check by eyes. 2) Remove the connection at one side, and measure it using a tester.	1) There must be no unusual record 2) It should be within ±10% tolerance range	Digital Multi-Meter/Analog Tester
	Diode, IGBT	Check if they are stained with trash or dust	Check by eyes.	Remove them by blowing a dry air.	-
	Circuit Board	1) Check if they generate unusual smell are discolored, rusted, covered with dust or oil mist 2) Check if the connector is mounted	Check by eyes	1) Clean it using anti-static cloth or cleaner. If not, replace with new circuit board 2) Do not clean the circuit board using the solution. 3) Remove trash or dust by blowing a dry air. 4) Mount the connectors again. 5) If the damaged area cannot be repaired or is the part that cannot be replaced, replace the inverter itself.	-
Control circuit protecting circuit	Operation	1) Check the unbalance of the output voltage during the operation of inverter 2) Display circuit must not have any unusual phenomenon after the sequence protecting operation test is done	1) Measure the voltage among the U, V, and W at the Inverter output terminal. 2) Have the inverter protecting circuit output shorted out or open it by force.	1) Balance of inter-phase voltage 200V (400V) Use: Within 4V(8V) 2) Unusual circuit to be operated in sequence	Digital Multi-Meter/ DC type Volt Meter
Cooling System	Cooling fan, Cooling pin	1) Isn't there any looseness on the junction? 2) Isn't cooling pin or cooling fan covered with dust	1) Fasten it once again. 2) Check with eyes and then remove dust	1) There must be no unusual record 2) There must be no dust	-

Area	Checking points	Description	How to Check	Judgment Criterion	Instrument
Indicator	Meter	Is the indicator value normal?	Check the indicator value on the display of the panel surface.	Check the value under the regulation and standard value	Volt Meter/ Current Meter, etc.

8.4 Regular Checking (1 year interval)

Area	Checking points	Description	How to Check	Judgment Criterion	Instrument
Main circuit	Entire system	1) Megger checking (between the main circuit terminal and ground terminal) 2) Isn't any fixed area missing? 3) Isn't there any trace of overheat on each component?	1) Unfasten the connection of inverter, connect R, S, T, U, V, and W terminals, and then measure the gap between this area and the ground terminal using a megger. 2) Fasten the screws. 3) Check it visually	1) To be 5MΩ or more There must be no unusual result from 2) and 3)	DC 500V Class Megger
	Conductor /Wire	1) Isn't there any corrosion on the conductor?2) Isn't there any damage to the wire sheath?	1) Switch the power Off and then turn it with a hand. 2) Fasten it once again.	1) Rotate it softly 2) There must be no unusual record	-
	Terminal block	Isn't it damaged?	Check by eyes.	There must be no unusual record	-
	Flat condenser	Measure the electrostatic capacity	Measure using the capacity meter.	85% or more of the rated capacity	Capacity meter.
	Relay	1) Isn't there any chattering sound? 2) Isn't there any damage to the contact point?	1) Check by ears. 2) Check by eyes.	There must be no unusual record	-

Area	Checking points	Description	How to Check	Judgment Criterion	Instrument
	Resistance	1) Isn't there any damage to the insulation resistance? 2) Check the existence of the clue	1) Check by eyes. 2) Remove the connection at one side, and measure it using a tester.	1) There must be no unusual record 2) It should be within ±10% tolerance range	Digital Multi-Meter/Analog Tester
	Diode, IGBT	Check if they are stained with trash or dust	Check by eyes.	Remove them by blowing a dry air.	-
	Circuit Board	1) Check if they generate unusual smell are discolored, rusted, covered with dust or oil mist 2) Check if the connector is mounted	Check by eyes	1) Clean it using anti-static cloth or cleaner. If not, replace with new circuit board 2) Do not clean the circuit board using the solution. 3) Remove trash or dust by blowing a dry air. 4) Mount the connectors again. 5) If the damaged area cannot be repaired or is the part that cannot be replaced, replace the inverter itself.	-
Control circuit protecting circuit	Operation	1) Check the unbalance of the output voltage during the operation of inverter 2) Display circuit must not have any unusual phenomenon after the sequence protecting operation test is done	1) Measure the voltage among the U, V, and W at the Inverter output terminal. 2) Have the inverter protecting circuit output shorted out or open it by force.	1) Balance of inter-phase voltage 200V (400V) Use: Within 4V(8V) 2) Unusual circuit to be operated in sequence	Digital Multi-Meter/ DC type Volt Meter
Cooling System	Cooling fan, Cooling pin	1) Isn't there any looseness on the junction? 2) Isn't cooling pin or cooling fan covered with dust	1) Fasten it once again. 2) Check with eyes and then remove dust	1) There must be no unusual record 2) There must be no dust	-
Indicator	Meter	Is the indicator value normal?	Check the indicator value on the display of the panel surface.	Check the value under the regulation and standard value	Volt Meter/ Current Meter, etc.

8.5 Regular Checking (2 year interval)

Area	Checking points	Description	How to Check	Judgment Criterion	Instrument
Main circuit	Entire system	Megger Checking (between the main circuit terminal and the ground terminal	Unfasten the connection of the inverter, and then measure the gap among R, S, T, U, V, and W terminals and this area after having them shorted out.	5MΩ or more	DC 500V Class Megger
Motor	Resistance Insulation	Megger checking (between the output terminal and the ground terminal)	Unfasten the connection among U, V, and W, and then bind the motor wiring.	5MΩ or more	500V Class Megger

8.6 Meggar Test

① For Exterior main circuit, remove all cables from inverter terminals to ensure that test voltage is not applied to the inverter.

② Use DC 500V meggar and isolate the main power before starting measurement. If the test voltage is connected to the control circuit, remove all connection cables to the control circuit.

③ Perform the Meggar test only between the common cables connected to the main circuit and ground.

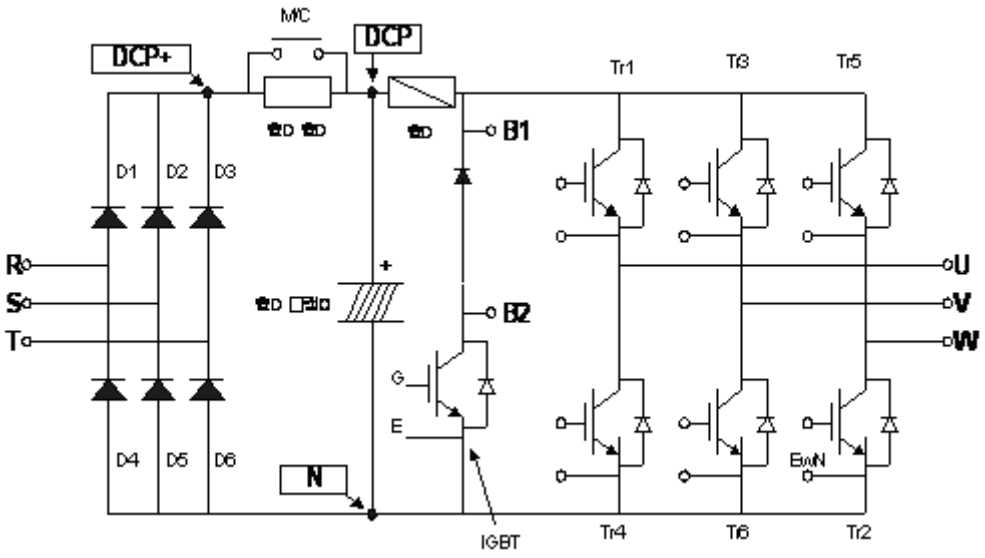
8.7 Replacement Interval and Maintenance of the Key Components

Inverter constitutes a number of electronic parts including semiconductor device. The parts used in the inverter are subject to change as time elapses for its construction or nature. Therefore without any replacement of parts, it may cause failure or deterioration in the performance the inverter. For this reason, it requires regular replacement of the parts.

Name of parts	Standard interval for replacement	Symptoms	How to Replace and Countermeasure
Cooling Fan	2 ~ 3 years	Poor Rotation	Replacement into new part
DC Link condenser	5 years	Reduction in Capacity	Replacement into new part
Control Panel Flat Condenser	5 years	Reduction in Capacity	Replacement into new part
Control Board Relay	-	Poor Operation	Replacement into new part
Braking Resistance	-	Reduction in Capacity	Replacement into new part

- Duration of the key components is based on the continuous operation at a rated load. Therefore the duration is subject to change depending on the service condition and ambient environment.

8.8 How to Check at Diode Module & IGBT Inspection



1. Remove the power source wire (R, S, T) and the motor output wire (U, V, W) connected from the outside
2. Check and determine whether R, S, T, U, V, W, B1 (or P/L1), N of the inverter terminal block are turned on or not by changing the polarity of the tester between each other.
3. Perform the test after making sure that the electrolytic condenser is discharged.
4. When they are not turned on, they will indicate several mega resistance values. It may indicate several mega resistance values when it is turned on for a moment owing to the influence of electrolytic condenser. When they are turned on, it indicates several Ω ~ dozens of Ω. The indicator value varies depending on the type of module, the type of tester, etc., but such values are shown in a similar range when it is sound product.

Chapter 9 – Troubleshooting and Maintenance

9.1 Fault Display

⚠ CAUTION
When a fault occurs, the inverter turns off its output and displays the fault status described below. In this case, the cause must be corrected before the fault can be cleared. If protective function keeps active, it could lead to reduction in product life and damage to the equipment.

Protective function	Keypad display	Type	Description
Over Current	OC-U OC-V OC-W	Latch	The inverter turns off its output when the output current of the inverter flows more than 200% of the inverter rated current.
Ground Fault Protection	Ground Fault	Latch	The inverter turns off its output when a ground fault occurs and the ground fault current is more than the internal setting value of the inverter. Over current trip function may protect the inverter when a ground fault occurs due to a low ground fault resistance
Over voltage protection	Over Voltage	Latch	The inverter turns off its output if the DC voltage of the main circuit increases higher than the rated value (200V class: 400V DC, 400V class: 820 V DC) when the motor decelerates or when regenerative energy flows back to the inverter due to a regenerative load. This fault can also occur due to a surge voltage generated at the power supply system.
Low Voltage Protection	Low Voltage	Level	The inverter turns off its output if the DC voltage is below the detection level because insufficient torque or over heating of the motor can occurs when the input voltage of the inverter drops.
Overload Protection	Over Load	Latch	The inverter turns off its output if the output current of the inverter flows at 180% of the inverter rated current for more than the current limit time (S/W).
Inverter Overload	Inv OLT	Latch	The inverter turns off its output when the rated current of the inverter flows more than regulation level(150% for 1 minute-Inversely proportional to time).
Heat Sink Over Heat	InvOver Heat	Latch	The inverter turns off its output if the heat sink over heats due to a damaged cooling fan or an alien substance in the cooling fan by detecting the temperature of the heat sink.
	OHD Open *1)	Latch	The inverter turns off its output when OHD is opened and the heat sink is overheated.
Inverter NTC Thermistor Open	InvThem OP	Latch	When inverter NTC Thermistor is open, inverter stops its output.
Motor overheat	MotOver Heat	Latch	When motor temp exceeds 150℃ , inverter stops its output to protect motor from overheated.
Motor Thermistor Error	MotThem Err	Latch	When there is an error in Thermistor that measures the temperature of motor, inverter stops its output. (Error—NTC: open , PTC: short-circuit)
Electronic Thermal	E-Thermal	Latch	The internal electronic thermal of the inverter determines the over heating of the motor. If the motor is overloaded the inverter turns off the output. The inverter cannot protect the motor when driving a multi-pole motor or when driving multiple motors, so consider thermal relays or other thermal protective devices for each motor. Overload capacity: 150% for 1 min.
External fault B	Ext Trip-B	Latch	Use this function if the user needs to turn off the output by an external fault signal.

***1) It only comes under SV2800 ~ 5000iV5.**

Protective function	Keypad display	Description
IGBT Short	Arm Short-U Arm Short-V Arm Short-W Arm Short-DB	Inverter output is stopped when IGBT Arm short or output short occurs. (Arm Short-DB is only come under SV110~220iV5) (SV2800~3750iV5 are displayed as ArmShort without reference to UVW phases.)
Fuse Open	Fuse Open	The inverter turns off its output by opening the fuse when something is wrong with the main circuit IGBT to protect the wiring from being damaged from short currents
Encoder Error	Encoder Err	1) Displayed when Encoder signal fault occurs.(H/W) 2) Displayed when there is a discord of detection time standard of motor error of PAR-14.(S/W)
BX protection (Instant Cut Off)	BX	Used for the emergency stop of the inverter. The inverter instantly turns off the output when the BX terminal is turned ON, and returns to regular operation when the BX terminal is turned OFF. Take caution when using this function.
Motor overspeed	Over Speed	Displayed when motor rotates over 120% its rated speed.
Communication Error	COM Error CPU Error	This fault is displayed when the inverter cannot communicate with the keypad.
H/W Error	HW- Diag	Displayed when CPU has a problem, and then the inverter blocks the IGBT gating signals.
FAN Lock*1)	FAN Lock	The inverter turns off its output when there is an Fan Lock.
Encoder PowerError*1)	Enc Power	When there is an error in Encoder power source, the inverter turns off its output.
AC FAN and M/C Poower Error	FAN/ MC PWR	Displayed when Step-down transformer for power input of AC FAN or Input fuse of transformer have an error. (AC input type 30 ~ 160 kW)
		The inverter turns off its output to prevent from damage when AC220V is not supplied to AC FAN and M/C. (DC input type 30 ~ 160 kW)
AC FAN Power Error	FAN PWR	Displayed when Step-down transformer for power input of AC FAN or Input fuse of transformer have an error. (AC input type 220 kW)
		The inverter turns off its output to prevent from damage when AC220V is not supplied to AC FAN and M/C. (DC input type 220 kW)

***1) It only comes under SV2800~5000iV5.**

9.2 Monitoring Fault Condition

9.2.1 Monitoring fault display

Code	LCD display	Description
DIS_05	OC-U	Current fault displayed. (U-phase overcurrent)

- Check the current fault display before pressing reset key. pressing [PROG] key and [▲(Up)],[▼(Down)] shows operating status at the time of the fault such as output frequency, current, voltage, F/B value, torque current reference/actual value, dc link voltage, input/output terminal status, operating status and run time) and the fault contents. Press [ENT] key to exit. Pressing [RESET] key will store the value in DIS_05 [Last Fault1].

9.2.2 Monitoring previous faults

- Previous 2 faults are saved in DIS_05 “Last fault 1/2“. Last fault 1 is more recent fault than Last fault 2. Refer to “8.2.1 monitoring fault display” to check the fault contents.

Code	LCD display	Description
DIS_05	Last Fault1	Previous fault 1
DIS_05	Last Fault2	Previous fault 2

- DIS_05 “ Fault Clear” removes Last Fault1, Last Fault2 data. It becomes the value of factory defualt.

9.3 Fault Reset

There are 3 ways to reset the inverter. After performing this, the number of automatic restart is initialized.

1) Use [RESET] key on the keypad.
2) Short the RST-CM terminal to reset.
3) Cycle the power (turn the power OFF and turn it ON).

9.4 Fault Remedy

9.4.1 Check the below diagnosis before troubleshooting.

1) Is the wiring of a motor and an inverter conducted correctly?

   ☞ Refer to Main Circuit Terminal

2) Is the Encoder-type jumper on I/O PCB set correctly?

   ☞ Refer to Encoder wiring

   If encoder type is either Complementary or Open collector, slide JP4 switch to “OC” and slide JP2 switch to “P15”. If encoder type is Line Drive, slide the JP4 switch to “LD” and slide JP2 switch to “P5”.

   Factory default: Line Drive Type

3) Is motor rotating direction set correctly?

   ☞ Refer to Monitoring Encoder operation. (Refer to 4-10p.)

   STARVERT-iV5 defines Forward rotation when motor rotates in clockwise from the view of Rear Bracket (Motor FAN).

4) Is inverter operating correctly in no load condition?

   ☞ Refer to Operation via Keypad and Control Terminal

9.4.2 Check list before installation

Check (1) ~ (9) before installation. Check (10) ~ (16) when problem has occurred during use.

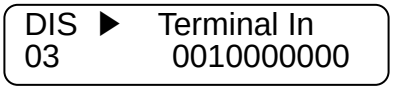
1) The Motor Does Not Rotate

① Is red lamp blinking ?

☞ Check whether other trips occur in DIS_05.

If fault occurs, press [RESET] key to clear trip status and try operation.

☞ Check whether BX (Emergency stop) signal is applied on keypad and input terminal defined as BX is ON in DIS_03. If so, release BX and try operation.



② RUN/STOP method is properly set ?

☞ Check FUN_01 RUN/STOP method setting matches the actual operation mode(RUN/STOP via keypad or terminal). If FUN_01 is set to terminal but operation is not performed, change it to keypad mode and try operation. If FUN_02 is set to Keypad but operation is not performed, change it to Terminal and try operation. If either way cannot work, refer to (6).

2) The motor does not rotate when Green lamp on [REV], [FWD] key is ON.

① Is inverter U, V, W output correctly wired to motor U, V, W output?

☞ Refer to Main circuit terminal

② Is the motor shaft jammed by brake or other mechanical devices?

☞ check the directly connected brake's relay on time and brake open time.

③ On DIS_01 PreRamp Ref, is speed reference displayed not "0"?

☞ set the desired speed reference if it is set to "0". If it is incorrectly set, refer to (7).

④ Is PAR_07 [motor rating] properly set?

☞ check the motor nameplate and setting matches.

⑤ Is PAR_17 [motor speed] properly set?

☞ check the motor nameplate and setting matches.

⑥ Is PAR_22 [motor rated current] properly set?

☞ check the motor nameplate and setting matches.

⑦ Is PAR_26 [motor flux current] properly set?

☞ If LG-OTIS vector motor is not used, consult LS representative or set the correct value in accordance with application. However, it cannot set to exceed PAR_22 [motor rated current]. Normally it is 30~40 % of rated motor current.

⑧ Is PAR_21 [motor rated slip] properly set?

☞ check the motor nameplate and setting matches.

⑨ Is PAR_27 [Motor secondary time constant (Tr) properly set?

☞ if motor is not LG-OTIS vector motor, perform the Auto-tuning or set this correctly. If it is incorrectly set, inverter performance will be dramatically deteriorated.

⑩ Is PAR_19 [number of motor poles] properly set?

☞ check the motor nameplate and setting matches.

⑪ CON_28 [Torque limit setting] is set to " Kpd Kpd Kpd ". Is CON_29 ~ CON_31 setting correct?

☞ CON_29 ~ CON_31 marks upper limit in inverter output torque. For the application lower torque limit is required, when torque shortage occurs, increase this value a little. STARVERT-iV5 's overload capacity is 150%/1 min. when using torque limit over 150%, time and the number of use should be limited.

⑫ When CON_28[torque limit setting] Analog or Option, the corresponding input value is properly set?

☞ CON_28 is set to Analog, one of Ai1/Ai2/Ai3 should be defined as "Torque limit". If set to Option, refer to Option manual for proper setting.

3) Motor speed is not increasing while it is running.

① Is PAR_10 [number of Encoder pulse] set properly?

☞ factory default is 1024. If it is not OTIS vector motor, contact with Encoder maker.

② FUN_01 is set to “Keypad”,FUN_02 to “Keypad1”, FUN_12(Speed 0) to 100.0rpm and press [FWD] key but motor speed is not 100.0rpm. In this case, check for encoder wiring.

☞ If encoder wiring is disconnected or switched, it rotates only uni-direction with low speed (30.0 ~ 60.0rpm) and over 150% its rated current. Check the encoder wiring and whether wiring of defined terminal and motor encoder terminal is shorted.

③ If motor speed does not increase and keeps abnormally 30.0 ~ 60.0 rpm, stop the motor and switch the wiring of A and B phase of Encoder. Check whether motor rotating direction is reversed as seen in (4).

☞ In the case of Line Drive type encoder, wire A+, A- phase to B+, B- and B+, B- phase to A+, A-. Complementary / for the case of Open Collector type encoder, reverse the wiring of PA and PB.

Or switch the encoder direction in **PAR 11 (Enc Dir Set) and try RUN.**

4) Motor rotates in reverse direction.

☞ Switch the wiring of output phase V and W. Switch the wiring of encoder phase A and B as indicated in (3).

Or switch the encoder direction in PAR_11(Enc Dir Set) and try RUN.

5) Motor rotating direction cannot be changed.

① Is RUN/STOP setting proper?

☞ Check FUN_01 RUN/STOP command setting matches the actual operating mode. If FUN_01 is set to Terminal (Keypad) but operation cannot be made, change it to Keypad (Terminal). If it does not work, refer to ‘6) Keypad or terminal malfunctions’.

② Is one of the terminal defined as FWD/REV Run Disable ON?

☞ Check one of DIO_01 ~ DIO_07 terminals is defined as “Prohibit FWD” or “Prohibit REV”. If so, check input terminal status in DIS_01 ~ DIS_03. If rotating direction is not changed, check the terminal is ON.

6) Keypad or terminal malfunctions.

① When [REV], [FWD], [STOP] key on the keypad is lit Red or Green

☞ Refer to 1) if RUN/STOP is not activated by Keypad or Terminal. If setting change is not available, PAR_04 may set to prohibit parameter write. To release this setting, enter 12 in PAR_04. If problem persists, contact

LS representatives.

② When [STOP] key is blinking

☞ This marks trip condition or BX active status. Check any other trips occur in DIS_05. Reset the trip and try run. Check BX signal is ON on the keypad and input terminal signal in DIS_01 ~ DIS_03. Reset BX and try run.

③ When green lamp on [REV], [FWD] key is blinking

☞ It marks accel/decel is in operation. If inverter keeps operation in this condition, it means load capacity calculation is incorrect and exceeds inverter rating. Refer to (16).

7) Operating speed does not change during run.

① Is FUN_02 speed setting proper?

☞ Speed setting methods in STARVERT-iV5 are Analog input, Keypad and Option. Select appropriate one among them.

② Is DIS_01(PreRamp Ref) setting the correct value?

☞ Current speed ref. Values are displayed in DIS_01 ~ DIS_03. Check the displayed value matches the setting value. If speed is not variable, check the encoder. (Refer to (13))

③ Speed setting method is “Keypad” and speed ref displayed DIS_01 ~ DIS_03 is not correct.

☞ Check terminal setting in DIO_01 ~ DIO_07 defined as Multi-step speed setting.

④ When speed setting method is Analog and DIS_01 ~ DIS_03 display is not desired value

☞ Check one of Ai1 ~ Ai3 is defined as “Speed Ref.”.

8) Motor keeps rotating at OV condition when speed setting is via Analog input.

① When AIO_11 Definition of Ai1 input is set to “Speed Ref”

☞ Adjust the Ai1_Bias at AIO_14. (Setting unit: %)

The displayed value is speed command. Set the desired value (ex: 0.0%) and press [ENTER] key.

② Follow the same steps to check Ai2 ~ Ai3.

9) Motor detects speed reference but motor rpm is showing decreasing while motor is overheated or

hunting.

① Check the motor wiring.

☞ There is a possibility of incorrect motor wiring when motor is 220V / 380V dual rating. Motor does not normally rotate when pole number setting is incorrect. However, motor may get damaged in case of miswiring. If this problem occurs, contact motor sales office. Refer to Power terminal description in this manual.

② Is motor capacity set correctly?

☞ Check PAR_07 motor rating selection is set the same as motor in use. See the nameplate for motor rating.

③ Is motor parameter set correctly?

☞ Motor parameters vary by manufacturer. STARVERT-iV5 setting is based on OTIS vector motor as default. Motor parameters should be changed when other makers' motor is used.

10) Nothing displayed on the LCD?

① Is the connection of inverter and keypad tight?

☞ Check the inverter and Keypad connection.

② Is input power turned on ?

☞ Check inverter power is applied. If nothing is displayed on the LCD in this condition, contact LS representatives.

11) Motor speed oscillates and speed is not constant during constant Run.

① Is encoder wired using twisted shield cable?

☞ encoder signal wiring should be conducted with Twisted Shield Cable. Otherwise, speed may oscillate at low speed (or high speed) due to encoder input noise, leading to motor vibration or abnormal motor sound at stop.

② Is the connection of inverter and motor and encoder grounding proper?

☞ Check the grounding of inverter and encoder is connected. This could occur when not connected. Fixed screw for the connection of encoder grounding and the inverter is located on the right bottom side of the control PCB. Loosen the fixed screw and insert the ground wire of the encoder and tighten the screw. (Refer to encoder wiring diagram). For grounding the motor, use G of the inverter Main terminal.

③ Connect inverter panel grounding connected with motor grounding to the building grounding.

☞ If not, incorrect motor speed may be input due to encoder input noise.

④ Is too large speed gain assigned to the inverter while motor load is light?

☞ Motor oscillates at stop when PI gain is set much larger than the actual load in CON_03 and CON_04. Therefore, gain should be set accordingly. Responsiveness increases when P gain is set higher and I lower but system may become unstable. Gain value varies system but generally set **30 ~ 70%** for **P gain** and set **100 ~ 500ms** for **I gain.**

⑤ Increase PAR_13 Enc LPF setting value.

⑥ Is there slip present at the connection of encoder and motor shaft?

☞ Poor encoder and motor connection may generate slip. Check the connection is tight.

12) Parameter change is not saved.

☞ Turn the power off and turn it on. If problem persists, contact LS representatives.

13) “Fuse Open” trip occurs constantly.

① is the input (line) voltage normal?

☞ Check the line voltage input. If phase to phase unbalance exceeds 2%(greater than 6V for 380V input), an AC reactor should be provided. Otherwise, inverter may get damaged and A/S fee will be charged during Warranty period.

② is the phase sequence of the output terminal U, V, W correct?

☞ Check the level of the input signal.

③ Is the motor insulation damaged?

☞ Various types of malfunction occur when the insulation is damaged. In general, operation stops at a certain speed (and more), overload or “OC-U (V,W)” trip occurs during regenerating. Or motor overheating and rotating speed oscillates. This condition persists for a while and then “Fuse Open” trip occurs. It marks motor insulation is damaged. In this case, replace the motor.

14) Motor input current is too large.

① Check the motor wiring.

☞ Check the motor wiring for the use of 220V / 380V transition type motor. (Refer to Main circuit terminal)

② Are motor and inverter capacity set correctly?

③ Is the setting of motor constants appropriate?

☞ Refer to 2) and 9) and check the motor and inverter setting.

15) OC-U (V,W) trip occurs frequently during operation. (Motor input current is oscillating.)

① check the encoder installation.

☞ If encoder connection is poor, motor vibration affects encoder and incorrect encoder signal is input to the inverter. Vector inverter controls the speed from Encoder F/B value so it follows the input signal whether correct or not, increasing inverter current. If so, contact motor maker or encoder commission company.

② Is there no inverter output phase loss?

③ Is the motor insulation not damaged?

☞ Refer to 13) and check the inverter and motor.

16) Accel/Decel cannot be made properly and green lamp in [REV], [FWD] key is blinking.

(load and frequency reference signal is oscillating.)

① Check motor wiring.

② FUN_40 ~ FUN_47 Accel/Decel time and DIS_00 motor load.

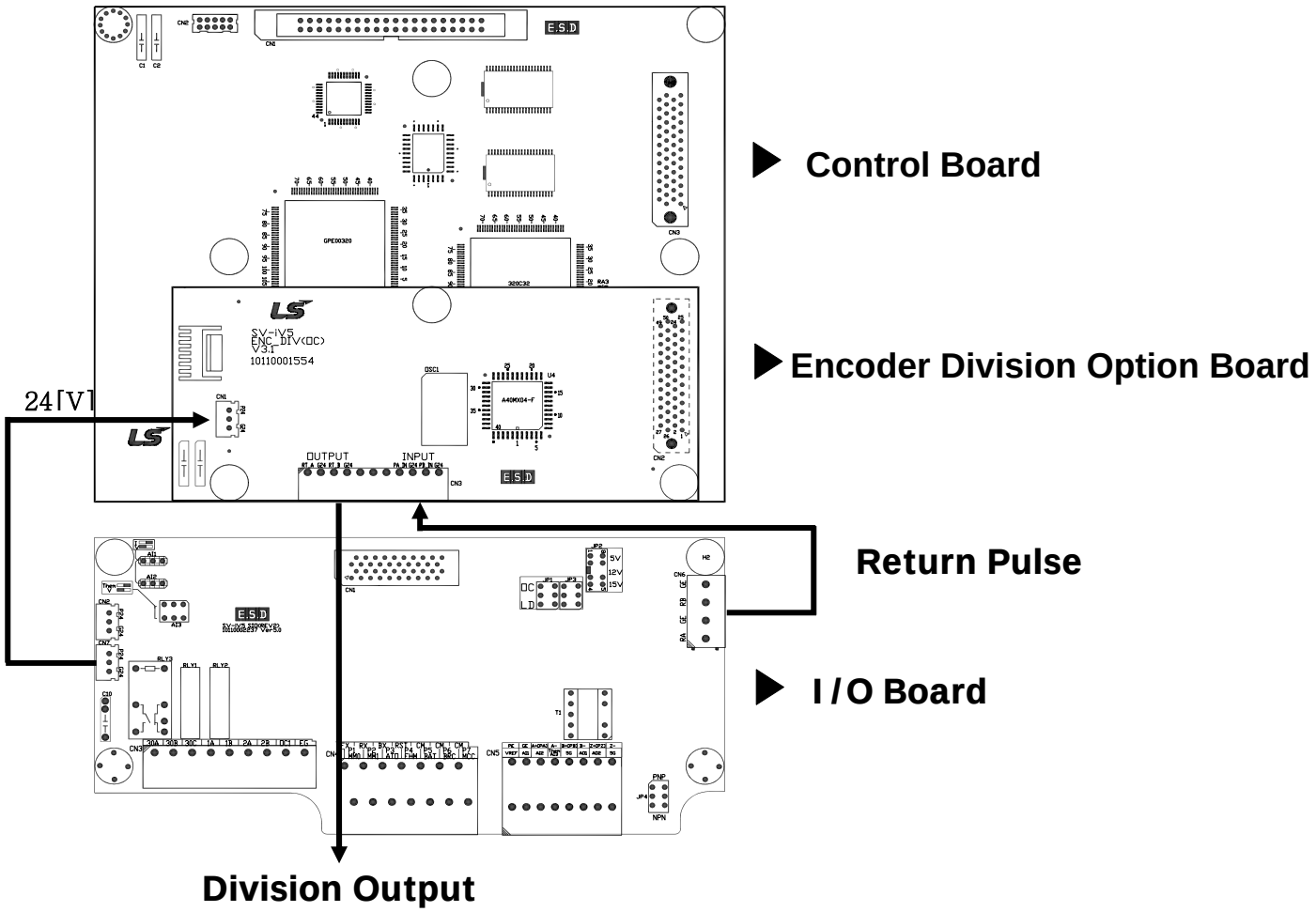
☞ Blinking Green lamp marks motor is accelerating or decelerating. If the rotating speed oscillates and green lamp is blinking, it marks inverter output torque shortage due to mis-calculation of load. In this case, increase the torque limit to enable inverter to accelerate/decelerate within its rating. If load is set too high, it will shorten inverter life or damage to the unit.

Chapter 10 - Option Devices

10.1 Encoder Division Option Board

10.1.1 Encoder division option board installation and WIRING guide.

- Connect the option card's CN2 connector to CN4 on the control board.



10.1.2 Wiring guide for encoder division option board

-. Connect Encoder output terminal (Open collector output) on I/O board to input terminal of the option card.

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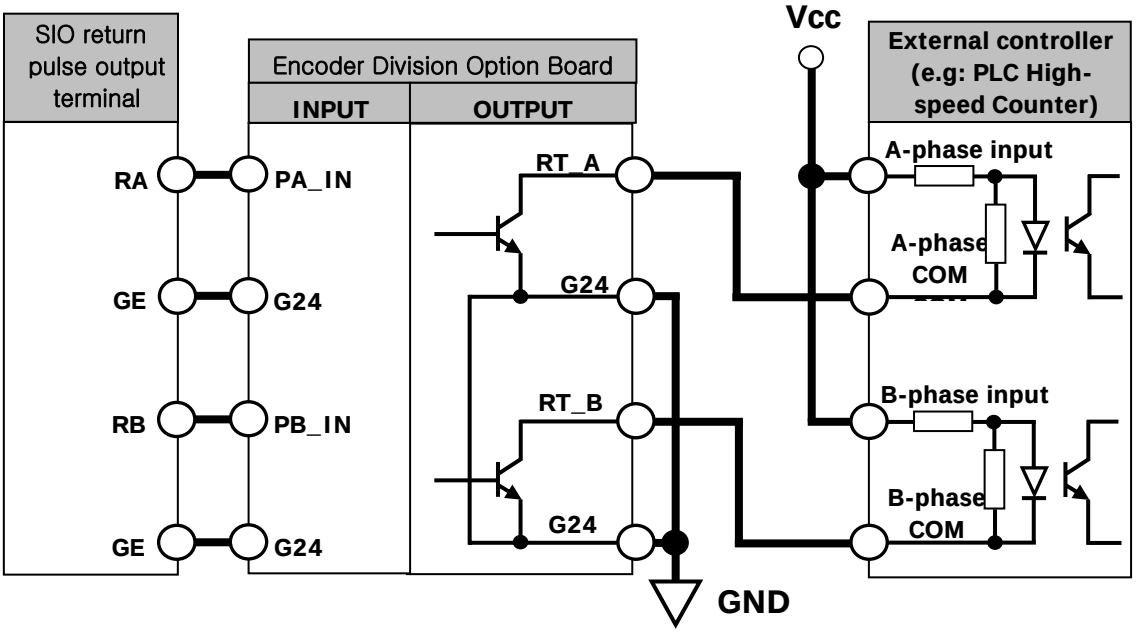
Encoder Division Option Board Terminal name		Encoder Division Option Board Description	Connection board and terminal
Input	PA_IN	Encoder Phase A Division Input	I/O Board: RA (Phase A Output)
	PB_IN	Encoder Phase B Division Input	I/O Board: RB (Phase B Output)
	G24	GND	I/O Board: GE (GND)
Output	RT_A	Encoder Phase A Division Input	External controller: Phase A Input
	RT_B	Encoder Phase B Division Input	External controller: Phase B Input
	G24	GND	External controller: GND



Warning

Wiring must be considered with input circuit . Because encoder output is open collector type. The figure is shown the wiring when inverter is connected with High-speed counter of LSIS PLC.

10.1.3 Encoder division output

Only available when Encoder Division Output Option Card is installed.

Sets the division ratio for monitoring the Encoder pulse signals.

Code	Address	LCD display	Description	Setting range	Unit	Factory setting
PAR_31	731F	EncDiv Ratio	Encoder Pulse Output Division Rate	1 ~ 1128		1
PAR_32	7320	EncDivFilter	Encoder Division Output Filter	0 ~ 15		0

Encoder division output option card outputs one pulse signal when input pulse number matches the value set in PAR_31. A/B pulse output follows input pulse phase. The relationship between output of A, B pulse follows the same as input pulse. Division ration can be set within the range of 1 (1 output pulse per 1 input pulse) ~ 1/128(1 output pulse to 128 input pulse).

PAR_31 setting range: 0001 ~ 1128. Division ratio cannot be set higher than 1 and only 1 or 2 can be set for numerator. The below is Division ratio calculation formula.

N refers to the value from thousand (**0**000) and M refers to value less than thousand (0**000**)

PAR_31 set value = N×1000 + M.

Division ratio = (1+N)/M

Setting range: N (0, 1), M (1 ~ 128)

PAR_31 = [] [] [] []

N M

When PAR_31 setting value is below 1000 (N=0), a numerator value becomes 1 and when above 1000 (N=1), a numerator value becomes 2. For example, if PAR_31 is set to 15, the division ratio is 1/15 and if 1015, the ratio is 2/15. Division ratio is settable up to 1/128 and greater than 1 is not settable. Using Up key on the keypad PAR_31 value is increased and increase routine is 1 → 2 → 3 → 4 → … → 127 → 128(Division ratio: 1/128) → 1002 (Division ratio: 1) → 1003 → … → 1128 (Division ratio: 1/64) and decrease routine (using Down key on the keypad) is the same as increase routine.

10.2 iV5 Option Board List

10.2.1 Dedicated option board for iV5

No.	Option board	Use	Product Code
1	ENC DIV(OC)	Encoder division option board	64070003
2	EL I/O	Elevator function otion board	64070004
3	SYNC I/O	Synchronization option board	64070006
4	SIN/COS(Encoder)	SIN/COS encoder option board	64070007
5	EXTN I/O	Extension I/O option board	64070008

The information of ENC DIV(OC) is described in chapter 10.1 and EXTN I/O is chapter 3.4.3.
For more information on other options, please refer to the option board manual.

10.3 iV5 External communication option board

No.	Option board	Use	Product Code
1	RS485/Modbus-RTU	RS485/Modbus-RTU communication option board	64000007
2	DEVICENET	DeviceNet communication option board	64050022
3	PROFIBUS-DP	Profibus-DP communication option board	64050023
4	CC-Link	CC-Link communication option board	64050024

For more information on above options, please refer to the option board manual.

Chapter 11 – Accessories

11.1 MCCB(LS), ELB(LS), Magnetic Contactor(LS), input/output Wire specifications

Voltage	Motor (kW)	Inverter models	MCCB, ELB (LS)	Magnetic contactor (LS)
200V	2.2	SV022iV5-2DB	TD125U/30A, EBS33b30A	GMC-18
	3.7	SV037iV5-2DB	TD125U/30A, EBS33b30A	GMC-32
	5.5	SV055iV5-2DB	TD125U/50A, EBS53b50A	GMC-40
	7.5	SV075iV5-2DB	TD125U/60A, EBS63b60A	GMC-50
	11	SV110iV5-2DB	TD125U/100A, EBS103b100A	GMC-65
	15	SV150iV5-2DB	TD125U/125A, EBS203b125A	GMC-100
	18.5	SV185iV5-2DB	TS250U/150A, EBS203b150A	GMC-125
	22	SV220iV5-2DB	TS250U/175A, EBS203b175A	GMC-150
	30	SV300iV5-2	TS250U/225A, EBS203b225A	GMC-150
	37	SV370iV5-2	TS400U/300A, EBS403b300A	GMC-220
400V	2.2	SV022iV5-4DB	TD125U/15A, EBS33b15A	GMC-12
	3.7	SV037iV5-4DB	TD125U/15A, EBS33b15A	GMC-18
	5.5	SV055iV5-4DB	TD125U/30A, EBS33b30A	GMC-22
	7.5	SV075iV5-4DB	TD125U30A, EBS33b30A	GMC-32
	11	SV110iV5-4DB	TD125U/50A, EBS53b50A	GMC-40
	15	SV150iV5-4DB	TD125U/60A, EBS103b60A	GMC-50
	18.5	SV185iV5-4DB	TD125U/80A, EBS103b80A	GMC-65
	22	SV220iV5-4DB	TD125U/100A, EBS103b100A	GMC-65
	30	SV300iV5-4(380V)	TD125U/125A, EBS203b125A	GMC-100
	37	SV370iV5-4(380V)	TS250U/150A, EBS203b150A	GMC-125
	45	SV450iV5-4(380V)	TS250U/175A, EBS203b175A	GMC-150
	55	SV550iV5-4(380V)	TS250U/225A, EBS203b225A	GMC-180
	75	SV750iV5-4(380V)	TS400U/300A, EBS403b300A	GMC-220
	90	SV900iV5-4(380V)	TS400U/400A, EBS403b400A	GMC-300
	110	SV1100iV5-4(380V)	TS800U/500A, EBS603b500A	GMC-400
	132	SV1320iV5-4(380V)	TS800U/600A, EBS603b600A	GMC-400
	160	SV1600iV5-4(380V)	TS800U/600A, EBS603b600A	GMC-600
	220	SV2200iV5-4(380V)	ABS803/800A, EBS803b800A	GMC-800
	280	SV2800iV5-4	ABS1003/1000A, EBS1003b1000A	1000A
	315	SV3150iV5-4	ABS1203/1200A, EBS1203b1200A	1200A
	375	SV3750iV5-4	1400A, 1400A	1400A

※ Please refer to our LSIS MCCB, ELB and MC catalog for the your order. The product indicated with only current will be released in the near future.

11.2 AC input fuse, AC reactor, DC reactor

Voltage	Motor kW)	Inverter models	AC input fuse	AC reactor	DC reactor
200V	2.2	SV022iV5-2DB	25 A	0.88 mH, 14 A	–
	3.7	SV037iV5-2DB	40 A	0.56 mH, 20 A	–
	5.5	SV055iV5-2DB	40 A	0.39 mH, 30 A	–
	7.5	SV075iV5-2DB	50 A	0.28 mH, 40 A	–
	11	SV110iV5-2DB	70 A	0.20 mH, 59 A	–
	15	SV150iV5-2DB	100 A	0.15 mH, 75 A	–
	18.5	SV185iV5-2DB	100 A	0.12 mH, 96 A	–
	22	SV220iV5-2DB	125 A	0.10 mH, 112 A	–
	30	SV300iV5-2	150A	0.08 mH, 134 A	0.35 mH, 152 A
	37	SV370iV5-2	200A	0.07 mH, 160 A	0.30 mH, 180 A
400V	2.2	SV022iV5-4DB	10 A	3.23 mH, 7.5 A	–
	3.7	SV037iV5-4DB	20 A	2.34 mH, 10 A	–
	5.5	SV055iV5-4DB	20 A	1.22 mH, 15 A	–
	7.5	SV075iV5-4DB	30 A	1.14 mH, 20 A	–
	11	SV110iV5-4DB	35 A	0.81 mH, 30 A	–
	15	SV150iV5-4DB	45 A	0.61 mH, 38 A	–
	18.5	SV185iV5-4DB	60 A	0.45 mH, 50 A	–
	22	SV220iV5-4DB	70 A	0.39 mH, 58 A	–
	30	SV300iV5-4(380V)	100 A	0.33 mH, 67 A	1.19 mH, 76 A
	37	SV370iV5-4(380V)	100 A	0.27 mH, 82 A	0.98 mH, 93 A
	45	SV450iV5-4(380V)	100 A	0.22 mH, 100 A	0.89 mH, 112 A
	55	SV550iV5-4(380V)	150 A	0.15 mH, 121 A	0.75 mH, 135 A
	75	SV750iV5-4(380V)	200 A	0.13 mH, 167 A	0.44 mH, 187 A
	90	SV900iV5-4(380V)	250 A	0.11 mH, 201 A	0.35 mH, 225 A
	110	SV1100iV5-4(380V)	300 A	0.09 mH, 245 A	0.30 mH, 274 A
	132	SV1320iV5-4(380V)	400 A	0.08 mH, 290 A	0.26 mH, 324 A
	160	SV1600iV5-4(380V)	400 A	0.06 mH, 357 A	0.22 mH, 399 A
	220	SV2200iV5-4(380V)	800A	0.029mH, 799 A	0.1mH, 530 A
	280	SV2800iV5-4	900A	0.029mH, 799 A	0.090mH, 836 A
	315	SV3150iV5-4	1000A	0.024mH, 952 A	0.076mH, 996 A
	375	SV3750iV5-4	1200A	0.024mH, 952 A	0.064mH, 1195 A

※ For 2.2~22kW, DC reactor standard is not provided, for not having DC reactor wiring terminal.

11.3 The Selection of Braking Resistor and the Unit

11.3.1 The selection of dynamic braking resistor

Resistor values shown in the following table is calculated on the basis of 150% of rated braking torque, 5% ED 1). Power rating of resistor should be doubled for resistor frequency 10% ED use. Additional braking unit should be installed for above SV 300iV5-2 / SV300iV5-4.

Inverter	Rated Capacity (5% ED)	
	[Ω]	[W](2)
SV 022iV5-2 DB	50	400
SV 037iV5-2 DB	33	600
SV 055iV5-2 DB	20	800
SV 075iV5-2 DB	15	1200
SV 110iV5-2 DB	10	2400
SV 150iV5-2 DB	8	2400
SV 185iV5-2 DB	5	3600
SV 220iV5-2 DB	5	3600
SV 022iV5-4 DB	200	400
SV 037iV5-4 DB	130	600
SV 055iV5-4 DB	85	800
SV 075iV5-4 DB	60	1200
SV 110iV5-4 DB	40	2400
SV 150iV5-4 DB	30	2400
SV 185iV5-4 DB	20	3600
SV 220iV5-4 DB	20	3600

✓ **(1): ED is based on 100 seconds.**

✓ **(2): Rated capacity is based on the self-cooling.**

11.3.2 Wiring of the temperature sensor on braking resistor

Temperature sensor is attached in the LSIS braking resistors to prevent the fire.

Terminal of Braking Resistor	Power Terminal of Inverter	Action
B1, B2	P, BR	
P7, CM	One of the multi-function input terminals (P1 ~ P7) should be set to 'External Fault Signal b Contact'.	Contact is normally ON at the ambient temperature and is OFF in case of over-temperature.

11.3.3 Braking unit

① SV037DBH-2: 37kW/200V Class Braking Unit (10% ED)

② SV037DBH-4: 37kW/400V Class Braking Unit (10% ED)

③ SV075DBH-4: 75kW/400V Class Braking Unit (10% ED)

④ SV075DB-4 : 75kW/400V Class Braking Unit (100% ED)

⑤ SV220DB-4 : 220kW/400V Class Braking Unit (100% ED)

- The Combination of two braking unit for 400V class is possible for more than SV900iV5-4 capacity.

- When ED is more than 10%, Use the braking unit for 100% ED (Ex: vertical load such as carne, hoist)

- When the inverter capacity is more than 220kW, use the braking unit for SV2200DB-4 (100% ED).

- Refer to description manual included in braking unit product for the use of 100% ED braking unit.

11.3.4 Combination of braking unit

Inverter / Braking unit		SV[][][]iV5-2	SV[][][][]iV5-4				
		300/370	300/370	450/550/750	900/1100/1320/1600	2200	2800/3150/3750
200V	37kW	1					
400V	37kW		1				
	75kW			1	2		
	220kW					1	2

Note)

1. Example) Combine two braking units of 75kW-400V Class for SV-900iV5-4(90kW) Class.

2. Refer to the Braking Unit user manual that came with the braking unit.

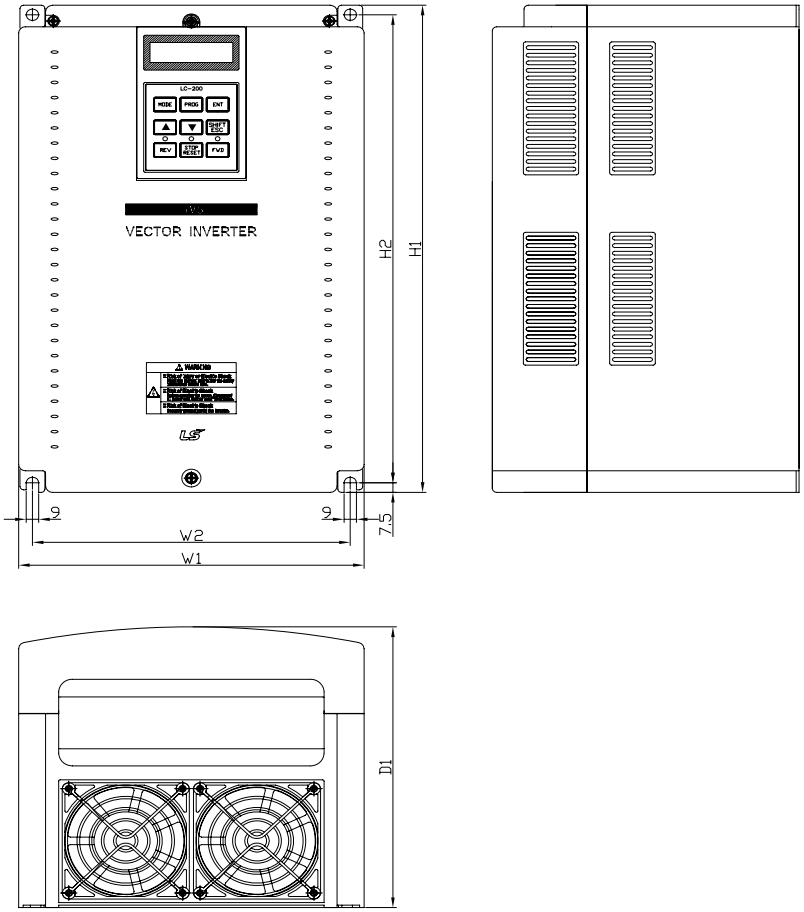
11.3.5 Braking resistor for braking unit

Braking Unit	100% of Braking Torque, 10% ED	
	Resistance [Ω]	Rated Power [kW]
37kW-200V	3	5
37kW-400V	12	5
75kW-400V	6	10
75kW-400V	6	Refer to extra manual in the case of 100% ED braking unit.
220kW-400V	2	

Chapter 12 – Dimensions

- SV 022, 037, 055, 075, 110, 150, 185, 220iV5-2DB(MD)
- SV 022, 037, 055, 075, 110, 150, 185, 220iV5-4DB(MD)

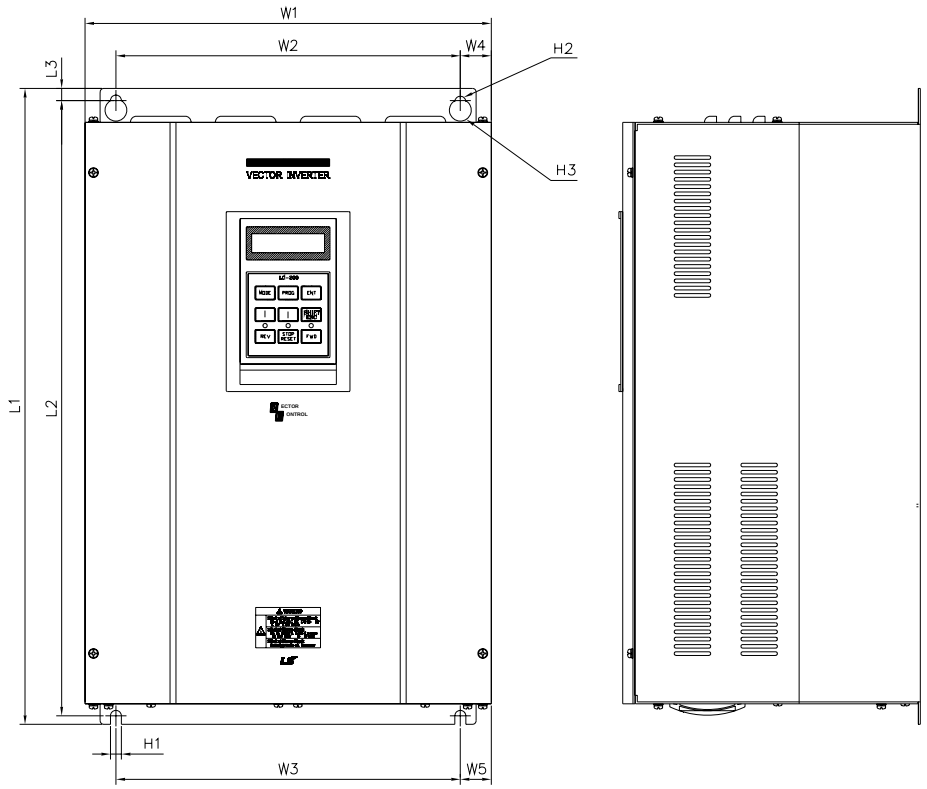
*MD: Mold type

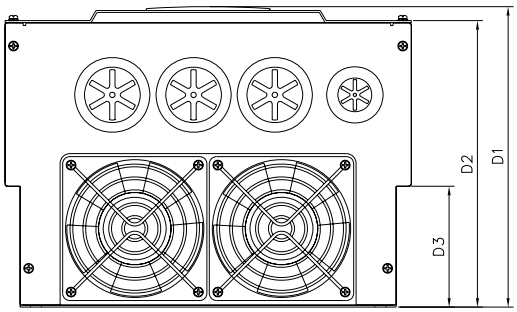


- **Dimensions (unit: mm [inches])**

Models	W1	W2	H1	H2	D1
SV022iV5-2/4DB(MD) SV037iV5-2/4DB(MD)	200 [7.87]	180 [7.09]	284 [11.18]	269 [10.69]	207 [8.15]
SV055iV5-2/4DB(MD) SV075iV5-2/4DB(MD)			355 [13.97]	340 [13.38]	202 [7.95]
SV110iV5-2/4DB(MD) SV150iV5-2/4DB(MD)	250 [9.84]	230 [9.06]	385 [15.16]	370 [14.57]	221 [8.70]
SV185iV5-2/4DB(MD) SV220iV5-2/4DB(MD)	304 [11.97]	284 [11.18]	460 [18.11]	445 [17.52]	254 [10.00]

- **SV055, 075, 110, 150, 185, 220iV5-2DB**
- **SV055, 075, 110, 150, 185, 220iV5-4DB**
- **SV055, 075, 110, 150, 185, 220iV5-4DC** ***DC : DC power input type**

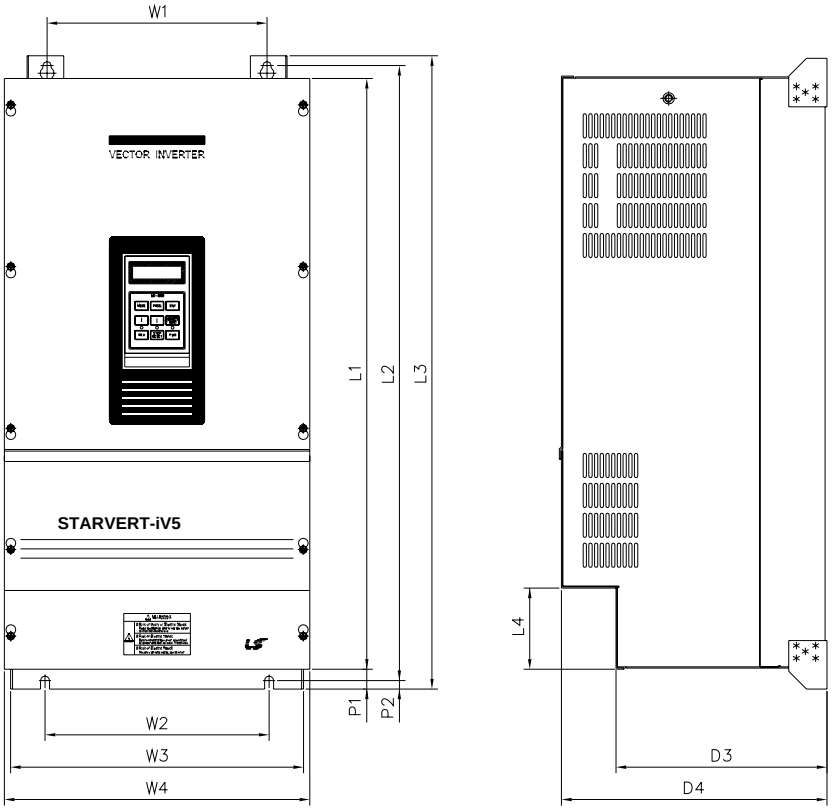


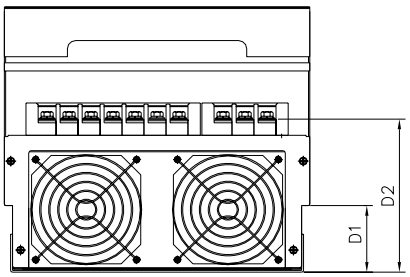


- **Dimensions (unit: mm [inches])** ***DC has a same dimension as AC.**

Models	W1	W2	W3	W4	W5	L1	L2	L3	D1	D2	D3	H1	H2	H3
SV055iV5-2/4DB SV075iV5-2/4DB	234.4 [9.22]	180 [7.08]	180 [7.08]	27.2 [1.07]	27.2 [1.07]	406.2 [15.9]	391.2 [15.4]	7.5 [0.29]	221.1 [8.7]	209.5 [8.24]	75 [2.95]	6 [0.23]	Φ6	Φ12
SV110iV5-2/4DB SV150iV5-2/4DB SV185iV5-2/4DB SV220iV5-2/4DB	335 [13.1]	284 [11.1]	284 [11.1]	25.5 [1.00]	25.5 [1.00]	526 [20.7]	509 [20.0]	10 [0.39]	248.6 [9.78]	237 [9.33]	100 [3.93]	7 [0.27]	Φ7	Φ14

- **SV300, 370iV5-2**
- **SV300, 370, 450, 550, 750iV5-4**
- **SV300, 370, 450, 550, 750iV5-4DC** ***DC : DC power input type**

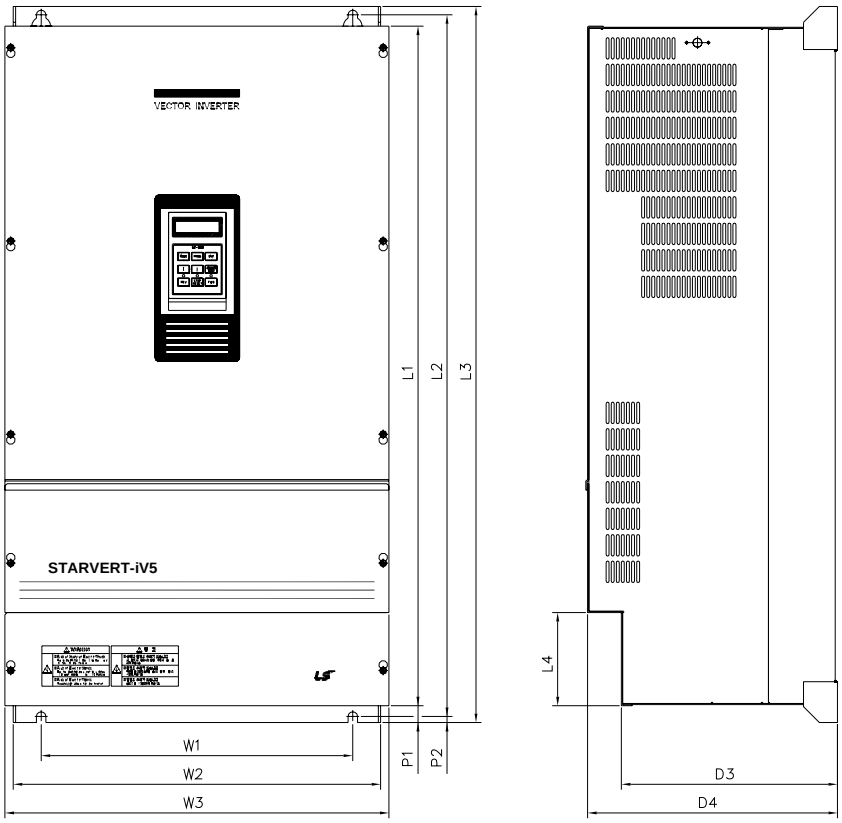


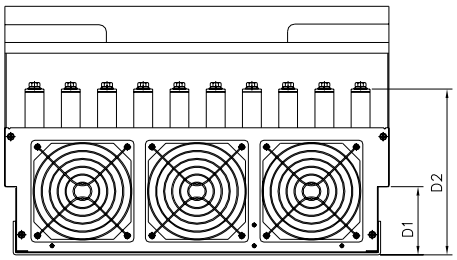


- **Dimensions (unit: mm [inches])** ***DC has a same dimension as AC.**

Models	W1	W2	W3	W4	L1	L2	L3	D1	D2	D3	D4	P1	P2
SV300iV5-2/4 SV370iV5-2/4	270 [10.6]	270 [10.6]	319.2 [12.5]	350 [13.7]	635 [25.0]	660 [26.0]	680 [26.7]	120 [4.72]	197 [7.76]	256.6 [10.1]	308.2 [12.1]	16.9 [0.66]	8 [0.31]
SV450iV5-4 SV550iV5-4 SV750iV5-4	275 [10.8]	275 [10.8]	359.6 [14.1]	375 [14.7]	730.6 [28.7]	758.5 [29.8]	780 [30.7]	82.3 [3.24]	189.3 [7.45]	259 [10.2]	326 [12.8]	24.5 [0.90]	10.5 [0.41]

- **SV900, 1100, 1320, 1600iV5-4**
- **SV900, 1100, 1320, 1600iV5-4DC** ***DC : DC power input type**



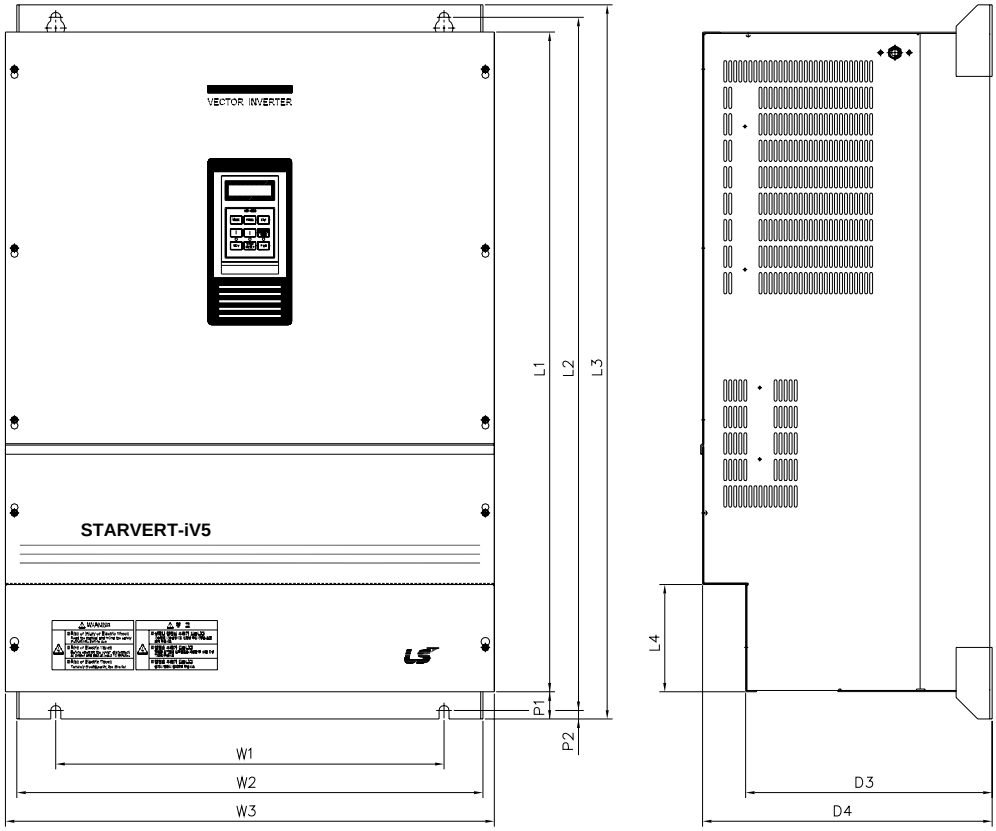


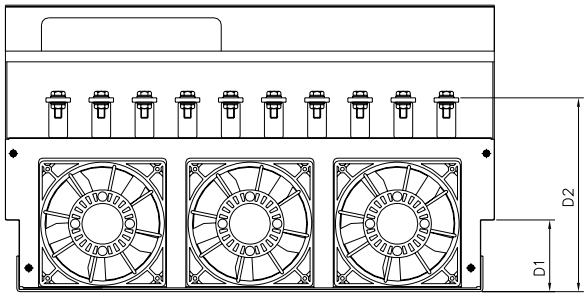
- **Dimensions (unit : mm[inches])** ***DC has a same dimension as AC.**

Models	W1	W2	W3	L1	L2	L3	D1	D2	D3	D4	P1	P2
SV900iV5-4 SV1100iV5-4	430 [16.9]	507 [19.9]	530 [20.8]	729 [28.7]	760 [29.9]	780 [30.7]	83.2 [3.27]	234.6 [9.23]	286.2 [11.2]	335 [13.2]	23.5 [0.92]	8.5 [0.33]
SV1320iV5-4 SV1600iV5-4	430 [16.9]	507 [19.9]	530 [20.8]	949 [37.3]	980 [38.5]	1000 [39.3]	95.2 [3.75]	231.6 [9.12]	298 [11.7]	345 [13.5]	23.5 [0.92]	8.5 [0.33]

■ **SV2200iV5-4**

■ **SV2200iV5-4DC** ***DC : DC power input type**



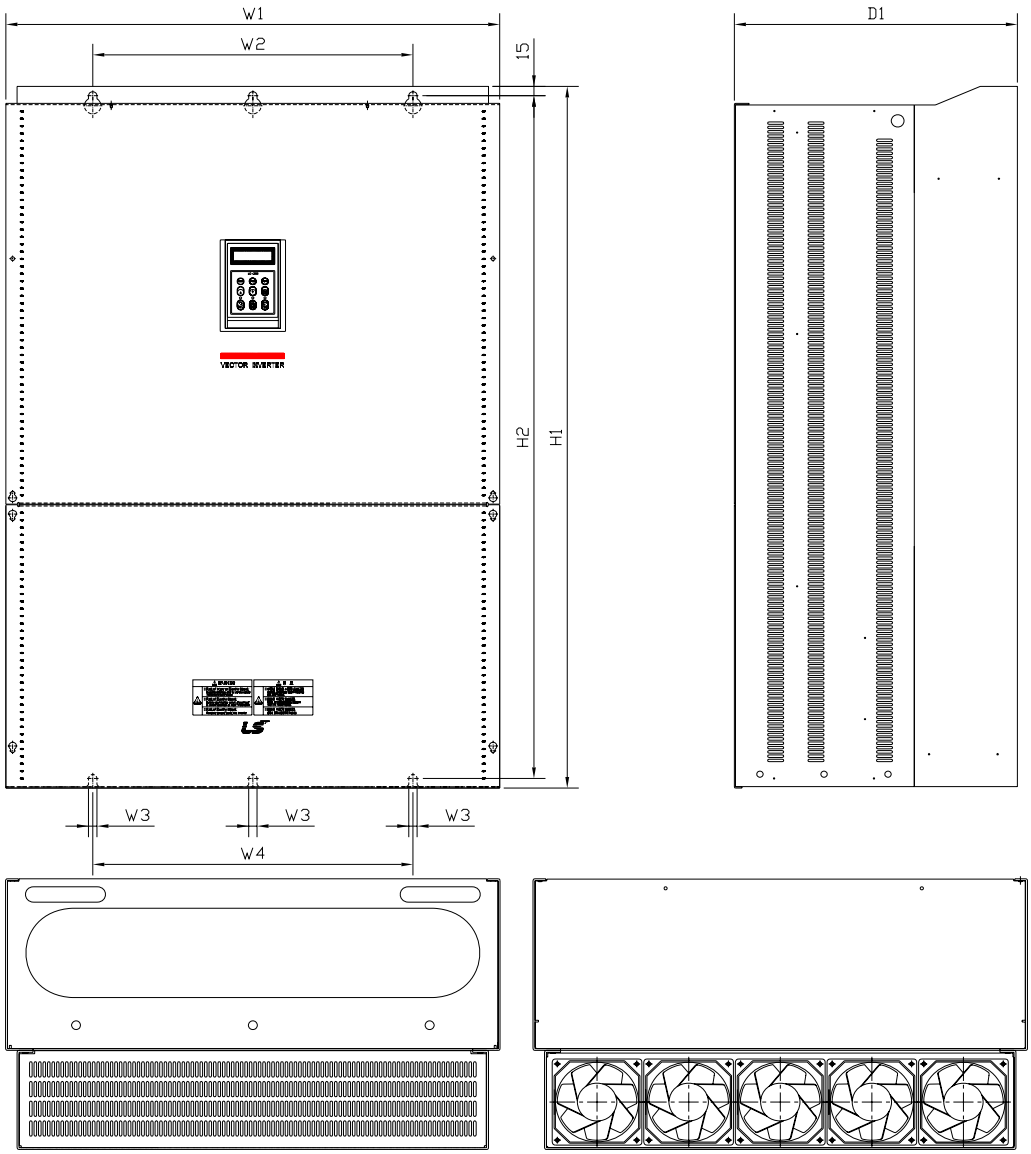


● **Dimensions (unit : mm[inches])** ***DC has a same dimension as AC.**

Models	W1	W2	W3	L1	L2	L3	L4	D1	D2	D3	D4	P1	P2
SV2200iV5-4	540 [21.26]	649 [25.55]	680 [26.77]	922 [36.3]	968.5 [38.13]	998 [39.29]	150 [5.91]	100.2 [3.94]	271 [10.67]	343 [13.5]	403 [15.87]	38 [1.49]	12 [0.47]

■ **SV2800, 3150, 3750iV5-4**

■ **SV2800, 3150, 3750iV5-4DC** ***DC : DC power input type**

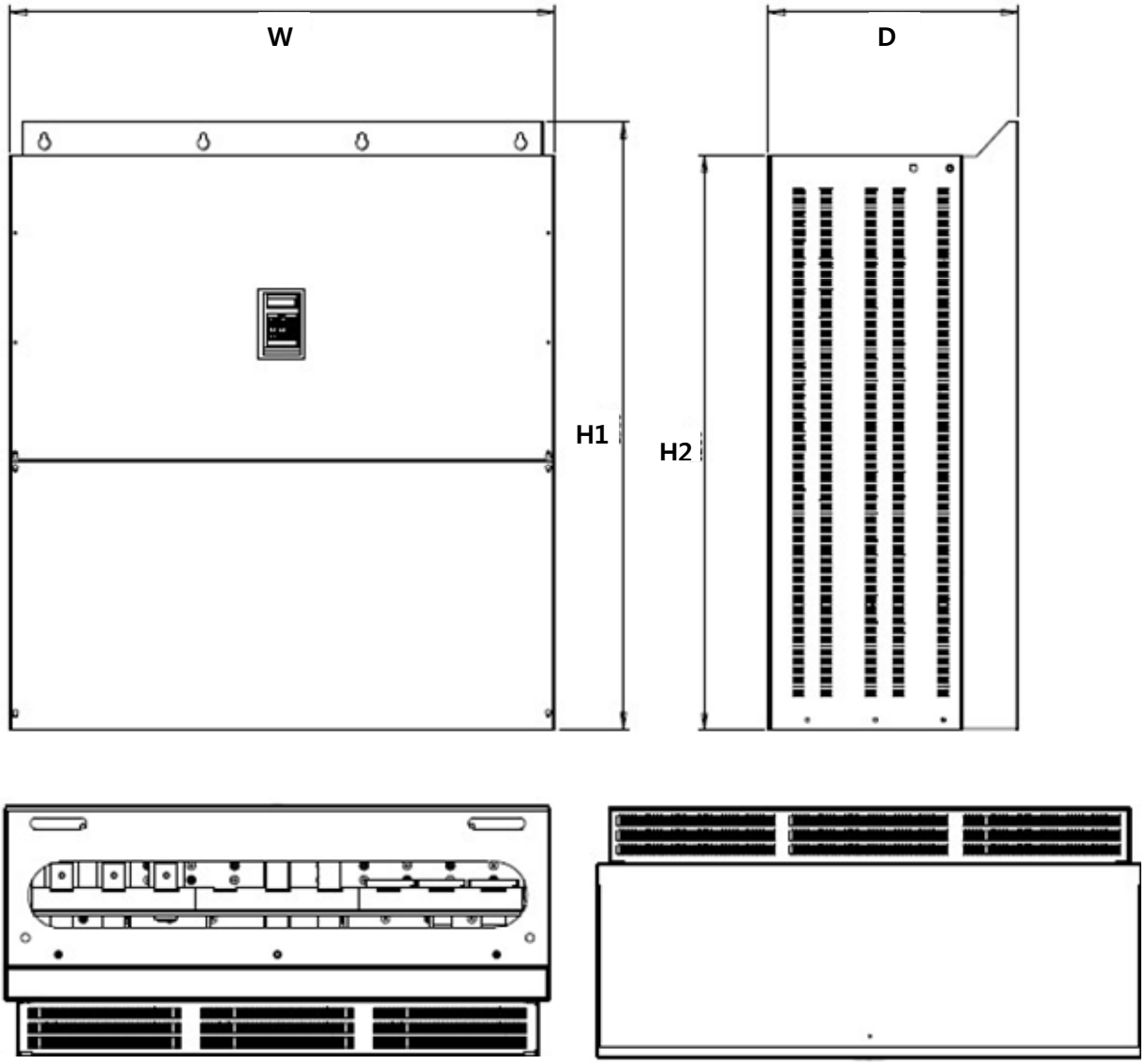


● **Dimensions (unit : mm[inches])** ***DC has a same dimension as AC.**

Models	W1	W2	W3	W4	H1	H2	D1
SV2800iV5-4	772 [30.39]	500 [19.69]	13 [0.51]	500 [19.69]	1140.5 [44.90]	1110 [43.70]	442 [17.40]
SV3150iV5-4 SV3750iV5-4	922 [6.30]	580 [22.83]	14 [0.55]	580 [22.83]	1302.5 [51.28]	1271.5 [50.06]	495 [19.49]

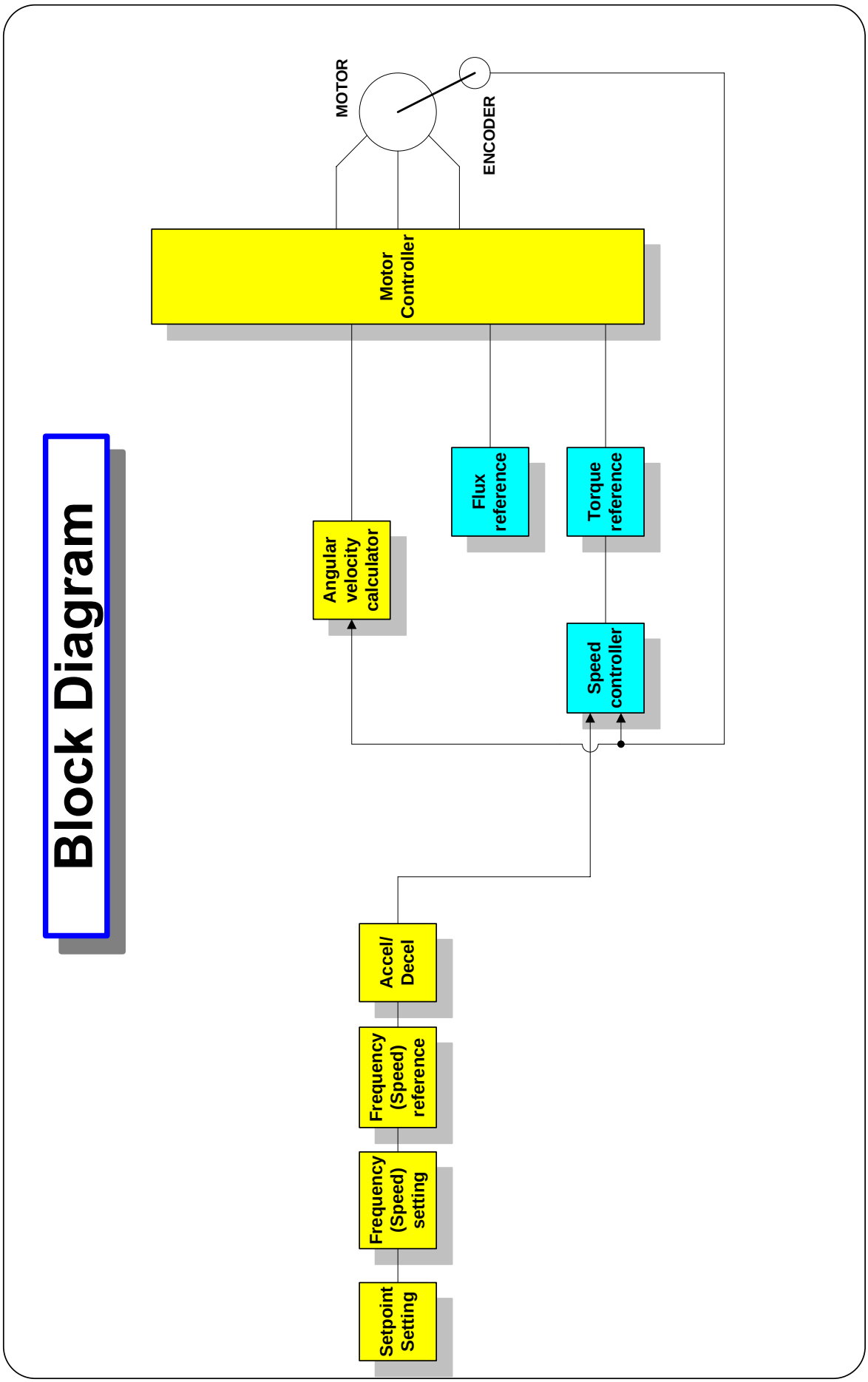
■ **SV5000iV5-4**

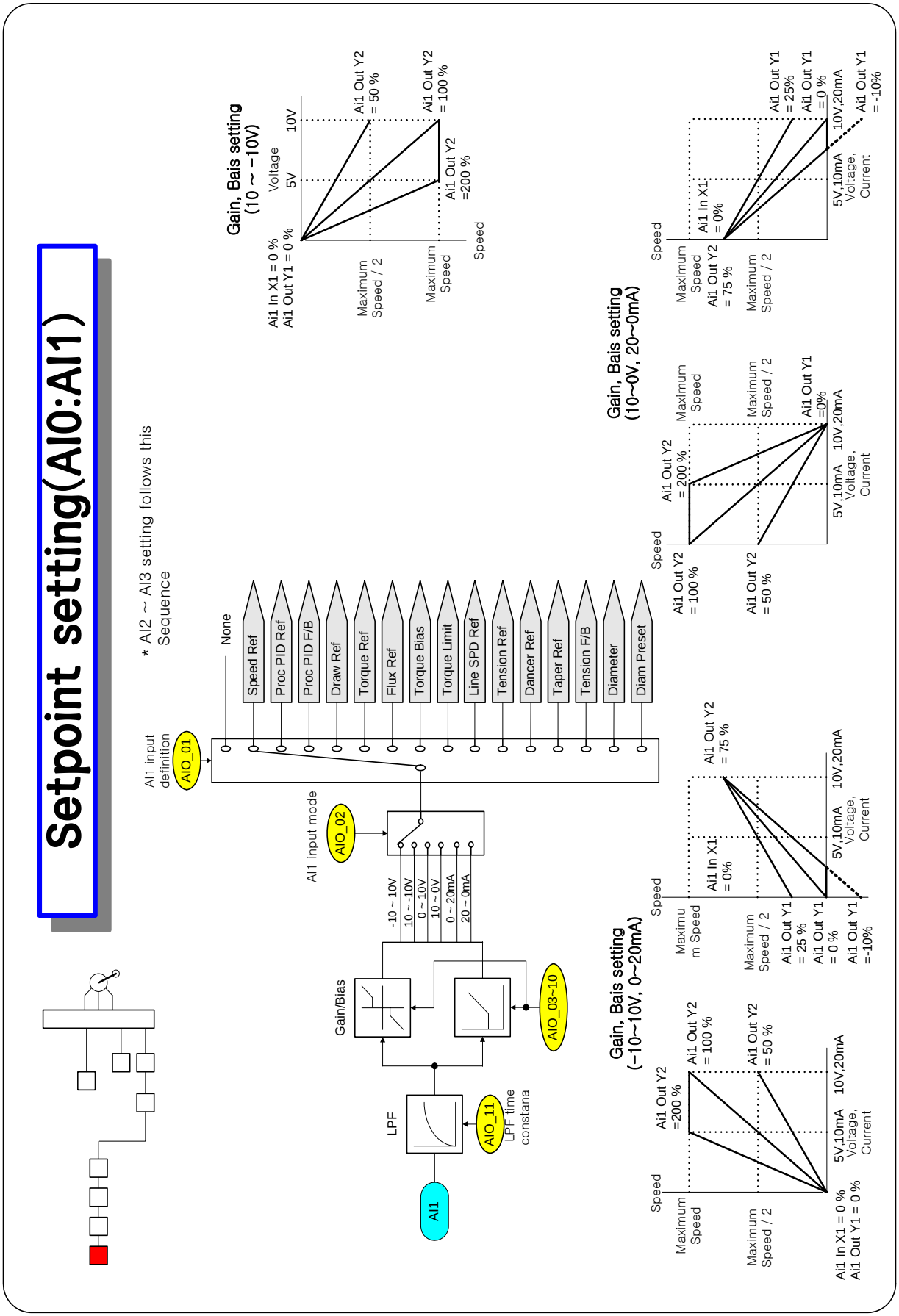
■ **SV5000iV5-4DC** ***DC : DC power input type**

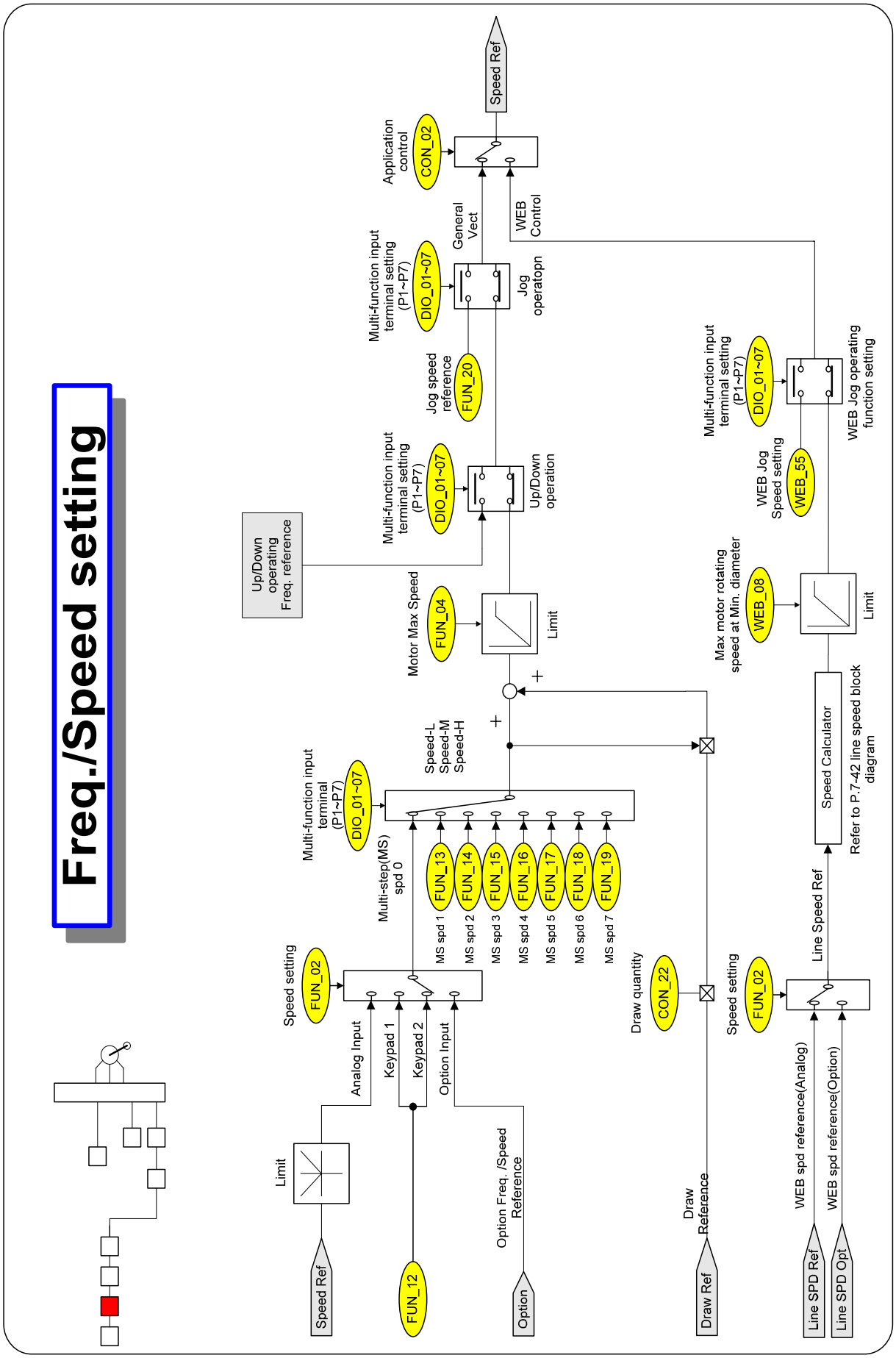


● **Dimensions (unit : mm[inches])** ***DC has a same dimension as AC.**

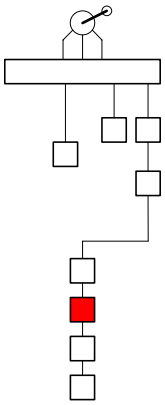
Models	W1	W3	H1	D1
SV5000iV5-4	1200 [30.39]	1330 [44.90]	1260 [43.70]	550 [17.40]

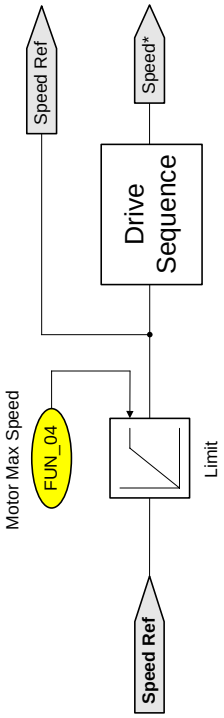

Block Diagram
MOTOR
ENCODER
Motor Controller
Angular velocity calculator
Flux reference
Torque reference
Speed controller
Accel/ Decel
Frequency (Speed) reference
Frequency (Speed) setting
Setpoint Setting

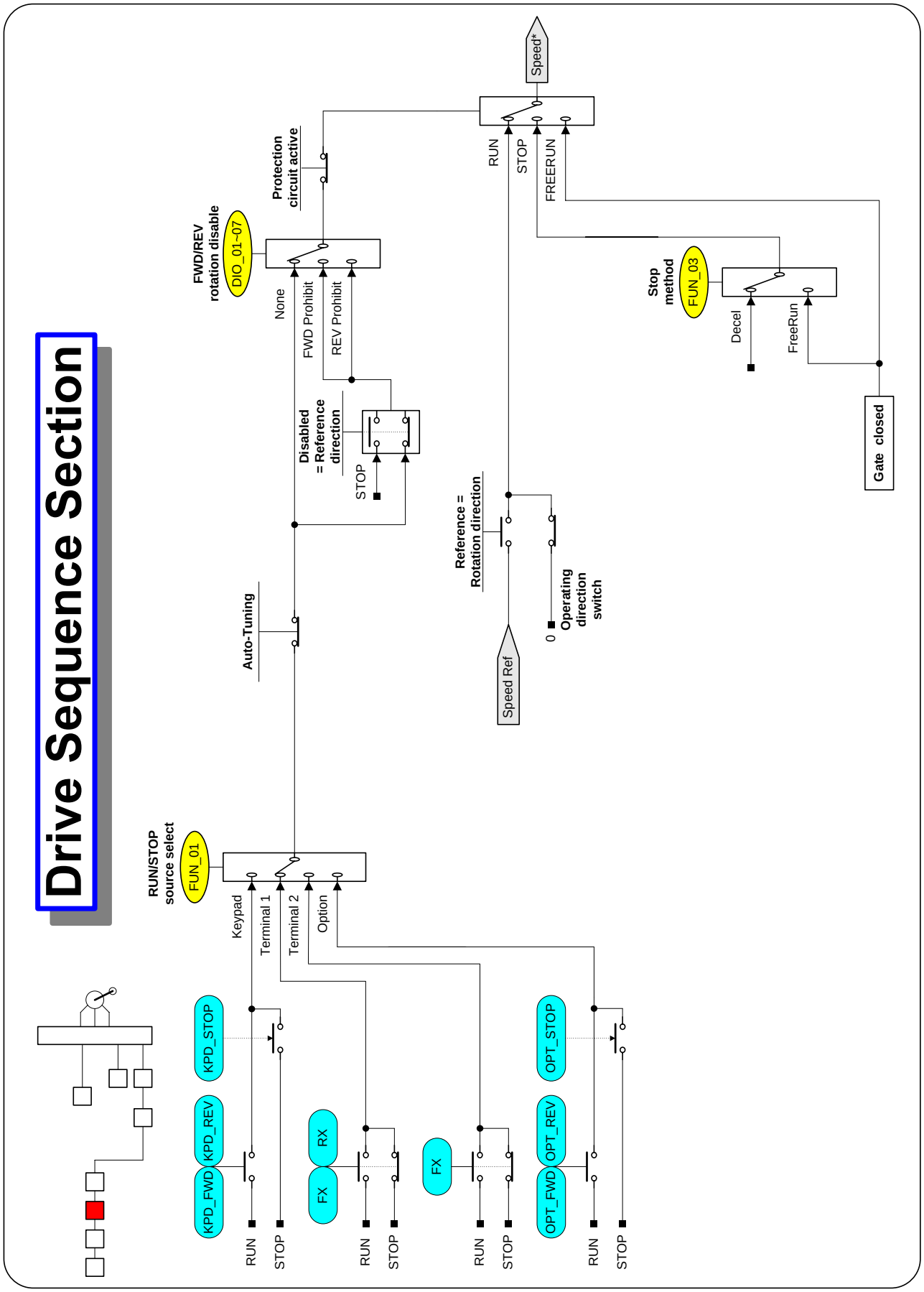

Setpoint setting(AI0:AI1)
* AI2 ~ AI3 setting follows this Sequence
AI1 input definition
AIO_01
None
Speed Ref
Proc PID Ref
Proc PID F/B
Draw Ref
Torque Ref
Flux Ref
Torque Bias
Torque Limit
Line SPD Ref
Tension Ref
Dancer Ref
Taper Ref
Tension F/B
Diameter
Diam Preset
AI1 input mode
AIO_02
-10 ~ 10V
10 ~ -10V
0 ~ 10V
10 ~ 0V
0 ~ 20mA
20 ~ 0mA
Gain/Bias
AIO_03~10
LPF
AIO_11
LPF time constana
AI1
Gain, Bais setting (10 ~ -10V)
Ai1 In X1 = 0 %
Ai1 Out Y1 = 0 %
Voltage
5V
10V
Ai1 Out Y2 = 50 %
Ai1 Out Y2 = 100 %
Ai1 Out Y2 =200 %
Maximum Speed / 2
Maximum Speed
Speed
Gain, Bais setting (10~0V, 20~0mA)
Ai1 Out Y2 = 200 %
Ai1 Out Y2 = 100 %
Ai1 Out Y2 = 50 %
Ai1 Out Y1 =0%
5V,10mA Voltage, Current
10V,20mA
Gain, Bais setting (-10~10V, 0~20mA)
Ai1 Out Y2 =200 %
Ai1 Out Y2 = 100 %
Ai1 Out Y2 = 50 %
Ai1 In X1 = 0 %
Ai1 Out Y1 = 0 %
Ai1 Out Y2 = 75 %
Ai1 In X1 = 0%
Ai1 Out Y2 = 75 %
Ai1 Out Y1 = 25 %
Ai1 Out Y1 = 0 %
Ai1 Out Y1 =-10%
Ai1 Out Y1 = 25%
Ai1 Out Y1 = 0 %
Ai1 Out Y1 = -10%

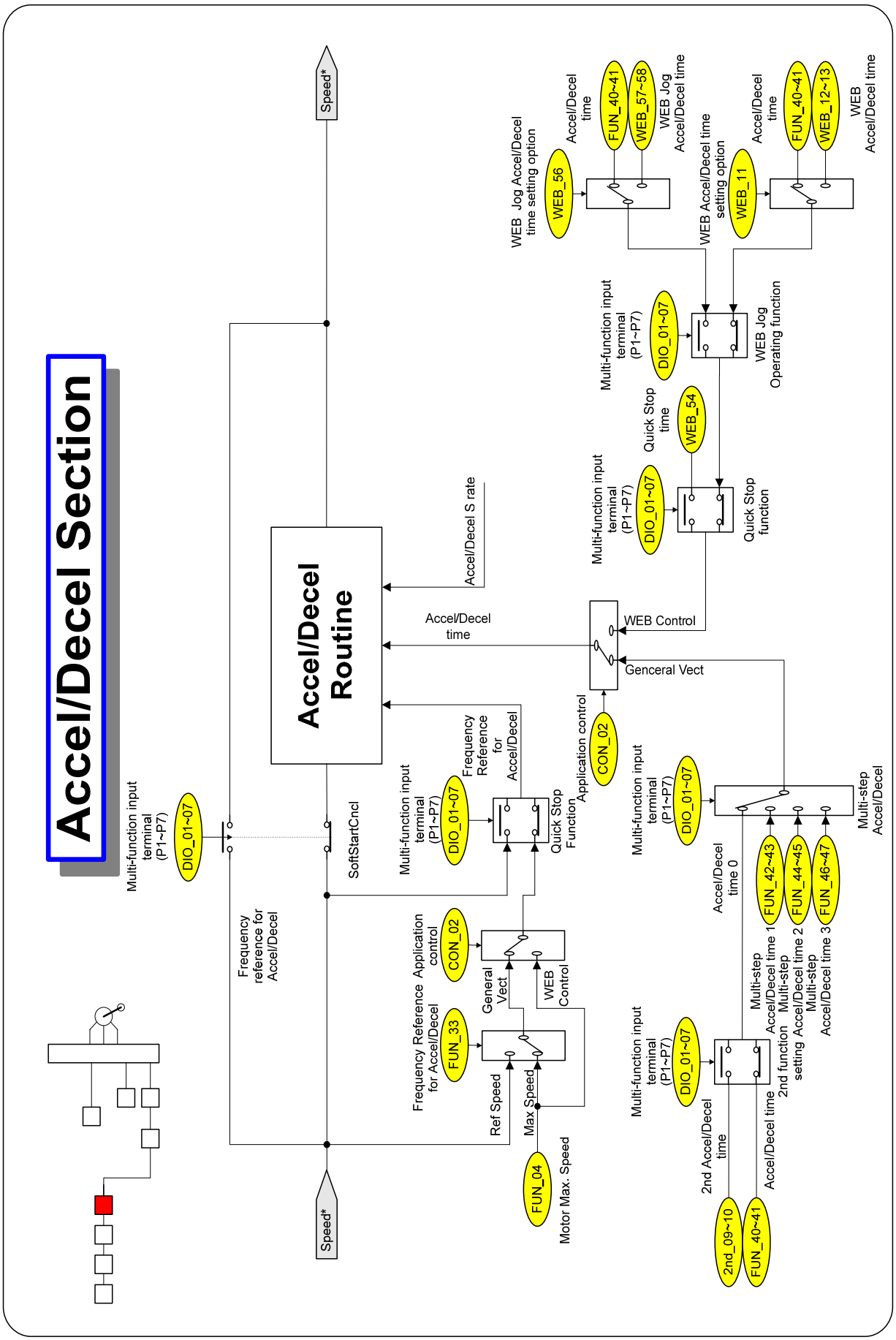

Freq./Speed setting
Speed Ref
Application control
CON_02
General Vect
WEB Control
Multi-function input terminal setting (P1~P7)
DIO_01~07
Jog operatopn
Jog speed reference
FUN_20
Up/Down operating Freq. reference
Multi-function input terminal setting (P1~P7)
DIO_01~07
Up/Down operation
Motor Max Speed
FUN_04
Limit
Multi-function input terminal (P1~P7)
DIO_01~07
Speed-L
Speed-M
Speed-H
Multi-step(MS) spd 0
FUN_13
FUN_14
FUN_15
FUN_16
FUN_17
FUN_18
FUN_19
MS spd 1
MS spd 2
MS spd 3
MS spd 4
MS spd 5
MS spd 6
MS spd 7
Speed setting
FUN_02
Analog Input
Keypad 1
Keypad 2
Option Input
Limit
Speed Ref
FUN_12
Option Freq. /Speed Reference
Option
Draw quantity
CON_22
Draw Reference
Draw Ref
Multi-function input terminal setting (P1~P7)
DIO_01~07
WEB Jog operating function setting
WEB Jog Speed setting
WEB_55
Max motor rotating speed at Min. diameter
WEB_08
Limit
Speed Calculator
Refer to P.7-42 line speed block diagram
Speed setting
FUN_02
Line Speed Ref
WEB spd reference(Analog)
WEB spd reference(Option)
Line SPD Ref
Line SPD Opt

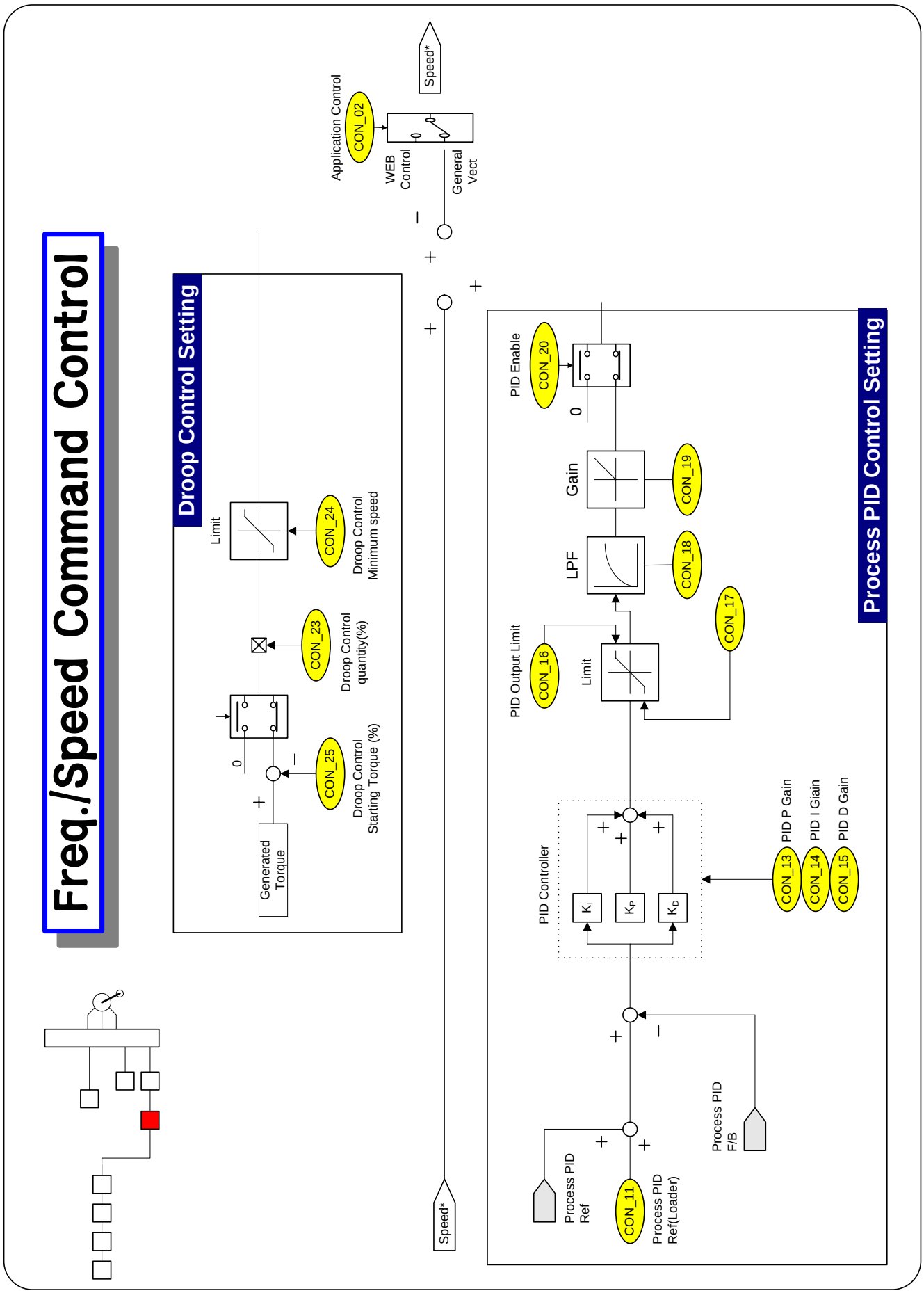
Freq./Speed Reference






Drive Sequence Section
RUN/STOP source select
FUN_01
Keypad
Terminal 1
Terminal 2
Option
Auto-Tuning
Disabled = Reference direction
STOP
FWD/REV rotation disable
DIO_01~07
None
FWD Prohibit
REV Prohibit
Protection circuit active
Reference = Rotation direction
Speed Ref
0
Operating direction switch
Speed*
RUN
STOP
FREERUN
Stop method
FUN_03
Decel
FreeRun
Gate closed
KPD_FWD
KPD_REV
KPD_STOP
FX
RX
OPT_FWD
OPT_REV
OPT_STOP
RUN
STOP


Accel/Decel Section
Accel/Decel Routine
Speed*
Speed*
Multi-function input terminal (P1~P7)
DIO_01~07
SoftStartCncl
Frequency reference for Accel/Decel
Accel/Decel S rate
Accel/Decel time
Frequency Reference for Accel/Decel
Multi-function input terminal (P1~P7)
DIO_01~07
Quick Stop Function
Application control
CON_02
WEB Control
Genceral Vect
Frequency Reference for Accel/Decel
FUN_33
Application control
CON_02
General Vect
WEB Control
Ref Speed
Max Speed
FUN_04
Motor Max. Speed
Multi-function input terminal (P1~P7)
DIO_01~07
Quick Stop time
WEB_54
Quick Stop function
Multi-function input terminal (P1~P7)
DIO_01~07
WEB Jog Operating function
WEB Jog Accel/Decel time setting option
WEB_56
Accel/Decel time
FUN_40~41
WEB_57~58
WEB Jog Accel/Decel time
WEB Accel/Decel time setting option
WEB_11
Accel/Decel time
FUN_40~41
WEB_12~13
WEB Accel/Decel time
Multi-function input terminal (P1~P7)
DIO_01~07
Multi-step Accel/Decel
Accel/Decel time 0
Multi-step Accel/Decel time 1
FUN_42~43
Multi-step Accel/Decel time 2
FUN_44~45
Multi-step Accel/Decel time 3
FUN_46~47
Multi-function input terminal (P1~P7)
DIO_01~07
2nd function setting
2nd Accel/Decel time
2nd_09~10
Accel/Decel time
FUN_40~41


Freq./Speed Command Control
Droop Control Setting
Limit
CON_24
Droop Control Minimum speed
CON_23
Droop Control quantity(%)
0
CON_25
Droop Control Starting Torque (%)
Generated Torque
Application Control
CON_02
WEB Control
General Vect
Speed*
Process PID Control Setting
PID Enable
CON_20
0
Gain
CON_19
LPF
CON_18
PID Output Limit
CON_16
Limit
CON_17
PID Controller
KI
KP
KD
CON_13
PID P Gain
CON_14
PID I Giain
CON_15
PID D Gain
Process PID F/B
Process PID Ref
CON_11
Process PID Ref(Loader)
Speed*

ADDITIONAL UL MARKING

1. Short Circuit Rating

"Suitable For Use On A Circuit Capable Of Delivering Not More Than Table1* RMS Symmetrical Amperes, 240 for rated 240V drives or 480 for rated 480V drives Volts Maximum," or equivalent.

Table1*

Inverter Capacity	Rating
200/400V Class: 5.5kW, 7.5kW, 11kW, 15kW, 18.5 kW, 22kW, 30kW, 37kW	5,000A
400V Class: 45kW, 55kW, 75kW, 90kW, 110kW, 132kW	10,000A
400V Class: 160kW, 220kW	18,000A

2. SHORT CIRCUIT FUSE/BREAKER MARKING

Use Class H or K5 UL Listed Input Fuse and UL Listed Breaker Only. See the table below for the Voltage and Current rating of the fuses and the breakers.

Input [V]	Inverter [kW]	External Fuse		Breaker		Internal Fuse			
		Current [A]	Voltage [V]	Current [A]	Voltage [V]	Current [A]	Voltage [Vac/dc]	Manufacturer	Model Number
200 Class	5.5	40	500	50	220	60	250	Hinode Elec	250GH-60
	7.5	50	500	60	220	60	250	Hinode Elec	250GH-60
	11	70	500	100	220	125	250	Hinode Elec	250GH-125
	15	100	500	100	220	150	250	Hinode Elec	250GH-150
	18.5	100	500	225	220	175	250	Hinode Elec	250GH-175
	22	125	500	225	220	225	250	Hinode Elec	250GH-225
	30	150	500	225	220	250	250	Hinode Elec	250GH-250S
	37	200	500	225	220	250	250	Hinode Elec	250GH-250S
400 Class	5.5	20	500	30	460	35	660	Hinode Elec	660GH-35
	7.5	30	500	30	460	35	660	Hinode Elec	660GH-35
	11	35	500	50	460	63	660	Hinode Elec	660GH-63
	15	45	500	60	460	80	660	Hinode Elec	660GH-80
	18.5	60	500	100	460	100	660	Hinode Elec	660GH-100
	22	70	500	100	460	125	660	Hinode Elec	660GH-125
	30	100	500	100	460	125	600	Hinode Elec	600FH-125S
	37	100	500	225	460	150	600	Hinode Elec	600FH-150S
	45	100	500	225	460	200	600	Hinode Elec	600FH-200S
	55	150	500	225	460	200	600	Hinode Elec	600FH-200S
	75	200	500	225	460	125	600	Hinode Elec	600FH-125S
	90	250	500	400	460	200	600	Hinode Elec	600FH-200S
	110	300	500	400	460	200	600	Hinode Elec	600FH-200S
	132	400	500	400	460	300	600	Hinode Elec	600FH-300S
	160	400	500	400	460	300	600	Hinode Elec	600FH-300S
	220	—	—	600	460	600	600	Hinode Elec	600SPF-600UL

3. FIELD WIRING TERMINAL

1) Use Copper wires only with Copper conductors, 75℃
2) Input and motor output terminal blocks are intended only for use with ring type connectors.

4. CAUTION-Risk of Electric Shock

"Before opening the cover, disconnect all power and wait at least 10 minutes"

Units suitable only for use in a pollution degree 2 environment. Be sure to mount the inverter in a forced-ventilated operating panel.

EC DECLARATION OF CONFORMITY

We, the undersigned,

Representative:	**LSIS Co., Ltd.**
Address:	**LS Tower, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do 1026-6, Korea**
Manufacturer:	**LSIS Co., Ltd.**
Address:	**181, Samsung-ri, Mokchon-Eup, Chonan, Chungnam, 330-845, Korea**

Certify and declare under our sole responsibility that the following apparatus:

Type of Equipment:	**Inverter (Power Conversion Equipment)**
Model Name:	**STARVERT-iV5 series**
Trade Mark:	**LSIS Co., Ltd.**

conforms with the essential requirements of the directives:

2006/95/EC Directive of the European Parliament and of the Council on the harmonisation of the laws of Member States relating to Electrical Equipment designed for use within certain voltage limits

2004/108/EC Directive of the European Parliament and of the Council on the approximation of the laws of the Member States relating to electromagnetic compatibility

based on the following specifications applied:

EN 61800-3:2004
EN 50178:1997

and therefore complies with the essential requirements and provisions of the 2006/95/CE and 2004/108/CE Directives.

Place: **Chonan, Chungnam, Korea**

16/01/2009 (Signature /Date)

Mr. Dok Ko Young Chul / Factory Manager
(Full name / Position)

EMI / RFI POWER LINE FILTERS
LS inverters, iV5 series

RFI FILTERS

THE LS RANGE OF POWER LINE FILTERS FF (Footprint) - FE (Standard) SERIES, HAVE BEEN SPECIFICALLY DESIGNED WITH HIGH FREQUENCY LG INVERTERS. THE USE OF LS FILTERS, WITH THE INSTALLATION ADVICE OVERLEAF HELP TO ENSURE TROUBLE FREE USE ALONG SIDE SENSITIVE DEVICES AND COMPLIANCE TO CONDUCTED EMISSION AND IMMUNITY STANDARDS TO EN 50081.

CAUTION

IN CASE OF A LEAKAGE CURRENT PROTECTIVE DEVICES IS USED ON POWER SUPPLY, IT MAY BE FAULT AT POWER-ON OR OFF. IN AVOID THIS CASE, THE SENSE CURRENT OF PROTECTIVE DEVICE SHOULD BE LARGER THAN VALUE OF LAKAGE CURRENT AT WORST CASE IN THE BELOW TABLE.

RECOMMENDED INSTALLATION INSTRUCTIONS

To conform to the EMC directive, it is necessary that these instructions be followed as closely as possible. Follow the usual safety procedures when working with electrical equipment. All electrical connections to the filter, inverter and motor must be made by a qualified electrical technician.

1-) Check the filter rating label to ensure that the current, voltage rating and part number are correct.

2-) For best results the filter should be fitted as closely as possible to the incoming mains supply of the wiring enclousure, usually directly after the enclousures circuit breaker or supply switch.

3-) The back panel of the wiring cabinet of board should be prepared for the mounting dimensions of the filter. Care should be taken to remove any paint etc... from the mounting holes and face area of the panel to ensure the best possible earthing of the filter.

4-) Mount the filter securely.

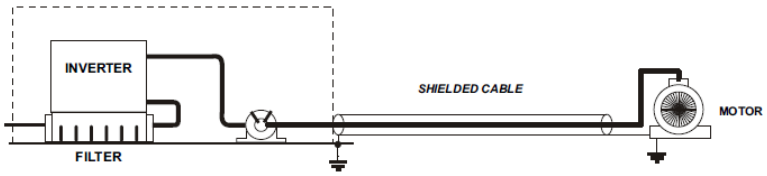
5-) Connect the mains supply to the filter terminals marked LINE, connect any earth cables to the earth stud provided. Connect the filter terminals marked LOAD to the mains input of the inverter using short lengths of appropriate gauge cable.

6-) Connect the motor and fit the ferrite core (output chokes) as close to the inverter as possible. Armoured or screened cable should be used with the 3 phase conductors only threaded twice through the center of the ferrite core. The earth conductor should be securely earthed at both inverter and motor ends. The screen should be connected to the enclousure body via and earthed cable gland.

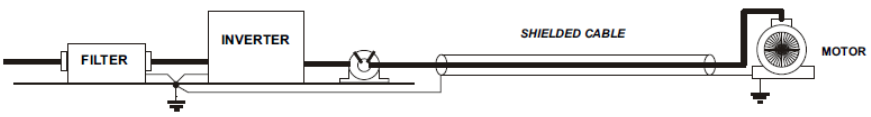
7-) Connect any control cables as instructed in the inverter instructions manual.

IT IS IMPORTANT THAT ALL LEAD LENGHTS ARE KEPT AS SHORT AS POSSIBLE AND THAT INCOMING MAINS AND OUTGOING MOTOR CABLES ARE KEPT WELL SEPARATED.

FF SERIES (Footprint)



FE SERIES (Standard)



iV5 series / Footprint Filters

INVERTER	POWER	CODE	CURRENT	VOLTAGE	LEAKAGE CURRENT	DIMENSIONS L W H	MOUNTING Y X	WEIGHT	MOUNT	FIG.	OUTPUT CHOKES
THREE PHASE					NOM. MAX.						
SV022iV5-2 (DB)	2.2kW	FFV5-T020-(x)	20A	250VAC	0.5mA 27mA	329x199.5x60	315x160	1.8Kg.	M5	A	FS-2
SV037iV5-2 (DB)	3.7kW										
SV055iV5-2 (DB)	5.5kW	FFV5-T030-(x)	30A	250VAC	0.5mA 27mA	451x234.5x60	437x190	2.1Kg.	M5	A	FS-2
SV075iV5-2 (DB)	7.5kW	FFV5-T050-(x)	50A	250VAC	0.5mA 27mA	451x234.5x60	437x190	2.6Kg.	M5	A	FS-2
SV110iV5-2 (DB)	11kW		100A	250VAC	0.5mA 27mA						
SV150iV5-2 (DB)	15kW										
SV185iV5-2 (DB)	18kW		120A	250VAC	0.5mA 27mA						
SV220iV5-2 (DB)	22kW										
SV300iV5-2 (DB)	30kW		150A	250VAC	0.5mA 27mA						
SV370iV5-2 (DB)	37kW		180A	250VAC	0.5mA 27mA						
SV022iV5-4 (DB)	2.2kW	FFV5-T011-(x)	11A	380VAC	0.5mA 27mA	329x199.5x60	315x160	1.5Kg.	M5	A	FS-2
SV037iV5-4 (DB)	3.7kW										
SV055iV5-4 (DB)	5.5kW	FFV5-T030-(x)	30A	380VAC	0.5mA 27mA	451x234.5x60	437x190	2Kg.	M5	A	FS-2
SV075iV5-4 (DB)	7.5kW										
SV110iV5-4 (DB)	11kW	FFV5-T051-(x)	51A	380VAC	0.5mA 27mA	605x335x65	579.5x265	2.5Kg.	M8	A	FS-2
SV150iV5-4 (DB)	15kW										
SV185iV5-4 (DB)	18kW	FFV5-T060-(x)	60A	380VAC	0.5mA 27mA	605x335x65	579.5x265	2.8Kg.	M8	A	FS-2
SV220iV5-4 (DB)	22kW	FFV5-T070-(x)	70A	380VAC	0.5mA 27mA	605x335x65	579.5x265	2.8Kg.	M8	A	FS-3
SV300iV5-4 (DB)	30kW	FFV5-T071-(x)	71A	380VAC	0.5mA 27mA	756x350x65	730.5x281	3Kg.	M8	A	FS-3
SV370iV5-4 (DB)	37kW		100A	380VAC	0.5mA 27mA						
SV450iV5-4 (DB)	45kW		120A	380VAC	0.5mA 27mA						
SV550iV5-4 (DB)	55kW										
SV750iV5-4 (DB)	75kW		170A	380VAC	0.5mA 27mA						
SV900iV5-4 (DB)	90kW		230A	380VAC	0.5mA 27mA						
SV1100iV5-4 (DB)	110kW		400A	380VAC	0.5mA 27mA						
SV1320iV5-4 (DB)	132kW										
SV1600iV5-4 (DB)	160kW		600A	380VAC	0.5mA 27mA						
SV2200iV5-4 (DB)	220kW										
SV2800iV5-4 (DB)	280kW		1000A	380VAC	0.5mA 27mA						
SV3150iV5-4 (DB)	315kW										
SV3750iV5-4 (DB)	375kW										
SV055iV5-2DB (MD)	5.5kW	FFV5-T031-(x)	31A	250VAC	0.5mA 27mA	400x199.5x60	386x160	2Kg.	M5	A	FS-2
SV075iV5-2DB (MD)	7.5kW	FFV5-T052-(x)	52A	250VAC	0.5mA 27mA	400x199.5x60	386x160	2.5Kg.	M5	A	FS-2
SV110iV5-2DB (MD)	11kW		100A	250VAC	0.5mA 27mA					A	FS-2
SV150iV5-2DB (MD)	15kW										
SV185iV5-2DB (MD)	18kW		120A	250VAC	0.5mA 27mA					A	FS-2
SV220iV5-2DB (MD)	22kW										
SV055iV5-4DB (MD)	5.5kW	FFV5-T031-(x)	31A	380VAC	0.5mA 27mA	400x199.5x60	386x160	2Kg.	M5	A	FS-2
SV075iV5-4DB (MD)	7.5kW										
SV110iV5-4DB (MD)	11kW	FFV5-T053-(x)	53A	380VAC	0.5mA 27mA	466x258x65	440.5x181	2.5Kg.	M5	A	FS-2
SV150iV5-4DB (MD)	15kW										
SV185iV5-4DB (MD)	18kW	FFV5-T061-(x)	61A	380VAC	0.5mA 27mA	541x312x65	515.5x235	2.6Kg.	M8	A	FS-2
SV220iV5-4DB (MD)	22kW	FFV5-T072-(x)	72A	380VAC	0.5mA 27mA	541x312x65	515.5x235	2.8Kg.	M8	A	FS-3

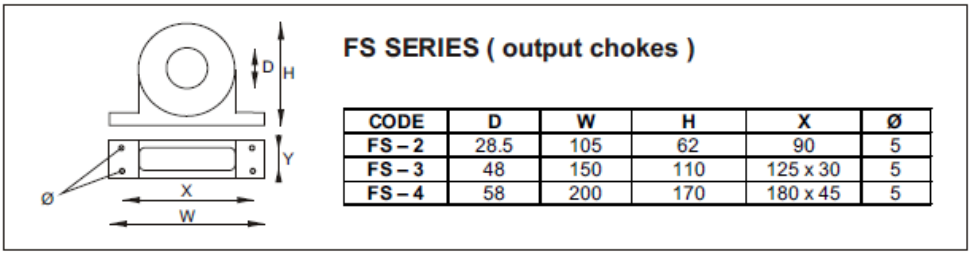
X (1) Industrial environment EN 50081-2 (A class) → EN61000-6-4:02

(2) Domestic and industrial environment EN50081-1 (B class) -> EN61000-6-3:02

iV5 series / Standard Filters

INVERTER	POWER	CODE	CURRENT	VOLTAGE	LEAKAGE CURRENT	DIMENSIONS L W H	MOUNTING Y X	WEIGHT	MOUNT	FIG.	OUTPUT CHOKES
THREE PHASE					NOM. MAX.						
SV022iV5-2 (DB)	2.2kW	FE-T020-(x)	20A	250VAC	0.5mA 27mA	270x140x60	258x106	2.2Kg.	---	B	FS-2
SV037iV5-2 (DB)	3.7kW										
SV055iV5-2 (DB)	5.5kW	FE-T030-(x)	30A	250VAC	0.5mA 27mA	270x140x60	258x106	2.4Kg.	---	B	FS-2
SV075iV5-2 (DB)	7.5kW	FE-T050-(x)	50A	250VAC	0.5mA 27mA	270x140x90	258x106	3.2Kg.	---	B	FS-2
SV110iV5-2 (DB)	11kW	FE-T100-(x)	100A	250VAC	0.5mA 27mA	425x200x130	408x166	13.8Kg.	---	B	FS-3
SV150iV5-2 (DB)	15kW										
SV185iV5-2 (DB)	18kW	FE-T120-(x)	120A	250VAC	0.5mA 27mA	425x200x130	408x166	13.8Kg.	---	B	FS-3
SV220iV5-2 (DB)	22kW										
SV300iV5-2 (DB)	30kW	FE-T150-(x)	150A	250VAC	0.5mA 27mA	480x200x160	468x166	15Kg.	---	B	FS-3
SV370iV5-2 (DB)	37kW	FE-T170-(x)	170A	250VAC	0.5mA 27mA	480x200x160	468x166	16Kg.	---	B	FS-3
SV022iV5-4 (DB)	2.2kW	FE-T012-(x)	12A	380VAC	0.5mA 27mA	250x110x60	238x76	1.6Kg.	---	B	FS-2
SV037iV5-4 (DB)	3.7kW										
SV055iV5-4 (DB)	5.5kW	FE-T030-(x)	30A	380VAC	0.5mA 27mA	270x140x60	258x106	2.4Kg.	---	B	FS-2
SV075iV5-4 (DB)	7.5kW										
SV110iV5-4 (DB)	11kW	FE-T050-(x)	50A	380VAC	0.5mA 27mA	270x140x90	258x106	3.2Kg.	---	B	FS-2
SV150iV5-4 (DB)	15kW										
SV185iV5-4 (DB)	18kW	FE-T060-(x)	60A	380VAC	0.5mA 27mA	270x140x90	258x106	3.5Kg.	---	B	FS-2
SV220iV5-4 (DB)	22kW	FE-T070-(x)	70A	380VAC	0.5mA 27mA	350x180x90	338x146	7.5Kg.	---	B	FS-3
SV300iV5-4 (DB)	30kW										
SV370iV5-4 (DB)	37kW	FE-T100-(x)	100A	380VAC	1.3mA 150mA	425x200x130	408x166	13.8Kg.	---	B	FS-3
SV450iV5-4 (DB)	45kW	FE-T120-(x)	120A	380VAC	1.3mA 150mA	425x200x130	408x166	13.8Kg.	---	B	FS-3
SV550iV5-4 (DB)	55kW										
SV750iV5-4 (DB)	75kW	FE-T170-(x)	170A	380VAC	1.3mA 150mA	480x200x160	468x166	16Kg.	---	B	FS-3
SV900iV5-4 (DB)	90kW	FE-T230-(x)	230A	380VAC	1.3mA 150mA	580x250x205	560x170	22.6Kg.	---	B	FS-4
SV1100iV5-4 (DB)	110kW	FE-T400-(x)	400A	380VAC	1.3mA 150mA	392x260x116	240x235	10.3Kg.	---	C	FS-4
SV1320iV5-4 (DB)	132kW										
SV1600iV5-4 (DB)	160kW	FE-T600-(x)	600A	380VAC	1.3mA 150mA	392x260x116	240x235	10.3Kg.	---	C	FS-4
SV2200iV5-4 (DB)	220kW										
SV2800iV5-4 (DB)	280kW	FE-T1000-(x)	1000A	380VAC	1.3mA 150mA	460x280x166	290x255	18Kg.	---	C	FS-4
SV3150iV5-4 (DB)	315kW										
SV3750iV5-4 (DB)	375kW										
SV055iV5-2DB (MD)	5.5kW	FE-T030-(x)	30A	250VAC	0.5mA 27mA	270x140x60	258x106	2.4Kg.	---	B	FS-2
SV075iV5-2DB (MD)	7.5kW	FE-T050-(x)	50A	250VAC	0.5mA 27mA	270x140x90	258x106	3.2Kg.	---	B	FS-2
SV110iV5-2DB (MD)	11kW	FE-T100-(x)	100A	250VAC	0.5mA 27mA	425x200x130	408x166	13.8Kg.	---	B	FS-3
SV150iV5-2DB (MD)	15kW										
SV185iV5-2DB (MD)	18kW	FE-T120-(x)	120A	250VAC	0.5mA 27mA	425x200x130	408x166	13.8Kg.	---	B	FS-3
SV220iV5-2DB (MD)	22kW										
SV055iV5-4DB (MD)	5.5kW	FE-T030-(x)	30A	380VAC	0.5mA 27mA	270x140x60	258x106	2.4Kg.	---	B	FS-2
SV075iV5-4DB (MD)	7.5kW										
SV110iV5-4DB (MD)	11kW	FE-T050-(x)	50A	380VAC	0.5mA 27mA	270x140x90	258x106	3.2Kg.	---	B	FS-2
SV150iV5-4DB (MD)	15kW										
SV185iV5-4DB (MD)	18kW	FE-T060-(x)	60A	380VAC	0.5mA 27mA	270x140x90	258x106	3.5Kg.	---	B	FS-2
SV220iV5-4DB (MD)	22kW	FE-T070-(x)	70A	380VAC	0.5mA 27mA	350x180x90	338x146	7.5Kg.	---	B	FS-3

X (1) Industrial environment EN 50081-2 (A class) → EN61000-6-4:02
(2) Domestic and industrial environment EN50081-1 (B class) -> EN61000-6-3:02



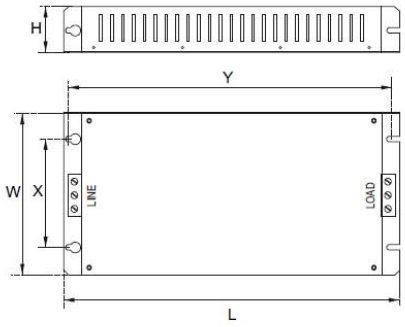
FS SERIES (output chokes)

CODE	D	W	H	X	Ø
FS – 2	28.5	105	62	90	5
FS – 3	48	150	110	125 x 30	5
FS – 4	58	200	170	180 x 45	5

DIMENSIONS

FF SERIES (Footprint)

FIG. A



FE SERIES (Standard)

FIG. B

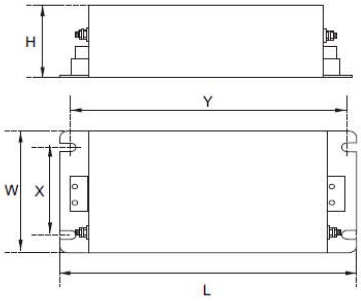
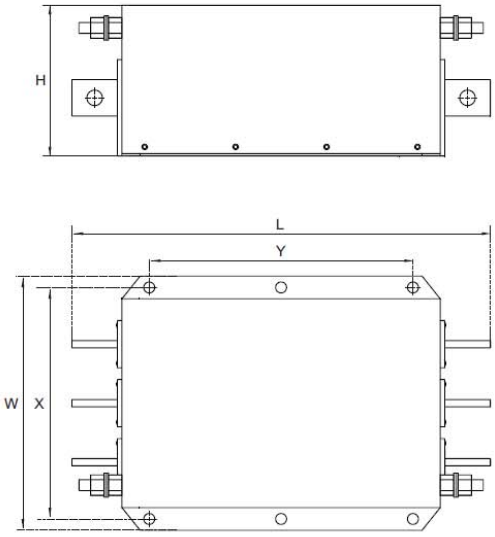


FIG.C



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Warranty

Maker	**LSIS Co., Ltd.**		**Installation (Start-up) Date**	
Model No.	***SV-iV5***		**Warranty Period**	
Customer Information	Name			
	Address			
	Tel.			
Sales Office (Distributor)	Name			
	Address			
	Tel.			

This product has been manufactured through a strict quality management and inspection process by LS Technical Team. The warranty period is 18 months from the date manufactured, provided that, the warranty period is subject change depending on the terms and condition of the agreement under separate cover.

FOC Service

If there is any failure in the product during the afore-mentioned warranty period you can have it repaired FOC by requesting our distributor or designated service center subject that you are found to have used it under our recommended environment. For further details, please refer to out company's regulation.

Charged Service

■ In the event of any of the following cases, the service will be charged.

- The failure occurred from the consumer's improper storage, handling, and careless handling
- The failure occurred from the consumer's error in the design of software or hardward
- The failure occurred from the error of power source and the defect of the connector
- The failure occurred from the force majeure (fire, flood, gas disaster, earthquake, etc.)
- The product was modified or repaired at the discretion of the consumer in the place other than our Distributor or the Service Center.
- The name plate provided by LS is not attached on the product
- The product was used in an improper way or beyond the operating range.

■ Repair Warranty Period for the Discontinued Model

- For the product discontinued, the repair service will be provided with charge for five years from the date discontinued.

■ Waiver of the warranty for the mechanical loss, etc.

LSIS Co., Ltd. doesn't bear any responsibility to indemnify indirect, special, incidental, or consequential loss (including the indemnification of sales loss, loss profit, etc.

Revision History

No.	Date	Edition	Changes
1	May, 2001	First Release	Ver. 1.00
2	March, 2002	2nd Edition	Ver. 1.20 / Added codes
3	April, 2002	3rd Edition	Ver. 1.30 / Changed functions
4	October, 2002	4th Edition	Ver. 1.40 / Added and changed functions
5	June, 2003	5th Edition	Ver. 1.50 / Added and changed functions
6	December, 2004	6th Edition	Ver. 1.70 / Added information on MD type
7	November, 2005	7th Edition	Ver. 1.91 / Changed CI and added capacity
8	May, 2006	8th Edition	Ver. 2.10 / Added functions
9	June, 2008	9th Edition	Ver.2.40 / Synchronization operation, WEB controlling, 280~375kW Capacity
10	April, 2009	10th Edition	Ver2.41 / Battery-operated mode function added
11	July, 2010	11th Edition	Ver. 2.61 DC power input source added
12	Mar, 2011	12th Edition	Ver.2.70 Capacity extended to 500kW

Environment management

LSIS regards the environmental preservation as a high priority, and all our employees do our best for the environmental preservation fresh earth.

Disposable product

LS inverter is designed for preserving environment. When you disuse the products, you can recycle by separating them to iron, aluminum, bronze, and synthetic plastic (cover).

LS values every single customer.
Quality and service come first at LSIS.
Always at your service, standing for our customers.

www.lsis.biz

LSIS

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※ LSIS constantly endeavors to improve its product so that nformation in this manual is subject to change without notice.

SV-iV5/2011.05

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