DRIVES DIRECT
Digital Phase Converters

DSA-5-10HP-240V

DSA Series
USER MANUAL

240V Single Phase to 415V 3Φ
Class 3～10Hp

Please hand this manual to the end-users. It will be of great help for their daily operation, maintenance, inspection and troubleshooting.

NOTE FOR SAFE OPERATION

Read this instruction manual thoroughly before installation, operation, maintenance or inspection of the inverter. And only authorized personnel should be permitted to perform maintenance, inspections or parts replacement.

In this manual, notes for safe operation are classified as "WARNING" or "CAUTION".

: Indicates a potentially hazardous situation which, if not heeded, could possibly result in death or serious injury.

: Indicates a potentially hazardous situation which, if not heeded, may result in moderate or minor injury and damage to the product. or faulty operation.

■ "WARNING" or "CAUTION"

WARNING

- Always turn off the input power supply before wiring terminals.
- After turning OFF the main circuit power supply, do not touch the circuit components until the "CHARGE" lamps extinguished.
- Never connect the main circuit terminals U, V, W to AC main power supply.

CAUTION

- When mounting units in an enclosure, install a fan or other cooling device to keep the intake air temperature below 45℃。
- Do not perform a withstand voltage test to the inverter.
- All the constants of the inverter have been preset at the factory. Do mot change the settings unnecessarily.

This inverter has been gone thorough all the demanding tests at the factory before shipment. After unpacking, check for the following:

1. Verify the model numbers with the purchase order sheet and/or packing slip.
2. Do not install any inverter which is damaged in any way or missing parts.
3. Do not install or operate any inverter that has no CE marking.

Contact our representative, if you find any irregularities mentioned above.

Thank you so much of adopting the Drives Direct DSA Range inverter.

The DSA range is a derivative of the 7200MA Series VECTOR inverters and will be referred to as the DSA Series from now on,

This manual firstly describes the correct application of handling, wiring, operating, specification, and maintenance/inspection. Then, the manual explains the digital operator performance, constants setting, operation, troubleshooting, etc. Before using the DSA Inverter, a thorough understanding of this manual is recommended for daily maintenance, troubleshooting and inspection. Please keep this manual in a secure and convenient place for any future reference.

Contents

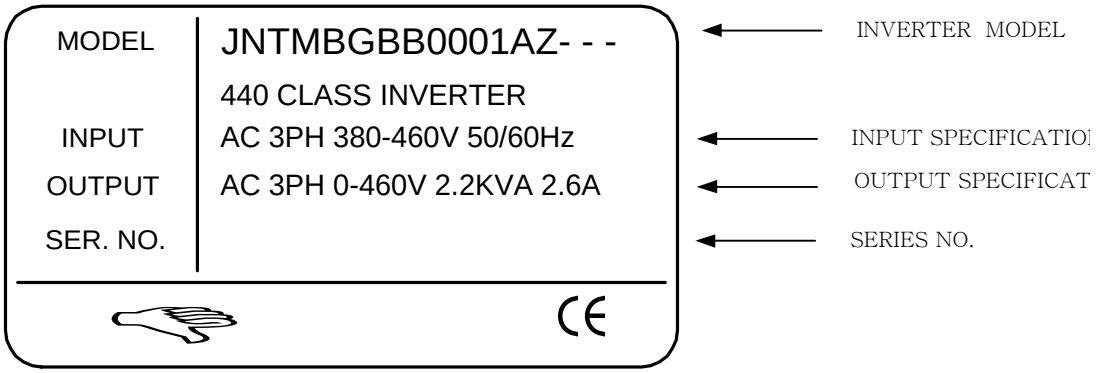
1. 7200 MA Handling Description

1.1 Inspection Procedure upon Receiving

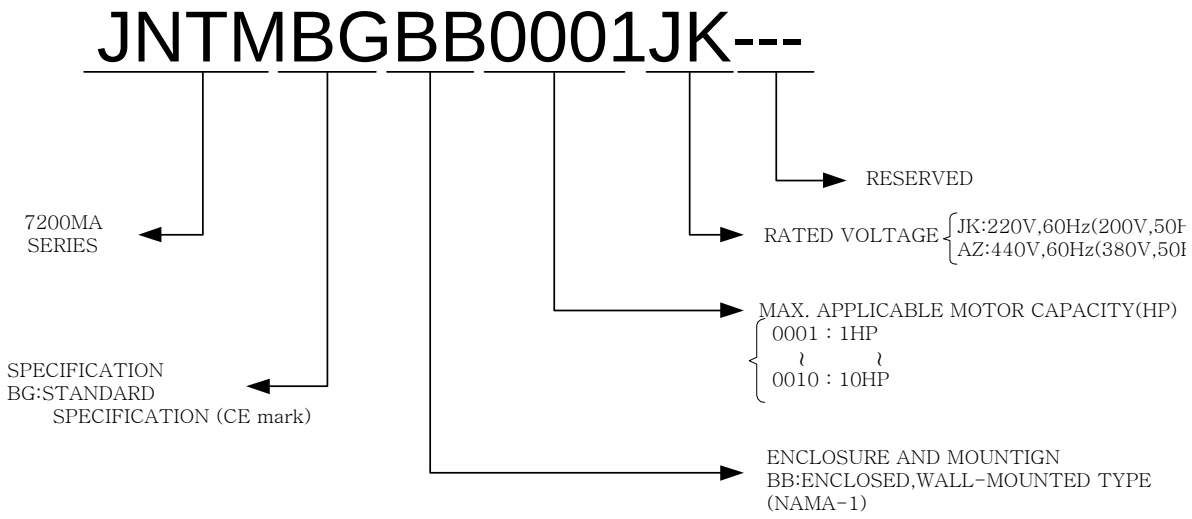
Before delivery, Every 7200 MA inverter have been properly adjusted and passed the demanding function test. After receiving the inverter, the customer should take it out and follow the below procedure:

- Verify that the Type No. of the inverter you've received is the same as the Type No. listed on your purchase order. (Please refer the Nameplate)
- Observe the condition of the shipping container and report any damage immediately to the commercial carrier that have delivered your inverter.

■ Inverter nameplate:

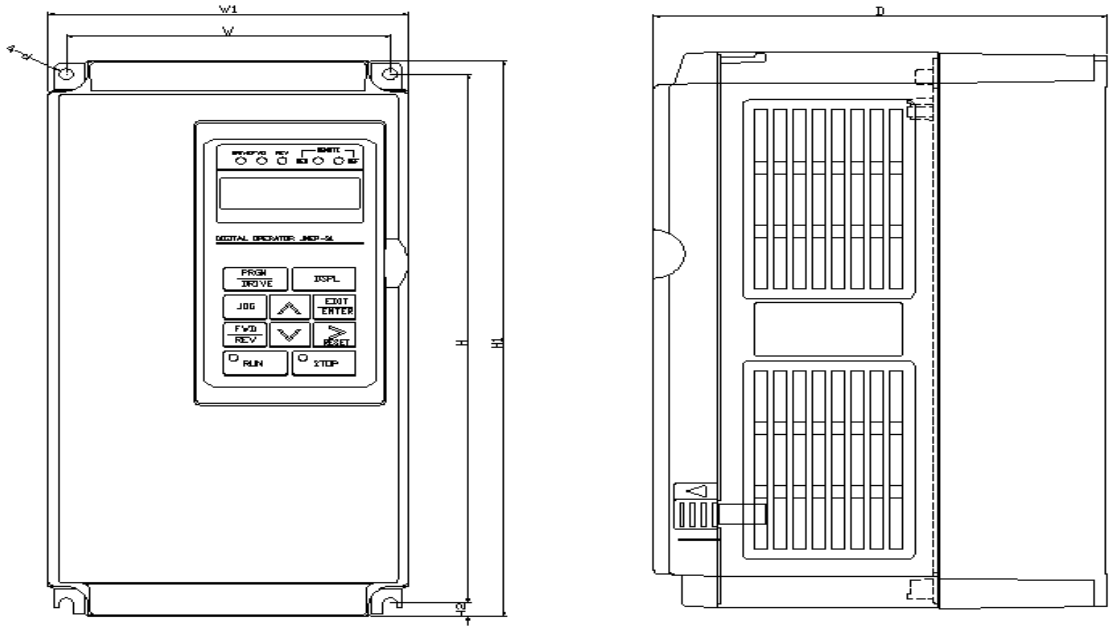


■ Inverter model number：



1.2 Installation

When installing the inverter, always provide the following space to allow normal heat dissipation.



(a) Horizontal space (b) Vertical space

(a) Horizontal space (b) Vertical space

Fig 1 DSA Series installation orientation and space.

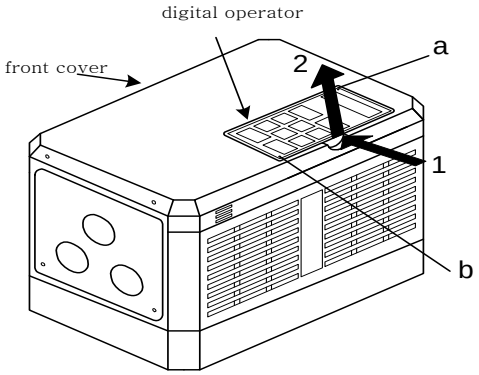
CAUTION
Location of equipment is important to achieve proper performance and normal operating life. The DSA Series model unit should be installed in area where the following conditions exist. · Ambient temperature : -10℃~+40℃ (For enclosed type) : -10℃~+45℃ (For open chased type) · Install DSA Series in a location free from rain, moisture and not in direct sunlight. · Install DSA Series in a location free from harmful mist, gases, liquids, dusts and metallic powder. · Install DSA Series in a location without excessive oscillation and electromagnetic noise. · If more than 1 inverter are installed in a box, be sure to add a cooling fan or air conditioner to maintain the air temperature below +45℃.

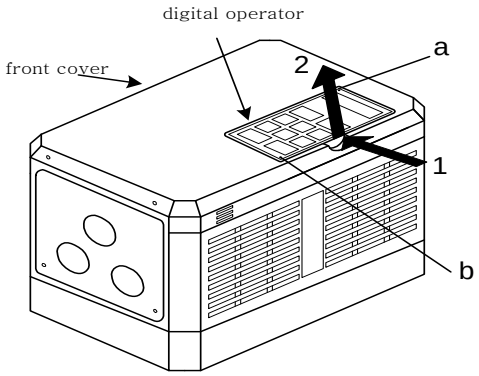
1.3 Removing/Attaching the Digital Operator and Front cover

Remove the front cover to wire the terminals.

・Removing the digital operator

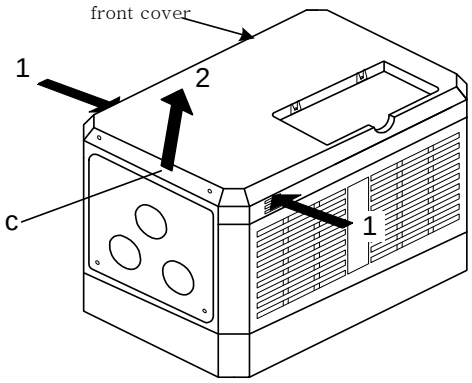
Take off the screws in the place a and b. Press the lever on the side of the digital Operator in the direction of arrow 1 to unlock the Digital Operator and lift the Digital Operator in the direction of arrow 2 to remove the Digital Operator as shown in the following illustration.





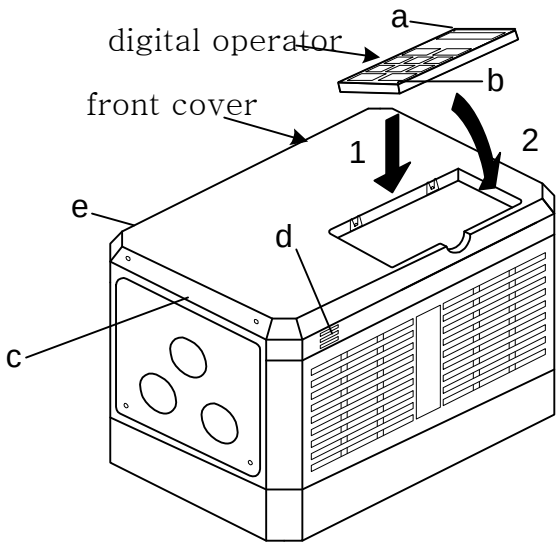
・Removing the front cover

Press the left and right side of the front cover in the directions of arrow 1 and lift the bottom of the cover in the direction of arrow 2 to remove the front cover as shown in the following illustration


front cover
1
2
c
1

• Mounting the front cover and digital operator

Insert the tab of the upper part of front cover into the groove of the inverter and press the lower part of the front cover onto the inverter until the front cover snaps shut. Hook the digital operator at A on the front cover in the direction of arrow 1 as shown in the following illustration. Press the digital operator in the direction of arrow 2 until it snaps in the place B. Then, tighten the screws in the place c and d. (on the front cover)



1.4 Wiring between Inverter and Peripheral devices and notice

Caution

1. After turning OFF the main circuit power supply, do not touch the circuit components or change any circuit components before the "CHARGE" lamps extinguished. (It indicates that there is still some charge in the capacitor).
2. Never do wiring work or take apart the connectors in the inverter while the power is still on.
3. Never connect the inverter output U、V、W to the AC source.
4. Always connect the ground lead E to ground.
5. Never apply high voltage test directly to the components within the inverter. (The semiconductor devices are vulnerable to high voltage shock.)
6. The CMOS IC on the control board is vulnerable to ESD. Do not try to touch the control board.
7. If Sn-03 is 7,9,11 (2-wire mode) or is 8,10,12 (3-wire mode), except parameter settings of Sn-01 and Sn-02, the other parameter settings will return to their initial settings at factory. If the inverter is initially operated in 3-wire mode (Sn-03= 8,10,12), the motor will rotate in CCW sense after setting changed to 2-wire mode. (Sn-03= 7,9,11). Be sure that the terminals 1 and 2 are OPEN so as not to harmful to personal or cause any potential damage to machines.

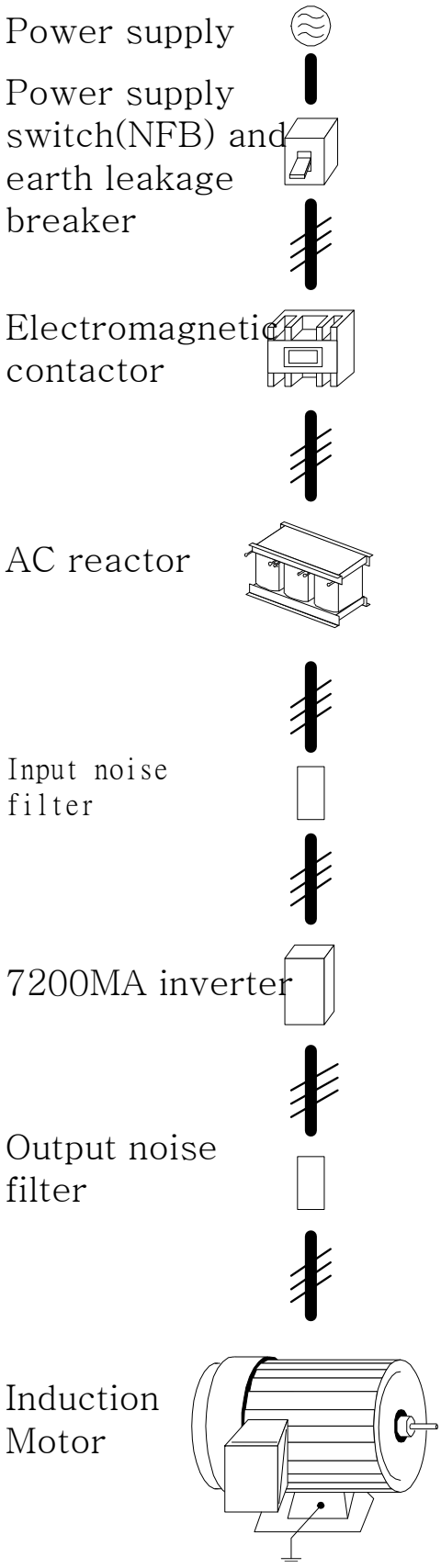
Caution

1.Determine the wire size for the main circuit so that the line voltage drop is within 2% of the rated voltage. If there is the possibility of excessive voltage drop due to wire length, use a larger wire (larger diameter) suitable to the required length

$$\text{Line voltage drop(V)} = \sqrt{3} \times \text{wire resistance}(\Omega/\text{km}) \times \text{wire length(m)} \times \text{current(A)} \times 10^{-3}$$

2.If the cable wire between the inverter and the motor is long enough, use a lower carrier frequency for PWM (adjust the parameter Cn-34). Refer to Page 16.

Example of connection between the DSA Series and typical peripheral devices are shown as below.



■Power supply switch(NFB) and earth leakage breaker

- Choose the power supply switch(NFB) of proper current rating.
- Do not use the power supply switch(NFB) as the switch that the inverter is used to control the running or stop of motor.
- When the earth leakage breaker installed to protect the leakage current fault, be sure that the earth leakage breaker has the sensitivity amperage≧200mA per inverter and operation time ≧0.1 sec to avoid false-triggering.

■ Electromagnetic contactor

- In normal operation, you don't need an electromagnetic contactor. However, you need to install an electromagnetic contactor while in the case of sequence control through the external device or automatically re-start after power outage.
- Do not use the electromagnetic contactor as the switch that control the operation of running or stop.

■ AC reactor

- The AC-side reactor on the input AC side can improve the power factor and suppress the surge current.

■ Input noise filter

- DSA Series will comply with the EN55011A regulation if an input noise filter (specified by DD) is used.
- Please consult with the selection guide "1.9 Peripheral device" on page.

■ DSA Series inverter

- Input power supply can be connected to any terminal R, S, T on the terminal block. The phase sequence of input power supply is irrelevant to phase sequence.
- Please connect the ground terminal E to the site ground securely.

■ Output noise filter

- Install the noise filter to eliminate noise transmitted between the power line and the inverter.
- Please consult with the selection guide "1.9 Peripheral device" on page.

■ Induction Motor

- If one inverter is to drive more than one motors, the inverter's rated current should be much greater than the sum of total current of motors while in operation.
- The inverter and motors should connect to the ground

■Connection diagram

The standard connection diagram of DSA Series is shown in Fig 2. Here, the sign ◎ indicates the main circuit terminal and the sign ○ indicates control circuit terminals). The terminal function and arrangement is summarized in Table 1 and Table 2.

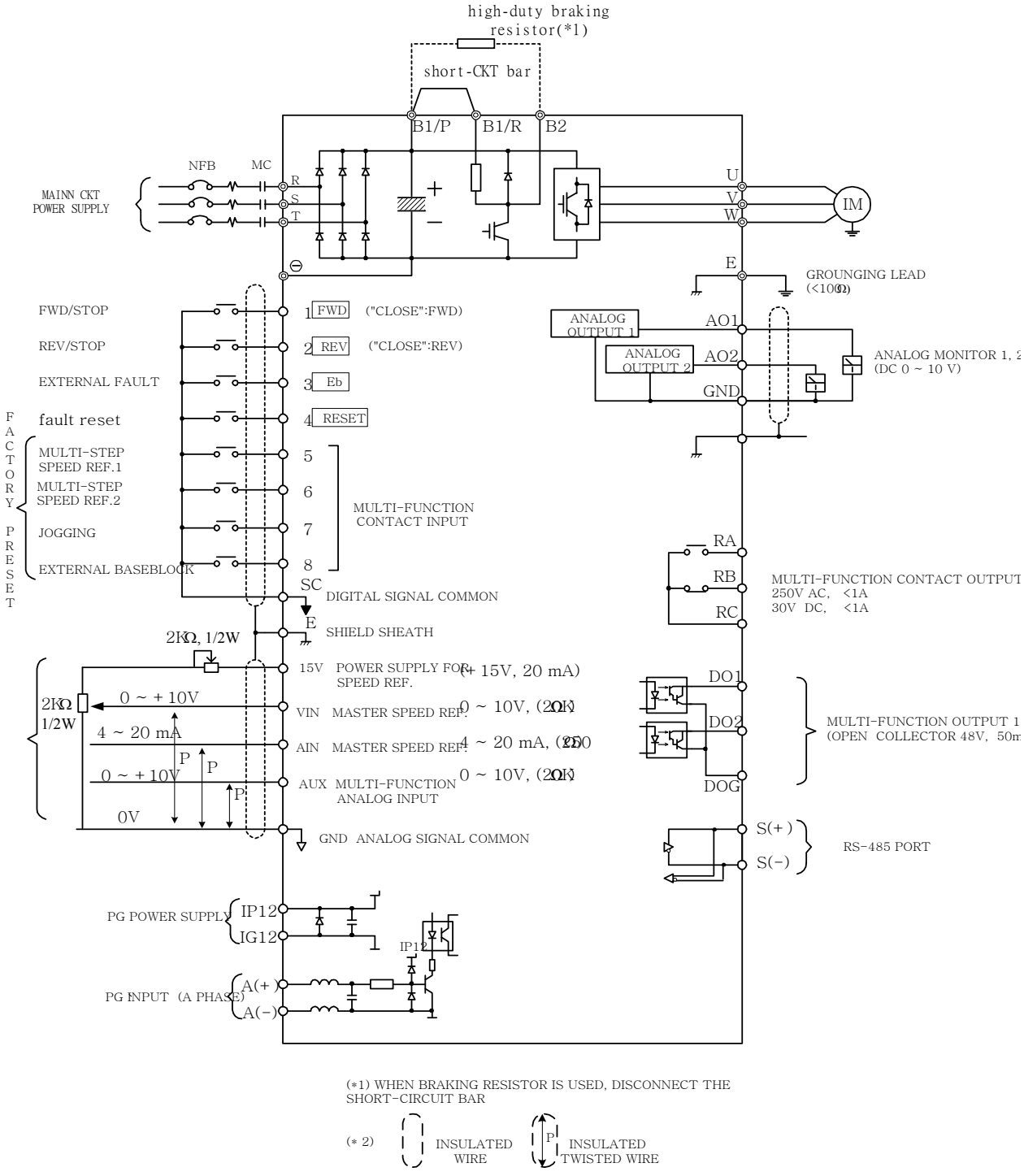


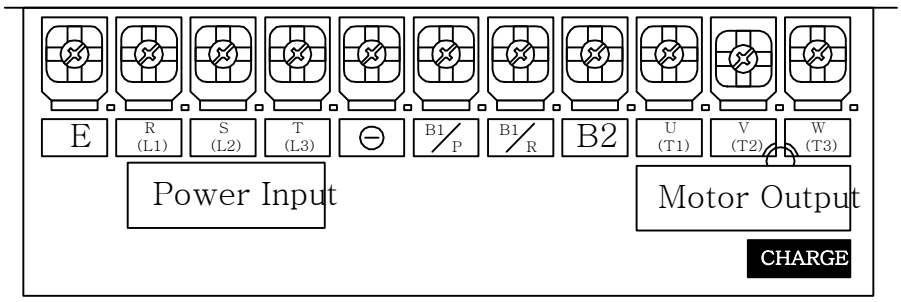
Fig. 2 Connection diagram

1.5 Description of terminal function

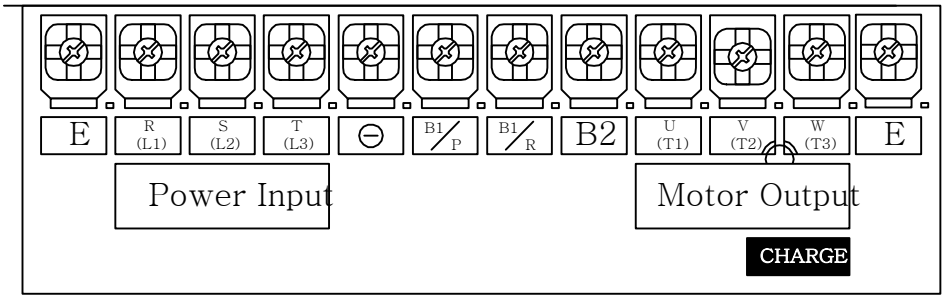
Terminal	Terminal Function
R (L1)	Main circuit input power supply
S (L2)	
T (L3)	
U (T1)	Inverter Output
V (T2)	
W (T3)	
⊖ B1/P B2/R B2	·B1/P, B1/R short-circuit: installed braking resistor ·B1/P, B1/R open-circuit: external braking resistor (B1P, B2) ·B1/P,⊖: DC power supply input
U	Inverter output
V	
W	
E	Grounding lead (3rd type grounding)

• Terminal block configuration

220V / 440V 1 ~ 5 Hp Model



220V / 440V 7.5 / 10 Hp Model



Factory setting : B1/P and B1/R short circuit

Table 2 Control circuit terminals

Terminal	Functions	
1	Forward Operation – Stop Signal	
2	Reverse Operation – Stop Signal	
3	External Fault Input	
4	Fault Reset	
5	Multifunction Input Terminal: 3-Wire Operation, Load/Remote Control, Multi-speed select, Forward/Reverse Select, ACC/DEC choice, ACC/DEC Halting, Base Block, Overheat Warn, PID control, DC Brake, Speed Search, Up/Down function, PG feedback control, External Fault, Timer function, Multifunction analog input setting	
6		
7		
8		
SC	Digital Signal Ground	
E	Connection to shield signal lead (Frame Ground)	
+15V	Power supply for external device	
VIN	Master speed Voltage reference (0~10V)	
AIN	Master speed Current reference (4~20mA)	
AUX	Auxiliary Analog Input: Auxiliary frequency Command, Frequency Gain, Frequency Bias, Overtorque Detection, Output Voltage Bias, ACC/DEC ramp, DC-brake Current, Stall Prevention current level during running mode, PID control, Lower-Bound of Frequency, frequency-Jump-4, etc	
GND	Analog signal Common	
IP12	Power source for PG feedback use	
IG12		
A (+)	Phase-A signal input of PG	
A (-)		
AO1	Analog multifunction output port: Frequency Commend, Output Frequency, Output Current,Output Voltage, DC Voltage, PID controlled value, Analog Command Input of VIN, or AIN or AUX.	
AO2		
GND	Common lead for Analog Port	
RA	Relay Contact Output A	Same function as terminal DO1, DO2
RB	Relay Contact Output B	
RC	Relay Contact Common	
DO1	Digital Multi-Function (Open Collector) output “1”, “2” terminal. During-Operation, Zero-speed, Agreed-frequency, Agreed-frequency-setting, Frequency-output, Inverter-operation-ready, During-undervoltage-detection, Baseblock, control-command, Frequency-reference-mode, Overtorque detection, Frequency-reference-missing, Fault, UV, OH, OL1, OL2 output, During-Retry, Communication-Fault, Timer-Function-Output	
DO2		
DOG	Common terminal of Open Collector Terminal	
S (+)	RS-485 Port	
S (-)		

Caution

- Do not use the control circuit terminals VIN，AIN at the same time. (If the signals applied at these 2 inputs at the same time, the resulted signal is the addition of them inside the inverter.)
- The MAX. Output current at terminal (+15V) is 20mA.
- The multi-function analog output terminals AO1，AO2 is a dedicated meter output for a frequency meter, ammeter, etc. Do not use this 2 analog outputs for feedback control or any control purpose.
- 7200 MA series have installed a low-duty braking resister (100% braking torque, 2%ED，5sec). If more braking torque is needed, an external high-duty braking resister is added. However, the short-circuit bar need to be taken off.

1.6 Wiring main circuit and notice

■ Main circuit wiring

The user should decide if it is necessary to install the non-fusible-breaker (NFB) Electromagnetic contactor block (MCB) between the AC source and the R-S-T input terminal of DSA Series inverter. To protect against the false triggering of leakage-current, the user should installed a leakage current breaker which has amperage sensitivity ≧200mA and operation time ≧ 0.1 sec.

Table 3 220V／440V class applicable wire size and connector

DSA Series model				Wire size (mm^2)			NFB*4	MCB*4
Power supply	Applicable Power Rating (HP)*1	Rated KVA	Rated current (A)	Main circuit*2	Ground connection wire E (G)	Control wire*3		
220V 1Φ／3Φ	1HP	2	4.8	2～5.5	2～5.5	0.5～2	TO-50E (15A)	C-11L
	2HP	2.7	6.4	2～5.5	3.5～5.5	0.5～2	TO-50E (20A)	C-11L
	3HP	4	9.6	3.5～5.5	3.5～5.5	0.5～2	TO-50E (20A)	C-11L
220V 3Φ	5.4HP	7.5	17.5	5.5	5.5	0.5～2	TO-50E (30A)	C-16L
	7.5HP	10.1	24	8	5.5～8	0.5～2	TO-100E (50A)	C-18L
	10HP	11.8	28	8	5.5～8	0.5～2	TO-100E (60A)	C-25L
440V 3Φ	1HP	2.2	2.6	2～5.5	2～5.5	0.5～2	TO-50E (15A)	C-11L
	2HP	3.4	4	2～5.5	3.5～5.5	0.5～2	TO-50E (15A)	C-11L
	3HP	4.1	4.8	2～5.5	3.5～5.5	0.5～2	TO-50E (15A)	C-11L
	5.4HP	7.5	8.7	2～5.5	3.5～5.5	0.5～2	TO-50E (15A)	C-18L
	7.5HP	10.3	12	3～5.5	3.5～5.5	0.5～2	TO-50E (20A)	C-18L
	10HP	12.3	16	5.5	5.5	0.5～2	TO-50E (30A)	C-25L

＊1 : It is assumed constant torque load.

＊2 : The main circuit has terminals of R (L1), S (L2), T (L3), U (T1), V (T2), W (T3), B1/P, B2/R,

B2,⊖.

＊3 : The control wire is the wire led to the pin terminals of control board.

＊4 : In Table 3, the specified Part NO. of NFB and MC are the item NO. of the products of Taian. The customer can use the same rating of similar products from other sources. To decrease the noise interference, be sure to add R-C surge suppressor (R: 10Ω/5W, C: 0.1 μF/1000VDC) at the 2 terminals of coils of electromagnetic contactor.

■ External circuit wiring precaution:

(A) Control circuit wiring:

(1) Separate the control circuit wiring from main circuit wiring (R、S、T、U、V、W) and other high-power lines to avoid noise interruption.

(2) Separate the wiring for control circuit terminals RA，RB，RC (contact output) from wiring for terminals (1)～ (8), A01, A02, GND, DO1, DO2, DOG and 15V, VIN, AIN, AUX, GND, IP12, IG12, A (+), A (-).

(3) Use the twisted-pair or shielded twisted-pair cables for control circuits to prevent operating faults. Process the cable ends as shown in Fig 3. The max. wiring distance should not exceed 50 meter.

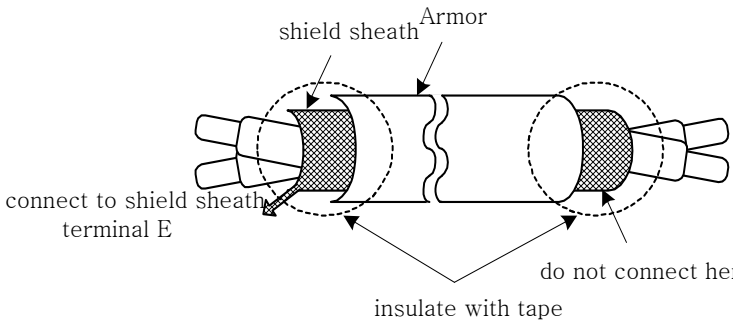


Fig 3 Processing the ends of twisted-pair cables

When the digital multi-function output terminals connect serially to an external relay, an anti-parallel freewheeling diode should be applied at both ends of relay, as shown below.

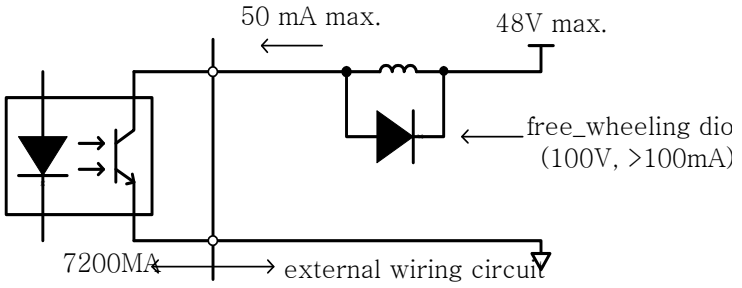


Fig 4 The Optical-couplers (open-collector) connect to external inductive load

(B) Wiring the main circuit terminals:

(1) Input power supply can be connected to any terminal R, S or T on the terminal block. The phase sequence of input power supply is irrelevant to the phase sequence.

(2) Never connect the AC power source to the output terminals U, V and. W.

(3) Connect the output terminals U, V, W to motor lead wires U, V, and W, respectively.

(4) Check that the motor rotates forward with the forward run source. Switch over any 2 of the output terminals to each other and reconnect if the motor rotates in reverse with the forward run source.

(5) Never connect a phase advancing capacitor or LC/RC noise filter to an output circuit.

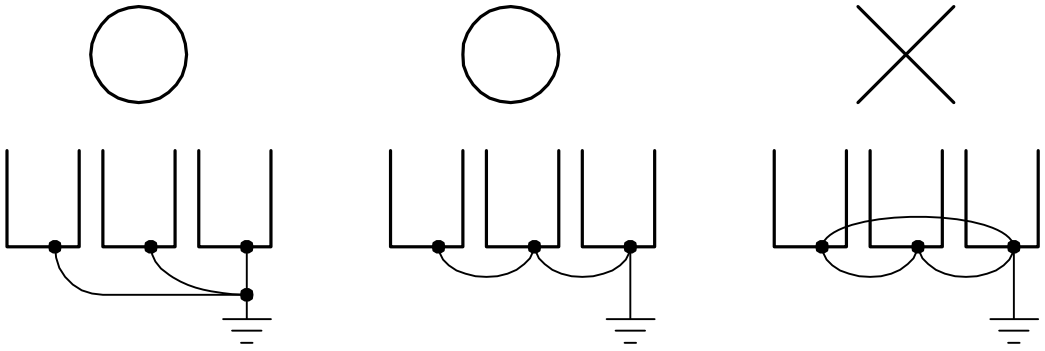
(C) GROUNDING：

(1) Always use the ground terminal (E) with a ground resistance of less than 100Ω.

(2) Do not share the ground wire with other devices, such as welding machines or power tools.

(3) Always use a ground wire that complies with the technical standards on electrical equipments and minimize the length of ground wire.

(4) When using more than 1 inverter, be careful not to loop the ground wire, as shown below.



(a) OK (b) OK (c) NO

Fig 5 DSA Series ground winding

- Determine the wire size for the main circuit so that the line voltage drop is within 2% of the rated voltage. If there is the possibility of excessive voltage drop, use a larger wire suitable to the required length)

$$\text{Line voltage drop(V)} = \sqrt{3} \times \text{wire resistance}(\Omega/\text{km}) \times \text{wire length(m)} \times \text{current(A)} \times 10^{-3}$$

- Installing an AC reactor
  If the inverter is connected to a large-capacity power source (600kVA or more), install an optional AC reactor on the input side of the inverter. This also improves the power factor on the power supply side.
- If the cable between the inverter and the motor is long, the high-frequency leakage current will increase, causing the inverter output current to increase as well. This may affect peripheral devices. To prevent this, adjust the carrier frequency, as shown below:

Cable length	30m max	50m max	100m max	≧100m
Carrier frequency (Cn-34)	15kHz max (Cn-34= 6)	10kHz max (Cn-34= 4)	5kHz max (Cn-34= 2)	2.5kHz (Cn-34= 1)

1.7 Inverter Specification

Input Voltage Class		220V CLASS						440V CLASS					
		1- / 3-Phase			3-Phase			3 Phase					
MODEL		JNTMBGBB□□□□JK---						JNTMBGBB□□□□AZ---					
		0001	0002	0003	0005	7R50	0010	0001	0002	0003	0005	7R50	0010
MAX Applicable Motor Output Hp (kW)		1 (0.75)	2 (1.5)	3 (2.2)	5.4 (4)	7.5 (5.5)	10 (7.5)	1 (0.75)	2 (1.5)	3 (2.2)	5.4 (4)	7.5 (5.5)	10 (7.5)
Output power	Rated Output Capacity (KVA)	2	2.7	4	7.5	10.1	11.8	2.2	3.4	4.1	7.5	10.3	12.3
	Rated Output Current (A)	4.8	6.4	9.6	17.5	24	28	2.6	4	4.8	8.7	12	15
	Max. Output Voltage (V)	3 Phase 200~230 V						3 Phase 380~460 V					
	Max. Output Frequency (Hz)	Through Parameter Setting (Up to 400Hz)											
Power source	Rated Voltage· Frequency	1- / 3-Phase 200~230V 50/60Hz			3-Phase 200~230V 50/60Hz			3 Phase 380~460V 50/60Hz					
	Allowable Voltage Fluctuation	-15% ~ +10%											
	Allowable Frequency Fluctuation	±5%											
Control feature	Operation Mode	Graphic LCD Panel (English and Chinese) with parameters copying											
	Control Mode	Sinusoidal PWM											
	Frequency Control Range	0.5Hz ~ 400Hz											
	Frequency Accuracy (varied with temperature)	Digital Command: ±0.01% (-10 ~ +40℃), Analog Command: ±1% (25℃±10℃),											
	Frequency Command Resolution	Digital Command: 0.01Hz , Analog Command: 0.06Hz/60Hz											
	Frequency Output Resolution	0.01Hz											
	Overload Resistibility	150% Rated Current for 1 min											
	Frequency Setting Signal	DC 0~+10V / 4~20 mA											
	ACC/DEC time	0.0~6000.0 sec (Accel/Decel time can be set independently)											
	Voltage-Frequency Characteristics	Can arbitrarily set V/F curve through Parameter setting											
	Regeneration Torque	100% rated current, 2% duty cycle within 5 sec (with installed brake resistor)											
	Basic Control Function	Restart_after_momentary_power_loss, PID control, Auto_Torque Boost, Slip_Compensation, RS_485 Communication, Speed_Feedback control, Simple PLC function, Installed Low-Duty brake resistor for all series, 2 Analog Output Port											
	Extra Function	Cumulative Power_on & Operation Hour memory, Energy-Saving, Up/Down Operation, 4 different sets of fault status record (include latest one), Modbus Communication, Multiple-Pulse Output Ports, etc.											

Protection Function	Stall Prevention	Current level selectable for Stall Prevention during Accelerating and Running, disable/enable during Decelerating											
	Instantaneous Overcurrent	Stopped if above 200% Rated Current											
	Motor Overload Protection (OL1)	Electronic Overload Curve Protection											
	Inverter Overload Protection (OL2)	Stopped if 150% Rated Current for 1 Min.											
	Overvoltage	Motor will stop if V_{DC}≥410V (220 Class) or V_{DC}≥820V (440 Class)											
	Undervoltage	Motor will stop if V_{DC}≤200V (220 Class) or V_{DC}≤400V (440 Class)											
	Momentary power loss ride-through time	≤15ms, stop otherwise											
	Overheating Protection	Protection by thermistor											
	Grounding Protection	Protection by DC current sensor											
	Charge Indication (LED)	Lit when the DC bus voltage above 50V											
Mechanical Construction		Enclosed, Wall-Mounted Type (NEMA-1)											
Cooling		Self		Forced				Self		Forced			
Weight (kg)		3.8	3.8	3.9	3.9	5.6	5.6	3.8	3.8	3.9	3.9	5.6	5.6
Environmental condition	Application Site	Indoor (no corrosive gas and dust present)											
	Ambient Temperature	-10℃ ~ +40℃ (not frozen)											
	Storage Temperature	-20℃ ~ +60℃											
	Ambient Humidity	Below 90%RH (Non-condensing)											
	Height, Vibration	Below 1000M, 5.9m/S^2 (0.6G), (JISC0911 Standard)											
Communication Function		RS-485 installed											
EMI		Meet EN50081-2 (1994) with specified EMI filter											
EMC Compatibility		Meet Pr EN 50082-2											
Option		Profibus Card											

1.8 Physical Dimension

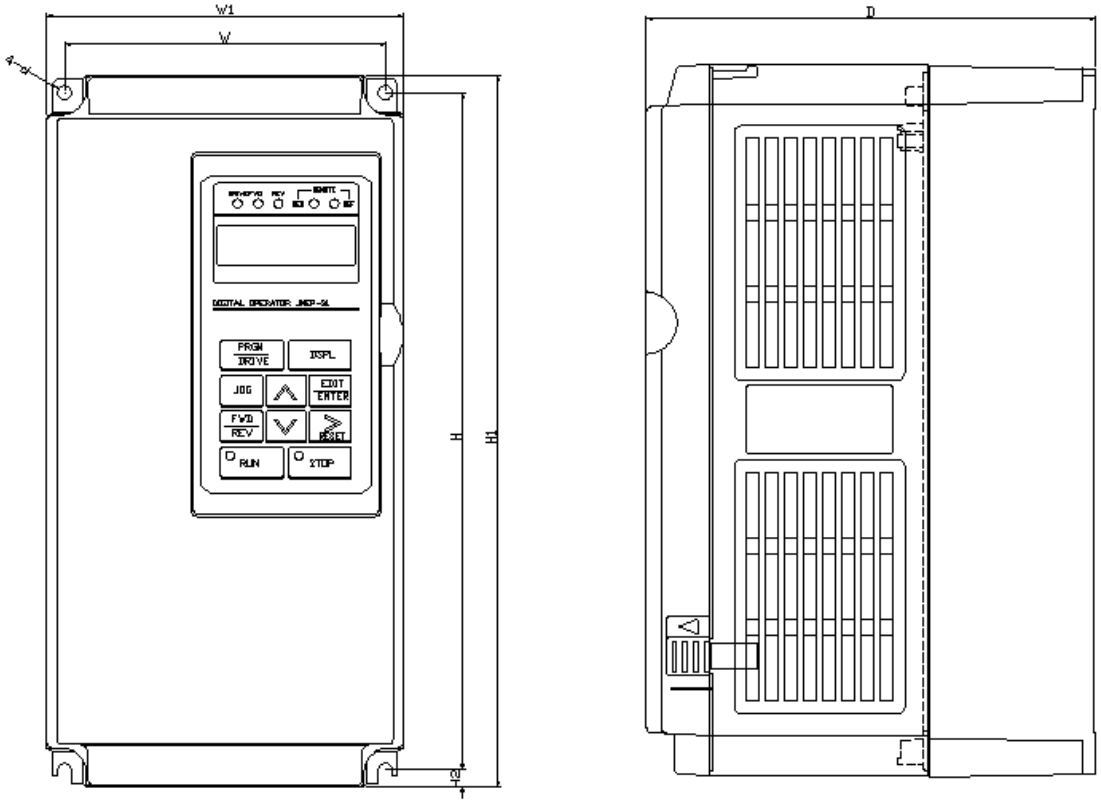


Fig 6 Physical dimension

Model		Mounting dimension (mm)			External dimension (mm)			Approx. mass (kg)
Voltage	Max. applicable motor output (HP)	W	H	D	W1	H1	D	
220v 1 ϕ/3ϕ	1	126	266	6.8	140	279.5	176.5	3.8
	2							
	3							3.9
220V 3 ϕ	5.4							
	7.5	192	286	7	211.2	300	215	5.6
	10							
440V 3 ϕ	1	126	266	6.8	140	279.5	176.5	3.8
	2							
	3							3.9
	5.4							
	7.5	192	286	7	211.2	300	215	5.6
	10							

1.9 Peripheral Devices

・Brake resistor

All DSA Series (220V／440V, below 10HP) model have installed a standard low-duty braking resistor (braking torque 100%，on-duty 2% for 5 sec) inside. If more braking capacity is needed, an external high-duty braking resistor should be added.

- All DSA Series (220V／440V, below 5HP) model can have an external high-duty braking resistor attached on the back of heat sink of inverter.
- All DSA Series (220V／440V, below 1HP) model should take off the short-circuit bar between the terminal B1/P and B1/R first. Then an external resistor can be added. As shown below:

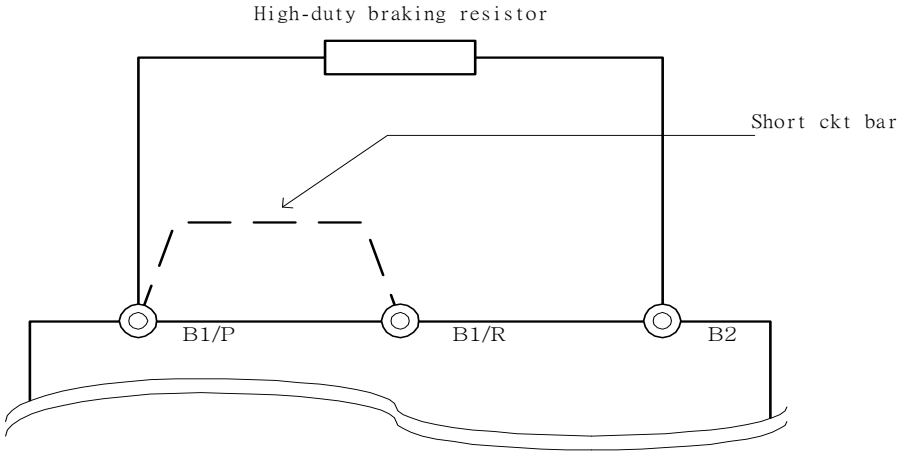


Fig 7

Table 4 Braking resistor list

Model		External braking resistor			Min. applicable
V	HP	Item number	Resistor specification	Approx. braking torque	External resistor (Ω)
220V 1φ /3φ	1	4H333D0010007	150W/200Ω	125%，3%ED	45Ω
	2	4H333D0020002	150W/100Ω	125%，3%ED	35Ω
	3	4H333D0030008	150W/70Ω	120%，3%ED	28Ω
220V 3φ	5.4	4H333D0040003	150W/62Ω	100%，3%ED	15Ω
	7.5	4H333D0050009	520W/30Ω	115%，10%ED	10Ω
	10	4H333D0060004	780W/20Ω	125%，10%ED	10Ω
440V 3φ	1	4H333D0070000	150W/750Ω	130%，3%ED	95Ω
	2	4H333D0080005	150W/400Ω	125%，3%ED	95Ω
	3	4H333D0090001	150W/300Ω	115%，3%ED	95Ω
	5.4	4H333D0010007	150W/200Ω	110%，3%ED	46Ω
	7.5	4H333D0100006	520W/100Ω	135%，10%ED	46Ω
	10	4H333D0110001	780W/75Ω	130%，10%ED	34Ω

■ AC reactor

- an AC reactor can be added on the power supply side if the inverter is connected to a much larger capacity power supply system, or the inverter is within short distance (<10m) from power supply systems, or to increase the power factor on the power supply side.
- Choose the proper AC reactor according to the below list.

Table 5 AC reactor list

Model			AC reactor	
V	HP	Rated current	Product NO	Specification (mH/A)
220V 1φ/3φ	1	4.8A	3M200D1610021	2.1mH/5A
	2	6.5A	3M200D1610030	1.1mH/10A
	3	9.6A	3M200D1610048	0.17mH/15A
220V 3φ	5.4	17.5A	3M200D1610056	0.53mH/20A
	7.5	24A	3M200D1610064	0.35mH/30A
	10	28A	3M200D1610072	0.265mH/40A
440V 3φ	1	2.6A	3M200D1610137	8.4mH/3A
	2	4A	3M200D1610145	4.2mH/5A
	3	4.8A	3M200D1610153	3.6mH/7.55A
	5.4	8.7A	3M200D1610161	2.2mH/10A
	7.5	12A	3M200D1610170	1.42mH/15A
	10	15A	3M200D1610188	1.06mH/20A

(Note) The AC reactors are applied only to input side. Do not applied to output side.

■ Noise filter

A. Installing a noise filter on power supply side to eliminate noise transmitted between the power line and the inverter

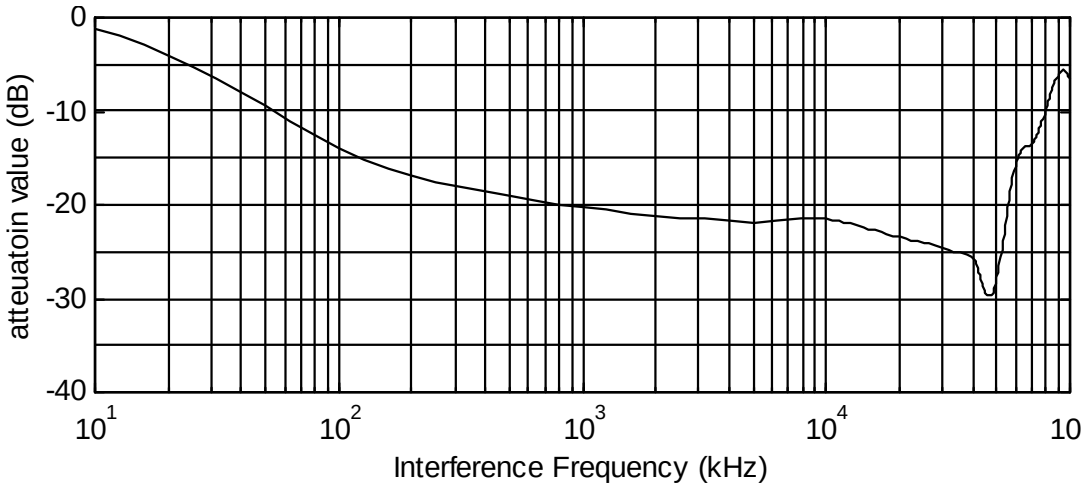
• DSA Series has its specified noise filter to meet the EN55011 class A specification

Table 6 Noise filter on the input side

Model			Noise filter			
V	HP	Rated current	Product NO		Specification	Rated Current
220V 1φ/3φ	1	4.8A	1φ	4M903D0600000	NF-12010	10 A
			3φ	4M903D0120008	NF-32006	6 A
	2	6.5A	1φ	4M903D0600018	NF-12015	15 A
			3φ	4M903D0120016	NF-32012	12 A
	3	9.6A	1φ	4M903D0600024	NF-12020	20 A
			3φ	4M903D0120016	NF-32012	12 A
220V 3φ	5.4	17.5A	4M903D0120024		NF-32024	24 A
	7.5	24A	4M903D0120024		NF-32024	24 A
	10	28A	4M903D0120032		SNF-32048	48 A
440V 3φ	1	2.6A	4M903D0130003		NF-34006	6 A
	2	4A	4M903D0130003		NF-34006	6 A
	3	4.8A	4M903D0130003		NF-34006	6 A
	5.4	8.7A	4M903D0130011		NF-34012	12 A
	7.5	12A	4M903D0130011		NF-34012	12 A
	10	15A	4M903D0130020		NF-34024	24 A

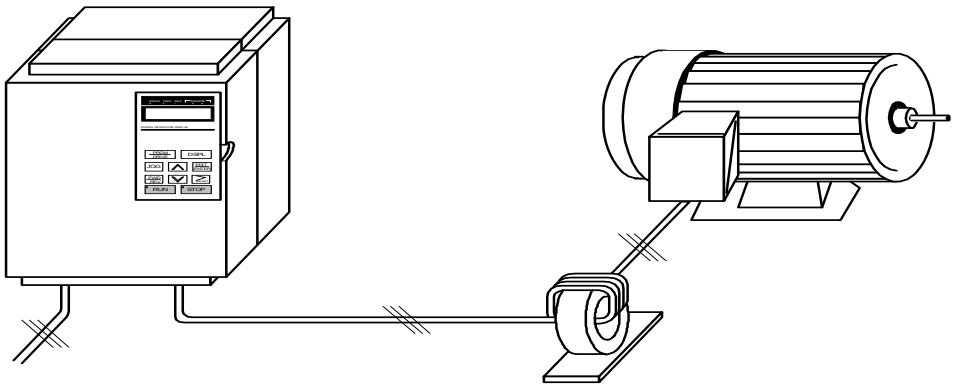
B、EMI SUPPRESSION FERRITE CORE

- According to the required power rating and wire size, select the matched ferrite core to suppress the zero sequence EMI filter.
- The ferrite core can attenuate the frequency response at high frequency range (from 100KHz to 50MHz, as shown below). It should be able to attenuate the RFI from inverter to outside.
- The zero-sequence noise filter ferrite core can be installed either on the input side or on the output side. The wire around the core for each phase should be winded by following the same convention and one direction. The more winding turns, the better attention effect. (without saturation). If the wire size is too big to be winded, all the wire can be grouped and go through these several cores together in one direction.

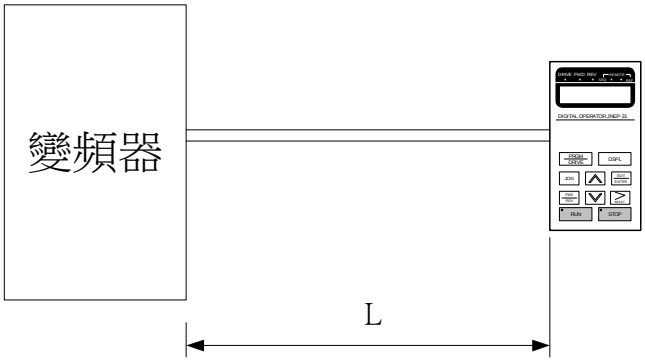


Frequency attenuation characteristics (10 windings case)

Example: EMI suppression ferrite core connection example



• LCD operator with extension wire



L	Item number
1m	4H332D0010000
3m	4H332D0020005

Fig 8

• Analog operator

All DSA Series have the digital LCD digital operator. Moreover, an analog operator as JNEP-16 (shown in Fig 9) is also available and can be connected through wire as a portable operator. The wiring diagram is shown below.

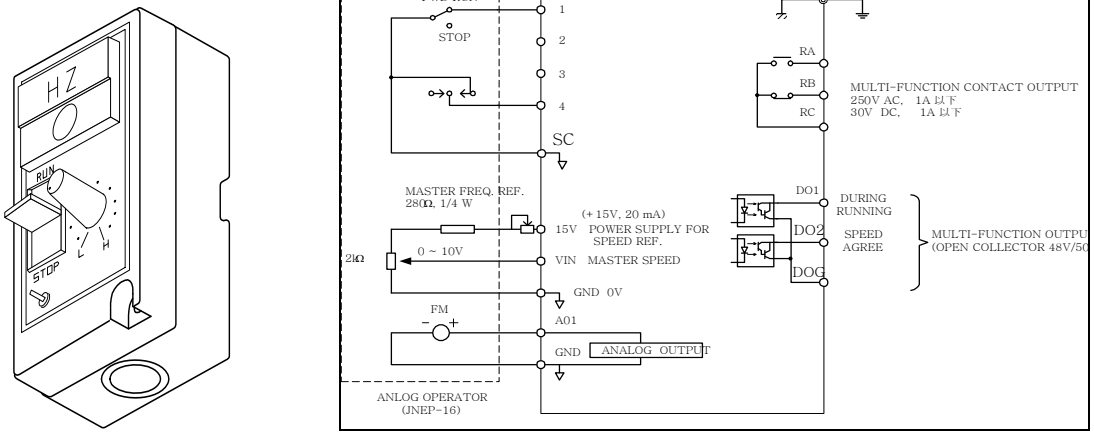


Fig 9

2. Description of using DSA Series

■ Using LCD digital operator

JNEP-31 LCD digital operator has 2 modes: DRIVE mode and PRGM mode. When the inverter is stopped, DRIVE mode or PRGM mode can be selected by pressing the key PRGM/DRIVE. In DRIVE mode, the operation is enabled. Instead, in the PRGM mode, the parameter settings for operation can be changed but the operation is not enabled. The component names and function are shown as below:

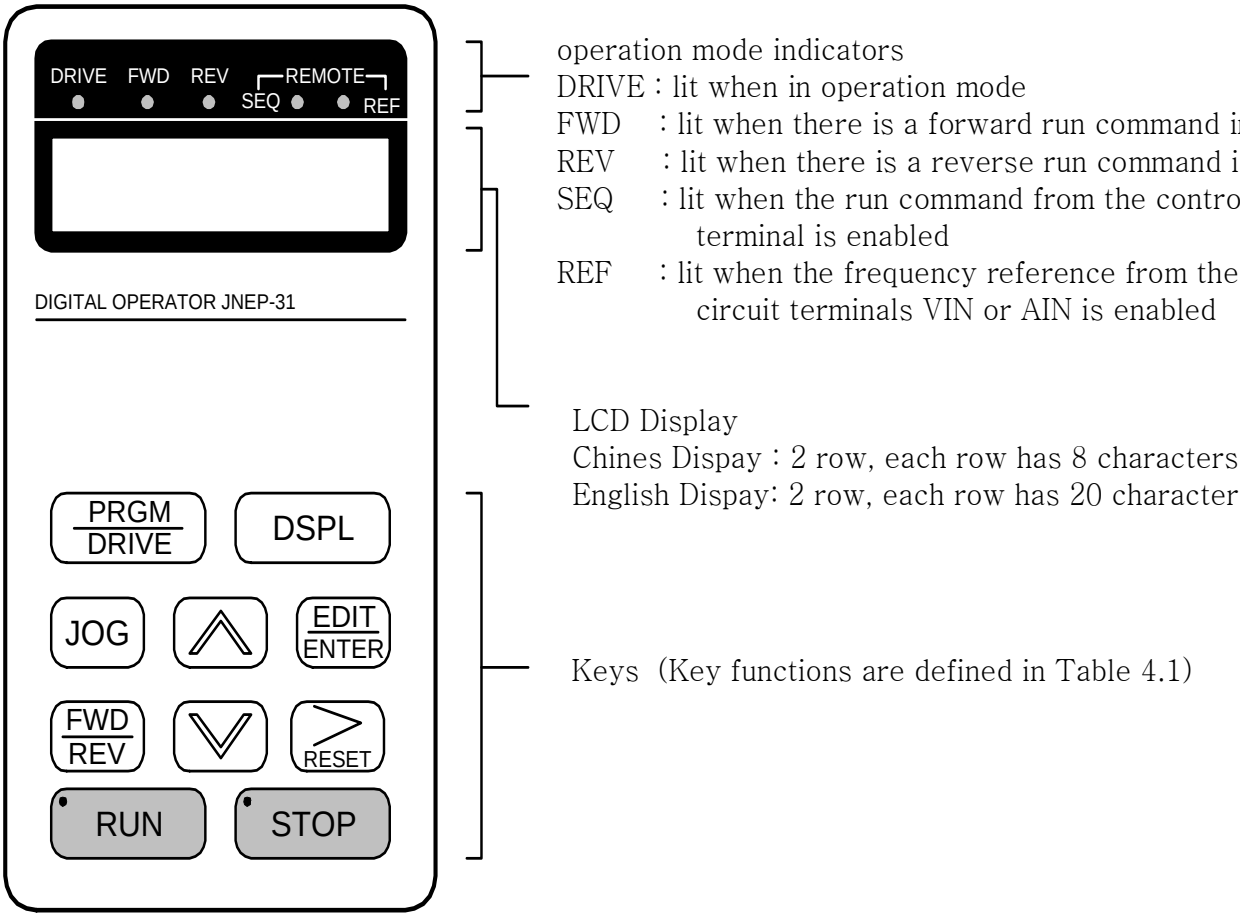
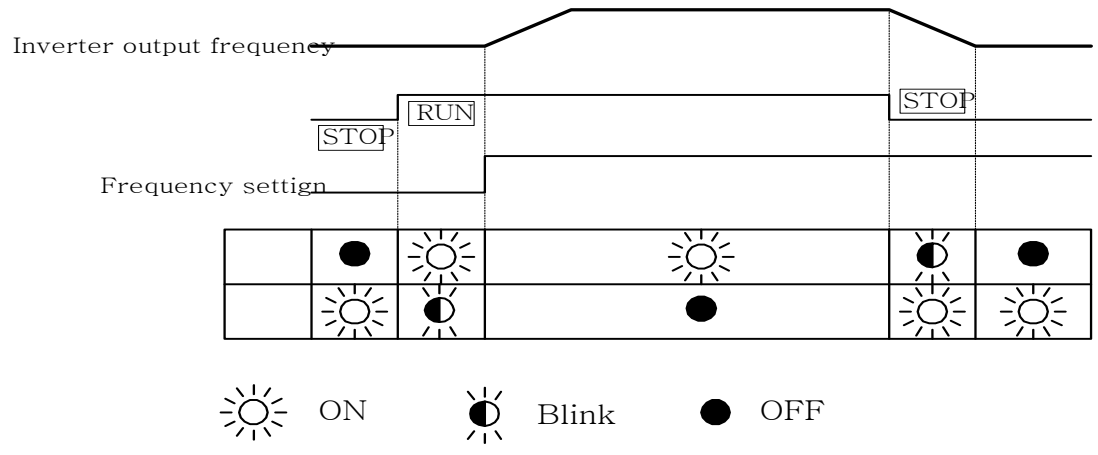


Fig 10 LCD Digital operator component names and functions

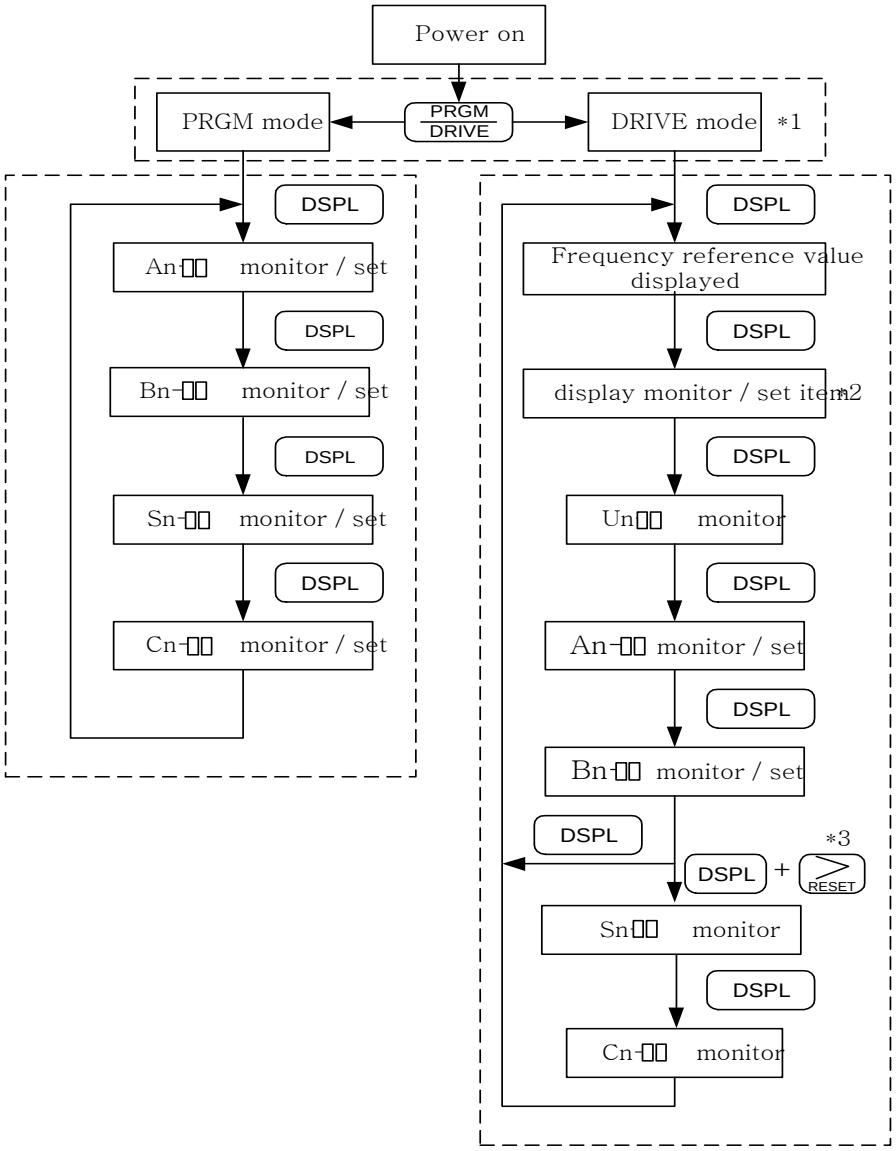
Table 7 Key's functions

Key	Name	Function
PRGM/DRIVE	PRGM/DRIVE key	Switches between operation (PRGM) and operation (DRIVE).
DSPL	DSPL key	Display operation status
JOG	JOG key	Enable jog operation from LCD digital operator in operation (DRIVE).
FWD/REV	FWD/REV key	Select the rotation direction from LCD digital operator.
RESET	RESET key	Set the number of digital for user constant settings. Also act as the reset key when a fault has occurred.
∧	INCREMENT key	Select the menu items, groups, functions, and user constant name, and increment set values.
∨	DECREMENT key	Select the menu items, groups, functions, and user constant name, and decrement set values.
EDIT/ENTER	EDIT/ENTER key	Select the menu items, groups, functions, and user constants name, and set values (EDIT). After finishing the above action, press the key (ENTER).
RUN	RUN key	Start inverter operation in (DRIVE) mode when the digital operator is used. The led will light.
STOP	STOP key	Stop DSA Series operation from LCD digital operator. The key can be enabled or disabled by setting a constant Sn-07 when operating from the control circuit terminal (in this case, the LED will light).

RUN，STOP indicator lights or blinks to indicate the 3 operating status:



■ DRIVE mode and PRGM mode displayed contents:



*1 When the inverter is put into operation, the inverter system immediately enters into DRIVE mode. Press the PRGM DRIVE key, the system will switch into PRGM mode. If the fault occurs, press the PRGM DRIVE key and enter into DRIVE mode to monitor the corresponding Un-□□ contents. If a fault occurs in the DRIVE mode, the corresponding fault will be displayed. Press the RESET key and reset the fault.

*2 The monitored items will be displayed according to the settings of Bn-12 and Bn-13.

*3 When in the DRIVE mode, press the DSPL key and RESET key, the setting values of Sn- and Cn-□□ will only be displayed for monitoring but not for changing or setting.

■ Parameter description

The DSA Series has 4 groups of user parameters:

Parameters	Description
An-□□	Frequency command
Bn-□□	Parameter settings can be changed during running
Sn-□□	System parameter settings (can be changes only after stop)
Cn-□□	Control parameter settings (can be changed only after stop)

The parameter setting of Sn-03 (operation status) will determine if the setting value of different

Parameter groups are allowed to be changed or only to be monitored, as shown below:

Sn-03	DRIVE mode		PRGM mode	
	To be set	To be monitored	To be set	To be monitored
0[*1]	An,Bn	Sn,Cn	An,Bn,Sn,Cn	
1[*2]	An	Sn,Cn	An	Bn,Sn,Cn

*1：Factory setting

*2：When in DRIVE mode, the parameter group Sn-, Cn- can only be monitored if the RESET key and the DSPL key are to be pressed at the same time 。

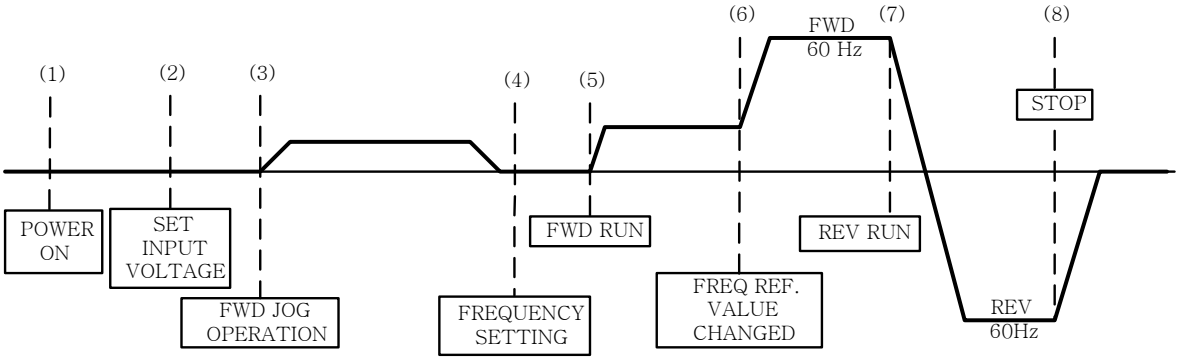
*3：After a few trial operation and adjustment, the setting value Sn-03 is set to be “1” so as not be modified again.

Sample example of using LCD digital operator

Note： Before operation: Control parameter Cn-01 value must be set as the input AC voltage value. For example, Cn-01=380 if AC input voltage is 380.

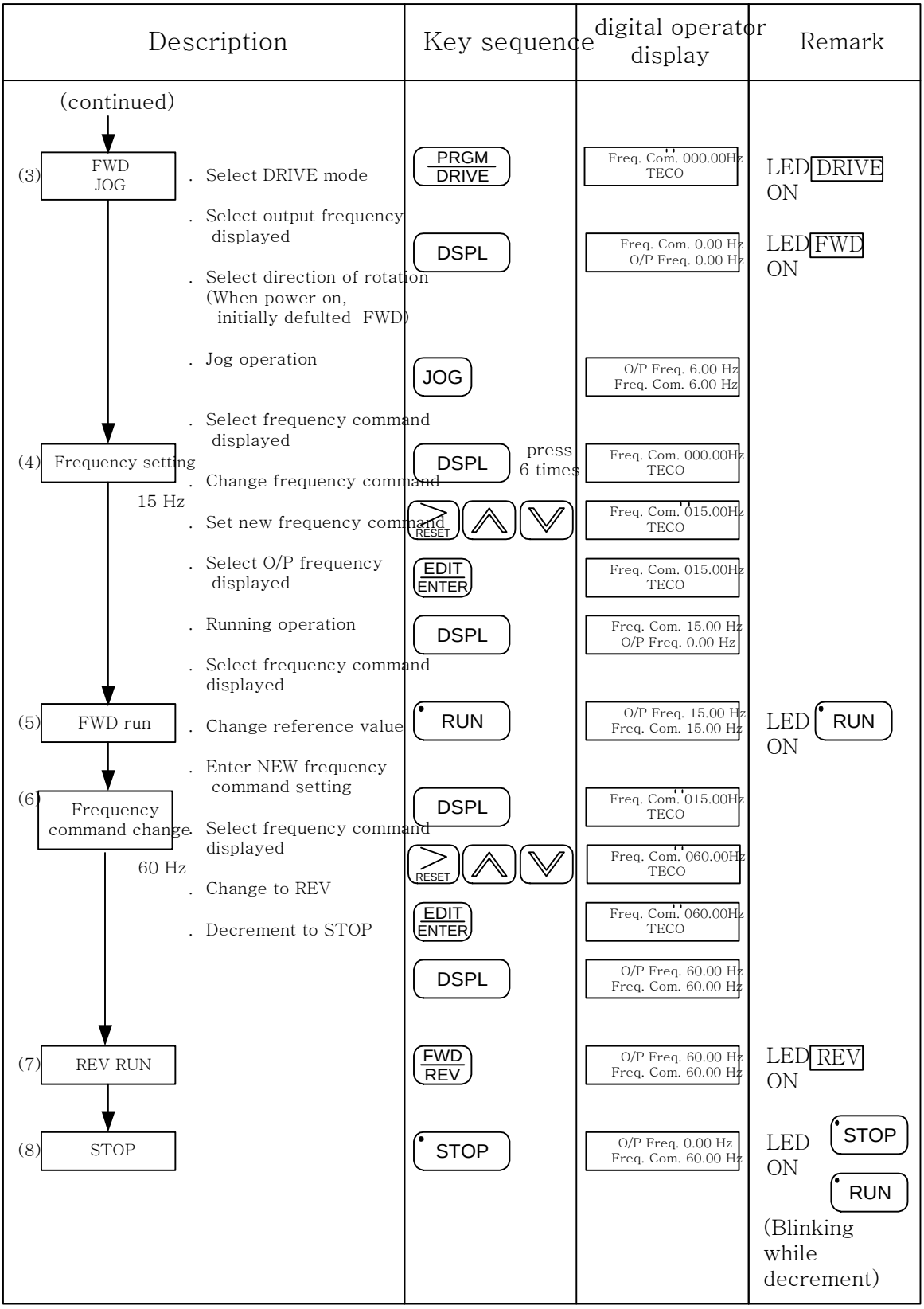
This sample example will explain the operating of DSA Series according to the following time chart.

■ OPERATION MODE



■ Sample operation

Description	Key sequence	digital operator display	Remark
(1) When Power on . Select frequency reference value displayed . Select PRGM mode (2) Input voltage setting (e.g. : AC input voltage is 380v) . Select CONTROL PARAMETER . Display Cn-01 setting . Input Voltage 380V (continued)	PRGM/DRIVE DSPL press 3 times EDIT/ENTER RESET ∧ ∨ EDIT/ENTER	Freq. Com. 000.00Hz TECO An -01 Freq. Com. 1 Cn -01- Input Voltage Cn-01 = 440.0V Input Voltage Cn-01 = 380.0V Input Voltage Entry Accepted	LED DRIVE OFF display for 1 sec


Description
Key sequence
digital operator display
Remark
(continued)
(3) FWD JOG
. Select DRIVE mode
PRGM DRIVE
Freq. Com. 000.00Hz TECO
LED DRIVE ON
. Select output frequency displayed
. Select direction of rotation (When power on, initially defulted FWD)
DSPL
Freq. Com. 0.00 Hz O/P Freq. 0.00 Hz
LED FWD ON
. Jog operation
JOG
O/P Freq. 6.00 Hz Freq. Com. 6.00 Hz
. Select frequency command displayed
(4) Frequency setting
DSPL
press 6 times
Freq. Com. 000.00Hz TECO
. Change frequency command
15 Hz
. Set new frequency command
RESET
Freq. Com. 015.00Hz TECO
. Select O/P frequency displayed
EDIT ENTER
Freq. Com. 015.00Hz TECO
. Running operation
DSPL
Freq. Com. 15.00 Hz O/P Freq. 0.00 Hz
. Select frequency command displayed
(5) FWD run
. Change reference value
RUN
O/P Freq. 15.00 Hz Freq. Com. 15.00 Hz
LED RUN ON
. Enter NEW frequency command setting
(6) Frequency command change
DSPL
Freq. Com. 015.00Hz TECO
. Select frequency command displayed
60 Hz
RESET
Freq. Com. 060.00Hz TECO
. Change to REV
. Decrement to STOP
EDIT ENTER
Freq. Com. 060.00Hz TECO
DSPL
O/P Freq. 60.00 Hz Freq. Com. 60.00 Hz
(7) REV RUN
FWD REV
O/P Freq. 60.00 Hz Freq. Com. 60.00 Hz
LED REV ON
(8) STOP
STOP
O/P Freq. 0.00 Hz Freq. Com. 60.00 Hz
LED ON
STOP
RUN
(Blinking while decrement)

■ Sample operation (use keys to display monitored items/contents)

Description	Key operation	LCD display	Remark
. Display Frequency Command		Freq. Com. 060.00Hz TECO	
. Display	DSPL	Freq. Com. 60.00 Hz Freq. Com. 60.00 Hz	
. Display Output Current	∧	Freq. Com. 60.00 Hz O/P I 12.5 A	
. Display Output Voltage	∧	Freq. Com. 60.00 Hz O/P Volt. 220.0 V	
. Display DC Voltage	∧	Freq. Com. 60.00 Hz DC Volt. 310.0 V	
. Display Output Voltage	∨	Freq. Com. 60.00 Hz O/P Volt 220..0 V	
. Display Output Current	∨	Freq. Com. 60.00 Hz O/P I 12.5 A	

3. Setting User Constant

3.1 Frequency command (in Multi-speed operation) An-□□

Under the DRIVE mode, the user can monitor the parameters and set their values.

Function	Parameter No.	Name	LCD display	Setting range	Setting unit	Factory setting	Page
V/F pattern	An-01	Frequency Command 1	An-01= 000.00Hz Freq. Com. 1	0.00～400.00Hz	0.01Hz	0.00Hz	80 91 (51 52)
	An-02	Frequency Command 2	An-02= 000.00Hz Freq. Com. 2	0.00～400.00Hz	0.01Hz	0.00Hz	
	An-03	Frequency Command 3	An-03= 000.00Hz Freq. Com. 3	0.00～400.00Hz	0.01Hz	0.00Hz	
	An-04	Frequency Command 4	An-04= 000.00Hz Freq. Com. 4	0.00～400.00Hz	0.01Hz	0.00Hz	
	An-05	Frequency Command 5	An-05= 000.00Hz Freq. Com. 5	0.00～400.00Hz	0.01Hz	0.00Hz	
	An-06	Frequency Command 6	An-06= 000.00Hz Freq. Com. 6	0.00～400.00Hz	0.01Hz	0.00Hz	
	An-07	Frequency Command 7	An-07= 000.00Hz Freq. Com. 7	0.00～400.00Hz	0.01Hz	0.00Hz	
	An-08	Frequency Command 8	An-08= 000.00Hz Freq. Com. 8	0.00～400.00Hz	0.01Hz	0.00Hz	
	An-09	Frequency Command 9	An-09= 000.00Hz Freq. Com. 9	0.00～400.00Hz	0.01Hz	0.00Hz	
	An-10	Frequency Command 10	An-10= 000.00Hz Freq. Com. 10	0.00～400.00Hz	0.01Hz	0.00Hz	
	An-11	Frequency Command 11	An-11= 000.00Hz Freq. Com. 11	0.00～400.00Hz	0.01Hz	0.00Hz	
	An-12	Frequency Command 12	An-12= 000.00Hz Freq. Com. 12	0.00～400.00Hz	0.01Hz	0.00Hz	
	An-13	Frequency Command 13	An-13= 000.00Hz Freq. Com. 13	0.00～400.00Hz	0.01Hz	0.00Hz	
	An-14	Frequency Command 14	An-14= 000.00Hz Freq. Com. 14	0.00～400.00Hz	0.01Hz	0.00Hz	
	An-15	Frequency Command 15	An-15= 000.00Hz Freq. Com. 15	0.00～400.00Hz	0.01Hz	0.00Hz	
	An-16	Frequency Command 16	An-16= 000.00Hz Freq. Com. 16	0.00～400.00Hz	0.01Hz	0.00Hz	
	An-17	Jog Frequency Command	An-17= 000.00Hz Jog Freq. Com.	0.00～400.00Hz	0.01Hz	6.00Hz	82

*1. The displayed “Setting Unit” can be changed through the parameter Cn-28.

*2. At factory setting, the value of “Setting Unit” is 0.01Hz.

*3. The setting of An-01~16 should be with the multi-function analog terminals ⑤~⑧.

3.2 Parameters Can Be Changed during Running Bn-□□

Under the DRIVE mode, the Parameter group can be monitored and set by the users

Function	Parameter No.	Name	LCD display	Setting range	Setting Unit	Factory Setting	Page
First Acc/Dec time	Bn-01	Acceleration time 1	Bn-01= 0010.0S Acc. Time 1	0.0～6000.0S	0.1S	10.0S	36
	Bn-02	Deceleration time 1	Bn-02= 0010.0S Dec. Time 1	0.0～6000.0S	0.1S	10.0S	
Second Acc/Dec time	Bn-03	Acceleration time 2	Bn-03= 0010.0S Acc. Time 2	0.0～6000.0S	0.1S	10.0S	
	Bn-04	Deceleration time 2	Bn-04= 0010.0S Dec. Time 2	0.0～6000.0S	0.1S	10.0S	
Analog frequency	Bn-05	Analog frequency command gain (Voltage)	Bn-05= 0100.00 Voltage Com. Gain	0.0～1000.0%	0.1%	100.00%	35
	Bn-06	Analog frequency command bias (Voltage)	Bn-06= 000.0% Voltage Com. Bias	-100.0%～100.0%	0.1%	0.0%	
	Bn-07	Analog frequency command gain (Current)	Bn-07= 0100.00% Current Com. Gain	0.0～1000.0%	0.1%	100.00%	
	Bn-08	Analog frequency command bias (Current)	Bn-08= 000.0% Current Com. Bias	-100.0%～100.0%	0.1%	0.0%	
Multi-function Analog input	Bn-09	Multi-function Analog input gain	Bn-09= 0100.00% Multi_Fun. ~Gain	0.0～1000.0%	0.1%	100.00%	36
	Bn-10	Multi-function Analog input bias	Bn-10= 00.0% Multi_Fun. ~Bias	-100.0%～100.0%	0.1%	0.0%	
Auto torque boost	Bn-11	Auto torque boost gain	Bn-11= 001.0 Auto_Boost Gain	0.0～2.0	0.1	1.0	36
Monitor	Bn-12	Monitor 1	Bn-12= 01 Display: Freq.Com.	1～17	1	1	37
	Bn-13	Monitor 2	Bn-13= 02 Display: O/P Freq.	1～17	1	2	
Multi-function Analog output	Bn-14	Multi-function Analog output AO1 gain	Bn-14= 1.00 ~Output AO1 Gain	0.01～2.55	0.01	1.00	38
	Bn-15	Multi-function Analog output AO2 gain	Bn-15= 1.00 ~Output AO2 Gain	0.01～2.55	0.01	1.00	
PID control	Bn-16	PID detection gain	Bn-16= 01.00 PID Com. Gain	0.01～10.00	0.01	1.00	38
	Bn-17	PID Proportional gain	Bn-17= 01.00 PID P_gain	0.01～10.00	0.01	1.00	

*1. The displayed “Setting Unit” can be changed through the parameter Cn-28.

*2. At factory setting, the value of “Setting Unit” is 0.01Hz.

Function	Parameter No.	Name	LCD display	Setting range	Setting Unit	Factory Setting	Page
PID control	Bn-18	PID integral time	Bn-18= 10.00S PID I_Time	0.00～1.00S	0.01S	0.00S	38
	Bn-19	PID differential time	Bn-19= 0.00S PID D_Time	0～109%	1%	0%	
	Bn-20	PID bias	Bn-20= 0% PID Bias	0.0～6000.0S	0.1S	0.0S	
Auto_run time function	Bn-21	1st_step time under auto_run mode	Bn-21= 0.0S Time 1	0.0～6000.0S	0.1S	0.0S	39
	Bn-22	2nd_step time under auto_run mode	Bn-22= 0.0S Time 2	0.0～6000.0S	0.1S	0.0S	
	Bn-23	3rd_step time under auto_run mode	Bn-23= 0.0S Time 3	0.0～6000.0S	0.1S	0.0S	
	Bn-24	4th_step time under auto_run mode	Bn-24= 0.0S Time 4	0.0～6000.0S	0.1S	0.0S	
	Bn-25	5th_step time under auto_run mode	Bn-25= 0.0S Time 5	0.0～6000.0S	0.1S	0.0S	
	Bn-26	6th_step time under auto_run mode	Bn-26= 0.0S Time 6	0.0～6000.0S	0.1S	0.0S	
	Bn-27	7th_step time under auto_run mode	Bn-27= 0.0S Time 7	0.0～6000.0S	0.1S	0.0S	
	Bn-28	8th_step time under auto_run mode	Bn-28= 0.0S Time 8	0.0～6000.0S	0.1S	0.0S	
	Bn-29	9th_step time under auto_run mode	Bn-29= 0.0S Time 9	0.0～6000.0S	0.1S	0.0S	
	Bn-30	10th_step time under auto_run mode	Bn-30= 0.0S Time 10	0.0～6000.0S	0.1S	0.0S	
	Bn-31	11th_step time under auto_run mode	Bn-31= 0.0S Time 11	0.0～6000.0S	0.1S	0.0S	
	Bn-32	12th_step time under auto_run mode	Bn-32= 0.0S Time 12	0.0～6000.0S	0.1S	0.0S	
	Bn-33	13th_step time under auto_run mode	Bn-33= 0.0S Time 13	0.0～6000.0S	0.1S	0.0S	
	Bn-34	14th_step time under auto_run mode	Bn-34= 0.0S Time 14	0.0～6000.0S	0.1S	0.0S	
	Bn-35	15th_step time under auto_run mode	Bn-35= 0.0S Time 15	0.0～6000.0S	0.1S	0.0S	
	Bn-36	16th_step time under auto_run mode	Bn-36= 0.0S Time 16	0.0～6000.0S	0.1S	0.0S	
Timer function	Bn-37	Timer Function On_delay time	Bn-37= 0.0S ON_delay Setting	0.0～6000.0S	0.1S	0.0S	39
	Bn-38	Timer Function Off_delay time	Bn-38= 0.0S OFF_delay Setting	50～150%	1%	100%	
Energy saving	Bn-39	Energy_saving gain	Bn-39= 100% Eg.Saving Gain	0.00～1.00S	0.01S	0.00S	40

(1) Acceleration time 1 (Bn-01)

(2) Deceleration time 1 (Bn-02)

(3) Acceleration time 2 (Bn-03)

(4) Deceleration time 2 (Bn-04)

- Set individual Acceleration/Deceleration times
- Acceleration time : the time required to go from 0% to 100% of the maximum output frequency
- Deceleration time : the time required to go from 100% to 0% of the maximum output frequency
- If the acceleration/Deceleration time sectors 1 and 2 are input via the multi-function inputs terminal ⑤～⑧, the acceleration/Deceleration can be switched between 2 sectors even in the running status.

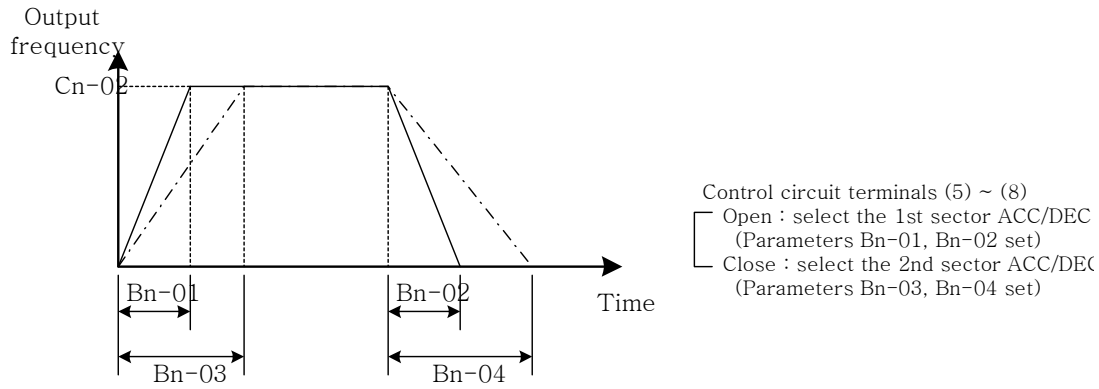


Fig 11 Acceleration and Deceleration time

(Note)

1. To set the S-curve characteristics function, please refer to page 56.
2. The S-curve characteristic times can be set respectively for beginning-acceleration, end-acceleration, beginning-deceleration, end-deceleration through the parameters setting of Cn-41～Cn-44.

(5) Analog frequency command gain (Voltage) (Bn-05)

(6) Analog frequency command Bias (Voltage) (Bn-06)

(7) Analog frequency command gain (Current) (Bn-07)

(8) Analog frequency command bias (Current) (Bn-08)

(9) Multi-function analog input gain (Bn-09)

(10) Multi-function analog input bias (Bn-10)

- For every different analog frequency command (voltage or current) and multi-function analog inputs, their corresponding gain and bias should be specified respectively.

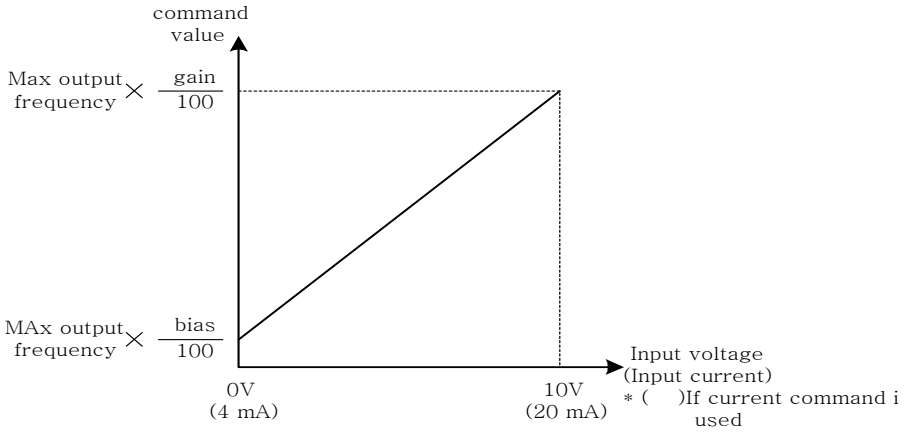


Fig 12 Analog input gain and bias

(11) Auto torque boost gain (Bn-11)

• The inverter increase the output torque to compensate the motor load through the V/F pattern automatically. As a result, the fault trip cases can be decreased. The energy efficiency is also improved. In the case that the wiring distance between the inverter and the motor is long enough (e.g. more than 100m), the motor torque is a little short because of voltage drop. Increase the value of Bn-11 gradually and make sure the current will not increase too much. Normally, no adjustment is required.

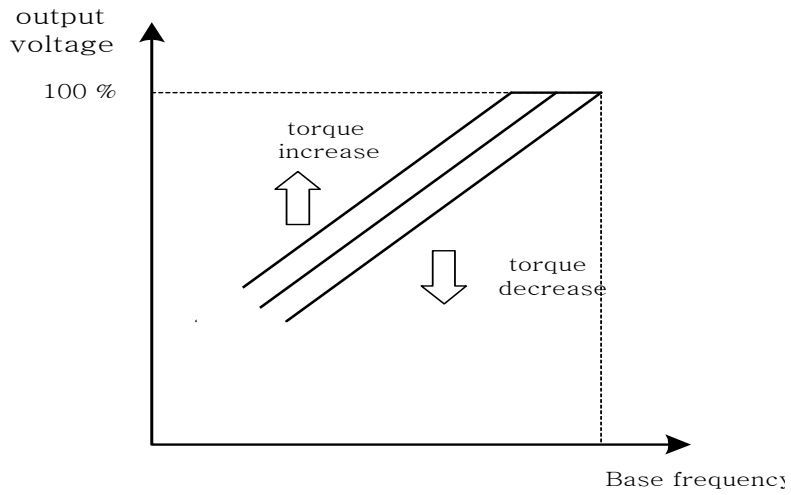


Fig 13 Adjust the auto torque boost gain Bn-11 to increase the output torque.

• If the driven motor capacity is less than the inverter capacity (Max. appliable motor capacity), raise the setting.

• If the motor generates excessive oscillation, lower the setting.

(12) Monitor 1 (Bn-12)

(13) Monitor 2 (Bn-13)

・Under the DRIVE mod, 2 inverter input/output statuses can be monitored at the same time. The specified items can be set through the setting of Bn-12 and Bn-13. For more details, refer to Table 7.

Example:

(1)	Bn-12= 02 Bn-13= 01	Display	O/P Freq. 15.00Hz Freq.Com. 15.00Hz
(2)	Bn-12= 03 Bn-13= 05	Display	O/P I 21.0A DC Volt 311V
(3)	Bn-12= 11 Bn-13= 12	Display	I/P Term. 00101010 O/P Term. 00010010

Note：1. While in the MONITOR mode, use the  or  key to show the next lower-row displayed. But the setting Bn-13 does not change.

2.

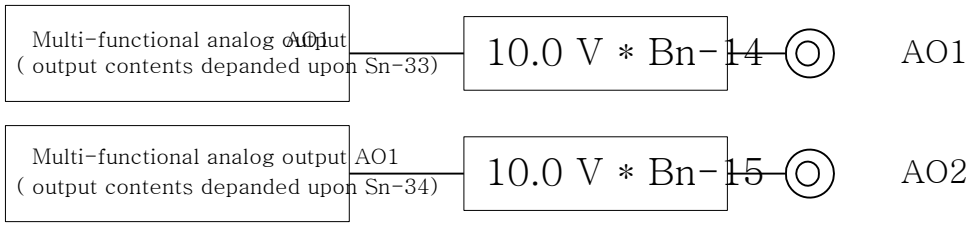
Table 7

Setting	Monitoring contents	Setting	Monitoring contents
Bn-12= 01	Freq.Com.	Bn-14= 01	Freq.Com.
Bn-12= 02	O/P Freq.	Bn-14= 02	O/P Freq.
Bn-12= 03	O/P I	Bn-14= 03	O/P I
Bn-12= 04	O/P V	Bn-14= 04	O/P V
Bn-12= 05	DC Volt	Bn-14= 05	DC Volt
Bn-12= 06	Term. VIN	Bn-14= 06	Term. VIN
Bn-12= 07	Term. AIN	Bn-14= 07	Term. AIN
Bn-12= 08	Term. AUX	Bn-14= 08	Term. AUX
Bn-12= 09	~ Output	Bn-14= 09	~ Output
Bn-12= 10	~ Output	Bn-14= 10	~ Output
Bn-12= 11	I/P Term	Bn-14= 11	I/P Term
Bn-12= 12	O/P Term	Bn-14= 12	O/P Term
Bn-12= 13	Sp. Fdk	Bn-14= 13	Sp. Fdk
Bn-12= 14	Sp. Comp.	Bn-14= 14	Sp. Comp.
Bn-12= 15	PID I/P	Bn-14= 15	PID I/P
Bn-12= 16	PID O/P	Bn-14= 16	PID O/P
Bn-12= 17	PID O/P	Bn-14= 17	PID O/P

(14) Multi-function Analog output AO1 gain (Bn-14)

(15) Multi-function Analog output AO1 gain (Bn-15)

• Multi-function analog output AO1 and AO2 can be set for their individual voltage level respectively.



(16) PID detection gain (Bn-16)

(17) PID Proportional gain (Bn-17)

(18) PID integral time (Bn-18)

(19) PID differential time (Bn-19)

(20) PID Bias (Bn-20)

• The PID control function matches a feedback value (i.e., a detected value) to the set target value. Combining the proportional (P), integral (I) and derivative (D) control make the control possible to achieve required response by constant setting and tuning procedure of proportional gain (P), integral time (I) and derivative time (D).

• See the appendix on page 108 for "Adjusting PID control".

• Fig 14 is a Block diagram of the inverter's internal PID control.

• If both the target value and feedback value are set to 0, adjust the inverter output frequency to zero.

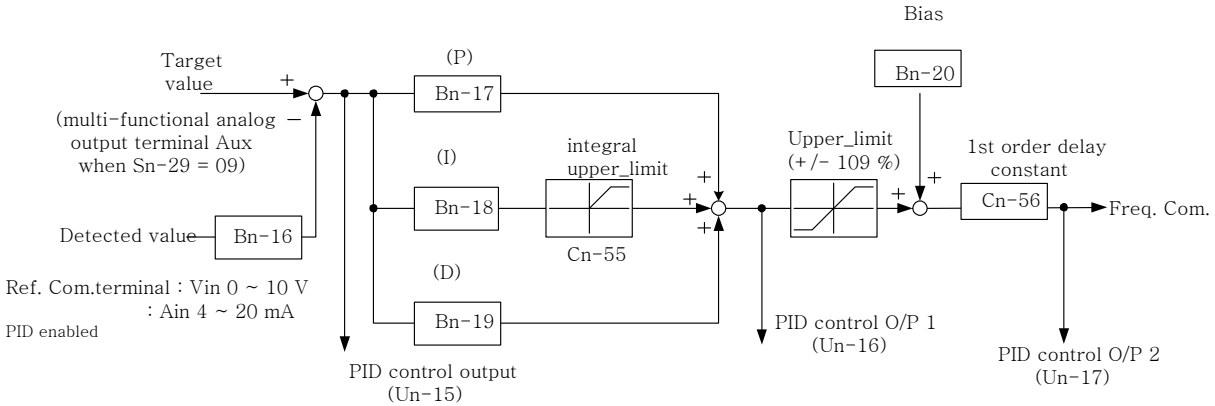


Fig 14 Block diagram for PID control in inverter

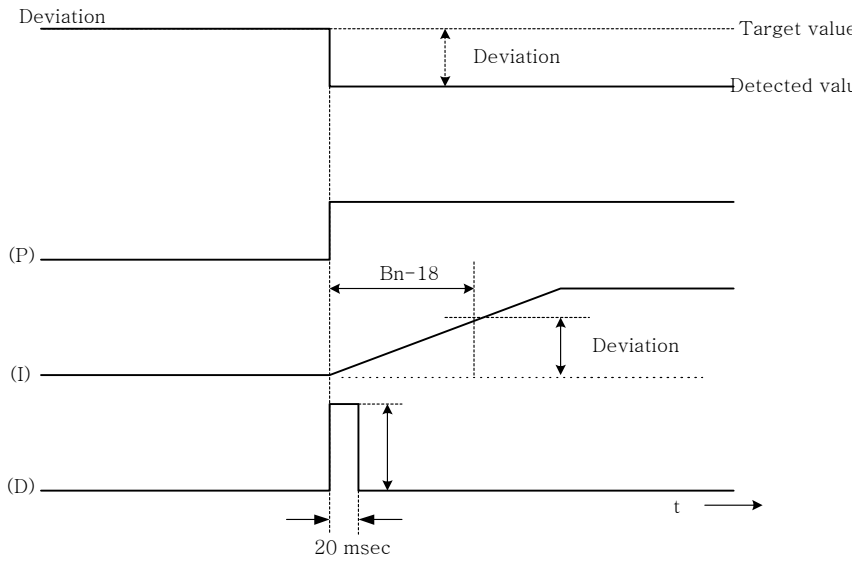


Fig 15 Response of PID control for STEP-shape (deviation) input

- Deviation= Target value－Detected_value ×Bn-16.
- P's control output= deviation ×Bn-17.
- It's control output is limited by upper bound Cn-55 with integral time Bn-18.
- D's control output= difference× ($\frac{\text{Bn-19}}{\text{5 msec}}$)

Note: The PID function is enabled by setting the parameter Sn-64 to 1.

(21) Time setting in auto_run mode (Bn-21～Bn-36)

- In Auto_Run mode, the time setting for individual step is described on page 93 "Auto_run mode selection and enable (Sn-44~60)".

(22) Timer ON_delay time (Bn-37)

(23) Timer OFF_delay time (Bn-38)

- The timer function is enabled when the timer function input (Sn-25~28=19) and its timer function output (Sn-30~32=21) are set for the multi-function input and multi-function output respectively.
- These inputs and outputs serve as general-purpose I/O . Setting ON/OFF delay time (Bn-37/38) for the timer can prevent chattering of sensors, switches and so on.
- When the timer function input ON times is longer than the value set for Bn-37 (timer function ON_delay time), the timer function output turns ON.
- When the timer function input OFF times is longer than the value set for Bn-38 (timer function OFF_delay time), the timer function output turns OFF. An example is shown below.

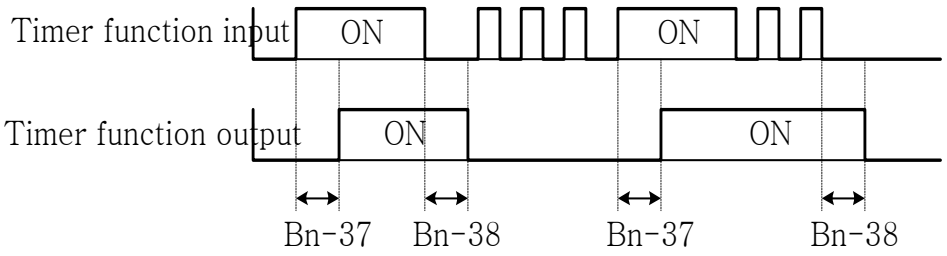


Fig 16 An operation example of timer function

(24) Energy Saving Gain (Bn-39)

- Input the energy saving command while a light load causes the inverter output voltage to be reduced and save energy. Set this value as a percentage of the V/F pattern. The setting range is 50~150%. The factory setting is 100% and the energy saving function is disabled. If the energy saving gain Bn-39 is not 100%, the energy saving function is enabled.
- In energy saving mode (Bn-39≠100), the output voltage will automatically decreased and proportional to energy saving gain Bn-39. The Bn-39 setting should not be small so that the motor will stall.
- The energy saving function is disabled during PID close-loop control and during deceleration.

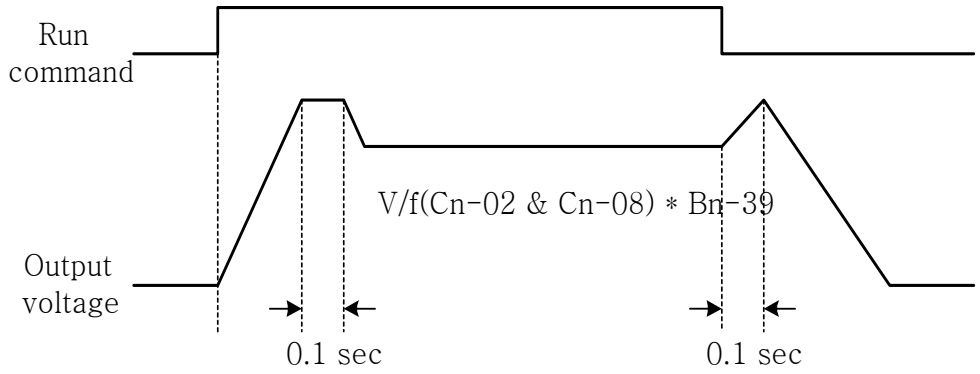


Fig 17 Time chart for energy-saving operation

3.3 Control Parameters Cn-□□

Function	Parameter No.	Name	LCD Display	Setting Range	Setting Unit	Factory Setting	Page
V/F Pattern Setting	Cn-01	Input Voltage	Cn-01= 220.0V Input Voltage	150.0～255.0V	0.1V	220.0V[*1]	44
	Cn-02	Max. Output Frequency	Cn-02= 060.0Hz Max. O/P Freq.	50.0～400.0Hz	0.1Hz	60.0Hz	44
	Cn-03	Max. Output Voltage	Cn-03= 220.0Hz Max. Voltage	0.1～255.0V	0.1V	220.0V	
	Cn-04	Max. voltage frequency	Cn-04= 060.0Hz Max. Volt Frequency	0.1～400.0Hz	0.1Hz	60.0Hz	
	Cn-05	Middle Output Frequency	Cn-05= 003.0Hz Middle O/P Freq.	0.1～400.0Hz	0.1Hz	3.0Hz	
	Cn-06	Middle voltage frequency	Cn-06= 016.5Hz Middle Voltage	0.1～255.0V	0.1V	16.5V	
	Cn-07	Min Output Frequency	Cn-07= 001.5Hz Min O/P Freq.	0.1～400.0Hz	0.1Hz	11.0V	
	Cn-08	Voltage at Min. Output Frequency	Cn-08= 011.0V Min. Voltage	0.1～255.0V	0.1V	11.0V[*1]	
Motor Parameter	Cn-09	Motor rated current	Cn-09= 0013.5V Motor Rated I	10～200%	0.1A	30%	45
	Cn-10	No Load Current of Motor	Cn-10= 30% Motor No-Load I	0～99%	1%	0.0%	45
	Cn-11	Rated Slip of Motor	Cn-11= 0.0% Motor Rated Slip	0～9.9%	0.1%	0.0%	45
	Cn-12	Line-to-line Resistance of Motor	Cn-12= 01.000Ω Motor Line R	0～65.535Ω	0.001Ω	5.732[*1]	46
	Cn-13	Torque Compensation of Core Loss	Cn-13= 0010W Core Loss	0～65535W	1W	64[*1]	
DC Braking Function	Cn-14	Dc Injection Braking Starting frequency	Cn-14= 01.5Hz DC Braking Start F	0.1～10.0Hz	0.1Hz	1.5Hz	46
	Cn-15	DC Braking Current	Cn-15= 050% DC Braking Current	0～100%	1%	50%	
	Cn-16	Dc Injection Braking Time at Stop	Cn-16= 00.5S DC Braking Stop Time	0.0～25.5S	0.1S	0.5S	
	Cn-17	Dc Injection Braking Time at Start	Cn-17= 00.0S DC Braking Start Time	0.0～25.5S	0.1S	0.0S	
Frequency Limit	Cn-18	Frequency Command Upper Bound	Cn-18= 100% Freq.Com. Up-Bound	0～109%	1%	100%	46
	Cn-19	Frequency Command Lower Bound	Cn-19= 000% Freq. Com. Low-Bound	0～109%	1%	0%	
Frequency Jump	Cn-20	Frequency Jump Point 1	Cn-20= 000.0Hz Freq. Jump 1	0.0～400.0Hz	0.1Hz	0.0Hz	47
	Cn-21	Frequency Jump Point 2	Cn-21= 000.0Hz Freq. Jump 2	0.0～400.0Hz	0.1Hz	0.0Hz	
	Cn-22	Frequency Jump Point 3	Cn-22= 000.0Hz Freq. Jump 3	0.0～400.0Hz	0.1Hz	0.0Hz	
	Cn-23	Jump Frequency width	Cn-23= 01.0Hz Freq. Jump Width	0.0～25.5Hz	0.1Hz	1.0Hz	

Function	Parameter No.	Name	LCD Display	Setting Range	Setting Unit	Factory Setting	Page
Retry Function	Cn-24	Number of Auto Restart Attempt	Cn-24= 00 Retry Times	0～10	1	0	49
Stall Prevention	Cn-25	Stall Prevention During Acceleration	Cn-25= 170% Acc. Stall	30～200%	1%	170%	49
	Cn-26	Stall Prevention During Running	Cn-26= 160% Run Stall	30～200%	1%	160%	
Display Unit	Cn-28	LCD digital Operator display unit	Cn-28= 1 Operator Disp. Unit	0-39999	1	1	49
Frequency Agree Detection	Cn-29	Frequency Agree Detection Level During Acceleration	Cn-29= 000.0Hz Acc. Freq. Det.Level	0.0～400.0Hz	0.1Hz	0.0Hz	50
	Cn-30	Frequency Agree Detection Level During Deceleration	Cn-30= 000.0Hz Dec. Freq. Det. Level	0.0～400.0Hz	0.1Hz	0.0Hz	
	Cn-31	Frequency Agree Detection Width	Cn-31= 02.0Hz Agree F Det. Width	0.1～25.5Hz	0.1Hz	2.0Hz	
Over-torque Detection	Cn-32	Overtorque Detection Level	Cn-32= 160% Over Tq. Det. Level	30～200%	1%	160%	52
	Cn-33	Overtorque Detection Time	Cn-33= 00.15S Over Tq. Det. Time	0.0～25.58	0.1S	0.1S	
Carrier Frequency	Cn-34	Carrier Frequency Setting	Cn-34= 6 Carry_Freq. Setting	1～6	1	6	53
Speed Search Control	Cn-35	Speed Search Detection Level	Cn-35= 150% Sp-Search Level	0～200%	1%	150%	54
	Cn-36	Speed Search Time	Cn-36= 02.0S Sp-Search Time	0.1～25.5S	0.1S	2.0S	
	Cn-37	Min. Baseblock Time	Cn-37= 0.5S Min. B.B. Time	0.5～5.0S	0.1S	0.5S	
	Cn-38	V/F Curve in Speed Search	Cn-38= 100 Sp-search V/F Gain	10～100%	1%	100%	
Low Voltage Detection	Cn-39	Low Voltage Alarm Detection Level	Cn-39= 190V Low Volt. Det. Level	150～210V	1V	190.0V *1	56
Slip Comp. Control	Cn-40	Slip Compensation Primary Delay Time	Cn-40= 02.0S Slip Filter	0.0～25.5S	0.1S	2.0S	56
S-curve time	Cn-41	S-curve Characteristic time at Acceleration Start	Cn-41= 0.0S S1 Curve Time	0.0～1.0S	0.1S	0.0S	56
	Cn-42	S-curve Characteristic time at Acceleration End	Cn-42= 0.0S S2 Curve Time	0.0～1.0S	0.1S	0.0S	
	Cn-43	S-curve Characteristic time at Deceleration Start	Cn-43= 0.0S S3 Curve Time	0.0～1.0S	0.1S	0.0S	
	Cn-44	S-curve Characteristic time at Deceleration end	Cn-44= 0.0S S4 Curve Time	0.0～1.0S	0.1S	0.0S	

Function	Parameter No.	Name	LCD Display	Setting Range	Setting Unit	Factory Setting	Page
Speed feedback control	Cn-45	PG Parameter	Cn-45= 0000.0 PG Parameter	0.0～3000.0P/R	0.1P/R	0.0P/R	58
	Cn-46	Pole no. of Motor	Cn-46= 04P Motor Pole	2～32P	2～32P	4 P	
	Cn-47	ASR Proportional Gain 1	Cn-47= 0.00 ASR Gain 1	0.00～2.55	0.00～2.55	0.00	
	Cn-48	ASR Integral Gain 1	Cn-48= 01.0S ASR Int. Time 1	0.1～10.0S	0.1～10.0S	1.0S	
	Cn-49	ASR Proportional Gain 2	Cn-49= 0.02 ASR Gain 2	0.00～2.55	0.00～2.55	0.02	
	Cn-50	ASR Integral Gain 2	Cn-50= 01.0S ASR Int. Time 2	0.1～10.0S	0.1～10.0S	1.0S	
	Cn-51	ASR Upper Bound	Cn-51= 05.0% ASR Up-Bound	0.1～10.0%	0.1～10.0%	5.0%	
	Cn-52	ASR Lower Bound	Cn-52= 00.1% ASR Low-Bound	0.1～10.0%	0.1～10.0%	0.1%	
	Cn-53	Excessive Speed Deviation Detection Level	Cn-53= 10% Sp.Deviat. Det.Level	1～50%	1～50%	10%	
	Cn-54	Overspeed Detection Level	Cn-54= 110% Over Sp.Det. Level	1～120%	1～120%	110%	
PID Control	Cn-55	PID Integral Upper Bound	Cn-55= 100% PID I-Upper	0～109%	0～109%	100%	58
	Cn-56	PID Primary Delay Time Constant	Cn-56= 0.0S PID Filter	0.0～2.5S	0.0～2.5S	0.0S	

Note:

(*1) These are for a 220V class inverter. Value(*2) for a 440V class inverter is double.

(1) Input voltage setting (Cn-01)

・Set inverter voltage to match power supply voltage at input side (e.g.：200V/220V，380V/415V/440V/460V)

(2) V/F curve parameter settings (Cn-02～Cn-08)

・The V/F curve can be set to either one of the preset curves (setting Sn-02=0～14) or a customer user-set curve (setting Sn-02=15).

・Setting Cn-02～Cn-08 can be set by the user when Sn-02 has been set to “15”. The user-defined V/F curve can be specified through the settings of Cn-02～Cn-08 as shown in Fig 18. The factory setting is straight line for the V/F curve. (Cn-05=Cn-07, Cn-06 is not used) as shown below (220V/60Hz case).

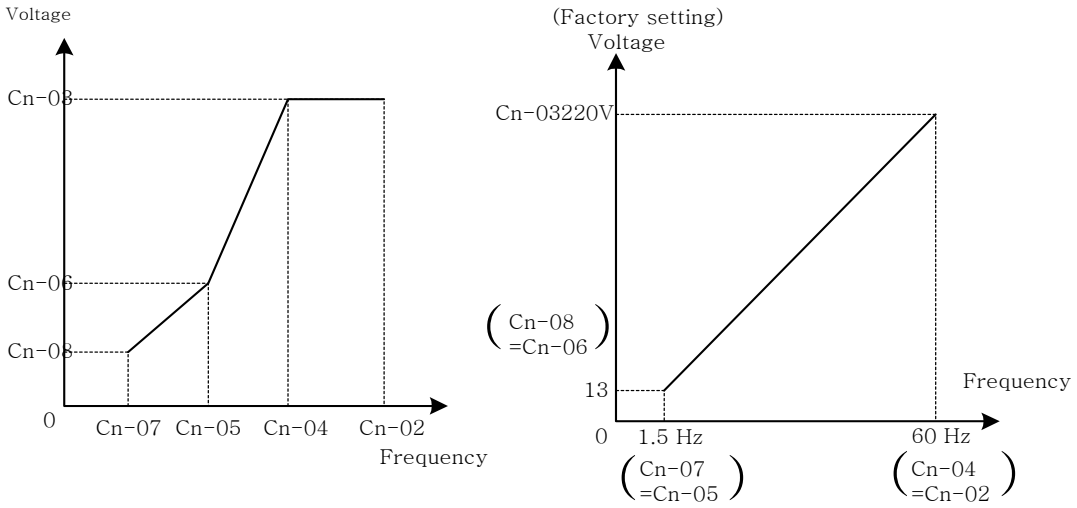


Fig 18 User-defined V/F curve

・In low speed operation (<3Hz), a larger torque can be generated by increasing the V/F curve. However, the motor will be hot due to over-excitation. At the same time the inverter will be more inclined to fault. Based upon the applied load, properly adjust the V/F curve according to the magnitude of monitored current into the motor. The four frequency settings must satisfy the following relationship, otherwise an error message “V/F Curve Invalid” will display.

(1)

Max. output frequency≧Max. voltage frequency＞Mid. Output frequency≧Min. output frequency

(Cn-02) (Cn-04) (Cn-05) (Cn-07)

(2)

Max. output voltage≧Mid. Output voltage＞Min. output voltage

(Cn-03) (Cn-06) (Cn-08)

(3)

If Mid. Output frequency (Cn-05)= Min. output frequency (Cn-07), the setting (Cn-06) is not effective.

(3) Motor rated current (Cn-09)

- Electronic overload thermal reference current
- The factory setting depends upon the capacity type of inverter (Sn-01).
- The setting range is 10%～200% of the inverter rated output current.
- Set the rated current shown on the motor nameplate if not using the DD motor.

(4) Motor no-load current (Cn-10)

- This setting is used as a reference value for torque compensation function.
- The setting range is 0～99% of the inverter rated current Cn-09 (100%).
- The slip compensation is enabled when the output current is greater than motor no-load current.

The slip compensation value and the compensated frequency are shown below. (See Fig 19)

$$\text{Slip compensation} = \frac{\text{Motor rated slip}(\text{Cn-11}) \times (\text{Output current} - \text{Motor no-load curren}(\text{Cn-10}))}{(\text{Motor rated curren}(\text{Cn-09}) - \text{Motor no-load current}(\text{Cn-10}))}$$

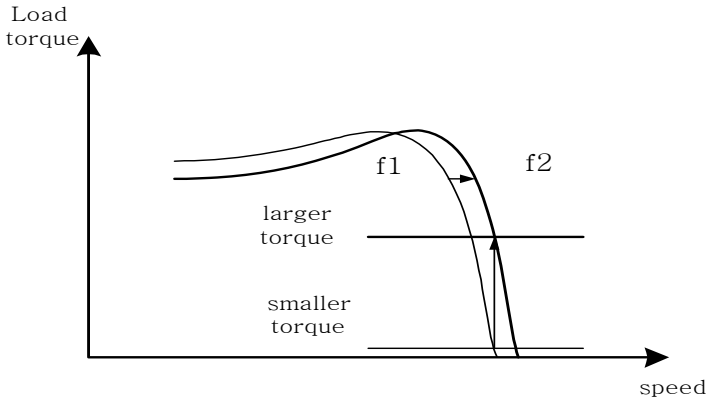


Fig 19 Output frequency with slip compensation. The output frequency will shift from f1 to f2 (>f1) for the positive change of load torque.

(5) Motor rated slip (Cn-11)

- This setting is used as a reference value for torque compensation function. See Fig 19. The setting is 0.0~9.9% as a percentage of motor Max. voltage frequency (Cn-04) as 100%.
- The setting is shown in Fig 20 in the constant torque and constant output range. If setting Cn-11 is zero, no slip compensation is used.

・There is no slip compensation in the cases when the frequency command is less than the Min. output frequency or during regeneration.

$$\text{Motor rated slip(Cn-11)} = \frac{\text{Motor rated frequency(Hz)} \times (\text{Rated speed(rpm)} \times (\text{Motor NO.of poles})/120)}{\text{Max. voltage frequency (Cn-04)}} \times 120$$

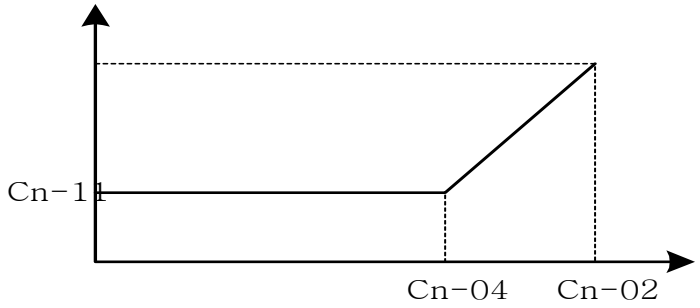


Fig 20 Slip compensation limit

(6) Motor line-to-line Resistance (Cn-12)

(7) Motor iron-core loss (Cn-13)

・It is for torque compensation function. The default setting depends upon the inverter capacity (Sn-01). Normally, the setting does not need to be altered. See Table 9~10 on page 66.

(8) DC injection braking starting frequency (Cn-14)

(9) DC injection braking current (Cn-15)

(10) DC injection braking time at stop (Cn-16)

(11) DC injection braking time at start (Cn-17)

・The DC injection braking function decelerates by applying a DC current to the motor. This happens in the 2 cases:

(1) DC injection braking time at start:

It is effective for temporarily stopping and then restarting, without regeneration, a motor coasting by inertia.

(2) DC injection braking time at stop:

It is used to prevent coasting by inertia when the motor is not completely stopped by normal deceleration when there is a large load. The stopping time can be shortened by lengthening the DC injection braking time (Cn-16) or increasing the DC injection braking current (Cn-15).

- For the DC injection braking current (Cn-15), set the value for the current that is output at the time of DC injection braking. DC injection braking current is set as a percentage of inverter rated output current, with the inverter rated output current taken as 100%.
- For the DC injection braking time at start (Cn-17), set the DC injection braking operating time when the motor is started.
- For the DC injection braking starting frequency (Cn-14), set the frequency for beginning DC injection braking for deceleration. If the excitation level is less than the Min. output frequency (Cn-07), the DC injection braking will begin from Min. output frequency.
- If the DC injection braking time at start (Cn-17) is 0.0, the motor starts from the Min. output frequency and no DC injection braking are enabled.
- If the DC injection braking time at stop (Cn-14) is 0.0, no DC injection braking is enabled. In this case, the inverter output will be blocked off when the output frequency is less than the DC injection braking starting frequency.

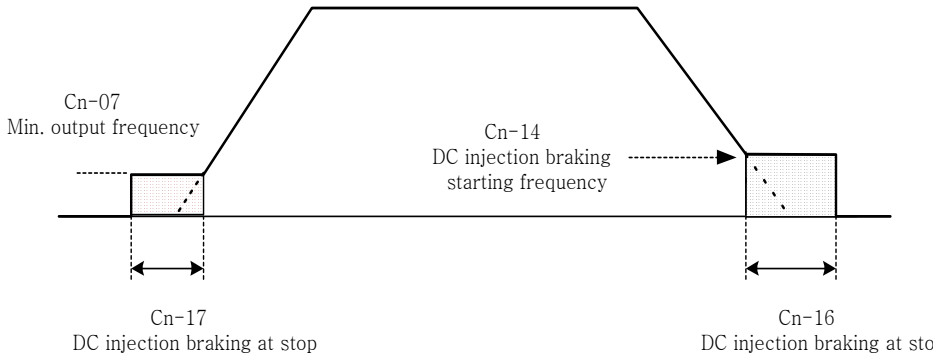


Fig 21 DC injection braking time chart

(12) Frequency command upper bound (Cn-18)

(13) Frequency command lower bound (Cn-19)

- The upper and lower bounds of the frequency command are set as a percentage of the Max. output frequency (Cn-02 as 100%), in increments of 1%. The relationship Cn-18 > Cn-19 must be abided by. If not, an error message “Frequency Limit Setting Error”.
- When the frequency command is zero and a run command is input, the motor operates at the frequency command lower bound (Cn-19). The motor will not operate, however, if the lower limit is set lower than the Min. output frequency (Cn-07).

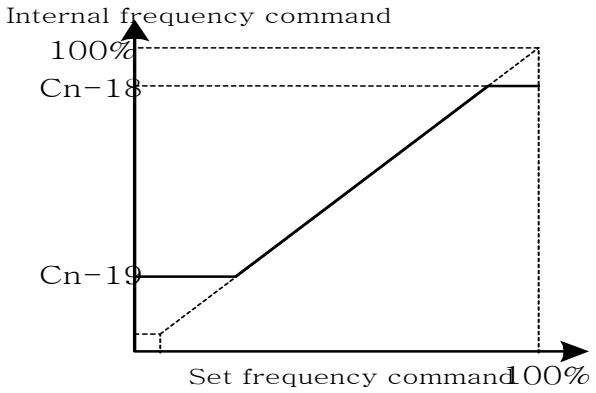


Fig 22 Upper and lower bounds of the frequency command

(14) Frequency jump point 1 (Cn-20)

(15) Frequency jump point 2 (Cn-21)

(16) Frequency jump point 3 (Cn-22)

(17) Jump Frequency width (Cn-23)

• These settings allow the "jumping" of certain frequencies within the inverter's output frequency range so that the motor can operate without resonant oscillations caused by some machine systems.

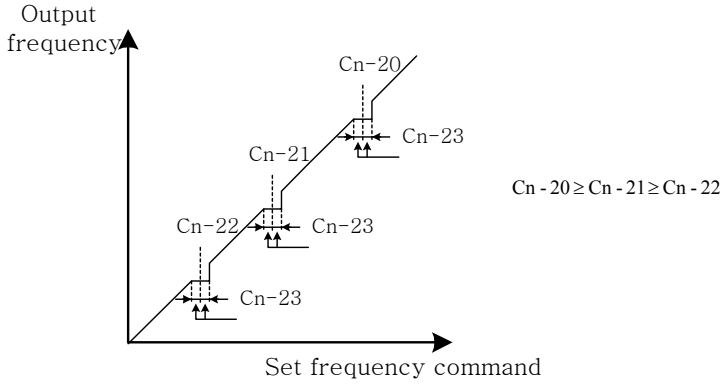


Fig 23 setting jump frequencies

· Operation is prohibited within the jump frequency range, but changes during acceleration and deceleration are smooth with no jump. To disable this function, set the jump frequency 1 ~3 (Cn-20~Cn-22) to 0.0Hz.

· For the jump frequency 1~3 (Cn-20~Cn-22), set the center frequency to be jumped.

· Be sure to set the jump so that Cn-20 ≥ Cn-21 ≥ Cn-22. If not, a message "Jump frequency Setting error" is displayed. For Cn-23, set the jump frequency bandwidth. If Cn-23 is set as 0.0Hz, the jump frequency function is disabled.

(18) Number of auto restart attempt (Cn-24)

- The fault restart function will restart the inverter even when an internal fault occurs during inverter operation. Use this function only when continuing operation is more important than possibly damaging the inverter.
- The fault restart function is effective with the following faults. With other faults, the protective operations will engage immediately without attempting to restart operation.
  - Over-current
  - Ground fault
  - Main circuit over-voltage
- The fault restart count will automatically increase upon the restart activated and will be cleared in the following cases:
  1) When the operation is normal for 10 minutes after a fault restart is performed.
  2) When the fault reset input is received after the protection operation has been activated and the fault confirmed. (e.g., by pressing RESET or enable Fault reset terminal ③)
  3) When the power is turned off and on again.
- When on of the multi-function output terminals (RA-AB-RC，DO1，DO2) is set to restart enabled, the output will be ON while the fault restart function is in progress. See page 88 for the setting of (Sn-30~Sn-32).

(19) Stall Prevention level During Acceleration (Cn-25)

(20) Stall Prevention level During Running (Cn-26)

- A stall occurs if the rotor can not keep up with the rotating electromagnetic field on the motor stator side when a large load is applied or a sudden acceleration or deceleration is performed. In this case, the inverter should automatically adjust the output frequency to prevent stall.
- The stall prevention function can be set independently for accelerating and running.
- Stall Prevention During Acceleration：See Fig 24. Stop acceleration if Cn-25 setting is exceeded. Accelerate again when the current recovers.
- Stall Prevention During running：See Fig 25. Deceleration is started if the run stall prevention level Cn-26 is exceeded, especially when an impact load is applied suddenly. Accelerate again when the current level is lower than Cn-26.

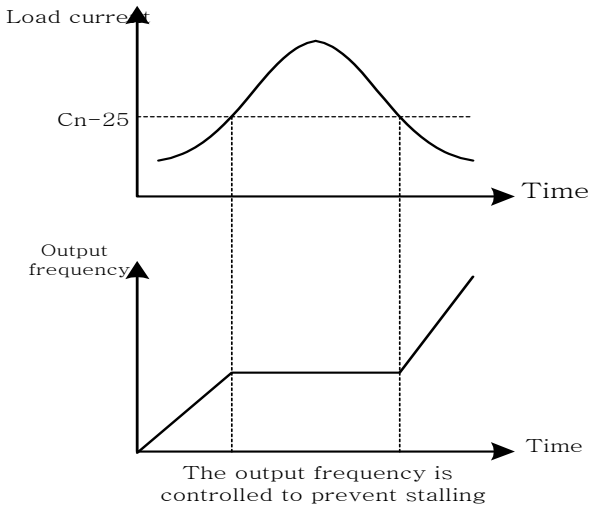


Fig 24 Acceleration stall prevention function

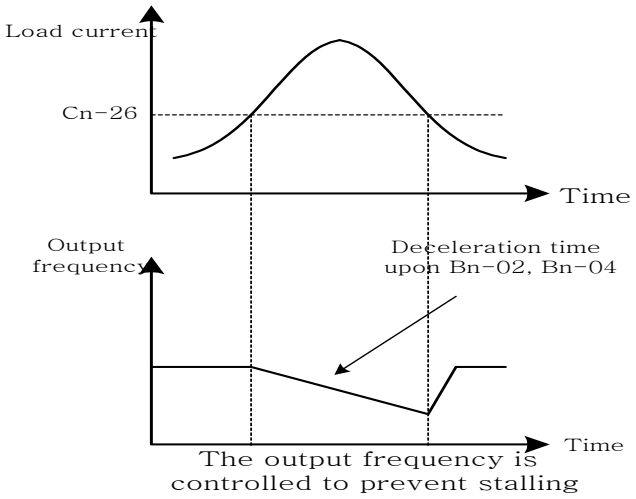


Fig 25 Run stall prevention function

- Set the parameters Cn-25 and Cn-26 as a percentage of inverter rated current (100% corresponds to inverter rated current).
- See page 75 for stall prevention function selection.

(21) LCD digital Operator display unit (Cn-28)

- Set the units that will be set and displayed for the frequency command and frequency monitor. As described below:

Table 8

<table>
<tr><td>Cn-28 setting</td><td colspan="3">Setting/Displayed contents</td></tr>
<tr><td>0</td><td colspan="3">0.01Hz unit.</td></tr>
<tr><td>1</td><td colspan="3">0.01% unit. (Max. output frequency is 100%)</td></tr>
<tr><td>2～39</td><td colspan="3">Rpm unit. (Cn-28 sets the motor poles.)
rpm= 120 × frequency command (Hz) / Cn-28</td></tr>
<tr><td rowspan="6">00040～39999</td><td colspan="3">Set the decimal point position using the value of the fifth digit.
The display when the fifth digit= 0 will be XXXX
The display when the fifth digit= 1 will be XXX.X
The display when the fifth digit= 2 will be XX.XX
The display when the fifth digit= 3 will be X.XXX</td></tr>
<tr><td>Setting</td><td>Display</td><td>Displayed examples</td></tr>
<tr><td>00040～09999</td><td>XXXXX</td><td>100% speed will be displayed 0200
→Cn-28= 00200</td></tr>
<tr><td>10000～19999</td><td>XXXX.X</td><td>100% speed will be displayed 200.0
→Cn-28= 12000
60% speed will be displayed 120.0</td></tr>
<tr><td>20000～29999</td><td>XXX.XX</td><td>100% speed will be displayed 65.00
→Cn-28= 26500
60% speed will be displayed 39.00</td></tr>
<tr><td>30000～39999</td><td>XX.XXX</td><td>100% speed will be displayed 2.555
→Cn-28= 32555</td></tr>
</table>

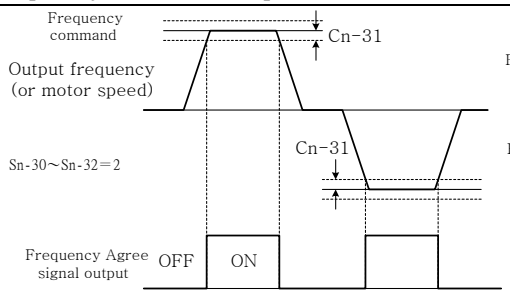
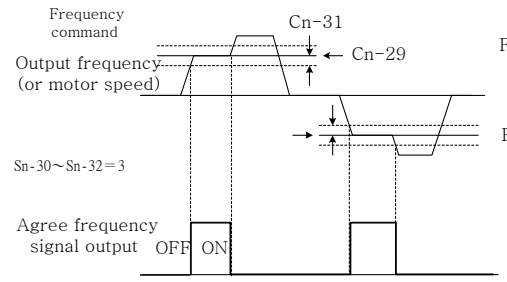
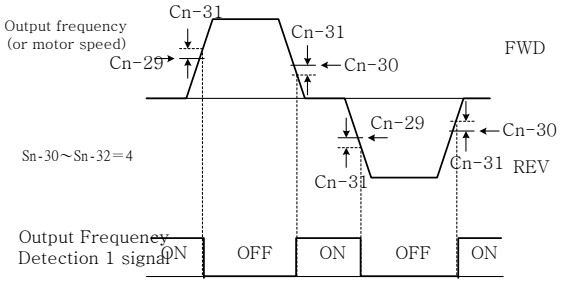
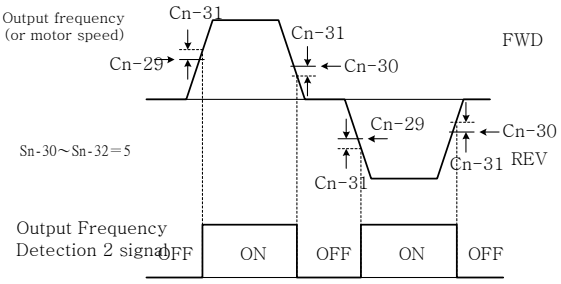
(22) Frequency Agree Detection Level During Acceleration (Cn-29)

(23) Frequency Agree Detection Level During Deceleration (Cn-30)

(24) Frequency Agree Detection Width (Cn-31)

・Frequency detection function: Set the multi-function output terminals (control circuit terminals RA-RB-RC，DO1，DO2) to output the desired Frequency Agree signal, Agreed Frequency and Output Frequency Detection level (through proper setting of Sn-30 ~ Sn-32).

The time chart for Frequency Detection operation is described as follows:

Function	Frequency Detection Operation	Description
Frequency Agree		・When Output Frequency is within Frequency Command +/- Frequency Detection Width (Cn-31), Frequency Agree output is “ON”. ・Set Sn-30～Sn-32 to be “02”.
Agreed Frequency		・After acceleration, the output frequency reaches Frequency Agree Detection Level During Acceleration (Cn-29) and within Frequency Detection Width (Cn-31), Agreed Frequency output is “ON”. ・Set Sn-30～Sn-32 to be “03”.
Output Frequency Detection 1		・During acceleration, the output frequency is less than Frequency Agree Detection Level During Acceleration (Cn-29), Output Frequency Detection1 is “ON”. ・During deceleration, the output frequency is less than Frequency Agree Detection Level During Deceleration (Cn-30), Output Frequency Detection1 is “ON”. ・Set Sn-30～Sn-32 to be “04”.
Output Frequency Detection 2		・During acceleration, the output frequency is larger than Frequency Agree Detection Level During Acceleration (Cn-29), Output Frequency Detection1 is “ON”. ・During deceleration, the output frequency is larger than Frequency Agree Detection Level During deceleration (Cn-30), Output Frequency Detection1 is “ON”. ・Set Sn-30～Sn-32 to be “05”.

(25) Overtorque Detection Level (Cn-32)

(26) Overtorque Detection Time (Cn-33)

・The Overtorque detection function detects the excessive mechanical load from an increase in output current. When an overtorque detection is enabled through the setting Sn-12, be sure to set Overtorque Detection Level (Cn-32) and Overtorque Detection Time (Cn-32). An overtorque

condition is detected when the output current exceeds the Overtorque Detection Level (Cn-32) for longer than the Overtorque Detection Time (Cn-33). The multi-function output terminals (control circuit terminals RA-RB-RC-DO1-DO2) can be set to indicate an overtorque condition has been detected.

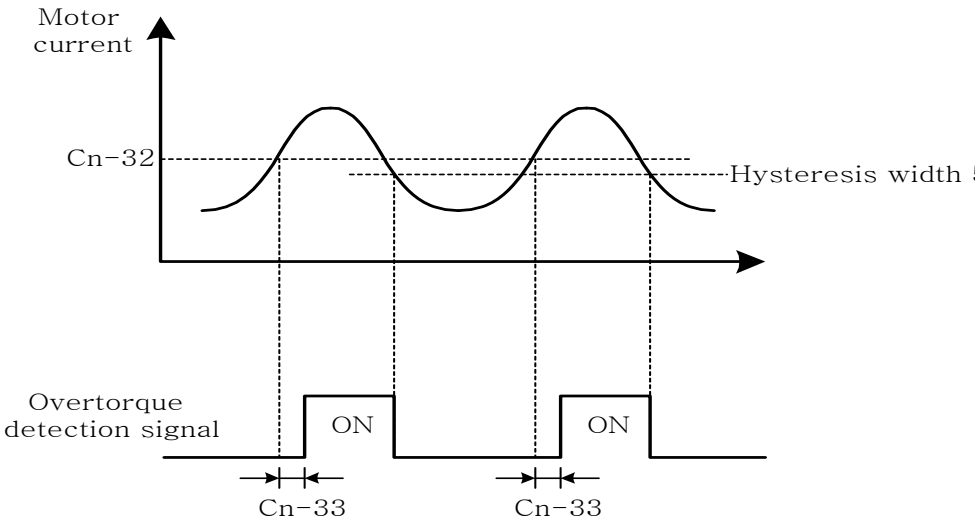


Fig 26 Time chart for overtorque detection

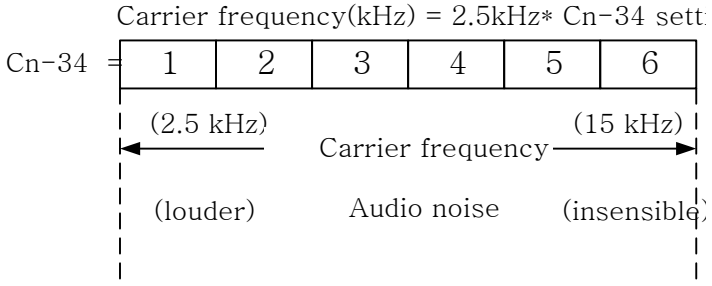
・Properly set the parameter Sn-12 will allow

1) detect only during frequency agreement. Continue operation even after detection.
2) detect at anytime. Continue operation even after detection.
3) detect only during frequency agreement. Stop operation after detection.
4) detect only at anytime. Stop operation after detection.

・See more details on page 74

(27) Carrier Frequency setting (Cn-34)

・Lower the carrier frequency can decrease the noise interference and leakage. Its setting is shown below.



・The output frequency does not normally need to be adjusted, but making adjustment in the following cases.

1) If the wiring distance between the inverter and motor is long, lower the carrier frequency as shown below to allow less leakage current.

Wiring distance	<30m	30m~50m	50m~100m	>100m
Carrier frequency (Cn-34)	<15kHz	<10kHz	<5KHz	<2.5KHz

2) If there is great irregularity in speed or torque, lower the carrier frequency.

(28) Speed search detection level (Cn-35)

(29) Speed search time (Cn-36)

(30) Min. baseblock time (Cn-37)

(31) Speed Search V/F Curve (Cn-38)

・The speed search function finds the speed of a coasting motor and starts up smoothly from that frequency or max. frequency. It is effective in situations such as switching from a commercial power supply to an inverter without tripping.

・The timing of speed search function as shown below：

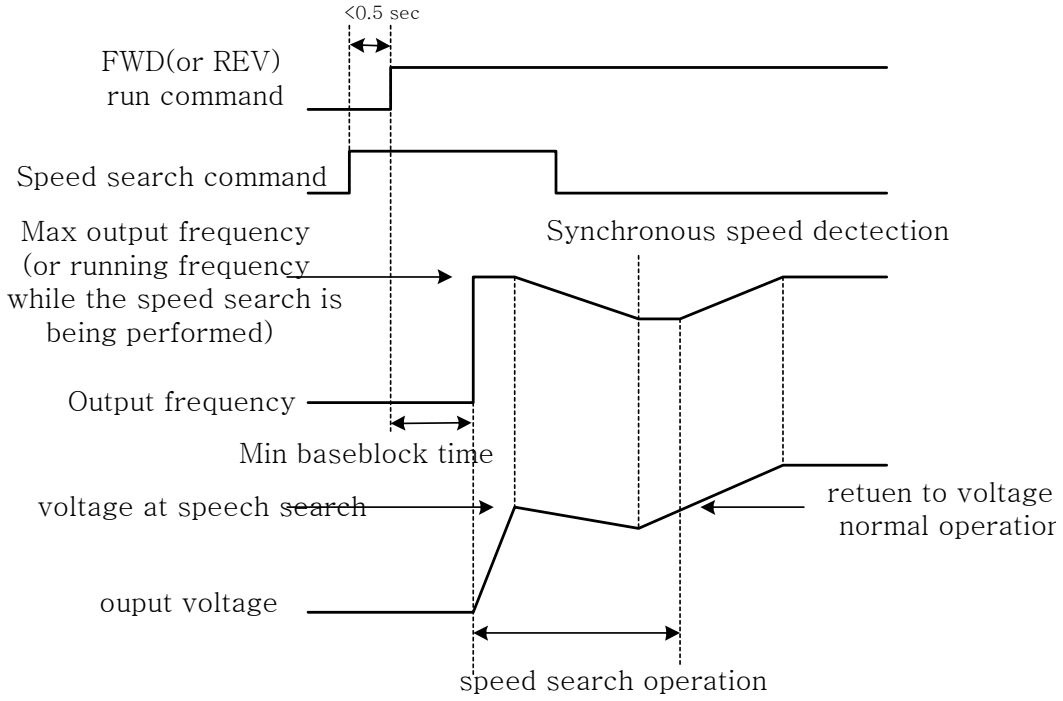


Fig 27 Speed search timing chart

・The speed search command can be set through the multi-function contact input terminal ⑤, ⑥, ⑦, ⑧ (By setting the parameters Sn-25 ~ Sn-28).

If Sn-25 ~ Sn-28= 20 : Speed search is performed from Max. output frequency and motor is started

If Sn-25 ~ Sn-28= 21 : Speed search starts from the running frequency when the speed search command is enabled.

・After the inverter output is blocked, the user should input speed search command then enable run operation, the inverter will begin to search the rotor speed after the min. baseblock time Cn-37.

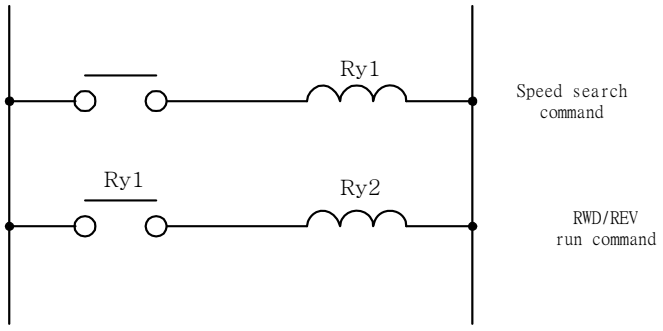
・Speed search operation, if the inverter output current is less than Cn-35, the inverter will take the output frequency as the real frequency at that time. From those values of real frequency, the inverter will accelerate or decelerate to the set frequency according to the acceleration or deceleration time.

・While the speed search command is being performed, the user can slightly decrease the setting of V/F curve (Cn-38) in order to prevent the OC protection function enabled. Normally, the V/F curve need not be changed. (As below)

Speed search operating V/F curve= Cn-38 * (normal operating V/F curve)

Note:

1. The speed search operation will be disabled if the speed search command is enacted from the Max. frequency and the setting frequency. (i.e., Sn-25=20, Sn-26=21 and multi-function input terminals ⑤, ⑥ is used at the same time).
2. Make sure that the FWD/REV command must be performed after or at the same time with the speed search command. A typical operation sequence is shown below.



When the speed search and DC injection braking are set, set the Min. baseblock time (Cn-37). For the Min. baseblock time, set the time to wait for the motor's residual voltage to dissipate. If an overcurrent is detected when starting a speed search or DC injection braking, raise the setting to prevent a fault from occurring. As a result, the Cn-37 setting cannot be set too small.

(32) Low voltage alarm detection level (Cn-39)

・In most cases, the setting Cn-39 need not be changed. If an external AC reactor is used, decrease the low voltage alarm detection level by adjusting Cn-39 setting smaller. Be sure to set a main-circuit DC voltage that will detect a main circuit undervoltage.

(33) Slip compensation primary delay time (Cn-40)

In most cases, the setting Cn-40 need not be changed. If the motor speed is not stable, increase the Cn-40 setting. If the speed response is slow, decrease the setting of Cn-40.

(34) S-curve Characteristic time at Acceleration start (Cn-41)

(35) S-curve Characteristic time at Acceleration end (Cn-42)

(36) S-curve Characteristic time at Deceleration start (Cn-43)

(37) S-curve Characteristic time at Acceleration start (Cn-44)

・Using the S-curve characteristic function for acceleration and deceleration can reduce shock to the machinery when stopping and starting. With the inverter, S-curve characteristic time can be set respectively for beginning acceleration, ending acceleration, beginning deceleration and ending deceleration. The relation between these parameters is shown in Fig 28.

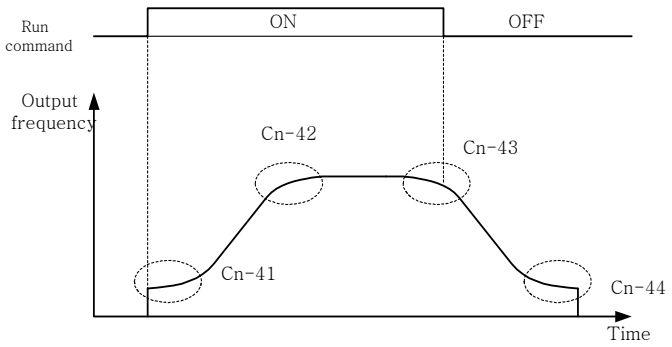


Fig 28 S curve

After the S-curve time is set, the final acceleration and deceleration time will be as follows:

- Acc. time= selected Acc. Time 1 (or 2) + $\frac{(Cn\text{-}41) + (Cn\text{-}42)}{2}$
- Dec. time= selected Dec. Time 1 (or 2) + $\frac{(Cn\text{-}42) + (Cn\text{-}44)}{2}$

(38) PG parameter (Cn-45)

・The parameter is set in the unit of pulse/revolution. The factory setting is 0.1 P/R.

(39) Pole number of motor (Cn-46)

・Cn-45 and Cn-46 must meet the following relationship:

$$\frac{2 * Cn\text{-}45 * Cn\text{-}02}{Cn\text{-}46} < 32767$$

・If not, an error message “Input Error” will be displayed

(40) ASR proportion gain 1 (Cn-47)

(41) ASR integral gain 1 (Cn-48)

・Set the proportion gain and integral time of the speed control (ASR)

(42) ASR proportion gain 2 (Cn-49)

(43) ASR integral 2 (Cn-50)

・Use these constants to set different proportional gain and integral time settings for low-speed operation.

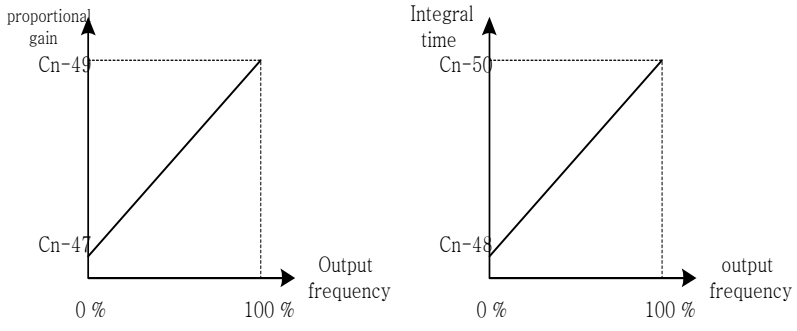


Fig 29

(44) ASR upper bound (Cn-51)

(45) ASR lower bound (Cn-52)

・These settings of Cn-51 and Cn-52 will limit the ASR range. See Fig 44 on page 85.

(46) Excessive speed deviation detection level (Cn-53)

・This parameter set the level of detecting PG speed deviation. The value of Cn-02 is referred as 100%, the default unit setting is 1%.

(47) Overspeed detection level (Cn-54)

・Set this parameter for detecting overspeed. The value of Cn-02 is referred as 100%, the default unit setting is 1%. Please refer setting of Sn-43 on page 93.

(48) PID integral upper bound (Cn-55)

(49) PID primary delay time constant (Cn-56)

・Please refer to Fig 14 “Block diagram for PID control in inverter”

・The parameter Cn-55 prevents the calculated value of the integral control of PID from exceeding the fixed amount. The value is limited within 0-109% of Max. output frequency (100%). Increase Cn-55 will improve the integral control. If we cannot reduce the hunting by decreasing the Bn-18 or increasing Cn-56, we have to decrease Cn-55. If the setting of Cn-55 is too small, the output may not match the target setting.

・The parameter Cn-56 is the low-pass filter setting for PID control output. If the viscous friction of the mechanical system is high, or if the rigidity is low, causing the mechanical system to oscillate, increase the setting Cn-56 so that it is higher than the oscillation frequency period. It will decrease the responsiveness, but it will prevent the oscillation.

3.4 System Parameters Sn-□□

Function	Parameter NO.	Name	LCD display	Description	Factory Setting	Page
Capacity setting	Sn-01	Inverter capacity selection	Sn-01= 01 220V 1HP	Inverter capacity selection	*1	66
V/F curve	Sn-02	V/F curve selection	Sn-02= 01 V/F curve	0~14:15 fixed V/F curve pattern 15:arbitrary V/F pattern selection		67
Operator status	Sn-03	Operator display	Sn-03= 00 Setting Valid	0:An-□□, Bn-□□, Cn-□□, Sn-□□ setting & reading enabled 1:An-□□,setting& reading enabled Bn-□□, Cn-□□, Sn-□□ setting only 2~5:reserved 6:clear message 7:2-wire initialization (220V/440V) 8:3-wire initialization (220V/440V) 9:2-wire initialization (200V/415V) 10:3-wire initialization (200V/415V) 11:2-wire initialization (200V/380V) 12:3-wire initialization (200V/380V) 13~15:reserved		70
Operation mode select	Sn-04	Run Source selection	Sn-04= 0 Run source Operator	Run source 0:Operator 1:Control terminal 2:RS-485 communication	0	70
	Sn-05	Frequency Command selection	Sn-05= 0 Ref. Com. Operator	Freq. Com. 0:Operator 1:Control circuit terminal 2:RS-485 communication	0	70
	Sn-06	Stopping method selection	Sn-06= 0 Dec. Stop	0:Deceleration to Stop 1:Coast to Stop 2:Whole_Range braking stop 3:Coast to Stop with Timer (restart after time Bn-02)	0	71
	Sn-07	Priority of stopping	Sn-07= 0 Stop Key Valid	If operation command from control terminal or RS-485 communication port 0:stop key effective from operator 1:stop key not effective from operator	0	73
	Sn-08	Prohibition of REV run	Sn-08= 0 Allow Reverse	0:reverse run enabled 1:reverse run disabled	0	73
Operation control mode selection	Sn-09	Output frequency Up/Down function	Sn-09= 0 Inhibit UP/DOWN	0:Reference frequency is changed through the key "UP/DOWN" pressing, later followed by key "EDIT/ENTER" pressing, and then this output frequency will be acknowledged. 1:reference frequency will be acknowledged immediately after the key "UP/DOWN" pressing.	0	73
	Sn-10	Frequency command characteristics selection	Sn-10= 0 Ref. Com. Fwd. Char.	0:Reference command has forward characteristics 1:Reference command has reverse characteristics	0	73
	Sn-11	Scanning times at input terminal	Sn-11= 0 Scan Time 5 ms	0:scan and confirm once per 5 ms 1:continuously scan and confirm twice per 10 ms	0	73

Function	Parameter NO.	Name	LCD display	Description	Factory Setting	Page
	Sn-12	Overtorque detection selection	Sn-12= 0 Overtorque Invalid	0:Overtorque detection function is not effective. 1:Overtorque is detected only at frequency_agree; the motor will sustain operation even after the overtorque has been detected 2:Overtorque is detected only at frequency_agree; the motor will stop after the baseblock time when the overtorque has been detected. 3:Overtorque is detected during running (ACC, DEC included). The motor will sustain operation even after the overtorque has been detected. 4:Overtorque is detected during running (ACC, DEC included). The motor will stop after the baseblock time when the overtorque has been detected.	0	74
	Sn-13	Output voltage limit selection	Sn-13= 0 V Limit Invalid	0:V/F output voltage is limited 1:V/F output voltage is not limited	0	74
Protection Characteristics selection	Sn-14	Stall prevention during Acc. function selection	Sn-14= 1 Acc. Stall Valid	0:invalid (Too much a torque may cause the stall) 1:valid (stop acceleration if current exceeds Cn-25 setting)	1	75
	Sn-15	Stall prevention during Dec. function selection	Sn-15= 1 Dec. Stall Invalid	0:invalid (installed with external brake unit) 1:valid (no external brake unit used)	1	75
	Sn-16	Stall prevention during running function selection	Sn-16= 1 Run Stall Valid	0:invalid 1:valid –Deceleration timel for stall prevention during running (no external brake unit used) 2:valid –Deceleration time2 for stall prevention during running (no external brake unit used)	1	75
	Sn-17	Fault retry setting	Sn-17= 1 Retry Not O/P	0:Do not output fault retry. (The fault contact does not operate.) 1:Output fault retry. (The fault contact operates.)	1	76
	Sn-18	Operation selection at power loss	Sn-18= 0 PwrL_to_ON Stop O/P	0:stop running 1:continue to run	0	76
	Sn-19	Zero speed braking operation selection	Sn-19= 0 Z_braking Invalid	(analog) Speed reference is 0 during running on, the braking function selection 0:invalid 1:valid	0	76
	Sn-20	External fault contact③ contact selection	Sn-20= 0 Term.3 NO_Cont.	0:A-contact (normally open input) 1:B-contact (normally close input)	0	76

Function	Parameter NO.	Name	LCD display	Description	Factory Setting	Page
Protection Characteristics selection	Sn-21	External fault contact③ detection selection	Sn-21= 0 All Time Ext. Fault	0:detect all time 1:detect only during operation	0	77
	Sn-22	External fault operation selection	Sn-22= 1 Ext. Fault Free run	0: deceleration to stop (upon deceleration timel Bn-02) 1:coast (free run) to stop 2:deceleration to stop (upon deceleration timel Bn-04) 3:continue operating	1	77
	Sn-23	Motor overload protection selection	Sn-23= 1 Cold Start Over Load	Electronically motor overload protection selection 0:Electronically motor overload protection invalid 1:standard motor cold start overload protection characteristics 2:standard motor hot start overload protection characteristics 3:special motor cold start overload protection characteristics 4:special motor hot start overload protection characteristics		77
	Sn-24	Frequency command characteristics selection at external analog input terminal	Sn-24= 0 ~ Com. VIN	Frequency command characteristics selection at external analog input terminal 0:voltage signal 0~10V (VIN) 1:addition of voltage signal 0~10V and current signal 4~20 mA (VIN+AIN) 2:subtraction of current signal 4~20mA and voltage signal 0~10V (VIN-AIN) 3:current signal 4~20mA (AIN)	0	78
Multi-function Input contact selection	Sn-25	Multi-function input terminal⑤ function selection	Sn-25= 02 Multi-Fun. Command1	00~25 Terminal⑤ as multi-function command1	02	78
	Sn-26	Multi-function input terminal⑥ function selection	Sn-26= 03 Multi-Fun. Command2	01~25 Terminal⑥ as multi-function command2	03	78
	Sn-27	Multi-function input terminal⑦ function selection	Sn-27= 06 Jog Command	02~25 Terminal⑦ as jog command1	06	78

Function	Parameter NO.	Name	LCD display	Description		Factory Setting	Page
	Sn-28	Multi-function input terminal⑧ function selection	Sn-28= 07 Acc. &Dec. Switch	03~27	Terminal⑧ as Acc. & Dec. Interrupt	07	78
Multi-function Analog input	Sn-29	Multi-function analog input (AUX) function selection	Sn-29= 00 Auxiliary Freq. Com.	00~25	Multi-function analog input terminal (AUX) as Auxiliary frequency command. (factory setting)	00	87
	Sn-30	Multi-function output terminal (Ra-Rb-Rc) function selection	Sn-30= 00 Fault	00~31	Terminal (Ra-Rb-Rc) as fault output (factory setting)	13	88
	Sn-31	Multi-function output terminal (DO1) function selection	Sn-31= 01 Running	00~31	Terminal (DO1-DOG) as digital output during running (factory setting).	00	88
	Sn-32	Multi-function output terminal (DO2) function selection	Sn-31= 00 Zero Speed	00~31	Terminal (DO2-DOG) as digital output at zero speed (factory setting)	01	88
Multi-function Analog output selection	Sn-33	Multi-function analog output (AO1) function selection	Sn-33= 01 Term. AO1 Freq. Com.	0:Freq. Com. (10V:MAX frequency command, Cn-02) 1:Output frequency (10V/MAX. output frequency) 2:Output current (10V/input rated current) 3:Output voltage (10V/input voltage Cn-01) 4:DC voltage (10V/400V or 10V/800V) 5:External analog input command VIN (0~10V/0~10V) 6:External analog input command AIN (0~10V/4~20mA) or (0~10V/0~20mA) 7:Multi-function analog Input (AUX) (10V/10V) 8:PID control input 9:PID control output1 10:PID control output2		00	91
	Sn-34	Multi-function analog output (AO2) function selection	Sn-34= 01 Term. AO2 O/P Freq.			01	91
	Sn-35	Pulse output multiplier selection	Sn-35= 1 Pulse Mul. 6	When multi-function output terminal (DO1,DO2) is set as pulse signal output 0:1X 1:6X 2:10X 3:12X 4:36X		1	91

Function	Parameter NO.	Name	LCD display	Description	Factory Setting	Page
RS_485 communication function	Sn-36	Inverter Address	Sn-36= 01 Inverter Address	Inverter address can be set as 1~31	01	92
	Sn-37	RS-485 communication baud rate setting	Sn-37= 1 Baud rate 2400	0:1200 bps 1:2400 bps 2:4800 bps 3:9600 bps	1	92
	Sn-38	RS-485 communication transmission parity setting	Sn-38= 0 Remain Bit	0:no parity 1:even parity 2:odd parity	0	92
	Sn-39	RS-485 communication Fault stop selection	Sn-39= 0 Fault Dec.stop	0:deceleration to stop 1:coast to stop 2:continue to run (stop running if the key STOP is pressed)	0	92
PG speed control	Sn-40	PG speed control function	Sn-40= 0 PG Invalid	0:without speed control 1:with speed control but no integration control during Acc/Dec. 2:with speed control and integration control during Acc/Dec.	0	93
	Sn-41	Operation selection at PG open circuit	Sn-41= 0 1st. Dec. Stop	0:deceleration to stop (Bn-02) 1:coast to stop 2:deceleration to stop (Bn-04) 3:continue to run	0	93
	Sn-42	Operation selection at PG large speed deviation	Sn-42= 0 1st. Dec Stop	0:deceleration to stop (Bn-02) 1:coast to stop 2:deceleration to stop (Bn-04) 3:continue to run	0	93
	Sn-43	Operation selection at PG overspeed detection deviation	Sn-43= 0 1st. Dec. Stop	0:deceleration to stop (Bn-02) 1:coast to stop 2:deceleration to stop (Bn-04) 3:continue to operate	0	93
Auto_Run mode	Sn-44	Operation mode selection during Auto_Run	Sn-44= 0 Auto_Run Invalid	0:Auto_Run mode not effective 1:Auto_Run mode for one single cycle. 2:Auto_Run mode be performed periodically 3:Auto_Run mode for one single cycle, then hold the speed of final step to run.	0	93

Function	Parameter NO.	Name	LCD display	Description	Factory Setting	Page
Auto_Run mode	Sn-45	Auto_Run mode operation selection1	Sn-45= 0 Auto_Run Stop	0:stop (Bn-02) 1:forward 2:reverse	0	93
	Sn-46	Auto_Run mode operation selection2	Sn-46= 0 Auto_Run Stop		0	
	Sn-47	Auto_Run mode operation selection3	Sn-47= 0 Auto_Run Stop		0	
	Sn-48	Auto_Run mode operation selection4	Sn-48= 0 Auto_Run Stop		0	
	Sn-49	Auto_Run mode operation selection5	Sn-49= 0 Auto_Run Stop		0	
	Sn-50	Auto_Run mode operation selection6	Sn-50= 0 Auto_Run Stop		0	
	Sn-51	Auto_Run mode operation selection7	Sn-51= 0 Auto_Run Stop		0	
	Sn-52	Auto_Run mode operation selection8	Sn-52= 0 Auto_Run Stop		0	
	Sn-53	Auto_Run mode operation selection9	Sn-53= 0 Auto_Run Stop		0	
	Sn-54	Auto_Run mode operation selection10	Sn-54= 0 Auto_Run Stop		0	
	Sn-55	Auto_Run mode operation selection11	Sn-55= 0 Auto_Run Stop		0	
	Sn-56	Auto_Run mode operation selection12	Sn-56= 0 Auto_Run Stop		0	
	Sn-57	Auto_Run mode operation selection13	Sn-57= 0 Auto_Run Stop		0	
	Sn-58	Auto_Run mode operation selection14	Sn-58= 0 Auto_Run Stop		0	
	Sn-59	Auto_Run mode operation selection15	Sn-59= 0 Auto_Run Stop		0	
	Sn-60	Auto_Run mode operation selection16	Sn-60= 0 Auto_Run Stop		0	
Applied load selection	Sn-61	Applied torque mode	Sn-61= 0 Const. Tq. Load	0:constant torque 1:derating torque		95
Language selection	Sn-62	Language selection	Sn-62= 1 Language: Chinese	0:English 1:Traditional Chinese		96

Function	Parameter NO.	Name	LCD display	Description	Factory Setting	Page
Parameter copy function	Sn-63	Parameter Copy	Sn-63=0 Not Load	0:not loaded (copied) 1:upload from digital operator to inverter 2:download from inverter to digital operator 3:inspect the EEPROM of digital operator 4:inspect the EEPROM of inverter		96
PID function selection	Sn-64	PID Function	SN-64=0 PID Invalid	0:PID invalid 1:PID valid	0	96

(1) Inverter capacity selection (Sn-01)

- The inverter capacity has already been set at factory according to the following tables. Whenever the control board is replaced, the setting Sn-01 must be set again according to the following tables.
- Whenever the setting Sn-01 has been changed, the inverter system parameter settings should be changed based upon the constant torque load (setting of Sn-61= 0) or variable torque load (Sn-61= 1).

Table 9 200V Class Inverter Capacity Selection

Sn-01 setting			20		21		22		23		24		25	
CT (Sn-61= 0) / VT (Sn-61= 1) / Item name			CT	VT	CT	VT	CT	VT	CT	VT	CT	VT	CT	VT
Inverter rated capacity (KVA)			2	2.7	2.7	4	4	7.5	7.5	10.1	10.1	11.8	11.8	11.8
Inverter rated current (A)			4.8	6.4	6.4	9.6	9.6	17.5	17.5	24	24	28	28	48
Max. applicable capacity (HP)			1	2	2	3	3	5	5	7.5	7.5	10	10	15
Factory Setting	Cn-09	Motor rated current (A)	3.4	6.1	6.1	8.7	8.7	13.5	13.5	20.1	20.1	25.1	25.1	36.7
	Cn-12	Motor line impedance (Ω)	5.732	2.407	2.407	1.583	1.583	0.684	0.684	0.444	0.444	0.288	0.288	0.288
	Cn-13	Core loss torque compensation (W)	64	108	108	142	142	208	208	252	252	285	285	370
	Cn-34	Carrier frequency (KHz)	15	15	15	15	15	15	15	15	15	15	15	15
	Cn-37	Min. baseblock time (sec)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.7	0.7	0.7
	Sn-02	V/F curve	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Table 10 440V Class Inverter Capacity Selection

Sn-01 setting			20		21		22		23		24		25	
Item name \ CT (Sn-61= 0) / VT (Sn-61= 1)			CT	VT	CT	VT	CT	VT	CT	VT	CT	VT	CT	VT
Inverter rated capacity (KVA)			2.2	3.4	3.4	4.1	4.1	7.5	7.5	10.3	10.3	12.3	12.3	20.6
Inverter rated current (A)			2.6	4	4	4.8	4.8	8.7	8.7	12	12	15	15	24
Max. applicable capacity (HP)			1	2	2	3	3	5	5	7.5	7.5	10	10	15
Factory Setting	Cn-09	Motor rated current (A)	1.7	2.9	2.9	4	4	6.8	6.8	10.2	10.2	12.6	12.6	18.6
	Cn-12	Motor line Impedance (Ω)	22.97	9.628	9.628	6.333	6.333	2.735	2.735	1.766	1.766	1.151	1.151	0.634
	Cn-13	Core loss torque compensation (W)	64	108	108	142	142	208	208	252	252	285	285	370
	Cn-34	Carrier frequency (KHz)	15	15	15	15	15	15	15	15	15	15	15	15
	Cn-37	Min. baseblock time (sec)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.7	0.7	0.7
	Sn-02	V/F curve	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

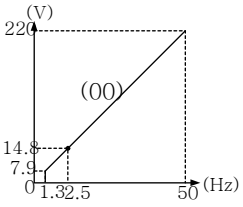
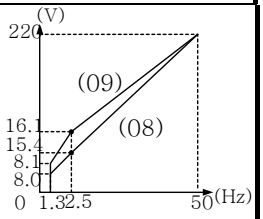
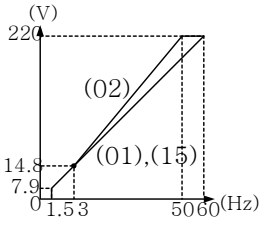
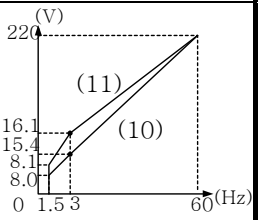
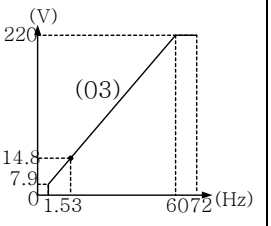
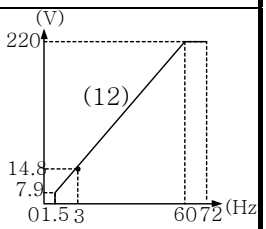
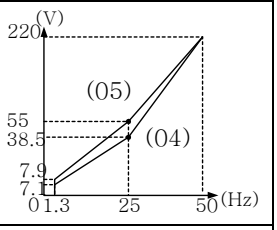
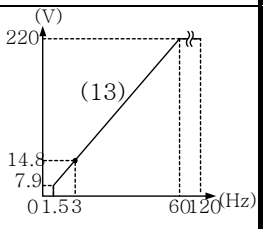
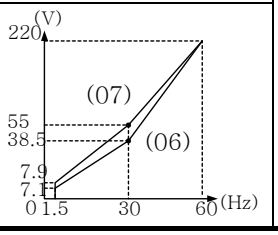
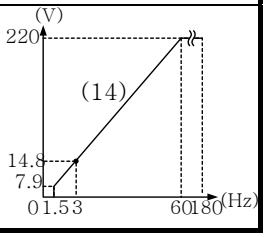
(2) V/F curve selection (Sn-02)

• Set the inverter input voltage (Cn-01) first to match the power supply voltage. The V/f curve can be set to ant of the following.

Sn-02= 00～14 ：one of 15 preset curve patterns

= 15 ：V/F pattern can be set by the user through setting of Cn-01～Cn-08

Table 11 V/F curve of 1~2 HP, 220V Class inverter

	Specifications		Sn-02	V/F Pattern †		Specifications		Sn-02	V/F Pattern †
General Propose	50Hz		00		High Starting Torque ‡‡	50Hz	Low starting torque	08	
							High starting torque	09	
	60Hz	60Hz Saturation	01 15			60Hz	Low starting torque	10 11	
							High starting torque		
	72Hz		03		Rated Output Operation (Machine Tool)	90Hz		12	
Variable Torque Characteristic	50Hz	Variable torque 1	04			120Hz		13	
		Variable torque 2	05						
	60Hz	Variable torque 3	06			180Hz		14	
		Variable torque 4	07						

* For 440V class, 2 times voltage value shown in table above.

† Consider the following items as the conditions for selecting a V/f pattern.
They must be suitable for

(1) The voltage and frequency characteristic of motor.

(2) The maximum rotation speed of motor.

‡ Select high starting torque only in the following conditions. Normally, the selection if not required.

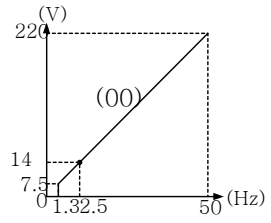
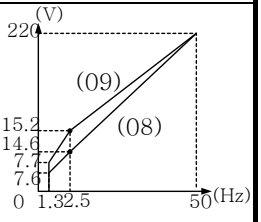
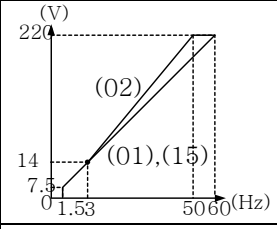
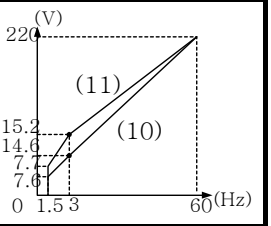
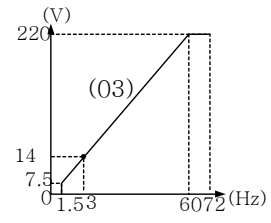
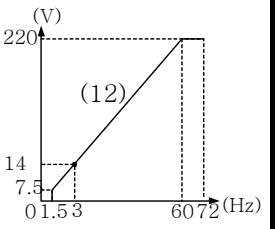
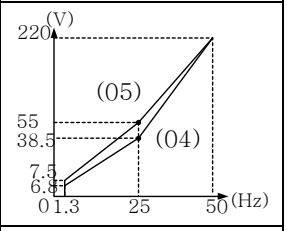
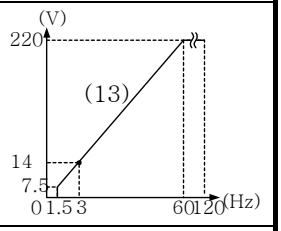
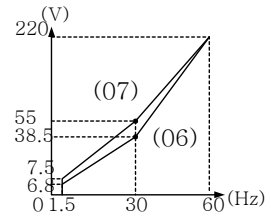
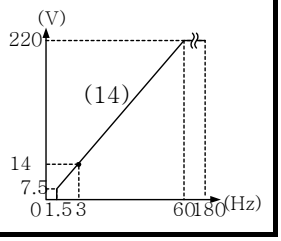
(1) The winding distance is long [492 ft (150m) and above].

(2) Voltage drop at startup is large.

(3) AC reactor is inserted in the input or output of the inverter.

(4) A motor smaller than the maximum applicable inverter is used.

Table 12 V/F curve of 3~10 HP, 220V Class inverter

	Specifications		Sn-02	V/F Pattern †		Specifications		Sn-02	V/F Pattern †
General Propose	50Hz		00		High Starting Torque ‡‡	50Hz	Low starting torque	08	
							High starting torque	09	
	60Hz	60Hz Saturation	01 15			60Hz	Low starting torque	10	
		50Hz Saturation	02				High starting torque	11	
	72Hz		03		Rated Output Operation (Machine Tool)	90Hz		12	
Variable Torque Characteristic	50Hz	Variable torque 1	04			120Hz		13	
		Variable torque 2	05						
	60Hz	Variable torque 3	06			180Hz		14	
		Variable torque 4	07						

* For 440V class, 2 times voltage value shown in table above.

† Consider the following items as the conditions for selecting a V/f pattern.
They must be suitable for

(1) The voltage and frequency characteristic of motor.

(2) The maximum rotation speed of motor.

‡Select high starting torque only in the following conditions. Normally, the selection is not required.

(1) The winding distance is long [492 ft (150m) and above].

(2) Voltage drop at startup is large.

(3) AC reactor is inserted in the input or output of the inverter.

(4) A motor smaller than the maximum applicable inverter is used.

(3) Operator display (Sn-03)

· Parameter code (Sn-03= 0 or 1)

Set the parameter Sn-03 as 0 or 1 to determine the access level as follows.

Sn-03	DRIVE mode		PRGM mode	
	Set & Reset	Read Only	Set & Reset	Read Only
0	An, Bn	Sn, Cn	An, Bn, Sn, Cn	—
1	An	Bn, Sn, Cn	An	Bn, Sn, Cn

- Initialized setting of parameter (Sn-03= 7～12)
- Except the parameter of Sn-01～02 and Sn-61, the parameter groups of An-□□ , Bn-□□ , Cn-□□ , Sn-□□ can be initialized as factory setting according to the different input voltage. At the same time, the terminal ⑤～⑧ can be set as 2-wire or 3-wire operation mode under different setting of Sn-03. Please see 2-/3-wire operation mode on page 80.

(4) Run source (Sn-04)

· The parameter is used to select the source of run source.

Sn-04= 0 : digital operator
1 : control circuit terminal
2 : RS-485 communication

· If Sn-04 is set as 1, the run source is from the control circuit terminal. Under the initial setting of 2-wire operation (through setting of Sn-03), the run source will be FWD/STOP.

· If Sn-04 is set as 1, the run source is from the control circuit terminal. Under the initial setting of 3-wire operation (through setting of Sn-03), the run source will be RUN, STOP, FWD and REV.

· For more details, see “2-/3- wire operation” on page 80.

· OPERATION The parameter is used to select the source of run source.

(5) Frequency command Setting Method Selection (Sn-05)

· The parameter is used to select the source of frequency command.

Sn-05= 0 : digital operator
1 : control circuit terminal
2 : RS-485 communication

(6) Stopping method selection (Sn-06)

· Setting the stopping method used when a stop command is input.

Setting	Function
0	Deceleration to stop
1	Coast to stop
2	DC braking stop: Stops faster than coast to stop, without regenerative operation.
3	Coast to stop with timer: Run sources are disregarded during deceleration time.

- The following diagrams show the operation of each stopping method.

  · 1. Deceleration to Stop (Sn-06= 0)

  Deceleration to a stop at a rate set with the selected deceleration time.

  · 2. Coast to Stop (Sn-06= 1)

  After the stop command is input, run source is disregarded until the Min. baseblock time Cn-37 has elapsed.

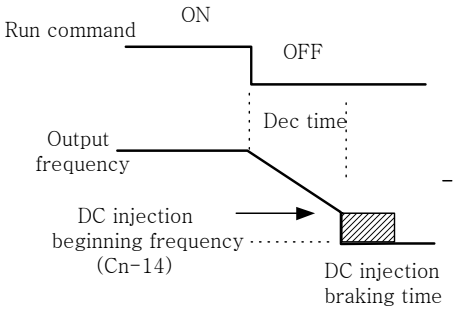


Fig 30 Deceleration to stop

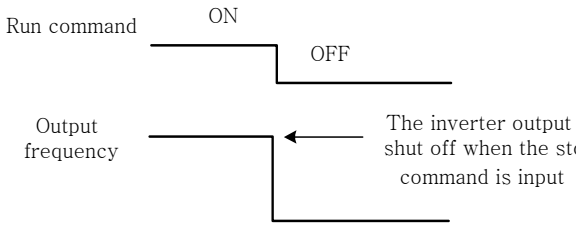


Fig 31 Coast to Stop

After the stop command is input, run sources are disregarded until the minimum baseblock time (Cn-37) has elapsed.

3. Whole Range DC Injection Braking Stop (Sn-06= 2)

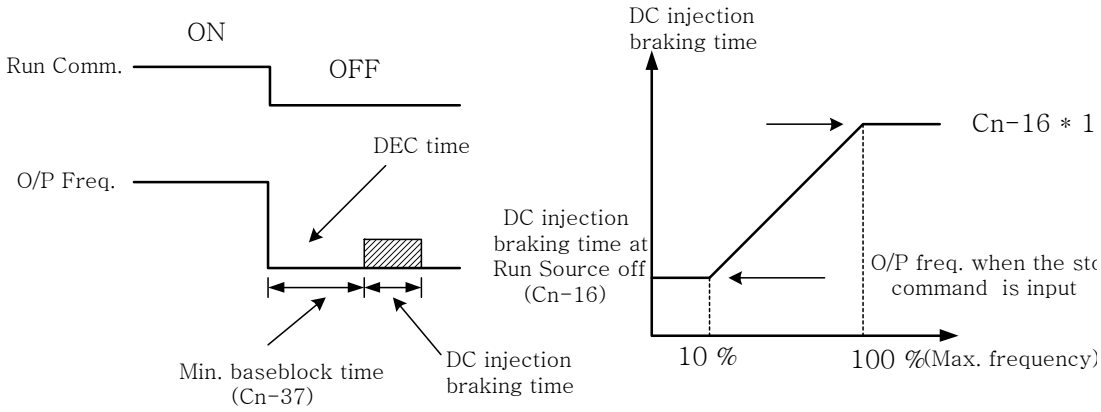


Figure 32 Whole range DC Injecting Braking Stop

- After the stop command is input and the minimum baseblock time (Cn-37) has elapsed, DC injection braking is applied and the motor stopped.
- The DC injection braking time depends upon the output frequency when the stop command is input and the "DC injection time at stop" setting (Cn-16) as shown in Fig 32.
- Lengthen the minimum baseblock time (Cn-37) when an overcurrent (OC) occurs during stopping. When the power to an induction motor is turned OFF, the counter-electomotive force generated by the residual magnetic field in the motor can cause an overcurrent to be detected when DC injection braking stop is applied.

4. Coast to Stop with Timer (Sn-06= 3)

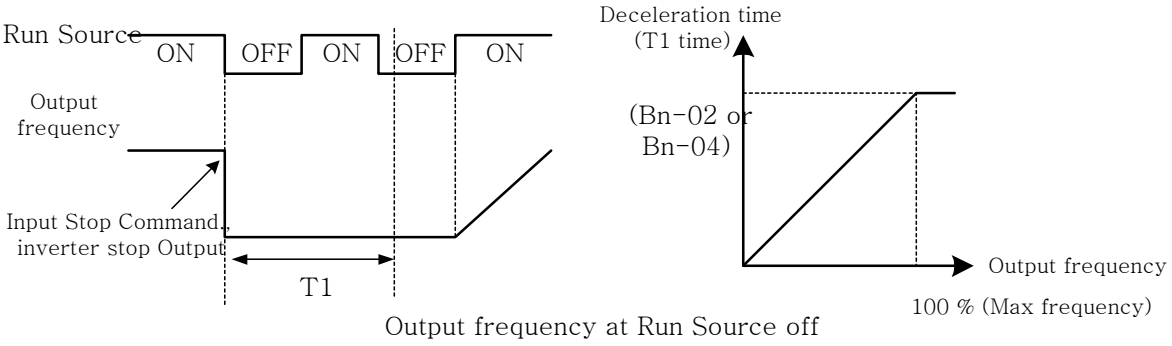


Figure 33 Coast to Stop with Timer

- After the stop command is input, run sources are disregarded until the time T1 has elapsed. The time T1 depends upon the output frequency when the stop command is input and the deceleration time (Bn-02 or Bn-04).

(7) Priority of Stopping (Sn-07)

· This parameter enable or disable the STOP key on the digital operator when the run source is from an control circuit terminal or RS-485 communicate port while the motor is running.

Sn-07= 0 : enabled. (The STOP key is enabled at all time during running)

= 1 : disabled (The STOP key is disabled when the run source is from control terminal or RS-485 port)

(8) Prohibition of REV run (Sn-08)

· While the parameter Sn-08 is set as 1. The reverse run of motor is not allowed

(9) Output Frequency UP/DOWN function (Sn-09)

· The output frequency can be increased or decreased (UP/DOWN) through digital operator

Sn-09 = 0 : Change output frequency through the ( / ) key. The frequency command will be acknowledged only after the key  has been pressed.

= 1 : Change output frequency through the ( / ) key. The frequency command can be recalled even restarting the inverter if the  key has been pressed at that time.

- The output frequency can be changed (increasing (UP) or decreasing (DOWN)) the output frequency through either the LCD digital operator or external multi-function input terminal (terminals ⑤～⑧). See page 78~79.

(10) Frequency command Characteristics Selection (Sn-10)

Sn-10 = 0 : Forward characteristics of frequency command (0~10V or 4~20mA)

= 1 : Reverse characteristics of frequency command (0~10V or 4~20mA)

(11) Scan times at input terminal (Sn-11)

· Setting of scan frequency of input terminal (Forward/Reverse, multi-function input)

Sn-11 = 0 : Scan input terminals every 5ms.

= 1 : Scan input terminals every 10ms.

(12) Overtorque detection selection (Sn-12)

· When overtorque detection is enabled, be sure to set the overtorque detection level (Cn-32) and the overtorque detection time (Cn-33). An overtorque condition us detected when the current exceeds the overtorque detection level for longer than the overtorque detection time.

• Sn-12 Setting

Sn-12	Function	Display
0	Overtorque detection disabled	
1	Detect only during speed agree. Continue operation even after detection. (Miner fault)	"Over Torque" blinks
2	Detect only during speed agree. Stop output after detection (Fault)	"Over Torque" lites
3	Detect overtorque at any time. Continue operation even after detection. (Miner fault)	"Over Torque" blinks
4	Detect overtorque at any time. Stop output after detection (Fault	"Over Torque" lites

(13) Output voltage limitation selection (Sn-13)

· In low speed region, if the output voltage from V/f pattern is too high, the inverter will be driven into fault status. As a result, the user can use the option to set the upper bound limit of output voltage.

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Fig 34 Output voltage limit

(14) Stall prevention selection during acceleration (Sn-14)

Sn-14 = 0 : Disabled (Accelerate according to the setting. Stall may occurs with large load)

= 1 : Enabled (Stop acceleration if Cn-25 setting is exceeds accelerate again when current recovers)

• Please refer to “Stall prevention level during acceleration” on page 49.

(15) Stall prevention selection during deceleration (Sn-15)

· If a high rating braking resistor unit is installed, the Sn-15 setting must be disabled (Sn-15= 0).

• If no external high rating braking resistor unit is installed, the inverter has a standard braking resistor (100% rated current, 2% ED, 5sec). If the load inertia is so large that it exceeds the regenerative braking torque, the parameter Sn-15 is set as “1”. When setting Sn-15= 1 (enabled) is selected, the deceleration time (Bn-02 or Bn-04) is extended so that a main circuit overvoltage does not occur.

•

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Fig 35 Stall prevention function during deceleration (Sn-15= 1)

(16) Stall prevention selection during running (Sn-16)

Sn-16 = 0 : Disabled (Run accruing to the setting. Stall may occur with large load)

= 1 : Enabled (Deceleration is started if the current of the stall prevention level during operation continues for more than 100ms. The motor is accelerated back to the reference frequency again when the current falls below this level Cn-26).

· Please refer to “Stall prevention level during running” on page 49.

(17) Operation selection at fault contact during fault retrying (Sn-17)

Sn-17 = 0 : Do not output fault retry. (The fault contact does not operate)

= 1 : Output fault restart. (The fault contact operates)

• Please refer to "Fault retry function" on page 49.

(18) Operation selection at power loss (Sn-18)

• This parameter specifies the processing that is performed when a momentary power loss occurs (within 2 secs)

Sn-18 = 0 : When power loss ride in enabled, operation will be restarted after a speed search if the power is restored within the allowed time.

= 1 : When power loss ride-through is disabled the inverter will stop after a momentary power loss. An undervoltage fault will be detected. If power is interrupted for more than 2 seconds, then the fault contact output will operate, the motor will coast to stop.

(19) Zero speed braking selection (Sn-19)

• The run-source and frequency command is input from control circuit under the setting of Sn-04=1 & Sn-05=1, If Sn-19 is enabled, blocking torque will be generated in DC-braking mode when the frequency command is 0V and forward -run source is "ON".

• A time-chart shown the above action is shown below. The zero-braking selection Sn-19= 1 and the DC-braking current Cn-15 is limited within 20% of rated current.

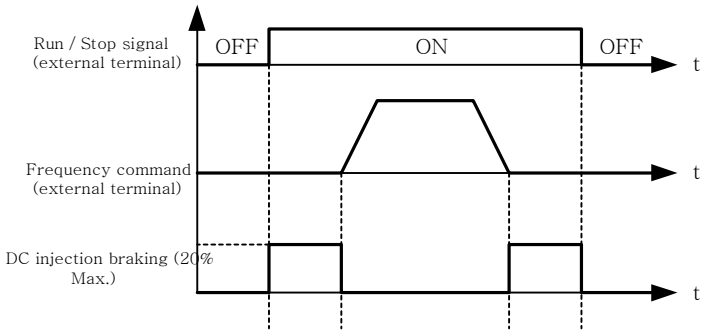

Fig 36 Zero speed braking operation selection

(20) External fault contact ③ contact selection (Sn-20)

Sn-20 = 0 : Input signal is from A-contact. (Normal-open contact)

= 1 : Input signal is from B-contact. (Normal-open contact)

(21) External fault contact ③ detection selection (Sn-21)

Sn-21 = 0 : Always detect.

= 1 : Detect only during running.

(22) Detection mode selection of external fault (Sn-22)

・An external fault is detected (at terminal ③), the following operation will be performed based upon the setting of Sn-22

Sn-22 = 0 : Decelerate to stop with the specified deceleration time Bn-02.

= 1 : Coast to stop.

= 2 : Decelerate to stop with the specified deceleration time Bn-04.

= 3 : Continue running with no regard of external fault.

(23) Motor overload protection selection (Sn-23)

- Sn-23 = 0 :Electronic overload protection disable.
- Sn-23 = 1~4 : Electronic overload protection enabled. The electronic thermal overload is detected according to the characteristic curves of protection operating time .vs. motor rated current setting (Cn-09).

Sn-23 = 1 :The overload is detected according to the standard motor cold start curve.

= 2 : The overload is detected according to the standard motor hot start curve.

= 3 : The overload is detected according to the specific motor cold start curve.

= 4 : The overload is detected according to the specific motor hot start curve.

- Disable the motor protection function (setting 0) when 2 or more motor s are connected to a single inverter. Use another method to provide overload protection separately to each other, such as connecting a thermal overload relay to the power line of each motor.
- The motor protection function should set as Sn-23= 2 or 4 (hot start protection characteristic curve) when the power supply is turned on or off separately.
- To protect the motor from overload by use of electronic overload protection, be sure to set the parameter Cn-09 according to the rated current value shown on the motor nameplate.

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Fig 37　Motor overload protection curve (Cn-09 setting= 100%)

(24) Frequency characteristics command selection at external analog input terminal (Sn-24)

Sn-22　= 0 :　Frequency command is input at Vin terminal (0~10V)

= 1 :　Frequency command is the addition (Vin + Ain) at Vin (0~10V) and Ain (4~20mA) terminal.

= 2 :　Frequency command is the combination (Vin - Ain) at Vin (0~10V) and Ain (4~20mA) terminal.

= 3 :　Frequency command is input at Ain terminal (4~20mA)

(25) Multi-function input terminal ⑤ function selection　(Sn-25)

(26) Multi-function input terminal ⑥ function selection　(Sn-26)

(27) Multi-function input terminal ⑦ function selection　(Sn-27)

(28) Multi-function input terminal ⑧ function selection　(Sn-28)

・The settings and functions for the multi-function input are listed in Table 11.

Table 13 Multi-Function Input Setting

Setting	Function	Description
00	Forward/Reverse command	3-wire operation mode
01	2-wire key-pressing input stop command	2-wire key-pressing operation mode (self-protection function)
02	Multi-speed command1	Multi-speed frequency command switch
03	Multi-speed command2	
04	Multi-speed command3	
05	Multi-speed command4	
06	Jogging	ON: select jogging frequency
07	Acc/Dec time switch command	OFF: the first stage Acc/Dec time (Bn-01, Bn-02), ON: the second stage Acc/Dec time (Bn-03, Bn-04),
08	External base-block command (input at A-contact)	ON: inverter output baseblock
09	External base-block command (input at B-contact)	OFF: inverter output baseblock
10	Inhibit Acc/Dec command	Inhibit Acc/Dec (hold frequency)
11	Inverter overheat warning	ON: blink show overheat (inverter can proceed running)
12	FJOG	ON: forward jog
13	RJOG	ON: reverse jog
14	PID integration reset	ON: Reset PID integration
15	PID control invalid	ON: PID control not effective
16	External fault (A-contact)	ON: External fault input (normally open) OFF: External fault input (normally close)
17	External fault (B-contact)	
18	Multi-function analog input setting	ON: multi-function analog input (AUX) effective
19	Timer function input	ON: signal with delay input
20	DC braking command	
21	Speed search 1 command	ON: speed search is performed from MAX. output frequency
22	Speed search 2 command	ON: speed search is performed from reference frequency
23	Local/Remote control	ON: local mode control (through LCD operator) OFF: control mode according to Sn-04 setting
24	Speed control without PG	ON: speed control without PG OFF: speed control with PG
25	Reset integration of speed control with PG	ON: Reset integration of speed control with PG
26	Frequency Up/Down function	Terminal⑦ take up command, terminal⑧ take down command only when Sn-28=26
27	Force operation signal	only when Sn-28=27

Note: An error message of “Multi-Fun. Parameter” / “Setting Error” will be displayed in the digital operator if:

・Setting combination of (Sn-25~Sn28) is not organized in monotonically increasing order.

・Setting 21, 22 (both for speed search) are set at the same time.

・Forward/Reverse change (setting：00)

・Under 3-wire initialization mode (Sn-03= 8 or 10 or 12)，the multi-function input terminals ⑤～⑧ have function setting “00”, the inverter will be in the 3-wire mode operation. As shown in Fig 38, the Forward/Reverse change mode is set at the terminal ⑤.

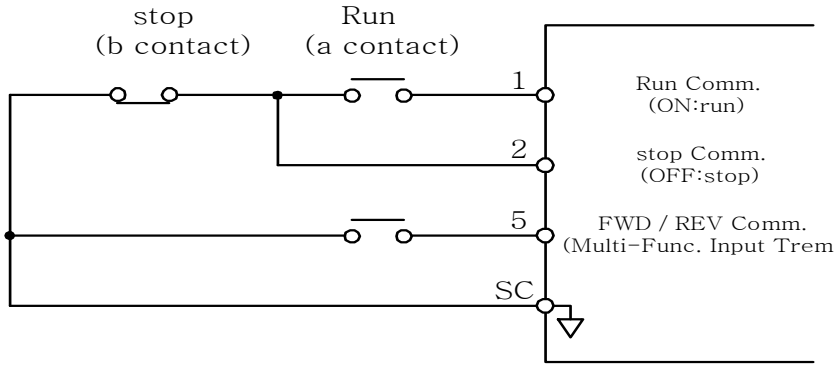

Fig 38 3-wire mode connection diagram

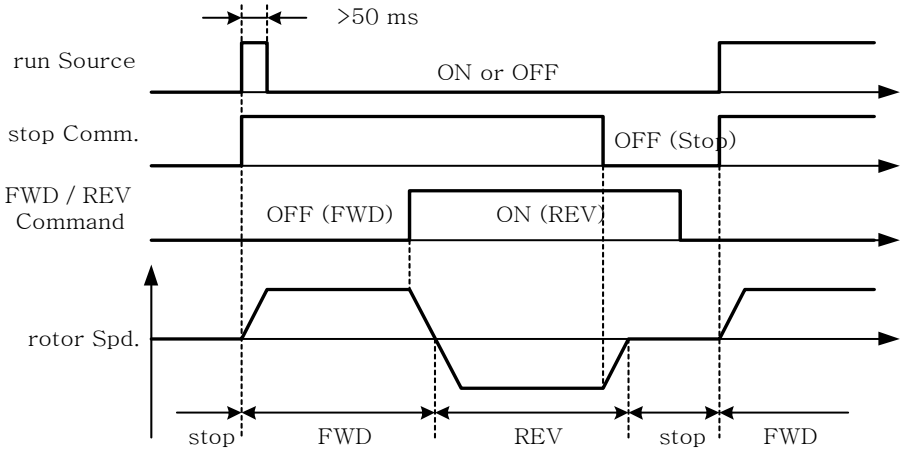

Fig 39 Operation sequence in 3-wire mode

・ 2-wire (key-press) input STOP command (setting：01)

・Under 2-wire initialization mode (Sn-03= 7 or 9 or 11), the operation is initialized in 2-wire mode that has its self-sustaining function. Only through the multi-function input terminal, the operator can stop the inverter after setting the stop key (self- sustaining function), as shown below.

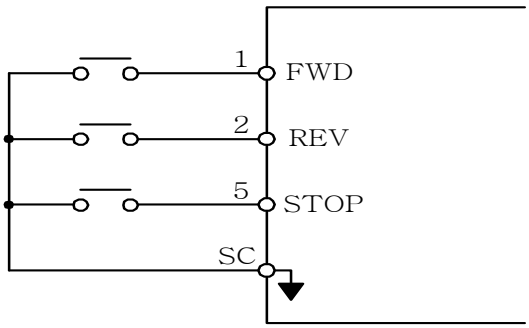

Fig 40　2-wire mode connection diagram

Note：1. For the other setting value (except “00”, “01”), the external operation mode is defaulted as 2-wire mode and no self-protecting function. (that is, the inverter will stop when contact (1) and (2) are not close.)。

2. Under the 2-wire mode, the error message “Freq. Comm. Error” will be displayed in the digital operator, the inverter will stop. After the above case cleared, the inverter will return normal.

- Multi-Step Speed Command1　(Setting：02)
- Multi-Step Speed Command2　(Setting：03)
- Multi-Step Speed Command3　(Setting：04)
- Multi-Step Speed Command4　(Setting：05)
- Jog Frequency Selection　(Setting：06)

・There are 16 (maximum) step speed command selection by use of the Multi-Step Speed Command and jog frequency command.

Multi-Step Speed command 1～4 及 Jog Frequency Selection Setting Table。

Terminal ⑧ (Sn-28= 05)	Terminal ⑦ (Sn-28= 04)	Terminal⑥ (Sn-28= 03)	Terminal ⑤ (Sn-28= 02)	Selected frequency
Multi-step speed command 4	Multi-step speed command 3	Multi-step speed command 2	Multi-step speed command 1	
0	0	0	0	Frequency Command 1 (An-01)*1
0	0	0	1	Frequency Command 2 (An-02)*1
0	0	1	0	Frequency Command 3 (An-03)*1
0	0	1	1	Frequency Command 4 (An-04)*1
0	1	0	0	Frequency Command 5 (An-05)*1
0	1	0	1	Frequency Command 6 (An-06)*1
0	1	1	0	Frequency Command 7 (An-07)*1
0	1	1	1	Frequency Command 8 (An-08)*1
1	1	1	1	Frequency Command 16 (An-16)*1

Note: “0”：terminal is “OFF”, “1”：terminal is “ON”

・An example shows the operation sequence of a multi-step and jog command is as below.

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Fig 41 Time chart for multi-step speed and jog command

*1 When the parameter Sn-04= 0, the reference command is input by the setting of An-01. Instead, when the parameter Sn-04= 1, the reference command is input from analog command through the terminal VIN and AIN.

・Acceleration time and deceleration time change (Setting：07)
The acceleration time and deceleration time can be changed through the control circuit terminal ⑤~ ⑧ as described on page 35.
・External baseblock (normally open) (Setting：08)
・External baseblock (normally close) (Setting：09)
・With either of these settings, the multi-function input controls baseblock operation.・During running: An external baseblock signal is detected, the digital operator will a “B.B. Alarm”, the inverter output is blocked. After the baseblock signal is cleared, the motor will resume running according to its then reference signal.
・During acceleration: An external baseblock signal is input, the digital operator will display “ B.B. Alarm”, the inverter is blocked from output and the output frequency will drop to zero. ・ Acceleration and deceleration ramp hold (Setting:10)
・With this setting, the multi-function input pauses Acceleration/deceleration and maintain the then output frequency. The motor will be stopped if a stop command is input while the acceleration / deceleration ramp hold input is ON, the then output frequency will be memorized.

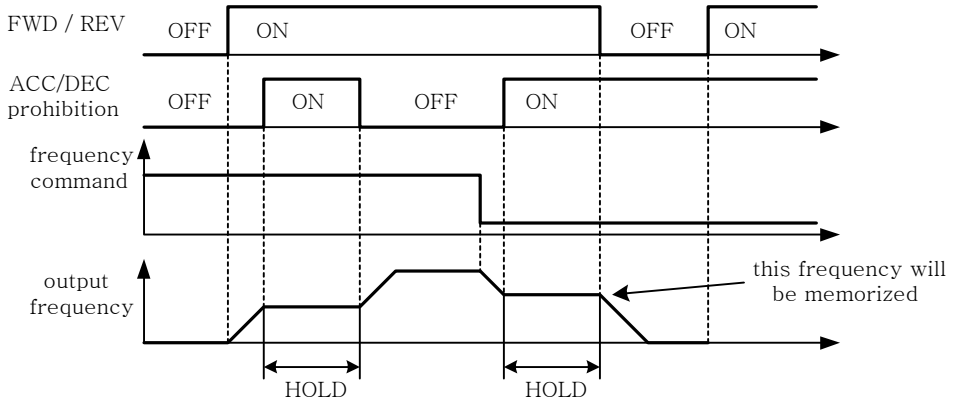


Fig 42 Acceleration and deceleration ramp hold

・Inverter overheat alarm (Setting：11)

・ When the inverter detects a overheat signal “ON”, the digital operator will change its display as “Overheat Alarm”, the inverter still maintains its operation. When the overheat signal is “OFF”, the digital operator will restore its previous display automatically. No RESET-key pressing is required.

・FJOG command (Setting：12)

・RJOG command (Setting：13)

・The jogging can be performed in forward or reverse.

Setting= 12：FJOG command “ON”: Run forward at the jog frequency (An-17).

= 13：RJOG command “ON”: Run reverse at the jog frequency (An-17).

・The forward jog and reverse jog commands have priority over other frequency command commands.

・The inverter will stop operation with the stopping method set in Sn-07 if the forward jog and reverse jog commands are both ON for more than 500 ms.

・PID integral reset (Setting：14)

・In the application of PID control，the integral can be reset to zero (ground) through the multi-function input terminal (5)~ (8) (Sn-25～28= 14).

・PID control invalid (Setting：15)

OFF	PID control valid (close-loop)
ON	PID control invalid (open-loop)

・This setting can be used in the test run. To disable the PID function (PID control invalid is “ON”)，an open-loop operation or jog operation can be performed in the test. The system can be set up properly after some test runs. Then, the system can be changed into PID control mode. Moreover, if the feedback signal is not usable, the PID function is disabled through this setting.

・External fault contact A (Setting：16)

・External fault contact B (Setting：17)

・The external fault input terminal will be displayed when an external fault occurs. If the external input terminal⑥ is set for the external fault input terminal use, a message of “Fault Ext. Fault (6)” will be displayed.

・There are 5 terminal to be assigned as external fault inputs, they are terminal (5), (6), (7) and (8).

・When an external fault occurs, the inverter will be blocked from output and the motor will stop.

・Multi-function analog input setting (Setting:18)

・To disable or enable the multi-function analog input is controlled by an external terminal.

・Timer function input terminal (Setting：19)

・Refer to the setting of timer function output terminal on page 90.

・DC injection braking command (Setting= 20)

・DC injection braking is used to prevent the motor from rotating due to inertia or external forces when the inverter is stopped.

・DC injection braking is performed if the DC injection braking input is on while the inverter is stopped.

・If a run source or jog command is input, the DC injection braking will be cleared and the motor operation will be started.

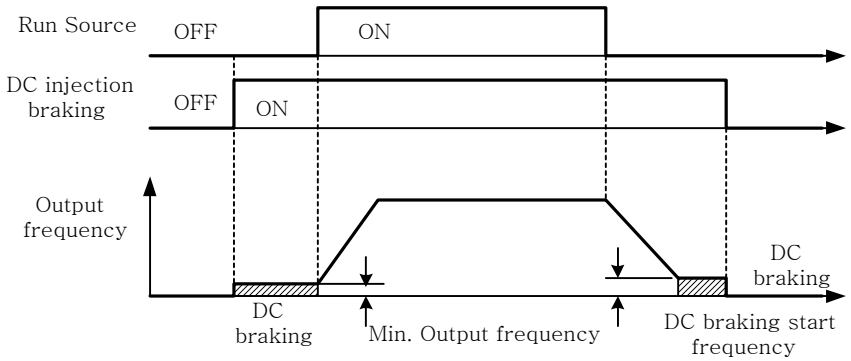


Fig 43 Time chart for DC injection braking command

・Speed search 1 (Setting：21)

• Speed search 2 (Setting：22)

· Refer speed search on page 54.

• LOCAL/REMOTE control (setting：23)

OFF	REMOTE control: performed through control circuit input or RS-485 communication port. The REMOTE-REF，SEQ LED light is off.
ON	LOCAL control: performed through digital operator. The REMOTE-REF，SEQ LED light is off.

· To change the operation mode from LOCAL to REMOTE mode is effective only when the inverter stops.

• PG-less speed control (Setting : 24)

• Reset new integral value in PG speed control (Setting : 25)

· When PG feedback is used, integral control can be disabled or enabled with to use the external terminals to add the PG feedback compensation or to clear the integral value.

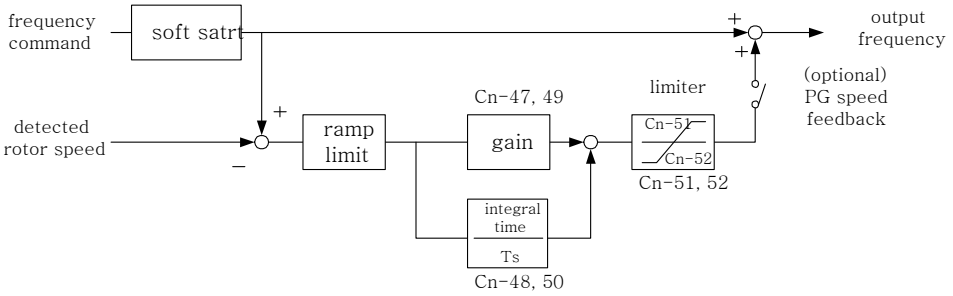


Fig 44 PG speed control block diagram

• Frequency UP/DOWN function (Setting：26)

· The inverter can use either the digital operator or external multi-function input terminals (terminal ⑦ or ⑧) to set output frequency upward or downward.

· By setting the parameters of (Sn-04= 1，Sn-05= 1), the run source and frequency command is set through the control circuit terminal. Next, set the parameter Sn-28= 26 (terminal⑦ will now have the function "UP", its original function is disabled). Then, terminal⑦ and ⑧ can be used for "UP" and "DOWN" function to control the output frequency.

· Operation sequence as below:

Control circuit terminal⑦: UP function	ON	OFF	OFF	ON
Control circuit terminal⑦: DOWN function	OFF	ON	OFF	ON
Operation status	ACC (UP)	DEC (DOWN)	Constant (HOLD)	Constant (HOLD)

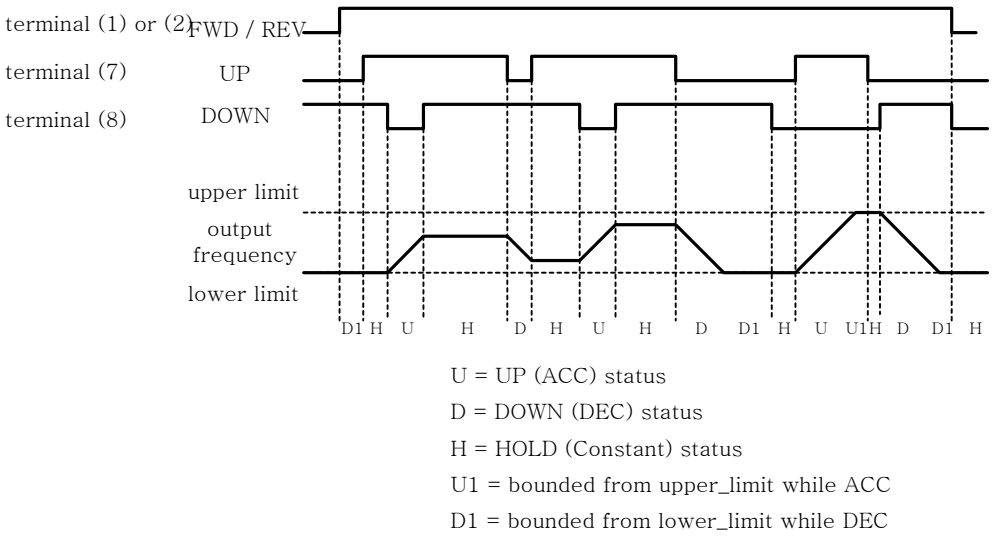


Fig 45 Time chart of output frequency through the external multi-function input terminal⑦ and ⑧.

- Only set through parameter Sn-28

- When the UP/DOWN function is being used, the output frequency will be accelerated to the lower_limit (Cn-19) if a run source is input.
- The output frequency held by the UP/DOWN function will be stored in memory. The output frequency will be retained even after a power loss, and operation will be re-started at this frequency the next time that a run source is input.
- When the UP/DOWN function and jog frequency command are both assigned to multi-function inputs, an ON jog frequency command input has the highest priority.

• Forced run (Setting : 27)

- Only set through parameter Sn-28. It is for special use (smoke fan, etc.) (29)

(29) Multi-function analog input function selection (Sn-29)

・The settings and functions for the multi-function analog input (terminal AUX) are listed in Table 14.

Table 14 Multi-function analog input function list

Setting	Function	Description (100% output is 10 V)
00	Auxiliary frequency command	(Max. output frequency)
01	Frequency command gain (FGAIN)	Total gain= Bn-09 ×FGAIN (Voltage_frequency command, terminal VIN frequency command)
02	Frequency command bias 1 (FBIAS1)	Total bias= Bn-10 + FBIAS1
03	Frequency command bias 2 (FBIAS2)	Total bias= Bn-10 + FBIAS2
04	Overtorque detection level	According to analog input voltage (0～10V), change overtorque detection level (setting of Cn-32 is disabled)
05	Output frequency bias (VBIAS)	Total output voltage= V/F pattern voltage + VBIAS
06	Scaling of ACC/DEC time (TK)	Real ACC/DEC time= ACC/DEC time (Bn-0~24) / TK
07	DC injection braking	According to analog input voltage (0～10V)，change the level of DC injection current (0-100%). [inverter rated current=100%, the setting of DC injection current Cn-15 is disabled]
08	Stall prevention level during running	According to analog input voltage (1.5V～10V) , change the level of stall prevention during running (30%～200%) [inverter rated current=100%, the setting Cn-26 is disabled].
09	PID control reference input	Multi-function analog input (terminal AUX) used as PID control reference input (0~10V).
10	Frequency command lower-limit	According to analog input voltage (0-10V), change the frequency command lower-limit (0-100%). [Max. output frequency (Cn-02)= 100%. The real frequency command lower-limit is the Maximum of (Cn-19, analog input)].
11	Jump frequency setting4	According to analog input voltage (0~10V) set the jump frequency4. [can be used to set jump frequency4, while (Cn-20～Cn-23) can be used to set jump frequency0~3.]

(30) Multi-function output terminal (RA-RB-RC) function selection (Sn-30)

(31) Multi-function output terminal (DO1-DOG) function selection (Sn-31)

(32) Multi-function output terminal (DO2-DOG) function selection (Sn-32)

Multi-function output terminal setting and its function as shown in Table 13.

Table 15 Multi-function output terminal function

Setting	Function	Description	Page
00	During running	ON：During running	87
01	Zero speed	ON：Zero speed	
02	Speed agree	Speed agree width: Cn-31	
03	Agreed frequency	ON：output frequency= ±Cn-29， Speed agree width: Cn-31	
04	Output frequency detection1	ON：while Accelerating, Cn-29 ≧ output frequency ≧ -Cn-29; while decelerating, Cn-30 ≧ output frequency ≧ -Cn-30; Speed agree width: Cn-31	
05	Output frequency detection2	ON：while Accelerating, Cn-29 ≧ output frequency ≧ -Cn-29; while decelerating, Cn-30 ≧ output frequency ≧ -Cn-30; Speed agree width: Cn-31	
06	Inverter ready	ON：READY	
07	Undervoltage detected	ON：Undervoltage detected	
08	Output baseblocked	ON：Output baseblocked	
09	Run source mode	ON：Run source from digital operator (Local mode)	
10	Frequency command mode	ON：Frequency command from digital operator (Local mode)	
11	Overtorque detected	ON：Overtorque detected	
12	Frequency command missing	ON：Frequency command missing	
13	Fault	ON：Fault	88
14	Pulse signal output	Only set by Sn-31, Sn-32 (terminal DO1-DOG)	
15	Undervoltage alarm	ON：Undervoltage alarm	
16	Inverter overheat	ON：Overheat	
17	Motor overload	ON：Motor Overload	
18	Inverter Overload	ON：Inverter Overload	
19	Fault retry	ON：retry	
20	RS-485 communication fault	ON：RS-485 communication fault	
21	Timer function output	Signal delay output (.vs. timer function input)	

• During running (Setting:00)

OFF	Run source OFF，inverter is off.
ON	Run source ON，或Run source OFF but residues output exists

• Zero speed (Setting：01)

OFF	Output frequency ≧ MIN. output frequency (Cn-07)
ON	Output frequency ＜ MIN. output frequency (Cn-07)

• Speed agree： (Setting：02)

• Agreed speed: (Setting：03)

• Output frequency detected1: (Setting：04)

• Output frequency detected: (Setting：05)

• Refer frequency detection function on page 51.

• Inverter ready (Setting：06)

• Undervoltage detected (Setting：07)

• Output blocked (Setting：08)

• Run source mode (Setting：09)

OFF	Remote mode (Sn-04= 1,2，or multi- function input terminal⑤-⑧ is set as Local/ remote control mode and is OFF)	Remote-SEQ light is on in digital operator
	Local mode (Sn-04= 0 multi- function input terminal⑤-⑧ is set as Local/ remote control mode and is ON)	Remote-SEQ light is off, run source is from digital operator

• Frequency command mode (Setting：10)

OFF	Remote mode (Sn-05= 1,2，or multi- function input terminal⑤-⑧ is set as Local/Remote control mode and is off)	Remote-SEQ light is on in digital operator
ON	Local mode (Sn-05= 0 multi- function input terminal⑤-⑧ is set as Local/ remote control mode and is ON)	Remote-SEQ light is off, run source is from digital operator

• Overtorque detected (Setting：11)

• See page 52/74 for overtorque detection function.

• Frequency command missing (Setting：12)

• Run source (RUN) is ON and frequency command is 0, the output at the multi-function output terminal is ON.

・Fault　(Setting：13)

・If a fault occurs, the multi-function output terminal is ON. However, no response will be if a communication fault occurs.

・Pulse signal output (Setting:14)

・Only multi-function output terminal DO1-DOG (Setting Sn-33) can be set as the pulse signal output.

・DO1，DO2 is a photo-coupler output, its pulse output frequency is set by parameter Sn-35. The wiring is:

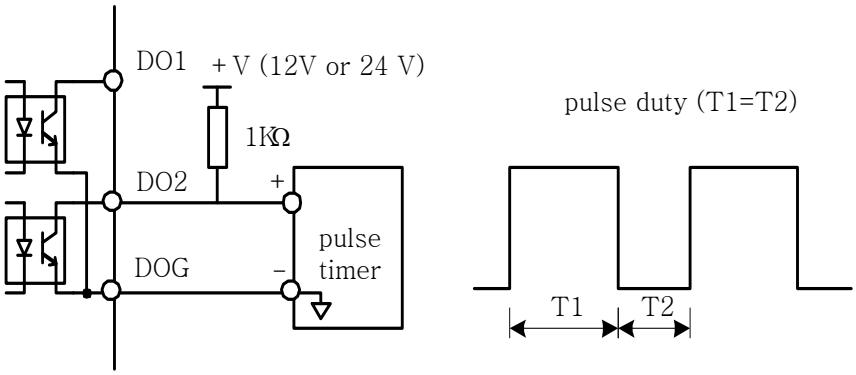


Fig 46 Pulse signal output

・Undervoltage alarm　(Setting：15)

・If the main circuit DC bus voltage is below the setting of Cn-39 (undervoltage alarm detected level), the multi-function output terminal is ON.

・Inverter overheat OH　(Setting：16)

・Motor overload OL1　(Setting：17)

・See “Motor overload protection selection” on page 78. If the motor has overload, the multi-function output terminal is ON.

・Inverter overload OL2　(Setting：18)

・If the inverter has overload, the multi-function output terminal is ON. See page 104.

・Fault retry　(Setting：19)

・See “Fault retry function” (Cn-24) on page 49. Upon re-start, the multi-function output terminal is ON.

・RS-485 communication fault　(Setting：20)

・Timer function output　(Setting：21)

・If the multi-function input terminal⑤～⑧ be set as the timer input terminals (Sn-25－28= 19)，the input signal will be output through the corresponding multi-function output terminals as specified by the ON-delay and OFF-delay, as shown below. See “Timer function” on page 39.

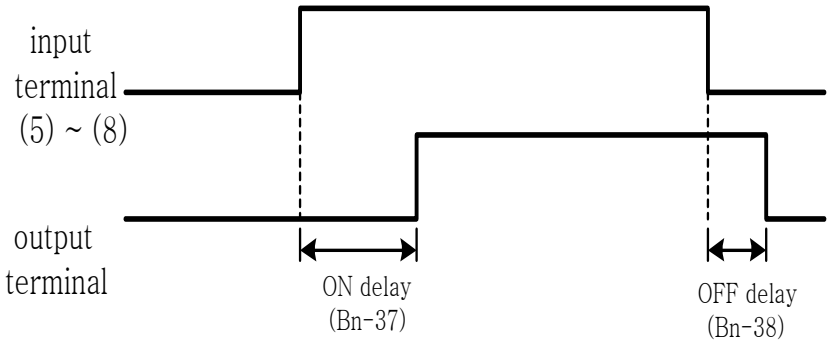


Fig 47

(33) Multi-function analog output (terminal A01) selection (Sn-33)

(34) Multi-function analog output (terminal A02) selection (Sn-34)

・The multi-function analog output can be set to monitor the following (11) status items as shown below：

Sn-33 (Sn-34) Setting	Monitored contents
00	Frequency command
01	Output frequency
02	Output current
03	Output voltage
04	DC voltage
05	VIN analog command
06	AIN analog command
07	AUX analog command
08	PID input
09	PID output1
10	PID output2

- For the output gain (Bn-14 and Bn-15), set what multiple of 10V will correspond to 100% output monitored item.

(35) Pulse output multiplication-gain selection (Sn-35)

・If the multi-function output terminal (DO1) be set as pulse output (when Sn-31 or Sn-32= 14),the final output pulse frequency is the multiple (according to Sn-35) of the inverter output frequency.

・EX1：when Sn-35= 0 (1F)，the inverter output frequency is 60Hz, the output pulse frequency is 60 Hz (duty= 50%).

・Refer to Fig 46 for pulse signal output.

・Different settings of Sn-35 and their corresponding multiple numbers as shown below：

Sn-35	Pulse output frequency	Applicable frequency range
0	1F： 1 ×inverter output frequency	3.83～400.0Hz
1	6F： 6 ×inverter output frequency	2.56～360.0Hz
2	10F：10 ×inverter output frequency	1.54～210.0Hz
3	12F：12 ×inverter output frequency	1.28～180.0Hz
4	36F：36 ×inverter output frequency	0.5 ～ 60.0Hz

(36) Inverter station address (Sn-36)

(37) RS-485communication baud rate setting (Sn-37)

(38) RS-485communication parity setting (Sn-38)

(39) RS-485 stopping method after communication error (Sn-39)

・The DSA Series inverter has a built-in RS-485 port for monitoring inverter status and reading the parameter setting. Under the remote mode operation, the inverter status and the parameter settings can be monitored. Moreover, The user can change the parameter setting to control the motor operation.

・MODBUS protocol is used.

・Parameter definition is as follows：

・Sn-36 ：inverter station address, setting range 1～31。

・Sn-37 = 0：1200bps (bps:bit／sec)
= 1：2400bps
= 2：4800bps
= 3：9600bps

・Sn-38 = 0：no parity
= 1：even parity
= 2：odd parity

・Sn-39 = 0： Deceleration to stop with Bn-02 (deceleration time), when RS-485 has communication error.
1： Deceleration to stop with Bn-04 (deceleration time), when RS-485 has communication error.
2： coast to stop
3： continue to run (will stop if the key stop is pressed)

・Every data has a data length of 11 bits：1 start_bit，8 Data_bits，1 parity_bit and 1 stop_bit. If Sn-38= 0, the parity_bit is “1” 。

・3 different commands are used for communication between the inverter and external units:
(1) Read command: external units to read the memory address of the inverter.

(2) Write command：external units to write the memory address of the inverter in order to control the inverter.

(3) Circuit test command: To test the communication status between the inverter and external units.

- The change of setting Sn-36，Sn-37，Sn-38 will be effective in the next start time after turning off the inverter.
- Forbid the DRIVE/PRGM change while writing through RS-485.
- For more details of RS-485 communication, refer to "DSA Series RS-485communication manual"。

(40) PG speed control settings (Sn-40)

Sn-40= 0：Disable speed control function.
1：Enable speed control. No integral action during ACC/DEC.
2：Enable speed control. Integral action is enabled.

(41) Operation selection at PG open (Sn-41)

Sn-41= 0：deceleration to stop (Bn-02)
1：coast to stop — Display "PG Open" alarm.
2：deceleration to stop (Bn-04)
3：continue to run — Blinking display "PG Open" alarm.

(42) Operation selection at PG speed deviation over (Sn-42)

Sn-42= 0：deceleration to stop (Bn-02)
1：coast to stop — Display "Sp. Deviat Over " fault message.
2：deceleration to stop (Bn-04)
3：continue to run — Blinking display "Sp. Deviat Over" alarm.

(43) Overspeed detection (Sn-43)

Sn-42= 0：deceleration to stop (Bn-02)
1：coast to stop — Display "Over Speed " fault message.
2：deceleration to stop (Bn-04)
3：continue to run — Blinking display "Over Speed" alarm.

(44) Auto_Run mode selection (Sn-44)

(45) Auto_Run mode setting selection (Sn-45～Sn-60)

- A PLC operation mode is ready to use with the setting of the multi-step frequency command1~16 (An-01～An-16), Auto_Run mode time setting (Bn-21～Bn-36) under the auto_run mode selection (Sn-44). The FWD/REV direction can be set with the setting of Sn45～60.
- In the auto_Run mode, the multi-step frequency command 1～4 derived from the multi-function input terminals ⑤～⑧ are ineffective.

・Some example in auto_run mode：

(A) Single cycle running (Sn-44= 1)

The inverter will run based upon the specified setting mode for a single full cycle. Then, it will stop.

Example：

Sn-44= 1　　An-01= 15Hz

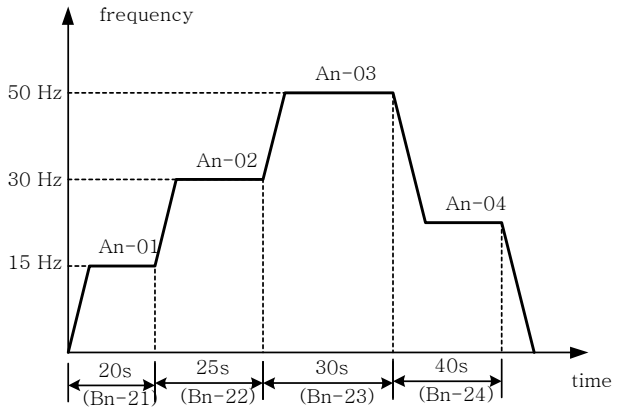
Bn-21= 20S　　An-02= 30Hz

Bn-22= 25S　　An-03= 50Hz

Bn-23= 30S　　An-04= 20Hz

Bn-24= 40S　　An-05～16= 0

Bn-25= 36S　　Sn-45～48= 1



(B) Continuously cyclically run (Sn-44= 2)

Auto_Run mode for one single cycle, then hold the speed of final step to run.

The inverter will run based upon the Auto_Run mode for one single cycle. Then, it repeats periodically.

Example:

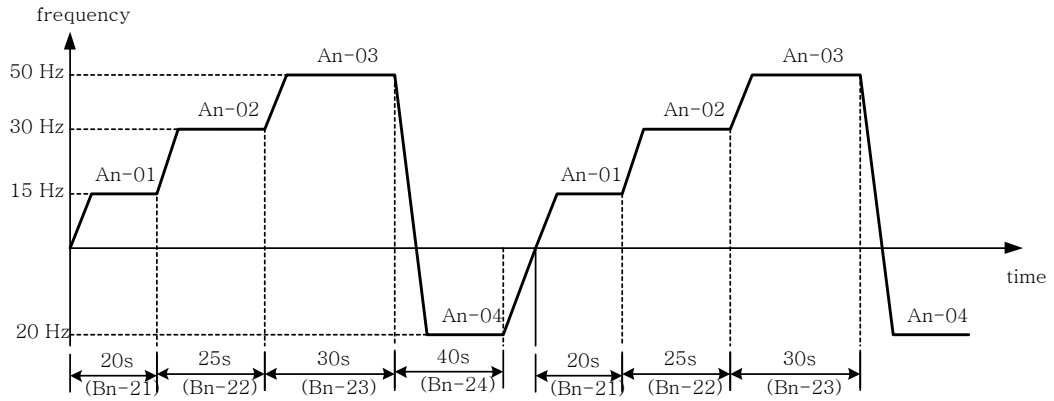
Sn-44= 2

Bn-21～36：same setting as (a)

An-01～16：same setting as (a)

Sn-45～47= 1

Sn-48= 2



(C) Auto_Run mode for one single cycle, then hold the speed of final step to run. (Sn-44 = 3)

Example:

Sn-44= 2

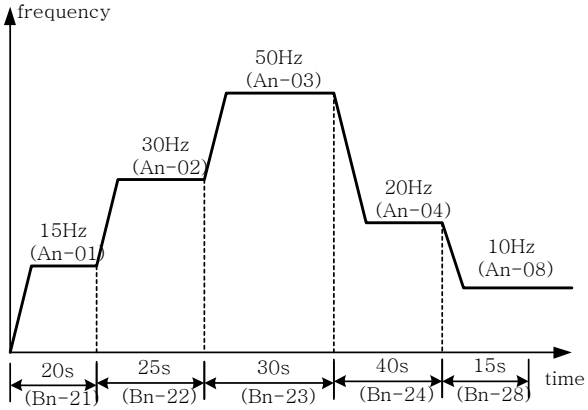
Bn-21～36：same setting as (a)

Bn-28= 15S

An-01～07：same setting as (a)

An-08= 10Hz　　An-09～An-16= 0

Sn-45～Sn-60= 1



・ACC/DEC time follow the setting of Bn-01，Bn-02 in Auto_Run mode.

・ If the setting values of Bn-21～Bn-36 are all zero, the Auto_Run mode is disabled.

(46) Applied torque load (Sn-61)

・Select either the constant torque load (Sn-61=0) or derated torque load (Sn-61=1). The inverter will automatically choose the proper V/F pattern and change the inverter overload protection curve.

(47) LCD language displayed selection (Sn-62)

・Sn-62= 1: Chinese

0: English

(48) Parameter copy (Sn-63)

・LCD digital operator can upload the parameter settings to inverter and download parameter settings from the inverter.

・LCD digital operator can have the verification check on its EEPROM or the inverter's EEPROM.

・Sn-63 = 0：NO action

= 1：Upload data (LCD digital operator →inverter). During this period, the LED on the LCD digital operator will light sequentially in the CW sense.

= 2：Download data (inverter →LCD digital operator). During this period, the LED on the LCD digital operator will light sequentially in the CCW sense.

= 3:Verification check on LCD's EEPROM; during this period the LED will be switch-on between 2 groups.

= 4：Verification check on inverter's EEPROM; during this period the LED will not light.

・Please follow the below steps to secure parameter setting copy between different inverters (either upload or download).

Step 1: check the EEPROM of LCD digital operator

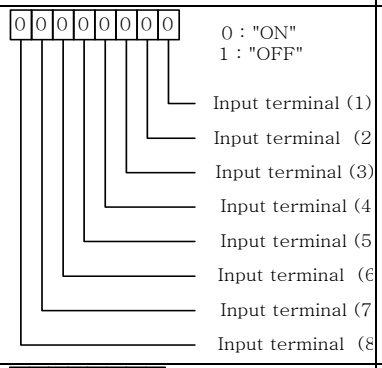
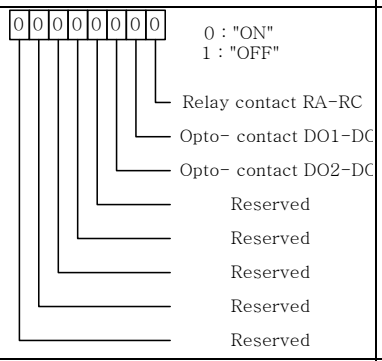
Step 2: download and copy the inverter's parameter setting to LCD digital operator EEPROM.

Step 3: upload and copy the parameter setting of LCD digital operator to the inverter's EEPROM.

(49) PID function selection (Sn-63)

・To enable PID control, set Sn-64=1. Otherwise, set Sn-64=0 to disable PID control function.

3.5 Monitoring parameters Un-□□

Parameter NO.	Name	LCD display	Smallest unit	Description	Multi-function analog output level
Un-11	Input terminal status	Un-11= 00000000 I/P Term. Status			
Un-12	Output terminal status	Un-12= 00000000 O/P Term. Status			
Un-13	Amount of PG speed feedback	Un-13= 100.0% PG Compen.	0.1%	100.0%=MAX. output frequency	
Un-14	Amount of PG speed compensation	Un-13= 100.0% PG Compen.	0.1%	100.0%=MAX. output frequency	
Un-15	PID control input	Un-14= 100% PID Input	0.1%	100.0%=MAX. output frequency	10V/max. output frequency
Un-16	PID control output	Un-15= 100% PID Output1	0.1%	100.0%=MAX. output frequency	10V/max. output frequency
Un-17	PID control output	Un-16= 00% PID Output2	0.1%	100.0%=MAX. output frequency	10V/max. output frequency
Un-18	Fault Message1	Overcurrent Message1		Fault message occurred now	
Un-19	Fault Message2	Overcurrent Message2		Fault message occurred before1	
Un-20	Fault Message3	Overheat Message3		Fault message occurred before2	
Un-21	Fault Message4	Overtorque Message4		Fault message occurred before3	

Parameter NO.	Name	LCD display	Smallest unit	Description	Multi-function analog output level
Un-22	The parameter of time period between last fault and the nearest fault.	Un-22= 2400Hr Last Fault Run Time	1Hr	The parameter will be cleared after fault has been reset.	
Un-23	Frequency command when fault occurred	Un-23= 60.00Hz Last Fault Freq.Com.	0.01Hz		
Un-24	Output frequency when fault occurred	Un-24= 60.00Hz Last Fault O/P Freq.	0.01Hz		
Un-25	Output current when fault occurred	Un-25= 12.5A Last Fault O/P I	0.1A		
Un-26	Output voltage when fault occurred	Un-26= 220.0V Last Fault O/P V	0.1V		
Un-27	DC voltage when fault occurred	Un-27= 310.0V Last Fault O/P V	0.1V		
Un-28	I/P terminal status when fault occurred	Un-28= 310.0V Last Fault I/P Term.		Same as Un-29, display terminal status	
Un-29	O/P terminal status when fault occurred	Un-29= 310.0V Last Fault O/P Term.		Same as Un-28, display terminal status	
Un-31	Time elapsed after run	Un-31= 00002Hr R Elapsed Time	1Hr	Display total time elapsed after pressing RUN	
Un-31	Time elapsed after run	Un-31= 00002Hr R Elapsed Time	1Hr	Display total time elapsed after pressing RUN	
Un-32	EPROM	Un-32= 00001 Soft Number		-Manufacturing use-	

· Frequency command (Un-01)
· Output frequency (Un-02)
· Output current (Un-03)
· Output voltage (Un-04)

· Main circuit DC voltage (Un-05)

Through the setting of Sn-26, Sn-27, the above contents can be displayed at the multi-function analog output terminals (AO1, AO2) in different voltage level 0f (0~10V)

· External analog command VIN (Un-06)

The parameter can monitor the external analog terminal voltage VIN (0~100%/0~10V). The voltage can be output through the multi-function analog output terminal AO1, AO2 (Sn-33=05 or Sn-34=05). The output voltage is the PID feedback voltage when the PID function is used. Please refer to the "PID controller block diagram".

· External analog command AIN (Un-07)

The parameter can monitor the external analog terminal current AIN (0~100%/0~20mA). The current can be output through the multi-function analog output terminal AO1, AO2 (Sn-33=06 or Sn-34=06). The output current is the PID feedback voltage when the PID function is used. Please refer to the "PID controller block diagram".

· Multi-function analog input command AUX (Un-08)

The parameter can monitor the multi-function analog input terminal AUX voltage (0~100%/0~20mA). The voltage can be output through the multi-function analog output terminal AO1, AO2 (Sn-33=07 or Sn-34=07). The output voltage is the PID target voltage (reference) when the PID function is used. Please refer to the "PID controller block diagram".

· External analog output AO1, AO2 (Un-09, Un-10)

The parameter can monitor analog output terminal AO1, AO2 voltage (0~10V). Their output gain can be adjusted through the setting of parameters Bn-14 or Bn-15. Their outputs are determined and varied proportionally according to the setting of (Sn-33 or Sn-34).

· Input terminal status (Un-11)

The parameter will monitor the status of input terminal ①~⑧: 'ON' or 'OFF'.

· Output terminal status (Un-12)

The parameter will monitor the status of input terminal RA-RC, DO1-DOG, DO2-DOG: 'ON' or 'OFF'.

· PG speed feedback and PG speed compensation (Un-13, Un-14)

These parameters will monitor the PG speed feedback and PG speed compensation signal if PG feedback function is used.

- PID control input (Un-15)
- PID control output1 (Un-16)
- PID control output2 (Un-17)

The values in Fig. 15 (on page 39) can be monitored through the parameters of Un-15, Un-16 and Un-17. Moreover, the multi-function analog output terminal AO1, AO2 can be used to monitor the output value through the proper setting of Sn-33 and Sn-34.

- Message1 (Un-18)
- Message2 (Un-19)
- Message3 (Un-20)
- Message4 (Un-21)

These parameters are used to display the fault messages whenever the fault occurred. The user can take proper action for trouble-shooting based upon the displayed message.

- The cumulative operation time setting (Un-22)

The parameter is used to count the elapsed time from the previous fault to the latest fault occurred recently. Its setting range is 0~65536 Hr. After the fault have been cleared and system reset again, the Un-22 will be cleared to zero and counted again.

- When fault occurs, the frequency command (Un-23)
- When fault occurs, the output frequency (Un-24)
- When fault occurs, the output current (Un-25)
- When fault occurs, the output voltage (Un-26)
- When fault occurs, the DC voltage (Un-27)
- When fault occurs, the input terminal status (Un-28)
- When fault occurs, the output terminal status (Un-29)

The above parameters will display the inverter status when the fault occurred lately. The contents of parameters Un-15~21 will be cleared after the faults have been cleared and the system reset again.

- The cumulative time whenever the input power is on (Un-30)

The parameter will record the cumulative operation time from power-on to power-off. Its value is 0~65536 Hr. If the value exceed 65536, it will restart from 0 again.

- The cumulative run time whenever the output power is on (Un-31)

The parameter will record the cumulative operation time from power-on to power-off. Its value is 0~65536 Hr. If the value exceeds 65536, it will restart from 0 again.

・The EPROM software version (Un-32)

The parameter will specify the updated software version in this 7200 MA inverter.

4. Fault display and troubleshooting

4.1 General

The DSA Series have the protective and warning self-diagnostic functions. If fault occurs, the fault code is displayed on the digital operator. The fault contact output (RA-RB-RC, DO1, Do2) operates, and the inverter shut off to stop the motor. If warning occurs, the digital operator will display the warning code. However, the fault-contact output does not operate. (except the OH2 warning function). The digital operator will return to its previous status when the above warning is clear.

- When a fault has occurred, refer to the following table to identify and to correct the cause of the fault.
- Use one of the following methods to reset the fault after restarting the inverter.
- 1) Turn on the fault reset signal.
- 2) Press the RESET key on the digital operator.
- 3) Turn the main circuit power supply off and on again.

4.2 Error Message and Troubleshooting

(A) Protective Function

Table 16 Protective function

LCD display	Protection function	Fault contact output	Error causes	Action to be taken
Fault DC Volt. Over Low	The main circuit DC voltage becomes lower than the lower voltage level.	Operation	· Power capacity is too small. · Voltage drop due to wiring resistance. · A motor of large capacity (11 kW or greater) connected to the same power system has been started. · Defective electromagnetic contractor.	· Check the source voltage and wiring. · Check the power capacity and power system.
Fault Over Current	The inverter output current becomes approx. 200% and above the inverter rated current.	Operation	· Extremely rapid Accel. Short-circuit or ground- fault at the inverter output side. · Motor of a capacity greater than the inverter rating has been started. · High-speed motor and pulse motor has been started.	· Extend the accel. time. · Check the load wiring.
Fault Ground Fault	The ground-fault current exceeds approx. 50% of the inverter rated current.	Operation	· Motor dielectric strength is insufficient. · Load Wiring is not proper.	· Check the motor wiring impedance and the load wiring.
Fault Over Voltage	The main circuit DC voltage becomes excessive because of regeneration energy caused by motor decelerating.	Operation	· Insufficient deceleration. Time. · High input voltage compared to motor rated voltage.	· Extend the accel. time. · Use a braking resistor.
Fault Over Heat	The temperature of the cooling fin reaches 90℃	Operation	· Detective cooling fan. · Ambient temperature rise · Clogged filter.	· Check for the fan, filter and the ambient temperature.
Fault Motor Over Load	Motor overload is detected by the electronic thermal relay. (motor protection)	Operation	· Overload, low speed operation or extended acceleration time. · Improper V-f characteristic setting	· Measure the temperature rising of the motor. · Decrease the output load. · Set proper V-f characteristic.

LCD display	Protection function	Fault contact output	Error causes	Action to be taken
Fault Inverter Over Load	The electronic thermal sensor detects inverter overload while the output current exceeds 112% of rated value. (inverter protection)	Operation	· Improper rated current (Cn-9) setting	· Set proper V-f characteristic. · Set proper rated current (Cn-9) · If inverter is repeated reset before fault removed, the inverter may fault.
Fault Over Torque	Over torque is detected while the output current is larger than or equal to the setting of Cn-26. (machine protection)	Operation	· Machine errors or overload	· Check the use of the machine. · Set a higher protection level (Cn-32).
Fault Ext. Fault3	External fault signal 3	Operation	· Fault input of external signal 3, 5, 6, 7 and 8.	· Identify the fault signal using Un-11.
Fault Ext. Fault5	External fault signal 5			
Fault Ext. Fault6	External fault signal 6			
Fault Ext. Fault7	External fault signal 7			
Fault Ext. Fault8	External fault signal 8			
Fault Inverter EEPROM	NVRAM (SRAM) fault	Operation	· Disturbance of external noise · Excessive impact or vibration	· Reset NVRAM by running Sn-03. · Replace the control board if the fault can't be removed.
	NVRAM (BCC, no.) is bad.			
Fault Inverter A/D	A/D converter (inside the CPU) fault			
Fault PG Over Sp.	Excessive PG speed fault	Operation	· Improper setting of ASR parameters or over-speed protection level.	· Check parameters of ASR and protection level.
Fault PG Open	PG is open-circuit	Operation	· The PG wiring is not properly connected or open-circuit.	· Check the PG wiring.
Fault Sp.Deviat Over	Excessive speed deviation	Operation	· Improper setting of ASR parameters or speed deviation level.	· Check parameters of ASR and speed deviation level.
Fault Inverter PROM_TEST	EEPROM of inverter fault	Operation	· Defective EEPROM of the inverter.	· Replace the control board.

B). Warning and Self-Diagnosis Functions

LCD display	Protection function	Fault contact output	· Error causes	Action to be taken
(blinking) Alarm DC Volt. Over Low	The main circuit DC voltage becomes lower than the lower under-voltage level before the motor starts.	No operation	· Input voltage drop	· Measure the main circuit DC voltage, if the voltage is lower allowance level, regulate the input voltage.
(blinking) Alarm Over Voltage	The main circuit DC voltage becomes higher than the lower under-voltage level before the motor starts.	No operation	· Input voltage rise	· Measure the main circuit DC voltage, if the voltage is higher than allowance level, regulate the input voltage.
(blinking) Alarm Over Heat	The thermal protector contact is input to the external terminal.	No operation	· Overload · Cooling fan fault Ambient temperature rises. · Clogged filter.	· Check for the fan, filter and the ambient temperature.
(blinking) Alarm Over Torque	Over torque is detected while the output current is larger than or equal to the setting of Cn-26. However, the Sn-12 has been set such that the inverter continue to run and disregard the overtorque warning.	Operation	· Machine errors or overload	· Check the use of the machine. · Set a higher protection level (Cn-32).
	Stall prevention operates while acceleration.	No operation	· Insufficient accel./Decel. Time · Overload · Excessive load impact occurs while operating	· Expand accel./Decel. Time. · Check the load.
	Stall prevention operates while operating.			
	Stall prevention operates while Deceleration.			
(blinking) Freq. Com. Error	Forward and reverse rotation commands are simultaneously detected for a period of time exceeding 500ms. (The inverter is stopped according to the stop method preset by Sn-04.)	No operation	· Operation sequence error • 3-wire/2-wire selection error	· Check the circuit of system · Check the setting of system parameters Sn-25, 26, 27, and 28.

LCD display	Protection function	Fault contact output	・Error causes	Action to be taken
(blinking) RS-485 Interrupt	MODBUS Communication fault occurs .The inverter remains operating.	No operation	・External noise ・Excessive vibration or impact Communication wire ・Not properly contacted	・Check the setting of all parameters, including Sn-01, Sn-02. ・Restart, if fault remains, please contact to us. ・Check if the communication wire is not properly contacted
Commu. Fault	Transmission fault of digital operator	No operation	・ Communication between digital operator and inverter has not been established after system starts for 5 seconds. ・ Communication is established after system starts, but transmission fault occurs for 2 seconds.	・Re-plug the connector of the digital operators. ・Replace the control board.
(blinking) Alarm B.B.	External B.B. signal is input (The inverter stops and the motors stops without brake)	No operation	・External B.B. signal is input.	・After external bb signal is removed, execute the speed search of the inverter.
Input Error	Improper inverter capacity (Sn-01) setting.	No operation	・Inverter KVA setting error.	・Set proper KVA value. Be aware of the difference of 220V and 440V
	Improper setting of multi-function input signal (Sn-25, 26, 26 and 28).	No operation	・The value of Sn-25~Sn-28 is not in order (Ex. Sn-25= 05, Sn-28= 02, those are improper setting). ・Set speed search command of 21 and 22 simultaneously.	・Set these values by order (the value of Sn-25 must be smaller than those of Sn-26, 27, 28) ・Command 21 and 22 can not be set on two multi-function-input contacts simultaneously.
	Improper setting of V/F characteristic (Cn-02~08)	No operation	・The values of Cn-02~Cn-08 do not satisfy $F_{max} \geq F_A \geq F_B \geq F_{min}$. ・Upper limit and lower limit setting is incorrect.	Change the settings.
	Improper inverter capacity (Sn-01) setting.	No operation	・Inverter KVA setting error.	・Set proper KVA value. Be aware of the difference of 220V and 440V
(blinking) Over Speed	Excessive speed (operation remains)	No operation	・Improper ASR parameter setting or over-torque protection level.	・Check the ASR parameter and over-torque protection level.
(blinking) PG Open	PG Open-circuit (operation remains)	No operation	・The circuit of PG is not properly connected or open-circuit.	・Check the wiring of PG.

LCD display	Protection function	Fault contact output	・Error causes	Action to be taken
Sp.Deviat Over	Excessive speed deviation (operation remains)	No operation	・Bad communication during operator and inverter. ・The connector is not properly connected.	・Check if the connector is not properly connected
Load Fail	Error during upload and download (operation remains)	No operation	・Improper ASR parameter setting or over-torque protection level.	・Check the ASR parameter and over-torque protection level.
EEPROM Fault	Operator EEPROM error.	No operation	・Operator EEPROM error.	・Disable load function of operator. ・Replace the operator.
LCD display	Protection function	Fault contact output	・Error causes	Action to be taken
Upload Error	Data incorrect during Communication from the operator to the inverter.	No operation	・Incorrect inverter data format ・Communication noise.	・Download the data to the operator again. ・Check if the connector is not properly connected.
Download Error	Data incorrect during Communication from the inverter to the operator.	No operation	・Communication noise	・Check if the connector is not properly connected.

Appendix 1.

Adjusting PID controller

Use the following procedure to activate PID control and then adjust it while monitoring the response.

1.Enable PID control.

2.Increase the proportional gain Bn-17 as far as possible without creating oscillation.

3.Reduce the integral time Bn-18 as far as possible without creating oscillation.

4.Increase the derivative time Bn-19 as far as possible without creating oscillation.

The Proportional, Integral and Derivative control function provides closed-loop control, or regulation, of a system process variable (pressure, temperature, etc.). This regulation is accomplished by comparing a feedback signal to a setpoint reference, which results in an error signal. The PID control algorithm then performs calculations, based upon the PID parameter settings (Bn-16 through Bn-20 on Page 38), on this error signal. The result of the PID algorithm is then used as the new frequency reference, or is added to the existing speed reference.

The PID target value can come from the frequency command (from operator) or a Multi-Function Analog Input.

Select the PID control feedback signal from external terminal AIN for a current signal (4-20mA DC) or from VIN for a voltage (0-10 VDC or －10 to +10 VDC).

The Proportional gain is the value by which the error signal is multiplied to generate a new PID controller output. A higher setting will result in a more responsive system. A lower setting will result in a more stable yet slower system.

The Integral Time is a parameter that determines how fast the PID controller will seek to eliminate any steady-state error. The smaller the setting, the faster the error will be eliminated. To eliminate the integral function entirely, set this parameter to 0.0 seconds. A lower setting will result in a more responsive system. A higher setting will result in a more stable yet slower system.

The Integral Upper Limit is a parameter that will limit the effect that the integrator can have. It works if the PID controller output is positive or negative. It can also be used to prevent integrator “wind-up.”

The Derivative Time is a parameter that can be adjusted to increase system response to fast

load or reference changes, and to reduce overshoot upon startup. To eliminate the differential function entirely, set this parameter to 0.00 seconds.

The PID Output Limit (Cn-51, Cn-52) are parameters that can be used to set the maximum effect the PID controller will have on the system. It also will limit the PID output when it is either positive or negative. NOTE: When the PID output limit is reached, the integrator will hold and not change in value until the PID output is less than the PID output limit.

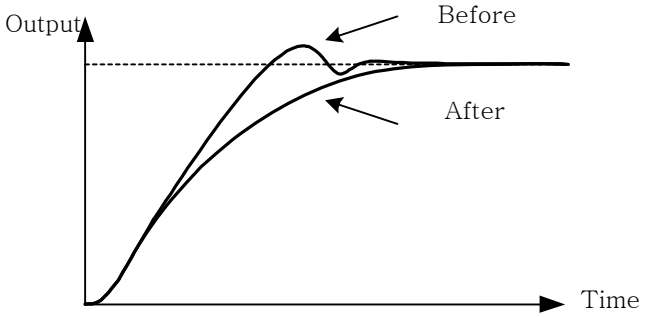
The PID bias (Bn-20) is a parameter that will add a fixed percentage to the PID output. It can be used to tune out small system offsets. NOTE: This parameter is set as a percentage of maximum output frequency.

The above parameters are factory set for optimum results for most applications, and generally do not need to be changed.

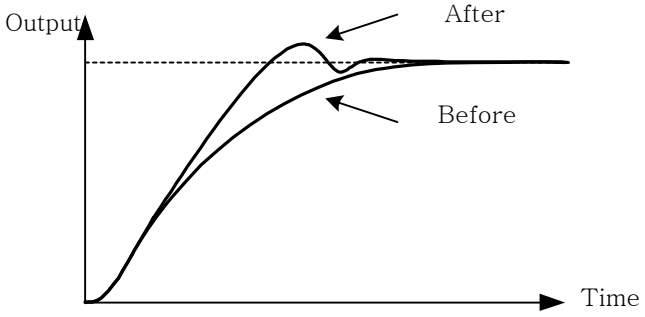
The PID Primary Delay Time is a parameter that adds a filter to the PID output to keep it from changing too quickly. The higher the setting, the slower the PID output will change.

All of these parameters are interactive, and will need to be adjusted until the control loop is properly tuned, i.e. stable with minimal steady-state error. A general procedure for tuning these parameters is as follows:

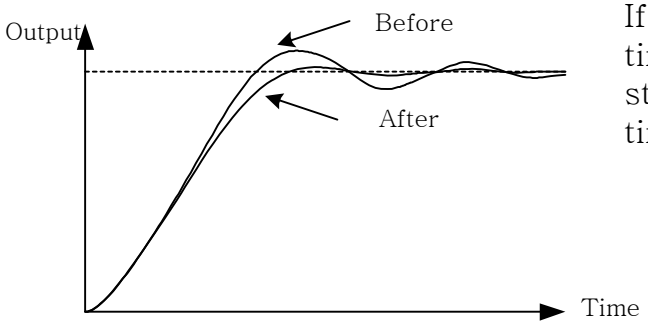
1. Adjust Proportional Gain until continuous oscillations in the Controlled Variable are at a minimum.
2. The addition of Integral Time will cause the steady-state error to approach zero. The time should be adjusted so that this minimal error is attained as fast as possible, without making the system oscillate.
3. If necessary, adjust derivative time to reduce overshoot during startup. The drive's Acceleration and Deceleration rate times can also be used for this purpose.



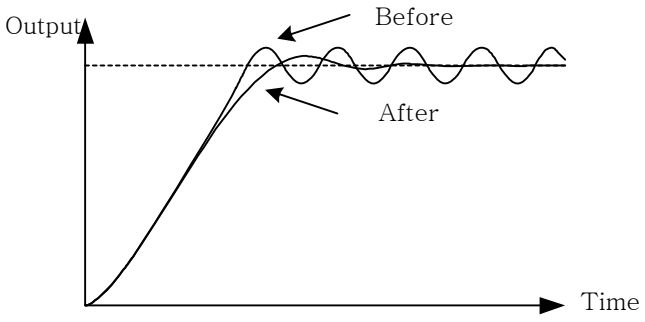
If overshoot occurs, shorten the deriv
time (D) and lengthen the integral tim



To rapidly stablize the control conditions even when overshooting occurs, shorten the integral time (I) and lengthen the derivative time (D).



If oscillation occurs with a longer cycle than the i
time(I) setting, it means that the integral operatio
strong. The oscillation will be reduced as the inte
time (I) is lengthened



If oscillation cycle is short and oscillation occu
with a cycle approximately the same as the de
time (D) setting, it means that the derivative
operation is strong. The oscillation will be red
the derivative time (D) is shortened. If oscillati
cannot be reduced even by setting the derivati
(D) to "0.00", then either the proportional gain
raise the PID primary delay time constant.

Appendix A2

Notes for circuit protection and environment ratings

■ Circuit Protection

The MA series are “suitable for use on a circuit capable of delivering not more than ____ rms symmetrical amperes, ____ V maximum.” Where the rms value symmetrical amperes and V maximum are to be as follows :

Device Rating		Short circuit Rating (A)	Maximum Voltage (V)
Voltage	HP		
220V	1.5 ~ 50	5,000	240V
	51 ~ 100	10,000	
440V	1.5 ~ 50	5,000	480V
	51 ~ 200	10,000	
	201 ~ 400	18,000	

■ Environmental Ratings

The MA series are intended for use in pollution degree 2 environments.

■ Field Wiring Terminals and Tightening Torque

The wiring terminals and tightening torque are listed as follows.

(The main circuit terminal specifications – use 60/75℃ copper wire only)

(a) 220V class

Circuit	Inverter Rating (HP)	Terminals Mark	Cable Size (mm^2)	Terminals	Tightening Torque (Pound-Inch)
Main Circuit	1	L1, L2, L3, T1, T2, T3, B1/⊕, B2, ⊖	2 ~ 5.5	M4	10
		⏚	2 ~ 5.5	M4	10
	2	L1, L2, L3, T1, T2, T3, B1/⊕, B2, ⊖	2 ~ 5.5	M4	10
		⏚	3.5 ~ 5.5	M4	10
	3	L1, L2, L3, T1, T2, T3, B1/⊕, B2, ⊖	3.5 ~ 5.5	M4	10
		⏚	3.5 ~ 5.5	M4	10
	5	L1, L2, L3, T1, T2, T3, B1/⊕, B2, ⊖	5.5	M4	10
		⏚	5.5	M4	10
	7.5	L1, L2, L3, T1, T2, T3, B1/⊕, B2, ⊖	8	M5	21
		⏚	5.5 ~ 8	M5	21
	10	L1, L2, L3, T1, T2, T3, B1/⊕, B2, ⊖	8	M5	21
		⏚	5.5 ~ 8	M5	21
Control Circuit	All series	1 ~ 33	0.2~2	M3	5

(b) 440V class

Circuit	Inverter Rating (HP)	Terminals Mark	Cable Size (mm2)	Terminal	Tightening Torque (Pound-Inch)
Main Circuit	1	L1, L2, L3, T1, T2, T3, B1/⊕, B2, ⊖	2 ~ 5.5	M4	10
		⏚	2 ~ 5.5	M4	10
	2	L1, L2, L3, T1, T2, T3, B1/⊕, B2, ⊖	2 ~ 5.5	M4	10
		⏚	2 ~ 5.5	M4	10
	3	L1, L2, L3, T1, T2, T3, B1/⊕, B2, ⊖	2 ~ 5.5	M4	10
		⏚	2 ~ 5.5	M4	10
	5	L1, L2, L3, T1, T2, T3, B1/⊕, B2, ⊖	2 ~ 5.5	M4	10
		⏚	3.5 ~ 5.5	M4	10
	7.5	L1, L2, L3, T1, T2, T3, B1/⊕, B2, ⊖	3.5 ~ 5.5	M4	10
		⏚	3.5 ~ 5.5	M4	10
	10	L1, L2, L3, T1, T2, T3, B1/⊕, B2, ⊖	5.5	M4	10
		⏚	5.5	M4	10
Control Circuit	All series	1 ~ 33	0.5 ~ 2	M3	5