



(10)

CUSTOMIZABLE Vector AC DRIVE



208 to 230V	3 Phase	1 ~ 40HP Heavy Duty Rated (150% for 1 minute)
380 to 480V	3 Phase	1 ~ 75HP Heavy Duty Rated (150% for 1 minute)
208 to 230V	3 Phase	1 ~ 50HP Normal Duty Rated (110% for 1 minute)
380 to 480V	3 Phase	1 ~ 100HP Normal Duty Rated (110% for 1 minute)

Installation Manual

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SAFE OPERATION NOTES

Read this instruction manual thoroughly before installation, operation, maintenance or inspection of the inverter. 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 that, if not avoided, could result in death or serious injury to personnel.



: Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury to personnel and damage to the equipment.

■ “WARNING” and “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” LED is extinguished. • Never connect power circuit output U/T1, V/T2, W/T3 to AC power supply.	

	CAUTION
• When mounting the C10 in a separate enclosure, install a fan or other cooling device to keep the intake air temperature below 113°F (45°C). • Do not perform a withstand voltage test to the inverter. • All the parameters of the inverter have been preset at the factory. Do not change the settings unnecessarily.	

This inverter has been placed through demanding tests at the factory before shipment. After unpacking, check for the following:

1. Verify that part numbers on shipping carton and unit match the purchase order sheet and/or packing list.
2. Do not install or operate any inverter that is damaged or missing parts.
3. Do not install or operate any inverter that has no QC marking.

Contact your local Saftronics authorized distributor or Saftronics representative if any of the above irregularities have been found.

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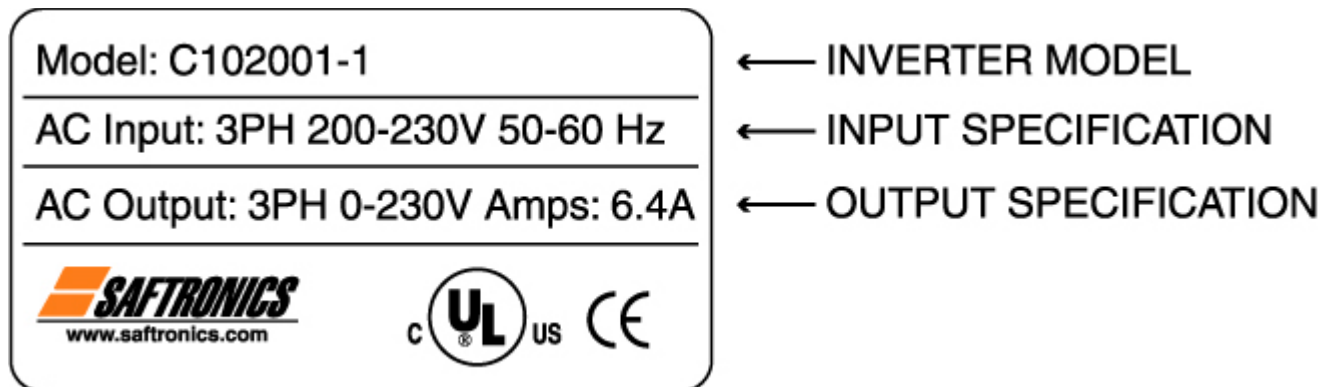
1. C10 Handling Description

1.1 Inspection Procedure upon Receiving

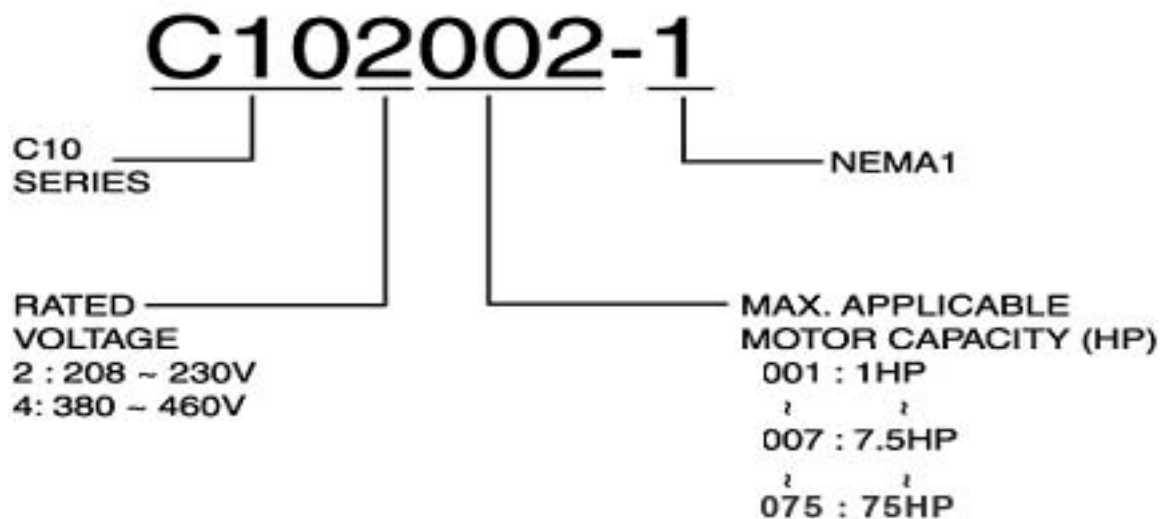
Before delivery, every C10 inverter has been properly adjusted and has passed a demanding factory test. After receiving the C10 inverter, the customer should follow the procedures listed below:

- Verify that the Model Number of the inverter you have received is the same as the Model Number listed on your purchase order. (Please read the Nameplate)
- Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your inverter.

■ Inverter Nameplate:



■ Inverter Model Number:



1.2 Installation

Install the C10 vertically and allow sufficient space for effective cooling as shown below in Figure 1.

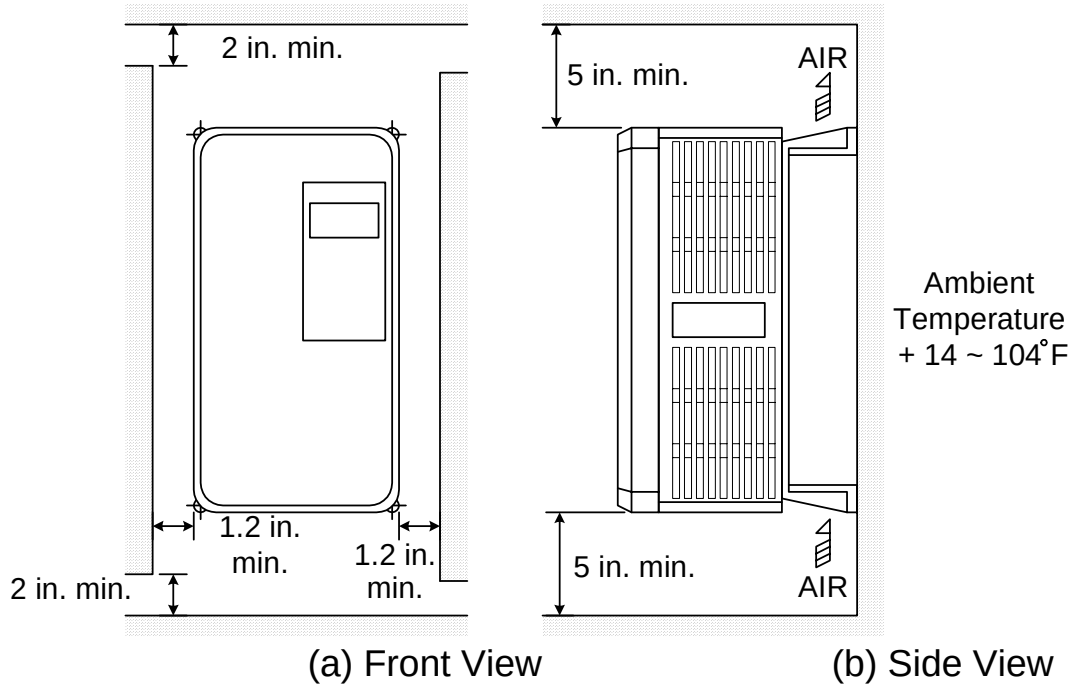


Figure 1 Recommended air clearance for wall mounting the C10.



CAUTION

Location of the equipment is important to achieve proper performance and normal operating life. The C10 inverter should be installed in areas where the following conditions exist:

- Ambient temperature: +14 to 104°F, (-10 to 40°C).
- Install the C10 in a location protected from rain, moisture and direct sunlight.
- Install the C10 in a location free from harmful mists, gases, liquids, airborne dusts and metallic particles.
- Install the C10 in a location free from vibration and electromagnetic noise. (i.e. welding machines, power units, etc...)
- When mounting multiple units in a common enclosure, install a cooling fan or some other means to cool the air entering the inverter to at least 113°F (+45°C) or below.

1.3 Removing/Attaching the Digital Operator and Front Cover



Caution

1. Do not remove or attach the LCD digital operator and/or the front cover of the unit using methods other than those described below, otherwise the inverter may break or malfunction due to improper connection.
2. Never hang the front cover on the inverter with the LCD digital operator still attached. Improper contact may result.

C10 Disassembly / assembly procedures will depend on the size of the model as follows:

(A) For Compact Size Type 230V: 1-2HP, 460V: 1-2HP

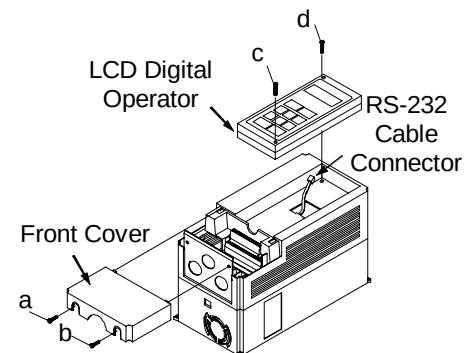
- C102001-1
- C102002-1
- C104001-1
- C104002-1

■ Removing the digital operator:

Take off the two screws on the front cover in the place a and b. Remove the front cover and take off the screws in the place c and d. Disconnect the RS-232 cable connector on the backside of the LCD digital operator. Lift and remove digital operator.

■ Attaching the front cover and digital operator:

Connect the RS-232 cable connector on the back of the LCD digital operator.



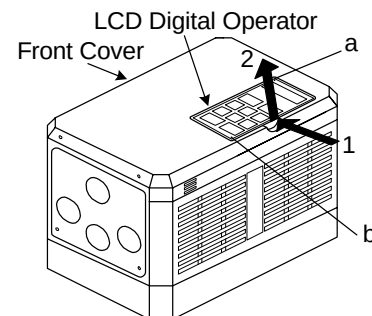
Attach the digital operator and tighten the screws in the place c and d. Insert the tabs on the upper part of front cover into the groove of the inverter and tighten the screws in the place a and b.

(B) For Standard Size Type 230V: 3-10HP, 460V: 3-10HP

- C102003-1
- C102005-1
- C102007-1
- C102010-1
- C104003-1
- C104005-1
- C104007-1
- C104010-1

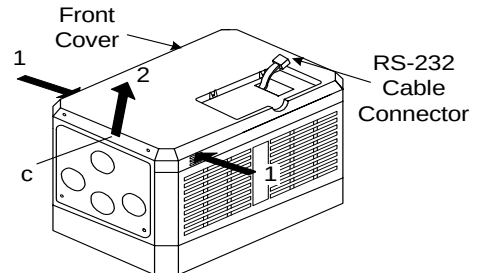
■ Removing the digital operator:

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. Disconnect the RS-232 cable connector on the backside of the LCD digital operator. Lift the digital operator in the direction of arrow 2 to remove the LCD digital operator.



■ **Removing the front cover:**

Press the left and right sides of the front cover inwards or the direction of arrow 1. Lift the bottom of the cover in the direction of arrow 2 to remove the front cover.

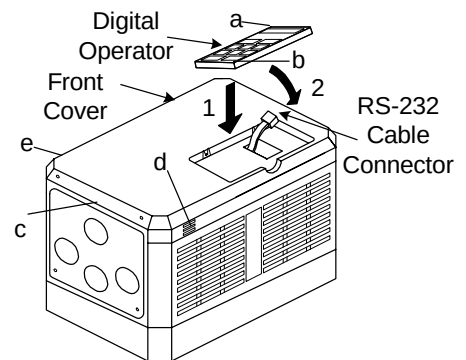


■ **Attaching the front cover and digital operator:**

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.

Connect the RS-232 cable connector on the backside of the LCD digital operator and hook the digital operator at a on the front cover in the direction of arrow 1.

Press the digital operator in the direction of arrow 2 until it snaps into place b and then tighten the screws in the place c. (on the front cover)



C) For 230V 15-20HP and 460V 15-20HP

- C102015-1 • C104015-1
- C102020-1 • C104020-1

■ **Removing the digital operator:**

Take off the screws in the place a and b. Disconnect the RS-232 cable connector on the backside of the LCD digital operator and then lift the digital operator upwards to remove.

■ **Removing the front cover:**

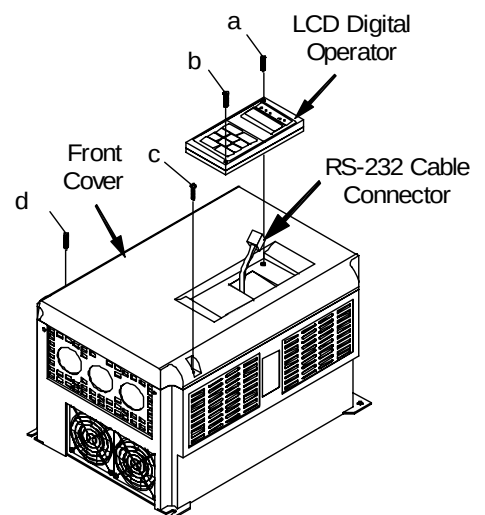
Loosen the two screws of the front cover in the place c and d. Then lift the bottom of the front cover to remove the front cover.

■ **Attaching the front cover and digital operator:**

Insert the tab of the upper part of front cover into the groove of the inverter and tighten the screws in the place c and d.

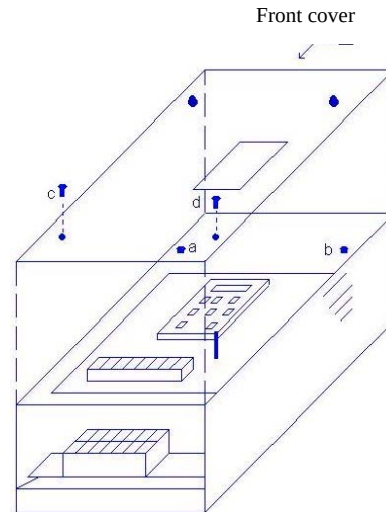
Connect the RS-232 cable connector on the backside of the LCD digital operator.

Attach the digital operator and tighten the screws in the place a and b.



(D) For 230V 30~40HP(HD) and 460V 40~75HP(HD) Series

- Removing the front cover: Loosen the two screws of the front cover in the place a and b. Then loosen the two screws c and d, lift the front cover upwards. (Don't removing the digital operator.)
- Mounting the front cover: Press the front cover and then tighten the screws in the place a, b, c and d.



1.4 Wiring between Inverter and Peripheral Devices



Caution

1. After turning OFF the main circuit power supply, do not touch or change any circuit components until the LED "CHARGE" lamp has extinguished. (LED "Charge" lamp indicates that there is still some charge in the capacitor).
2. Never do wiring work or take apart connectors in the inverter while the power is still on.
3. Never connect the inverter output U/T1, V/T2, W/T3 to AC power supply.
4. Always connect the ground lead E to ground.
5. Never perform high voltage test directly on 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 Electro-Static Discharge. Do not try to touch the control board.
7. If Sn-03 is set to 7,9, or 11 for 2-wire operation or if Sn-03 is set to 8,10, or 12 for 3-wire operation, the parameter settings will return to factory default settings. (Except for parameter settings in Sn-01 and Sn-02, they will remain at their modified settings). If the inverter is initially operated in 3-wire mode (Sn-03= 8,10, or 12), the motor will rotate in CCW direction after setting has been changed to 2-wire mode. (Sn-03= 7,9, or 11). Terminal 1 represents Forward and Terminal 2 represents Reserve in this situation. Be sure that terminals (1) one and (2) two are open to ensure protection against personal harm or injury and to prevent any potential damage to machines.



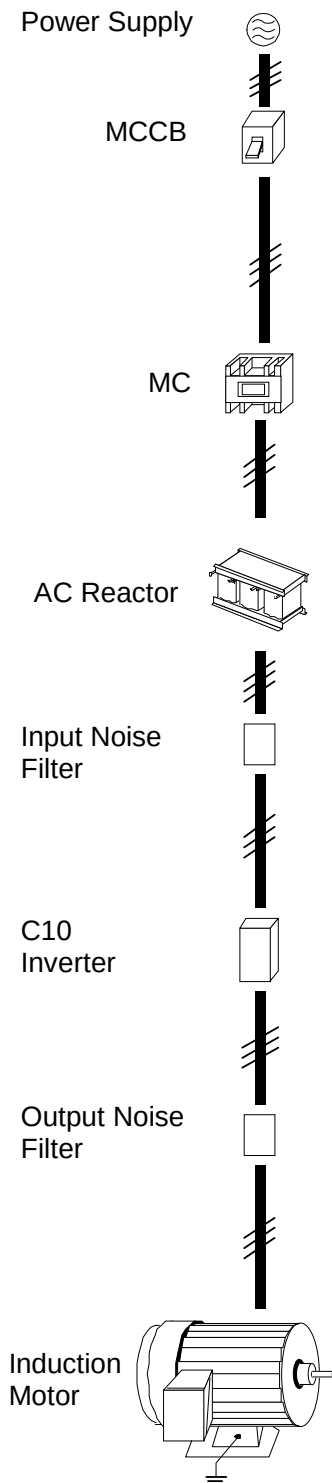
Caution

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 for 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 length of the cable wire between the inverter and the motor exceeds 100ft, use a lower carrier frequency for PWM (parameter Cn-34). Refer to Page 58.

Connection Example for C10 to Peripheral Devices



■ MCCB (Molded-Case Circuit Breaker)

- Choose the Molded Case Circuit Breaker (MCCB) of proper current rating. Please refer to section 1.7 – Specifications on page 17.
- Do not use a circuit breaker for start/stop operation.
- When a ground fault interrupter is used, select the one with not influenced by high frequency. Setting current should be 200mA or above and the operating time at 0.1 second or longer to avoid false triggering.

■ MC (Magnetic Contactor)

- It is not necessary to have a Magnetic Contactor on the input side. However, an input Magnetic Contactor is used to prevent an automatic restart after recovery from an external power loss during remote control operation.
- Do not use the Magnetic Contactor for start/stop operation.

■ AC Reactor

- To improve power factor or to reduce surge current, install an AC Reactor on the input side of the C10 inverter.

■ Input Noise Filter

- When used with Safronics specified Input Noise Filter, the C10 inverter will comply with EN55011 class A regulation.

■ C10 Inverter

- The input power supply can be connected to any terminal R/L1, S/L2, T/L3 on the terminal block.
- Please connect the ground terminal E to the site ground securely.

■ Output Noise Filter (Zero Phase Core)

- Install an Output Noise Filter between the C10 and the Induction Motor to eliminate noise transmitted between the power line and the inverter.

■ Induction Motor

- When multiple motors are driven in parallel with an inverter, the inverter rated current should be at least 1.1 times the total motor rated current.
- The inverter and the motor must be separately grounded.

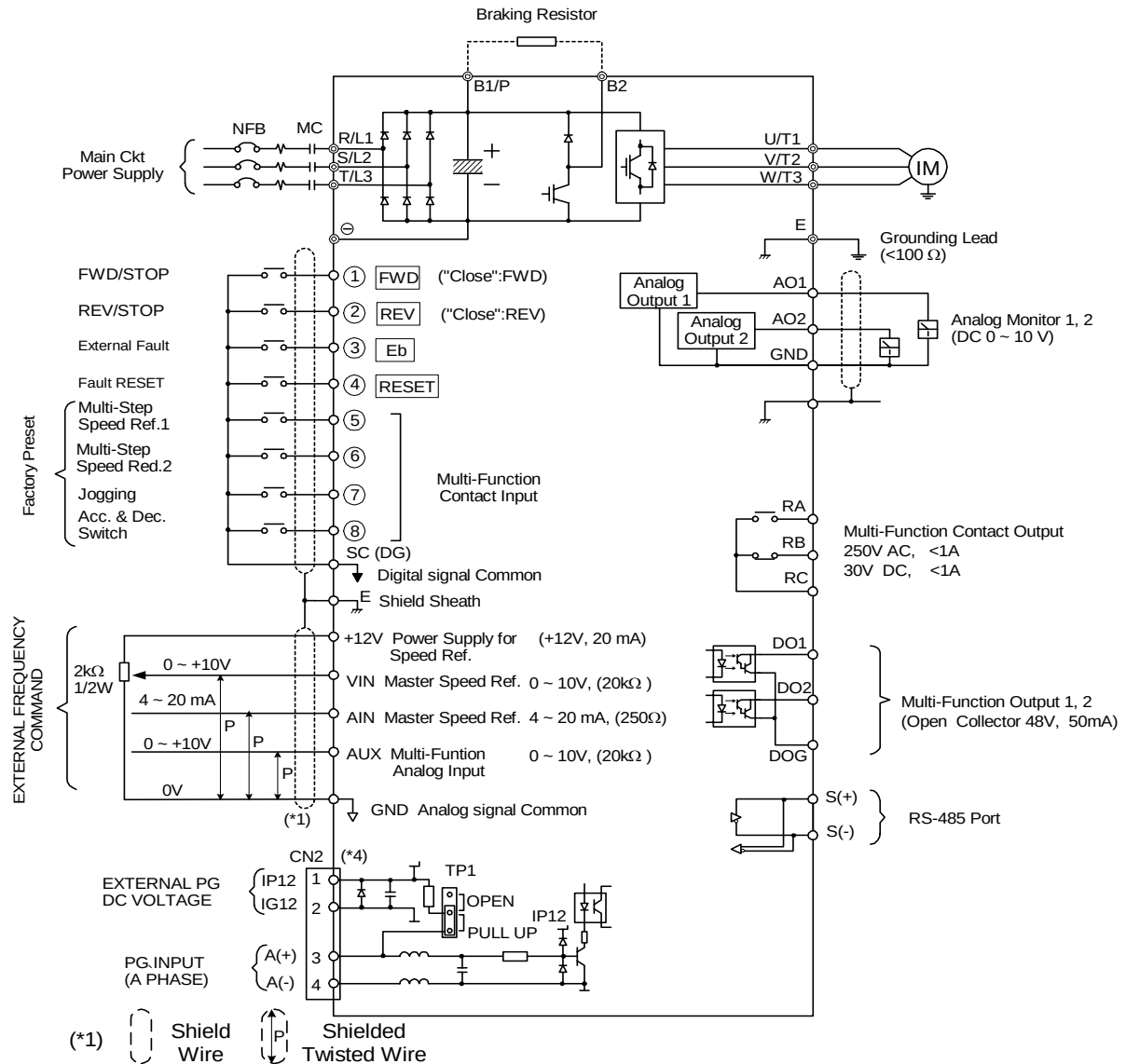
■ Standard Connection Diagram

The standard connection diagram of C10 is shown in Figure 2. The sign $\odot$ indicates the power circuit terminal and the sign $\bigcirc$ indicates control circuit terminal. The terminal function and arrangement are summarized in Table 1 and Table 2. There are three types of control boards, the terminal arrangement is shown below.

(A) For Compact Size Type 230V: 1-2HP, 460V: 1-2HP(HD)

- C102001-1
- C102002-1

- C104001-1
- C104002-1



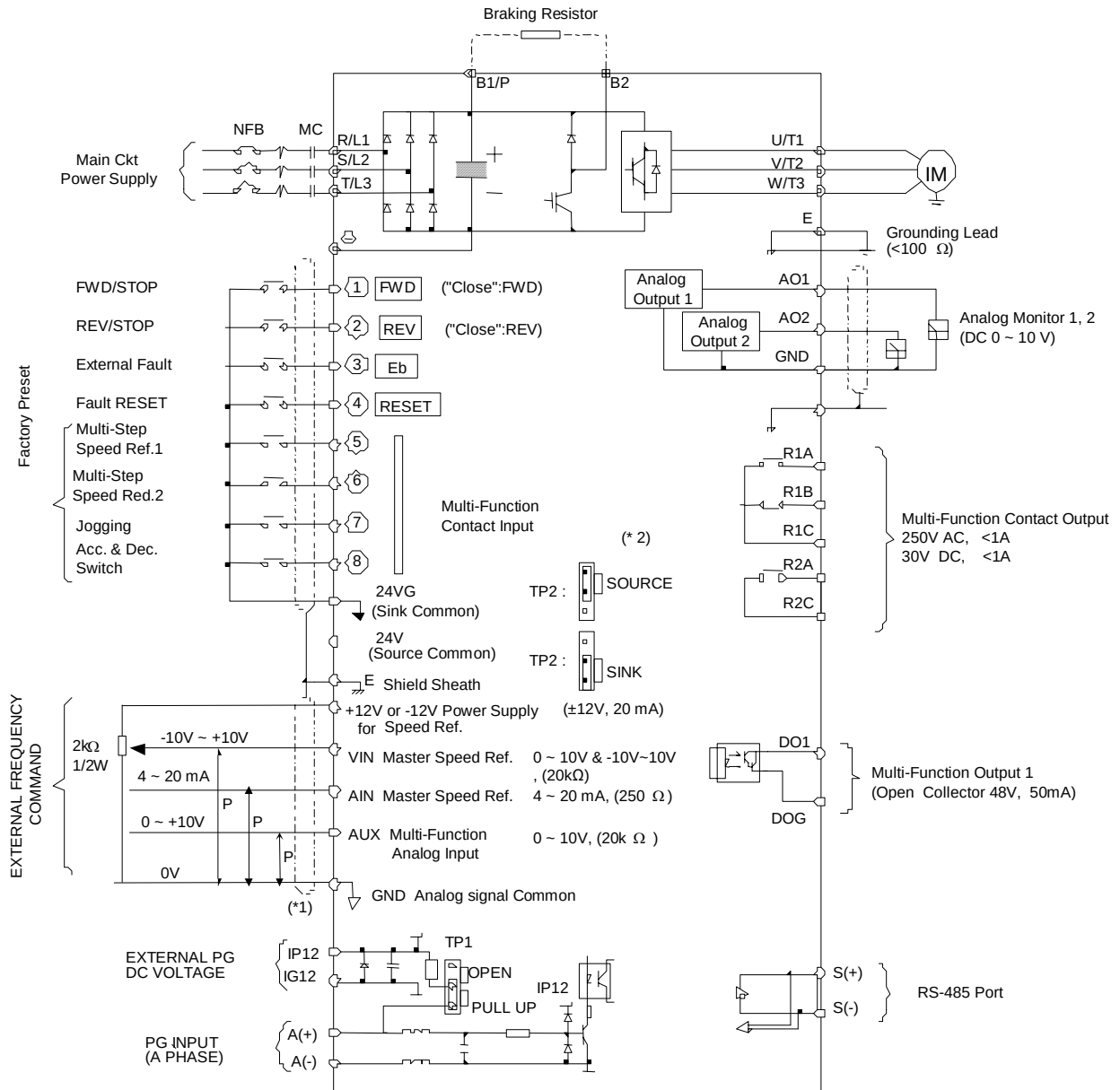
- (*)1 Shield Wire (P) Shielded Twisted Wire
- (*)2 The terminal arrangement
- | | | | | | | | | | | | |
|----|---|---|---|---|------|-----|-----|-----|-----|------|------|
| SC | 1 | 3 | 5 | 7 | VIN | AIN | AUX | DO1 | DO2 | DOG | S(-) |
| E | 2 | 4 | 6 | 8 | +12V | GND | GND | AO1 | AO2 | S(+) | E |
- (*)3 The control board code No. : 4P101C0040001
- (*)4 The CN2 wire code No. : 4H339D0250001

Figure 2-a Standard Connection Diagram

(B) 230V : 3-40HP, 460V : 3-75HP(HD)

• C102003-1 through C102040-1

• C104003-1 through C104075-1



(*1) Shield Wire Shielded Twisted Wire

(*2) The terminal ① ~ ⑧ can be set as SINK or SOURCE type input interface, when setting ① ~ ⑧ as sink type input, the short jumper of TP2 must be set to SINK position, and set to SOURCE position for source type input.

(*3) The terminal arrangement

24VVG	1	3	5	7	24V	VIN	AIN	AUX	DO1	DOG	IP12	A(+)	A(-)
E	2	4	6	8	+12V	GND	GND	AO1	AO2	E	IG12	S(+)	S(-)

R2A	R2C	R1A	R1B	R1C
-----	-----	-----	-----	-----

(*4) The control board code No. : 4P101C0060002

Figure 2-b Standard Connection Diagram

1.5 Description of Terminal Function

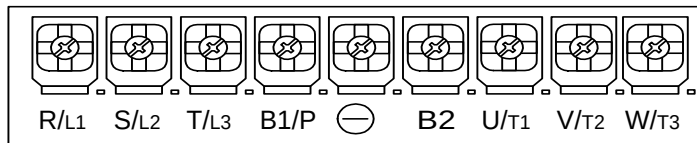
Table 1 Main circuit terminals

Terminal	Terminal Function
R/L1	Main circuit input power supply (For single phase power supply, please use R/L1, S/L2 as input terminal)
S/L2	
T/L3	
⊖	B1/P, B2: External braking resistor B1/P, ⊖ : DC power supply input
B1/P	
B2/R	
B2	Inverter output
U/T1	
V/T2	
W/T3	Grounding lead (3rd type grounding)
E	

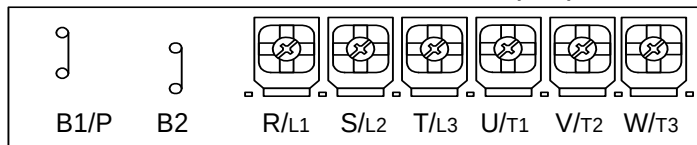
■ Terminal block configuration

- For 230V : 1-2HP, 460V : 1-2HP (HD)

- C102001-1 • C102002-1

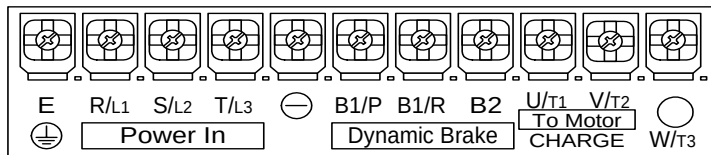


- C104001-1 • C104002-1 (HD)

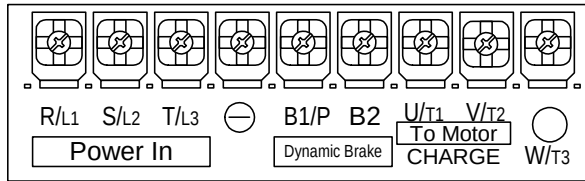


- For 230V : 3-5HP, 460V : 3-5HP (HD)

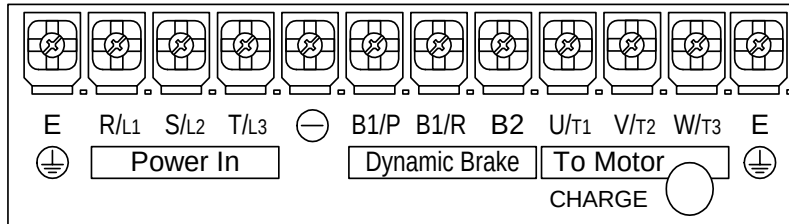
- C102003-1 • C102005-1



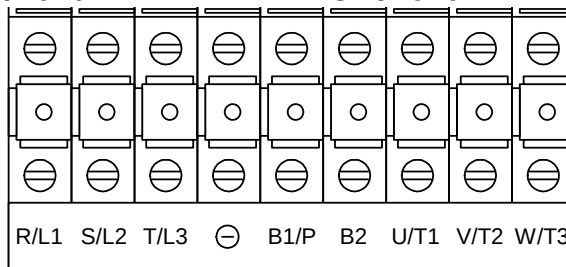
- C104003-1
- C104005-1 (HD)



- For 230V : 7.5-10HP, 460V : 7.5-10HP (HD)
 - C102007-1
 - C104007-1
 - C102010-1
 - C104010-1



- For 230V : 15-20HP, 460V : 15-20HP (HD)
 - C102015-1
 - C104015-1
 - C102020-1
 - C104020-1



- For 230V : 25-40HP, 460V : 25-75HP (HD)
 - C102025-1
 - C104025-1
 - to
 - C102040-1
 - to
 - C104075-1

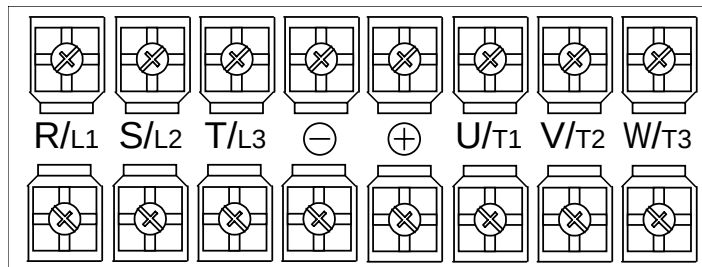


Table 2 Control Circuit Terminals

Terminal	Functions	
1(DI1)	Forward Operation – Stop Signal	
2(DI2)	Reverse Operation – Stop Signal	
3(DI3)	External Fault Input	
4(DI4)	Fault Reset	
5(DI5)	Multi-Function Input Terminal: 3-Wire Operation, Local/Remote Control, Multi-Speed Select, FWD/REV Select, ACC/DEC Choice, ACC/DEC Halting, Base Block, Overheat Warn, PID Control, DC Braking, Speed Search, Up/Down Function, PG Feedback Control, External Fault, Timer Function, Multi-Function Analog Input Setting	
6(DI6)		
7(DI7)		
8(DI8)		
SC(DG)	Digital Signal Ground	
(24VG)	Sink Common Point (Locate the short jumper of TP2 in SINK position)	
24V ^{*1}	Source Common Point (Locate the short jumper of TP2 in SOURCE position)	
E	Connection to Shield Signal Lead (Frame Ground)	
+12V	DC Voltage for External Device	
-12V	Only supported by High HP Control card 4P101C01301)	
VIN	Master Speed Voltage Reference (0-10V) (4PC101C01301 supports –10V to +10V input)	
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 Command, Frequency-Jump-4, etc...	
GND	Analog Signal Common	
IP12	External Power Source for PG Feedback Use	
IG12		
A(+)	Phase-A Signal Input of PG	
A(-)		
AO1	Analog Multi-Function Output Port: Frequency Command, Output Frequency, Output Current, Output Voltage, DC Voltage, PID Controlled Value, Analog Command Input of VIN, AIN or AUX.	
AO2		
GND	Common Lead for Analog Port	
RA(R1A)	Relay Contact Output A	Same Function as Terminal DO1, DO2
RB(R1B)	Relay Contact Output B	
RC(R1C)	Relay Contact Common	
DO1	Digital Multi-Function (Open Collector) Output “1”, “2” Terminals: During-Running, Zero-Speed, Agreed-Frequency, Agreed-Frequency-Setting, Frequency-Output, Inverter-Operation-Ready, Undervoltage-Detection, Base-Block Output, Run Source, Frequency Command, Overtorque Detection, Frequency Command Invalid, Fault, Undervoltage, Overheat, Motor Overload, Inverter Overload, During-Retry, Communication-Fault, Timer-Function-Output	
DO2 (^{R2A} _{R2B})		
DOG	Common Terminal (of Open Collector Transistor)	
S(+)	RS-485 Port	
S(-)		

(*1) 3HP(HD) and up of the C10 models have 24V terminal.

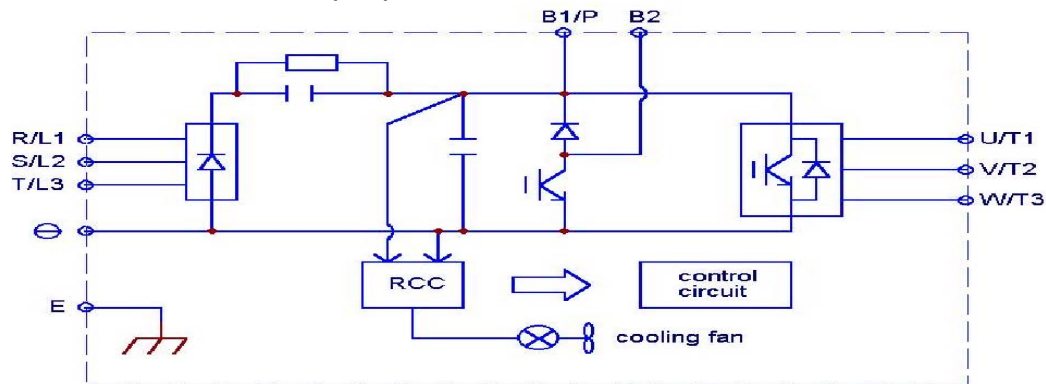


Caution

- Use the control circuit terminals VIN, AIN according to the setting of Sn-24.
- The maximum output current at terminal (+15V or +12V) is 20mA.
- The multi-function analog output terminals AO1, AO2 is a dedicated output for a frequency meter, ammeter, etc. Do not use these 2 analog outputs for feedback control or for any other control purpose.

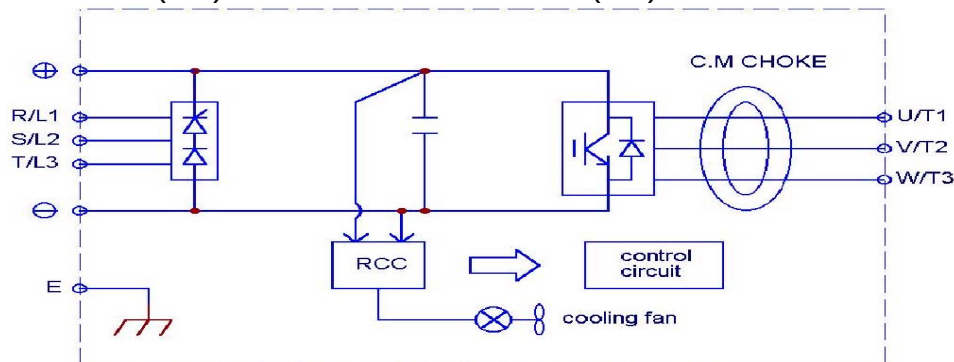
1.6 Main Circuit Wiring Diagram

1. 230V/460V: 1~20HP (HD)



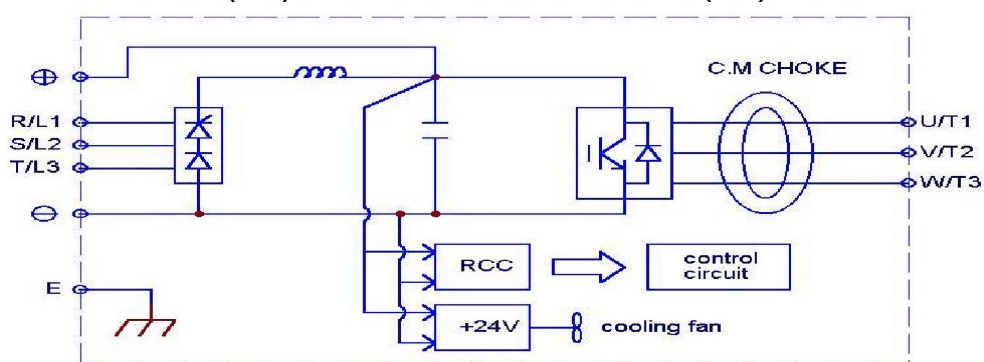
2. 230V: 25HP (HD)

460V: 25~30HP (HD)



3. 230V: 30~40HP (HD)

460V: 40~75HP (HD)



1.7 Wiring Main Circuit

■ Main Circuit Wiring

The MCCB (Molded-Case Circuit Breaker) should be installed between the AC power supply and input terminals R/L1-S/L2-T/L3 on the C10 inverter. The user can make his own decision whether or not to install a MC (Magnetic Contactor). When a ground fault interrupter is used, select the one not influenced by high frequency, setting current should be 200mA or above and the operating time at 0.1 second or longer to avoid false triggering.

Table 3 230V and 460V Series Applicable Wire Size and MCCB

C10 Inverter				Wire size: mm ² (AWG)			MCCB
Power supply	Applicable Power Rating (HP) ^{*1}	Rated KVA	Rated current (A)	Main circuit ^{*2}	Ground connection wire E (G)	Control wire ^{*3}	
230V 1/3-phase	1HP	2	4.8	2-5.5 (14 -10)	2-5.5 (14 -10)	0.5-2 (20-14)	15A
	2HP	2.7	6.4	2-5.5 (14 -10)	3.5-5.5 (12 -10)	0.5-2 (20-14)	20A
	3HP	4	9.6	3.5-5.5 (12 -10)	3.5-5.5 (12 -10)	0.5-2 (20-14)	20A
230V 3-phase	5HP	7.5	17.5	5.5 (10)	5.5 (10)	0.5-2 (20-14)	30A
	7.5HP	10.1	24	8 (8)	5.5-8 (10 -9)	0.5-2 (20-14)	50A
	10HP	13.7	32	8 (8)	5.5-8 (10 -9)	0.5-2 (20-14)	60A
	15HP	20.6	48	14 (6)	8 (8)	0.5-2 (20-14)	100A
	20HP	27.4	64	22 (4)	8 (8)	0.5-2 (20-14)	100A
	25HP	34	80	22 (4)	14 (6)	0.5-2 (20-14)	150A
	30HP	41	96	30 (2)	14 (6)	0.5-2 (20-14)	175A
	40HP	54	130	60 (2/0)	22 (4)	0.5-2 (20-14)	175A
460V 3-phase	1HP	2.2	2.6	2-5.5 (14 -10)	2-5.5 (14 -10)	0.5-2 (20-14)	15A
	2HP	3.4	4	2-5.5 (14 -10)	3.5-5.5 (12 -10)	0.5-2 (20-14)	15A
	3HP	4.1	4.8	2-5.5 (14 -10)	3.5-5.5 (12 -10)	0.5-2 (20-14)	15A
	5HP	7.5	8.7	2-5.5 (14 -10)	3.5-5.5 (12 -10)	0.5-2 (20-14)	15A
	7.5HP	10.3	12	3.5-5.5 (12 -10)	3.5-5.5 (12 -10)	0.5-2 (20-14)	20A
	10HP	12.3	15	5.5 (10)	5.5 (10)	0.5-2 (20-14)	30A
	15HP	20.6	24	8 (8)	8 (8)	0.5-2 (20-14)	30A
	20HP	27.4	32	8 (8)	8 (8)	0.5-2 (20-14)	50A
	25HP	34	40	8 (8)	8 (8)	0.5-2 (20-14)	75A
	30HP	41	48	14 (6)	8 (8)	0.5-2 (20-14)	100A
	40HP	54	64	22 (4)	8 (8)	0.5-2 (20-14)	100A
	50HP	68	80	22 (4)	14 (6)	0.5-2 (20-14)	125A
	60HP	82	96	38 (1)	14 (6)	0.5-2 (20-14)	175A
	75HP	110	128	60 (2/0)	22 (4)	0.5-2 (20-14)	175A

*1 : All rating shown are all Heavy Duty rated.

*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 leading to the terminals of the control board.

Note: To decrease the noise interference, be sure to add R-C surge suppressor (R: 10Ω/5W, C: 0.1μF/1000VDC) at the 2 terminals of coils of electromagnetic contactor.

■ External Circuit Wiring Precaution:

(A) Control Circuit Wiring:

- (1) Separate the control circuit leads from the main circuit leads (R/L1, S/L2, T/L3, U/T1, V/T2, W/T3) and other power cables to prevent erroneous operation caused by noise interference.
- (2) Separate the control circuit terminals leads RA-RB-RC (R1A-R2B-R2C) (contact output) from leads to terminals ①~⑧, A01, A02, GND, DO1, DO2 (R2A-R2C), DOG and 15V, VIN, AIN, AUX, GND, IP12, IG12, A (+), A (-).
- (3) Use twisted-pair or shielded twisted-pair cables for control circuits to prevent operating faults. Process the cable ends as shown in Figure 3. The maximum wiring distance should not exceed 150 feet.

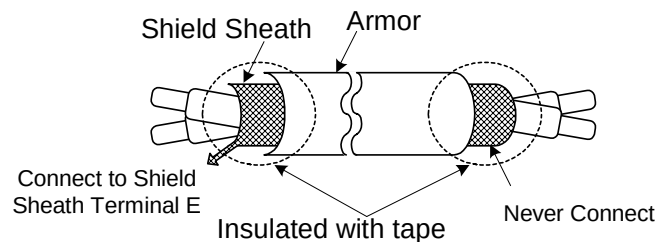


Figure 3 Shielded Wire Termination

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

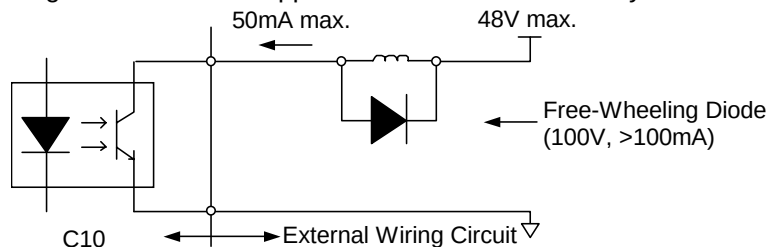


Figure 4 The Optical-Couplers Connect to an External Inductive Load

(B) Wiring the Main Circuit Terminals:

- (1) Phase rotation of input terminals R/L1, S/L2, T/L3 is possible in either direction. (Clockwise and Counter-Clockwise)
- (2) Never connect AC main circuit power supply to output terminals U/V1, V/T2 and W/T3.
- (3) Connect the output terminals U/T1, V/T2, W/T3 to motor lead wires U/T1, V/T2, and W/T3, respectively.
- (4) Check that the motor rotates forward with the forward run command. Switch over any 2 of the output terminals to each other and reconnect if the motor rotates in reverse with the forward run command.
- (5) Never connect power factor correction capacitors or EMI/RFI filters to the C10 output terminals

(C) Grounding:

- (1) Always use the ground terminal (E) with a ground resistance of less than 100 Ω .
- (2) Never ground C10 with other devices such as welding machines, motors, and other large-current electrical equipment, or ground pole. Run the ground lead in separate conduit from leads for large-current electrical equipment.
- (3) Always use ground leads that comply with AWG standards and make sure the length is as short as possible.
- (4) When using several C10 inverters side by side, it is preferable to ground each unit separately to ground poles. However, connecting all the ground terminals of C10 in parallel while only grounding one of the C10's to the ground pole is also permissible. (Figure 5) Be sure not to form a loop with the ground leads.

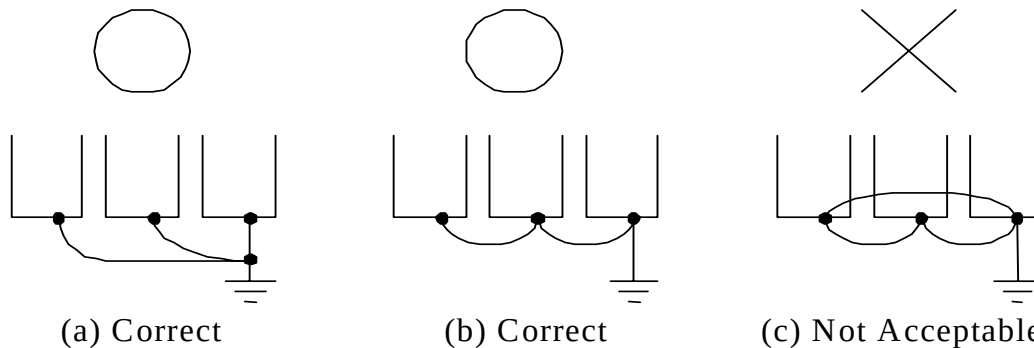


Figure 5 Grounding of C10 Inverters.

- 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 diameter wire suitable for the required length)
- Installing a Line Reactor
If the inverter is connected to a large-capacity power source (600kVA or more), install an optional Line Reactor on the input side of the inverter. This may also improve the power factor on the power supply side.
- If the cable between the inverter and the motor is excessively 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	< 100ft.	100-165ft.	166-328ft.	$\geq$ 329ft.
Carrier Frequency (Cn-34)	15kHz max (Cn-34=6)	10kHz max (Cn-34=4)	5kHz max (Cn-34=2)	2.5kHz (Cn-34=1)

1.8 Inverter Specifications

■ Basic Specifications

(a) 230V Series

Inverter (HP)		1	2	3	5	7.5	10	15	20	25	30	40
Max. Applicable Motor Output HP* ¹ (KW)		1 (0.75)	2 (1.5)	3 (2.2)	5.4 (4)	7.5 (5.5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)
Output Characteristics	Rated Output Capacity (KVA)	2	2.7	4	7.5	10.1	13.7	20.6	27.4	34	41	54
	Rated Output Current (A)	4.8	6.4	9.6	17.5	24	32	48	64	80	96	130
	Max. Output Voltage (V)	3-Phases, 200V~230V										
	Max. Output Frequency (Hz)	Through Parameter Setting 0.1~400.0 Hz										
Power Supply	Rated Voltage, Frequency	1/3-Phase 200V~240V, 50/60Hz				3-Phases, 200V~230V, 50/60Hz						
	Allowable Voltage Fluctuation	-15% ~ +10%										
	Allowable Frequency Fluctuation	±5%										

(b) 460V Series

Inverter (HP)		1	2	3	5	7.5	10	15	20	25	30	40	50	60	75
Max. Applicable Motor Output HP* ¹ (KW)		1 (0.75)	2 (1.5)	3 (2.2)	5.4 (4)	7.5 (5.5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	50 (37)	60 (45)	75 (55)
Output Characteristics	Rated Output Capacity (KVA)	2.2	3.4	4.1	7.5	10.3	12.3	20.6	27.4	34	41	54	68	82	110
	Rated Output Current (A)	2.6	4	4.8	8.7	12	15	24	32	40	48	64	80	96	128
	Max. Output Voltage (V)	3-Phases, 380V~460V													
	Max. Output Frequency (Hz)	Through Parameter Setting 0.1~400.0 Hz													
Power Supply	Rated Voltage, Frequency	3-Phases, 380V ~ 460V , 50/60Hz													
	Allowable Voltage Fluctuation	-15% ~ +10%													
	Allowable Frequency Fluctuation	±5%													

*1 Based on 4 pole motor

All specifications based Heavy Duty Rated (HP).

■ General Specifications

Control Characteristics	Operation Mode	Graphic LCD Panel with parameters copying (LED: option)
	Control Mode	Sinusoidal PWM
	Frequency Control Range	0.1Hz ~ 400Hz
	Frequency Accuracy (varied with temperature)	Digital Command: $\pm 0.01\%$ ($-10 \sim +40^{\circ}\text{C}$), Analog Command: $\pm 0.1\%$ ($25^{\circ}\text{C} \pm 10^{\circ}\text{C}$),
	Speed Control Accuracy	$\pm 0.1\%$ (V/F with PG feedback), $\pm 0.5\%$ (Sensorless Vector Control)
	Frequency Command Resolution	Digital Command: 0.01Hz Analog Command: 0.06Hz/60Hz
	Frequency Output Res.	0.01Hz
	Overload Curve	150% Rated Current for 1 Min
	Frequency Setting Signal	DC 0~+10V / 4~20mA, DC-10V~+10V and Pulse Input Frequency Command (Above 230V/460V 3HP)
	Acc./Dec. Time	0.0~6000.0 sec (Accel/Decel Time Can Be Set Independently)
	Voltage-Frequency Characteristics	V/F Curve Can Be Set Through Parameter Setting
	Regeneration Torque	Approx. 20%
	Basic Control Function	Restart After Momentary Power Loss, PID Control, Auto Torque Boost, Slip Compensation, RS_485 Communication, Speed Feedback Control, Simple PLC function, 2 Analog Output Port
	Extra Function	Cumulative Power on & Operation Hour memory, Energy Saving, Up/Down Operation, 4 Different sets of Fault Status Record (Including Latest one), MODBUS Communication, Multiple-Pulse Output Ports, Select Local/Remote, Customer Application Software Environment (C.A.S.E), SINK/SOURCE Interface.
Protection Function	Stall Prevention	During Acceleration/Deceleration and constant Speed Running (Current Level Can Be Selected During Acceleration and Constant Speed Running. During Deceleration, Stall Prevention Can Be Enabled or Disabled)
	Instantaneous Overcurrent	Stopped if above 200% Rated Current
	Motor Overload Protection	Electronic Overload Curve Protection
	Inverter Overload Protection	Stopped if above 150% Rated Current for 1 Min.
	Overvoltage	Stop if $\text{VDC} \geq 410\text{V}$ (230 Class) or $\text{VDC} \geq 820\text{V}$ (460 Class)
	Undervoltage	Stop if $\text{VDC} \leq 200\text{V}$ (230 Class) or $\text{VDC} \leq 400\text{V}$ (460 Class)
	Momentary Power Loss Ride-Through time	$\geq 15\text{ms}$, stop otherwise
	Overheat Protection	Protected by Thermistor
	Grounding Protection	Protection by DC Current Sensor
	Charge Indication (LED)	Lit when the DC Bus Voltage Above 50V
	Input Phase Loss (IPL)	Motor coasts to stop at Input Phase Loss
	Output Phase Loss (OPL)	Motor coasts to stop at Output Phase Loss
Environmental Condition	Application Site	Indoor (No Corrosive Gas And Dust Present)
	Ambient Temperature	$-10^{\circ}\text{C} \sim +40^{\circ}\text{C}$ (Not Frozen)
	Storage Temperature	$-20^{\circ}\text{C} \sim +60^{\circ}\text{C}$
	Ambient Humidity	Below 90%RH (Non-Condensing)
	Height, Vibration	Below 1000M, 5.9m/S^2 (0.6G), (JISC0911 Standard)
	Communication Function	RS-485 Installed (MODBUS Protocol)
	Encoder Feedback Interface	Built-in PG Feedback Interface and set to Open-collector Interface Drive or Complementary Interface Drive
	EMI	Meet EN 61800-3 With Specified EMI Filter
	EMS Compatibility	Meet EN 61800-3
	Option	PROFIBUS Card

Electrical Ratings For Heavy Duty (CT) and Normal Duty (VT)

C10 Model	Heavy Duty (150%, 1minute)			Normal Duty (110%, 1minute)		
	Max. Applic. Motor Output HP	Rated Output Current (A)	Max. Switching Freq. (kHz)	Max. Applic. Motor Output HP	Rated Output Current (A)	Max. Switching Freq. (kHz)
C102001-1	1	4.8 A	15	2	5.6 A	10
C102002-1	2	6.4 A	15	3	7.6 A	5
C102003-1	3	9.6 A	15	3	9.8 A	15
C102005-1	5	17.5 A	15	(5) 7.5	22.7 A	5
C102007-1	7.5	24 A	15	10	32 A	10
C102010-1	10	32 A	15	10	32 A	10
C102015-1	15	48 A	10	(15) 20	56.7 A	5
C102020-1	20	64 A	10	25	70.9 A	5
C102025-1	25	80A	10	30	80A	5
C102030-1	30	96A	10	40	108	5
C102040-1	40	130A	10	50	130A	10
C104001-1	1	2.6 A	15	2	2.9 A	10
C104002-1	2	4 A	15	3	4.6 A	5
C104003-1	3	4.8 A	15	3	4.9 A	15
C104005-1	5	8.7 A	15	(5) 7.5	12.5 A	5
C104007-1, C104007A-1	7.5	12 A	15	10	15.4 A	10
C104010-1, C104010A-1	10	15 A	15	15	22.7 A	5
C104015-1	15	24 A	10	20	30.3 A	5
C104020-1	20	32 A	10	25	38.0 A	5
C104025-1	25	40A	15	30	44A	5
C104030-1	30	48A	10	30	48A	5
C104040-1	40	64A	10	50	71A	5
C104050-1	50	80A	15	60	80A	5
C104060-1	60	96A	10	75	108A	5
C104075-1	75	128A	10	100	140A	5

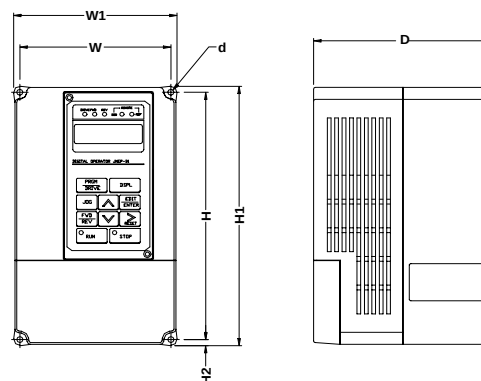
*Same as Heavy Duty (HD) setting (Sn-61=0)

Item	Common details	
	Heavy Duty Rated	Normal Duty Rated
Output Overload	150% for 60s	110% for 60s
Operation Ambient Temperature	+14 ~ 104°F	+14 ~ 104°F
Allowable Voltage Fluctuation	-15% ~ +10%	-15% ~ +10%
Output Frequency	0.5Hz ~ 400Hz	0.5Hz ~ 400Hz
V/F curve	Dependent on parameter setting	Variable (or Cubic) Torque

1.9 Dimensions

(A) For Compact Size Type 230V: 1-2HP(HD), 460V: 1-2HP(HD)

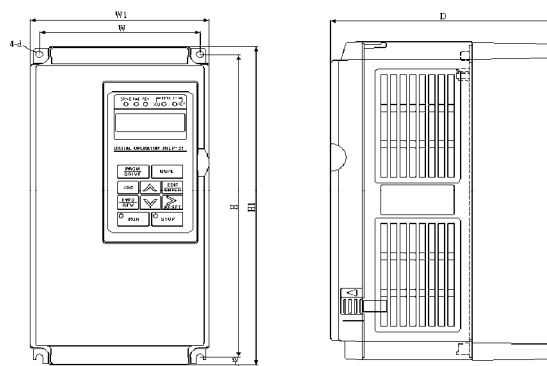
- C102001-1
- C102002-1
- C104001-1
- C104002-1



Voltage	Max. Applicable Motor Output (HP)	Mounting Dimensions (in.)				External Dimensions (in.)			Approx. Mass (lbs.)
		W	H	H2	D	W1	H1	D	
230V 1Ø/3Ø	1	4.80	8.15	0.20	M5	5.20	8.54	5.65	5
	2								
460V 3Ø	1	4.80	8.15	0.20	M5	5.20	8.54	5.65	5
	2								

(B) For Standard Type 230V: 3-10HP(HD), 460V: 3-10HP(HD)

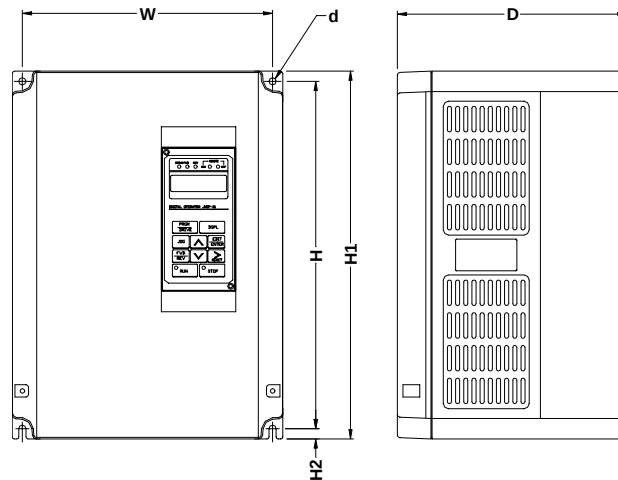
- C102003-1 through C102010-1
- C104003-1 through C104010-1



Voltage	Max. Applicable Motor Output (HP)	Mounting Dimensions (in.)				External Dimensions (in.)			Approx. Mass (lbs.)
		W	H	H2	D	W1	H1	D	
230V 1 $\emptyset$ / 3 $\emptyset$	3	4.96	10.47	0.27	M6	5.51	11.00	6.95	10
230V 3 $\emptyset$	5								
	7.5								
	10	7.76	11.26	0.28	M6	8.31	11.81	8.46	13
460V 3 $\emptyset$	3	4.96	10.47	0.27	M6	5.51	11.00	6.95	10
	5								
	7.5	7.76	11.26	0.28	M6	8.31	11.81	8.46	13
	10								

(C) For Type 230V: 15-25HP(HD), 460V: 15-30HP (HD)

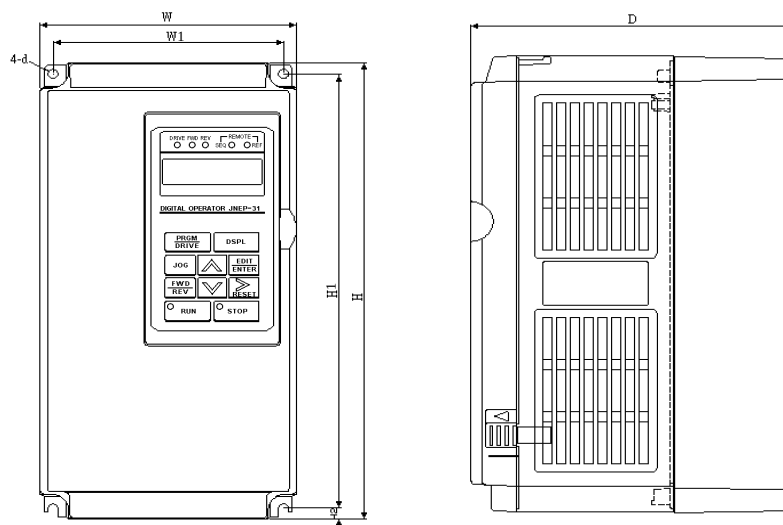
- C102015-1 • C102025-1 • C104015-1 • C104025-1
- C102020-1 • C104020-1 • C104030-1



Voltage	Max. Applicable Motor Output (HP)	Mounting Dimensions (in.)				External Dimensions (in.)			Approx. Mass (lbs.)
		W	H	H2	D	W1	H1	D	
230V 3 $\emptyset$	15	9.65	13.39	0.39	M6	10.43	14.17	8.84	24
	20/25								
460V 3 $\emptyset$	15	9.65	13.39	0.39	M6	10.43	14.17	8.84	24
	20/25/30								

(D) For Type 230V: 30-40HP(HD), 460V: 40-50HP(HD)

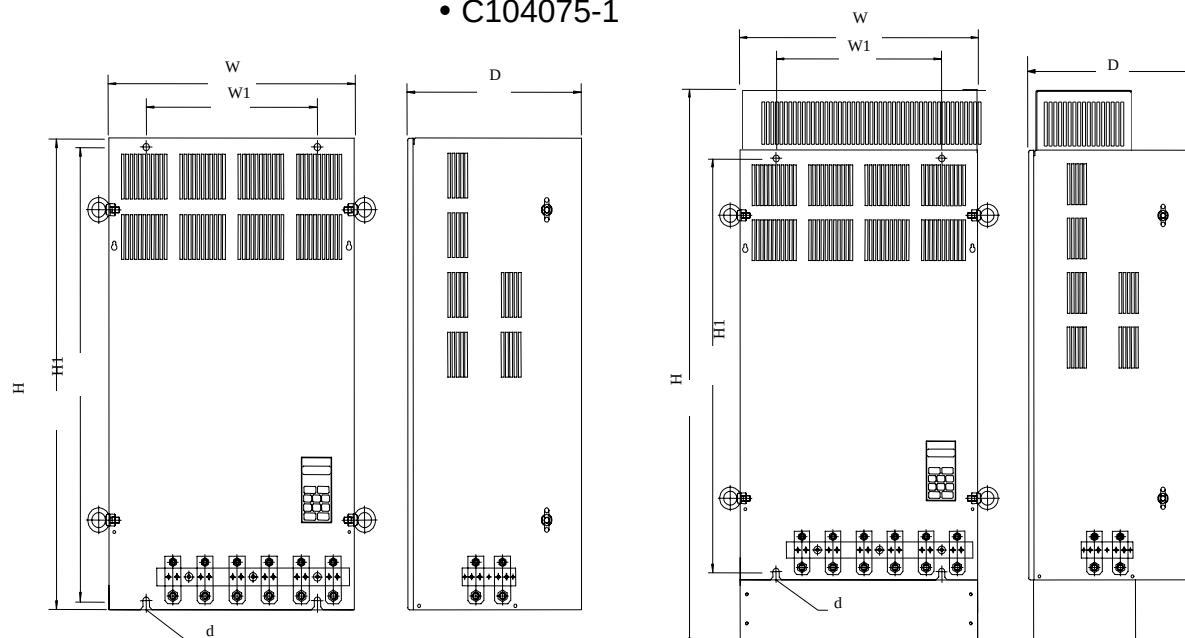
- C102030-1 • C104040-1
- C102040-1 • C104050-1



Voltage	Max. Applicable Motor Output (HP)	Mounting Dimensions (in.)				External Dimensions (in.)			Approx. Mass (lbs.)
		W	H	H2	D	W1	H1	D	
230V 3	30/40	10.59	25.47	0.39	M6	8.27	20.87	10.91	68
460V 3	40/50	10.59	25.47	0.39	M6	8.27	20.87	10.91	68

(E) For Type 230V: 50HP(HD), 460V: 60-75HP(HD)

- C102050-1 • C104060-1
- C104075-1



Voltage	Max. Applicable Motor Output (HP)	Mounting Dimensions (in.)				External Dimensions (in.)			Approx. Mass (lbs.)
		W	H	H2	D	W1	H1	D	
230V 3Ø	50	12.13	29.41	0.39	M6	9.84	24.80	11.10	104
460V 3Ø	60/75	12.13	29.41	0.39	M6	9.84	24.80	11.10	104

1.10 Peripheral Units

■ Braking Resistors

- (A) C10 230/460Vac units up to 20Hp, have built-in braking transistor and can be connected to a external braking resistor between B1/P and B2 (see Figure 6) when increased braking is required for the application
- (B) C10 230/460Vac units 25Hp and above need a braking module connected to (+ and – Terminals) and braking resistor if increased braking is required for the application.

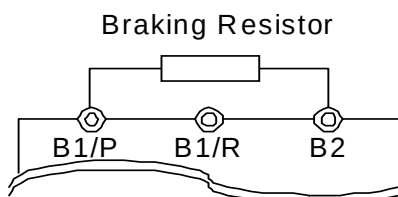


Figure 6 Wiring Diagram for External Braking Resistor (20Hp and Below)

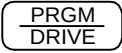
Table 4 Braking Resistor Selection Chart

C10 Inverter		Braking Model	Braking Resistor		Approximate Braking Torque (%)
Voltage	HP	Part Number	Part Number	Specification	
230Vac 1/3 Ø	1	-	005-4278	200W/200 Ω	125%, 3%ED
	2	-	005-4239	150W/35 Ω	125%, 3%ED
	3	-	005-4202	200W/70 Ω	120%, 3%ED
230Vac 3 Ø	5	-	005-4202	200W/70 Ω	100%, 3%ED
	7.5	-	005-4204	600W/36 Ω	100%, 10%ED
	10	-	005-4205	800W/22 Ω	100%, 10%ED
	15	-	005-4208	2400W/22 Ω	100%, 10%ED
	20	-	005-4209	3000W/14 Ω	100%, 10%ED
	25	909-0001	005-0606	4000W/5 Ω	125%, 10%ED
	30	909-0001	005-0606	4000W/5 Ω	125%, 10%ED
	40	909-0002	005-4249	7000W/3 Ω	100%, 10%ED
460Vac 3 Ø	1	-	005-2807	100W/750 Ω	130%, 3%ED
	2	-	005-2806	100W/300 Ω	125%, 3%ED
	3	-	005-4237	300W/300 Ω	115%, 3%ED
	5	-	005-4238	450W/200 Ω	110%, 3%ED
	7.5	-	005-4242	2 x 300W/60 Ω	105%, 10%ED
	10	-	2 x 005-4244	2 x 500W/40 Ω	100%, 10%ED
	15	-	2 x 005-4204	2 x 600W/36 Ω	100%, 10%ED
	20	-	2 x 005-4247	2 x 800W/25 Ω	100%, 10%ED
	25	909-0003	035-4217P	4000w / 22 Ω	125%, 10%ED
	30	909-0003	035-4217P	4000w / 22 Ω	125%, 10%ED
	40	909-0003	005-4263	7000W/14 Ω	125%, 10%ED
	50	909-0003	005-4252	9000W/ 10 Ω	125%, 10%ED
	60	909-0003	005-4252	9000W/ 10 Ω	125%, 10%ED
	75	909-0003	005-4254	1000W/9 Ω	125%, 10%ED

Note: HP ratings are shown in Heavy Duty Rated.
ED%: Braking Effective Period (Duty Cycle)

2. Using the LCD Digital Operator

■ Functions of LCD Digital Operator

JNEP-36 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 . In DRIVE mode, the operation is enabled. In PRGM mode, the parameter settings for operation can be changed but the operation is not enabled. The component names and functions are shown below:

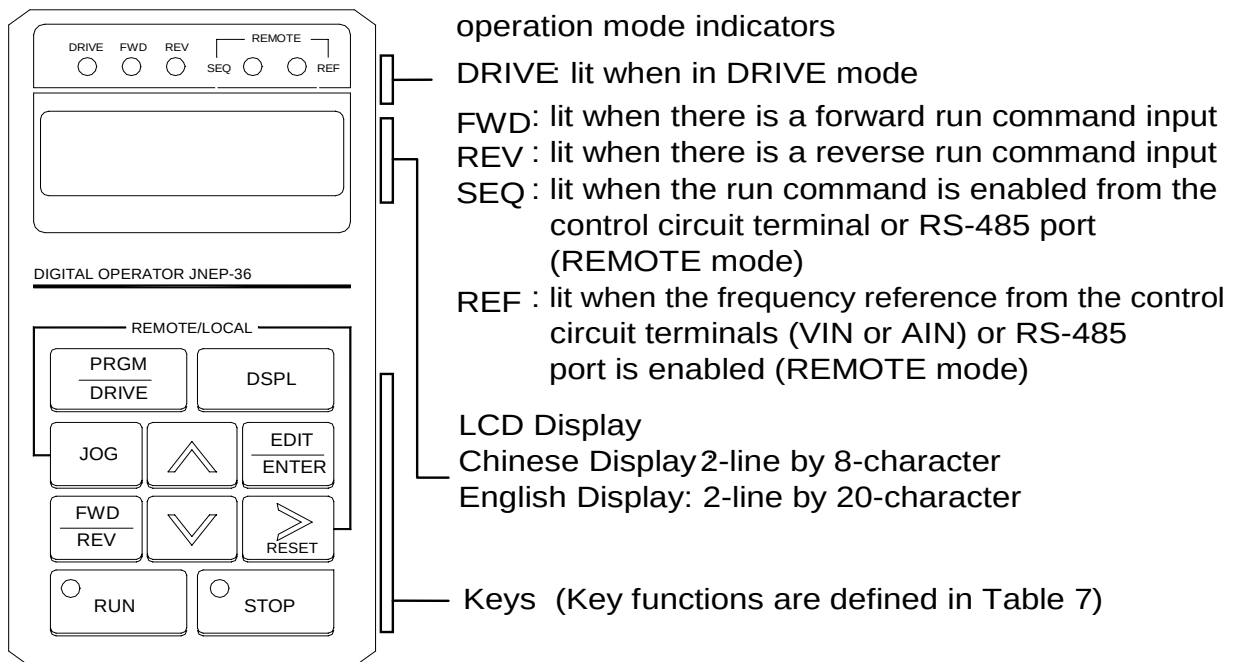


Figure 10 LCD Digital Operator

Local / Remote function:

When needed, the C10 drive can be switched from local to remote, or remote to local mode, via the keypad. The C10's Factory default mode is "Remote", the Run / Stop sequence commands and Frequency reference is initiated by the external terminals.

The "remote REF – SEQ LED's will be on "

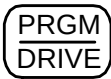
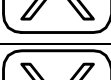
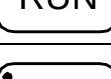
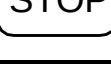
Start / Stop / Speed reference will be determined by parameters SN-04 and Sn-05.

By depressing the "Reset" and "Jog" keys at the same time, the command mode will be changed to "Local" where as the Start / Stop sequence command and

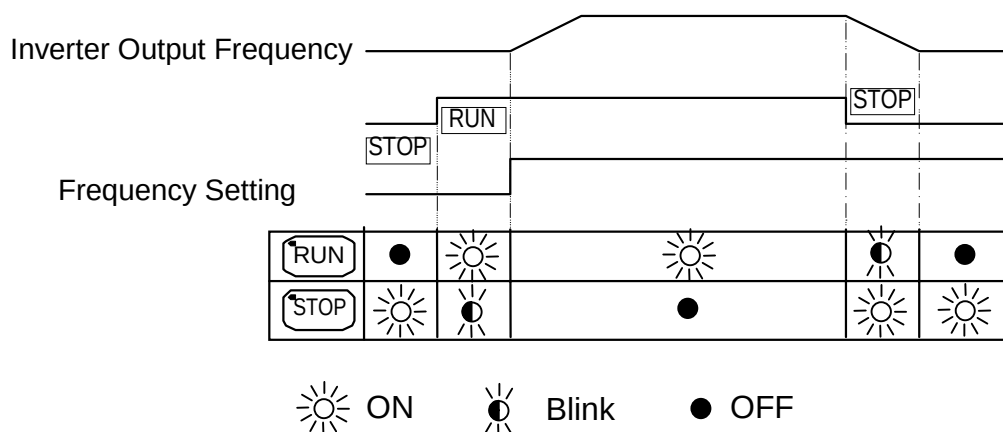
Speed reference will be initiated by the Keypad buttons. The “remote REF – SEQ LED’s will turn off ”

NOTE: if one of the “Multifunction Digital Input” values are set to a value of 23 or 24 (See parameters SN-25 through SN-28) the Digital Operator “Local /Remote” function will be disabled.

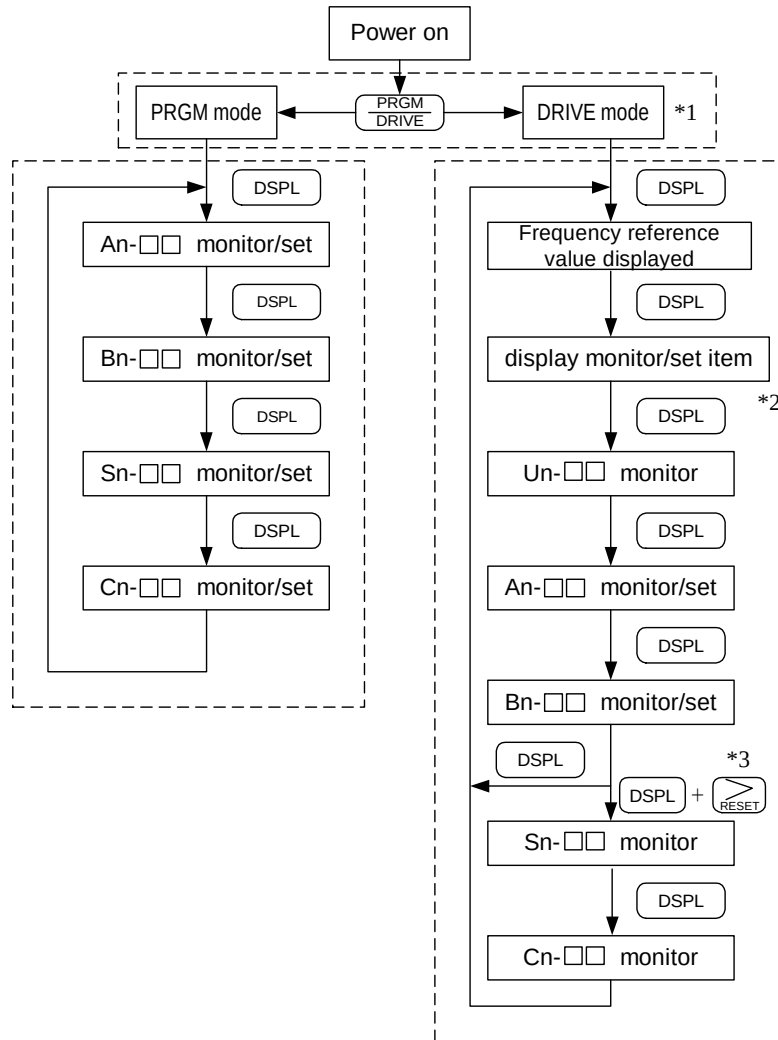
Table 7 Function Keys

Key	Name	Function
	PRGM/DRIVE Key	Switches between program mode (PRGM) and drive mode (DRIVE).
	DSPL Key	Displays operation status.
	JOG Key	Enables jog operation from LCD digital operator during operation (DRIVE).
	FWD/REV Key	Selects the rotation direction from LCD digital operator.
	RESET Key	Sets the number of digits for user constant settings. Also acts as the reset key when a fault has occurred.
	INCREMENT Key	Selects the menu items, groups, functions, user constant name, and increment set values.
	DECREMENT Key	Selects the menu items, groups, functions, user constant name, and decrement set values.
	EDIT/ENTER Key	Selects the menu items, groups, functions, user constants name, and set values (EDIT). After finishing the above action, press the (ENTER) key.
	RUN Key	Starts inverter operation in (DRIVE) mode when the digital operator is used. The LED will light.
	STOP Key	Stops inverter operation from LCD digital operator. The STOP key can be enabled or disabled by setting parameter Sn-07 when operating from the control circuit terminal.

RUN or STOP indicator lamp lights or blinks in accordance with the following operations:



■ Display Contents in DRIVE Mode and PRGM Mode



*1 When the inverter is powered up, the inverter system immediately enters into DRIVE mode. Press the key and the system will switch into PRGM mode. If a fault occurs, press the 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 key to 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 key and key, the setting values of Sn- and Cn-□□ will only be displayed for monitoring but not for changing or setting.

■ Parameter Description

The C10 has 4 groups of user parameters:

Parameters	Description
An-□□	Frequency command
Bn-□□	Parameter groups can be changed during running
Sn-□□	System parameter groups (can be changed only after stop)
Cn-□□	Control parameter groups (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	An	Bn,(Sn,Cn) ^{*2}	An	Bn,Sn,Cn

*1 : Factory Setting

*2 : When in DRIVE mode, the parameter group Sn-, Cn- can only be monitored if the  key and the  key are pressed simultaneously.

After a few trials and adjustments, the setting value Sn-03 is set to be “1” and need not be modified again. This prevents Bn, Sn, Cn constants from being changed. They will remain Read Only unless Sn-03 is changed to “0”.

■ Example of using LCD Digital Operator

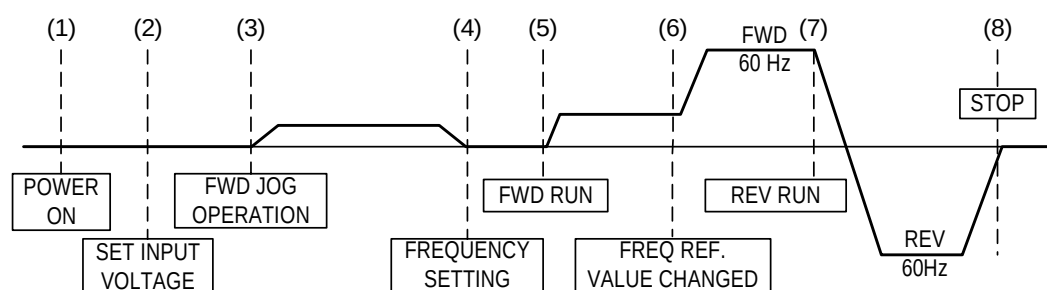
Note :

Before operation: Control parameter Cn-01 value must be set at the input AC voltage value.

For example, Cn-01=380 if AC input voltage is 380.

This example will explain the operation of the inverter according to the following time chart.

■ OPERATION MODE



■ EXAMPLE OF 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 460V) • Select CONTROL PARAMETER • Display Cn-01 setting • Input Voltage 460V (continued)	PRGM DRIVE DSPL press 3 times EDIT ENTER RESET EDIT ENTER	Freq. Cmd.000.00Hz SAFTRONICS An -01 Freq. Cmd. 1 Cn -01- Input Voltage Cn-01 = 440.0V Input Voltage Cn-01 = 460.0V Input Voltage Entry Accepted	LED DRIVE OFF Display for 0.5 sec

Description	Key Sequence	Digital Operator Display	Remark
(continued)			
(3) FWD JOG - Select DRIVE mode - Select output frequency displayed - Select direction of rotation (When power on, initially defaulted FWD) - Jog operation		Freq. Cmd.000.00Hz SAFTRONICS Freq. Cmd.0.00 Hz O/P Freq. 0.00 Hz O/P Freq. 6.00 Hz Freq. Cmd. 6.00 Hz	LED ON LED ON
(4) Frequency setting 15 Hz - Select frequency cmd displayed - Change frequency cmd - Set new frequency cmd	press 4 times	Freq. Cmd.000.00Hz SAFTRONICS Freq. Cmd.015.00Hz SAFTRONICS Freq. Cmd.015.00Hz SAFTRONICS Entry Accepted	Displayed for 0.5sec Confirm the display.
(5) FWD run - Select O/P frequency displayed - Running operation		O/P Freq. 0.00 Hz Freq. Cmd. 15.00 Hz O/P Freq. 15.00 Hz Freq. Cmd. 15.00 Hz	LED ON
(6) Frequency command change 60 Hz - Select frequency cmd displayed - Change reference value - Enter new frequency cmd setting		Freq. Cmd.015.00Hz SAFTRONICS Freq. Cmd.060.00Hz SAFTRONICS Freq. Cmd.060.00Hz SAFTRONICS Entry Accepted	Displayed for 0.5sec Confirm the display.
(7) REV RUN - Select frequency cmd displayed - Change to REV		O/P Freq. 60.00 Hz Freq. Cmd. 60.00 Hz O/P Freq. 60.00 Hz Freq. Cmd. 60.00 Hz	LED ON
(8) STOP Decrement to STOP		O/P Freq. 0.00 Hz Freq. Cmd. 60.00 Hz	LED ON (Blinking while decel.)

- Example of display (use  and  keys to display monitored items/contents)

Description	Key Sequence	Digital Operator Display	Remark
• Display Frequency Command		Freq. Cmd. 60.00Hz SAFTRONICS	
• Display Monitor Contents *1		Freq. Cmd. 60.00 Hz O/P Freq. 60.00 Hz	
• Display Output Current		Freq. Cmd. 60.00 Hz O/P I 12.5 A	
• Display Output Voltage		Freq. Cmd. 60.00 Hz O/P Volt. 220.0 V	
• Display DC Voltage		Freq. Cmd. 60.00 Hz DC Volt. 310.0 V	
• Display Output Voltage		Freq. Cmd. 60.00 Hz O/P Volt. 220.0 V	
• Display Output Current		Freq. Cmd. 60.00 Hz O/P I 12.5 A	

*1 The monitor contents can be selected by the setting of Bn-12 and Bn-13.

3. Parameter Setting

3.1 Frequency Command (in Multi-Speed Operation)

An^{*1}-□□

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

Parameter No.	Name	LCD Display (English)	Setting Range	Setting Unit ^{*2}	Factory Setting	Ref. Page
An-01	Frequency Command 1	An-01= 000.00Hz Freq. Cmd. 1	0.00~400.00Hz	0.01Hz	0.00Hz	81, 82 84, 86, 87, 97, 98
An-02	Frequency Command 2	An-02= 000.00Hz Freq. Cmd. 2	0.00~400.00Hz	0.01Hz	0.00Hz	
An-03	Frequency Command 3	An-03= 000.00Hz Freq. Cmd. 3	0.00~400.00Hz	0.01Hz	0.00Hz	
An-04	Frequency Command 4	An-04= 000.00Hz Freq. Cmd. 4	0.00~400.00Hz	0.01Hz	0.00Hz	
An-05	Frequency Command 5	An-05= 000.00Hz Freq. Cmd. 5	0.00~400.00Hz	0.01Hz	0.00Hz	
An-06	Frequency Command 6	An-06= 000.00Hz Freq. Cmd. 6	0.00~400.00Hz	0.01Hz	0.00Hz	
An-07	Frequency Command 7	An-07= 000.00Hz Freq. Cmd. 7	0.00~400.00Hz	0.01Hz	0.00Hz	
An-08	Frequency Command 8	An-08= 000.00Hz Freq. Cmd. 8	0.00~400.00Hz	0.01Hz	0.00Hz	
An-09	Frequency Command 9	An-09= 000.00Hz Freq. Cmd. 9	0.00~400.00Hz	0.01Hz	0.00Hz	
An-10	Frequency Command 10	An-10= 000.00Hz Freq. Cmd. 10	0.00~400.00Hz	0.01Hz	0.00Hz	
An-11	Frequency Command 11	An-11= 000.00Hz Freq. Cmd. 11	0.00~400.00Hz	0.01Hz	0.00Hz	
An-12	Frequency Command 12	An-12= 000.00Hz Freq. Cmd. 12	0.00~400.00Hz	0.01Hz	0.00Hz	
An-13	Frequency Command 13	An-13= 000.00Hz Freq. Cmd. 13	0.00~400.00Hz	0.01Hz	0.00Hz	
An-14	Frequency Command 14	An-14= 000.00Hz Freq. Cmd. 14	0.00~400.00Hz	0.01Hz	0.00Hz	
An-15	Frequency Command 15	An-15= 000.00Hz Freq. Cmd. 15	0.00~400.00Hz	0.01Hz	0.00Hz	
An-16	Frequency Command 16	An-16= 000.00Hz Freq. Cmd. 16	0.00~400.00Hz	0.01Hz	0.00Hz	
An-17	Jog Frequency Command	An-17= 000.00Hz Jog Command.	0.00~400.00Hz	0.01Hz	6.00Hz	81, 82, 84

*1. At factory setting, the value of "Setting Unit" is 0.01Hz.

*2. The displayed "Setting Unit" can be changed through parameter Cn-28.

3.2 Parameters Groups That Can Be Changed during Running Bn-□□

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

Function	Parameter No.	Name	LCD Display (English)	Setting Range	Setting Unit	Factory Setting	Ref. Page
Acc/Dec Time	Bn-01	Acceleration Time 1	Bn-01= 0010.0s Acc. Time 1	0.0~6000.0s	0.1s	10.0s	39
	Bn-02	Deceleration Time 1	Bn-02= 0010.0s Dec. Time 1	0.0~6000.0s	0.1s	10.0s	
	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 Cmd. Gain (Voltage)	Bn-05= 0100.0% Term. VIN Cmd. Gain	0.0~1000.0%	0.1%	100.0%	39
	Bn-06	Analog Frequency Cmd. Bias (Voltage)	Bn-06= 000.0% Term. VIN Cmd. Bias	-100.0%~100.0%	0.1%	0.0%	
	Bn-07	Analog Frequency Cmd. Gain (Current)	Bn-07= 0100.0% Term. AIN Cmd. Gain	0.0~1000.0%	0.1%	100.0%	
	Bn-08	Analog Frequency Cmd. Bias (Current)	Bn-08= 000.0% Term. AIN Cmd. Bias	-100.0%~100.0%	0.1%	0.0%	
Multi-Function Analog Input	Bn-09	Multi-Function Analog Input Gain	Bn-09= 0100.0% Term. AUX ~Gain	0.0~1000.0%	0.1%	100.0%	39
	Bn-10	Multi-Function Analog Input Bias	Bn-10= 000.0% Term. AUX ~Bias	-100.0%~100.0%	0.1%	0.0%	
Torque Boost	Bn-11	Auto Torque Boost Gain	Bn-11= 0.5 Auto Boost Gain	0.0~2.0	0.1	0.5	40
Monitor	Bn-12	Monitor 1	Bn-12= 01 Display: Freq.Cmd.	1~18	1	1	41
	Bn-13	Monitor 2	Bn-13= 02 Display: O/P Freq.	1~18	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	42
	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 Cmd. Gain	0.01~10.00	0.01	1.00	42
	Bn-17	PID Proportional Gain	Bn-17= 01.00 PID P Gain	0.01~10.00	0.01	1.00	
	Bn-18	PID Integral Tme	Bn-18= 10.00s PID I Time	0.00~100.00s	0.01s	10.00s	

Function	Parameter No.	Name	LCD Display (English)	Setting Range	Setting Unit	Factory Setting	Ref. Page
PID Control	Bn-19	PID Differential Time	Bn-19= 0.00s PID D Time	0~1.00s	0.01s	0.00s	42
	Bn-20	PID Bias	Bn-20= 0% PID Bias	0~109%	1%	0%	
Auto Run Time Function	Bn-21	1st Step Time Under Auto Run Mode	Bn-21= 0000.0s Run Time 1	0.0~6000.0s	0.1s	0.0s	43, 101, 102
	Bn-22	2nd Step Time Under Auto Run Mode	Bn-22= 0000.0s Run Time 2	0.0~6000.0s	0.1s	0.0s	
	Bn-23	3rd Step Time Under Auto Run Mode	Bn-23= 0000.0s Run Time 3	0.0~6000.0s	0.1s	0.0s	
	Bn-24	4th Step Time Under Auto Run Mode	Bn-24= 0000.0s Run Time 4	0.0~6000.0s	0.1s	0.0s	
	Bn-25	5th Step Time Under Auto Run Mode	Bn-25= 0000.0s Run Time 5	0.0~6000.0s	0.1s	0.0s	
	Bn-26	6th Step Time Under Auto Run Mode	Bn-26= 0000.0s Run Time 6	0.0~6000.0s	0.1s	0.0s	
	Bn-27	7th Step Time Under Auto Run Mode	Bn-27= 0000.0s Run Time 7	0.0~6000.0s	0.1s	0.0s	
	Bn-28	8th Step Time Under Auto Run Mode	Bn-28= 0000.0s Run Time 8	0.0~6000.0s	0.1s	0.0s	
	Bn-29	9th Step Time Under Auto Run Mode	Bn-29= 0000.0s Run Time 9	0.0~6000.0s	0.1s	0.0s	
	Bn-30	10th Step Time Under Auto Run Mode	Bn-30= 0000.0s Run Time 10	0.0~6000.0s	0.1s	0.0s	
	Bn-31	11th Step Time Under Auto Run Mode	Bn-31= 0000.0s Run Time 11	0.0~6000.0s	0.1s	0.0s	
	Bn-32	12th Step Time Under Auto Run Mode	Bn-32= 0000.0s Run Time 12	0.0~6000.0s	0.1s	0.0s	
	Bn-33	13th Step Time Under Auto Run Mode	Bn-33= 0000.0s Run Time 13	0.0~6000.0s	0.1s	0.0s	
	Bn-34	14th Step Time Under Auto Run Mode	Bn-34= 0000.0s Run Time 14	0.0~6000.0s	0.1s	0.0s	
	Bn-35	15th Step Time Under Auto Run Mode	Bn-35= 0000.0s Run Time 15	0.0~6000.0s	0.1s	0.0s	
	Bn-36	16th Step Time Under Auto Run Mode	Bn-36= 0000.0s Run Time 16	0.0~6000.0s	0.1s	0.0s	
Timer Function	Bn-37	Timer Function On Delay Time	Bn-37= 0000.0s ON Delay Setting	0.0~6000.0s	0.1s	0.0s	44
	Bn-38	Timer Function Off Delay Time	Bn-38= 0000.0s OFF Delay Setting	0.0~6000.0s	0.1s	0.0s	
Energy Saving	Bn-39	Energy Saving Gain	Bn-39= 100% Eg. Saving Gain	50~150%	1%	100%	44
Monitor	Bn-40	Monitor 3	Bn-40=3 Display: O/P Freq.	1~18	1	3	41

Acceleration Time 1 (Bn-01)

Deceleration Time 1 (Bn-02)

Acceleration Time 2 (Bn-03)

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 Input Terminals ⑤~⑧, the Acceleration/Deceleration can be switched between 2 sectors even in the running status.

Output Frequency

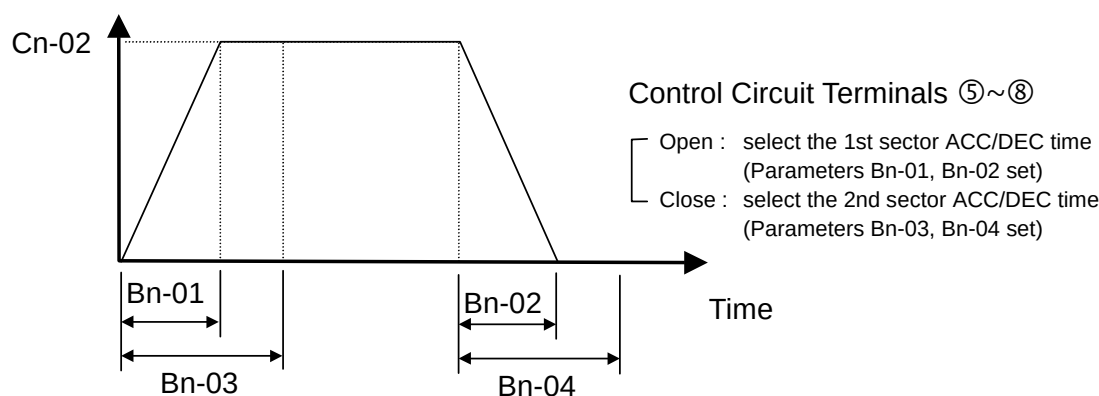


Figure 11 Acceleration and Deceleration Time

- Note : 1. To set the S-Curve characteristics function, please refer to page 61.
2. The S-Curve characteristic times can be set respectively for beginning-accel. end-accel., beginning-decel., and end-decel. through the parameters setting of Cn-41~Cn-44.

Analog Frequency Command Gain (Voltage)	(Bn-05)
Analog Frequency Command Bias (Voltage)	(Bn-06)
Analog Frequency Command Gain (Current)	(Bn-07)
Analog Frequency Command Bias (Current)	(Bn-08)
Multi-Function Analog Input Gain	(Bn-09)
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.

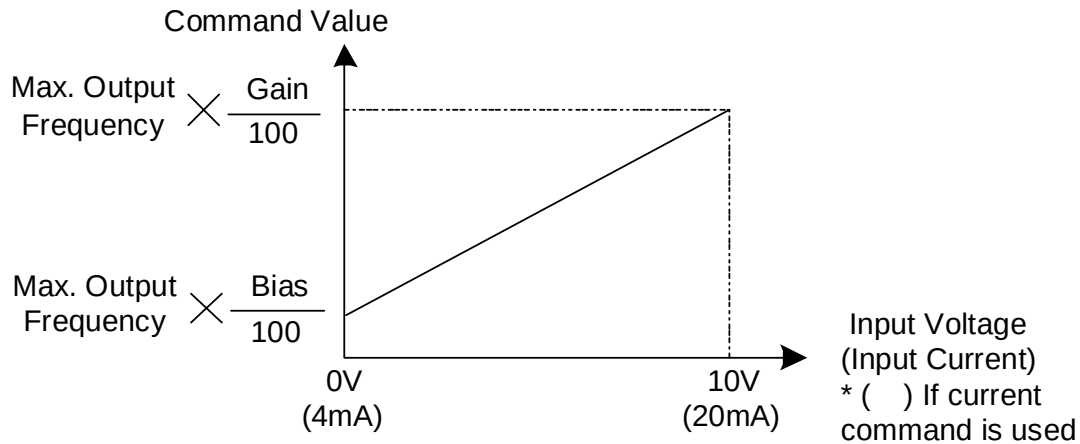


Figure 12 Analog Input Gain and Bias

Auto Torque Boost Gain (Bn-11)

- The inverter can increase the output torque to compensate for load increase automatically through the Auto Torque Boost function. Then the output voltage will increase. As a result, the fault trip cases will be decreased. The energy efficiency is also improved. In the case that the wiring distance between the inverter and the motor is too long (e.g. more than 328ft.), the motor torque can be 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.

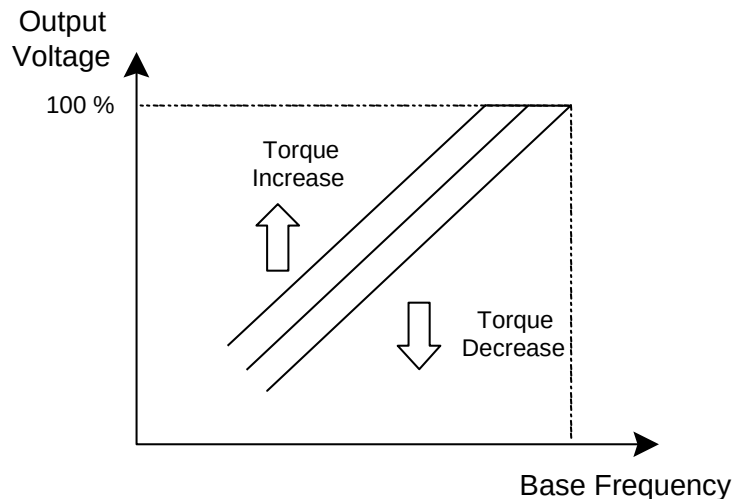


Figure 13 Adjust the Auto Torque Boost Gain Bn-11 to increase the output torque.

- If the driven motor capacity is less than the inverter capacity (Max. applicable motor capacity), you may raise the setting.
- If the motor generates excessive oscillation, lower the setting.

Monitor 1 (Bn-12)

Monitor 2 (Bn-13)

Monitor 3 (Bn- 40)

- In the DRIVE mode, 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 8.

• Example:

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

Note : While monitoring, use the  or  key to show the next lower-row displayed. (The setting of Bn-12 and Bn-13 does not change.)

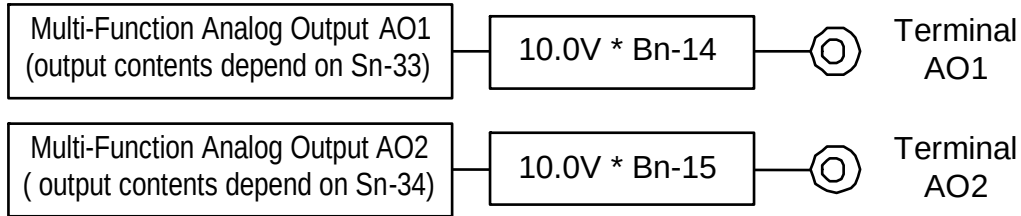
Table 8

Setting	Monitoring Contents	Setting	Monitoring Contents
Bn-12= 01	Freq. Cmd.	Bn-13= 01	Freq. Cmd.
Bn-12= 02	O/P Freq.	Bn-13= 02	O/P Freq.
Bn-12= 03	O/P I	Bn-13= 03	O/P I
Bn-12= 04	O/P V	Bn-13= 04	O/P V
Bn-12= 05	DC Volt	Bn-13= 05	DC Volt
Bn-12= 06	Term. VIN	Bn-13= 06	Term. VIN
Bn-12= 07	Term. AIN	Bn-13= 07	Term. AIN
Bn-12= 08	Term. AUX	Bn-13= 08	Term. AUX
Bn-12= 09	~ Output(AO1)	Bn-13= 09	~ Output(AO1)
Bn-12= 10	~ Output(AO2)	Bn-13= 10	~ Output(AO1)
Bn-12= 11	I/P Term	Bn-13= 11	I/P Term
Bn-12= 12	O/P Term	Bn-13= 12	O/P Term
Bn-12= 13	Sp. FBK	Bn-13= 13	Sp. FBK
Bn-12= 14	Sp. Compen.	Bn-13= 14	Sp. Compen.
Bn-12= 15	PID I/P	Bn-13= 15	PID I/P
Bn-12= 16	PID O/P(Un-16)	Bn-13= 16	PID O/P(Un-16)
Bn-12= 17	PID O/P(Un-17)	Bn-13= 17	PID O/P(Un-17)
Bn-12= 18	Motor Sp.	Bn-13= 18	Motor Sp.

Multi-Function Analog Output AO1 Gain (Bn-14)

Multi-Function Analog Output AO1 Gain (Bn-15)

- Multi-Function Analog Output AO1 and AO2 can be set for their individual voltage level respectively.



PID Detection Gain (Bn-16)

PID Proportional Gain (Bn-17)

PID Integral Time (Bn-18)

PID Derivative Time (Bn-19)

PID Bias (Bn-20)

- The PID Control Function is a control system that matches a feedback value (i.e., a detected value) to the set target value. Combining the Proportional (P), Integral (I) and Derivative (D) control enable the control to achieve required response with the constant setting and tuning procedure of PID Proportional Gain Bn-17, PID Integral Time Bn-18 and PID Derivative Time Bn-19.
- See Appendix Page 117 for “PID Parameter Setting”.
- Figure 14 is a Block Diagram of the inverters’ internal PID Control.
- If both the target value and feedback value are set to 0, adjust the inverter output frequency to zero.

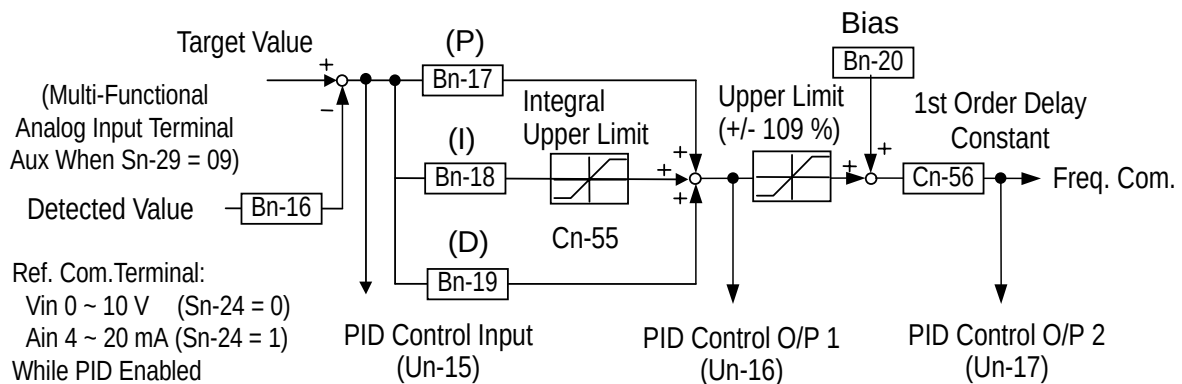


Figure 14 Block Diagram for PID Control in C10

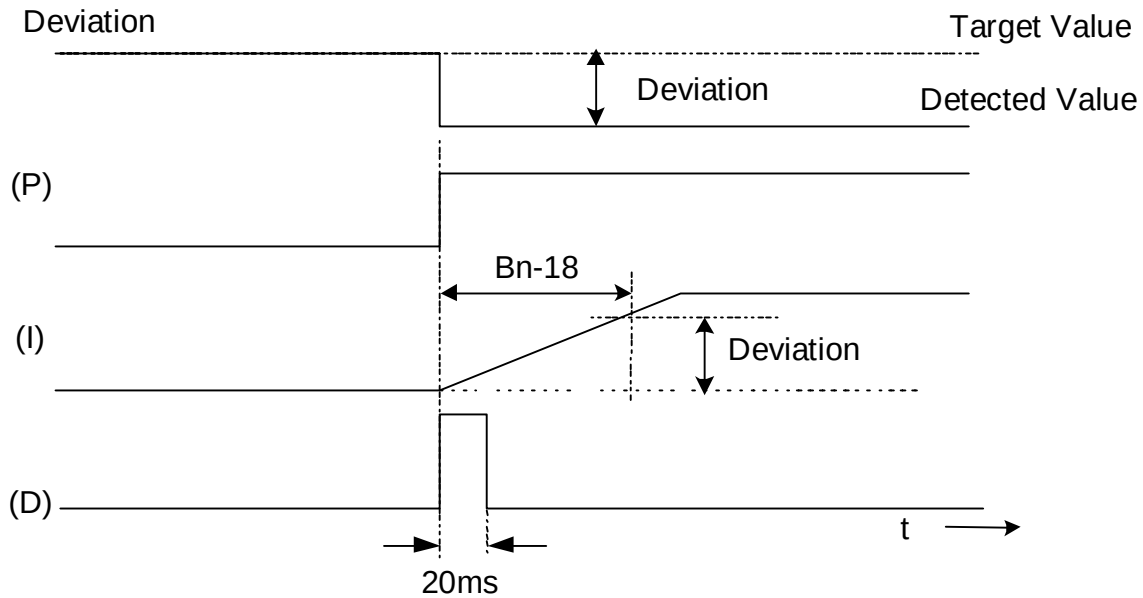


Figure 15 Response of PID Control for STEP-Shape (Deviation) Input

- Deviation = Target Value – Detected Value × Bn-16.
- P's Control Output = Deviation × Bn-17.
- I's Control Output will increase with time and the output will be equal to the deviation after time specified by parameter Bn-18.

The parameter Cn-55 will prevent the calculated value of the Integral Control (with the Integral Time Bn-18) in the PID Control from exceeding the fixed amount.

- D's Control Output = Difference × $\left(\frac{\text{Bn-19}}{5\text{m sec}} \right)$

Note : To enable PID Function, parameter Sn-64 must be set to 1.

Time Setting in Auto Run Mode (Bn-21~Bn-36)

- In Auto Run Mode, the time setting for individual step is described on Page 102. (Auto Run Mode Selection and Enable (Sn-44~60)).

Timer ON Delay Time(Bn-37)

Timer OFF Delay Time (Bn-38)

- The Timer Function is enabled when the Timer Function input setting (Sn-25~28=19) and its Timer Function output setting (Sn-30~32=21) are set for the Multi-Function Input and 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 time is longer than the value set for Bn-37, the Timer Function output turns ON.
- When the Timer Function input OFF time is longer than the value set for Bn-38, the Timer Function output turns OFF. An example is shown in Figure 16.

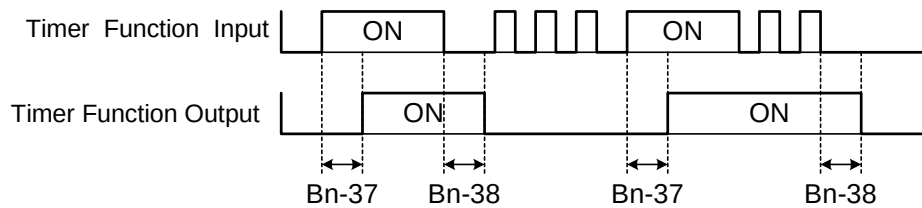


Figure 16 Timer Function

Energy Saving Gain (Bn-39)

- The Energy Saving command, when used for a light load, causes the inverter output voltage to be reduced resulting in an energy savings. Set this value as a percentage of the V/F pattern. The setting range is 50~150%. The factory setting is 100% when 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 $\neq$ 100), the output voltage will automatically decrease and be proportional to Energy Saving Gain Bn-39. The Bn-39 setting should be large enough to avoid stalling the motor.
- The Energy Saving Function is disabled in the PID Closed-Loop Control and during Acceleration and Deceleration.

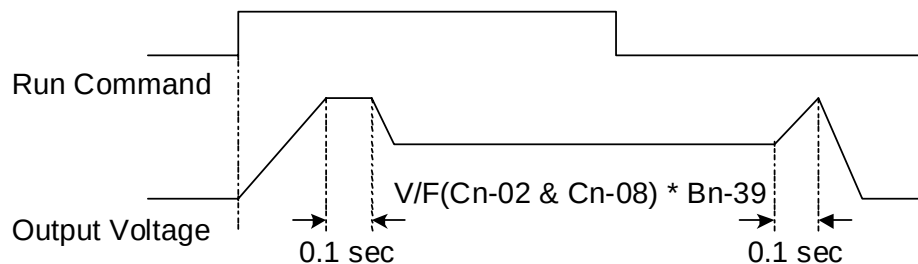


Figure 17 Time Chart for Energy Saving Operation

3.3 Control Parameters Cn-

Function	Parameter No.	Name	LCD Display (English)	Setting Range	Setting Unit	Factory Setting	Ref. Page
V/F Pattern Setting	Cn-01	Input Voltage	Cn-01= 220.0V Input Voltage	150.0~255.0V ^{*2}	0.1V	220.0V ^{*1}	48
	Cn-02	Max. Output Frequency	Cn-02= 060.0Hz Max. O/P Freq.	50.0~400.0Hz	0.1Hz	60.0Hz	
	Cn-03	Max. Output Voltage	Cn-03= 220.0Hz Max. Voltage	0.1~255.0V ^{*2}	0.1V	220.0V ^{*1}	
	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	Voltage at Middle Output Frequency	Cn-06= 014.9V Middle Voltage	0.1~255.0V ^{*2}	0.1V	14.9V ^{*1}	
	Cn-07	Min. Output Frequency	Cn-07= 001.5Hz Min. O/P Freq.	0.1~400.0Hz	0.1Hz	1.5Hz	
	Cn-08	Voltage at Min. Output Frequency	Cn-08= 007.9V Min. Voltage	0.1~255.0V ^{*2}	0.1V	7.9V ^{*1}	
Motor Parameter	Cn-09	Motor Rated Current	Cn-09= 0003.3A Motor Rated I	*3	0.1A	3.3A ^{*4}	48
	Cn-10	No Load Current of Motor	Cn-10= 30% Motor No Load I	0~99%	1%	30%	49
	Cn-11	Rated Slip of Motor	Cn-11= 0.0% Motor Rated Slip	0~9.9%	0.1%	0.0%	49
	Cn-12	Line-to-Line Resistance of Motor	Cn-12= 05.732Ω Motor Line R	0~65.535Ω	0.001 Ω	5.732 ^{*4}	50
	Cn-13	Torque Compensation of Core Loss	Cn-13= 0064W Core Loss	0~65535W	1W	64 ^{*4}	
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	50
	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. Cmd. Up Bound	0~109%	1%	100%	51
	Cn-19	Frequency Command Lower Bound	Cn-19= 000% Freq. Cmd. 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	52
	Cn-21	Frequency Jump Point 2	Cn-21= 000.0Hz Freq. Jump 2	0.0~400.0Hz	0.1Hz	0.0Hz	

C10
Custom AC Drive

Function	Parameter No.	Name	LCD Display (English)	Setting Range	Setting Unit	Factory Setting	Ref. Page
Frequency Jump	Cn-22	Frequency Jump Point 3	Cn-22= 000.0Hz Freq. Jump 3	0.0~400.0Hz	0.1Hz	0.0Hz	52
	Cn-23	Jump Frequency Width	Cn-23= 01.0Hz Freq. Jump Width	0.0~25.5Hz	0.1Hz	1.0Hz	
Retry Function	Cn-24	Number of Auto Restart Attempts	Cn-24= 00 Retry Times	0~10	1	0	52
Stall Prevention	Cn-25	Stall Prevention During Acceleration	Cn-25= 170% Acc. Stall	30~200%	1%	170%	53
	Cn-26	Stall Prevention During Running	Cn-26= 160% Run Stall	30~200%	1%	160%	
Comm. Fault Detection	Cn-27	Communication Fault Detection Time	Cn-27=01.0s Comm. Fault Det. Time	0.1~25.5s	0.1s	1s	
Display Unit	Cn-28	LCD Digital Operator Display Unit	Cn-28= 00000 Operator Disp. Unit	0-39999	1	0	55
Frequency Agree Detection	Cn-29	Freq. Agree Detection Level During Accel.	Cn-29= 000.0Hz Acc. Freq. Det. Level	0.0~400.0Hz	0.1Hz	0.0Hz	56
	Cn-30	Freq. Agree Detection Level During Decel.	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 Agreed 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%	57
	Cn-33	Overtorque Detection Time	Cn-33= 00.1s Over Tq. Det. Time	0.0~25.5s	0.1s	0.1s	
Carrier Frequency	Cn-34	Carrier Frequency Setting	Cn-34= 6 Carry Freq. Setting	1~6	1	6	58
Speed Search Control	Cn-35	Speed Search Detection Level	Cn-35= 150% Sp_Search Level	0~200%	1%	150%	58
	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= 200V Low Volt. Det. Level	150~210V	1V	200V ^{*1}	61
Slip Comp.	Cn-40	Slip Compensation Primary Delay Time	Cn-40= 02.0s Slip Filter	0.0~25.5s	0.1s	2.0s	61
S-Curve Time	Cn-41	S-curve Characteristic Time at Accel. Start	Cn-41= 0.0s S1 Curve Time	0.0~1.0s	0.1s	0.0s	61
	Cn-42	S-curve Characteristic Time at Accel. End	Cn-42= 0.0s S2 Curve Time	0.0~1.0s	0.1s	0.0s	
	Cn-43	S-curve Characteristic Time at Decel. Start	Cn-43= 0.0s S3 Curve Time	0.0~1.0s	0.1s	0.0s	
	Cn-44	S-curve Characteristic Time at Decel. End	Cn-44= 0.0s S4 Curve Time	0.0~1.0s	0.1s	0.0s	

Function	Parameter No.	Name	LCD Display (English)	Setting Range	Setting Unit	Factory Setting	Ref. 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	62
	Cn-46	No. of Motor Poles	Cn-46= 04P Motor Pole	2~32P	2P	4 P	
	Cn-47	ASR Proportional Gain 1	Cn-47= 0.00 ASR Gain 1	0.00~2.55	0.01	0.00	
	Cn-48	ASR Integral Gain 1	Cn-48= 01.0s ASR Integral. Time 1	0.1~10.0S	0.1s	1.0s	
	Cn-49	ASR Proportional Gain 2	Cn-49= 0.02 ASR Gain 2	0.00~2.55	0.01	0.02	
	Cn-50	ASR Integral Gain 2	Cn-50= 01.0s ASR Integral. Time 2	0.1~10.0S	0.1s	1.0s	
	Cn-51	ASR Upper Bound	Cn-51= 05.0% ASR Upper Bound	0.1~10.0%	0.1%	5.0%	63
	Cn-52	ASR Lower Bound	Cn-52= 00.1% ASR Lower Bound	0.1~10.0%	0.1%	0.1%	
	Cn-53	Excessive Speed Deviation Detection Level	Cn-53= 10% Speed Deviat. Det. Level	1~50%	1%	10%	
	Cn-54	Overspeed Detection Level	Cn-54= 110% Overspeed Det. Level	1~120%	1%	110%	
PID Control	Cn-55	PID Integral Upper Bound	Cn-55= 100% PID I-Upper	0~109%	1%	100%	63
	Cn-56	PID Primary Delay Time Constant	Cn-56= 0.0s PID Filter	0.0~2.5s	0.1s	0.0s	
Sensorless Vector Control	Cn-57	Motor Line-to-Line Resistance (R1)	Cn-57= 02.233Ω Motor Line Resistance	0.001~60.000Ω	0.001Ω	2.233Ω ^{*4}	64
	Cn-58	Motor Rotor Equivalent Resistance (R2)	Cn-58= 01.968Ω Motor Rotor Resistance	0.001~60.000Ω	0.001Ω	1.968Ω ^{*4}	
	Cn-59	Motor Leakage Inductance (Ls)	Cn-59= 9.6mH Motor Leakage X	0.01~200.00mH	0.01mH	9.6mH ^{*4}	
	Cn-60	Motor Mutual Inductance (Lm)	Cn-60= 149.7mH Motor Mutual X	0.1~6553.5mH	0.1mH	149.7mH ^{*4}	64
	Cn-61	Slip Compensation Gain	Cn-61= 1.00 Slip Compensation Gain	0.00~2.55	0.01	1.00	

*1 For 230V Class C10. Value(*1) for a 460V Class C10 is double.

*2 For 230V Class C10. Value(*2) for a 460V Class C10 is double.

*3 Setting range is 10% ~200% of the inverter rated current.

*4 Factory setting values will vary based upon the inverter capacity selection (Sn-01) value.
In this case, the setting is for a 4-pole, 230V, 60Hz, 1Hp Safronics Standard Induction Motor.

Input Voltage Setting (Cn-01)

- Set Inverter Voltage to match power supply voltage at input side (e.g. : 200V/208V/220V/230V, 380V/415V/440V/460V)

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 Figure 18. The factory setting is straight line for the V/F Curve. (Cn-05=Cn-07, Cn-06 is not used) as shown below (230V/60Hz case).

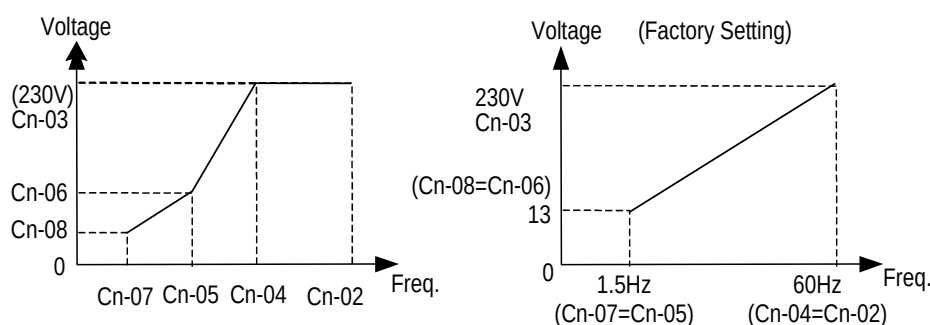


Figure 18 User-Defined V/F Curve

- In low speed operation (<3Hz), a larger torque can be generated by increasing the slope of the V/F Curve. However, the motor temperature will increase 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.

(a) Max. Output Freq. $\geq$ Max. Voltage Freq. $>$ Mid. Output Freq. $\geq$ Min. Output Freq.
(Cn-02) (Cn-04) (Cn-05) (Cn-07)

(b) Max. Output Voltage $\geq$ Mid. Output Voltage $>$ Min. Output Voltage
(Cn-03) (Cn-06) (Cn-08)
- If Mid. Output Frequency (Cn-05) = Min. Output Frequency (Cn-07), the setting (Cn-06) will not be effective.

Motor Rated Current (Cn-09)

- Electronic Overload Thermal Reference Current
- The factory setting depends upon the capacity of the inverter (Sn-01).
- The setting range is 10%~200% of the inverter rated output current.
- Set the rated current shown on motor nameplate if not using a Standard 4-Pole Motor.

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%).
- Slip compensation is enabled when the output current is greater than Motor No-Load Current (Cn-10). The output frequency will shift from f1 to f2 (>f1) for the positive change of load torque. (See Figure 19)
- Slip Compensation = $\frac{\text{Motor Rated Slip (Cn-11)} \times (\text{Output Current} - \text{Motor No-Load Current (Cn-10)})}{\text{Motor Rated Current (Cn-09)} - \text{Motor No-Load Current (Cn-10)}}$

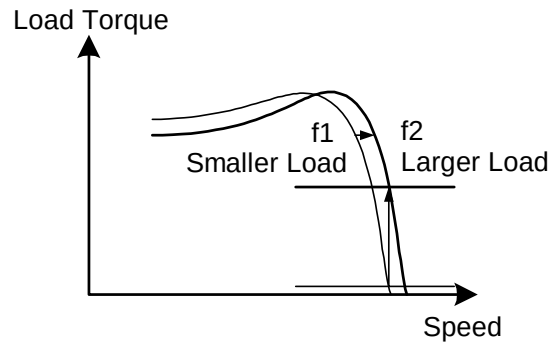


Figure 19 Output Frequency with Slip Compensation.

Motor Rated Slip (Cn-11)

- This setting is used as a reference value for torque compensation function. See Figure 19. The setting is 0.0~9.9% as a percentage of motor Maximum Voltage Frequency (Cn-04) as 100%.
- The setting is shown in Figure 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 cases when the frequency command is less than the Minimum Output Frequency or during regeneration.
- Motor Rated Slip (Cn-11) = $\frac{\text{Motor Rated Freq. (Hz)} \times (\text{Rated Speed (RPM)} - \text{No. of Motor Poles})}{\text{Maximum Voltage Frequency (Cn-04)} \times 120} \times 100\%$

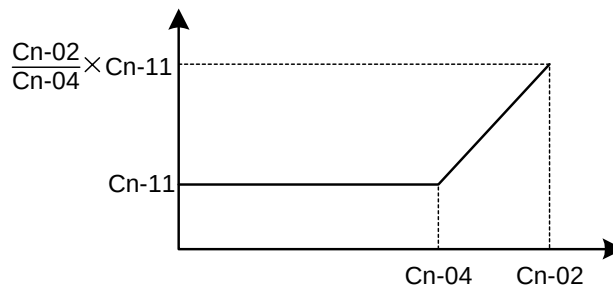


Figure 20 Slip Compensation Limit

Motor Line-to-Line Resistance (Cn-12)

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 10~11 on Page 72.

DC Injection Braking Starting Frequency (Cn-14)

DC Injection Braking Current (Cn-15)

DC Injection Braking Time at Stop (Cn-16)

DC Injection Braking Time at Start (Cn-17)

Note : DC Injection Braking should be disabled if Speed Search is enabled.

- The DC Injection Braking Function decelerates by applying a DC current to the motor. This happens in the following 2 cases:
 - a. DC Injection Braking Time at Start: It is effective for temporarily stopping and then restarting, without regeneration, a motor coasting by inertia.
 - b. 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. Lengthening the DC Injection Braking Time (Cn-16) or increasing the DC Injection Braking Current (Cn-15) can shorten the stopping time.
- 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 Minimum Output Frequency (Cn-07), the DC Injection Braking will begin from Minimum Output Frequency.
- If the DC Injection Braking Time at Start (Cn-17) is 0.0, the motor starts from the Minimum Output Frequency and no DC Injection Braking is enabled.

- If the DC Injection Braking Time at Stop (Cn-16) 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 at Start frequency (Cn-14).

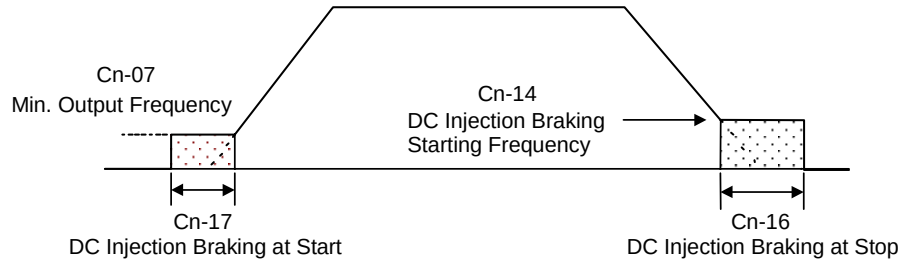


Figure 21 DC Injection Braking Time Chart

Frequency Command Upper Bound (Cn-18)

Frequency Command Lower Bound (Cn-19)

- The upper and lower bounds of the frequency command are set as a percentage of the Maximum 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 "Freq. Limit Setting Error" may occur.
- 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 Minimum Output Frequency (Cn-07).

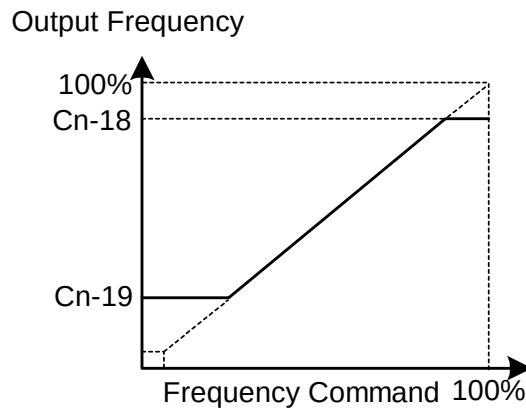


Figure 22 Upper and Lower Bounds of the Frequency Command

Frequency Jump Point 1	(Cn-20)
Frequency Jump Point 2	(Cn-21)
Frequency Jump Point 3	(Cn-22)
Jump Frequency Width	(Cn-23)

- These settings allow the “jumping” of certain frequencies within the inverters’ output frequency range so that the motor can operate without resonant oscillations caused by some mechanical systems.

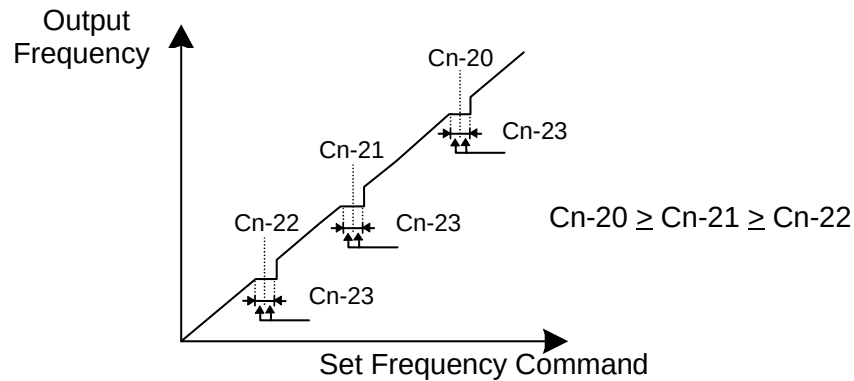


Figure 23 Setting Jump Frequencies

- Operation is prohibited within the jump frequency range, but ramp up/ramp down 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 frequencies so that $Cn-20 \geq Cn-21 \geq Cn-22$. 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.

Number of Auto Restart Attempts (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.
 - Overcurrent
 - Ground fault
 - Main circuit over-voltage

With other faults, the protective operations will engage immediately without attempting to restart operation.

- The fault restart count will automatically increase upon the restart activated and will be cleared in the following cases:
 - a. When the operation is normal for 10 minutes after a fault restart is performed.
 - b. When the fault-reset input is received after the protection operation has been activated and the fault confirmed. (e.g., by pressing  or enable Fault Reset Terminal ③)
 - c. When the power is turned off and on again.
- When one of the Multi-Function Output Terminals (RA-RB-RC or R1A-R1B-R1C, DO1, DO2 or R2A-R2C) is set to restart enabled, the output will be ON while the fault restart function is in progress. See Page 95 for the setting of (Sn-30~Sn-32).

Stall Prevention Level During Acceleration (Cn-25)

Stall Prevention Level During Running (Cn-26)

- A stall occurs if the rotor cannot keep up with the rotating electromagnetic field in the motor stator when a large load is applied or when 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 Figure 24. Inverter stops accelerating if Cn-25 setting is exceeded. Accelerates again when the current recovers.
- Stall Prevention During Running : See Figure 25. Deceleration is started if the Run Stall Prevention Level Cn-26 is exceeded, especially when an impact load is suddenly applied. Accelerates again when the current level is lower than Cn-26.

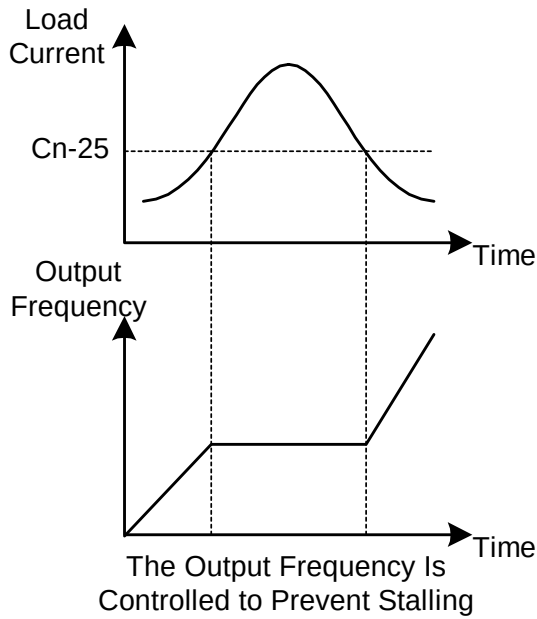


Figure 24 Stall Prevention During Acceleration

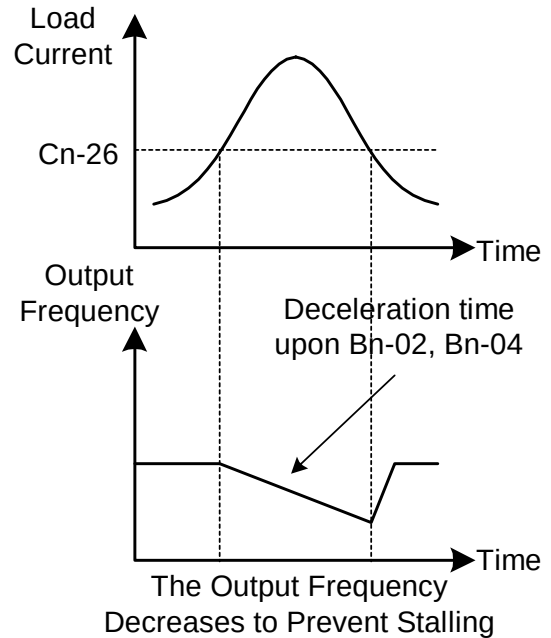


Figure 25 Stall Prevention During Running

- Set the parameters Cn-25 and Cn-26 as a percentage of inverter rated current (100% corresponds to inverter rated current).
- See Page 80 for Stall Prevention Function Selection.

Communication Fault Detection Time (Cn-27)

LCD Digital Operator Display Unit (Cn-28)

- Set the units to be displayed for the frequency command and frequency monitoring as described below:

Table 9

Cn-28 Setting	Setting/Displayed Contents		
0	0.01Hz unit.		
1	0.01% unit. (Maximum Output Frequency is 100%)		
2~39	RPM unit. (Cn-28 sets the Motor Poles.) RPM = 120 x Frequency Command (Hz) / Cn-28		
00040~39999	Set the decimal point position using the value of the fifth digit.		
	Setting	Display	Display Examples
	<u>0</u> 0040~ <u>0</u> 9999	XXXX	100% speed will be displayed 0200 →Cn-28= 00200
	<u>1</u> 0000~ <u>1</u> 9999	XXX.X	100% speed will be displayed 200.0 →Cn-28= 12000 60% speed will be displayed 120.0
	<u>2</u> 0000~ <u>2</u> 9999	XX.XX	100% speed will be displayed 65.00 →Cn-28= 26500 60% speed will be displayed 39.00
	<u>3</u> 0000~ <u>3</u> 9999	X.XXX	100% speed will be displayed 2.555 →Cn-28= 32555

Frequency Agree Detection Level During Acceleration (Cn-29)

Frequency Agree Detection Level During Deceleration (Cn-30)

Frequency Agree Detection Width (Cn-31)

- Frequency Detection Function: Set the Multi-Function Output Terminals (Control Circuit Terminals RA-RB-RC or R1A-R1B-R1C, DO1, DO2 or R2A-R2C) to output the desired Frequency Agree signal, Setting Frequency Agree 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), Freq. Agree output is "ON". • Set Sn-30~Sn-32 to "02" for the setting of frequency agree output.
Setting Frequency Agree		• After acceleration, the output freq. reaches Frequency Agree Detection Level During Accel. (Cn-29) and within Frequency Agree Detection Width (Cn-31), agreed freq. output is "ON". • Set Sn-30~Sn-32 to "03".
Output Frequency Detection 1		• During acceleration, the output freq. is less than Freq. Agree Detection Level During Acceleration (Cn-29), output freq. Detection 1 is "ON". • During deceleration, the output freq. is less than Freq. Agree Detection Level During Deceleration (Cn-30), output freq. Detection 1 is "ON". • Set Sn-30~Sn-32 to "04" for the setting of output freq. detection.
Output Frequency Detection 2		• During acceleration, the output freq. is larger than Freq. Agree Detection Level During Accel. (Cn-29), output freq. detection 2 is "ON". • During deceleration, the output freq. is larger than Freq. Agree Detection Level During Deceleration (Cn-30), output freq. detection 2 is "ON". • Set Sn-30~Sn-32 to be "05" for the setting of output freq. detection.

Overtorque Detection Level	(Cn-32)
Overtorque Detection Time	(Cn-33)

- The Overtorque Detection Function detects excessive mechanical load from an increase of output current. When Overtorque Detection is enabled through the setting Sn-12, be sure to set Overtorque Detection Level (Cn-32) and Overtorque Detection Time (Cn-33). 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). See Figure 26 below. The Multi-Function Output Terminals (Control Circuit Terminals RA-RB-RC or R1A-R1B-R1C, DO1, DO2 or R2A-R2C) can be set to indicate an overtorque condition has been detected.

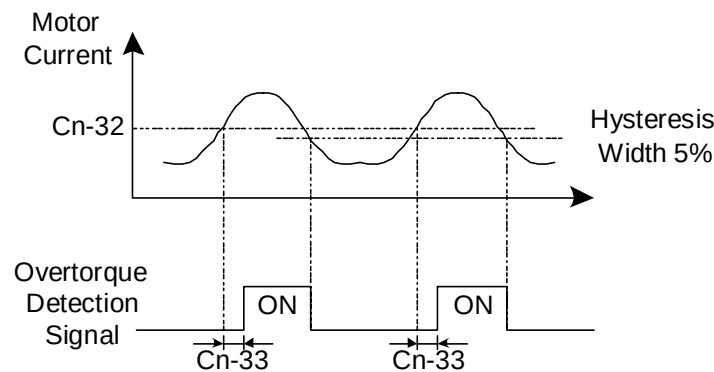
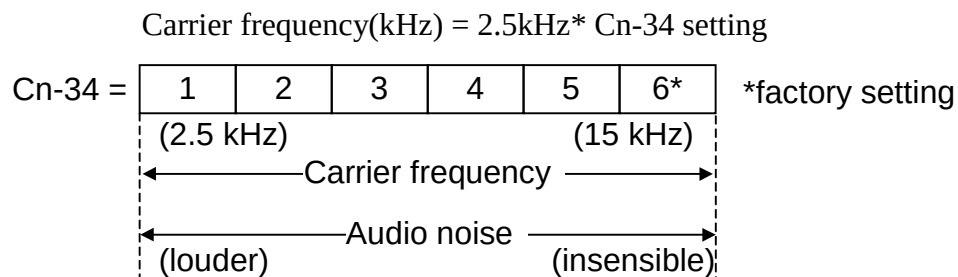


Figure 26 Overtorque Detection Time Chart

- Properly setting the value of Sn-12 will allow
 - a. Enable only during frequency agreement. Continue operation even after detection.
 - b. Enable only during frequency agreement. Stop operation after detection.
 - c. Enable at anytime. Continue operation even after detection.
 - d. Enable at anytime. Stop operation after detection.
- For more details, See Page 79.

Carrier Frequency Setting (Cn-34)

- Lowering the carrier frequency can decrease the electrical interference and leakage current. Its setting is shown below.



- The output frequency does not need to be adjusted, except in the following cases.
 - 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	<100ft.	100-165ft.	166-328ft.	>328ft.
Carrier Frequency (Cn-34)	<15kHz	<10kHz	<5KHz	<2.5KHz

- If there is a great irregularity in speed or torque, lower the carrier frequency.

Speed Search Detection Level (Cn-35)

Speed Search Time (Cn-36)

Minimum Baseblock Time (Cn-37)

Speed Search V/F Curve (Cn-38)

- The speed search function will search for the speed of a coasting motor from the frequency command or max. frequency downward, then restart 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 occurring.
- The timing of speed search function is shown below :

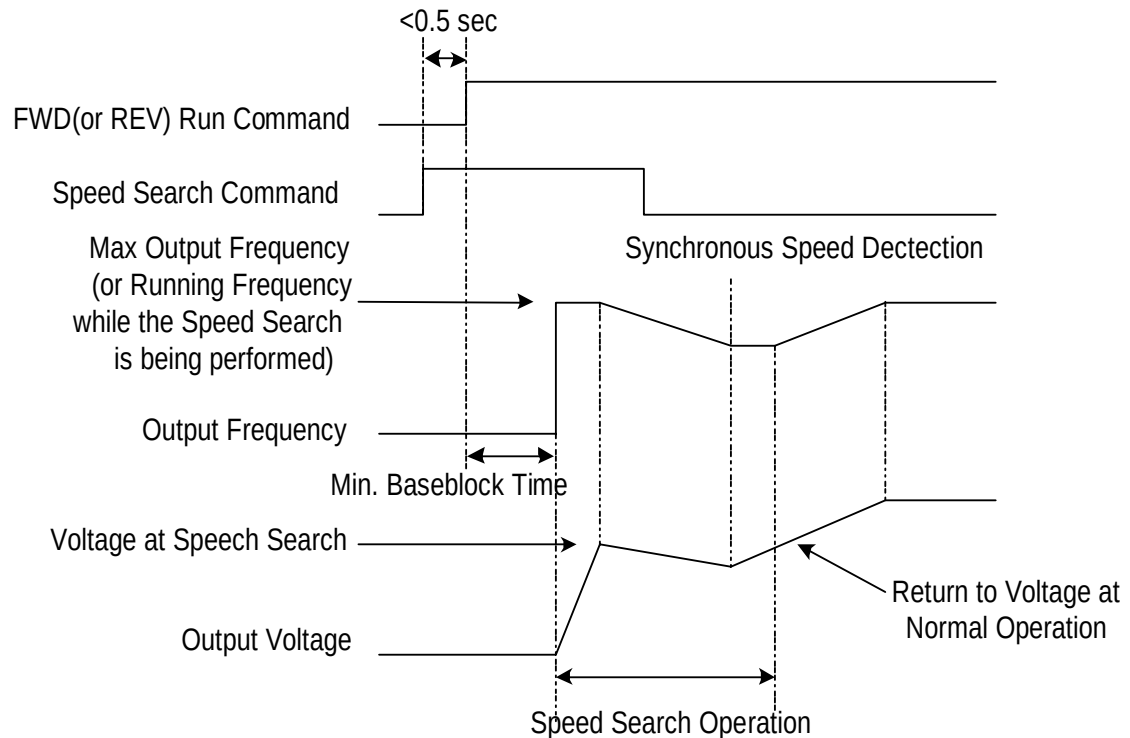
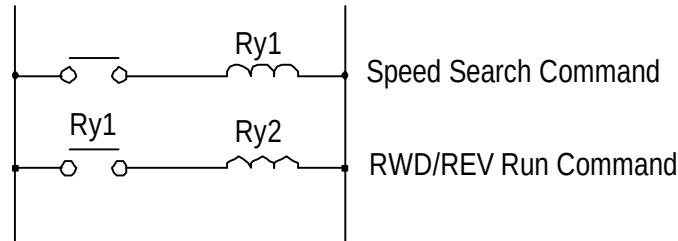


Figure 27 Speed Search Time Chart

- The speed search command can be set through the Multi-Function Contact Input Terminals ⑤ ~ ⑧ (By setting the parameters Sn-25 ~ Sn-28).
 If Sn-25 ~ Sn-28= 21 : Speed Search is performed from Max. output frequency and motor is coasting freely.
 If Sn-25 ~ Sn-28= 22 : Speed Search starts from the frequency command when the speed search command is enabled.
- After the inverter output is blocked, the user should input speed search command and then enable run operation. The inverter will begin to search the motor 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 does need not need to be changed.
- 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=21, Sn-26=22 and Multi-Function Input Terminals ⑤, ⑥ is used at the same time).
 2. 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.



3. 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 long enough to allow the motor's residual voltage to dissipate. If an overcurrent is detected when starting a Speed Search or DC Injection Braking, raise the setting Cn-37 to prevent a fault from occurring. The Cn-37 setting cannot be set too small.

Low Voltage Alarm Detection Level (Cn-39)

- In most cases, the default setting Cn-39 does not need to be changed. If an external AC Reactor is used, decrease the setting in Low Voltage Alarm Detection Level Cn-39. Be sure to set a main-circuit DC Voltage so that a main circuit undervoltage is detected.

Slip Compensation Primary Delay Time (Cn-40)

- In most cases, setting Cn-40 does not need to 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.

S-Curve Characteristic Time at Acceleration Start (Cn-41)

S-Curve Characteristic Time at Acceleration End (Cn-42)

S-Curve Characteristic Time at Deceleration Start (Cn-43)

S-Curve Characteristic Time at Deceleration End (Cn-44)

- Using the S-Curve Characteristic Function for acceleration and deceleration can reduce shock to the machinery when stopping and starting. With the C10, the S-Curve Characteristic Time can be set respectively for: beginning acceleration, ending acceleration, beginning deceleration and ending deceleration. The relationship between these parameters is shown in Figure 28.

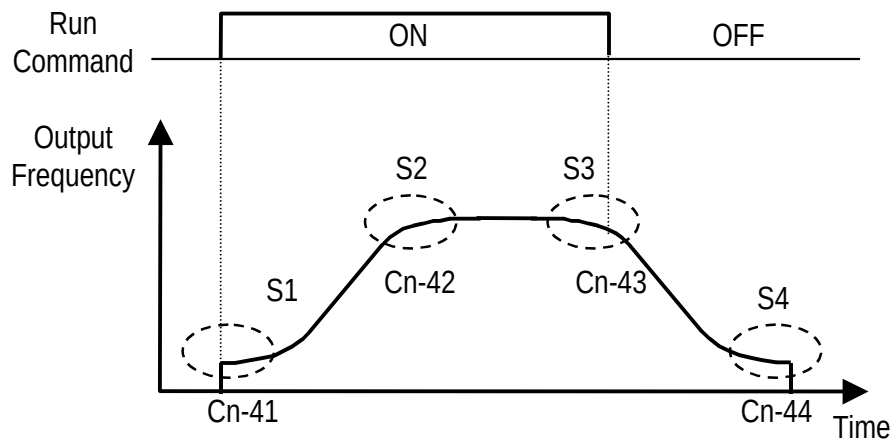


Figure 28 S Curve

- 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) + $\frac{(Cn-41) + (Cn-42)}{2}$
- Dec. Time = Selected Dec. Time 1 (or 2) + $\frac{(Cn-43) + (Cn-44)}{2}$

PG Parameter (Cn-45)

- The PG Parameter is set in units of pulse/revolution. The factory setting is 0.1P/R.

Number of Motor Poles (Cn-46)

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

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

- If not, an error message "Input Error" will be displayed.

ASR Proportional Gain 1 (Cn-47)

ASR Integral Gain 1 (Cn-48)

- Sets the Proportional Gain and Integral Time of the speed control (ASR)

ASR Proportional Gain 2 (Cn-49)

ASR Integral Gain 2 (Cn-50)

- Use these constants to set different Proportional Gain and Integral Time settings for high-speed operation.

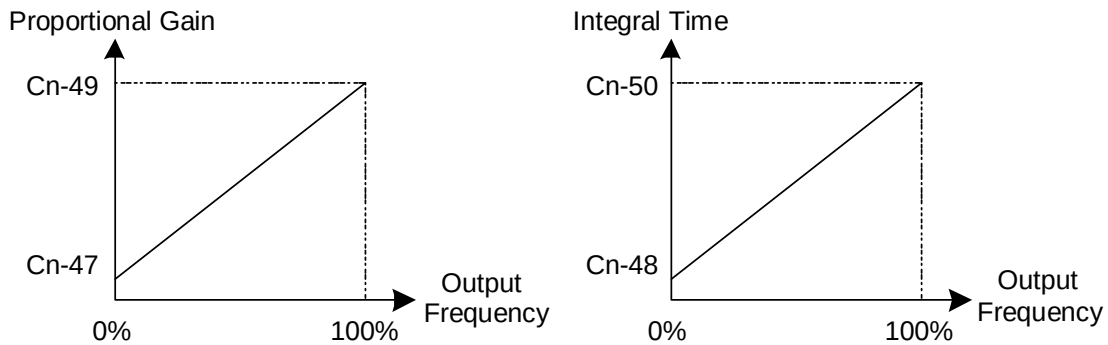


Figure 29

ASR Upper Bound (Cn-51)

ASR Lower Bound (Cn-52)

- Settings of Cn-51 and Cn-52 will limit the ASR Range.
See Figure 44 on Page 91.

Excessive Speed Deviation Detection Level (Cn-53)

- This parameter sets the level for detecting PG Speed Deviation. The value of Cn-02 is referred as 100%, the default unit setting is 1%.

Overspeed Detection Level (Cn-54)

- Set this parameter for overspeed detection. The value of Cn-02 is referred as 100%, the default unit setting is 1%.
Please refer to setting of Sn-43 on Page 101.

PID Integral Upper Bound (Cn-55)

PID Primary Delay Time Constant (Cn-56)

- Please refer to Figure 14, "Block Diagram for PID Control in C10".
- 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%). Increasing Cn-55 will improve the integral control. If hunting cannot be reduced by decreasing Bn-18 or increasing Cn-56, reduce setting in Cn-55. If the setting of Cn-55 is set 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 period. It will decrease the responsiveness, but it will prevent the oscillation.

Motor Line-to-Line Resistance R1 (Cn-57)

- Set the motor's terminal resistance (including the motor external cable resistance) in Ω units.
- The default setting depends upon the type of inverter (do not include the motor external motor cable resistance).
- This value will be automatically set during Autotuning. See "Motor Parameter Autotuning Selection" on Page 125.
- Increase the setting when the generating torque is not large enough at low speed.
- Decrease the setting when the generating torque is extremely high and causes overcurrent trips at low speed.

Motor Rotor Equivalent Resistance R2 (Cn-58)

- Set the motor's rotor Y-equivalent model resistance in Ω units.
- The default setting depends upon the type of inverter. Normally this value isn't shown on the motor's nameplate, so it might be necessary to contact the motor manufacturer.
- This value will be automatically set during Autotuning. See "Motor Parameter Autotuning Selection" on Page 125.

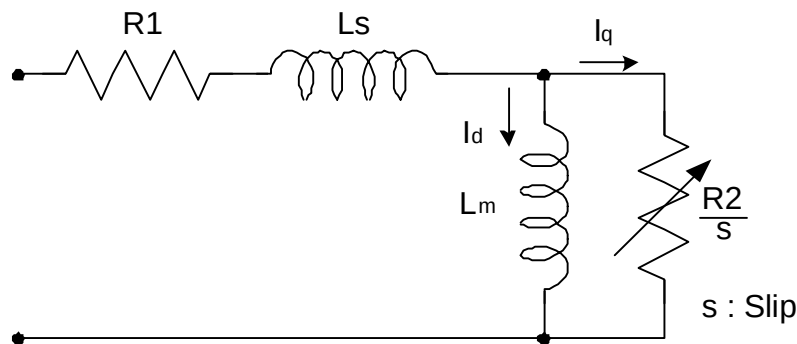
Motor Leakage Inductance Ls(Cn-59)

- Set the motor's rotor Y-equivalent model leakage inductance in mH units.
- The default setting depends upon the type of inverter.
- This value will be automatically set during Autotuning. See "Motor Parameter Autotuning Selection" on Page 125.

Motor Mutual Inductance Lm (Cn-60)

- Set the motor Y-equivalent model mutual inductance in mH units.
- The default setting depends upon the type of inverter.
- This value will be automatically set during Autotuning. See "Motor Parameter Autotuning Selection" on Page 125.

Note : The Induction Motor Y-equivalent Model



Slip Compensation Gain (Cn-61)

- Parameter Cn-61 improves speed accuracy while operating with a load.
- Usually, setting Cn-61 does not need to be changed. Adjust the setting if the speed accuracy needs to be improved.
- When actual speed is low, increase the set value.
- When actual speed is high, decrease the set value.

3.4 System Parameters Sn-

Function	Parameter No.	Name	LCD Display (English)	Description	Factory Setting	Ref. Page
Capacity Setting	Sn-01	Inverter Capacity Selection	Sn-01= 01 230V 1HP	Inverter Capacity Selection	*1	71
V/F Curve	Sn-02	V/F Curve Selection	Sn-02= 01 V/F Curve	0~14 : 15 Fixed V/F curve patterns 15 : Arbitrary V/F pattern selection		73-75
Operator Status	Sn-03	Operator Display	Sn-03= 00 Setting Valid	0 : An- , Bn- , Cn- and Sn- setting & reading enabled 1 : An- , setting & reading enabled Bn- , Cn- , Sn- read only 2~5 : Reserved 6 : Clear fault message 7 : 2-wire initialization (230V/460V) 8 : 3-wire initialization (230V/460V) 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		76
Operation Control Mode Selection	Sn-04	Run Source Selection	Sn-04= 0 Run Source Operator	Run source 0 : Operator 1 : Control circuit terminal 2 : RS-485 communication	0	76
	Sn-05	Frequency Command Selection	Sn-05= 0 Ref. Cmd. Operator	Frequency command 0 : Operator 1 : Control circuit terminal 2 : RS-485 communication	0	76
	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	76
	Sn-07	Priority of Stopping	Sn-07= 0 Stop Key Valid	If operation command from control terminal or RS-485 communication port 0 : Operator stop key effective 1 : Operator stop key not effective	0	78
	Sn-08	Prohibition of REV Run	Sn-08= 0 Reverse Enable	0 : Reverse run enable 1 : Reverse run disable	0	78
	Sn-09	Output Frequency Up/Down Function	Sn-09= 0 Inhibit UP/DOWN	0 : Reference frequency is changed by pressing the "UP/DOWN" key followed by the "EDIT/ENTER" key. This will acknowledge output freq. setting has been entered. 1 : Reference frequency will be acknowledged immediately after pressing the "UP/DOWN" key.	0	78

*1 The default setting will depend upon the different inverter capacity.

Function	Parameter No.	Name	LCD Display (English)	Description	Factory Setting	Ref. Page
Operation Control Mode Selection	Sn-10	Frequency Command Characteristics Selection	Sn-10= 0 Ref. Cmd. Fwd. Char.	0 : Reference command has forward characteristics (0~10V or 4~20mA/0~100%) 1 : Reference command has reverse characteristics (10~0V or 20~4mA/0~100%)	0	79
Operation Control Mode Selection	Sn-11	Scanning Times at Input Terminal	Sn-11= 0 Scan Time 5ms	0 : scan and confirm once per 5 ms 1 : continuously scan and confirm twice per 10 ms.	0	79
	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 (Accel., Decel. included). The motor will sustain operation even after the overtorque has been detected. 4 : Overtorque is detected during running (Accel., Decel included). The motor will stop after the baseblock time when the overtorque has been detected.	0	79
	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	80
Protection Characteristic Selection	Sn-14	Stall Prevention During Acc. Function Selection	Sn-14= 1 Acc. Stall Valid	0 : Invalid (too much torque may cause stall) 1 : Valid (stops acceleration if current exceeds Cn-25 setting)	1	80
	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	80
	Sn-16	Stall Prevention During Running Function Selection	Sn-16= 1 Run Stall Valid	0 : Invalid 1 : Valid –Deceleration time 1 for stall prevention during running (no external brake unit used) 2 : Valid –Deceleration time 2 for stall prevention during running (no external brake unit used)	1	81
	Sn-17	Fault Retry Setting	Sn-17= 1 Retry No O/P	0 : Do not output fault retry. (The fault contact does not operate.) 1 : Output fault retry. (The fault contact operates.)	1	81

*1 The default setting will depend upon the different inverter capacity.

Function	Parameter No.	Name	LCD Display (English)	Description	Factory Setting	Ref. Page
Protection Characteristic Selection	Sn-18	Operation Selection at Power Loss	Sn-18= 0 PwrL to ON Stop O/P	0 : Stop running 1 : Continue to run	0	81
	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	82
Protection Characteristic Selection	Sn-20	External Fault Contact ③ Contact Selection	Sn-20= 0 Term.3 NO Cont.	0 : A-contact (normally open input) 1 : B-contact (normally closed input)	0	82
	Sn-21	External Fault Contact ③ Detection Selection	Sn-21= 0 All Time Ext. Fault	0 : Detect all time 1 : Detect only during operation	0	82
	Sn-22	External Fault Operation Selection	Sn-22= 1 Ext. Fault Free Run	0 : Dec. to stop (upon dec. time 1 Bn-02) 1 : Coast (free run) to stop 2 : Dec. to stop (upon dec. time 1 Bn-04) 3 : Continue operating	1	82
	Sn-23	Motor Overload Protection Selection	Sn-23= 1 Cold Start Overload	Electronic motor overload protection selection. 0 : Electronic 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	1	82
	Sn-24	Frequency Command Characteristics Selection at External Analog Input Terminal	Sn-24= 0 ~ Cmd. VIN	Frequency command characteristics. selection at external analog input terminal. 0 : Voltage signal 0~10V (VIN) 1 : Current signal 4~20mA (AIN) 2 : Addition of voltage signal 0~10V and current signal 4~20 mA (VIN+AIN) 3 : Subtraction of current signal 4~20mA and voltage signal 0~10V (VIN-AIN)	0	83

*1 The default setting will depend upon the different inverter capacity.

Function	Parameter No.	Name	LCD Display (English)	Description		Factory Setting	Ref. Page
Multi-Function Input Contact Selection	Sn-25	Multi-Function Input Terminal ⑤ Contact Selection	Sn-25= 02 Multi_Fun. Command 1	00~25	The factory setting is multi-function command 1	02	83
	Sn-26	Multi-Function Input Terminal ⑥ Contact Selection	Sn-26= 03 Multi_Fun. Command 1	01~26	The factory setting is multi-function command 2	03	
Multi-Function Input Contact Selection	Sn-27	Multi-Function Input Terminal ⑦ Contact Selection	Sn-27= 06 Jog Command	02~27	The factory setting is jog command	06	83
	Sn-28	Multi-Function Input Terminal ⑧ Contact Selection	Sn-28= 07 Acc. & Dec Switch	03~29	The factory setting is Acc. & Dec. Interrupt	07	
Multi-Function Analog Input Selection	Sn-29	Multi-Function Analog Input (AUX) Selection	Sn-29=00 Auxiliary Freq.Cmd.	00~12	Multi-Function analog input terminal (AUX) as Auxiliary frequency command. (Factory setting)	00	93
Multi-Function Digital Output Selection	Sn-30	Multi-Function Output Terminal (RA-RB-RC) Function Selection	Sn-30=13 Fault	00~22	Terminal (RA-RB-RC or R1A-R1B-R1C) as fault output (factory setting)	13	95
	Sn-31	Multi-Function Output Terminal (DO1) Function Selection	Sn-31=01 Running	00~22	Terminal (DO1-DOG) as digital output during running (factory setting).	00	
	Sn-32	Multi-Function Output Terminal (DO2) Function Selection	Sn-32=00 Zero Speed	00~22	Terminal (DO2-DOG or R2A-R2C) as digital output at zero speed (factory setting)	01	
Multi-Function Analog Output Selection	Sn-33	Multi-Function Analog Output (AO1) Function Selection	Sn-33= 00 Term. AO1 Freq. Cmd.	0 : Freq. Cmd. (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 command VIN (0~10V/0~10V) 6 : External analog command AIN (0~10V/4~20mA) 7 : Multi-function analog input (AUX) (10V/10V) 8 : PID control input 9 : PID control output 1 10:PID control output 2 11:Communication control		00	99
	Sn-34	Multi-Function Analog Output (AO2) Function Selection	Sn-34= 01 Term. AO1 O/P Freq.			01	
		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 0:1F 1:6F 2:10F 3:12F 4:36F		1
*1 The default setting will depend upon the different inverter capacity.							

Function	Parameter No.	Name	LCD Display (English)	Description	Factory Setting	Ref. Page
PG Speed Control	Sn-40	PG Speed Control Function	Sn-40= 0 PG Invalid	0 : without speed control 1 : with speed control 2 : with speed control but no integration control during Acc/Dec. 3 : with speed control and integration control during Acc/Dec.	0	101
	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	
	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	
	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 run	0	
Auto_Run Mode Operation Selection	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 single cycle. (continues running from the unfinished step if restarting) 2 : Auto_Run mode performed periodically (continues running from the unfinished step if restarting) 3 : Auto_Run mode for single cycle, then holds the speed of final step to run. (continues running from the unfinished step if restarting) 4 : Auto_Run mode for single cycle. (starts a new cycle if restarting) 5 : Auto_Run mode performed periodically (starts a new cycle if restarting) 6 : Auto_Run mode for single cycle, then holds the speed of final step to run. (starts a new cycle if restarting)	0	102
	Sn-45	Auto_Run Mode Operation Select. 1	Sn-45= 0 Auto_Run Stop	0 : Stop (Bn-02) 1 : Forward 2 : Reverse	0	
	Sn-46	Auto_Run Mode Operation Select. 2	Sn-46= 0 Auto_Run Stop		0	
	Sn-47	Auto_Run Mode Operation Select. 3	Sn-47= 0 Auto_Run Stop		0	
	Sn-48	Auto_Run Mode Operation Select. 4	Sn-48= 0 Auto_Run Stop		0	
	Sn-49	Auto_Run Mode Operation Select. 5	Sn-49= 0 Auto_Run Stop		0	
	Sn-50	Auto_Run Mode Operation Select. 6	Sn-50= 0 Auto_Run Stop		0	

*1 The default setting will depend upon the different inverter capacity.

Function	Parameter No.	Name	LCD display (English)	Description	Factory Setting	Ref. Page
Auto_Run Mode Operation Selection	Sn-51	Auto_Run Mode Operation Select. 7	Sn-51= 0 Auto_Run Stop	0 : Stop (Bn-02) 1 : Forward 2 : Reverse	0	102
	Sn-52	Auto_Run Mode Operation Select. 8	Sn-52= 0 Auto_Run Stop		0	
	Sn-53	Auto_Run Mode Operation Select. 9	Sn-53= 0 Auto_Run Stop		0	
	Sn-54	Auto_Run Mode Operation Select. 10	Sn-54= 0 Auto_Run Stop		0	
	Sn-55	Auto_Run Mode Operation Select. 11	Sn-55= 0 Auto_Run Stop		0	
	Sn-56	Auto_Run Mode Operation Select. 12	Sn-56= 0 Auto_Run Stop		0	
	Sn-57	Auto_Run Mode Operation Select. 13	Sn-57= 0 Auto_Run Stop		0	
	Sn-58	Auto_Run Mode Operation Select. 14	Sn-58= 0 Auto_Run Stop		0	
	Sn-59	Auto_Run Mode Operation Select. 15	Sn-59= 0 Auto_Run Stop		0	
	Sn-60	Auto_Run Mode Operation Select. 16	Sn-60= 0 Auto_Run Stop		0	
-	Sn-61	Applied Torque Mode	Sn-61= 0 Const. Trq. Load	0 : Constant torque 1 : Variable(quadratic) torque	0	104
	Sn-62	Language Selection	Sn-62= 0 Language: English	0 : English 1 : Traditional Chinese	0	104
	Sn-63	Parameter Copy	Sn-63=0 Not Loaded	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	0	104
	Sn-64	PID Function	Sn-64=0 PID Invalid	0 : PID invalid 1 : PID valid	0	105
	Sn-65	Brake Resistor Protection	Sn-65=0 Protect Invalid	0 : Braking resistor protection invalid 1 : Braking resistor protection valid	0	105

Function	Parameter No.	Name	LCD display (English)	Description	Factory Setting	Ref. Page
Sensorless Vector Control	Sn-66	Motor Parameters Autotuning Selection	Sn-66=0 Auto Tun. Invalid	0 : Autotuning invalid 1 : Autotuning valid	0	106
	Sn-67	Control Mode Selection	Sn-67=0 V/F Control	0 : V/F control mode (includes V/F control with pulse generator feedback) 1 : Sensorless Vector Control Mode	0	

*1 The default setting will depend upon the different inverter capacity.

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 reset according to the following tables.
- Whenever the setting Sn-01 has been changed, the inverter system parameter settings should be changed based upon the Heavy Duty (HD) load (setting of Sn-61= 0) or Normal Duty (ND) load (Sn-61= 1).

Table 10 230V Inverter Capacity Selection

Sn-01 Setting			001		002		003		004		005		006		007		008	
HD (Sn-61= 0) ND (Sn-61= 1)			HD	ND	HD	ND	HD	ND	HD	ND	HD	ND	HD	ND	HD	ND	HD	ND
Item Name																		
Inverter Rated Capacity(KVA)			2		2.7		4		7.5		10.1		13.7		20.6		27.4	
Inverter Rated Current (A)			4.8 / 6.9		6.4 / 9.8		9.6 / 9.8		17.5 / 22.7		24 / 32		32 / 32		48 / 56.7		64 / 70.9	
Max. Applicable Capacity (HP)			1	2	2	3	3	3	5.4	7.5	7.5	10	10	10	15	20	20	25
Factory Setting	Cn-09	Motor Rated Current (A)	3.4	6.1	6.1	8.7	8.7	8.7	14.6	20.1	20.1	25.1	25.1	25.1	36.7	50.3	50.3	62.9
	Cn-12	Motor Line Impedance (Ω)	5.73 2	2.40 7	2.40 7	1.58 3	1.58 3	1.58 3	0.68 4	0.44 4	0.44 4	0.28 8	0.28 8	0.28 8	0.15 9	0.10 9	0.10 9	0.07 7
	Cn-13	Core Loss Torque Compensation (W)	64	108	108	142	142	142	208	252	252	285	285	285	370	471	471	425
	Cn-34	Carrier Freq. (kHz)	15	10	15	5	15	15	15	5	15	10	15	15	10	5	10	5
	Cn-37	Min. Baseblock Time (sec)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Sn-02	V/F Curve	01	07 ⁻¹	01	07 ⁻¹	01	07 ⁻¹	01	07 ⁻¹	01	07 ⁻¹	01	07 ⁻¹	01	07 ⁻¹	01	07 ⁻¹

Table 11 460V Inverter Capacity Selection

HD (Sn-61= 0) ND (Sn-61= 1)			HD		ND		HD		ND		HD		ND		HD		ND	
Item Name																		
Inverter Rated Capacity (KVA)			2.2		3.4		4.1		7.5		10.3		12.3		20.6		27.4	
Inverter Rated Current (A)			2.6 / 3.5		4 / 4.9		4.8 / 4.9		8.7 / 12.5		12 / 15.4		15 / 22.7		24 / 30.3		32 / 38	
Max. Applicable Capacity (HP)			1	2	2	3	3	3	5.4	7.5	7.5	10	10	15	15	20	20	25
Factory Setting	Cn-09	Motor Rated Current (A)	1.7	2.9	2.9	4	4	4	7.3	10.2	10.2	12.6	12.6	18.6	18.6	24.8	24.8	31.1
	Cn-12	Motor Line Impedance (Ω)	22.9 7	9.62 8	9.62 8	6.33 3	6.33 3	6.33 3	2.73 5	1.77 6	1.77 6	1.15 1	1.15 1	0.63 4	0.63 4	0.43 6	0.43 6	0.30 8
	Cn-13	Core Loss Torque Compensation (W)	64	108	108	142	142	142	208	252	252	285	285	370	471	471	471	425
	Cn-34	Carrier Freq. (kHz)	15	10	15	5	15	15	15	5	15	10	15	5	10	5	10	5
	Cn-37	Min. Baseblock Time (sec)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Sn-02	V/F Curve	01	07 ⁻¹	01	07 ⁻¹	01	07 ⁻¹	01	07 ⁻¹	01	07 ⁻¹	01	07 ⁻¹	01	07 ⁻¹	01	07 ⁻¹

- *1 Use the normal duty patterns when there is a quadratic or cubic relationship between the speed and load, such as in fan or centrifugal pump applications. The user can properly choose the desired (V/F) patterns (Sn-02=04, 05, 06, or 07) based upon the load torque characteristics.
- *2 In fan or centrifugal pump applications, the load torque have a quadratic or cubic relationship between the speed and load. The inverter capacity rating can be increased to a value that doubles its own specified capacity rating in some cases. For example, a 1HP inverter can be used to drive a 2HP motor with same voltage class. However, due to hardware limitations, the 230V 3HP, 10HP and 460V 3HP units cannot be adapted to any larger capacity.

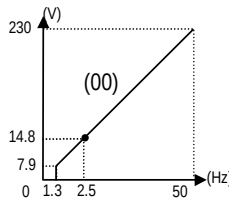
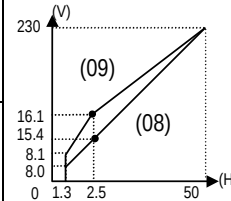
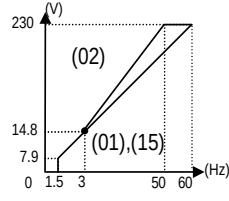
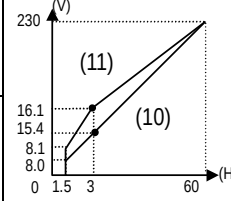
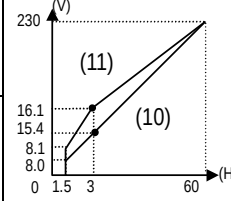
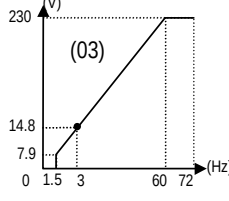
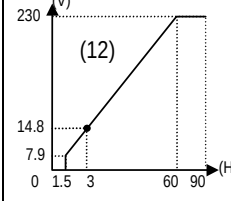
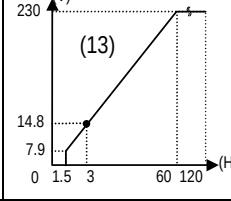
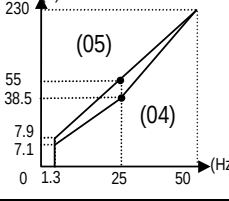
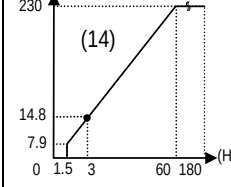
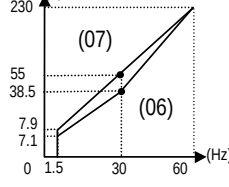
V/F Curve Selection (Sn-02)

Set the Inverter Input Voltage (Cn-01) to match the power supply voltage. The V/F Curve can be set as belows.

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

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

Table 12 V/F Curve of 1~2HP Compact Size, 230V Class C10*

	Specification		Sn-02	V/F Pattern [†]		Specificatio		Sn-02	V/F Pattern [†]
General Purpose	50Hz		00		High Saring Torque ⁺⁺	50Hz	Low Starting Torque	08	
	60Hz	60Hz Saturation	01 15			60Hz	High Starting Torque	09	
		50Hz Saturation	02			60Hz	Low Starting Torque	10	
	72Hz		03			90Hz		12	
Variable Torque Characteristic	50Hz	Variable Torque 1	04	Rated Output Operation (Machine Tool)	120Hz	13			
		Variable Torque 2	05				180Hz	14	
	60Hz	Variable Torque 3	06						
		Variable Torque 4	07						

* These values are for the 230V Class; double the values for 460V Class inverters.

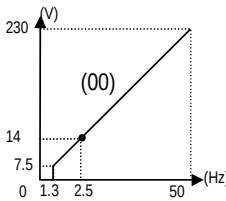
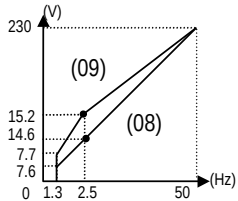
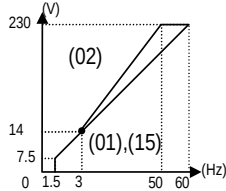
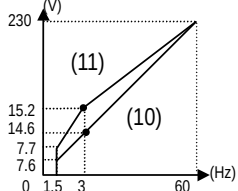
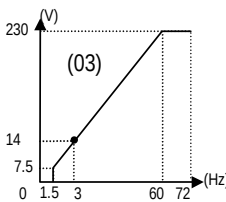
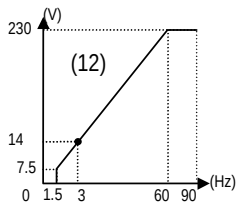
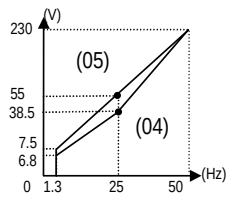
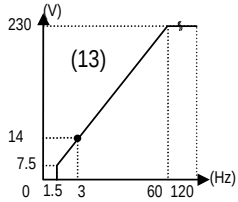
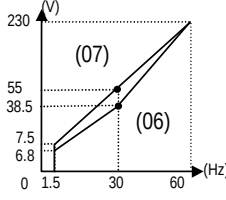
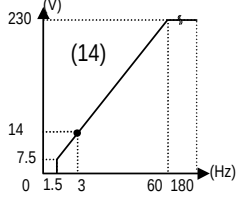
† Consider the following items as the conditions for selecting a V/F pattern. They must be suitable for

- (1) The voltage and frequency characteristic of the motor.
- (2) The maximum speed of the motor.

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

- (1) The power cable length is long [492ft (150m) and above].
- (2) Voltage drop at startup is large.
- (3) An AC Reactor is inserted at the input or output side of the inverter.
- (4) A motor with a capacity smaller than the maximum applicable inverter capacity is used.

Table 13 V/F Curve of 3~20HP, 230V Class C10*

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

* These values are for the 230V Class; double the values for 460V Class inverters.

† 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 the motor.
- (2) The maximum speed of the motor.

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

- (1) The power cable length is long [492ft (150m) and above].
- (2) Voltage drop at startup is large.
- (3) An AC Reactor is inserted at the input or output side of the inverter.
- (4) A motor with a capacity smaller than the maximum applicable inverter capacity is used.

Operator Display (Sn-03)

- Parameter Code (Sn-03= 0 or 1)
Set parameter Sn-03 to 0 or 1 to determine the access status. See Chart Below.

Sn-03	DRIVE Mode		PRGM Mode	
	Set	Read Only	Set	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)

With the exception of parameters Sn-01~02 and Sn-61, the parameter groups of An-□□, Bn-□□, Cn-□□ and Sn-□□ can be initialized as factory setting according to the different input voltage. At the same time, terminals ⑤~⑧ can be set for 2-wire or 3-wire operation mode with different settings of Sn-03. Please see 2/3wire Operation Mode on Page 85.

Run Source Selection (Sn-04)

- This parameter is used to select the source of run command.
Sn-04 = 0 : Digital Operator
 1 : Control circuit terminal
 2 : RS-485 communication
- If Sn-04 is set to 1, the run source is from the control circuit terminal. Under the initial setting of 2-wire operation (through setting of Sn-03=7 or 9 or 11), the run source will be FWD/STOP, REV/STOP.
- If Sn-04 is set to 1, the run source is from the control circuit terminal. Under the initial setting of 3-wire operation (through setting of Sn-03=8 or 10 or 12), the run source will be RUN, STOP, FWD/ REV.
- For more details, see “2/3 wire Operation Mode” on Page 85.

Frequency Command Setting Method Selection (Sn-05)

- This parameter is used to select the source of frequency command.
Sn-05 = 0 : Digital operator
 1 : Control circuit terminal
 2 : RS-485 communication

Stopping Method Selection (Sn-06)

- Setting the stopping method used when a stop command is executed.

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 decel. time.

- The following diagrams show the operation of each stopping method.
 - a) Deceleration to Stop (Sn-06= 0)
Deceleration to a stop at a rate set with the selected deceleration time.
 - b) Coast to Stop (Sn-06= 1)
After the stop command is executed, run source is disregarded until the Min. Baseblock time Cn-37 has elapsed.

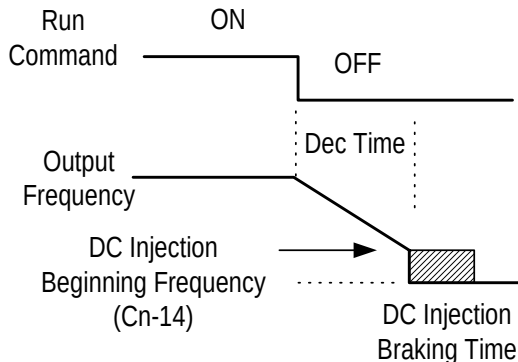


Figure 30 Deceleration to Stop

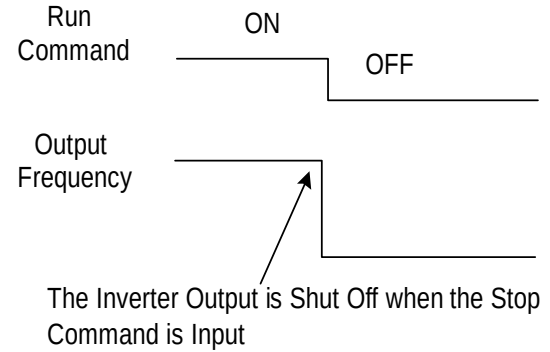


Figure 31 Coast to Stop

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

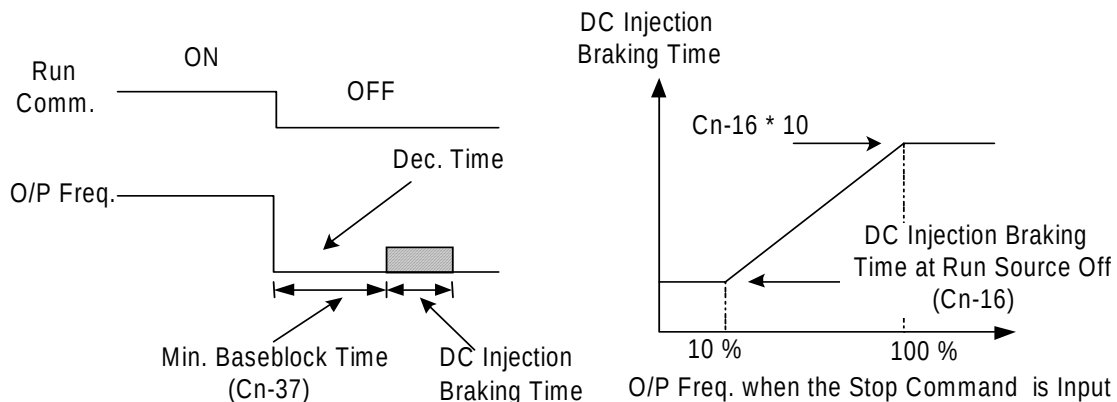


Figure 32 Whole Range DC Injection Braking Stop

- After the stop command is input and the Minimum Baseblock Time (Cn-37) has elapsed, DC Injection Braking is applied and the motor is stopped. DC Injection Braking Time depends upon the output frequency when the stop command
- 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-electromotive force generated by the residual magnetic field in the motor can cause an overcurrent to be detected when DC Injection Braking at Stop is applied.

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

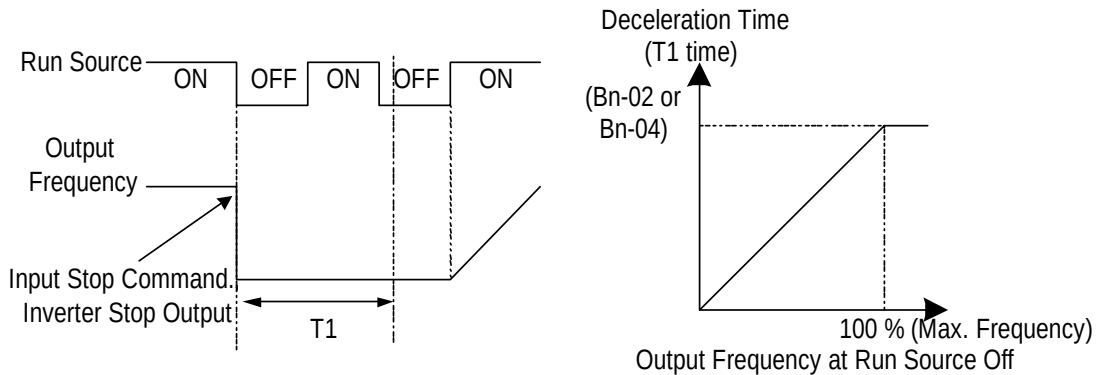


Figure 33 Coast to Stop with Timer

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

Priority of Stopping (Sn-07)

- This parameter enables or disables the STOP key on the digital operator when the run source is from a Control Circuit Terminal or RS-485 Communication Port while the motor is running.

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

= 1 : Disabled (The STOP key is disabled when the run source is from a Control Circuit Terminal or RS-485 Communication Port)

Prohibition of REV Run (Sn-08)

- When the parameter Sn-08 is set to 1, reverse run of the motor is not allowed.

Output Frequency UP/DOWN Function (Sn-09)

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

Sn-09= 0 : Change output frequency through the ( / ) key. The frequency command will be accepted 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)) through either the LCD Digital Operator or through the External Multi-Function Input Terminals (Terminals ⑤~⑧). See Page 92.

Frequency Command Characteristics Selection (Sn-10)

Sn-10 = 0 : Forward characteristics of frequency command
(0~10V or 4~20mA /0~100%)

= 1 : Reverse characteristics of frequency command
(10~0V or 20~4mA /100~0%)

Scan Time at Input Terminal (Sn-11)

- Scan Frequency Setting of Input Terminal (Forward/Reverse, Multi-Function Input)

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

= 1 : Scans input terminals every 10ms.

Overtorque Detection Selection (Sn-12)

- When Overtorque Detection is enabled, be sure to set the values of the Overtorque Detection Level (Cn-32) and Overtorque Detection Time (Cn-33). An overtorque condition is detected when the current exceeds the Overtorque Detection Level for longer than the Overtorque Detection Time.

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

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 this option to set the upper bound limit of output voltage.

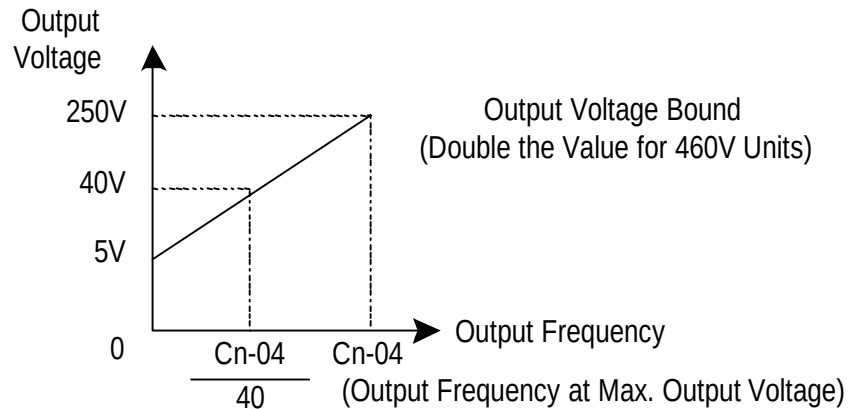


Figure 34 Output Voltage Limit

Stall Prevention Selection During Acceleration (Sn-14)

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

= 1 : Enabled (Stops acceleration if Cn-25 setting is exceeded. Accelerates again when current recovers).

Please refer to "Stall Prevention Level During Acceleration" on page 53.

Stall Prevention Selection During Deceleration (Sn-15)

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

If no external braking resistor unit is installed, the inverter can provide about 20% regenerative braking torque. If the load inertia is so large that it exceeds the regenerative braking torque, then set parameter Sn-15 to "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.

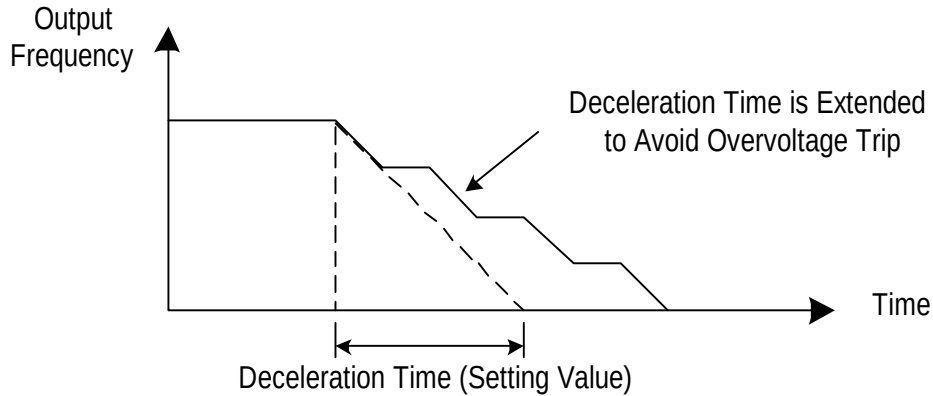


Figure 35 Stall Prevention Function During Deceleration (Sn-15= 1)

Stall Prevention Selection During Running(Sn-16)

Sn-16 = 0 : Disabled (Stall may occur when a large load is applied).

= 1 : Enabled (Deceleration will start if the motor current is larger than the Stall Prevention Level During Running and 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 53.

Operation Selection at Fault Contact During Fault Retrying (Sn-17)

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

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

Please refer to “Number of Auto Restart Attempts” on Page 52.

Operation Selection at Power Loss (Sn-18)

- This parameter specifies the operation to be performed when a Momentary Power Loss occurs (within 2 sec).

Sn-18= 0 : When Power Loss Ride-Through is enabled, operation will be restarted after a speed search is invoked 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 then. If the power is interrupted for more than 2 seconds, the fault contact output will operate and the motor will coast to stop.

Zero Speed Braking Selection (Sn-19)

- The Run Source and Frequency Command is input from control circuit under the settings of Sn-04=1 & Sn-05=1. If Sn-19 is enabled, the blocking torque will be generated in DC-braking mode when the frequency command is 0V and forward –run source is “ON”.

Figure 36 describes the above action. The Zero Braking Selection Sn-19 is set to 1 and the DC

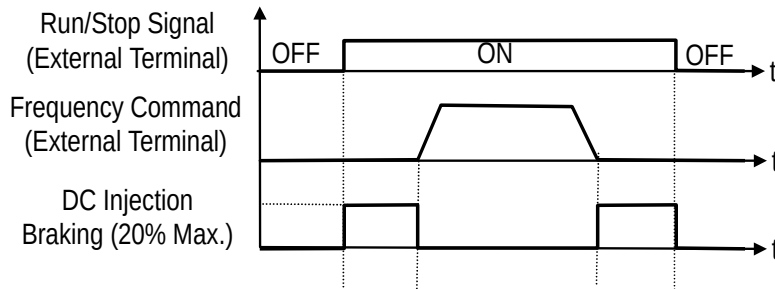


Figure 36 Zero Speed Braking Operation Selection

External Fault Contact ③ Contact Selection (Sn-20)

- Sn-20 = 0 : Input signal is from A-contact. (Normally open input)
- = 1 : Input signal is from B-contact. (Normally closed input)

External Fault Contact ③ Detection Selection (Sn-21)

- Sn-21 = 0: Always detects.
- = 1: Detects only during running.

Detection Mode Selection of External Fault (Sn-22)

- If an external fault is detected (at terminal ③), the following operation will be performed based upon the setting of Sn-22.
- Sn-22 = 0: Decelerates to stop with the specified Deceleration Time Bn-02.
- = 1: Coasts to stop.
- = 2: Decelerates to stop with the specified Deceleration Time Bn-04.
- = 3: Continues running with no regard of external fault.

Motor Overload Protection Selection (Sn-23)

- Sn-22 = 0: Electronic overload protection disabled.
- 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 special motor cold start curve.
- = 4 : The overload is detected according to the special motor hot start curve.

Disable the motor protection function (setting 0) when 2 or more motors are connected to a single The Motor Overload Protection Function Sn-23 should be set to 2 or 4 (hot start protection For motors without a forced cooling fan, the heat dissipation capability is lower when in the low speed For motors with a forced cooling fan, the heat dissipation capability is not dependent upon the rotating To protect the motor from overload by use of electronic overload protection, be sure to set parameter

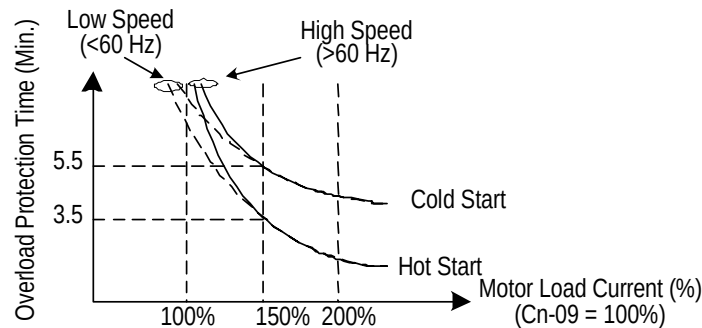


Figure 37 Motor Overload Protection Curve (Cn-09 Setting = 100%)

Freq. Characteristics Cmd. Selection at External Analog Input Terminal (Sn-24)

- Sn-24 = 0 : Frequency command is input at VIN terminal (0~10V)
- = 1 : Frequency command is input at AIN terminal (4~20mA)
- = 2 : Frequency command is the addition (VIN + AIN) at VIN (0~10V) and AIN (4~20mA) terminal.
- = 3 : Frequency command is the combination (VIN - AIN) at VIN (0~10V) and AIN (4~20mA) terminal. If the value (VIN - AIN) is negative, the reference command will take '0' as a result.

Multi-Function Input Terminal ⑤ Contact Selection (Sn-25)

Multi-Function Input Terminal ⑥ Contact Selection (Sn-26)

Multi-Function Input Terminal ⑦ Contact Selection (Sn-27)

Multi-Function Input Terminal ⑧ Contact Selection (Sn-28)

- The settings and functions for the Multi-Function Inputs are listed in Table 14.

Table 14 Multi-Function Input Settings

Setting	Function	LCD Display	Description
00	Forward/Reverse Command	3-wire Run	3-wire operation mode
01	2-wire Key Pressing Input Stop Command	2-wire Stop Key	2-wire operation mode
02	Multi-Speed Command 1	Multi-Fun. Command 1	Multi-speed frequency command selection
03	Multi-Speed Command 2	Multi-Fun. Command 2	
04	Multi-Speed Command 3	Multi-Fun. Command 3	
05	Multi-Speed Command 4	Multi-Fun. Command 4	
06	Jogging	Jog Command	ON: select jogging frequency
07	Acc/Dec Time Switch Command	Acc/Dec Switch	OFF: the first stage Acc/Dec Time (Bn-01, Bn-02), ON: the second stage Acc/Dec Time (Bn-03, Bn-04),
08	External Baseblock Command (A-contact)	Ext.BB NO Cont	ON: inverter output baseblock
09	External Baseblock Command (B-contact)	Ext.BB NC Cont	OFF: inverter output baseblock
10	Inhibit Acc/Dec Command	Inhibit Acc/Dec	Inhibit Acc/Dec (hold frequency)
11	Inverter Overheat Warning	Overheat Alarm	ON: blink shows overheat (inverter can proceed running)
12	FJOG	Forward Jog	ON: forward jog
13	RJOG	Reverse Jog	ON: reverse jog
14	PID Integration Reset	I _ Time Reset	ON: Reset PID integration
15	PID Control Invalid	PID Invalid	ON: PID control not effective
16	External Fault (A-contact)	Ext.Fault NO Cont	ON: External fault input (normally open)
17	External Fault (B-contact)	Ext.Fault NC Cont	OFF: External fault input (normally closed)
18	Multi-Funct. Analog Input	~ Input Valid	ON: Multi-function analog input (AUX) effective
19	Timer Function Input	Timer Function	ON: ON-delay/OFF-delay timer input
20	DC Braking Command	DC Braking Command	ON: DC injection braking applied when the frequency output is less than the DC injection start frequency
21	Speed Search 1 Cmd.	Max Freq. Sp Search	ON: Speed search is performed from max. output freq.
22	Speed Search 2 Cmd.	Set Freq. Sp Search	ON: Speed search is performed from reference frequency
23	Local/Remote Control I	Operator Control	ON: Local mode control (through LCD operator) OFF: Run Source and Frequency Command is determined according to (Sn-04, Sn-05) setting
24	Local/Remote Control II	Ext. Term. Control	ON: Local mode control (through control circuit terminal) OFF: Run Source and Frequency Command is determined according to (Sn-04, Sn-05) setting
25	RS-485 Communication Application	Comm. Control	PLC application extension use.
26	Speed Control w/out PG	PG Invalid	ON: Speed control without PG
27	Reset Integration of Speed Control with PG	I _ Time Invalid	ON: Reset integration of speed control with PG
28	Frequency Up/Down Function	UP/DOWN Function	Only Sn-28 can be set as Sn-28=28, terminal ⑦ used as up cmd. and terminal ⑧ used as down cmd. when Sn-28=28
29	Force Operation Signal	Force Run	Only Sn-28 can be set as Sn-28=29

Note to Table 14: An error message of "Multi-Fun. Parameter" / "Setting Error" will be displayed if:

- Setting combination of (Sn-25~Sn-28) is not organized in numerically increasing order.
- Setting 21, 22 (both for speed search command) 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 setting “00”, the inverter will be in 3-wire mode operation. As shown in Figure 38, the Forward/Reverse change mode is set at the terminal ⑤.

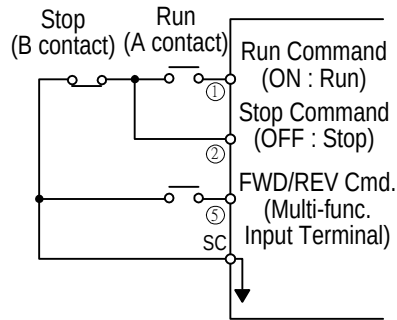


Figure 38 3-wire Mode Connection Diagram

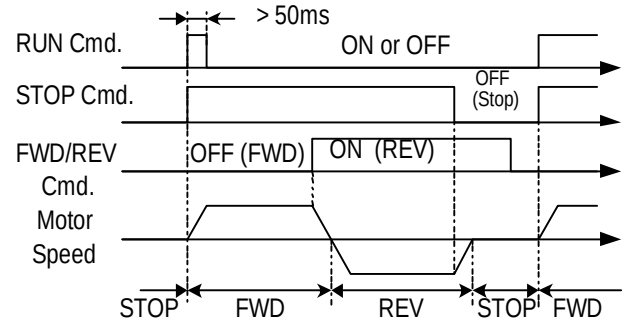
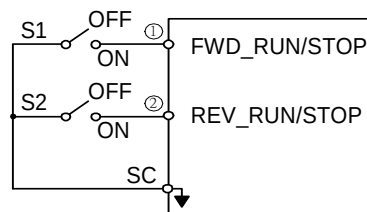


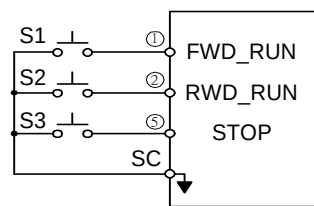
Figure 39 Operation Sequence in 3-wire Mode

Input STOP Command during 2-Wire Mode Operation (setting : 01)

- In a standard 2-wire initialization mode as shown in Figure 40(a), S1 and S2 cannot both be “ON” at the same time. When S1=“ON” and S2=“OFF”, the motor is running FWD. When S1=“OFF” and S2=“ON”, the motor is running REV. When S1=“OFF” and S2=“OFF”, the motor stops running.
- When Sn-25=‘01’, the 2-wire operation mode has its self-sustaining function. Only through the Multi-Function Input Terminal ⑤, the operator can stop the inverter after pressing the “STOP” key as shown in Figure 40(b). As shown in Figure 40(b), the switches S1, S2 and S3 do not need to be the self-sustaining switches. When S1 is depressed “ON”, the motor will be running FWD. After S3 is depressed “ON”, the motor will stop. When S2 is depressed “ON”, the motor will be running REV. After S3 is depressed “ON”, the motor will stop.



(a)



(b)

Figure 40 2-wire Mode Connection Diagram

Note to Figure 40;

1. For other setting values (except "00", "01"), the external operation mode is defaulted as 2-wire mode with no self-sustaining function. (that is, the inverter will stop when contact ① and ② are not closed).
- a. In the 2-wire mode, the error message "Freq. Comm. Error" will be displayed in the digital operator when terminal ① and ② are both ON at the same time, the inverter will stop. After the above case has cleared, the inverter will return to normal.

Multi-Step Speed Command 1 (Setting : 02)
Multi-Step Speed Command 2 (Setting : 03)
Multi-Step Speed Command 3 (Setting : 04)
Multi-Step Speed Command 4 (Setting : 05)
Jog Frequency Selection (Setting : 06)

- There is a maximum of 16 Multi-Step Speed Command Selections from the combination of the Multi-Step Speed Command and jog frequency command.
- Multi-Step Speed command 1~4 and Jog Frequency Selection Setting Table.

Terminal ⑧ (Sn-28= 05)	Terminal ⑦ (Sn-27= 04)	Terminal ⑥ (Sn-26= 03)	Terminal ⑤ (Sn-25= 02)	Selected Frequency
Multi-Step Speed Cmd. 4	Multi-Step Speed Cmd. 3	Multi-Step Speed Cmd. 2	Multi-Step Speed Cmd. 1	
0	0	0	0	Freq. Command 1 (An-01) ^{*1}
0	0	0	1	Freq. Command 2 (An-02) ^{*1}
0	0	1	0	Freq. Command 3 (An-03) ^{*1}
0	0	1	1	Freq. Command 4 (An-04) ^{*1}
0	1	0	0	Freq. Command 5 (An-05) ^{*1}
0	1	0	1	Freq. Command 6 (An-06) ^{*1}
0	1	1	0	Freq. Command 7 (An-07) ^{*1}
0	1	1	1	Freq. Command 8 (An-08) ^{*1}
1	1	1	1	Freq. Command 16 (An-16) ^{*1}

Note: "0" : Terminal is "OFF" "1" : Terminal is "ON"

- Figure 41 shows the operation sequence of a multi-step speed and jog command.

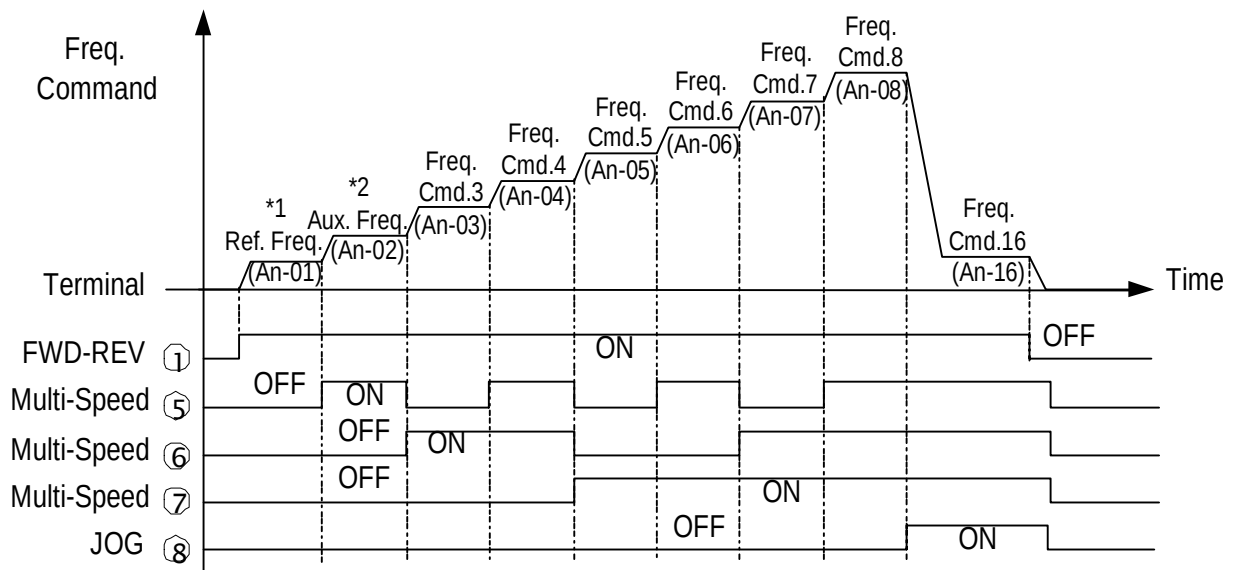


Figure 41 Time Chart for Multi-Step Speed and Jog Command

- *1 When parameter Sn-05= 0, the reference command is input by the setting of An-01. When parameter Sn-05= 1, the reference command is input from the analog command through terminals VIN and AIN.
- *2 If parameter Sn-29= 0, the auxiliary frequency (the 2nd step frequency setting: AUX frequency) is input from the AUX terminal. If the parameter Sn-29 ≠ 0, then the 2nd step frequency setting is determined by the parameter setting in An-02.

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 39.

External Baseblock (A-Contact) (Setting : 08)

External Baseblock (B-Contact) (Setting : 09)

- With either of these settings, the Multi-Function Input Terminal controls its inverter Baseblock operation.
- During running : As an External Baseblock signal is detected, the digital operator will display a "B.B. Alarm". Then, the inverter output is blocked. After the Baseblock signal is cleared, the motor will resume running according to its then reference signal.

- During deceleration : As 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. The motor will then coast to stop freely. After this External Baseblock signal is cleared, the inverter will stay in stop mode.

Acceleration and Deceleration Ramp Hold (Setting:10)

- With this setting, the signal of Acceleration/Deceleration ramp hold (input from the Multi-Function Input Terminals) will pause the Acceleration/Deceleration of motor and maintain the output frequency. The motor will coast to stop if an OFF command is input while the Acceleration/Deceleration ramp hold input is ON. The output frequency will be memorized and the command of Acceleration/Deceleration ramp hold is released.

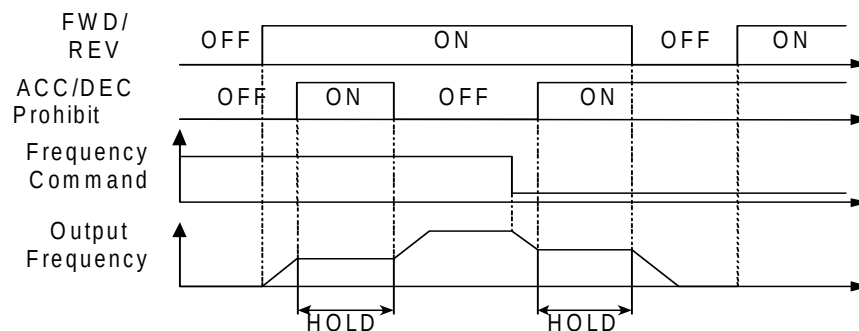


Figure 42 Acceleration and Deceleration Ramp Hold

Inverter Overheat Alarm (Setting : 11)

- When the inverter detects an overheat signal “ON”, the digital operator will change its display to “Overheat Alarm” and the inverter will still maintain 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)

- Jogging can be performed in forward or reverse rotation.
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 commands.
- The inverter will stop running with the stopping method set by the setting of Sn-06 if the Forward Jog and Reverse Jog commands are both ON for more than 500ms.

PID Integral Reset (Setting : 14)

- In the PID control, the Integral can be reset to zero (ground) through Multi-Function Input Terminals ⑤~⑧ (Sn-25~28= 14).

PID Control Invalid (Setting : 15)

OFF	PID Control Valid (closed-loop)
ON	PID Control Invalid (open-loop)

- This setting can be used in the changeover of 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.
- The setting of Sn-64 can be used to enable or disable the PID Function.

External Fault A-Contact (Setting : 16)

External Fault B-Contact (Setting : 17)

- When the External Fault Input terminal is set to "ON", an external fault occurs. If External Input Terminal ⑥ is set for External Fault Input Terminal use, a message of "Fault Ext. Fault 6" will be displayed.
- Five terminals can be assigned as External Fault Inputs, they are terminals ③, ⑤, ⑥, ⑦ and ⑧.
- When an External Fault occurs, the inverter will be blocked from output and the motor will coast to stop.

Multi-Function Analog Input Setting (Setting:18)

- Disables or enables the Multi-Function Analog Input at AUX terminal when controlled by the input signal at an external terminal. When the PID function is enabled, the original AUX function will be disabled.

Timer Function Input Terminal (Setting : 19)

- Refer to the setting of Timer Function output terminal on Page 98.

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 will be performed and the inverter will be stopped if the DC Injection Braking input is ON.

If a Run Source or Jog Command is input, DC Injection Braking will be cleared and the motor will begin to run.

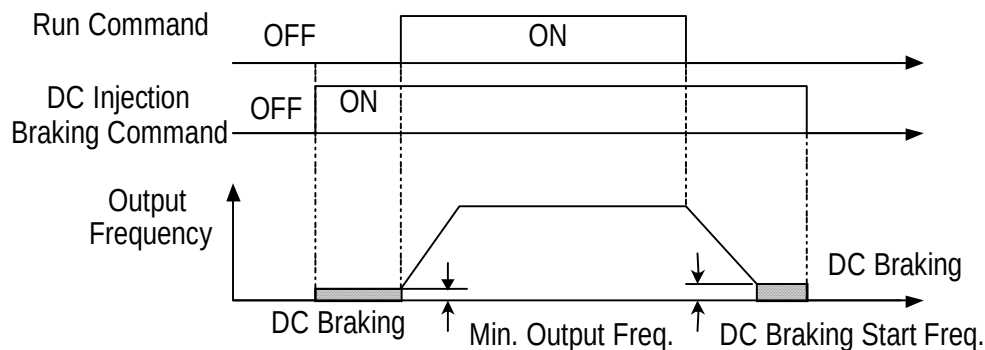


Figure 43 Time Chart for DC Injection Braking Command

Speed Search 1 (Setting : 21)

Speed Search 2 (Setting : 22)

- Refer to "Speed Search" function on Page 58.

LOCAL/REMOTE Control I (setting : 23)

OFF	Remote Control Run Command and Frequency Command is performed through Control Circuit Input or RS-485 Communication Port. (It will be set by the combination of settings of Sn-04 and Sn-05.) The REMOTE-REF, SEQ LED light is ON. See page 28 "Local / Remote function"
ON	Local Control Run Command and Frequency Command is performed through the LCD Digital Operator. The REMOTE-REF, SEQ LED light is OFF. See page 26 "Local / Remote function"

- The inverter must be in the STOP mode to change the operation from LOCAL to REMOTE.

LOCAL/REMOTE Control II (setting : 24)

OFF	Remote Control Run Command and Frequency Command is performed through Control Circuit Input or RS-485 Communication Port. (It will be set by the combination of settings of Sn-04 and Sn-05.) The REMOTE-REF, SEQ LED light is ON. See page 28 "Local / Remote function"
ON	Local Control Run Command and Frequency Command is performed through Control Circuit Terminal. The REMOTE-REF, SEQ LED light is OFF. See page 28 "Local / Remote function"

- The inverter must be in the STOP mode to change the operation from LOCAL to REMOTE.

RS-485 Communication Application (Setting : 25)

- Multi-Function Input Terminals ⑤ ~ ⑧ can be used as the extension contact terminals of PLC with the command communicated through the RS-485 port.

PG-Less Speed Control Action (Setting : 26)

Reset Integration of Speed Control with PG (Setting : 27)

- When PG Feedback is used, the integral control (to add the PG feedback compensation) can be disabled or enabled from the external terminals. The user can use the external terminals to clear the integral value.

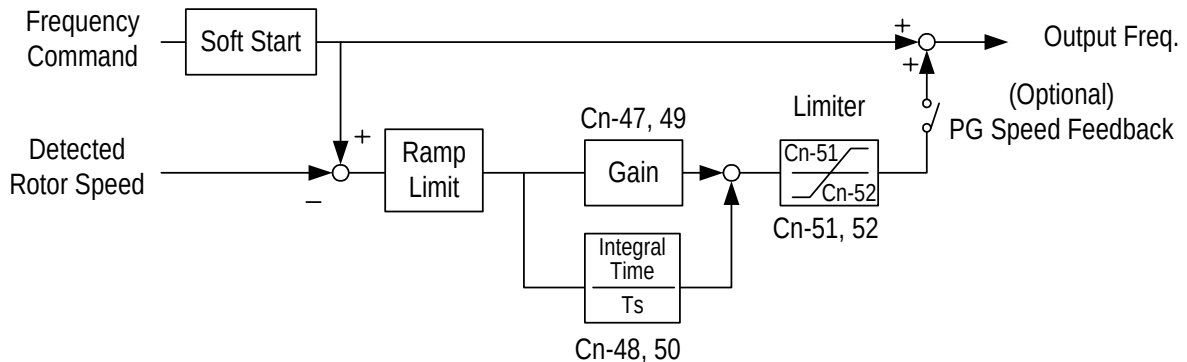


Figure 44 PG Speed Control Block Diagram

Frequency UP/DOWN Function (Setting : 28)

- The inverter can use either the Digital Operator or External Multi-Function Input Terminals (terminal ⑦ or ⑧) to change the output frequency upward or downward.
- Set parameters Sn-04 and Sn-05 to 1. The run source and frequency command is set through the control circuit terminals. Then set parameter Sn-28 to 28 (terminal ⑦ will now have the function “UP”, its original function is disabled). Terminal ⑦ and ⑧ can now be used for “UP” and “DOWN” function to control /change the output frequency.
- Operation sequence as below:

Control circuit terminal ⑦ : UP Function	ON	OFF	OFF	ON
Control circuit terminal ⑧ : DOWN Function	OFF	ON	OFF	ON
Operation Status	ACC (UP)	DEC (DOWN)	Constant (HOLD)	Constant (HOLD)

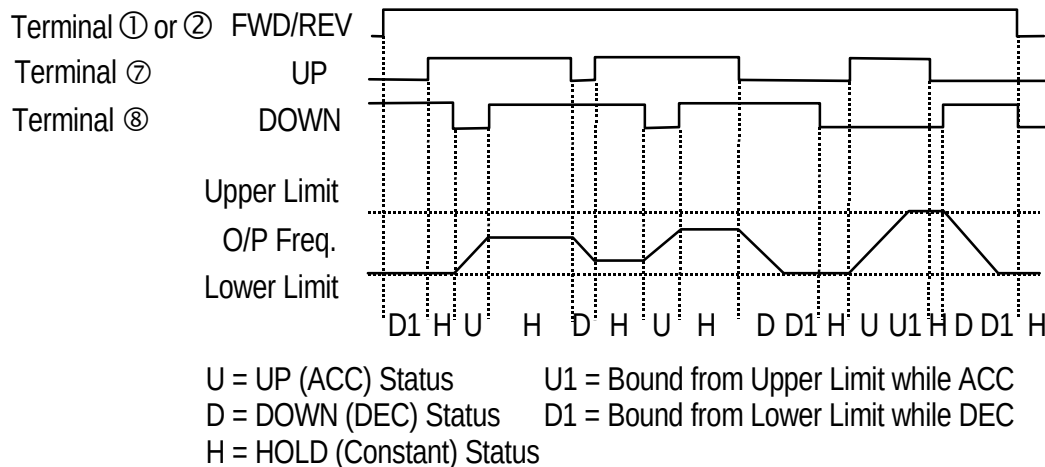


Figure 45 Time Chart of Output Frequency with the UP/DOWN Function

- Only set through parameter Sn-28.
- When the frequency UP/DOWN function is being used, the output frequency will accelerate to the lower limit (Cn-19) if a run command is pressed.
- The output frequency held by the UP/DOWN function will be stored in memory. This output frequency will be retained even after a power loss. When power is reapplied, the inverter will restart at this hold frequency if a run command is pressed next time.
- If the UP/DOWN function and jog frequency command are both assigned to Multi-Function Inputs, the jog frequency command input has highest priority.

Forced Run (Setting : 29)

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

Multi-Function Analog Input Function Selection (Sn-29)

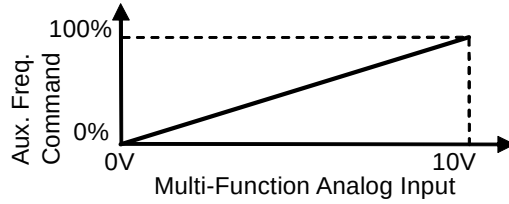
- The settings and functions for the Multi-Function Analog Input (Terminal AUX) are listed in Table 15.

Table 15 Multi-Function Analog Input Function Listing

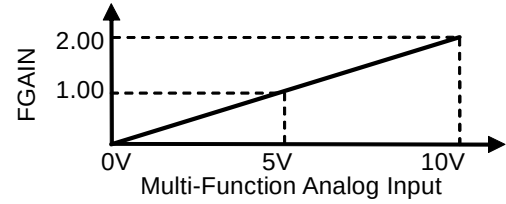
Setting	Function	LCD Display	Description (100% Output Corresponds to 10V Level)
00	Auxiliary Frequency Command	Auxiliary Freq. Cmd.	(Max. output frequency)
01	Frequency Command Gain (FGAIN)	~Freq. Cmd. Gain	Total gain= Bn-09 x FGAIN (Frequency command in voltage form, terminal VIN frequency command)
02	Frequency Command Bias 1 (FBIAS1)	Cmd. Bias 1	Total bias= Bn-10 + FBIAS1
03	Frequency Command Bias 2 (FBIAS2)	Cmd. Bias 2	Total bias= Bn-10 + FBIAS2
04	Overtorque Detection Level	Over Tq. Level	According to analog input voltage (0~10V), change overtorque detection level (setting of Cn-32 is disabled)
05	Output Freq. Bias (VBIAS)	Output Voltage	Total output voltage= V/F pattern voltage + VBIAS
06	Scaling ACC/DEC Time(TK)	ACC.&DEC. Coeff.	Real ACC/DEC time= ACC/DEC time (Bn-0~24) / TK
07	DC Injection Braking	DC Braking Current	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	Run Stall Level	According to analog input voltage (1.5V~10V), change the level of stall prevention during running (30%~200%) (Inverter rated current=100%, setting Cn-26 is disabled.)
09	PID Control Reference Input	PID Command	Multi-function analog input (terminal AUX) used as PID control reference input (0~10V). Please refer to "PID CONTROL BLOCK DIAGRAM" on Page 42.
10	Frequency Command Lower Limit	Freq.Cmd. Lower Bound	Change the frequency command lower-limit (0-100%) value according to the analog input voltage (0~10V). (Max. output frequency (Cn-02) corresponds to 100% analog output. The actual lower-limit is determined by the maximum of Cn-19 and the value corresponding to the multi-function analog input terminal).
11	Jump Frequency Setting 4	Freq. Jump 4	Set jump frequency 4 according to analog input voltage (0~10V). Cn-20~Cn-23 can be used to set jump frequency 1~3 and their jump frequency width.
12	RS-485 Communication Application	Comm. Control	The analog value of AUX (0-1024/0-10V) can be read through RS-485 communication.

• Multi-Function Analog Input Characteristics

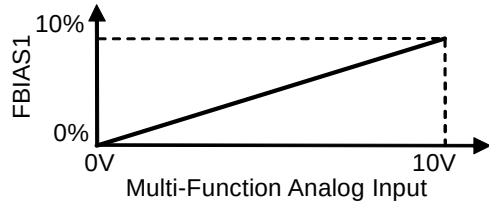
(1) Sn-29 = 00



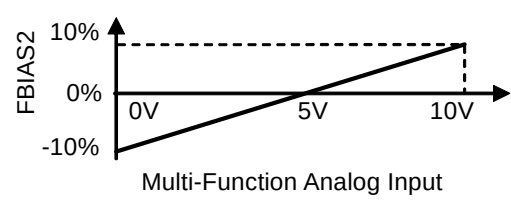
(2) Sn-29 = 01



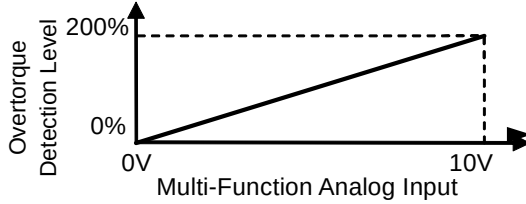
(3) Sn-29 = 02



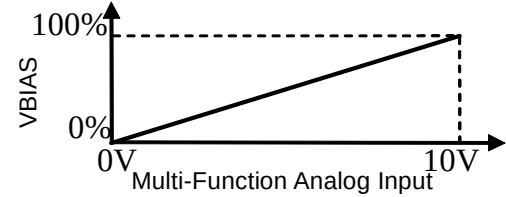
(4) Sn-29 = 03



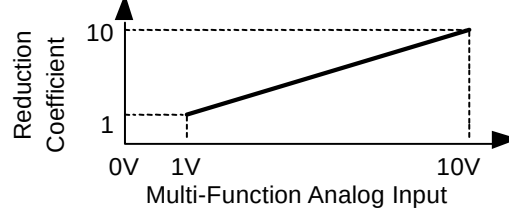
(5) Sn-29 = 04



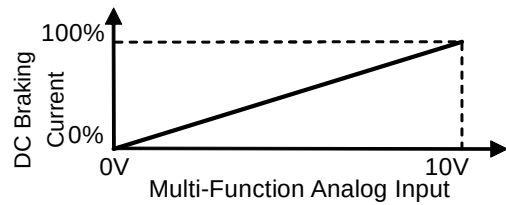
(6) Sn-29 = 05



(7) Sn-29 = 06

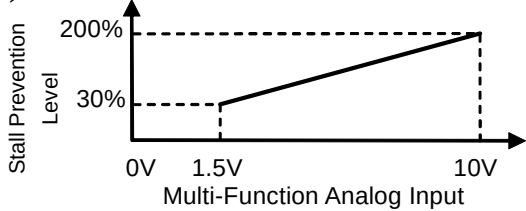


(8) Sn-29 = 07



$$\text{Real ACC/DEC Time} = \frac{\text{ACC/DEC Time (Bn-01~04)}}{\text{Reduction Coefficient (TK)}}$$

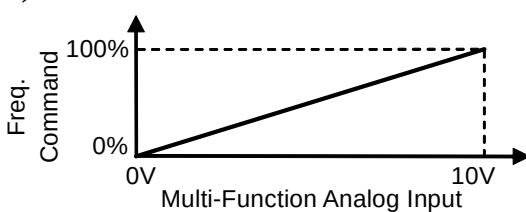
(9) Sn-29 = 08



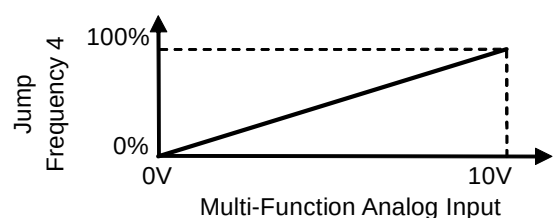
(10) Sn-29 = 09

Multi-Function Analog Input (terminal AUX) used as PID control reference input (0~10V). Please refer to "PID CONTROL BLOCK DIAGRAM" on page 42 and 120.

(11) Sn-29 = 10



(12) Sn-29 = 11



Sn-29=12 : For RS-485 Communication use. The analog value of AUX (0-1024/0-10V) can be read through RS-485 Communication.

Multi-Function Output Terminal (RA-RB-RC or R1A-R1B-R1C) Function Selection (Sn-30)

Multi-Function Output Terminal (DO1-DOG) Function Selection (Sn-31)

Multi-Function Output Terminal (DO2-DOG or R2A-R2C) Function Selection (Sn-32)

Multi-Function Output Terminal setting and its functions are shown in Table 16.

Table 16 Multi-Function Output Terminal Function Listing

Setting	Function	LCD Display	Description	Ref. Page
00	During Running	Running	ON : During running	96
01	Zero Speed	Zero Speed	ON : Zero speed	
02	Frequency Agree	Frequency Arrive	Speed agree width: Cn-31	56
03	Setting Frequency Agree	Agreed F Arrive	ON : output frequency = $\pm$ Cn-29, Speed agree width: Cn-31	
04	Output Frequency Detection 1	Freq. Det. 1	ON : while ACC, -Cn-29 $\geq$ output freq. $\geq$ Cn-29 while DEC, -Cn-30 $\geq$ output freq. $\geq$ Cn-30 Speed agree width: Cn-31	
05	Output Frequency Detection 2	Freq. Det. 2	ON : while ACC, output freq $\geq$ Cn-29(or $\leq$ -Cn-29) while DEC, output freq $\geq$ Cn-30(or $\leq$ -Cn-30) Speed agree width: Cn-31	
06	Inverter Ready	Run Ready OK!	ON : READY	96
07	Undervoltage Detected	Low Volt Detect	ON : Undervoltage detected	
08	Output Baseblock	Output B.B.	ON : Output baseblock	
09	Run Source Mode	Run Source Operator	ON : Run source from digital operator (Local mode)	
10	Frequency Command Mode	Ref. Cmd. Operator	ON : Frequency command from digital operator (Local mode)	
11	Overtorque Detected	Over Tq. Detect.	ON : Overtorque detected	57,97
12	Frequency Command Invalid	Freq. Cmd. Invalid	ON : Frequency command invalid	97
13	Fault	Fault	ON : Fault	
14	Pulse Signal Output	Pulse Mul. Output	Only set by Sn-31, Sn-32 (terminal DO1-DOG)	
15	Undervoltage Alarm	Low Volt. Alarm	ON : Undervoltage alarm	
16	Inverter Overheat	Inverter Overheat	ON : Inverter Overheat	
17	Motor Overload	Motor Overload	ON : Motor Overload	
18	Inverter Overload	Inverter Overload	ON : Inverter Overload	
19	Fault Retry	Fault Retry	ON : Retry	52
20	RS-485 Communication Fault	RS-485 Fault	ON : RS-485 communication fault	98
21	Timer Function Output	Timer Function	Signal delay output (vs. timer function input)	98
22	RS-485 Communication Application	Comm. Control	Extension output contact application	98

During Running (Setting : 00)

OFF	Run Source OFF, Inverter is OFF.
ON	Run Source ON, or Run Source OFF but residual output exists.

Zero Speed (Setting : 01)

OFF	Output Frequency $\geq$ MIN. Output Frequency (Cn-07).
ON	Output Frequency < MIN. Output Frequency (Cn-07).

Frequency Agree : (Setting : 02)

Setting Frequency Agree : (Setting : 03)

Output Frequency Detected 1 : (Setting : 04)

Output Frequency Detected 2 : (Setting : 05)

- Refer to Frequency Detection Function on Page 52.

Inverter Ready (Setting : 06)

Undervoltage Detected (Setting : 07)

- When the DC link voltage of main circuit is lower than the Undervoltage Detection Level (Cn-39), the output contact is in 'ON' state.

Output Blocked (Setting : 08)

Run Command Mode (Setting : 09)

OFF	Remote Mode (Sn-04 = 1, 2, or Multi-Function Input Terminal ⑤~⑧ is set as Local/Remote Control I mode or Local/Remote Control II mode and Contact Terminal is OFF). REMOTE-SEQ LED is lit on the LCD Digital Operator. "See page 28 "Local / Remote functions"
ON	Local Mode (Sn-04 = 0, Multi-Function Input Terminal ⑤~⑧ is set as Local/Remote Control I mode and Contact Terminal is ON). REMOTE-SEQ LED is OFF, Run Command is from LCD Digital Operator. "See page 28 "Local / Remote functions"

Frequency Command Mode (Setting : 10)

OFF	Remote Mode (Sn-05 = 1, 2, or Multi-Function Input Terminal ⑤~⑧ is set as Local/Remote Control I mode or Local/Remote Control II mode and Contact Terminal is OFF). REMOTE-REF LED is lit on the LCD Digital Operator. "See page 28 "Local / Remote functions"
ON	Local Mode (Sn-05 = 0, Multi-Function Input Terminal ⑤~⑧ is set as Local/Remote Control I mode and Contact Terminal is ON). REMOTE-REF LED is OFF, Run Command is from LCD Digital Operator. "See page 28 "Local / Remote functions"

Overtorque Detected (Setting : 11)

- See Pages 57 and 79 for Overtorque Detection Function.

Frequency Command Missing (Setting : 12)

- Run Source 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 occur if a communication fault occurs.

Pulse Signal Output (Setting : 14)

- Only Multi-Function Output Terminal DO1-DOG (Setting Sn-31) can be set for Pulse Signal Output.
- DO1 is a Photo-Coupler Output, its Pulse Output Frequency is set by parameter Sn-35. See Figure 46.

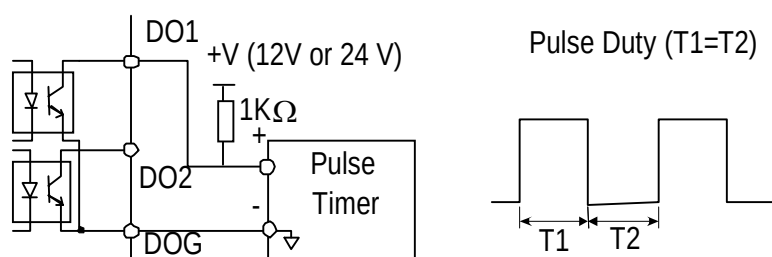


Figure 46 Pulse Signal Output

Undervoltage Alarm (Setting : 15)

- If the main circuit DC Bus Voltage is below the Undervoltage Alarm Detected Level, the Multi-Function Output Terminal is ON.
- Undervoltage Alarm Detected Level :
220V Class : 240VDC
440V Class : 460VDC

Inverter Overheat (Setting : 16)

- See Page 113. The Multi-Function Output Terminal is ON if the cooling fin overheats.

Motor Overload (Setting : 17)

- See “Motor Overload Protection Selection” on page 82. The Multi-Function Output Terminal is ON if the motor has an overload fault.

Inverter Overload OL2 (Setting : 18)

- The Multi-Function Output Terminal is ON if the inverter has an overload fault. See Page 113.

Fault Retry (Setting : 19)

- See Fault Restart Function (Cn-24) on Page 52. Upon restart, the Multi-Function Output Terminal is ON.

RS-485 Communication Fault (Setting : 20)

- See Page 122.

Timer Function Output (Setting : 21)

- If the Multi-Function Input Terminals ⑤~⑧ are set as the Timer Input Terminals (Sn-25~28= 19), the signal will be output through the corresponding Multi-Function Output Terminals with the specified ON-delay and OFF-delay as shown below. See Timer Function on Page 44.

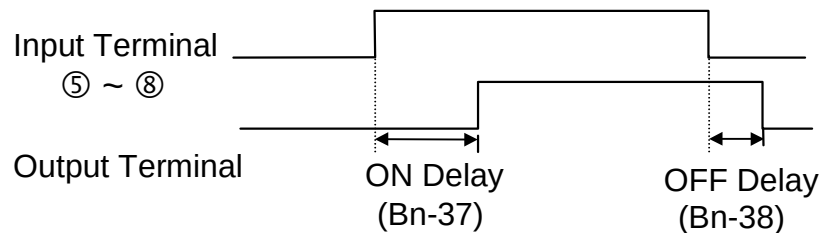


Figure 47 The Input/Output Signal in 'Timer' Function Application

RS-485 Communication Application (Setting:22)

- In applications where the control commands are executed through the RS-485 Communication Port, the Multi-Function Output Terminals can be used as the PLC Extension Output Contact Terminals.

Multi-Function Analog Output (Terminal AO1) Selection

(Sn-33)

Multi-Function Analog Output (Terminal AO2) Selection

(Sn-34)

- The Multi-Function Analog Output can be set to monitor the following 12 status items as shown below :

Sn-33, Sn-34 Setting	Monitored Contents	Description	
		Input	Output
00	Frequency Command	0 ~ Max. frequency	0~10V
01	Output Frequency	0 ~ Max. frequency	
02	Output Current	0 ~ Rated current	
03	Output Voltage	0 ~ Rated voltage	
04	DC Voltage	230V Class 0~400V 460V class 0~800V	
05	VIN Analog Command	0~10V	
06	AIN Analog Command	4~20mA	
07	AUX Analog Command	0~10V	
08	PID Input	0 ~ Max frequency	
09	PID Output1	0 ~ Max frequency	
10	PID Output2	0 ~ Max frequency	
11	Communication Control	0~100% ¹	

Note : *1: When Sn-33~34=11, the Multi-Function Output Terminals AO1, AO2 are controlled through RS-485 Communication Port either by MODBUS

- The Output Gain (Bn-14 and Bn-15) will determine the Output Voltage at Multi-Function Analog Output at AO1, AO2 Terminal. The specified multiple of 10V will correspond to the 100% output monitored value.

Pulse Output Multiplication-Gain Selection (Sn-35)

- When the Multi-Function Output Terminal (DO1) is 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. Refer to Figure 46 for pulse signal output.
- Example : when Sn-35= 0, the inverter output frequency is 60Hz, the output pulse frequency is 60Hz (duty = 50%).
- Different settings of Sn-35 and their corresponding multiple numbers are shown below :

Sn-35 Setting	Pulse Output Frequency	Applicable Freq. Range
0	1F : 1 x Inverter Output Frequency	3.83 ~ 400.0Hz
1	6F : 6 x Inverter Output Frequency	2.56 ~ 360.0Hz
2	10F : 10 x Inverter Output Frequency	1.54 ~ 210.0Hz
3	12F : 12 x Inverter Output Frequency	1.28 ~ 180.0Hz
4	36F : 36 x Inverter Output Frequency	0.5 ~ 60.0Hz

Inverter Station Address	(Sn-36)
RS-485 Communication Baud Rate Setting	(Sn-37)
RS-485 Communication Parity Setting	(Sn-38)
RS-485 Stopping Method After Communication Error	(Sn-39)

- The C10 inverter has a built-in RS-485 port for monitoring inverter status and reading parameter settings. Under the remote mode operation, the inverter status and the parameter settings can be monitored. Moreover, the user can change the parameter settings to control the motor operation.
- The C10 uses MODBUS protocol to communicate with external units by means of the cable line from the RS-485 port.
- 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 : Coast to stop
 - = 2 : Deceleration to stop with Bn-04 (Deceleration Time), when RS-485 has communication error.
 - = 3 : Continue to run (will stop if the key stop is pressed)
- Every data stream 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:
 - a. Read Command : external units to read the memory address of the inverter.
 - b. Write Command : external units to write the memory address of the inverter in order to control the inverter.
 - c. 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.
- Do not make the DRIVE/PRGM changeover while writing the data into the inverter through the RS-485 port.

PG Speed Control Settings (Sn-40)

- Sn-40 = 0 : Disables speed control function.
- = 1 : Enables speed control.
- = 2 : Enables speed control. No integral action during ACC/DEC.
- = 3 : Enables speed control. Integral action is enabled.

Operation Selection at PG Opens (Sn-41)

- Sn-41 = 0 : Deceleration to stop (Bn-02)
 - = 1 : Coast to stop
 - = 2 : Deceleration to stop (Bn-04)
 - = 3 : Continue to run
- } Displays "PG Open" alarm.
- Blinking display "PG Open" alarm.

Operation Selection at PG Speed Deviation Over (Sn-42)

- Sn-42 = 0 : Deceleration to stop (Bn-02)
 - = 1 : Coast to stop
 - = 2 : Deceleration to stop (Bn-04)
 - = 3 : Continue to run
- } Displays "Sp. Deviat Over" fault message.
- Blinking display "Sp. Deviat Over" alarm.

Overspeed Detection (Sn-43)

- Sn-43 = 0 : Deceleration to stop (Bn-02)
 - = 1 : Coast to stop
 - = 2 : Deceleration to stop (Bn-04)
 - = 3 : Continue to run
- } Displays "Over Speed" fault message.
- Blinking display "Over Speed" alarm.

Auto_Run Mode Selection (Sn-44)

Auto_Run Mode Setting Selection (Sn-45~Sn-60)

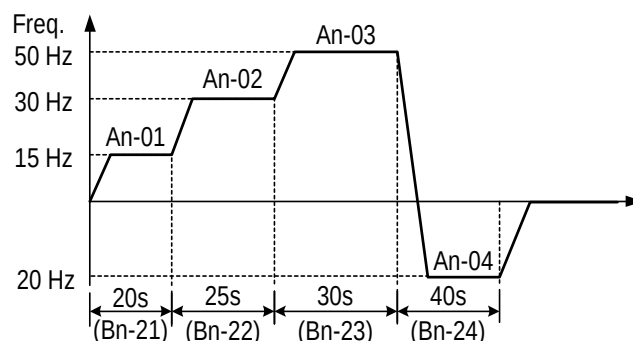
- A PLC operation mode is ready to use with the following setting of Multi-Step Frequency Command 1~16 (An-01~An-16), Auto_Run Mode Time Setting (Bn-21~Bn-36) under the Auto_Run Mode Selection (Sn-44). The FWD/REV direction can be set with the setting of Sn-45~60.
- In the Auto_Run mode, the Multi-Step Frequency Command 1~4 derived from the Multi-Function Input Terminals ⑤~⑧ are ineffective.
- Example of Auto_Run Mode :

(A) Single Cycle Running (Sn-44= 1, 4)

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

For example :

Sn-44=1	Sn-45~47=1(FWD)	Sn-48=2(REV)
	Sn-49~60=0	
An-01=15Hz	An-02=30Hz	An-03=50Hz
	An-04=20Hz	
Bn-21=20s	Bn-22=25s	Bn-23=30s
	Bn-24=40s	
An-05~16=0Hz	Bn-25~36=0s	



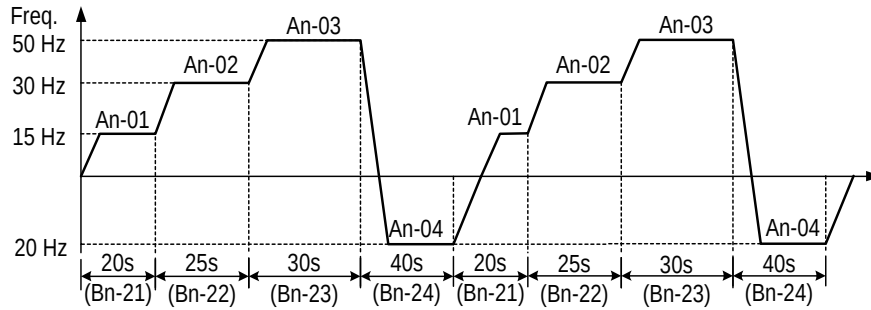
(B) Periodic Running (Sn-44=2, 5)

The inverter will repeat the same cycle periodically.

For example :

Sn-44 = 2

An-01~16, Bn-21~36, Sn-45-60 : same setting as the example (A)



(C) Auto_Run Mode for Single Cycle

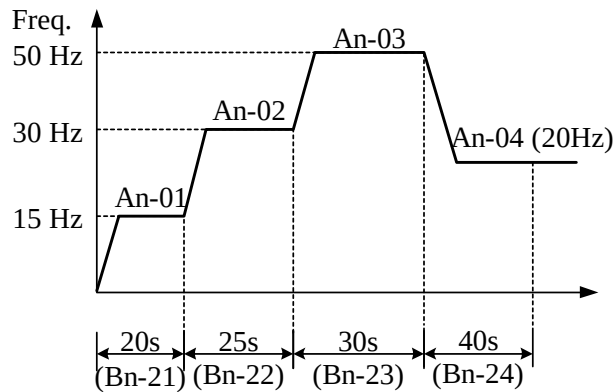
The speed of final step will be held to run.

For example :

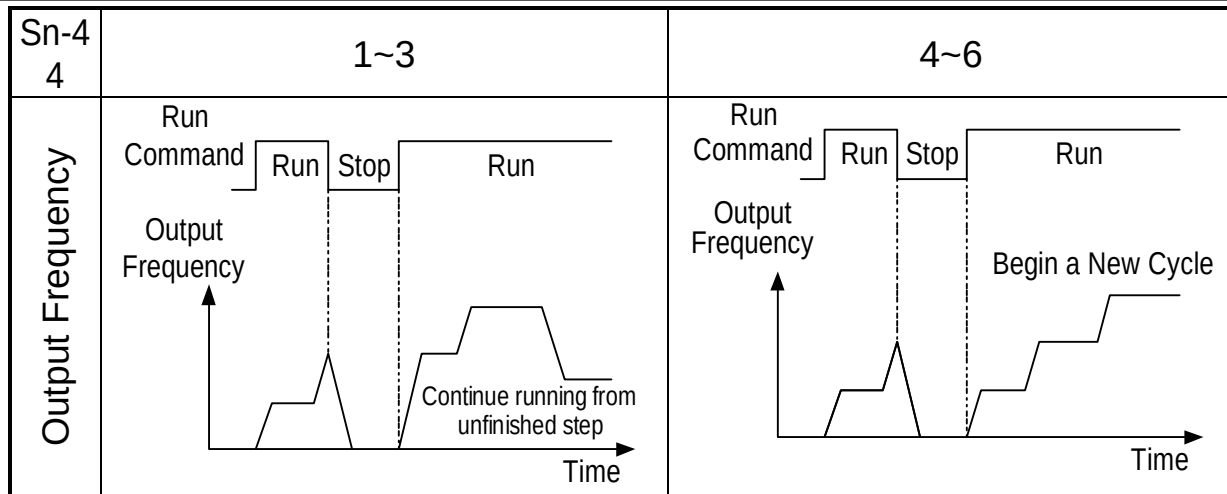
Sn-44 = 3

Sn-45~48 = 1 (FWD) Sn-49~60 = 0

An-01~16, Bn-21~36 : same setting as the example (A)



- Sn-44 = 1~3 : If the inverter stops and restarts again, it will continue running from the unfinished step, according to the setting of Sn-44.
- = 4~6 : If the inverter stops and restarts again, it will begin a new cycle and continue running according to the setting of Sn-44.



- ACC/DEC time follows the settings 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.

Applied Torque Load (Sn-61)

- Select either the Constant Torque Load (Sn-61=0) or Variable Torque Load (Sn-61=1). The inverter will automatically choose the proper V/F pattern and change the inverter overload protection curve. (See Page 72 for Inverter Capacity Selection).

LCD Language Display Selection (Sn-62)

- Sn-62 = 0 : English
= 1 : Chinese

Parameter Copy (Sn-63)

- JNEP-36 LCD Digital Operator can upload the parameter settings from the LCD Digital Operator to inverter and download parameter settings from the inverter to the LCD Digital Operator.
- LCD Digital Operator will check its EEPROM or the inverter's EEPROM under the following settings.

- 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 CW direction.
 - = 2 : Download data (Inverter → LCD Digital Operator). During this period, the LED on the LCD Digital Operator will light sequentially in the CCW direction.
 - = 3 : Verification check on LCD's EEPROM; during this period the LED will switch-on between 2 groups.
 - = 4 : Verification check on inverter's EEPROM; during this period the LED will not light.
- Please follow the following steps to implement the action of Parameter Copy between different inverters (either upload or download).
 - Step 1 : Check the contents of LCD Digital Operator EEPROM (Sn-63 = 03), then check the contents of inverter's EEPROM (Sn-63 = 04). Make sure that both EEPROM function properly.
 - Step 2 : Download and copy the inverter's parameter settings to LCD Digital Operator EEPROM (Sn-63=2).
 - Step 3 : Upload and copy the parameter settings of LCD Digital Operator to other inverter's EEPROM (Sn-63=1).

PID Function Selection (Sn-64)

- To enable PID Control, set Sn-64=1. Otherwise, set Sn-64=0 to disable PID Control Function. It is also possible to use Multi-Function Terminals ~ to Enable/Disable PID Control.

Braking Resistor Protection Selection (Sn-65)

- Sn-65 = 0 : External braking resistor protection invalid.
 - = 1 : External braking resistor protection valid.
- Be sure to set parameter Sn-65 to 1 when an External Braking Resistor is used.

Motor Parameter Autotuning Selection (Sn-66)

- The AUTOTUNE feature can be used to identify and store the motor's parameters
- Sn-66 = 0 : Autotuning Disable
= 1 : Autotuning Enable

Control Mode Selection (Sn-67)

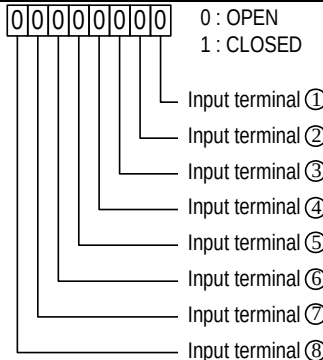
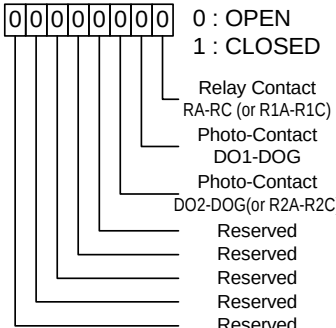
- Select one of the two following control modes
- Sn-67 = 0 : V/F Control Mode (includes V/F Control with PG Feedback)
= 1 : Sensorless Vector Control Mode

Sensorless Vector Control ^{*1}

1. Set Sn-67 = 1 for Sensorless Vector Control.
Set Sn-66 = 1 for Autotuning.

*1. For output frequency less than 1.5Hz in sensorless vector control, set Sn-02=15 and then change Cn-07 to required frequency.

3.5 Monitoring Parameters Un-□□

Parameter No.	Name	LCD Display (English)	Unit	Description	Multi-Function Analog Output Level
Un-01	Frequency Command	Un-01=60.00Hz Frequency Command	0.01Hz	Display frequency command. The displayed unit is determined by Cn-28.	10V/MAX. Output Frequency
Un-02	Output Frequency	Un-02=60.00Hz Output Frequency	0.01Hz	Display output frequency. The displayed unit is determined by Cn-28.	10V/MAX. Output Frequency
Un-03	Output Current	Un-03=12.5A Output Current	0.1A	Display inverter output current.	10V/Inverter Rated Current
Un-04	Output Voltage	Un-04=220.0V Output Voltage	0.1V	Display output voltage command of inverter.	10V/220V or 10V/440V
Un-05	Main Circuit DC Voltage	Un-05=310.0V DC Voltage	0.1V	Display DC voltage of inverter main circuit.	10V/400V or 10V/800V
Un-06	External Analog Command VIN	Un-06=100% Voltage ~Command	0.1%	—	10V/100%
Un-07	External Analog Command AIN	Un-07=100% Current ~Command	0.1%	—	20mA/100%
Un-08	Multi-Function Analog Input Command AUX	Un-08=100% Multi-Function ~Cmd.	0.1%	—	10V/100%
Un-09	External Analog Output AO1	Un-09=100% Term. AO1 Output	0.1%	—	10V/100%
Un-10	External Analog Output AO2	Un-10=100% Term. AO2 Output	0.1%	—	10V/100%
Un-11	Input Terminal Status	Un-11= 00000000 I/P Term. Status	—		—
Un-12	Output Terminal Status	Un-12= 00000000 O/P Term. Status	—		—

Parameter No.	Name	LCD Display (English)	Unit	Description	Multi-Function Analog Output Level
Un-13	Amount of PG Speed Feedback	Un-13= 100.0% PG Feedback	0.1%	100.0%=MAX. output freq.	10V/MAX. output frequency
Un-14	Amount of PG Speed Compen.	Un-14= 100.0% PG Compen.	0.1%	100.0%=MAX. output freq.	10V/MAX. output frequency
Un-15	PID Control Input	Un-15= 100% PID Input	0.1%	100.0%=MAX. output freq.	10V/MAX. output frequency
Un-16	PID Control Output 1	Un-16= 100% PID Output 1	0.1%	100.0%=MAX. output freq.	10V/MAX. output frequency
Un-17	PID Control Output 2	Un-17= 00% PID Output 2	0.1%	100.0%=MAX. output freq.	10V/MAX. output frequency
Un-18	Fault Message 1	Overcurrent Message 1	—	Fault message occurred now	—
Un-19	Fault Message 2	Overcurrent Message 2	—	Fault message occurred last time	—
Un-20	Fault Message 3	Overheat Message 3	—	Fault message occurred last two times	—
Un-21	Fault Message 4	Overtorque Message 4	—	Fault message occurred last three times	—
Un-22	The Parameter of Time Period Between Last Fault and the Nearest Fault	Un-22= 2400Hr Last Fault Run Time	1Hr	The value of 'Run Elapse Time' parameter will be cleared after fault has been cleared.	—
Un-23	Frequency Command While Fault Occurred	Un-23= 60.00Hz Last Fault Freq.Cmd.	0.01Hz	—	—
Un-24	Output Freq. While Fault Occurred	Un-24= 60.00Hz Last Fault O/P Freq.	0.01Hz	—	—
Un-25	Output Current While Fault Occurred	Un-25= 12.5A Last Fault O/P I	0.1A	—	—
Un-26	Output Voltage While Fault Occurred	Un-26= 220.0V Last Fault O/P V	0.1V	—	—
Un-27	DC Voltage While Fault Occurred	Un-27= 310.0V Last Fault O/P V	0.1V	—	—
Un-28	I/P Terminal Status While Fault Occurred	Un-28= 00000000 Last Fault I/P Term.	—	Same as Un-11, Displays terminal status	—
Un-29	O/P Terminal Status While Fault Occurred	Un-29= 00000000 Last Fault O/P Term.	—	Same as Un-12, Displays terminal status	—
Un-30	Time Elapsed After Power-On	Un-31= 00002Hr P Elapsed Time	1Hr	Displays total time elapsed after power ON	—
Un-31	Time Elapsed After Run	Un-31= 00002Hr R Elapsed Time	1Hr	Displays total time elapsed after pressing RUN	—
Un-32	EPROM S/W Version	Un-32= 00001 Soft Number	—	-Manufacturer's use-	—
Un-33	Feedback Motor Speed	Un-33= 00000rpm Motor Speed	1rpm	Displays motor speed while PG feedback is set.	10V/MAX. motor speed

Frequency Command	(Un-01)
Output Frequency	(Un-02)
Output Current	(Un-03)
Output Voltage	(Un-04)
Main Circuit DC Voltage	(Un-05)

- Through settings Sn-33 and Sn-34, the above contents can be displayed at the Multi-Function Analog Output Terminals (AO1, AO2) in different voltage level of (0~10V).

External Analog Command VIN (Un-06)

- This parameter monitors the External Analog Terminal Voltage VIN (0~100%/0~10V). The voltage can be output through 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 Page 42, PID Control Block Diagram.

External Analog Command AIN (Un-07)

- This parameter monitors 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 Page 42, PID Control Block Diagram.

Multi-Function Analog Input Command AUX (Un-08)

- This parameter monitors 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 Page 42, PID Control Block Diagram.

External Analog Output AO1, AO2 (Un-09, Un-10)

- This parameter monitors 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)

- This parameter will monitor the status of input terminal ~ : 'ON' or 'OFF'.

Output Terminal Status (Un-12)

- This parameter will monitor the status of output terminal RA-RC or R1A-R1C, DO1-DOG, DO2-DOG or R2A-R2C: 'ON' or 'OFF'.

PG Speed Feedback and PG Speed Compensation (Un-13, Un-14)

- These parameters monitor the PG Speed Feedback and PG Speed Compensation signal if PG Feedback Function is used.

PID Control Input (Un-15)

PID Control Output 1 (Un-16)

PID Control Output 2 (Un-17)

- The values in Figure 14 (Page 39) can be monitored through parameters Un-15, Un-16 and Un-17. Moreover, the Multi-Function Analog Output Terminal AO1, AO2 can be used to monitor the output value setting of Sn-33 and Sn-34.

Message 1 (Un-18)

Message 2 (Un-19)

Message 3 (Un-20)

Message 4 (Un-21)

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

Cumulative Operation Time Setting (Un-22)

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

Frequency Command While Last Fault Occurred (Un-23)

Output Frequency While Last Fault Occurred (Un-24)

Output Current While Last Fault Occurred (Un-25)

Output Voltage While Last Fault Occurred (Un-26)

DC Voltage While Last Fault Occurred (Un-27)

Input Terminal Status While Last Fault Occurred (Un-28)

Output Terminal Status While Last Fault Occurred (Un-29)

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

Cumulative Time Whenever The Input Power is On (Un-30)

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

Cumulative Run Time Whenever The Output Power is On (Un-31)

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

EPROM Software Version (Un-32)

- This parameter indicates the software version in the C10 inverter.

Motor Speed While PG Feedback is Set (Un-33)

- When PG Feedback Control is Set, the motor speed can be monitored through Un-33.

4. Fault Display and Troubleshooting

4.1 General

The C10 has protective and warning self-diagnostic functions. If a fault occurs, the fault code is displayed on the LCD Digital Operator and the Fault Contact Output (RA-RB-RC or R1A-R1B-R1C, DO1, DO2 or R2A-R2C) operates causing the inverter to shut off and stop the motor. If a warning occurs, the LCD Digital Operator will display the warning code. However, the fault-contact output does not operate, except for some certain cases. (See Page 113, Warning and Self-Diagnosis Functions). The LCD Digital Operator will return to its previous status when the above warning is cleared.

- When a fault has occurred, refer to the following table to identify and to clear the cause of the fault.
- Use one of the following methods to reset the fault after restarting the inverter.
 1. Stop the inverter.
 2. Switch the fault reset input at terminal ④ signal or press the RESET key on the digital operator.
 3. Turn off the main circuit power supply and turn on again.

4.2 Error Message and Troubleshooting (A)

Protective Function

LCD Display	Fault Contents	Fault Contact Output	Error Causes	Action to be Taken
Fault DC Volt. Low	The main circuit DC voltage becomes lower than the low voltage detection level (Cn-34).	Operation	1 Power capacity is too small. 2 Voltage drop due to wiring resistance. 3 A motor of large capacity connected to the same power system has been started. 4 Defective electromagnetic contactor.	1 Check the source voltage and wiring. 2 Check the power capacity and power system
Fault Over Current	The inverter output current becomes approx. 200% above the inverter rated current.	Operation	1 Extremely rapid accel. 2 Short-circuit or ground-fault at the inverter output side. 3 Motor of a capacity greater than the inverter rating has been started. 4 High speed motor or pulse motor has been started.	1 Extend the accel. time. 2 Check the load wiring.
Fault Ground Fault	A ground fault occurs at the inverter output side and the ground-fault current exceeds approx. 50% of the inverter rated current.	Operation	1 Motor dielectric strength is insufficient. 2 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 regenerative energy caused by decelerating motor.	Operation	1 Insufficient deceleration time. 2 High input voltage compared to motor rated voltage.	1 Extend the accel. time. 2 Add a braking resistor.
Fault Over Heat	The temperature of the cooling fin reaches the detection level.	Operation	1 Defective cooling fan 2 Ambient temperature rise 3 Clogged filter	1 Check the fan, filter and the ambient temperature
Fault Motor Over Load	Motor overload is detected by the electronic thermal relay. (motor protection)	Operation	1 Overload, low speed operation or extended accel. time. 2 Improper V/F characteristic setting.	1 Measure the temperature rise of the motor. 2 Decrease the output load 3 Set proper V/F characteristic
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-09) setting.	1 Set proper V/F characteristic. 2 Set proper rated current. (Cn-09) 3 If inverter is reset repetitively before fault removed, the inverter may be damaged

LCD Display	Fault Contents	Fault Contact Output	Error Causes	Action to be Taken
Fault Over Torque	Overtorque is detected while the output current is larger than or equal to the setting of Cn-26. (machine protection)	Operation	Machine errors or overload.	1 Check Application. 2 Set a higher protection level (Cn-32).
Fault Ext. Fault3	The electronic thermal sensor detects inverter overload while the output current exceeds 112% of rated value. (inverter protection)	Operation	Fault input of external Terminals 3, 5, 6, 7 and 8.	Identify the fault signal using Un-11
Fault Ext. Fault5	Ext. fault signal Terminal 5	Operation		
Fault Ext. Fault6	Ext. fault signal Terminal 6	Operation		
Fault Ext. Fault7	Ext. fault signal Terminal 7	Operation		
Fault Ext. Fault8	Ext. fault signal Terminal 8	Operation		
Fault Inverter EEPROM	1 EEPROM fault 2 EEPROM (BCC, no.) is bad	Operation	1 External noise. 2 Excessive vibration or shock	1 Reset NVRAM by running Sn-03 2 Replace the control board if the fault cannot be cleared
Fault Inverter A/D	A/D converter (inside the CPU) fault	Operation		
Fault PG Over Sp.	Excessive PG speed fault	Operation	Improper setting of ASR parameter or overspeed protection level	Check the parameters of ASR and the protection level
Fault PG Open.	PG 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 parameter or speed deviation level.	Check parameters of ASR and speed deviation level
Fault RS-485 Interrupt	MODBUS Communication fault occurs. The inverter remains operating.	Operation	1 External noise 2 Excessive vibration or shock on communication wire 3 Not properly contacted	1 Check the parameter setting, including Sn-01, Sn-02. 2 Check if the comm. wire is not properly contacted. 3 Restart, if fault remains, please contact factory
(blinking) Alarm DC Volt. Low	The main circuit DC voltage becomes lower than the lower undervoltage level before the motor starts	No Operation	Input voltage drop	Measure the main circuit DC voltage. If the voltage is lower than allowance level, regulate the input voltage

LCD Display	Fault Contents	Fault Contact Output	Error Causes	Action to be Taken
(blinking) Alarm Over Voltage	The main circuit DC voltage becomes higher than the lower undervoltage 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 protection contact is input to the external terminal	No Operation	1 Overload 2 Cooling fan fault. Ambient temperature rises 3 Clogged filter	Check the fan, filter and the ambient temperature
(blinking) Alarm Over Torque	Overtorque is detected when 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 continues to run and disregards the overtorque warning.	No Operation	Machine error or overload	1 Check application 2 Set a higher protection level (Cn-32).
-	1 Stall prevention operates during acceleration. 2 Stall prevention operates during running 3 Stall prevention operates during deceleration.	No Operation	1 Insufficient Accel./Decel. Time 2 Overload 3 Excessive load impact occurs while operating	1 Increase Accel./Decel. time. 2 Check the load
(blinking) Alarm External Fault	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	1 Operation sequence error. 2 3-wire/2-wire selection error	1 Check the circuit of system. 2 Check the setting of system parameters Sn-25, 26, 27, and 28
(blinking) Alarm RS-485 Interrupt	MODBUS Communication fault occurs. The inverter remains operating	No Operation	1 External noise. 2 Excessive vibration or shock on communication wire. 3 Not properly contacted	1 Check the parameter setting, including Sn-01, Sn-02. 2 Check if the comm. Wire is not properly contacted 3. Restart, if fault remains, please contact us
Comm. Fault	Transmission fault of digital operator	No Operation	1 Comm. between digital operator and inverter has not been established after system starts for 5 seconds. 2 Communication is established after system starts, but transmission fault occurs for 2 seconds	1 Replug the connector to the digital operator. 2 Replace the control board

LCD Display	Fault Contents	Fault Contact Output	Error Causes	Action to be Taken
(blinking) Alarm B. B.	External baseblock signal (terminal X) is input (The inverter stops and the motors stops without braking).	No Operation	External B.B. signal is input.	After external BB signal is removed, execute the speed search of the inverter
Alarm Input Error	Inverter KVA setting error.	No Operation	Inverter KVA setting Error	Set proper KVA value. Be aware of the difference of 220V and 440V
	The value of Sn-25~Sn-28 is not in ascending order (Ex. Sn-25= 05, Sn-28= 02)	No Operation	Set these values by order (the value of Sn-25 must be smaller than those of Sn-26, 27, 28)	Set these values by order (the value of Sn-25 must be smaller than those of Sn-26, 27, 28)
	Set speed search command of 21 and 22 simultaneously	No Operation	Command 21 and 22 cannot be set for two multi-function-input contacts simultaneously	Command 21 and 22 cannot be set for two multi-function-input contacts simultaneously
	Improper setting of Cn-18, Cn-19.	No Operation	Upper limit and lower limit setting is incorrect	Change the settings
(blinking) Alarm Over Speed	Excessive speed. (operation remains)	No Operation	Improper ASR parameter setting or overtorque protection level	Check the ASR parameter and overtorque protection level
(blinking) Alarm PG Open	PG Open-circuit. (operation remains)	No Operation	The circuit of PG is not properly connected or open-circuit	Check the wiring to PG
(blinking) Alarm Sp.Deviat Over	Excessive speed deviation. (operation remains)	No Operation	Improper ASR parameter setting or overtorque protection level	Check the ASR parameter and overtorque protection level.
Load Fail	Error during upload and download. (operation remains)	No Operation	1 Bad communication during operator and inverter 2 The connector is not properly connected.	Check if connector is not properly connected
EEPROM Fault	Operator EEPROM error	No Operation	Operator EEPROM error.	1 Disable load function of operator 2 Replace the operator
Upload Error	Data incorrect during Communication from the operator to the inverter	No Operation	1 Incorrect inverter data format. 2 Communication noise	1 Download the data to the operator again 2 Check if connector is not properly connected
Download	Data incorrect during Communication from the inverter to the operator.	No Operation	Communication noise	Check if connector is not properly connected.
Alarm Auto Tun-Error	Motor parameter autotuning error	No Operation	1 Inverter capacity and motor rating are not properly matched. 2 The wiring between inverter and motor is disconnected. 3 Motor load unbalance	Correct the inverter/motor capacity ratio, wiring cable and motor load.

APPENDIX

A. Adjusting PID Controller

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

1. Enable PID control. (Sn-64 = 1)
2. Increase the Proportional gain Bn-17 as far as possible without creating oscillation.
3. Decrease 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 with a reference signal, 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 42), 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).

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 system with quicker response. 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 parameter 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) parameter can be used to set the maximum effect the PID controller will have on the system. It will also 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) parameter will add a fixed percentage to the PID output. It can be used to tune out small system offsets.

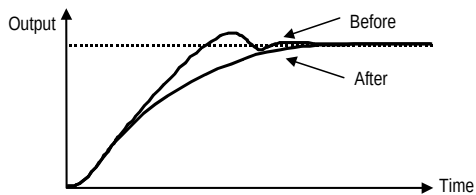
NOTE : This parameter is set as a percentage of maximum output frequency.

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

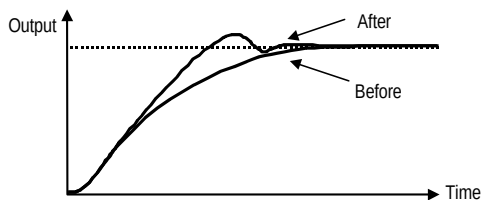
The PID Primary Delay Time parameter adds a filter to the PID output to keep it from changing too quickly. The higher the setting, the slower the PID output will change.

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:

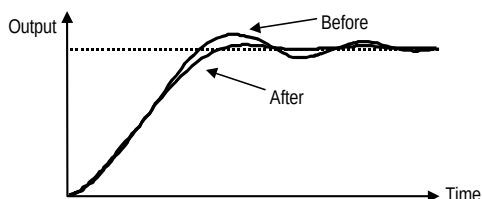
1. Adjust Proportional Gain until continuous oscillations in the Controlled Variable are at a minimum.
2. The addition of Integral Time will cause the steady-state error to approach zero. The time should be adjusted so that this minimal error is attained as fast as possible, without making the system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



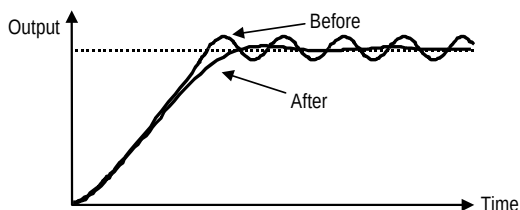
If overshoot occurs, shorten the derivative time (D) and lengthen the integral time (I).



To rapidly stabilize 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 integral time (I) setting, then the integral operation is strong. The oscillation will be reduced as the integral time (I) is lengthened.



If oscillation cycle is short and approx. the same as the derivative time (D) setting, then the derivative operation is strong. The oscillation will be reduced as the derivative time (D) is shortened. If even setting the derivative time (D) to 0.00 cannot reduce oscillation, then either decrease the proportional gain (P) or raise the PID primary delay time constant.

B. Supplementary on PID Control Block Diagram

A PID Control Block Diagram is:

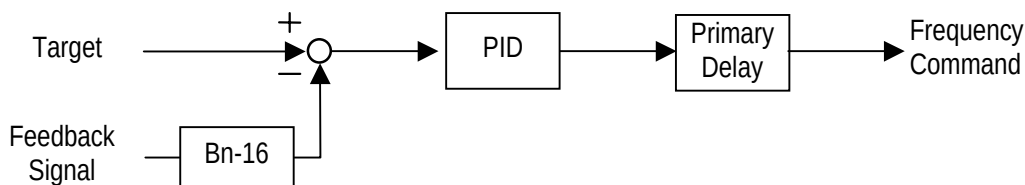


Figure 48 PID Control Block Diagram

- Note :
1. A target signal may come from the LCD Digital Operator, RS-485 Port or Multi-Function Analog Input Terminal-AUX Setting. (upon Sn-05 setting).
 2. The detected signal can be input either from terminal VIN (Sn-24=0, Voltage Command 0~10V) or from terminal AIN (Sn-24=1, Current Command 4~20mA).
 3. If the target signal is from the terminal AUX, please use the wiring diagram indicated below: (Sn-05=01, Sn-29=09).

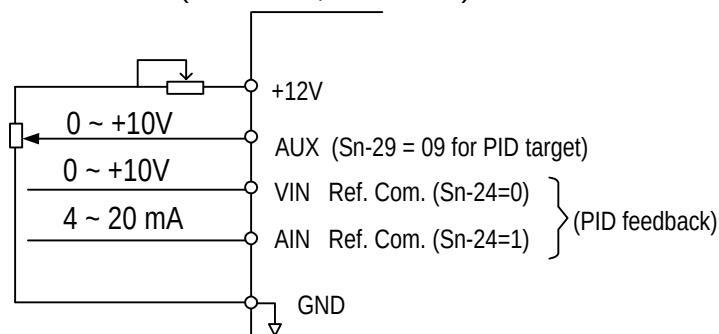


Figure 49 PID Wiring Diagram

4. Refer to Page 42 for more details about PID use.

C. Wiring for PG Feedback Use

The C10 inverter has a built-in PG interface, no external PG feedback option card is needed. An independent DC source of +12V should be provided from an external source.

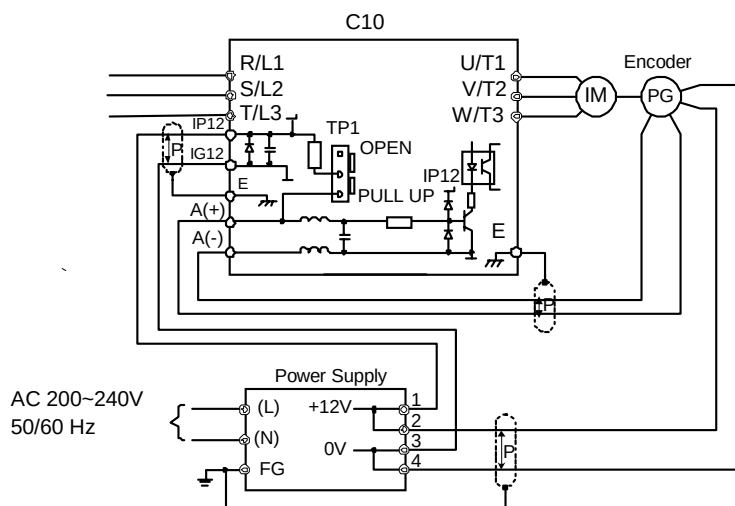


Figure 50 Wiring of PG feedback

Note :

1.  : Isolated twisted cable wire.
2. Notation for PG terminals

Terminal	Function
A(+)	PG signal input terminal. The voltage level is (H: 4~12V, L: ≤1V). Its Max. frequency is < 32767 Hz
A(-)	
IP12	Terminals feed in the (+12)VDC external power source (+12V± 10%, the Max. current is 40mA)
IG12	
+12V	(+12)V DC source (+12V± 10%, min. 0.5A)
0V	
E	Inverter ground.

3. Please refer to page 69 and 110 for more details on PG feedback.
4. The A(+), A(-), IP12, IG12 terminals are integrated as CN2 in compact version. (see page 11). The code No. of the wire is 4H339D0250001.
5. The PG interface only allows the open-collector interface drive or complementary interface drive.
6. The short pin of TP1 set to PULL UP position for open-collector interface (factory setting) and set to OPEN position for complementary interface. The PG interface only allows the open-collector interface drive or complementary interface drive.
7. The shielded twisted-pair cable wire should be used between the inverter and PG, its length should be less than 150 feet.

D. RS-485 Communication Interface

- C10 RS-485 interface (terminal S(+), S(-)) can provide MODBUS protocol for communication.

(a) MODBUS Protocol Communication

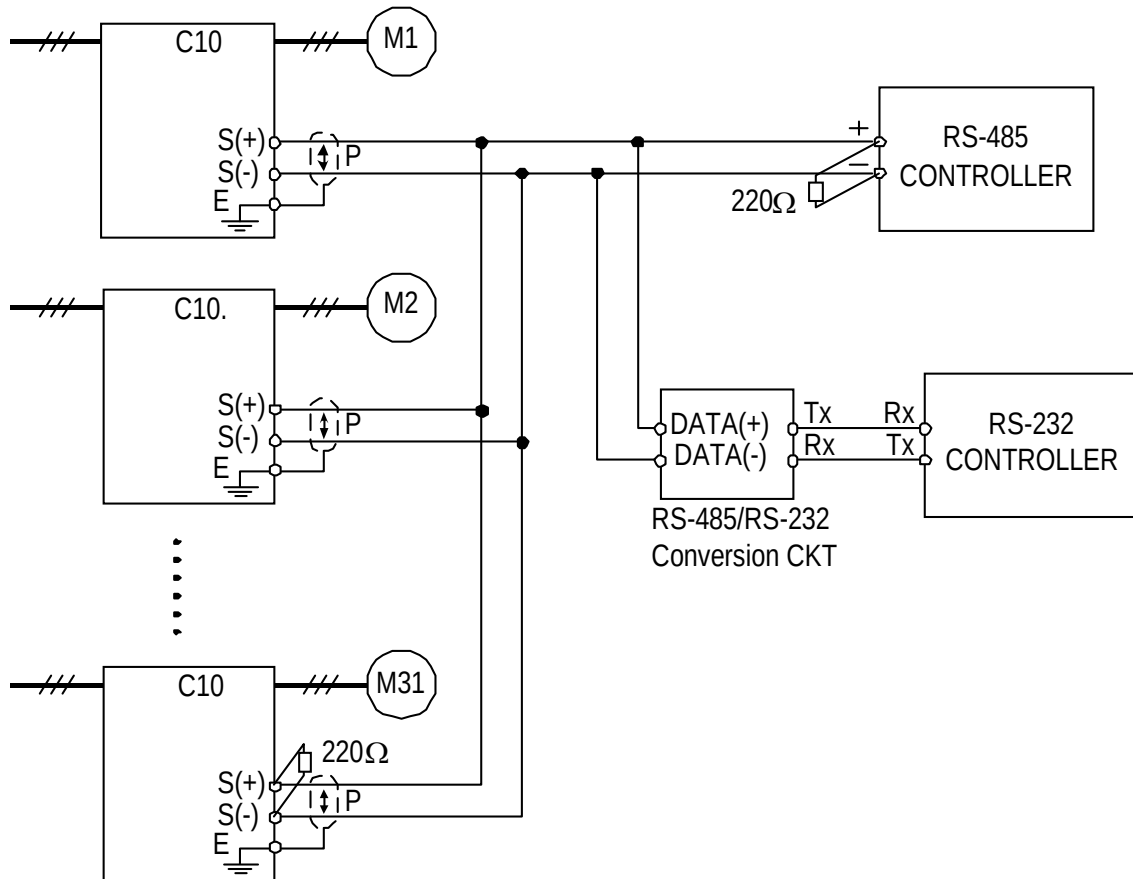
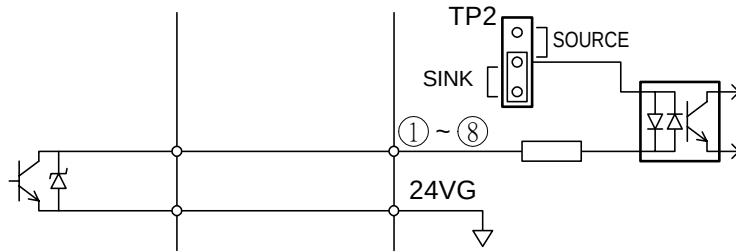


Figure 51 Wiring for MODBUS Protocol Communication

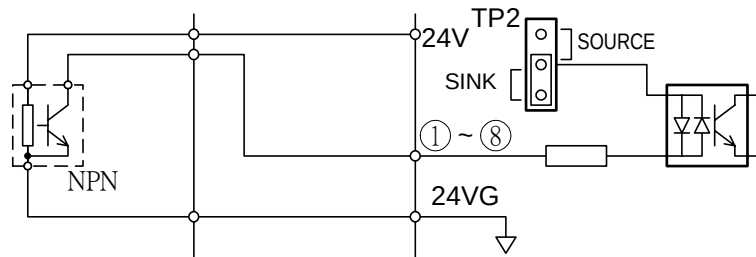
- Note: 1. A Host Controller with RS-485 interface can communicate with the C10 unit through RS-485 interface connection directly. If the Host Controller does not provide the RS-485 port and its RS-232 port is available, an RS-485/RS-232 conversion card should be used to connect between this Host Controller and the C10 unit.
1. A MODBUS Host Controller can drive the network with no more than 31 inverters connected, using MODBUS communication standard. If the inverter (e.g., C10) is at the end of the network, It must have terminating resistors 220Ω at both terminals. All other inverters in the system should not have terminators.

E. SINK/SOURCE Typical Connection Diagram

- The UL/CUL Standard Type Control Board (Code No. : 4P101C0060002)
Terminal ①~⑧ can be set as Sink or Source Type Input Interface. Typical connection examples are shown below.
- (a) SINK Type Input Interface : The short pin of TP2 is set to SINK position.
 - Transistor (Open-collector) used for operation signal.

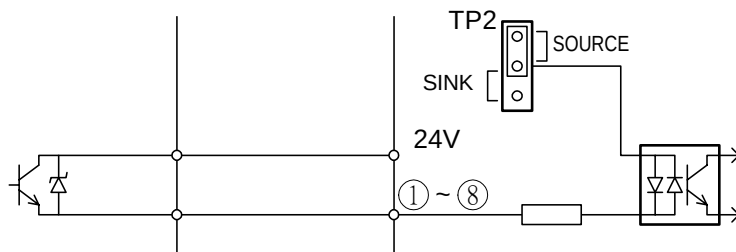


- NPN Sensor (Sink) used for operation signal.



- (b) SOURCE Type Input Interface : The short pin of TP2 is set to SINK position.

- Transistor (Open-collector) used for operation signal.



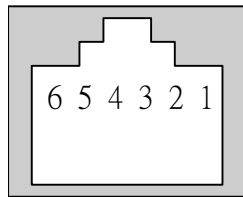
- PNP Sensor (Source) used for operation signal.

F. RS-232C Serial Communication Connection Diagram

The LCD Digital Operator uses RS-232C Serial Communication through connector CN1 to communicate with control board. Using the CN1 port on the control board, the parameters can be monitored and updated by using a suitable PC programming tool.

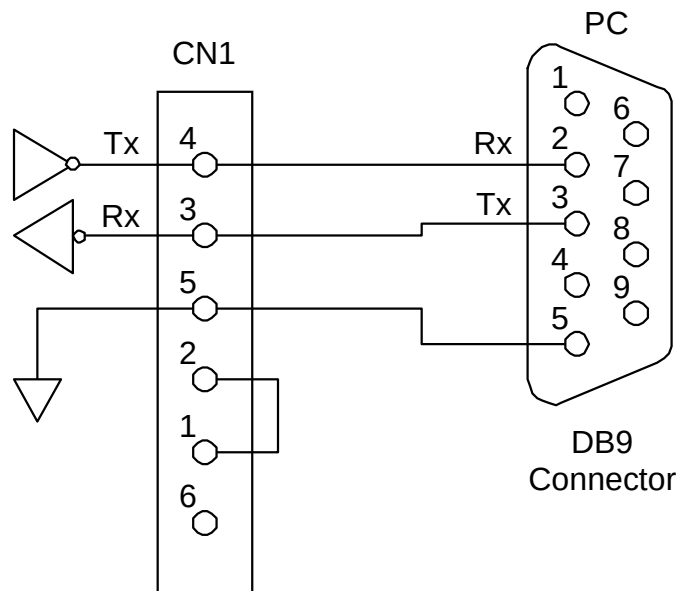
The CN1 port is a non-isolated RS-232C port with a baud rate of 2400 bps. Contact your Safronics factory representative or distributor for further information.

- The pin definitions of CN1
–6 pin telephone jack



Pin	Signal Definition
1	LCD/PC selection
2	5V
3	Rx
4	Tx
5	0V
6	Reserved (-5V, for LCD display)

- Typical connection diagram



G. Sensorless Vector Control Set-up

The C10 has two standard two selectable control modes, V/F Control Mode (Sn-67=0) and Sensorless Vector Control Mode (Sn-67=1). When the Sensorless Vector Control Mode is selected, be sure that the inverter capacity and the motor rating are suitably matched.

The AUTOTUNE feature can be used to identify and store the important motor parameters for the Sensorless Vector Control Mode.

Note : • If Output Line Reactor/Filter is used, Autotune will not function properly.
• Motor parameters for Sensorless Vector operation will need to be entered manually. Consult motor manufacturer for motor parameter data.

Refer to pages 71 and 106 for more details about Sensorless Vector Control.

- The Sequence of Motor Parameter Autotuning:
 1. Disconnect the motor load and make sure that the wiring between the inverter and the motor is suitable. The difference between inverter capacity and motor rating should not be greater than two frame sizes.
 2. Switch to PRGM operation mode by pressing the Digital Operator  key.
 3. Input the Motor Rated Voltage Data to parameter Cn-03 (Max. Output Voltage) and the Motor Rated Frequency to parameter Cn-04 (Max. Voltage Frequency) using data from motor's nameplate. Enable Sensorless Vector Control Mode (Sn-67= 1).
 4. Enable the Autotuning Function by setting Sn-66= 1.
 5. Switch to DRIVE operation mode by pressing the  key, then run the inverter by pressing the  key.
 6. The inverter system immediately enters into the autotuning operation until completing the autotuning procedure (normally about 25 seconds). The inverter then returns to a stopped condition. Press the  key to stop the parameter autotuning operation if an abnormality occurs during autotuning operation.

7. Finally, press the  key to return the system to normal operation mode. The value of motor parameter will be automatically stored in these parameters: Cn-57 (Motor Line-to-Line Resistance R1), Cn-58 (Motor Rotor Equivalent Resistance R2), Cn-59 (Motor Leakage Inductance Ls) and Cn-60 (Mutual Inductance Lm).

- The Operations and Adjustments of Sensorless Vector Control :

1. Make sure the inverter capacity and motor rating is suitably matched. Use the AUTOTUNE feature to identify and store the motor parameters in the first time sensorless vector operation after installation, and key in the Motor Rated Voltage data into Cn-03 and the Motor Rated Frequency into Cn-04 according to the motor nameplate.
2. Enable the Sensorless Vector Control Mode by setting Sn-67= 1.
3. Increase setting Cn-57 to increase the generating torque at low speed. Decrease setting Cn-57 to reduce the generating torque to avoid overcurrent trip at low speed.
4. Adjust setting Cn-61 if the speed accuracy needs to improve. When the actual speed is low, increase the set value and when the actual speed is high, decrease the set value.
5. If the motor speed is not stable or the load inertia is too large, increase the Cn-40 (Slip Compensation Primary Delay Time) setting.
If the speed response is slow, decrease the setting of Cn-40.

H. Notes for Circuit Protection and Environmental Ratings

■ Circuit Protection

The C10 is “suitable for use in 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		
230V	1.5 ~ 50	5,000	240V
	51 ~ 100	10,000	
460V	1.5 ~ 50	5,000	480V
	51 ~ 200	10,000	

■ Environmental Ratings

The C10 is intended for use in pollution degree 2 environments.

■ Field Wiring Terminals and Tightening Torque

The wiring terminals and tightening torque are listed as follows.
(Main Circuit Terminal Specifications – use 140/167°F(60/75°C) copper wire only).

(A) 230V class

Circuit	Inverter Rating (HP)	Terminals Mark	Cable Size (AWG)	Terminals	Tightening Torque (Pound-inch)
Main Circuit	1	L1, L2, L3, T1, T2, T3, B1/P, B2, $\ominus$	14 ~ 10	M4	10
		$\oplus$	14 ~ 10	M4	10
	2	L1, L2, L3, T1, T2, T3, B1/P, B2, $\ominus$	14 ~ 10	M4	10
		$\oplus$	12 ~ 10	M4	10
	3	L1, L2, L3, T1, T2, T3, B1/P, B1/R, B2, $\ominus$	12 ~ 10	M4	10
		$\oplus$	12 ~ 10	M4	10
	5	L1, L2, L3, T1, T2, T3, B1/P, B1/R, B2, $\ominus$	12 ~ 10	M4	10
		$\oplus$	10	M4	10
	7.5	L1, L2, L3, T1, T2, T3, B1/P, B1/R, B2, $\ominus$	8	M4	10
		$\oplus$	10 ~ 8	M4	10
	10	L1, L2, L3, T1, T2, T3, B1/P, B1/R, B2, $\ominus$	8	M4	10
		$\oplus$	10 ~ 8	M4	10
	15	L1, L2, L3, T1, T2, T3, B1/P, B2, $\ominus$	8 ~ 6	M6	30
		$\oplus$	10 ~ 8	M6	35
	20	L1, L2, L3, T1, T2, T3, B1/P, B2, $\ominus$	8 ~ 6	M6	30
		$\oplus$	10 ~ 8	M6	35
Control Circuit	All series	①~⑧, 15V, VIN, AIN, AUX, AO1, AO2 RA, RB, RC, DO1, DO2, (or R2A, R2C)	24~14	M2.6	4

(B) 460V class

Circuit	Inverter Rating (HP)	Terminals Mark	Cable Size (AWG)	Terminals	Tightening Torque (Pound-inch)
Main Circuit	1	L1, L2, L3, T1, T2, T3	14 ~ 10	M4	10
		$\oplus$	14 ~ 10	M4	10
	2	L1, L2, L3, T1, T2, T3	14 ~ 10	M4	10
		$\oplus$	14 ~ 10	M4	10
	3	L1, L2, L3, T1, T2, T3, B1/P, B2, $\ominus$	14 ~ 10	M4	10
		$\oplus$	14 ~ 10	M4	10
	5	L1, L2, L3, T1, T2, T3, B1/P, B2, $\ominus$	14 ~ 10	M4	10
		$\oplus$	12 ~ 10	M4	10
	7.5	L1, L2, L3, T1, T2, T3, B1/P, B1/R, B2, $\ominus$	12 ~ 10	M4	10
		$\oplus$	12 ~ 10	M4	10
	10	L1, L2, L3, T1, T2, T3, B1/P, B1/R, B2, $\ominus$	10	M4	10
		$\oplus$	10	M4	10
	15	L1, L2, L3, T1, T2, T3, B1/P, B1/R, B2, $\ominus$	10 ~ 8	M6	15
		$\oplus$	12 ~ 10	M6	35
	20	L1, L2, L3, T1, T2, T3, B1/P, B1/R, B2, $\ominus$	10 ~ 8	M6	15
		$\oplus$	12 ~ 10	M6	35
Control Circuit	All series	①~⑧, 15V, VIN, AIN, AUX, AO1, AO2 RA, RB, RC, DO1, DO2, (or R2A, R2C)	24~14	M2.6	4

I. Spare Parts

(A) 230V class

Inverter & Parts Name			Control PC Board	Power Board
HP	MODEL	SPEC.		
1	C102001-1	MODEL	—	—
		CODE	4P101C0040001	4P106C01600A1
		Qty	1	1
2	C102002-1	MODEL	—	—
		CODE	4P101C0040001	4P106C0160003
		Qty	1	1
3	C102003-1	MODEL	—	—
		CODE	4P101C0060002	4P106C01800B1
		Qty	1	1
5.4	C102005-1	MODEL	—	—
		CODE	4P101C0060002	4P106C01800C9
		Qty	1	1
7.5	C102007-1	MODEL	—	—
		CODE	4P101C0060002	4P106C0210001
		Qty	1	1
10	C102010-1	MODEL	—	—
		CODE	4P101C0060002	4P106C0220006
		Qty	1	1
15	C102015-1	MODEL	—	—
		CODE	4P101C0060002	4P106C01500A6
		Qty	1	1
20	C102020-1	MODEL	—	—
		CODE	4P101C0060002	4P106C01500B4
		Qty	1	1

Main Circuit Transistor	Main Circuit Diode	Cooling Fan	Digital Operator
CM15MDL-12H	—	KD1204PFBX	JNEP-36V
277830540	—	4M903D0880002	4H300C0020003
1	—	1	1
CM20MDL-12H	—	KD1204PFBX	JNEP-31V
277830558	—	4M903D0880002	4H300C0020003
1	—	1	1
MUBW20-06A7 or 7MBR30SA060	—	AFB0624H	JNEP-31V
277830132 277831619	—	4H300D0190004	4H300C0020003
1 1	—	1	1
MUBW30-06A7 or 7MBR50SA060	—	AFB0624H	JNEP-31V
277830141 277831627	—	4H300D0190004	4H300C0020003
1 1	—	1	1
7MBP50RA060	DF75LA80	AFB0824SH	JNEP-31V
277831660	4M903D1480016	4H300D0200000	4H300C0020003
1	1	1	1
7MBP75RA060	DF75LA80	AFB0824SH	JNEP-31V
277831678	4M903D1480016	4H300D0200000	4H300C0020003
1	1	1	1
PM100RSE060 or 7MBP100RA060	DF100BA80	AFB0824SH	JNEP-31V
277820242 277831511	277192209	4H300D1440004	4H300C0020003
1 1	1	1	1
PM150RSE060 or 7MBP150RA06	DF150BA80	AFB0824SH	JNEP-31V
277820251 277831520	277192179	4H300D1440004	4H300C0020003
1 1	1	1	1

(B) 460V class

Inverter & Parts Name			Control PC Board	Power Board
HP	MODEL	SPEC.		
1	C104001-1	MODEL	—	—
		CODE	S4P101C0040001	S4P106C0250002
		Qty	1	1
2	C104002-1	MODEL	—	—
		CODE	S4P101C0040001	S4P106C02500A1
		Qty	1	1
3	C104003-1	MODEL	—	—
		CODE	S4P101C0060002	S4P106C0240007
		Qty	1	1
5	C104005-1	MODEL	—	—
		CODE	S4P101C0060002	S4P106C02400A5
		Qty	1	1
7.5	C104007-1	MODEL	—	—
		CODE	S4P101C0060002	S4P106C0110006
		Qty	1	1
10	C104010-1	MODEL	—	—
		CODE	S4P101C0060002	S4P106C0110006
		Qty	1	1
15	C104015-1	MODEL	—	—
		CODE	S4P101C0060002	S4P106C0150008
		Qty	1	1
20	C104020-1	MODEL	—	—
		CODE	S4P101C0060002	S4P106C0150016
		Qty	1	1

Main Circuit Transistor	Main Circuit Diode	Cooling Fan	Digital Operator
CM10MDL-24H	—	KD1204PFBX	JNEP-31V
277840049	—	4M903D0880002	4H300C0020003
1	—	1	1
CM10MDL-24H	—	KD1204PFBX	JNEP-31V
277840049	—	4M903D0880002	4H300C0020003
1	—	1	1
MUBW10-12A7 or 7MBR15SA120	—	AFB0624H	JNEP-31V
277830159 277831643	—	4H300D0190004	4H300C0020003
1 1	—	1	1
MUBW15-12A7 or 7MBR25SA120	—	AFB0624H	JNEP-31V
277830167 277831651	—	4H300D0190004	4H300C0020003
1 1	—	1	1
7MBP50RA120	6RI30G-160	AFB0824SH	JNEP-31V
277831686	277191067	4H300D0200000	4H300C0020003
1	1	1	1
7MBP50RA120	6RI30G-160	AFB0824SH	JNEP-31V
277831686	277191067	4H300D0200000	4H300C0020003
1	1	1	1
PM75RSE120 or 7MBP75RA120	DF75AA160	AFB0824SH	JNEP-31V
277820269 277831538	277192128	4H300D1440004	4H300C0020003
1 1	1	1	1
PM75RSE120 or 7MBP75RA120	DF75AA160	AFB0824SH	JNEP-31V
277820269 277831538	277192128	4H300D1440004	4H300C0020003
1 1	1	1	1

J. Electrical Ratings For Constant Torque (HD) and Variable Torque (ND)

C10 Model	Heavy Duty (150%, 1minute)			Normal Duty (110%, 1minute)		
	Max. Applic. Motor Output HP	Rated Output Current (A)	Max. Switching Freq. (kHz)	Max. Applic. Motor Output HP	Rated Output Current (A)	Max. Switching Freq. (kHz)
C102001-1	1	4.8 A	15	2	6.9 A	10
C102002-1	2	6.4 A	15	3	9.8 A	5
C102003-1	3	9.6 A	15	3	9.8 A	15
C102005-1	5	17.5 A	15	(5) 7.5	22.7 A	5
C102007-1	7.5	24 A	15	10	32 A	10
C102010-1	10	32 A	15	10	32 A	10
C102015-1	15	48 A	10	(15) 20	56.7 A	5
C102020-1	20	64 A	10	25	70.9 A	5
C102025-1	25	80A	10	30	80A	5
C102030-1	30	96A	10	40	108	5
C102040-1	40	130A	10	50	130A	10
C104001-1	1	2.6 A	15	2	3.5 A	10
C104002-1	2	4 A	15	3	4.9 A	5
C104003-1	3	4.8 A	15	3	4.9 A	15
C104005-1	5	8.7 A	15	(5) 7.5	12.5 A	5
C104007-1, C104007A-1	7.5	12 A	15	10	15.4 A	10
C104010-1, C104010A-1	10	15 A	15	15	22.7 A	5
C104015-1	15	24 A	10	20	30.3 A	5
C104020-1	20	32 A	10	25	38.0 A	5
C104025-1	25	40A	15	30	44A	5
C104030-1	30	48A	10	30	58A	5
C104040-1	40	64A	10	50	71A	5
C104050-1	50	80A	15	60	80A	5
C104060-1	60	96A	10	75	97A	5
C104075-1	75	128A	10	75	128A	5

*Same as constant torque setting (Sn-61=0)

Item	Common details	
	Heavy Duty	Normal Duty
Output Overload	150% for 60s	110% for 60s
Operation Ambient Temperature	+14 ~ 104°F	+14 ~ 104°F
Allowable Voltage Fluctuation	-15% ~ +10%	-15% ~ +10%
Output Frequency	0.5Hz ~ 400Hz	0.5Hz ~ 400Hz
V/F curve	Dependent on parameter setting	Variable (or Cubic) Torque

K. Inverter Heat Loss

(A) 200 to 230V

Model C10 XXXX-1		2001	2002	2003	2005	2007	2010	2015	2020
Inverter Capacity kVA		2	2.7	4	7.5	10.1	13.7	20.6	27.4
Rated Current A		4.8	6.4	9.6	17.5	24	32	48	64
Heat Loss W	Fin	22	34	73	156	214	257	457	599
	Inside Unit	61	74	63	83	93	116	173	217
	Total Heat Loss	83	108	136	239	307	373	630	816

(B) 380 to 460V

Model C10XXXX-1		4001	4002	4003	4005	4007	4010	4015	4020
Inverter Capacity kVA		2.2	3.4	4.1	7.5	10.3	12.3	20.6	27.4
Rated Current A		2.6	4	4.8	8.7	12	15	24	32
Heat Loss W	Fin	17	27	44	96	129	181	301	411
	Inside Unit	60	76	72	71	82	100	125	184
	Total Heat Loss	77	103	116	167	211	281	426	595