KE200 User manual

High performance vector control inverter

Model: KE200-□□□G-T□

3AC 220V 2.2~75kW

3AC 380V 4~300 kW

Please hand the manual to ultimate user, and keep it for future reference.

Preface

Thank you for selecting KE200 series frequency inverter from Shenzhen Micno Electric Co., Ltd.

KE200 inverter is a series of high performance vector control frequency inverter with 4 kinds of control modes - V/F control without PG, V/F control with PG, open loop vector control, close-loop vector control. It has abundant advanced functions including slip compensation, torque compensation, dwell function, zero servo function, speed control and parameter autotuning. It is applicable in many situations which need accurate speed control, fast torque response speed and high start-torque.

This manual describes how to use KE200 series inverter properly. Please read it carefully before installation, operation, maintenance and inspection. Besides, please use the product after understanding the safety precautions.

Precautions
● In order to describe the product's details, the drawings presented in this instruction are sometimes shown without covers or protective guards. When using the product, please make sure to install the cover or protective guard as specified firstly, and operate the products in accordance with the instructions. ● Since the drawings in this manual are represented examples, some are subject to differ from delivered products. ● This manual may be modified when necessary because of improvement of the product, modification or changes in specifications. Such modifications are denoted by a revised manual No.. ● If you want to order the manual due to loss or damage, please contact our company agents in each region or our company customer service center directly. • If there is still any problem during using the products, please contact our company customer service center directly.

Contents

Safety Precautions

During the installation, operation and maintenance of the product, please make sure to follow the safety precautions.

Improper operations can cause dangerous, which may cause personal injuries or even deaths.

Danger

Improper operations can cause dangerous, which may cause equipment damage or personal injury.

Caution

 **Danger**
● Do not touch PCB and other components before the charging indicator is off after power off. ● Prohibit wiring during power on, do not check the components and signals on PCB when inverter running. ● Do not disassemble or change the inside connection, wiring and components of the inverter without permission. ● The ground terminal must be connected to ground correctly. 220V class: the third ground connection, 380V class: special ground connection.

 **Caution**
● Do not do withstand voltage test for the inverter's inside components, these semiconductor components will be damaged easily with high voltage. ● Never connect the U, V and W output terminals of inverters to AC power. ● Do not touch the main PCB, as IC on CMOS of PCB is affected and damaged easily by static.

Chapter 1 Product Information

Caution
Never install or operate any inverter that is damaged or missing components. If not, injury will be caused.

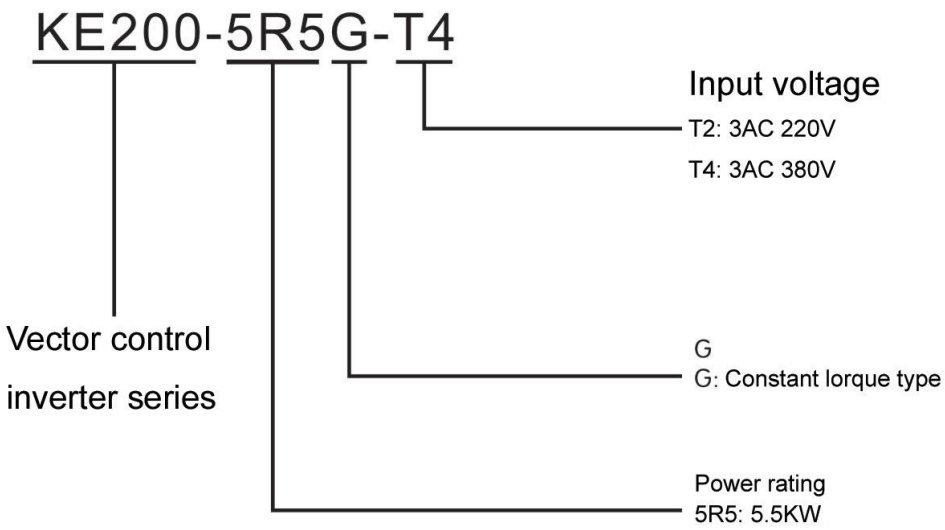
1.1 Product Inspection

Checking the following items when receiving the inverter:

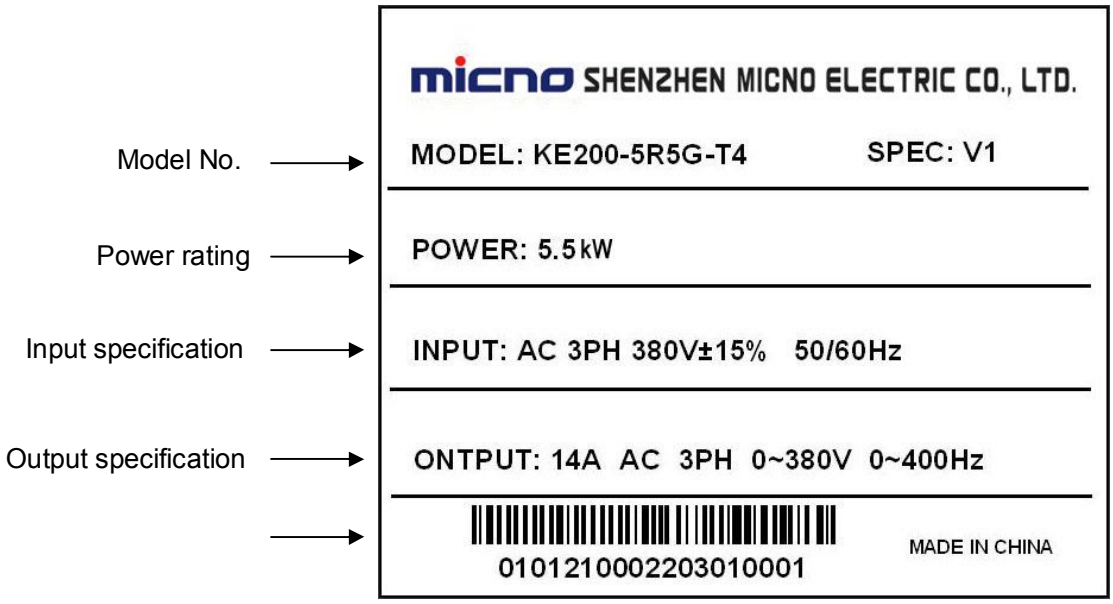
Confirmation Items	Method
Confirm if the inverter is what you ordered	Check KE200 name plate
Damaged or not	Inspect the entire exterior of the inverter to see if there are any scratches or other damage resulting from shipping
Confirm if the fastening parts (screws, etc) are loosing or not	Check with a screw driver if necessary
User's manual, certification and other spares	KE200 user's manual and the relative spares

Please contact the local agent or our company directly if there is any damage on the inverter.

1.2 Model Description



1.3 Nameplate Description



1.4 Selection Guide

Table 1-1 KE200 Inverter Model and Technical Data

Inverter Model	Motor		Rated Input Current (A)	Rated Output Current (A)
	kW	HP		
3AC 220~240V ±15%				
KE200-2R2G-T2	2.2	3	12	11
KE200-004G-T2	3.7	5	18	17.5
KE200-5R5G-T2	5.5	7.5	26	25
KE200-7R5G-T2	7.5	10	34	33
KE200-011G-T2	11	15	50	49
KE200-015G-T2	15	20	66	64
KE200-018G-T2	18.5	25	81	80
KE200-022G-T2	22	30	98	96
KE200-030G-T2	30	40	133	130
KE200-037G-T2	37	50	166	160
KE200-045G-T2	45	60	188	183
KE200-055G-T2	55	75	211	224
KE200-075G-T2	75	100	288	300
3AC 380~460V ±15%				
KE200-004G-T4	4.0	5	9	8
KE200-5R5G-T4	5.5	7.5	16	14
KE200-7R5G-T4	7.5	10	21	18
KE200-011G-T4	11	15	28	27
KE200-015G-T4	15	20	38	34

KE200-018G-T4	18.5	25	43	41
KE200-022G-T4	22	30	51	48
KE200-030G-T4	30	40	68	65
KE200-037G-T4	37	50	84	80
KE200-045G-T4	45	60	98	96
KE200-055G-T4	55	75	124	128
KE200-075G-T4	75	100	155	165
KE200-090G-T4	90	125	181	195
KE200-110G-T4	110	150	218	224
KE200-132G-T4	132	175	260	270
KE200-160G-T4	160	210	292	302
KE200-185G-T4	185	250	330	340
KE200-220G-T4	220	300	440	450
KE200-300G-T4	300	420	580	605

1.5 Technical Specifications

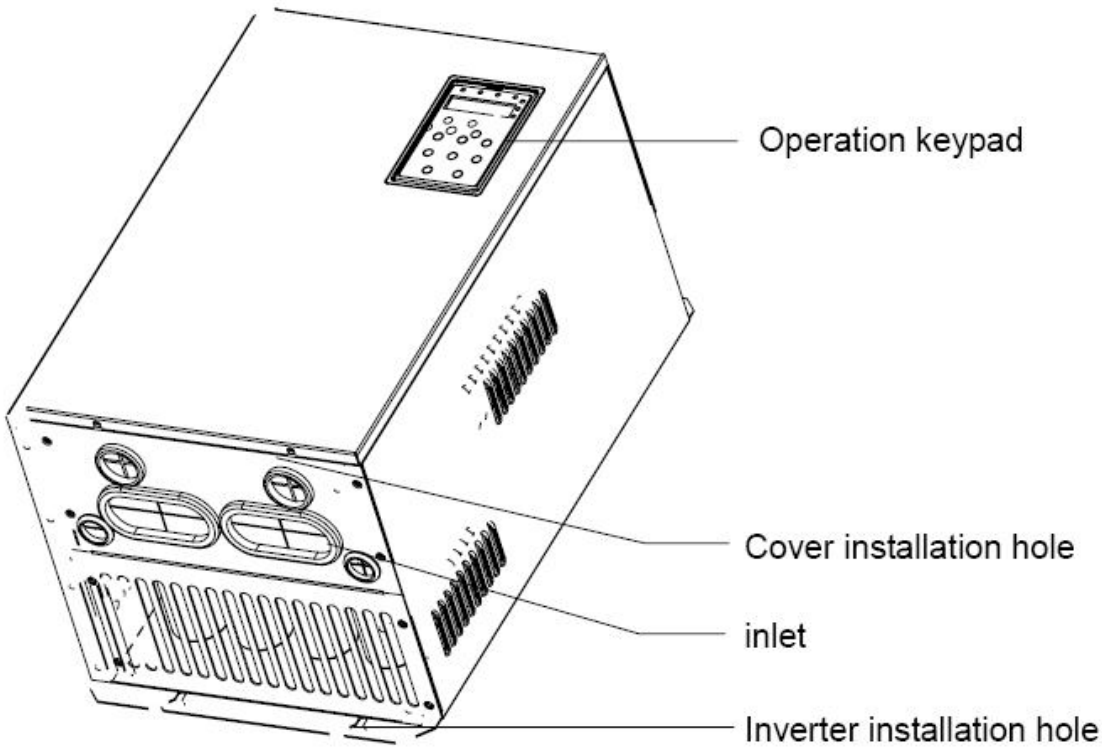
Table 1-2 KE200 Inverter Technical Specifications

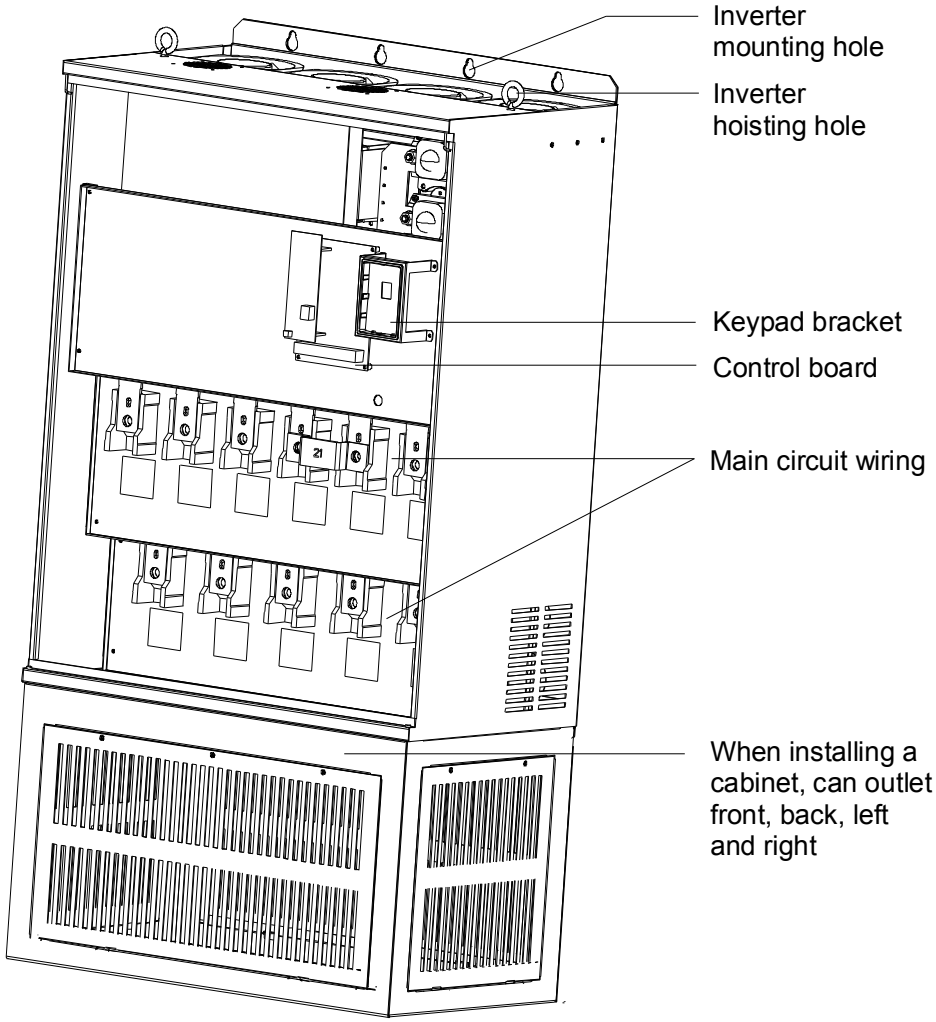
Item		Specification
Input	Input voltage	220~240V±15%, 3AC 380~460V±15%
	Input frequency	47~63Hz
Output	Output voltage	0 ～ input voltage
	Output frequency	0~400Hz
Control feature	Control mode	V/f control (with/without PG) Open loop vector control (SVC) Close loop vector control (VC)
	Operation command mode	Keypad control, terminal control, communication control
	Frequency reference source	Digital setting, analog setting, serial communication setting, multi-step speed setting, PID setting, etc. These frequency settings can be combinated and switched between different modes.
	Overload capacity	150% 60S, 180% 10S, 200% 3s
	Start torque	0Hz/150% (VC), 1Hz/150% (SVC)
	Speed adjustment range	1: 1000 (VC), 1: 100 (SVC)
	Speed control accuracy	±0.02% (VC), ±0.2% (SVC)
	Speed control response	＜3.5ms (VC), ＜20m s(SVC)
	Torque limit	Available (parameter setting 4 modes)
	Torque control accuracy	±5%(VC)
	Torque control response	40Hz(VC), 20Hz(SVC)
	Frequency control range	0.1~400Hz

	Frequency control accuracy	Digital reference: 0.01% (-10℃～40℃) Analog reference: 0.1% (25℃～10℃)
	Frequency setting resolution	Digital reference: ±0.01Hz Analog reference: 0.03Hz/60Hz (11bit + code)
	Output frequency resolution	0.01Hz
	Frequency setting signal	-10~10V, 0~10V (20kΩ), 4~30mA
	Acceleration/ deceleration mode	Linear/S curve, four kinds of acceleration/ deceleration time (range 0.01～6000.0S)
	Braking torque	20% (150% when equipped with braking resistor)
	V/f curve	15 fixed types and random V/f curve setting
	Fault protective function	Provide more than 30 kinds of fault protective functions, which are overcurrent, overvoltage, undervoltage, overheating, phase failure, overload, short circuit, etc. It can record the detailed state of inverter operation during failure and has fault automatic reset function.
Input/output terminals	Input terminal	Programmable DI: 8 on-off inputs (2 fixed) 2 Programmable AI: AI1: voltage -10～10V, AI2: voltage 0～10V or current 0/4～20mA
	Output terminal	2 programmable open collector outputs 2 programmable analog outputs: -10 ~ 10V 1 relay output (normal open) 1 programmable relay output
	Communication terminal	Offer RS485 communication interface, support MODBUS-RTU communications
Environment constraint	Environmental temperature	-10℃～40℃，when it exceeds 40℃, inverters will be derated use. It must not exceed 50℃ maximum. Derating will be 4% when the temperature rise by every 1℃.
	Humidity	≤90, no condensation
	Altitude	≤1000M: output rated power, ＞1000M: output derating
	Storage temperature	-20℃～60℃
	Storage environment	Indoor, without direct sunlight, dust, corrosive gas, combustible gas, oil mist, steam, water, salt, vibration

1.6 External & Installation Dimensions

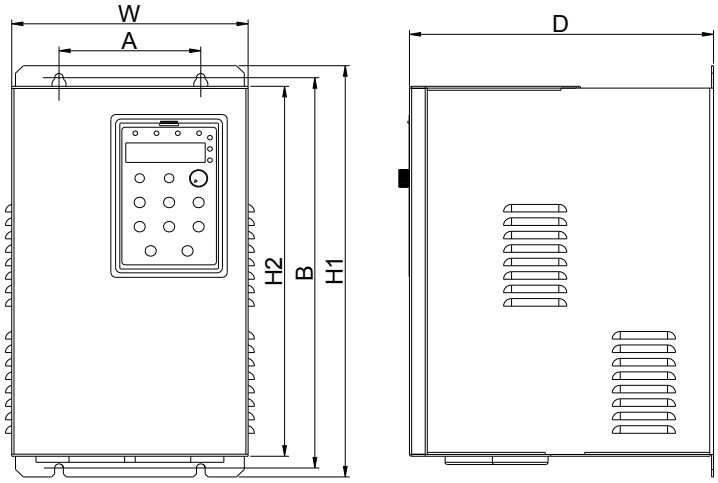
1.6.1 Parts Description



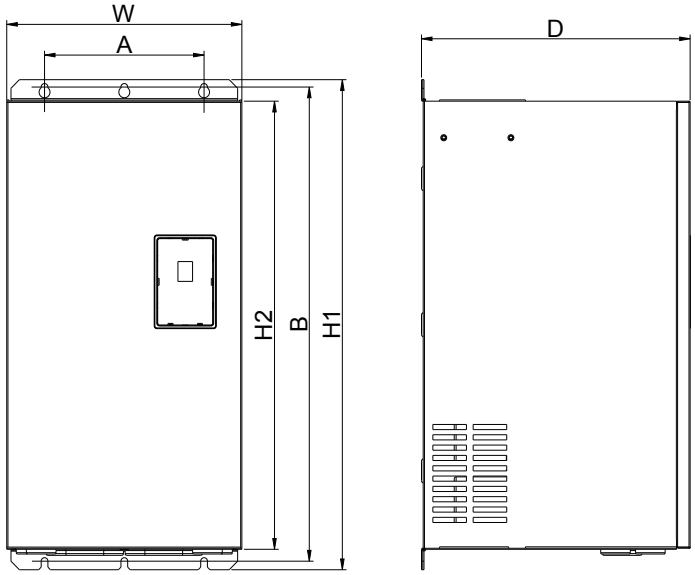

Inverter mounting hole
Inverter hoisting hole
Keypad bracket
Control board
Main circuit wiring
When installing a cabinet, can outlet front, back, left and right

1.6.2 External & Installation Dimensions

3AC 220V inverter dimension



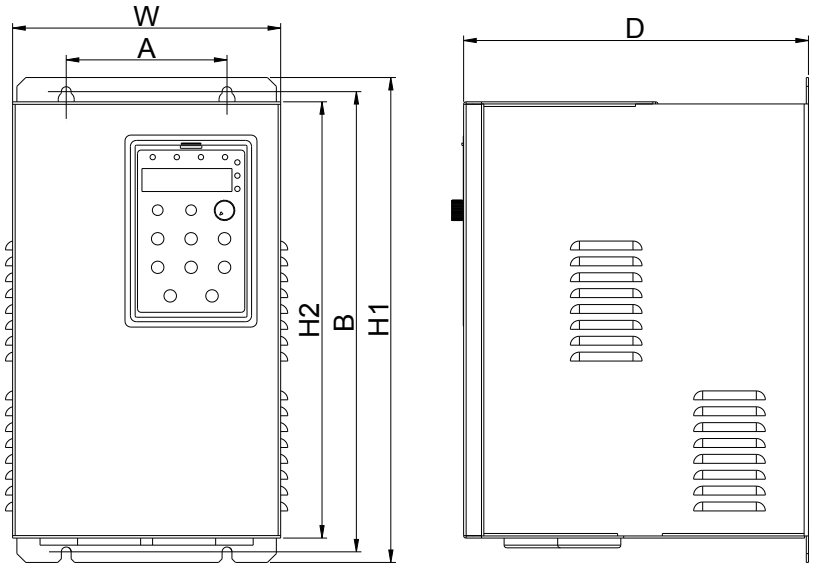
2.2~15kW



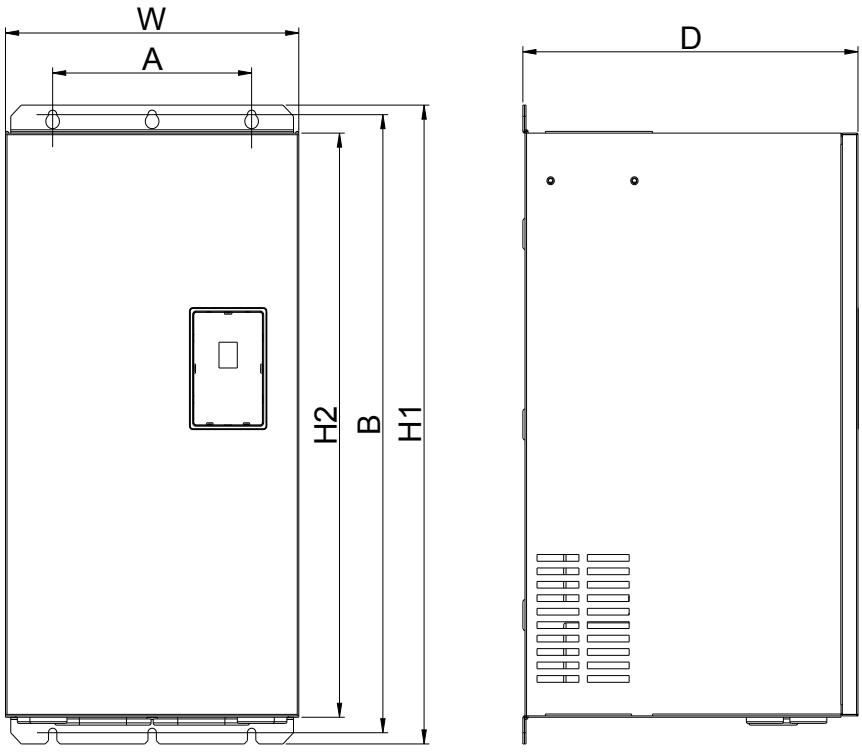
18.5～75kW

Power Range	External Dimension (mm)				Installation Dimension (mm)		Mounting Bolt Model
	W	H1	H2	D	A	B	
2.2~7.5kW	200	330	300	188.8	90	317	M4
11~15kW	255	440	403	229	140	423.6	M5
18.5~22kW	280	570	521	253	190	552	M6
30~37kW	320	600	552	330	230	582	M8
45~55kW	320	715	662	356	230	695.5	M8
75kW	480	790	725	385	360	768	M10

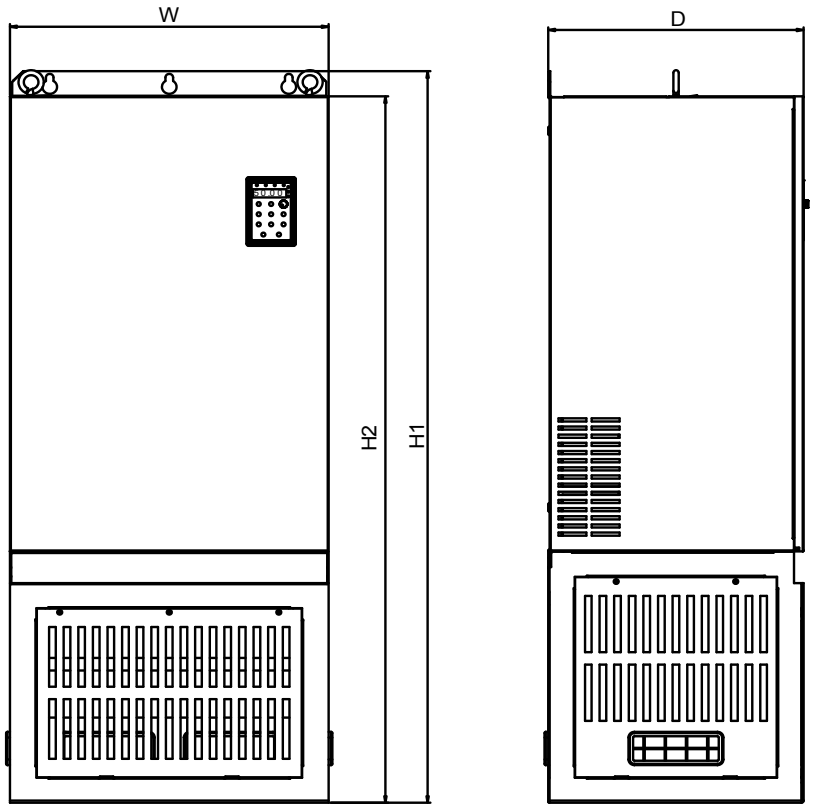
3AC 380V inverter dimension



4.0～30kW



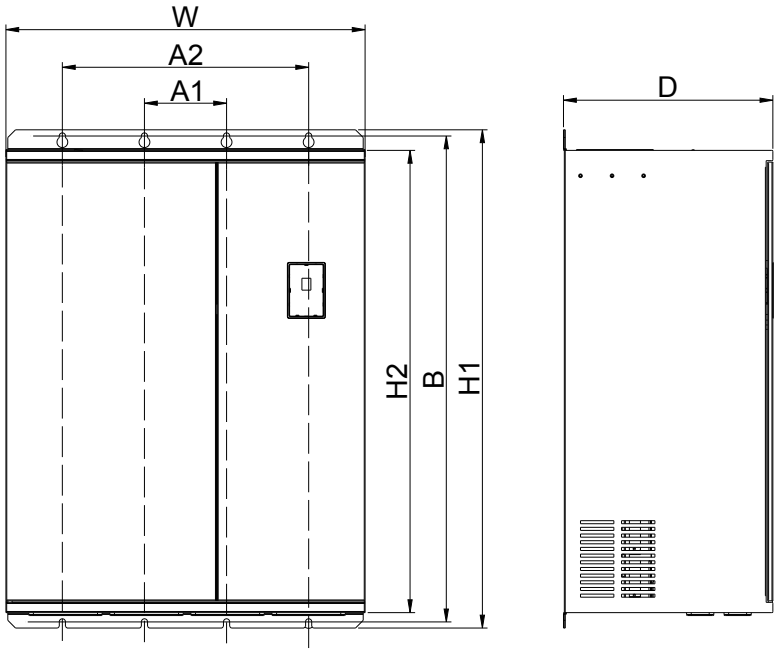
37～200kW (including 90～200kW standard inverter)



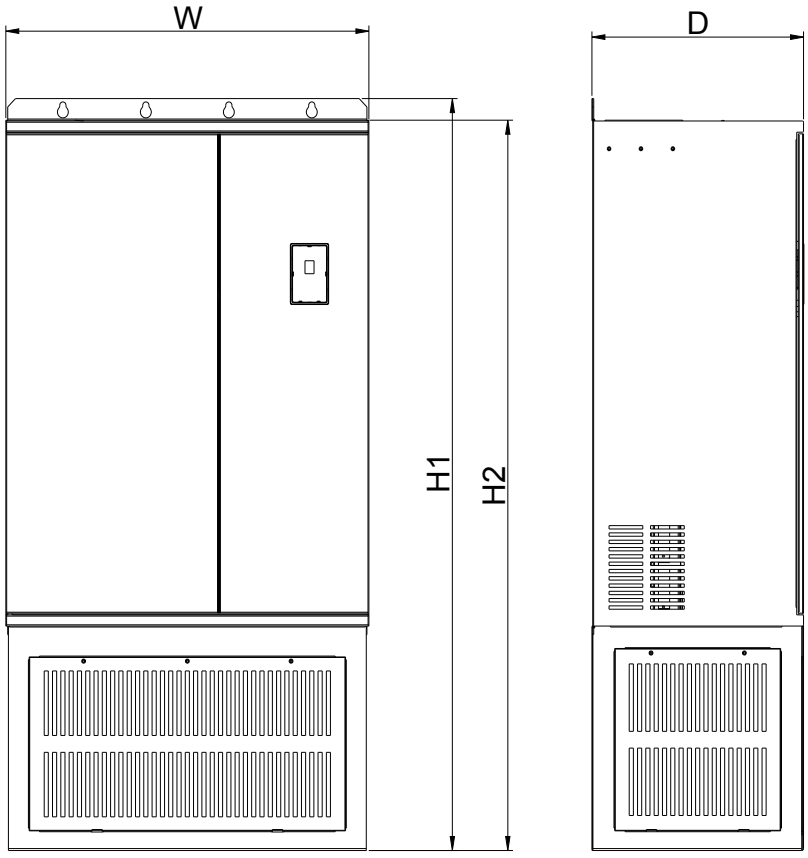
90～200kW nonstandard inverter (with base)

Power Range	External Dimension (mm)				Installation Dimension (mm)		Mounting Bolt Model
	W	H1	H2	D	A	B	
4～5.5kW	150	280	253	206	90	266	M3
7.5~15kW	200	330	300	188.8	90	317	M4
18.5~30kW	255	440	403	229	140	423.6	M5
37~45kW	280	570	521	253	190	552	M6
55~75kW	320	600	552	330	230	582	M8
90~110kW (without base)	320	715	662	356	230	695.5	M8
90~110kW (with base)	320	992	962	356			
132~200kW (without base)	480	790	725	385	360	768	M10
132~200kW (with base)	480	1165	1125	385			

Note: Base is optional for 90~200kW inverters. Standard invertes are without base.



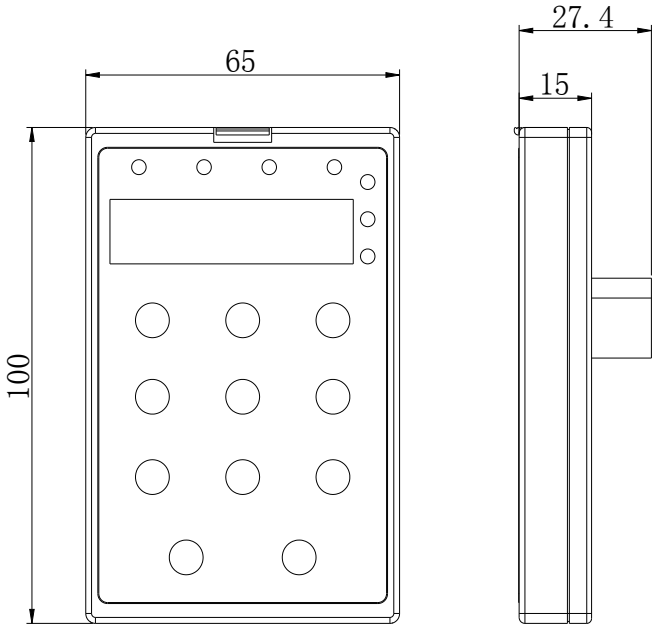
220～315kW without base



220～315kW with base

Power Range	External Dimension (mm)				Installation Dimension (mm)			Mounting Bolt Model
	W	H1	H2	D	A1	A2	B	
220~315kW (without base)	700	970	900	408	160	480	946	M10
220~315kW (with base)	700	1390	1350	408				

1.6.3 Keypad External Dimension

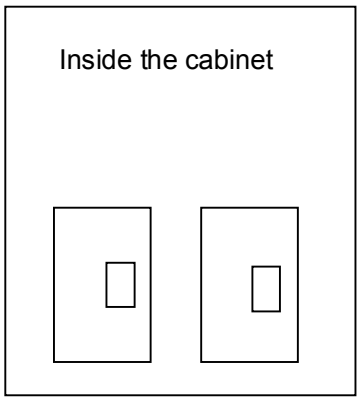


Chapter 2 Installation

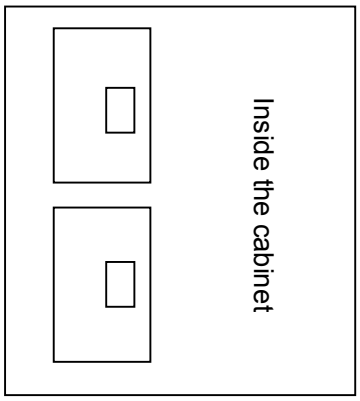
Using Environment

Be sure that the inverter is mounted in a location protected against the following conditions:

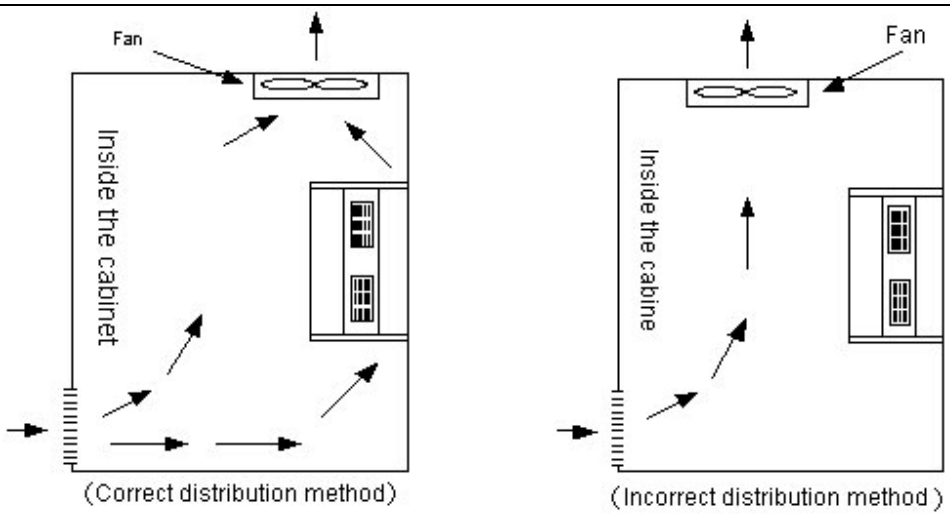
- Ambient temperature range: NEMA 1: -10 to 40°C (14 to 104°F)
  Open Chassis: -10 to 45°C (14 to 113°F)
- Direct sunlight (not for use outdoors)
- Rain, moisture
- High humidity
- Oil sprays, splashes
- Salt spray
- Dust or metallic particles in the air
- Corrosive gases (e.g. sulfurized gas) or liquids
- Radioactive substances
- Combustibles (e.g. thinner, solvents, etc.)
- Physical shock, vibration
- Magnetic noise (e.g. welding machines, power devices, etc.)
- When mounting units in an enclosure, install a fan or other cooling device to limit the air temperature within the inverter to below 45°C.



（Correct distribution method）

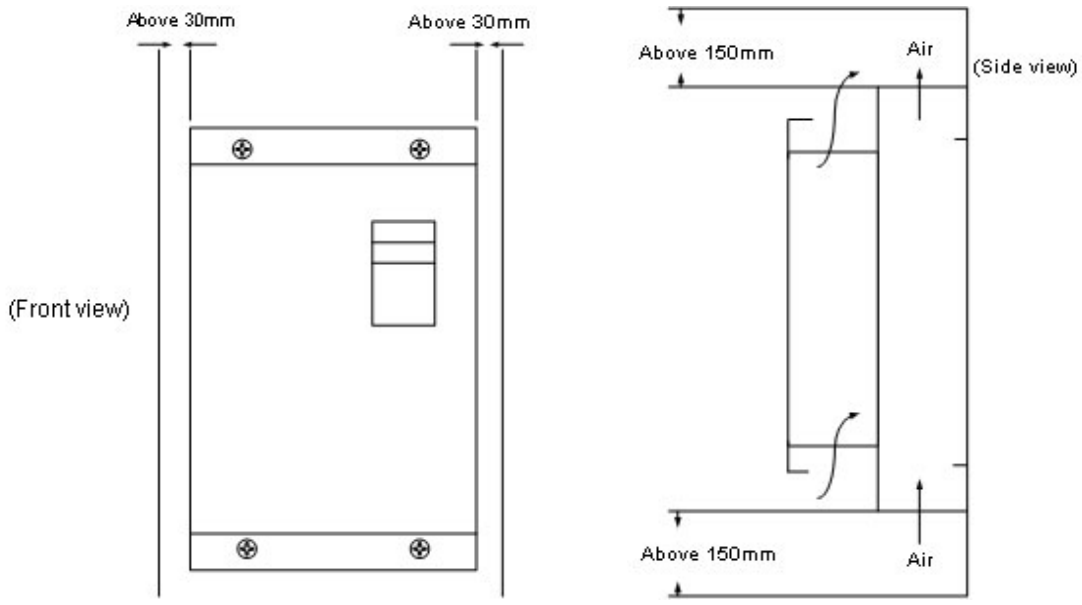


（Incorrect distribution method）



- Please make sure the inverter front is facing forward and the inverter top is facing upward for cooling when installation.

- The installation clearance must fit the following rules: When the inverter is installed in the cabinet or the surrounding is OK, the dustproof top cover can be removed for cooling.



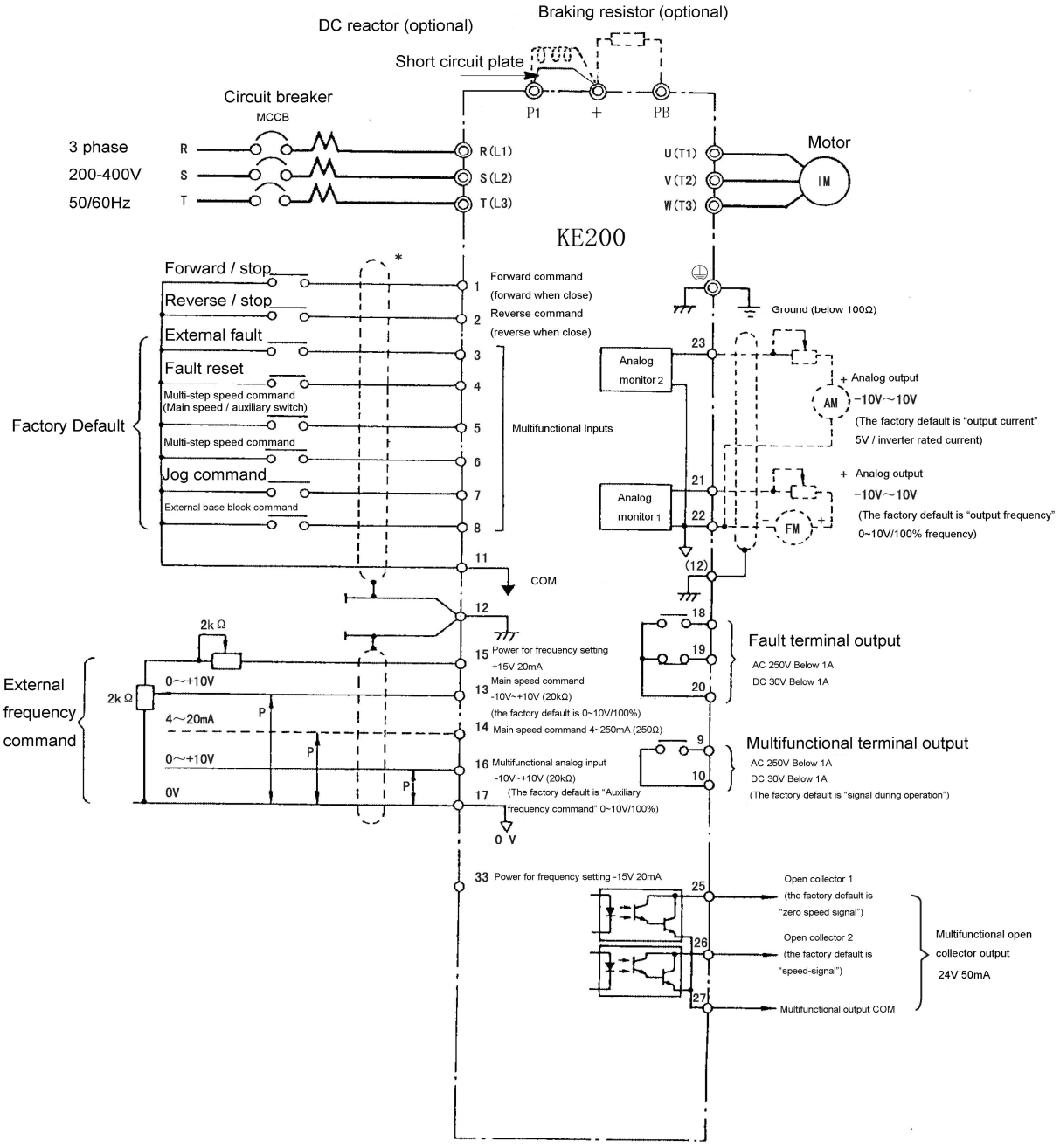
Chapter 3 Wiring

A terminal configuration diagram is placed in the inverter when shipping, as shown below. Please note the terminal numbers when wiring.

11	12（G）	13	14	15	16	17	25	26	27	33		18	19	20
1	2	3	4	5	6	7	8	21	22	23			9	10

3.1 Wiring Diagram

The following inverter standard wiring diagram, if keypad operation, only use main circuit terminals.
（R, S, T, input power; U, V, W, motor input）



Note: 1.  shielded wire,  shielded stranded wire.

2. The rated output of terminals 15 and 33 are ＋15V, －15V, 20mA.

3. The terminals 13 and 14 could not be used at the same time. If used at the same time, the frequency source is addition.

4. The multifunction analog output terminals are used for external “frequency/current” indicator.

3.2 Instructions of Main Circuit Terminals

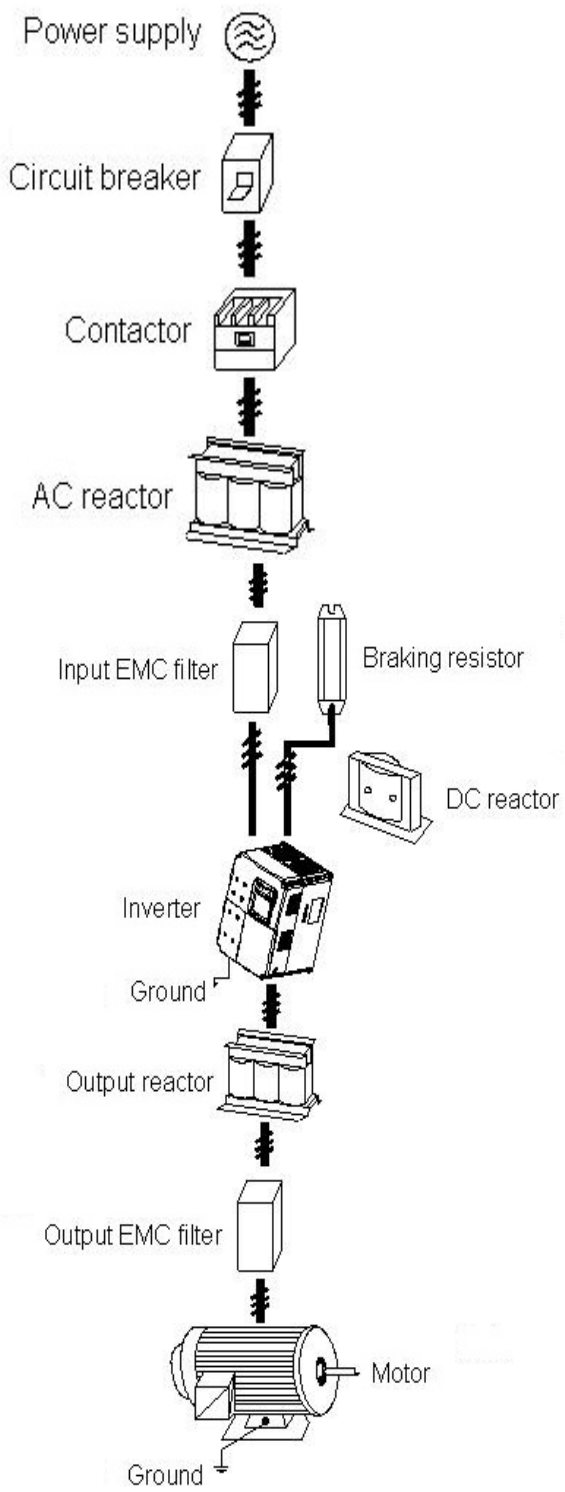
Terminal	Description
R, S, T	Input terminal of three phase power supply
U, V, W	Output terminal of inverter
(+) , (-)	Negative and positive terminals of DC bus
P1, (+)	Connection terminal of external DC reactor
(+) , PB	Connection terminal of brake resistor
	Earth terminal

3.3 Function Description of Control Circuit Terminals

The table below outlines the functions of the control circuit terminals.

Classification	Terminal	Signal Function	Description		Signal Level
Sequence Input Signal	1	Forward run/stop	Forward run when closed, stop when open (2-wire configuration)		Photo-coupler insulated Input: +24VDC, 8mA
	2	Reverse run/stop	Reverse run when closed, stop when open (2-wire configuration)		
	3	External fault input	Fault when closed, normal state when open	Multi-function contact inputs (*H1-01* to *H1-06*)	
	4	Fault reset input	Reset when closed		
	5	Master/Aux. change Multi-step speed ref.1)	Aux. freq. ref. when closed		
	6	Multi-step speed ref.2	Effective when closed		
	7	Jog reference	Jog run when closed		
	8	External baseblock	Inv. output baseblocked when closed		
	11	Sequence control input common terminal	Signal input when terminal 1~8 short-circuit		
Analog Input Signal	15	+15V Power supply output	For analog command +15V power supply		+15V (Allowable current 20mA max.)
	33	-15V Power supply output	For analog command -15V power supply		-15V (Allowable current 20mA max.)
	13	Master frequency ref. (voltage)	-10 to +10V/-100% to +100% 0 to +10V/100%		-10 to +10V (20k), 0 to +10V/(20k)
	14	Master frequency ref. (current)	4 to 20mA/100%.	Multi-function analog input (*H3-08, H3-09, H3-10, H3-11*)	4 to 20mA (250)
	16	Multi-function analog input	-10 to +10V/-100% to +100% 0 to +10 V/100%	Multi-function analog input (*H3-04, H3-05, H3-06, H3-07*)	-10 to +10V (20k), 0 to +10V/(20k)
	17	Common terminal for control	Terminal 13, 14 speed command		—
	12	Connection to shield sheath of signal lead	—		—
Sequence Output Signal	9	During running (NO contact)	Closed when running	Multi-function output (H2-01 to H2-03)	Dry contact Contact capacity: 250VAC, 1A or less 30VDC, 1A or less
	10				
	25	Zero speed detection	Activates at min. freq. *(E1-09)* or less		Open collector output 48V, 50mA or less
	26	Speed agree detection	Activates when the freq. reaches to ±1Hz of set freq.		
	27	Open collector output common			—
	18	Fault contact output (NO/NC contact)	When faulted closed between terminals 18 and 20 When faulted open between terminals 19 and 20		Dry contact Contact capacity: 250VAC, 1A or less 30VDC, 1A or less
	19				
	20				
Analog Output Signal	21	Frequency meter output	0 to ±10V/100% frequency	Multi-function analog monitor 1 *(H4-01, H4-02, H4-03)*	0 to ±11V Max. ±5% 2mA or less
	22	Common			
	23	Current monitor	5V/inverter rated current	Multi-function analog monitor 2 *(H4-04, H4-05, H4-06)*	—

3.4 Connection to Peripheral Devices



- Do not install the capacitor or surge suppressor at the output side of the inverter, otherwise it may cause inverter failure or capacitor and surge suppressor damaged.
- The Inverter input / output (main circuit) contains harmonic components, it may interfere with inverter accessories communications equipment. Therefore, please install anti-interference filter to make minimize interference.
- The details of external devices and accessories selection refer to the manual of external devices.

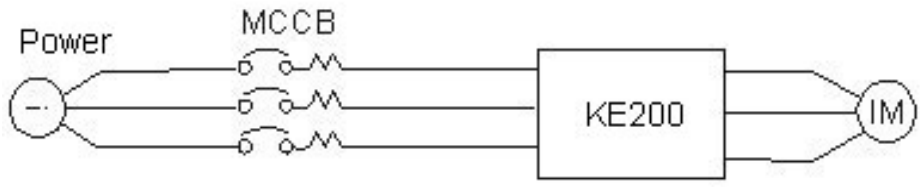
Using instruction of the external electrical parts

Part Name	Installing Location	Function Description
Circuit breaker	Frontend of input circuit	Disconnect the power supply when the equipment at the lower part is over current.
Contactor	Between the circuit breaker and the inverter input side	Connection and disconnection of inverter. Frequent power-on and power-off operations on the inverter shall be avoided.
AC input reactor	Input side of the inverter	Improve the power factor of the input side; Eliminate the higher harmonics of the input side effectively and prevent other equipment from damaging due to distortion of voltage wave. Eliminate the input current unbalance due to unbalance between the power phases.
EMC input filter	Input side of the inverter	Reduce the external conduction and radiation interference of the inverter. Decrease the conduction interference flowing from the power end to the inverter and improve the anti-interference capacity of the inverter.
DC reactor	KE series inverter adopts DC reactor of more than 18.5kW as standard.	Improve the power factor of the input side; Improve the whole efficiency and thermal stability of the inverter. Eliminate the impact of higher harmonics of the input side on the inverter and reduce the external conduction and radiation interference.
AC output reactor	Between the inverter output side and the motor close to the inverter	The inverter output side generally has higher harmonics. When the motor is far from the inverter, since there are many distributed capacitors in the circuit, certain harmonics may cause resonance in the circuit and bring about the following two impacts: Degrade the motor insulation performance and damage the motor if long running. Generate large leakage current and cause frequent inverter protection. In general, the distance between the inverter and the motor exceeds 100 meters, installation of output AC reactor is recommended.

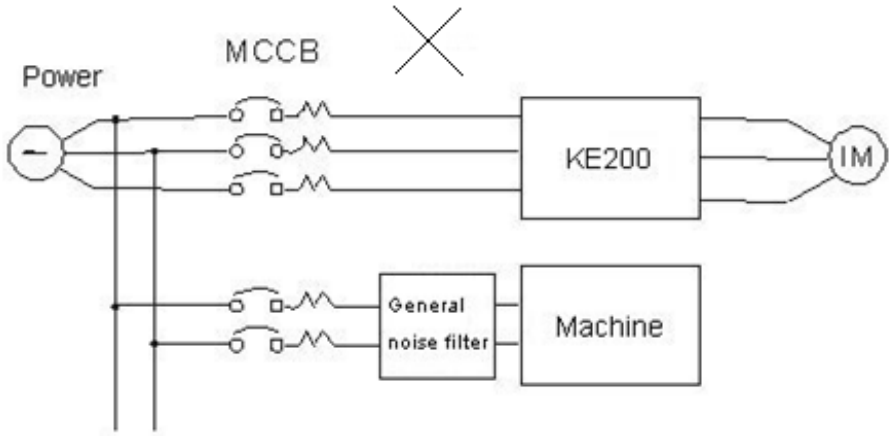
Please check the following items for external wiring & check if it is correct after finishing the connection (do not use the buzzer on the control circuit to check).

(A) The wiring of main power circuit must be kept away from other power cables with high voltage or big current to avoid noise interference. Please refer to the below figures.

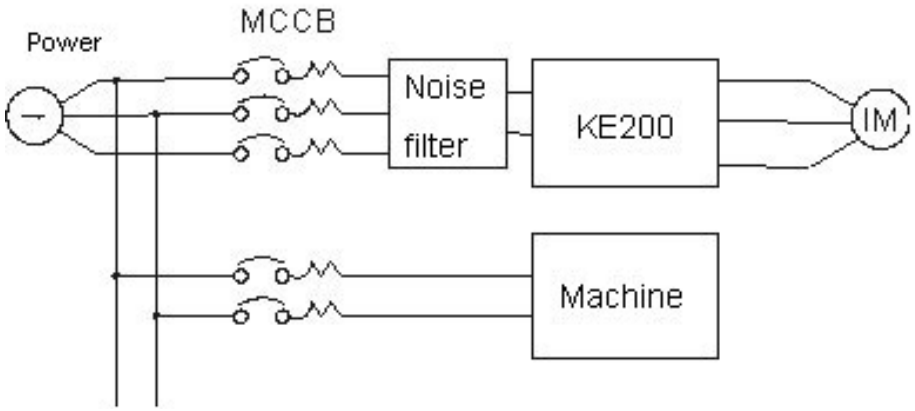
- A separate power circuit for the inverter.

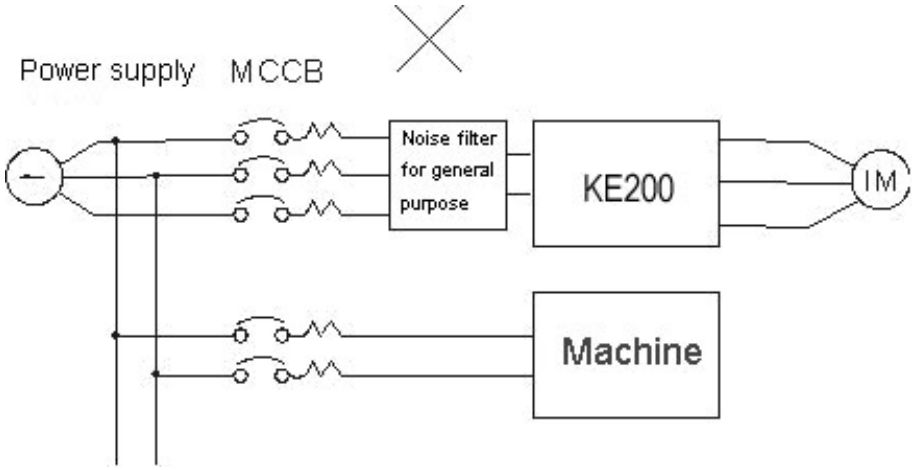


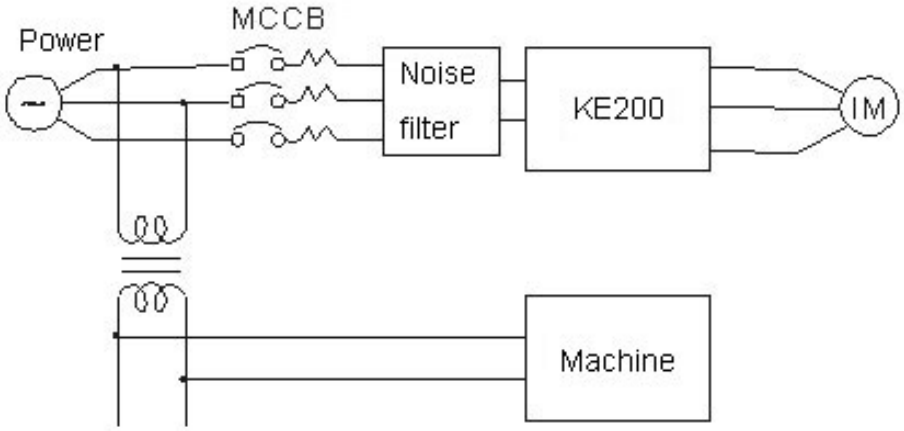
- The general noise filter is not very effective, so it is not recommended.



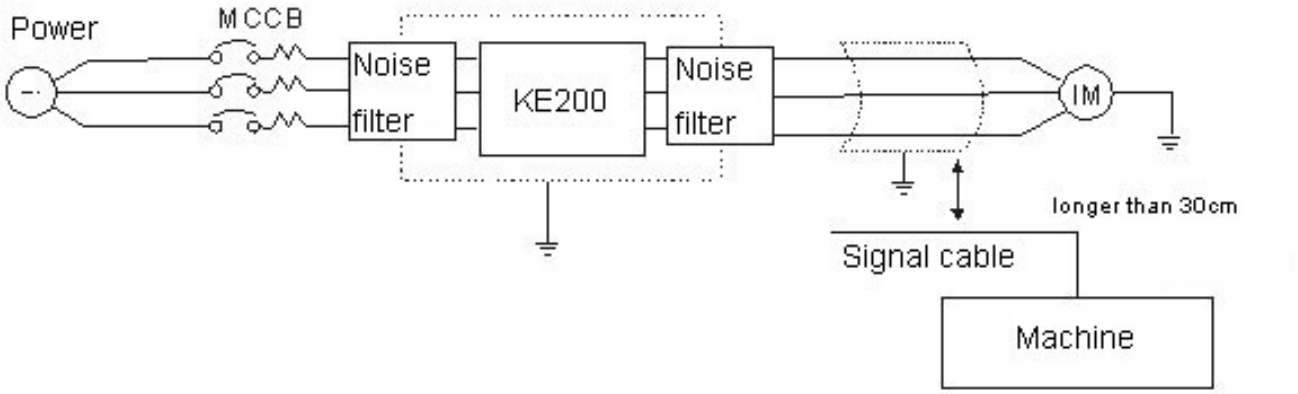
- Please install a noise filter or an isolation transformer if the power circuit is shared by the inverter and other machine.







- Install a noise filter on the output of the main circuit to restrain the transmission interference. Please install metal tube on the circuit & keep a distance longer than 30cm from signal cables of other control machine.



- When the wiring distance between the inverter and motor is too long, please consider the voltage drop of the circuit, phase to phase voltage drop (V) = $\sqrt{3}$ * wire resistance (Ω/km) * wire distance (m) * current * 10^{-3}, and adjust the carrier frequency according to the wiring distance.

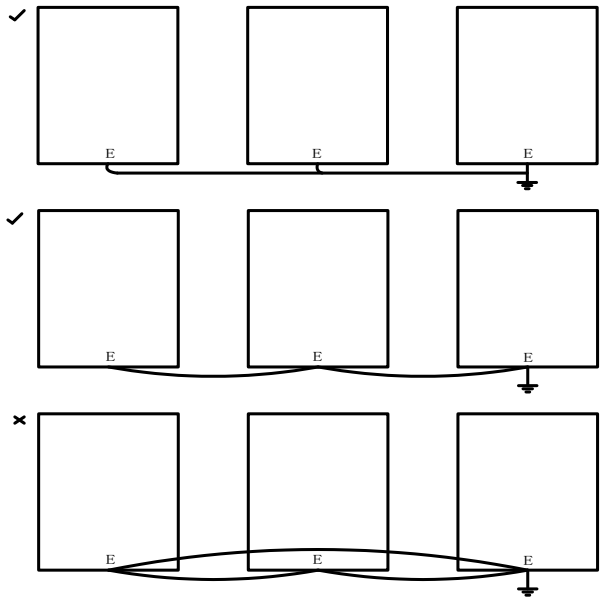
Wiring distance between inverter and motor	Below 50M	Below 100M	Above 100M
Carrier frequency	15kHz or less	10kHz or less	5kHz or less
Setting value of parameter C6-01	15.0	10.0	5.0

(B) The wiring of the control circuit must be kept away from the main control circuit's control cable or other power cable with high voltage or big current to avoid noise interference.

- Wiring terminals 9, 10, 18, 19, 20 (contact output) of the control circuit must be wired separately from other terminals.
- Please use shielded cables as the control circuit's cables to avoid fault because of noise interference. The wiring distance of the control cable must be no longer than 50m.

(C) The inverter's ground terminal must be properly grounded, the third ground connection for 220V class, the special ground connection for 380V class.

- The ground wiring depends on electrical equipment technology (AWG), keep the ground wire as short as possible.
- Never ground the inverter together with welding machines, motors, or other high-current electrical equipments. Please make all ground wiring in a separate conduit.
- When several inverters are grounded together, please do not form a ground loop.



（D）The specifications of wires and the diameter specifications of wiring of main power circuit and control circuit is selected according to electrical standards, to ensure the safety.

（E）After finishing the wiring, please make sure that the wiring is correct, the wires are good, and the screws are tighten.

Chapter 4 Testing & Operation

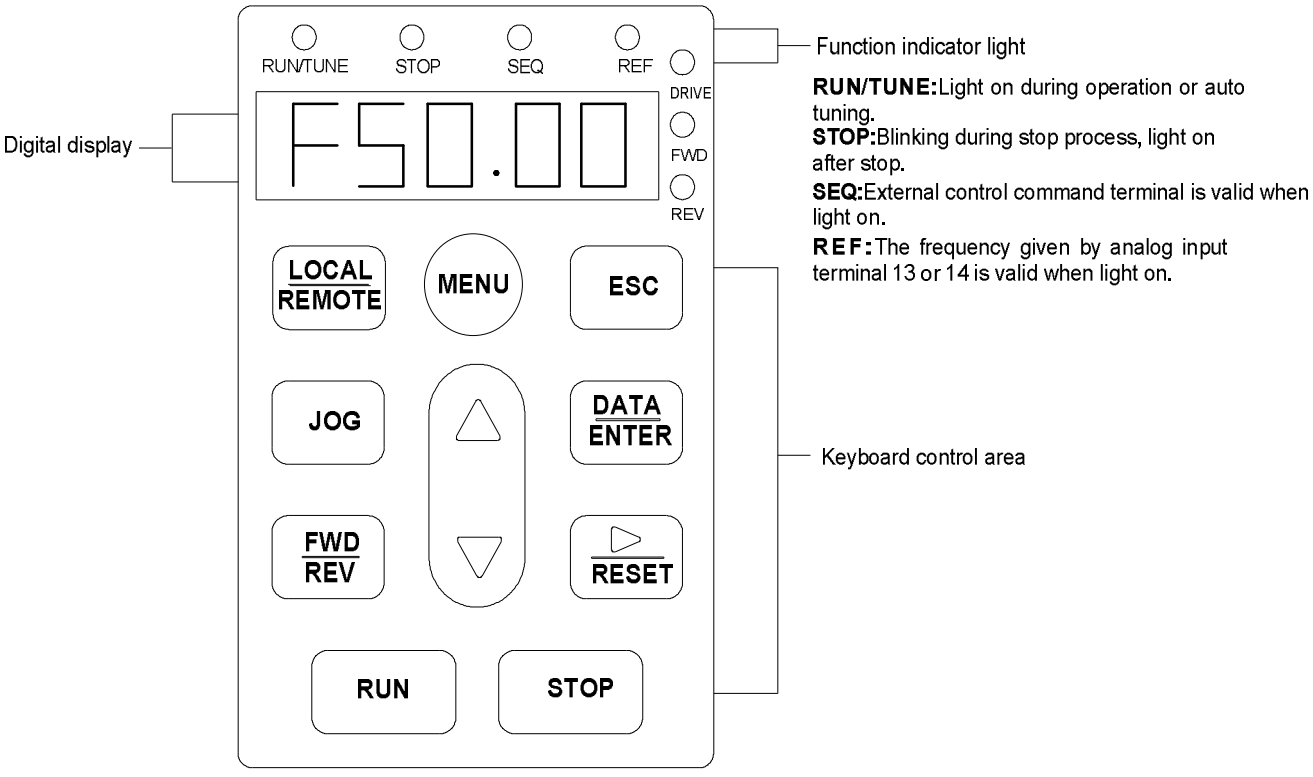
4.1 Power on Inspection

Inspection before power on:

- Check if the wiring of the main circuit is correct.
- Check if the screws are securely tightened.
- Check if the wiring is correct or there is short circuit caused by broken wires.
- Check if the load status is normal.

4.2 Trial Operation

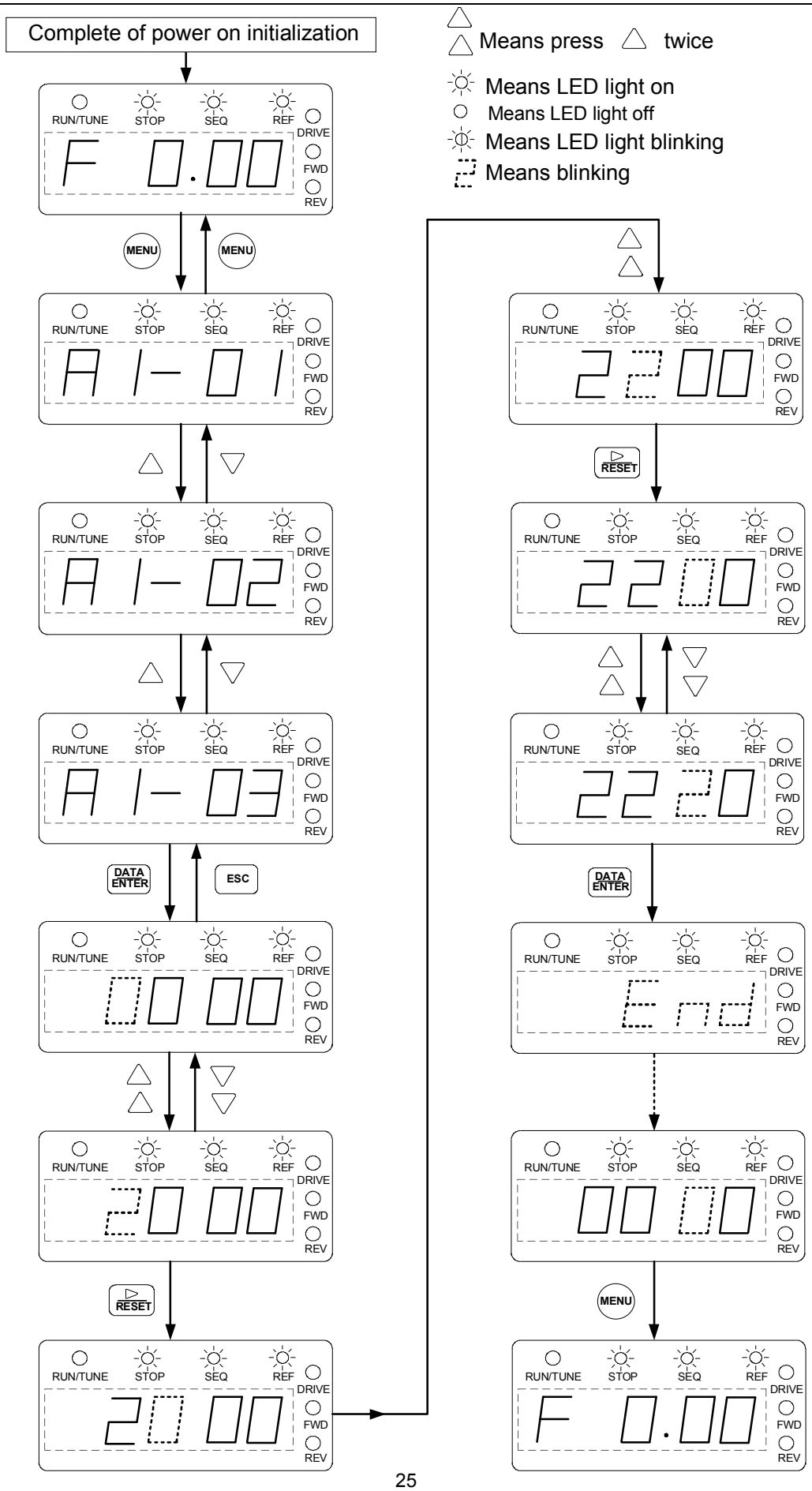
- Please reconfirm the power supply voltage and the wiring are correct before power on.
- Please cut off the power if there is abnormal noise, smoke or abnormal smell after power on.
- Check if the motor runs smoothly, the motor rotation direction is correct and there is abnormal vibration on the motor.
- Check if the motor runs smoothly during acceleration and deceleration.
- Check if the load current is in the range of rated value.
- Check if the display and signal of the keypad are normal.
- The display of the keypad after power on is showed as follow:



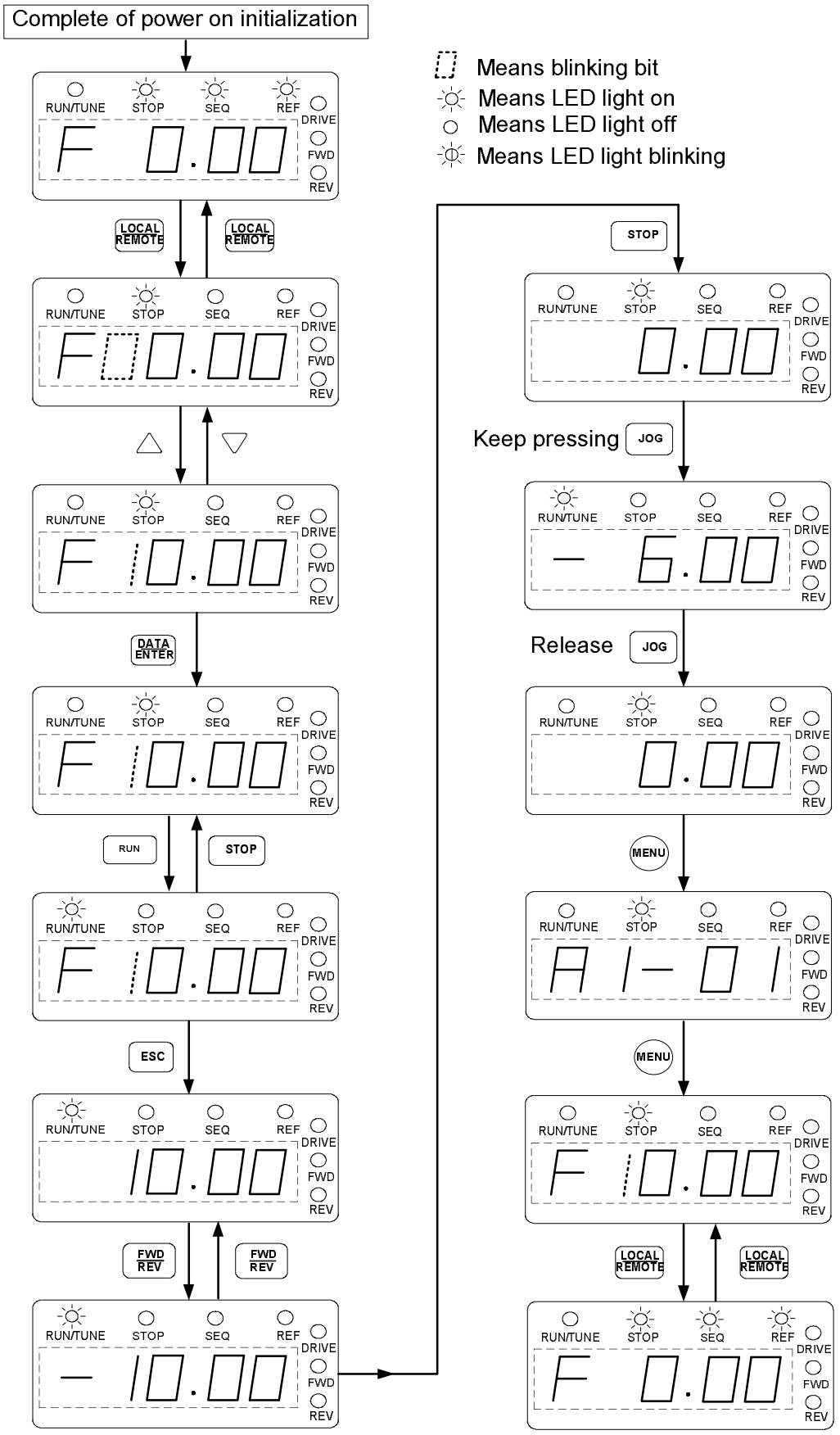
KE200 keypad function description:

Function Key	Name	Function Description
LOCAL/REMOTE	LOCAL/REMOTE	Switch key for keypad control and external terminal control
MENU	MENU	Switch key for setting frequency and function code parameters
ESC	ESC	Returns display to the previous status, switch operation or monitor parameters at stop status
JOG	JOG	Jog key, the default jog frequency is 6Hz
FWD/REV	FWD/REV	Select forward or reverse running
RESET	RESET	Selects a digit when setting value. As reset key at faults.
△	Increment key	Selects mode, group, function, parameter or setting value (Increase).
▽	Decrement key	Selects mode, group, function, parameter or setting value (Decrease).
DATA/ENTER	DATA/ENTER	Parameter confirmation key, the setting value is entered by pressing this key.
RUN	RUN	Run inverter by pressing this key under keyboard control mode
STOP	STOP	Stop inverter by pressing this key under keyboard control mode

(1) Example of keypad operation: Reset KE200 default setting (two wire system) from the initialize interface after power on.


Complete of power on initialization
Means press twice
Means LED light on
Means LED light off
Means LED light blinking
Means blinking
RUN/TUNE
STOP
SEQ
REF
DRIVE
FWD
REV
F 0.00
MENU
A I- 01
A I- 02
A I- 03
DATA ENTER
ESC
0.0.0.0
2.0.0.0
RESET
2.0.0.0
2.2.0.0
2.2.0
2.2.2.0
End
0.0.0.0
F 0.00

(2) Example of keypad operation: Set 10Hz by keypad, forward/reverse KE200, and test jog function.



Safety precautions during trial operation

Danger
● Do not remove the front cover of the inverter during power on to keep away from electric shock. ● The motor will run automatically after stop if the auto restart function is set, please keep away from the machine to avoid danger. ● Kindly note, the function of stop switch is only valid after being set, which is different from the usage of the function of emergency stop switch.

Caution
● Do not touch the heating elements, such as radiator, braking resistor, etc. ● The inverter can run from low speed to high speed easily, please confirm the tolerance range of motor and machinery. ● Please pay attention to the relative setting when using the braking unit. ● Do not check signals on PCB during operation ● All inverter parameters have been preset at the factory. Do not change the settings unless it is required.

Parameter access level and control mode setting:

5 kinds of KE200 access level: Special for monitor, Selection of customer usage, Quick-start, Basic, Advanced

4 control modes of KE200: V/F control without PG, V/F control with PG, Open loop vector control, close loop vector control

Function code	Name	Factory default	Frequency command selection
A1－01	Parameter access level	2	0: Special for monitor (only the drive modes and environment parameters can be modified) 1: Selection of customer usage (only A2-01—A2-32 can be read & set) 2: Quick-start (only read & set 25 required parameters for start) 3: Basic (can read & set normal parameters) 4: Advanced (can read & set all parameters)
A1－02	Control mode selection	2	0: V/F control without PG 1: V/F control with PG 2: Open loop vector control 3: Close loop vector control

4.3 Setting before Operation

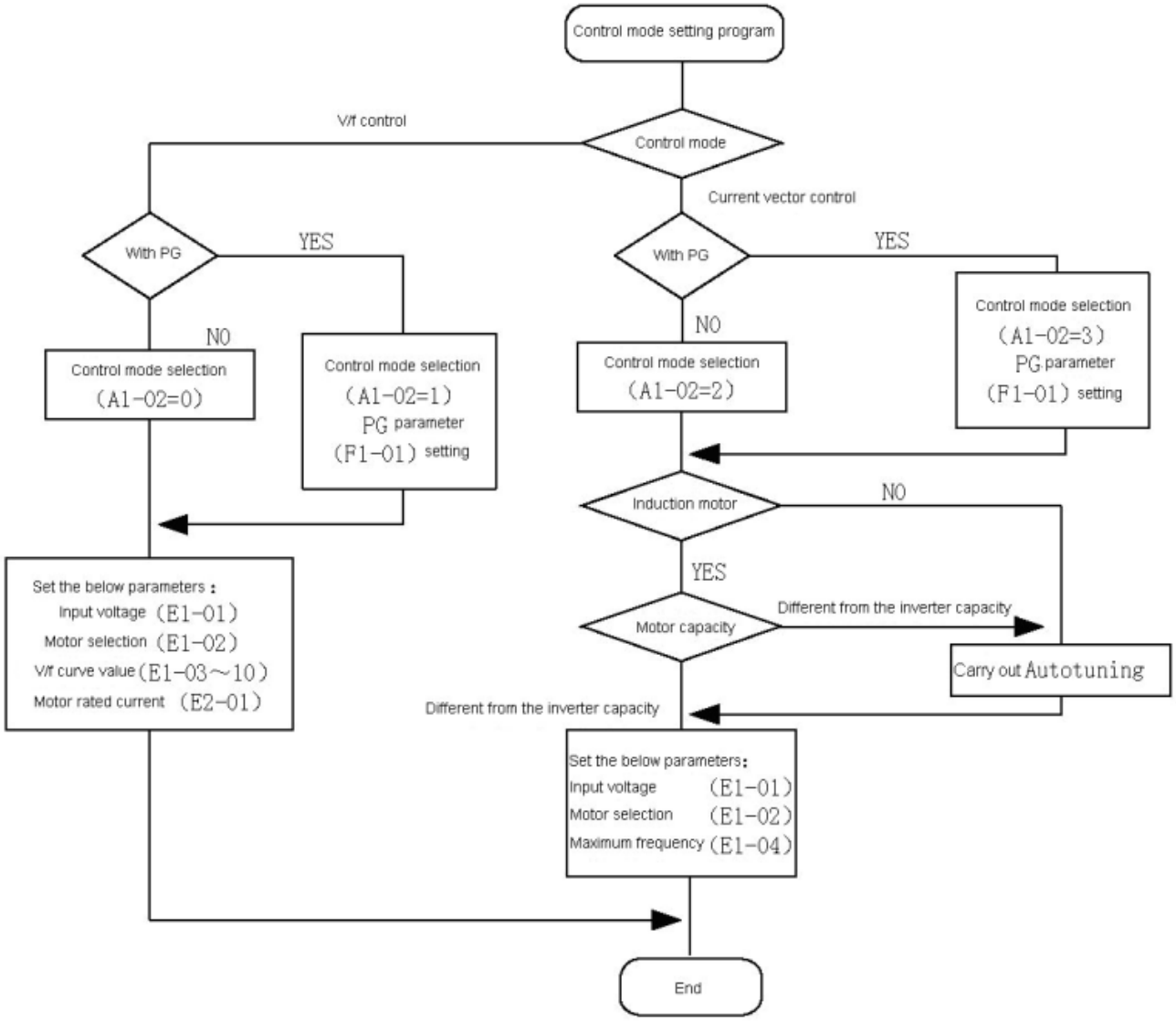
Trial operation in advance without load to avoid damaging the machine because of misoperation. Please do pay attention to the safety of machine and person if trial operation with load is necessary.

Chapter 5 Control Mode Setting

5.1 Four Control Modes

KE200 series inverter provides four kinds of control mode:
0. V/F control without PG
1. V/F control with PG
2. Open loop vector control
3. Close loop vector control

Users can select the control mode via keypad accordingly. The factory default control mode is open loop vector control. Please set the control mode and motor parameters according to the following steps.



5.2 Specifications of Four Control Modes

Control mode	V/f control without PG	V/f control with PG	Open loop vector control	Close loop vector control
Basic control	Voltage/frequency control (open loop)	Voltage/frequency control with speed compensation	Current vector control without PG	Current vector control with PG
Speed detector	Without	With PG	Without	With PG
Option of speed detection	Without	KE200-PGA2 KE200-PGD2	Without	KE200-PG2 KE200-PG3
Speed control range	1: 40	1: 40	1: 100	1: 1000
Starting torque	150%/3HZ	150%/3HZ	150%/1HZ	150%/0r/min
Speed control accuracy	±2%～±3%	±0.03%	±0.2%	±0.02%
Torque control	No	No	No	Possible
Low noise corresponding	Standard corresponding	Standard corresponding	Standard corresponding	Standard corresponding
Suitable application	1. Drive several motors together 2. Motor parameters are unknown 3. Can not auto tuning	The machinery with pulse generator	Situations require varying speed	1. Simple servo drive 2. High accuracy speed control 3. Torque control

5.3 Frequency Command and Running Command Selection

<table>
<tr><th>Function code</th><th>Name</th><th>Factory default</th><th>Description</th></tr>
<tr><td>B1-01</td><td>Frequency command selection</td><td>1</td><td>
<table>
<tr><th>Setting value</th><th>Description</th></tr>
<tr><td>0</td><td>Keypad</td></tr>
<tr><td>1</td><td>Analog terminals</td></tr>
<tr><td>2</td><td>Communication</td></tr>
<tr><td>3</td><td>Option card</td></tr>
</table>
</td></tr>
<tr><td>B1-02</td><td>Running command selection</td><td>1</td><td>
<table>
<tr><th>Setting value</th><th>Description</th></tr>
<tr><td>0</td><td>Keypad</td></tr>
<tr><td>1</td><td>No. 1, 2 control terminal</td></tr>
<tr><td>2</td><td>Communication</td></tr>
<tr><td>3</td><td>Option card</td></tr>
</table>
</td></tr>
</table>

5.4 Autotuning Program

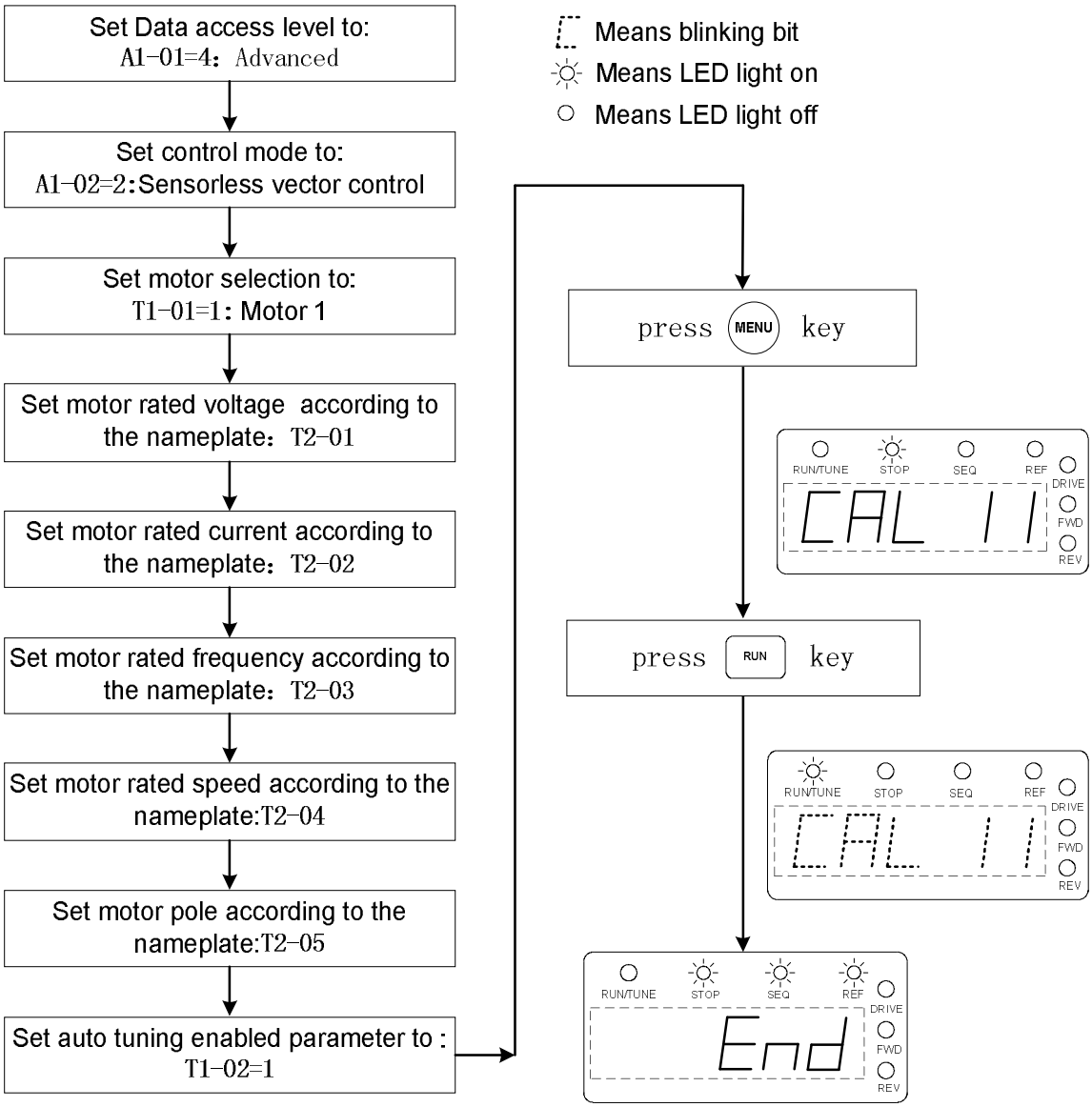
5.4.1 For Open loop vector control, please confirm the following items before auto tuning.

(1) Please confirm the load disconnects with the motor completely, otherwise it may cause danger and the auto tuning parameters inaccurate.

(2) Please run with factory default parameters if the load cannot be removed. Or consult the manufacturer to set motor parameters manually.

Please adopt V/F control mode for the situation which does not require high control accuracy and the load cannot be fully removed.

Auto tuning procedure of sensorless vector control



5.4.2 Countermeasure to the abnormal auto tuning when open loop vector control

When a fault happens during auto tuning, the following abnormal status will be showed & the motor will stop. Please check the following reasons and carry out the relative countermeasures. After the problem is solved, please restart auto tuning. Press “MENU” key to remove the abnormal display.

The motor parameters will restore to the original values if a fault happens. Please reset the parameters when restarting auto tuning.

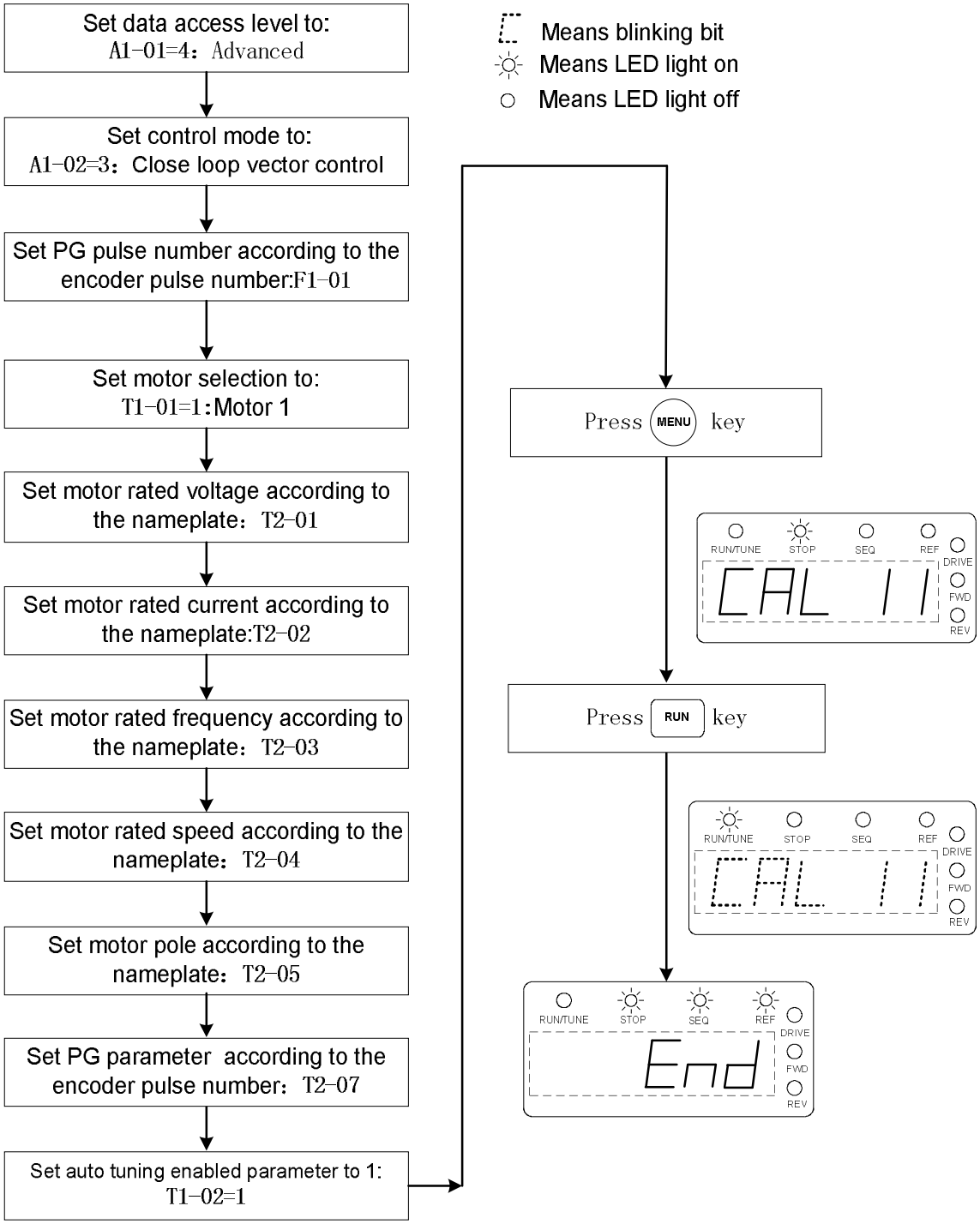
Countermeasure to the abnormal auto tuning when open loop vector control		
Abnormal content	Reason	Countermeasure
The set data is abnormal during auto tuning	The relationship between rated frequency, rated speed and motor pole number is abnormal	Revise according to the formula, rated speed<120*rated frequency/motor pole number
The actual load rate exceeds 20% during auto tuning	Load connects with motor	Disconnect the load with motor
	The setting value is abnormal during auto tuning	Set the correct rated current
	Motor bearing is abnormal	Rotate the motor bearing manually when power off. Please change the motor if the rotation is not smooth.
Torque command value exceeds 100% during auto tuning	Motor’s power line is broken	Check the wiring, repair the broken line
	Load connects with motor	Disconnect the load with motor
Motor does not accelerate in the set time.	Torque limit function does not take action	Restore torque limit (L7-01-L7-04) to factory defaults
	The acceleration time is too short	Extend acceleration time (C1-01)
	Load connects with motor	Disconnect the load with motor
Rated slip can be not adjusted in the set time	Load connects with motor	Disconnect the load with motor
Core saturation coefficient cannot be adjusted in the set time	Motor rated speed is set improperly	Set the proper value
	Motor’s power line is broken	Check the wiring, repair the broken line
Line resistance cannot be adjusted in the set time, there is no load current	Motor rated current is set improperly	Set the proper value
	Motor’s power line is broken	Check the wiring, repair the broken line
During auto tuning, torque command exceeds 100% and current without load exceeds 70% of motor rated current	Rated voltage and rated frequency are set improperly	Set the proper values
	Load connects with motor	Disconnect the load with motor

5.4.3 For close loop vector control, please confirm the following items before auto tuning.

(1) Please confirm the load disconnects with the motor completely, otherwise it may cause danger and the auto tuning parameters inaccurate.

(2) Please confirm the encoder and PG card are installed well, and make sure their connection is correct.

Auto tuning procedure of close loop vector control

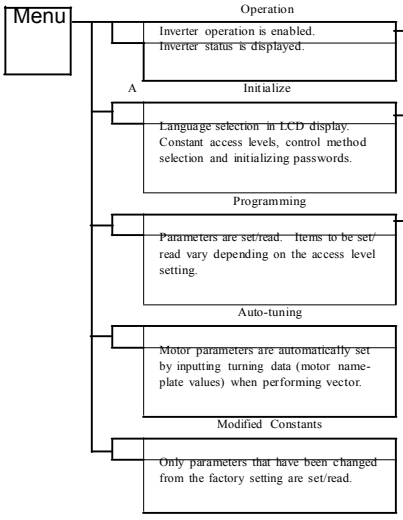


5.4.4 Countermeasure to the abnormal auto tuning when close loop vector control

Countermeasure to the abnormal auto tuning of close loop vector control		
Abnormal content	Reason	Countermeasure
The set data is abnormal during auto tuning	The relationship between rated frequency, rated speed and motor pole number is abnormal	Revise according to the formula, rated speed<120*rated frequency/motor pole number
The actual load rate exceeds 20% during auto tuning	Load connects with motor	Disconnect the load with motor
	The setting value is abnormal during auto tuning	Set the correct rated current
	Motor bearing is abnormal	Rotate the motor bearing manually when power off. Please change the motor if the rotation is not smooth.
Torque command value exceeds 100% during auto tuning	Motor's power line is broken	Check the wiring, repair the broken line
	Load connects with motor	Disconnect the load with motor
Motor does not accelerate in the set time.	Torque limit function does not take action	Restore torque limit (L7-01-L7-04) to factory defaults
	The acceleration time is too short	Extend acceleration time (C1-01)
	Load connects with motor	Disconnect the load with motor
Rated slip can be not adjusted in the set time	Load connects with motor	Disconnect the load with motor
Core saturation coefficient can not be adjusted in the set time	Motor rated speed is set improperly	Set the proper value
	Motor's power line is broken	Check the wiring, repair the broken line
Line resistance can not be adjusted in the set time, there is no load current	Motor rated current is set improperly	Set the proper value
	Motor's power line is broken	Check the wiring, repair the broken line
PG fault	The connection between PG (A, B phase), the motor (U, V, W) and the inverter is not well	Check the wirings of PG and the motor, check the PG direction and F1-05.
There is output from motor, but no input from PG pulse	PG is disconnected PG power line is broken	Check & repair the connection
During auto tuning, torque command exceeds 100% and current without load exceeds 70% of motor rated current	Rated voltage and rated frequency are set improperly	Set the proper values
	Load connects with motor	Disconnect the load with motor

Chapter 6 Parameter Description

KE200 Series Parameter Tree



Group	Function	Display	Access Level
U Monitoring Items			
Monitor			
U1	Status monitoring	Monitor	Q, B, A
U2	Fault trace	Fault Trace	Q
U3	Fault history	Fault History	Q
A Initialize			
A1	Initialization	Initialize	Q
A2	User setting parameter	User Parameters	A
B Application			
Application			
B1	Operation method selection	Sequence	Q, B, A
B2	DC injection braking	DC Braking	B
B3	Speed search	Speed Search	A
B4	Timer function	Delay Timers	A
B5	PID control	PID Control	A
B6	DWELL function	Reference Hold	A
B7	Droop control	Droop control	A
B8	Energy-saving control	Energy Saving	A
B9	Zero Servo	Zero Servo	A
C Tuning			
Tuning			
C1	Accel/decel time	Accel/Decel	Q, B, A
C2	S-curve characteristics	S-curve Acc/Dec	A
C3	Motor slip compensation	Motor-slip Comp	B. A
C4	Torque compensation	Torque Comp	B, A
C5	ASR	ASR Tuning	B, A
C6	Carrier frequency	Carrier Freq	BA
C7	Hunting prevention	Hunting Prev	A
C8	Factory-tuning constant	Factory Tuning	A
D Reference			
Reference			
D1	Frequency reference value	Preset Reference	Q, A
D2	Upper/lower limits	Reference Limits	B
D3	Jump frequency	Jump Frequencies	B
D4	Sequence	Sequence	A
D5	Torque reference	Torque Control	A
E Motor Parameters			
Motor			
E1	V/f pattern	V/F Pattern	Q
E2	Motor parameters	Motor Setup	Q, A
E3	Motor 2 control method	Motor 2 Ctl Meth	A
E4	V/f pattern/2	V/f Pattern 2	A
E5	Motor 2 constants	Motor 2 Setup	A
F Option			
Option			
F1	PG speed control card	PG Option setup	Q, B, A
F2	Analog reference card	A1-14 Setup	B
F3	Digital input card	DI-08, 16 Setup	B
F4	Analog monitor card	AO-08, 16 Setup	B
F5	Digital output card	DO-02 Setup	B
F6	Digital output card	DO-08 Setup	B
F7	Pulse monitor card	PO-36F Setup	B
F8	SI-F/G card	SI-F/G	B
F9	DDS-B/SI-B card	DDSS/SI-B	B
H Control Circuit Terminals			
Terminal			
H1	Sequence input	Digital Inputs	B
H2	Sequence output	Digital Outputs	B
H3	Analog input	Analog Inputs	B, A
H4	Analog output	Analog Outputs	B
H5	MODBUS communication (RS-485)	Serial Com Setup	A
L Protection			
Protection			
L1	Motor electric thermal overload relay	Motor Overload	B L2
	Momentary power loss ride-through	PwrLoss Ridethru	B, A
L3	Stall prevention	Stall Prevention	B, A, F
L4	Frequency Detection	Ref Detection	B, A
L5	Fault retry	Fault Restart	B
L6	Overtorque detection	Torque Detection	B, A
L7	Torque limit	Torque Limit	B
L8	Hardware protection	Hdwe Protection	B, A
O Digital Operator			
Operator			
O1	Display selection	Monitor Select	B, A
O2	Key selection	Key Selections	B, A

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

Main Menu: Initialize <ENTER>

A Initialization Parameters

A1 Initialization Set-up

A1-00 Language Selection *Select Language*

Q	Q	Q	Q

Select the language displayed on the digital operator according to the following table:

Setting	Description
0	English *(factory default)*

A1-01 Parameter Access Level *Access Level*

Q	Q	Q	Q

This parameter allows the "masking" of parameters according to user level. See the following table:

Setting	Description
0	Operation Only
1	User Program - Accesses parameters selected by OEM (*A2-01* to *A2-32*).
2	Quick Start Level *(factory default)* - For maintenance-level programming.
3	Basic Level - For basic programming in most applications.
4	Advanced Level - For advanced programming in special applications.

A1-02 Control Method Selection *Control Method*

Q	Q	Q	Q

Select the control method best suited for your application.

Setting	Description
0	V/f Control - For general-purpose and multiple motor applications.
1	V/f with PG Feedback - For general-purpose applications requiring closed loop speed control.
2	Open Loop Vector *(factory default)* - For applications requiring precise speed control, quick response and higher torque at low speeds (150% torque below 1Hz).
3	Close Loop Vector - For applications requiring very precise speed and torque con- trol at a wide speed range including 0 speed. Uses encoder

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

A1-03 Operator Status *Init Parameters*

Q	Q	Q	Q

Use this parameter to reset the inverter to its factory default settings. Initialize the inverter after changing the control PCB, or after selecting language *(A1-00)*, control method *(A1-02)*, or inverter capacity *(O2-04)*.

Setting	Description
0	No Initialization *(factory default)*
1110	User Initialization - resets the inverter to user-specified initial values. To set user-specified initial values, make all required changes to parameter settings, then set O2-03 to "1". The inverter will memorize all current settings as the user-specified initial values. Up to 50 changed parameters can be stored.
2220	2-Wire Initialization - terminal 1 becomes FWD run command and terminal 2 becomes REV run command. All other parameters are reset to their original factory default settings.
3330	3-Wire Initialization - terminal 1 becomes run command, terminal 2 becomes stop command and terminal 3 becomes FWD/REV run selection. All other parameters are reset to their original factory default settings.

A1-04 Password Entry *Enter Password*

Q	Q	Q	Q

Parameter A1-04 is used to enter a password into the inverter, to be able to make adjustments to locked parameters.

Password protection is provided for:
A1-01 Access Level
A1-02 Control Method
A1-03 Initialization
A2-01 to A2-32 User Parameters (If selected)

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

A2 User's Parameters

The user can select up to 32 parameters for quick-access programming. By setting the user access level *(A1-01)* to "User Program", only the parameters selected in function A2 can be accessed by the user.

Parameter A1-01 must be set to 4 (advanced access level) to input parameter numbers into A2-01 through A2-32, and then A1-01 must be set to 1 (User Level) for only the user selected parameters to be viewed.

Main Menu: Programming <ENTER>

B Application Parameters

B1 Sequence

B1-01	*Frequency Reference Selection*	*Reference Source*	Q	Q	Q	Q
B1-02	*Operation Method Selection*	*Run Source*	Q	Q	Q	Q

Frequency reference and run command can be set independently as shown below:

Setting	Description
0	Command from digital operator
1	Command from control circuit terminal *(factory default)*
2	Command from serial communication
3	Command from option card
4	EWS (Reference from CP-717)* <1110> This setting will be used with the CP-717 to run and change the reference through DP-RAM.

* Setting parameter B1-01 or B1-02 to 4 allows reference and/or run source from CP-717 when either CP-916 or CP-216 option cards are installed.

By depressing the LOCAL/REMOTE key on the digital operator, the operation mode can be selected as shown below:

Local: Operation according to frequency reference and run command from digital operator.
Remote: Operation according to frequency reference and run command set by *B1-01* and *B1-02*.

The digital operator is reset to remote operation when power is cycled.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

B1-03 Stopping Method Selection *Stopping Method*

Q	Q	Q	Q

This function selects the stopping method suitable for the particular application.

Setting	Description
0	Ramp to stop *(factory default)*
1	Coast to stop
2	DC injection to stop
3	Coast to stop with timer

· Ramp to Stop (*B1-03* = "0")

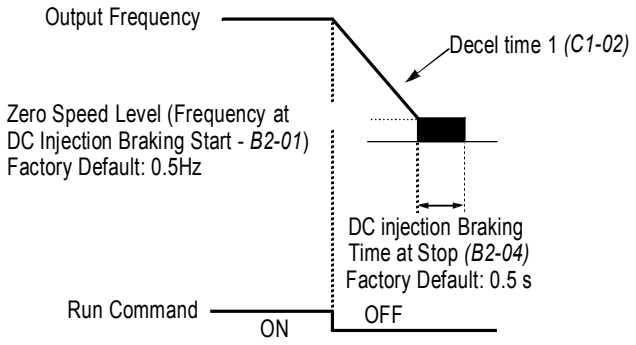


Figure 1 Stopping Method - Ramp to Stop

Upon removal of the FWD (REV) run command, the motor decelerates at a rate determined by the time set in deceleration time 1 *(C1-02)* and DC injection braking is applied after the minimum output frequency (E1-09) has been reached. If the deceleration time is set too short or the load inertia is large, an overvoltage fault (OV) may occur during deceleration. In this case, increase the deceleration time or install an optional braking transistor and/or braking resistor (braking transistors are provided as standard for units 230V 7.5kW and smaller, 460V 15kW and smaller).

Braking torque: without braking resistor, approx. 20% of motor rated torque
with braking option, approx. 150% of motor rated torque

· Coast to Stop (*B1-03* = "1")

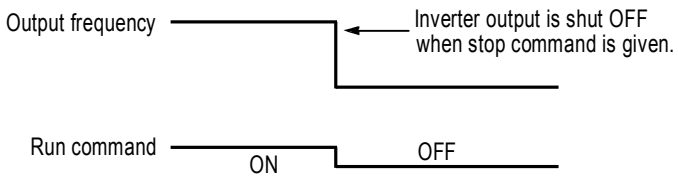


Figure 2 Stopping Method - Coast to Stop

Upon removal of the FWD (REV) run command, the motor starts to coast. After a stop command is given, a run command is accepted and operation will start after the minimum baseblock time *(L2-03)* elapses. If there is a possibility that a run command might be entered before the motor has come to a stop, the speed search function (B3) or Coast to Stop with Timer 1 (*B1-03* = "3") should be employed.

· DC Injection Braking to Stop (*B1-03* = "2")

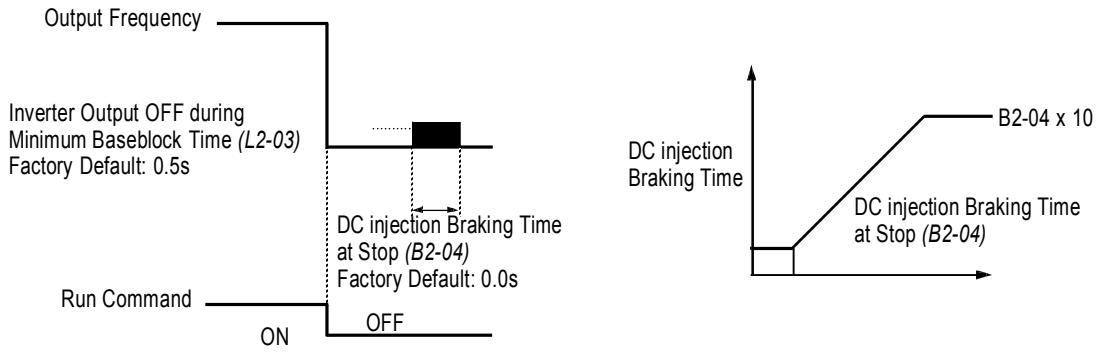


Figure 3 Stopping Method - DC Injection Braking to Stop

Upon removal of the FWD (REV) run command, the motor brakes to stop, according to the DC injection braking time at stop set in *B2-04*. If this value is set to "0" *(factory default)*, DC injection braking is disabled, and the motor coasts to stop. When choosing this function, note that the actual stop time is the time set in *B2-04* multiplied by 10 (see Figure 3 above). This stopping method is disabled during close loop vector control. Braking duty cycle should allow excess motor heat to dissipate.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

· Coast to Stop with Timer 1 (*B1-03* = "3 ")

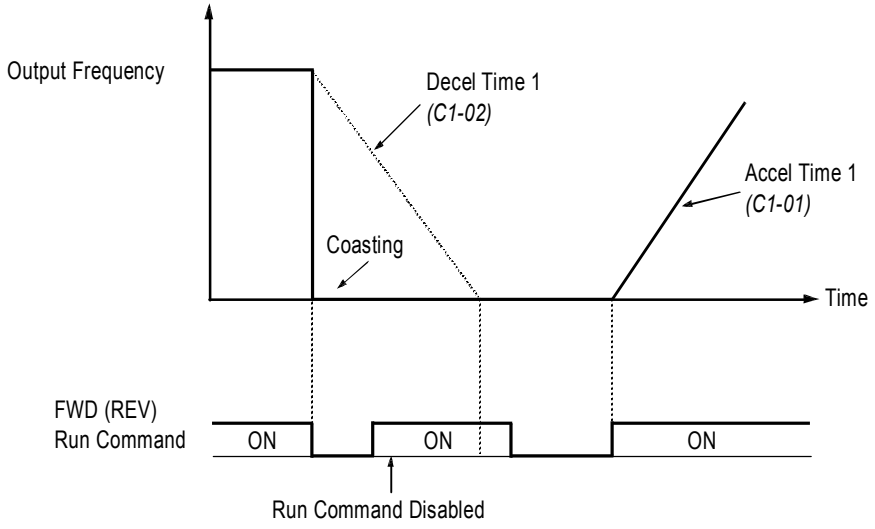


Figure 4 Stopping Method - Coast to Stop w/ Timer

After a stop command is given, a run command is not accepted while the coast to stop timer elapses (same as Decel 1). After the timer runs out, another run command must be given for the inverter to begin acceleration. This stopping method is disabled during close loop vector control.

B1-04 Prohibition of Reverse Operation *Reverse Oper*

B	B	B	B

A "reverse run disabled" setting does not allow a reverse run command from the control circuit terminal or the digital operator. This setting is used in applications where a reverse run command is undesirable.

Setting	Description
0	Reverse run enabled *(factory default)*
1	Reverse run disabled

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

B1-05 Operation Selection at Zero Speed *Zero Speed Oper*

-	-	-	A

During close loop vector control, select an operation mode to be employed when the frequency reference (ana- log input) drops below the minimum output frequency *(El -09)*. During V/f or open loop vector control, baseblock is applied when the output frequency drops below the minimum output frequency *(El -09)*.

Setting	Description
0	*E1 -09* disabled, run according to frequency reference *(factory default)*
1	Baseblock
2	Run at minimum output frequency *(E1-09)*
3	Zero-speed operation (internal speed reference is set to "0")

B1-06 Input Scan Time *Cntl Input Scans*

B	B	B	B

This parameter selects the microprocessor scan time for reading sequence input data from the control circuit terminals.

Setting	Description
0	2ms scan time for 2 scans
1	5ms scan time for 2 scans *(factory default)*

Set to "0" when a quicker response is needed from the control circuit terminals.

B1-07 Operation Selection After Switch to Remote Mode LOC/REM RUN Sel

A	A	A	A

Parameter b1-07 determines how the inverter will function when switching between local and remote operation. This function prevents the motor from running when switching between local/remote and the inverter is controlled from the digital operator.

Setting	Description
0	(Cycle Extrn RUN) - If the run command is closed when switching from local control to remote control, the inverter will not run. *The run command must be cycled for the inverter to run. (factory default)*
1	(Accept Extrn RUN) - If the run command is closed, when switching from local control to remote con-trol, the inverter will run.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

B1-08 Run Command Acceptance During Programming RUN CMD at PRG

A	A	A	A

As a safety precaution the drive will not respond to a change in the run command when the digital operator is being used to set or adjust parameters. This parameter will allow the drive to accept or reject a change in the run command when the digital operator is being used to change or adjust parameters. <1110>

Table 1:

Setting	Description
0	Run command is disabled when drive is in the programming mode. *(factory default)*
1	Run command is enabled when the drive is in the program mode

B2 DC Braking

B2-01 DC Braking Frequency (Zero Speed Level) DCInj Start Freq

B	B	B	B

Setting Range: 0.0 to 10.0Hz
Factory Default: 0.5Hz

Sets the frequency at which DC injection braking (or initial excitation for close loop vector control) starts, in units of 0.1 Hz. When *B2-01 < E1-09*, DC injection braking starts from the minimum frequency refer- ence *(E1-09)*.

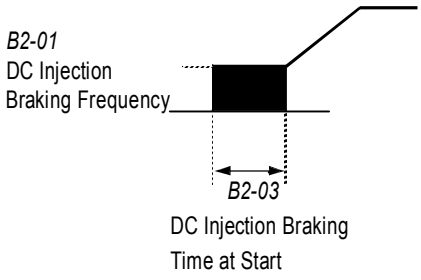


Figure 5 DC Injection Braking at Starting

B2-02 DC Braking Current DCInj Current

B	B	B	-

Setting Range: 0 to 100%
Factory Default: 50%

DC injection braking current is set as a percentage of inverter rated current. In close loop vector control mode, initial excitation is performed according to the motor no-load current set in *E2-03*. This param- eter should not be set unnecessarily high or motor overexcitation may occur.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

B2-03 DC Braking Time at Start *DCInj Time@Start*

B	B	B	B

Setting Range: 0.00 to 10.00s
Factory Default: 0.00s

DC injection braking at start can be used to stop a spinning motor (or when motor rotation direction is unknown) prior to running. DC injection braking time at start (or initial excitation for close loop vector con- trol) is set in units of 0.1 second. When *B2-03* is set to "0", DC injection braking is disabled and accel-
eration starts from the minimum output frequency.

B2-04 DC Braking Time at Stop *DCInj Time@Stop*

B	B	B	B

Setting Range: 0.00 to 10.00s
Factory Default: 0.00s

DC injection braking time at stop (or initial excitation for close loop vector control) is set in units of 0.1 sec- ond. When *B2-04* is set to "0", DC injection braking is disabled, and the inverter output shuts OFF.

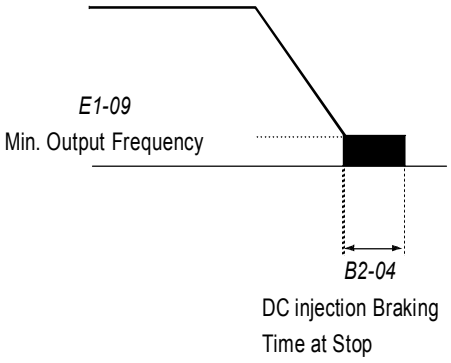


Figure 6 DC Injection Braking Time at Stop

When coast to stop is selected as the stopping method *(B1-03)*, DC injection braking at stop is disabled.

B2-08 Magnetic Close loop Compensation Level <1110> *FieldComp*

-	-	A	A

Setting Range: 0 to 500%
Factory Default: 0%

This parameter allows the magnetizing motor close loop to be boosted when starting the motor. This parameter will facilitate a quick ramp-up of the torque reference and magnetizing current reference to reduce motor slip during start. A setting of 100% equals motor no-load current *E1-09*. This flux level will be applied below *Minimum Output Frequency (E1-09)* until the *DC Injection Time at Start (B2-03)* expires. This parameter is useful when starting motors that are relatively larger than the inverter, due to the requirement for increased magnetizing current. This parameter may also compensate for reduced starting torque due to motor circuit inefficiencies.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

B3 Speed Search

When starting into a coasting motor, use the speed search command or DC injection braking at start, to prevent a drive trip and motor burnout.

This function allows the restart into a coasting motor without the necessity to stop. It is useful during inverter bypass operation, when switching between the motor receiving power directly from the line and from the inverter. Two interlocking contactors must be employed for commercial power switchover to prevent line power from being applied to the inverter output terminals.

Set the multi-function contact input selection *(H1-01* to *H1-06)* to "61" (start search command from maximum output frequency), "62" (start search command from the set frequency), or "64" (start search command from the SFS frequency when baseblock is applied).

B3-01 Speed Search after Run Command *SpdSrch at Start*

A	-	A	-

Setting	Description
0	Speed search disabled, the motor accelerates to the set frequency from the min. frequency reference after run command is given *(factory default)*.
1	Speed search enabled after run command is given, according to multi-function contact input selection. When using an encoder, the motor accelerates/decelerates to the set frequency from the motor speed.

Note: This parameter is disabled except when (A1-02=1) (V/F w/PG Fdbk) or 3 (Close loop vector)

B3-02 Speed Search Detection Current Level *SpdSrch Current*

A	-	A	-

Setting Range: 0 to 200%
Factory Default: 150%

After power loss and recovery, speed search begins to ramp the frequency down from a specified point in order to locate the frequency of the spinning motor. During initial speed search the inverter's output current exceeds the speed search detection current level. This level is set as a percentage of inverter rated current. When the inverter's output current is less than the speed search detection level, the frequency is interpreted as the speed agree level, and the inverter accelerates/decelerates to the specified frequency.

Note: Factory setting defaults to 150 when A1-02=0 (V/F Control). When A1-02=2 (Open Loop Vector), the default is 100.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

B3-03 Speed Search Deceleration Time *SpdSrch Dec Time*

A	-	A	-

Setting Range: 0.1 to 10.0s
Factory Default: 2.0s

Sets deceleration time during speed search in units of 0.1 second. When speed search deceleration time is set to 0.0 second, speed search is disabled. The speed search deceleration time should be set to be somewhat faster than the decel rate of coasting motor. Build an input sequence so that the speed search command is input at the same time or prior to the FWD (REV) run command. If the run command is input before the search command, the search command is not effective. Below is a timing diagram of the search command input:

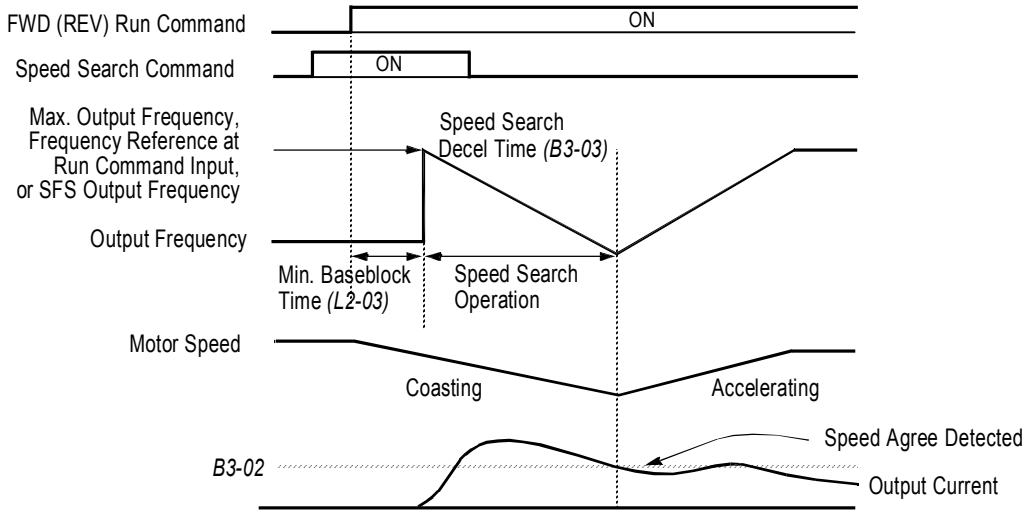


Figure 7 Search Command Input Timing Diagram

B4 Delay Timers

The inverter input and output contacts can be used in place of an external timer. When multi-function contact input (*H1-__* = "18") is closed, a multi-function contact output (*H2-__* = "12") can be set to close after the On-delay time (*B4-01*) has expired. When multi-function contact input (*H1-__* = "18") is opened, a multi-function contact output (*H2-__* = "12") can be set to open after the Off-delay time (*B4-01*) has expired. This function operates independently of any action the inverter is performing.

B4-01 On-delay Timer *Delay-ON Timer*

A	A	A	A

Setting Range: 0.0 to 100.0s
Factory Default: 0.0s

Sets the ON-delay time in units of 0.1 second. The multi-function input must be "closed" for longer than the ON-delay timer for the multi-function output to close.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

B4-02 Off-delay Timer *Delay-OFF Timer*

A	A	A	A

Setting Range: 0.0 to 100.0s
Factory Default: 0.0s

Sets the OFF-delay time in units of 0.1 second. The multi-function input must be "open" for longer than the OFF-delay timer for the multi-function output to open.

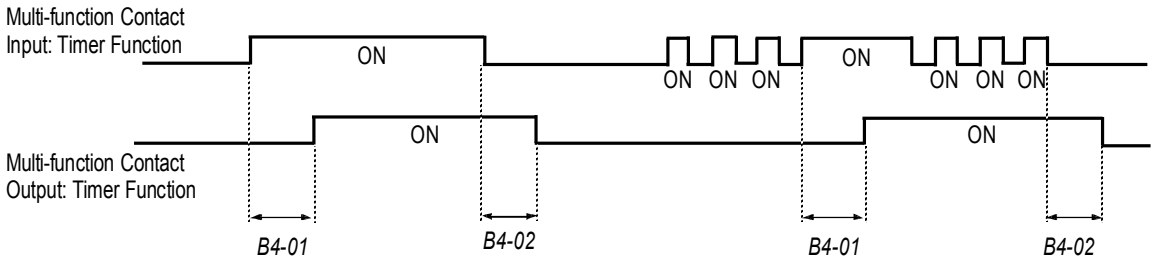


Figure 8 Timing Diagram of Timer Function

B5 PID Control

The Proportional, Integral and Derivative (PID) control function provides closed-loop control and regulation of a system variable such as temperature or pressure. A control signal based on the difference (or proportion) between a feedback signal and a desired setpoint is produced. Integration and derivative calculations are then performed on this signal, based upon the PID parameter settings (*B5-01* to *B5-08*), to minimize deviation, for more precise control.

Proportional - P

PID refers to the type of action used to control modulating equipment such as valves or dampers. With **proportional** control, a control signal based on the difference between an actual condition and a desired condition is produced. The difference, such as that between an actual temperature and setpoint is the "error". The inverter adjusts its output signal related directly to the error magnitude.

Integral - I

The **integral** action is designed to minimize offset. An integrating term is used to observe how long the error condition has existed, summing the error over time. Once the system has stabilized, the offset would be minimized.

Derivative - D

Overshoot refers to a control loop tendency to overcompensate for an error condition, causing a new error in the opposite direction. **Derivative** action provides an anticipatory function that exerts a "braking" action on the control loop. When combined, the proportional integral, and **derivative** actions provide quick response to error, close adherence to the setpoint, and control stability.

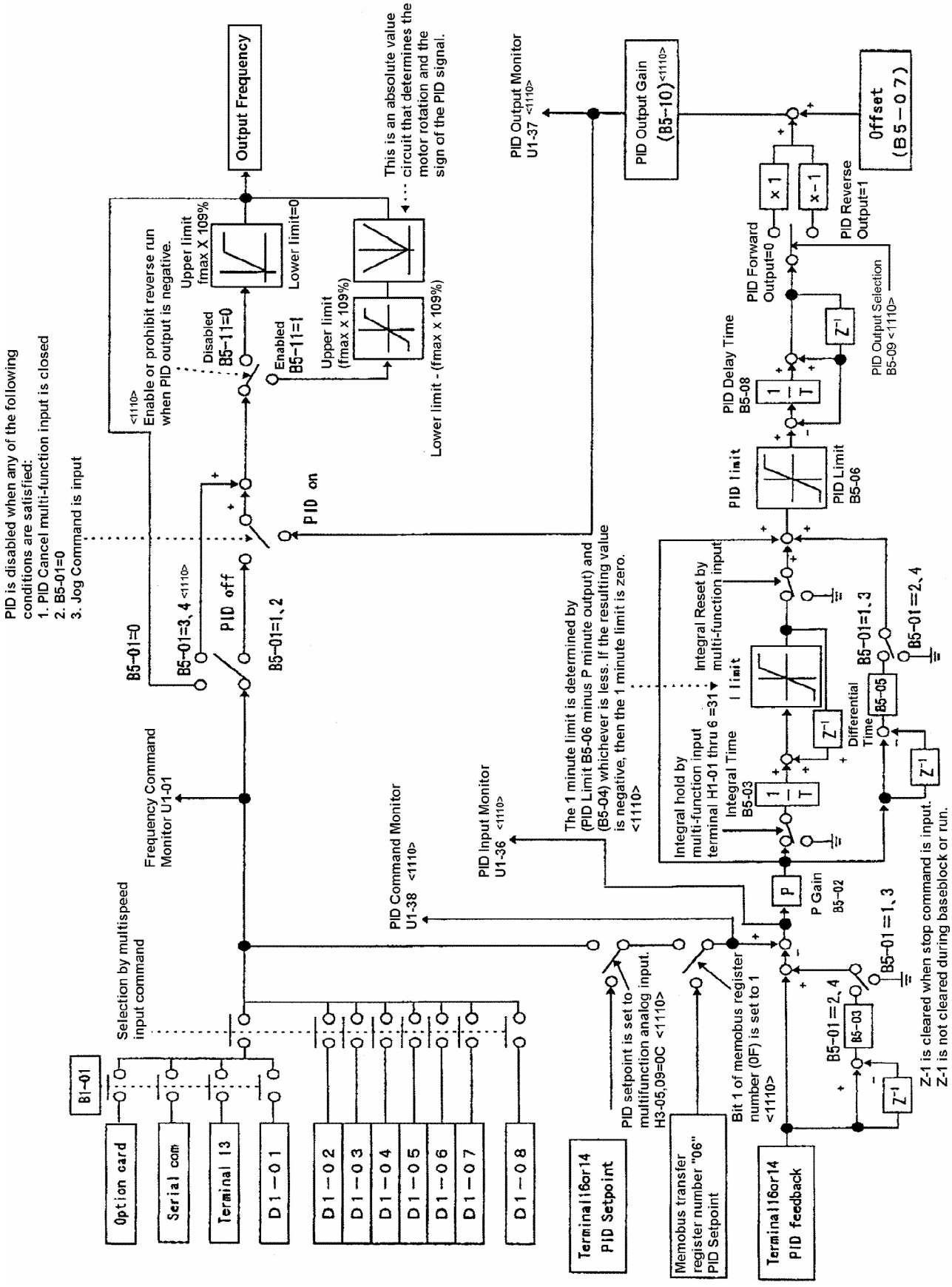


Figure 9 PID Block Diagram

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

B5-01 PID Control Mode Selection *PID Mode*

A	A	A	A

To enable PID control, set PID control mode selection to "1" or "4", according to the description below. Also be sure to set terminal 16 function selection *(H3-05)* to PID feedback (setting: "B").

Setting	Description
0	PID disabled *(factory default)*
1	PID enabled (deviation signal is put through derivative control)
2	PID with feed forward (feedback signal is put through derivative control)
3 <1110>	Reference= Frequency reference + PID output, D is Feedback
4 <1110>	Reference= Frequency reference + PID output, D is feed-forward

Notes:

1. PID with feed forward applies control much quicker than normal PID, without waiting for the deviation signal to build up.
2. A PID inverse feedback signal can be selected by inverting the settings for terminal 16 gain and bias.

Then select the PID control intended value set point or detected feedback value set point as follows:

Intended Value Setting
The control circuit terminal 16 voltage signal (0 to 10V, -10 to 10V) or multi-step speed parameters *H1-03* to *H1-06* can be used to set the PID intended value.

Control circuit terminal 16 voltage signal:
Set reference selection *(B1-01)* to "1".

Multi-step speed parameters (*H1-03* to *H1-06*):
Set reference selection *(B1-01)* to "0".
(combination of multi-step speed references and jog frequency reference)

Detected Value Setting (Feedback)
The control circuit terminal 14 current signal (4 to 20mA) or voltage signals (0 to 10V, -10 to 10V) can be used to set the PID detected value.

Control circuit terminal 14 current signal:
Set terminal 14 signal selection *(H3-08)* to "2".

Control circuit terminal 14 voltage signal:
Set terminal 14 signal selection *(H3-08)* to "0"or "1".

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

Notes:

1. I value is reset to ”0” when operation stops.
2. The upper limit of the I value can be set by parameter *B5-04*.
   Increase the value of parameter *B5-04* to upgrade control capability by integration. If the control system vibrates and it cannot be stopped by adjusting the integral time, output delay time, etc., decrease the set value of parameter *B5-04*.
3. PID control can be canceled by a multi-function contact input signal.
   By setting any of parameters *H1-01* to *H1-06* to “19” and by closing the contact during running, PID control is disabled and the intended value signal itself is used as a frequency reference signal.

B5-02 PID Control Proportional Gain *PID Gain*

A	A	A	A

Setting Range: 0.00 to 25.00
Factory Default: 1.00

The proportional gain is the value by which the deviation signal is multiplied to generate a new frequency reference.

B5-03 PID Control Integral Time *PID I Time*

A	A	A	A

Setting Range: 0.00 to 360.0 seconds
Factory Default: 1.00 seconds

The integral calculation sums the deviation over time, which eliminates the offset, thus achieving the intended value. The integral time determines how quickly the integral gain increase is added to the control loop.

B5-04 PID Control Integral Limit *PID I Limit*

A	A	A	A

Setting Range: 0.0 to 100.0%
Factory Default: 100.0%

The integral limit value eliminates oscillations and improves stability. This value is set as a percentage of maximum output frequency *(E1-04)*.

B5-05 PID Control Derivative Time *PID D Time*

A	A	A	A

Setting Range: 0.00 to 10.00 seconds
Factory Default: 0.00 seconds

The derivative calculation attempts to control the remaining overshoot left over after the proportion and integral calculations. If the system is approaching the intended value very rapidly, the derivative control produces a strong braking action to prevent overshoot. If the system is already stable with very little deviation change, derivative control has very little effect. The derivative time is used to dampen oscillations and reduce overshoot, thus improving stability. Setting the derivative time to a larger number produces more braking action in the control system.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

B5-06 PID Control Limit *PID Limit*

A	A	A	A

Setting Range: 0.0 to 100.0%
Factory Default: 100.0%

The PID limit value further eliminates oscillations and improves stability. This value is set as a per- centage of maximum output frequency *(E1-04)*.

B5-07 PID Control Offset *PID Offset*

A	A	A	A

Setting Range: -100.0% to +100.0% Factory Default: 0.0%

The PID offset adds a bias to the calculated PID value, in order to reduce any offset.

B5-08 PID Control Output Primary Delay Time *PID Delay Time*

A	A	A	A

Setting Range: 0.00 to 100.0 seconds
Factory Default: 0.00 seconds

The output delay time is used to delay changes in the calculated PID value, which can prevent oscilla- tions and improve stability.

Parameters *B5-04* and *B5-06* to *B5-08* are preset at the factory to optimum values for most applications, hence, do not need to be changed. When tuning a system, first adjust the proportional gain until oscillations are reduced. Then adjust the integral time so that minimal deviation is achieved as quickly
as possible, without oscillations. Finally, adjust the derivative time to reduce any overshoot at start-up.

B5-09 PID Output Selection <1110> *Output Level Sel*

A	A	A	A

The PID output term for the inverter control can be either negative or positive output.

Setting	Description
0	PID Normal or Forward Output *(factory default)* Increase in the manipulated variable when the process variable is larger than the setpoint and decrease the manipulated variable when the process variable is smaller.
1	PID Reverse or Inverse Output Increase the manipulated variable when the process variable is smaller than the setpoint and decrease the manipulated variable when the process variable is larger than the setpoint.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

B5-10 PID Output Gain <1110> *Output Gain*

A	A	A	A

Setting Range: 0.0 to 25.0
Factory Default: 1.0

This parameter sets the gain of the PID output. The PID output can be monitored by parameter *U1-37 PID Output Monitor.* Refer to PID Block Diagram Figure 9.

B5-11 PID Output Reverse <1110> *Output Rev Sel*

A	A	A	A

This parameter is used when the motor is required to change direction during PID operation in response to a negative PID output signal. The PID output can be monitored using parameter *U1-37 PID Output Monitor.*

Setting	Description
0	Zero limit *(factory default)* When PID output is negative, motor direction is not changed. The PID output is limited to 0.
1	Reverse When PID output is negative the motor will reverse direction.

Note: When *Reverse Prohibit B1-04* is selected, reverse will not operate.

B5-12 Loss of Feedback Action <1110> *Fb Los Det Sel*

A	A	A	A

This parameter is used to select what action the inverter will take on a loss of PID feedback. A loss of PID feedback occurs when the feedback signal falls below the *B5-13 Feedback Loss Detection Level* for the time set by *B5-14 Feedback Loss Detection Time.*

Setting	Description
0	Disabled *(factory default)* PID feedback missing detection is disabled.
1	Alarm PID feedback missing detection is enabled. Operation continues after loss of feedback. The text "Fbl" will be displayed on the digital operator.
2	Fault PID feedback missing detection is enabled. The inverter output to the motor is shut off (the motor is stopped) and "Fbl" is displayed on the digital operator.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

B5-13 PID Feedback Loss Detection Level <1110> *Fb los Det Lvl*

A	A	A	A

Setting Range: 0 to 100%
Factory Default: 1%

This parameter sets the level at which a loss of PID feedback is detected. The PID feedback must be at or below this level for the time defined by *B5-14* before a loss of feedback can be detected. A setting of 100% represents 100% of the feedback signal.

B5-14 PID Output Gain <1110> *Output Gain*

A	A	A	A

Setting Range: 0.0 to 25.0
Factory Default: 1.0

This parameter sets the gain of the PID output. The PID output can be monitored by parameter *U1-37 PID Output Monitor*. Refer to PID Block Diagram Figure 9.

B6 Reference Hold

The reference hold or dwell function is used to temporarily hold the output frequency at a set reference, for a set time, and then start it again. This function can be used when driving a permanent magnet motor, or a motor with a heavy starting load. This pause in acceleration allows the magnets in a permanent magnet motor to synchronize with the stator field of the motor, thus reducing traditionally high starting current.

B6-01 Dwell Frequency Reference at Start *Dwell Ref @Start*

A	A	A	A

Setting Range: 0.0 to 400.0Hz
Factory Default: 0.0Hz

Sets the dwell frequency reference during acceleration in units of 0.1Hz.

B6-02 Dwell Time at Start *Dwell Time@Start*

A	A	A	A

Setting Range: 0.0 to 10.0s
Factory Default: 0.0s

Sets the amount of time that the frequency reference "dwells" during acceleration in units of 0.1s.

B6-03 Dwell Frequency Reference at Stop *Dwell Ref @Stop*

A	A	A	A

Setting Range: 0.0 to 400.0Hz
Factory Default: 0.0Hz

Sets the dwell frequency reference during deceleration in units of 0.1Hz.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

B6-04 Dwell Time at Stop *Dwell Time @Stop*

A	A	A	A

Setting Range: 0.0 to 10.0s
Factory Default: 0.0s

Sets the amount of time that the frequency reference "dwells" during deceleration in units of 0.1s.

B7 Droop Control

The Drooping function reduces the motor speed based on the load torque of the motor.

B7-01 Droop Control Gain *Droop Quantity*

-	-	-	A

Setting Range: 0.0 to 100.0
Factory Default: 0.0

Parameter b7-01 sets the amount of motor speed reduction when the motor is producing 100% of rated torque. The actual amount of motor speed reduction is based on the ratio of the amount of motor torque and the maximum output frequency (E1-04).

B7-02 Droop Control Delay Time *Droop Delay Time*

-	-	-	A

Setting Range: 0.03 to 2.00
Factory Default: 0.05

Parameter b7-02 sets the response time for the drooping function. Decreasing the droop delay time, will cause the response to become quicker; however, instability may occur.

B8 Energy Saving

This feature can save energy during operation under lightly loaded conditions, by decreasing output voltage, energy-saving operation is made available. Energy saving control is enabled by a **multi-function contact input,** when control mode selection *(A1-02)* is set to "0" (V/f Control) or "1" (V/f w/PG Fdbk).
Parameters B8-03, B8-04 and B8-05 are for energy savings in the vector modes. B8-01 and B8-02 are only functional in the V/f modes via a multi-function input command. Parameters B8-03, B8-04 and B8-05 are for automatic energy savings in the vector modes.

B8-01 Energy Saving Gain *Energy Save Gain*

A	A	-	-

Setting Range: 0 to 100%
Factory Default: 80%

The output voltage during energy-saving operation is the product of the normal V/f settings (*El-03* to *E1-10*) and the energy saving gain. The output voltage decreases and recovers in the voltage recovery time *(L2-04)*. As the energy saving gain increases, the output voltage increases also. **This feature is only enabled by a multi-function contact input.**

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

B8-02 Energy Saving Starting Frequency *Energy Save Freq*

A	A	-	-

Setting Range: 0.0 to 400.0Hz
Factory Default: 0.0Hz

After the multi-function contact input for energy-saving operation closes (*H1-__*, setting: "63"), the output voltage is decreased when the output frequency reaches the energy-saving starting frequency. This feature is only enable by multi-function contact input.

.

B8-03 Automatic Energy Saving <1110> *Energy Save Sel*

-	-	A	A

This parameter is used to select if Automatic Energy Saving Mode is to be on or off. A multi-function contact input **is not** required to activate Automatic Energy Saving Mode. This mode of operation automatically searches for the optimum motor voltage required to save energy. This function is separate and not to be confused with parameters B8-01 and B8-02. The energy saving mode that utilizes B8-01 and B8-02 requires a multi-function input to be activated for operation. This Automatic Energy Saving Mode selection **does not** require a multi-function input to activate operation.

Setting	Description
0	Disabled *(factory default)* Energy saving mode will not be activated under light loads.
1	Enabled The energy saving mode will be activated under light loads.

B8-04 Energy Saving Control Gain *Energy Save Gain*

-	-	A	A

Setting Range: 0 to 10.0
Factory Default: 0.7

The output voltage during energy-saving operation is the product of the normal V/f settings (*El-03* to *E1-10*) and the energy saving gain. The output voltage decreases and recovers according to the *Energy-Saving Control Time Constant B8-05*. As the energy saving gain increases, the output voltage increases also.

Note: When the control mode A1-02=3, the default factory setting becomes 1.0

B8-05 Energy Control Time-Constant *Energy Save F. T*

-	-	A	A

Setting Range: 0.00 to 10.00
Factory Default: 0.50

Parameter *B8-05* sets the response time for the *Automatic Energy Saving* function.
Decreasing the *Energy Control Time-Constant*, will cause the response to become quicker; however, instability may occur if this is decreased too much.
Note: When control mode A1-02=3, the default factory setting becomes 0.01.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

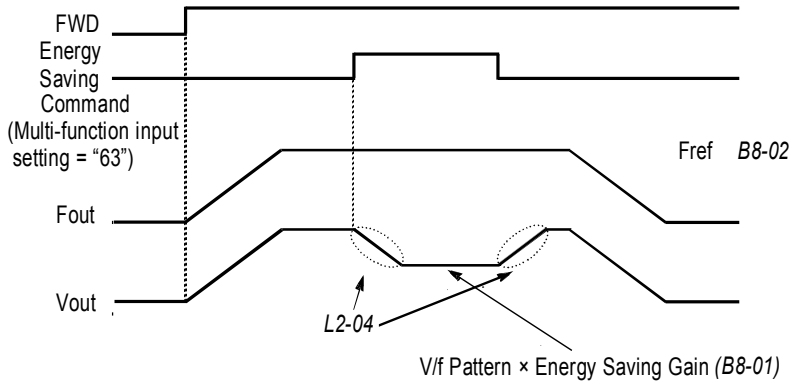


Figure 10 Timing Diagram of Energy Saving Function

B9 Zero Servo

The zero servo function is enabled when the multi-function contact input is set to zero servo command (*H1-__* = "72"). The motor position is then memorized when motor speed feedback is less than the zero speed level *(B2-01)*.

B9-01 Zero Servo Gain *Zero Servo Gain*

-	-	-	A

Setting Range: 0 to 100
Factory Default: 5

Sets the zero-servo position loop gain. When adjusting the gain, the higher the setting, the quicker the response. However, if the gain is set too high, it can cause overshoot and a possible runaway condition.

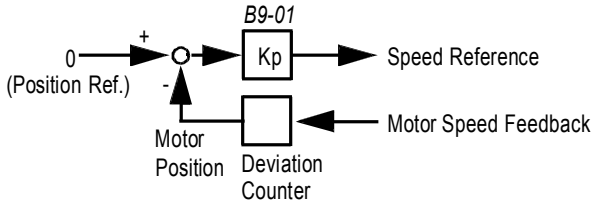


Figure 11 Zero Servo Position Loop

B9-02 Zero Servo Bandwidth *Zero Servo Count*

-	-	-	A

Setting Range: 0 to 16383 pulses
Factory Default: 10 pulses
Sets zero servo bandwidth in units of one pulse. During zero servo control, the multi-function contact output (H2-___= "33") is closed until the number of pulses (or bandwidth) is completed. Then the contact output opens.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

.

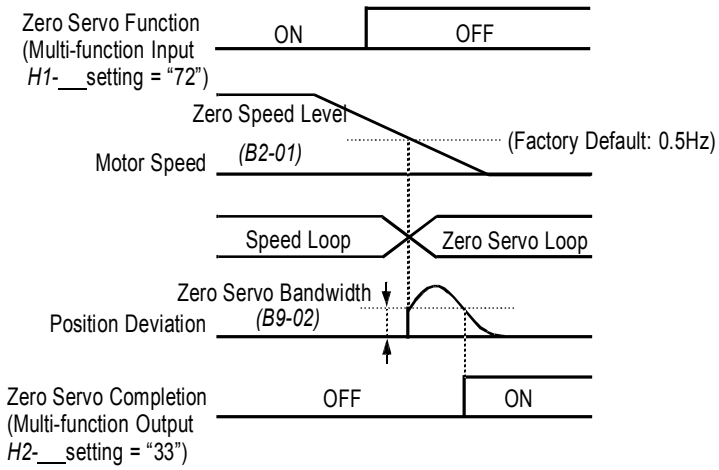


Figure 12 Timing Diagram of Zero Servo Function

Notes:

1. For multi-function contact input function selection, refer to parameters *H1-01* to *H1-06*.
2. For multi-function contact output function selection, refer to parameters *H2-01* to *H2-03*.
3. This function is only available during close loop vector control (*Al-02* = "3").

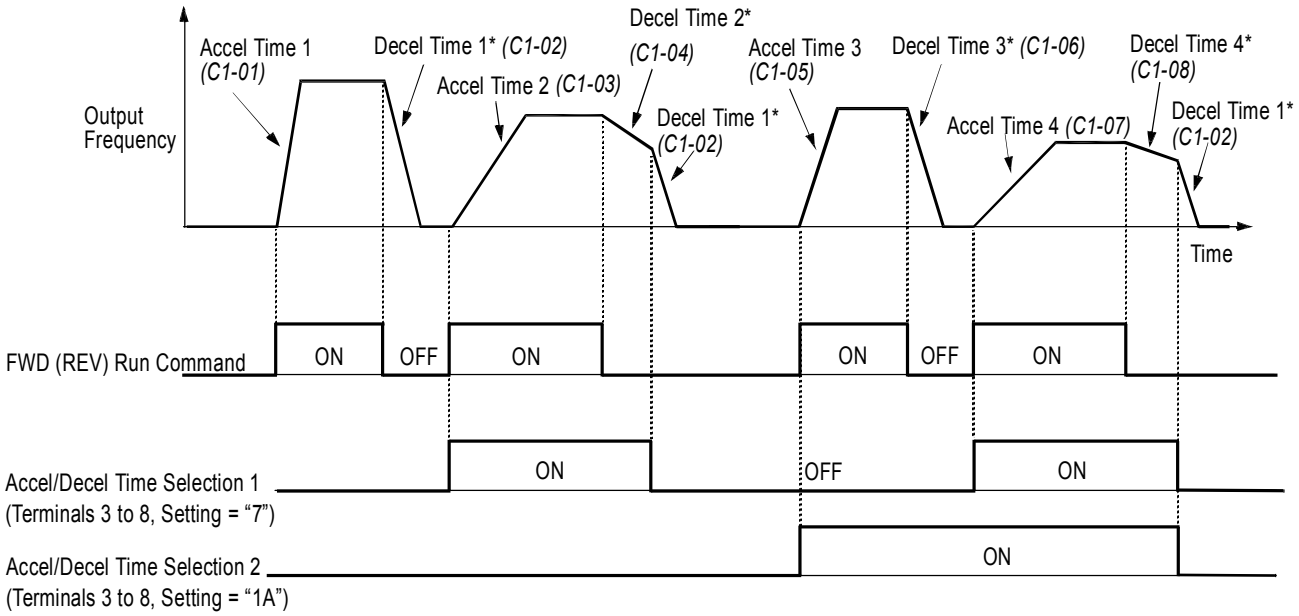
C Tuning Parameters

C1 Accel/Decel

C1-01	*Acceleration time 1*	*Accel Time 1*	Q	Q	Q	Q
C1-02	*Deceleration time 1*	*Decel Time 1*	Q	Q	Q	Q
C1-03	*Acceleration time 2*	*Accel Time 2*	B	B	B	B
C1-04	*Deceleration time 2*	*Decel Time 2*	B	B	B	B
C1-05	*Acceleration time 3*	*Accel Time 3*	A	A	A	A
C1-06	*Deceleration time 3*	*Decel Time 3*	A	A	A	A
C1-07	*Acceleration time 4*	*Accel Time 4*	A	A	A	A
C1-08	*Deceleration time 4*	*Decel Time 4*	A	A	A	A

Setting Range: 0.00 to 6000.0s
Note: Setting range may be 0.00-600.0 or 0.0-6000.0 depending on the setting of parameter C1-10.
Factory Default: 10.0s
Acceleration time sets the time necessary for the output frequency to accelerate from 0Hz to maximum output frequency. Deceleration time sets the time necessary for the output frequency to decelerate from the maximum output frequency to 0Hz.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector



* When "deceleration to stop" is selected (*B1-03* = "0")

Figure 13 Timing Diagram of Accel/Decel Time Adjustment

When any of the multi-function contact input selections (*H1-01* to *H1-06*) are set to "7"and "1A", up to four accel/decel times can then be selected by opening or closing the appropriate accel/decel time selection commands (terminals 3 to 8).

Accel/decel Time Selection 1 Multi-function Input Setting = "7"	Accel/decel Time Selection 2 Multi-function Input Setting = "1A"	Accel Time	Decel Time
Open or not set	Open or not set	*C1-01*	*C1-02*
Closed	Open or not set	*C1-03*	*C1-04*
Open or not set	Closed	*C1-05*	*C1-06*
Closed	Closed	*C1-07*	*C1-08*

C1-09 Fast-Stop Time *Fast Stop Time*

B	B	B	B

Setting Range: 0.00 to 6000.0s
Factory Default: 10.0s

Fast-stop time is enabled when:
Multi-function contact input is set to fast-stop command (setting = "15"), and the contact closes.
The default stopping method when a fault is detected is fast-stop.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

C1-10 Accel/Decel Time Setting Unit *Acc/Dec Units*

A	A	A	A

Setting	Description
0	Accel/decel time (*C1-01* to *C1-09*) setting range is in units of 0.01 second. Accel/decel time setting range: 0.00 to 600.00s
1	Accel/decel time (*C1-01* to *C1-09*) setting range is in units of 0.1 second. Accel/decel time setting range: 0.0 to 6000.0s *(factory default)*

If any of the parameters *C1-01* to *C1-09* is set to 600.1 seconds or more, *C1-10* cannot be set to "0".

C1-11 Accel/Decel Time Switching Frequency Level *Acc/Dec SW Freq*

A	A	A	A

Setting Range: 0.0 to 400.0Hz
Factory Default: 0.0Hz

Accel/decel times can be changed automatically, without using the multi-function contact inputs.
Use accel/decel times set in parameters *C1-01* and *C1-02* when output frequency *C1-11*.
Use accel/decel times set in parameters *C1-07* and *C1-08* when output frequency < *C1-11*.
When multi-function contact inputs are set for accel/decel selection, this command has priority over automatic change of accel/decel.

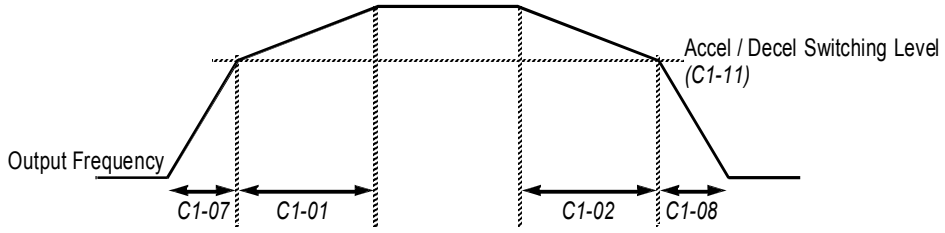


Figure 14 Accel/Decel Switching Level Adjustment

C2 S-Curve Accel/Decel

An S-curve pattern is used to reduce shock and provide smooth transitions during machine acceleration and deceleration. S-curve characteristic time is the time from the output frequency to the set accel/decel time.

C2-01	*S-Curve Time at Acceleration Start*	*SCrv Acc @ Start*	A	A	A	A
C2-02	*S-Curve Time at Acceleration End*	*SCrv Acc @ End*	A	A	A	A
C2-03	*S-Curve Time at Deceleration Start*	*SCrv Dec @ Start*	A	A	A	A
C2-04	*S-Curve Time at Deceleration End*	*SCrv Dec @ End*	A	A	A	A

Setting Range: 0.00 to 2.50s
Factory Default: 0.20s

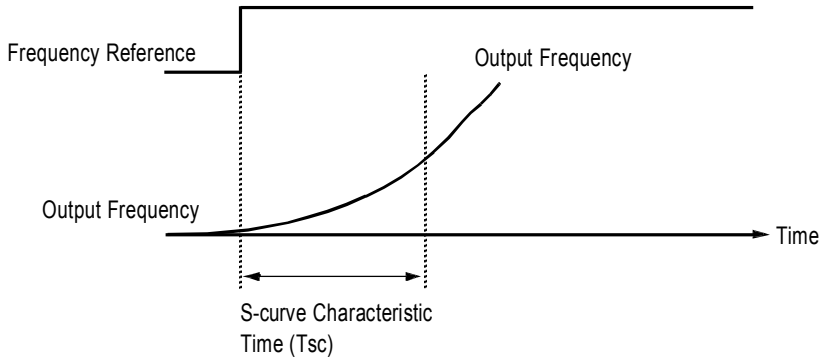


Figure 15 S-curve Characteristic Timing Diagram

The following figure shows FWD/REV run switching during deceleration to stop.

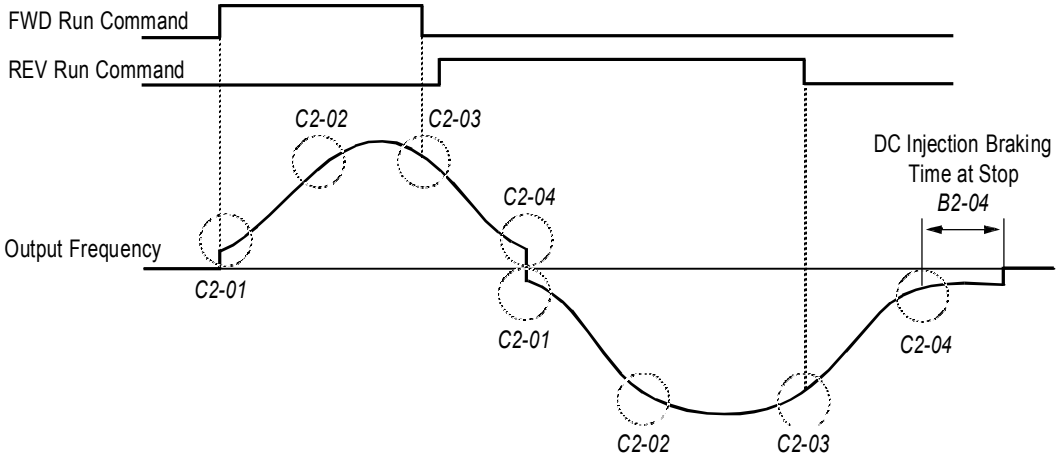


Figure 16 S-curve Characteristics - FWD/REV Operation

Time to accelerate from the minimum frequency to the maximum frequency (total acceleration) = *C1-__* + (*C2-01* + *C2-02*)/2

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

C3 Motor Slip Compensation

As the load becomes larger, the motor speed is reduced and motor slip increases. The slip compensation function keeps the motor speed constant even under varying load conditions.

C3-01 Slip Compensation Gain *Slip Comp Gain*

B	-	B	B

Setting Range: 0.0 to 2.50
Factory Default: 1.0

This function controls the output frequency in response to the load's torque demand. Increase the set value in one tenth (0.1) increments when operating at low speeds; decrease the set value as the motor speed increases.

During close loop vector control, this gain compensates for motor slip causes by changes in temperature. Normally, this setting does not have to be modified.

Note: Default factory setting will be 0.0 when parameter A1-02=0 [V/F mode]. When parameter A1-02=2 [Open Loop Vector] or 3 [Close loop vector] the default factory setting will be 1.0.

C3-02 Slip Compensation Primary Delay Time *Slip Comp Time*

A	-	A	-

Setting Range: 0 to 10000ms
Factory Default: 200ms

Adjust the slip compensation delay time when motor speed is unstable or speed response is slow. Increase the set value in 10ms increments when operating at low speeds; decrease the set value as the motor speed increases.

C3-03 Slip Compensation Limit *Slip Comp Limit*

A	-	A	-

Sets the slip compensation limit as a percentage of motor rated slip *(E2-02)*.

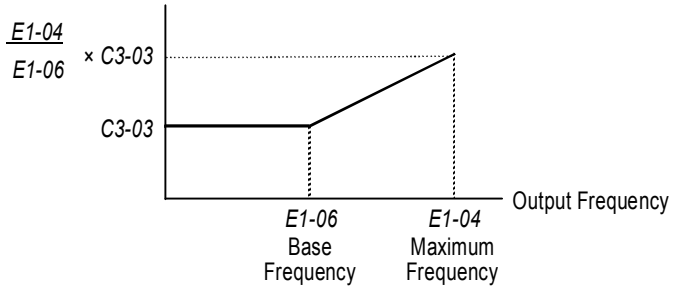


Figure 17 Slip Compensation Limit Adjustment

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

C3-04 Slip Compensation During Regeneration *Slip Comp Regen*

A	-	A	-

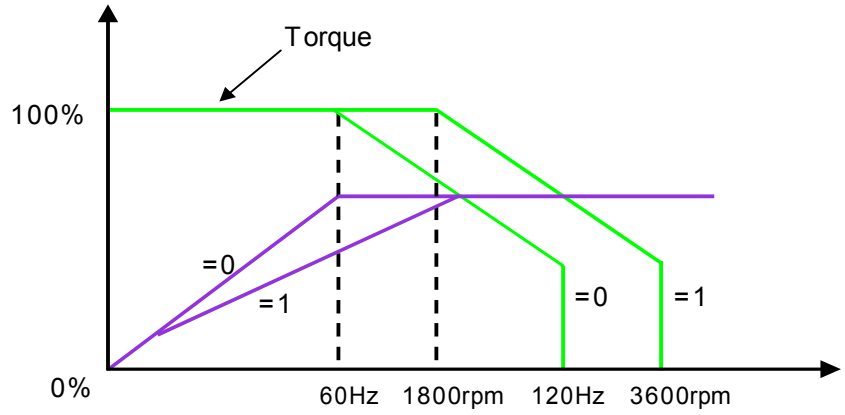
Setting	Description
0	Slip compensation disabled during regeneration *(factory default)*
1	Slip compensation enabled during regeneration

C3-05 Flux Calculation Method *Flux Select*

-	-	A	-

Parameter C3-05 determines if the motor torque characteristic is based on output frequency or motor speed.

Setting	Description
0	Slip Included Motor torque characteristic is based on frequency. *(factory default)*
1	Slip Excluded Motor torque characteristic is based on motor speed.



When running the motor only in the constant torque region, leave parameter C3-05 set to 0 for the best performance.
When running the motor in the constant horsepower region, set parameter C3-05 to 1 because the larger flux will result in better motor stability.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

C3-06 Output Voltage Limit Operation Selection <1110> *Output V Limit*

-	-	A	A

Setting	Description
0	Disabled *(factory default)* When this parameter is "0" slip compensation will be disabled when the motor is operating above its base speed. The motor voltage will not be reduced above base speed.
1	Enabled **Open Loop Vector Mode**: When this parameter is set to "1" the motor voltage will be reduced slightly when the motor is operating above 90% base speed. Slip Compensation is enabled. Speed control accuracy is improved. This may prevent speed instabilities due to motor voltage saturation. This setting may improve speed regulation however motor torque/amp will be reduced by up to 10% due to motor voltage reduction above base speed. **Close loop vector Mode**: Torque linearity is improved.

C4 Torque Compensation

Motor torque can be adjusted by changing the V/f pattern *(E1-03)* or by adjusting the torque compensation gain. For details on setting the V/f pattern, see section ***E1***, ***V/f Pattern Adjustment***,.

Parameters C4-03, C4-04 and C4-05 are added for the OLV mode to help improve starting/breakaway response. Individual torque compensation settings are possible for forward (C4-03) and reverse (C4-04). The delay time (C4-05) is the time for which the internal torque reference will be increased. This torque compensation is much like inputting an analog torque reference via an analog input.

C4-01 Torque Compensation Gain *Torq Comp Gain*

B	B	B	-

The motor torque requirement changes according to load conditions. Full-range automatic torque boost adjusts the voltage of the V/f pattern according to the required torque. The KE200 Series automatically adjusts the voltage during constant-speed operation as well as during acceleration.

The required torque is calculated by the inverter. This ensures tripless operation and power savings.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

Output voltage Torque compensation gain × Required torque

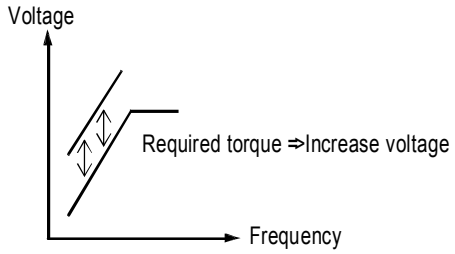


Figure 18 Torque Characteristics

Normally, no adjustment is necessary for torque compensation gain. When more torque is needed, increase the torque compensation gain in one tenth (0.1) increments. When the wiring distance between the inverter and the motor is long, or when the motor generates excessive vibration, decrease the torque compensation gain.

Increasing torque compensation gain increases motor torque, but an excessive increase may cause the following:

- Inverter fault trips due to motor overexcitation
- Motor overheat or excessive vibration

C4-02 Torque Compensation Time Constant *Torq Comp Time*

A	A	A	-

Setting Range: 0 to 10000ms
Factory Default: 20ms

Increase the torque compensation time constant in 10ms increments when the motor output current is unstable, and decrease this value when speed response is slow.

Note: When A1-02=2 [Open Loop Vector] the factory default setting is 20 ms. When A1-02=1or 3 [V/F or V/F w/PG] factory default setting is 200 ms.

C4-03 Forward Torque Compensation Value at Start<1110> *F TorqCmp @ start*

-	-	A	-

Setting Range: 0.0 to 200.0%
Factory Default: 0.0

This parameter may improve the motor performance during start. This feature functions only when starting a motor. Torque reference and motor flux can be ramped up quickly to improve speed response during start. A setting of 0.0 disables this feature.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

C4-04 Reverse Torque Compensation Value at Start<1110> *R TorqCmp @ start*

-	-	A	-

Setting Range: 0.0 to 200.0%
Factory Default: 0.0

This parameter may improve the motor performance during start. This feature functions only when starting a motor. Torque reference and motor flux can be ramped up quickly to improve speed response during start. A setting of 0.0 disables this feature.

C4-05 Torque Compensation Time Constant@Start<1110> *TorqCmp Delay T*

-	-	A	-

Setting Range: 0 to 200 ms
Factory Default: 1 ms

This parameter functions with C4-03 and C4-04. This parameter is the time delay that will be applied to the Torque Compensation parameters C4-03 and C4-04. A setting of less than 4 milliseconds (ms) causes this filter to be disabled.

C5 ASR Tuning

The automatic speed regulator (ASR) provides optimum performance during changes in motor speed or load, when speed feedback is provided.

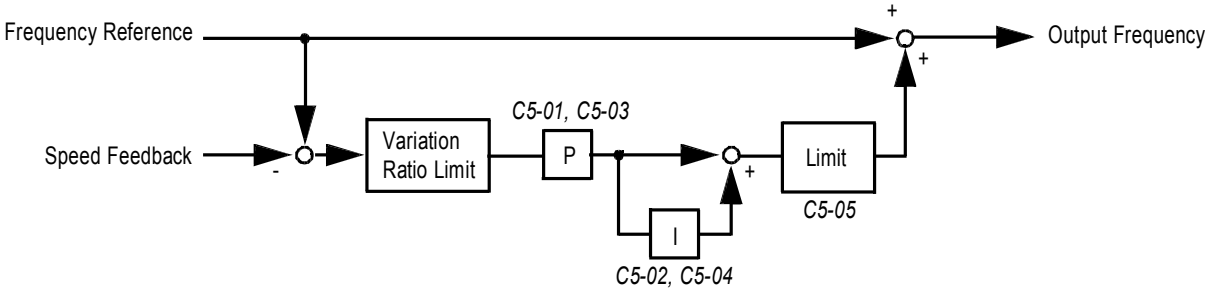


Figure 19 ASR Block Diagram (V/f Control with PG Feedback)

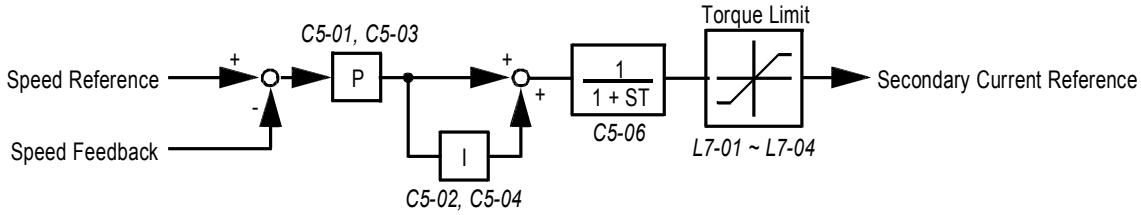


Figure 20 ASR Block Diagram (Close loop vector Control)

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

C5-01 ASR Proportional Gain 1 *ASR P Gain 1*

-	B	-	B

Setting Range: 0.00 to 300.00
Factory Default: 20.00

The ASR proportional gain 1 adjusts the speed in response to speed deviation, and softens the effect of changes in load. Speed response increases as the proportional gain is increased. However, the load may become unstable if the ASR proportional gain is set too high.

Note: When parameter A1-02=1 [V/f w/PG] the factory default setting is 0.20. When parameter A1-02=3 the factory default setting is 20.00.

C5-02 ASR Integral Time 1 *ASR I Time 1*

-	B	-	B

Setting Range: 0.000 to 10.000s
Factory Default: 0.500s

The ASR integral time 1 adjusts the inverter's response time to changes in load. Speed response increases as the integral time is decreased. However, the load may become unstable if the ASR integral time is set too low.

Note: When A1-02=1 [V/f w/PG] the factory default setting is .200. When A1-02=3 factory default setting is 0.500

When A1-02=1 [V/f w/PG] factory default setting is 0.20. When A1-02=3 factory default setting is 20.00.
When A1-02=1 [V/f w/PG] factory default setting is 0.200. When A1-02=3 factory default setting is 0.500
When A1-02=1 [V/f w/PG] factory default setting is 0.02 When A1-02=3 factory default setting is 20.00.

C5-03 ASR Proportional Gain 2 *ASR P Gain 2*

-	B	-	B

Setting Range: 0.00 to 300.00
Factory Default: 20.00

The ASR proportional gain 2 is an additional proportional gain adjustment that can be enabled by a multi-function contact input (*H1-__* = "77").

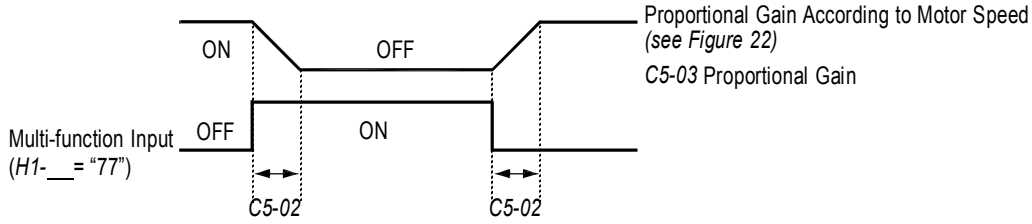


Figure 21 ASR Multi-function Input Timing Diagram

Note: When parameter A1-02=1 [V/f w/PG] factory default setting is .02 When A1-02=3 the factory default setting is 20.00.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

C5-04 ASR Integral Time 2 *ASR I Time 2*

-	B	-	B

Setting Range: 0.000 to 10.000s
Factory Default: 0.500s

The ASR integral time 2 is an additional integral time adjustment.

C5-05 ASR Limit *ASR Limit*

-	A	-	-

Sets ASR frequency compensation limit as a percentage of maximum output frequency *(El -04)*. This function is enabled when V/f control with PG feedback is selected as the control method *(A1-02)*.

C5-06 ASR Output Primary Delay Time *ASR Delay Time*

-	-	-	A

Setting Range: 0.000 to 0.500s
Factory Default: 0.004s

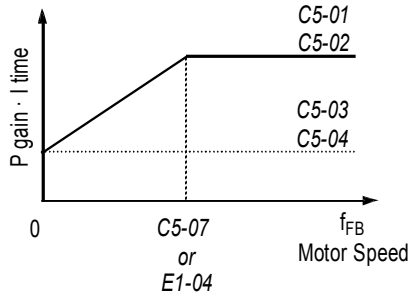
Mechanical backlash in an application causes secondary current (I_2) reference variations in the motor's rotor. This condition can prevent the adjustment of ASR parameters. The output delay time constant is used to control these secondary current (I_2) reference variations.

C5-07 ASR Switching Frequency Level *ASR Gain SW Freq*

-	-	-	A

Setting Range: 0.0 to 400.0Hz
Factory Default: 0.0Hz

Sets frequency to change ASR proportional gain and integral time constant in units of 0.1Hz when close loop vector control is selected.



$$f_{FB} = \frac{P \cdot N}{120}$$

where:
P = Number of Motor Poles
N = Motor RPM

* When *C5-07* ="0", proportional gain 1 *(C5-01)* and integral time 1 *(C5-02)* are selected.

Figure 22 ASR Switching Frequency Level

Notes:

1. When *C5-07* ="0", proportional gain 1 *(C5-01)* and integral time 1 *(C5-02)* are selected.
2. During V/f control with PG feedback (*A1-02* = "1"), the frequency switching level becomes the maximum output frequency *(E1-04)*.

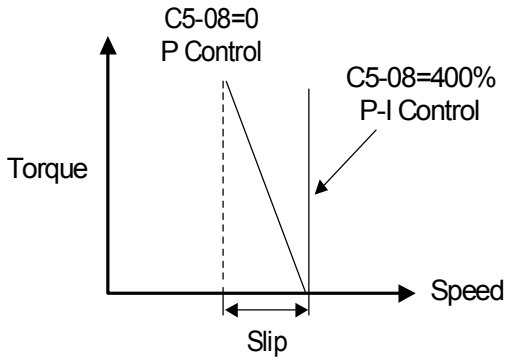
V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

C5-08 ASR Integral Limit *ASR I Limit*

-	-	-	A

Setting Range: 0 to 400%
Factory Default: 400%

.Parameter C5-08 adjusts the amount of Integral control of the automatic speed regulator in the Closed Loop Vector control mode. Setting parameter C5-08 to zero will make the ASR control propor- tional. Setting C5-08 to 400% will make the ASR control proportional and integral.



C6 Carrier Frequency

This function sets the inverter output transistor switching frequency (carrier frequency). Increase the carrier frequency to reduce motor noise and decrease it to reduce leakage current.

C6-01 Carrier Frequency Upper Limit *CarrierFreq Max*

B	B	B	B

C6-02 Carrier Frequency Lower Limit *CarrierFreq Min*

A	A	-	-

Setting Range: 0.4 to 15.0kHz
Factory Default: 15.0Hz*

For constant carrier frequency operation, set the gain *(C6-03)* to "0", and set the upper limit *(C6-01)* and lower limit *(C6-02)* to the same value.
* Factory defaults vary depending on drive rating. See the following table for more details:

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

Carrier Frequency Factory Defaults

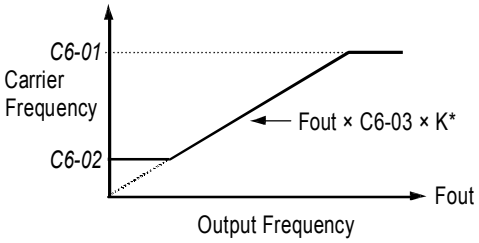
Model No.	Upper Limit *C6-01* Setting	Lower Limit *C6-02* Setting	Gain *C6-03* Setting	Model No.	Upper Limit *C6-01* Setting	Lower Limit *C6-02* Setting	Gain *C6-03* Setting
220~240V							
KE200-2R2G-T2	15.0	15.0	0	KE200-022G-T2	10.0	15.0	0
KE200-004G-T2	15.0	15.0	0	KE200-030G-T2	10.0	15.0	0
KE200-5R5G-T2	15.0	15.0	0	KE200-037G-T2	10.0	10.0	0
KE200-7R5G-T2	15.0	15.0	0	KE200-045G-T2	10.0	10.0	0
KE200-011G-T2	15.0	15.0	0	KE200-055G-T2	10.0	10.0	0
KE200-015G-T2	15.0	15.0	0	KE200-075G-T2	10.0	10.0	0
KE200-018G-T2	15.0	15.0	0				
380~460V							
KE200-004G-T4	15.0	15.0	0	KE200-055G-T4	6.0	8.0	0
KE200-5R5G-T4	15.0	15.0	0	KE200-075G-T4	6.0	8.0	0
KE200-7R5G-T4	12.5	15.0	0	KE200-090G-T4	5.0	6.0	0
KE200-011G-T4	12.5	15.0	0	KE200-110G-T4	5.0	6.0	0
KE200-015G-T4	10.0	15.0	0	KE200-132G-T4	5.0	6.0	0
KE200-018G-T4	10.0	15.0	0	KE200-160G-T4	5.0	6.0	0
KE200-022G-T4	8.0	15.0	0	KE200-185G-T4	2.0	5.0	0
KE200-030G-T4	8.0	12.5	0	KE200-220G-T4	2.0	5.0	0
KE200-037G-T4	6.0	12.5	0	KE200-300G-T4	2.0	5.0	0
KE200-045G-T4	6.0	10.0	0				

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

C6-03 Carrier Proportional Gain *Carrier Freq Gain*

A	A	-	-

Setting Range: 0 to 99
Factory Default: 0



* K varies depending on the carrier frequency upper limit *(C6-01)*:

C6-01 > 10.0kHz	K = 3
10.0kHz > *C6-01* > 5.0kHz	K = 2
C6-01 < 5.0kHz	K = 1

Figure 23 Carrier Frequency Setting

Note: An OPE11 fault occurs if either of the following conditions is present:
1. *C6-03* > 6kHz and *C6-02* > *C6-01*
2. *C6-01* > 5kHz and *C6-02* 5kHz

C7 Hunting Prevention

Occasionally, in an application, resonance between the internal control system and the mechanical system causes current instability. This instability is called hunting, and may cause the machine to vibrate at lower speeds (up to 30Hz). The hunting prevention function monitors the motor flux and uses a special control circuit to "smooth out" any peaks in the output current waveform.

C7-01 Hunting Prevention Selection *Hunt Prev Select*

A	A	-	-

Enables the hunting prevention function in V/f control mode.

Setting	Description
0	Hunting prevention is disabled.
1	Hunting prevention is enabled *(factory default)*.

C7-02 Hunting Prevention Gain *Hunt Prev Gain*

A	A	-	-

Setting Range: 0.00 to 2.50
Factory Default: 1.00

Sets hunting prevention gain in units of 0.01. When hunting is present while driving a light load, increase the set value in one tenth (0.1) increments. When the motor vibrates or stalls while driving a heavy load, decrease the set value.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

C8 Factory Tuning

This section describes parameters not normally accessed by the user, but which may require adjustment.

C8-08 Automatic Frequency Regulator Adjustment *AFR Gain*

-	-	A	-

Setting Range: 0.00 to 10.00
Factory Default: 1.00

Sets AFR gain in units of 0.01. When hunting is present during open loop vector control, decrease the set value in one tenth (0.1) increments. If the speed or torque response is slow, increase the set value.

C8-09 Automatic Frequency Regulator Time Constant *AFR Time*

-	-	A	-

Setting Range: 0 to 2000 milliseconds
Factory Default: 50 milliseconds

Parameter C8-09 sets the AFR (automatic frequency regulator) time. Adjusting C8-09 will increase or decrease the AFR frequency response, when the load changes.
If the motor is unstable, increase the set value.
If the speed response is slow, decrease the set value.

C8-30 Carrier Frequency Selection During Auto-tuning *Carrier in Tune*

-	-	A	A

During normal auto-tuning, the inverter is tuned while running at a carrier frequency of 2kHz. This parameter allows the user to specify the inverter carrier frequency during auto-tuning. Adjustment may be necessary when using a spindle motor with low inductance.

Setting	Description
0	Carrier frequency during auto-tuning is 2kHz *(factory default)*.
1	Carrier frequency during auto-tuning is set by *C6-01*.
2	Carrier frequency is 5kHz. Except for 185-300 kW which is 2.5 kHz

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

D Reference Parameters

D1 Preset References

			Q	Q	Q	Q
D1-01	*Preset Frequency Reference 1*	*Reference 1*	Q	Q	Q	Q
D1-02	*Preset Frequency Reference 2*	*Reference 2*	Q	Q	Q	Q
D1-03	*Preset Frequency Reference 3*	*Reference 3*	Q	Q	Q	Q
D1-04	*Preset Frequency Reference 4*	*Reference 4*	B	B	B	B
D1-05	*Preset Frequency Reference 5*	*Reference 5*	B	B	B	B
D1-06	*Preset Frequency Reference 6*	*Reference 6*	B	B	B	B
D1-07	*Preset Frequency Reference 7*	*Reference 7*	B	B	B	B
D1-08	*Preset Frequency Reference 8*	*Reference 8*				

Setting Range: 0.0 to 400.0Hz
Factory Default: 0.0Hz

Up to *9* preset speed references (including jog) can be set through multi-function contact input function selections. When using the multi-step speed references, set the reference selection *(B1-01)* to "0", and set terminal 16 selection *(H3-05)* to "1F". See the following table for programming preset speed references.

Terminal 5 *H1-03* = "3"	Terminal 6 *H1-04* = "4"	Terminal 7 *H1-05* = "5"	Terminal 8 *H1-06* = "6"	Speed Reference
Open	Open	Open	Open	Speed Reference 1 - Set Reference Source *(B1-01)* to "0".
Closed	Open	Open	Open	Speed Reference 2 - Set Terminal 16 Selection *(H3-05)* to "1F".
Open	Closed	Open	Open	Speed Reference 3
Closed	Closed	Open	Open	Speed Reference 4
Open	Open	Closed	Open	Speed Reference 5
Closed	Open	Closed	Open	Speed Reference 6
Open	Closed	Closed	Open	Speed Reference 7
Closed	Closed	Closed	Open	Speed Reference 8
Closed	Closed	Closed	Closed	Jog Speed Reference

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

D1-09 Jog Frequency Reference *JOG Reference*

Q	Q	Q	Q

Setting Range: 0.0 to 400.0Hz
Factory Default: 0.0Hz

The jog frequency reference can be set in this parameter. Depress the JOG key on the digital operator, or close terminal 7, to use this function. The jog command always has priority over other reference commands. When using the multi-step speed references, change the jog command from terminal 7 to terminal 8 (*H1-06* = "6").

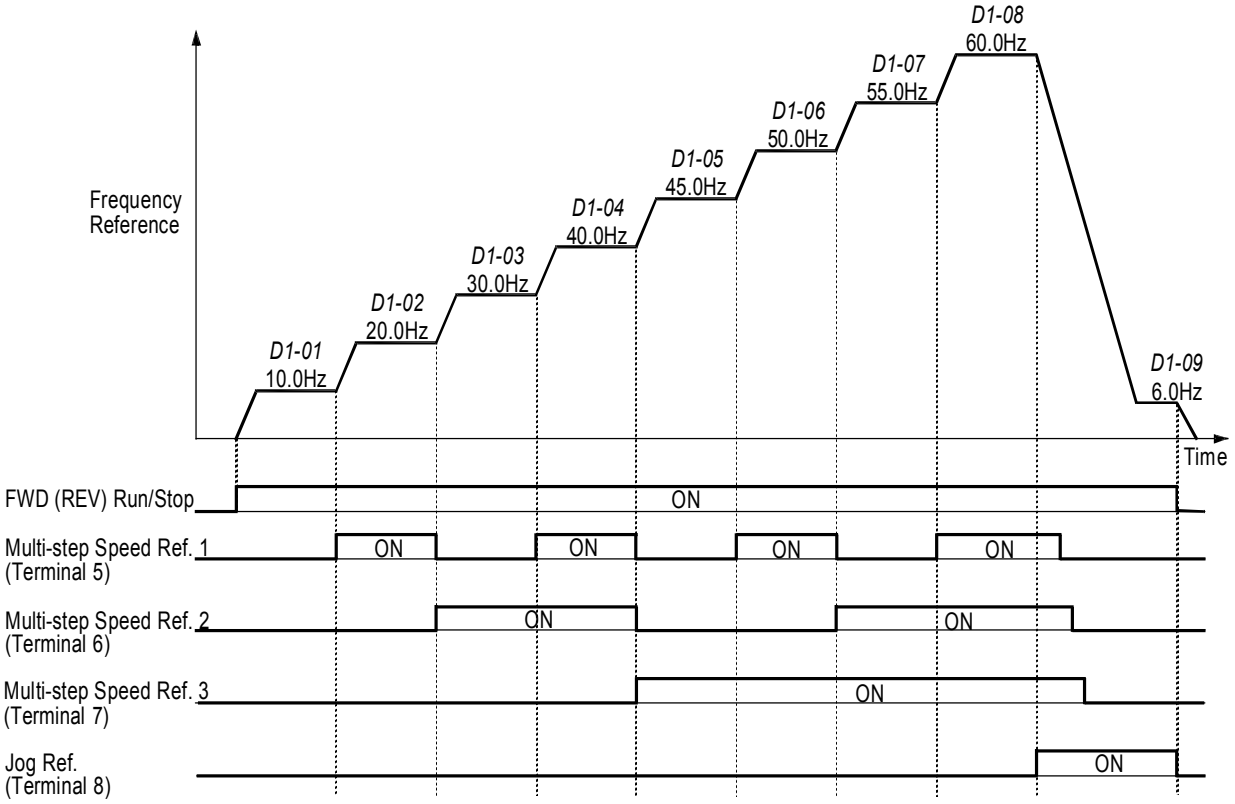


Figure 24 Multi-step Speed Operation - Timing Diagram

Note: Setting units for *D1-01* to *D1-09* are dependent upon the setting of digital operator display mode *(O1-03)*. Possible setting units include Hz, percentage, RPM or engineering units. See section ***O1***, ***Monitor Selection***, on page 120 for more details.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

D2 Reference Limits

D2-01 Frequency Reference Upper Limit *Ref Upper Limit*

B	B	B	B

Setting Range: 0.0 to 110.0%
Factory Default: 100.0%

The frequency reference upper limit is set as a percentage of the maximum output frequency *(E1-04)* in increments of 1%.

D2-02 Frequency Reference Lower Limit *Ref Lower Limit*

B	B	B	B

Setting Range: 0.0 to 109.0%
Factory Default: 100.0%

The frequency reference lower limit is set as a percentage of the maximum output frequency *(E1-04)* in increments of 1%. When a run command is input and the frequency reference is less than the lower limit, operation continues at the frequency reference lower limit. However, when the lower limit is set to less than the minimum output frequency *(E1-09)*, operation discontinues.

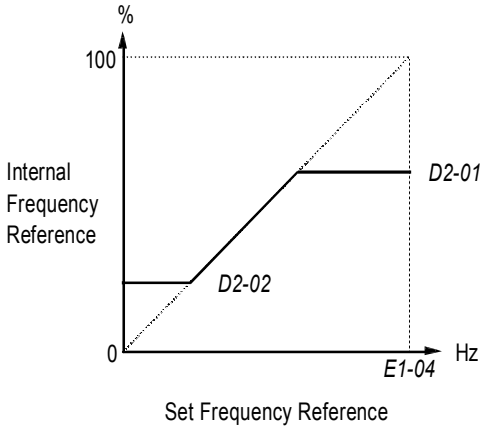


Figure 25 Setting Frequency Upper and Lower Limits

D3 Jump Frequencies

D3-01	*Jump Frequency Reference 1*	*Jump Freq 1*	B	B	B	B
D3-02	*Jump Frequency Reference 2*	*Jump Freq 2*	B	B	B	B
D3-03	*Jump Frequency Reference 3*	*Jump Freq 3*	B	B	B	B
D3-04	*Jump Frequency Reference Bandwidth*	*Jump Bandwidth*	B	B	B	B

This function allows the prohibition or “jumping” of critical frequencies so that the motor can operate without resonant vibrations caused by some machine systems. This function is also used for dead-band control. Setting the value to 0.0Hz disables this function.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

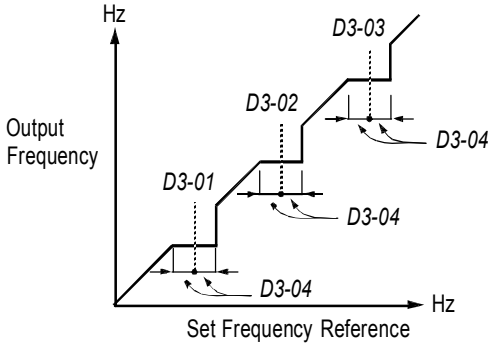


Figure 26 Jump Frequencies

D4 Sequence

D4-01 Hold Reference Memory Selection *MOP Ref Memory*

A	A	A	A

Selects whether the held frequency during motor operated potentiometer (MOP) simulation operation is stored when operation is stopped (when power is removed or when the run command is removed).

Setting	Description
0	Held frequency during MOP operation not retained. If a stop command is given or if power is removed, the frequency reference is reset to 0Hz. If the inverter is still decelerating when the run command is restored, operation resumes at the frequency reference which the inverter has ramped down to *(factory default).*
1	Held frequency during MOP operation is retained. If a stop command is given, or if power is removed, operation resumes at the held frequency reference when run command is restored.

Note: MOP operation is set using the multi-function contact input function selections (*H1-01* to *H1-06*, setting = "10" and "11"). See section ***H1, Digital Inputs***, on page 76 for more information.

D4-02 Trim Control Level *Trim Control Lvl*

A	A	A	A

Setting Range: 0 to 100%
Factory Default: 10%

Sets the motor operated pot or "trim" control level as a percentage of maximum output frequency in units of 1%. When trim control increase and decrease are selected as multi-function contact input functions (setting: *H1-__* = "1C" and "1D", respectively), the trim control level is added to or subtracted from the analog frequency reference, when each respective contact closes. This is useful in applications such as winders and unwinders, where speed compensation may be needed.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

D5 Torque Control

D5-01 Torque Control Selection *Torq Control Sel*

-	-	-	A

Selects between speed and torque control during close loop vector operation (*A1-03* = "3").

Setting	Description
0	Speed control enabled with torque limit *(factory default)*
1	Torque control enabled with speed limit

Speed/torque control selection can also be made by using a multi-function contact input function selection (*H1-__* = "71").

D5-02 Torque Limit Primary Delay Time *Torq Ref Filter*

-	-	-	A

Setting Range: 0 to 1000ms
Factory Default: 0ms

Sets delay time constant for torque reference input in the torque control mode, in units of 1ms.

D5-03 Speed Limit Input Selection *Speed Limit Sel*

-	-	-	A

Sets speed limit selection in the torque control mode.

Setting	Description
1	Speed limit is the analog speed reference set by terminal 13 or 14 *(factory default)*.
2	Speed limit is the reference set by *B1-01*.

D5-04 Speed Limit Value *Speed Lmt Value*

-	-	-	A

Setting Range: -120 to 120%
Factory Default: 0%

Sets the speed limit value in the torque control mode as a percentage of the maximum output frequency, when *D5-03* = "2".

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

D5-05 Speed Limit Bias — *Speed Lmt Bias*

-	-	-	A

Setting Range: 0 to 120%
Factory Default: 10%

Sets the speed limit bias value in the torque control mode as a percentage of the maximum output frequency.

D5-06 Reference Delay Timer — *Ref Hold Time*

-	-	-	A

Setting Range: 0 to 1000ms
Factory Default: 0ms

Sets delay time from when the speed/torque control selection is made to when the control mode is actually changed, in units of 1ms.

Torque Control Operation

To select torque control, set torque selection *(D5-01)* to "1", or close the multi-function contact input set to speed/torque control (*H1-__* = "71") and set terminal 16 function selection to torque reference (*H3-05* = "13").

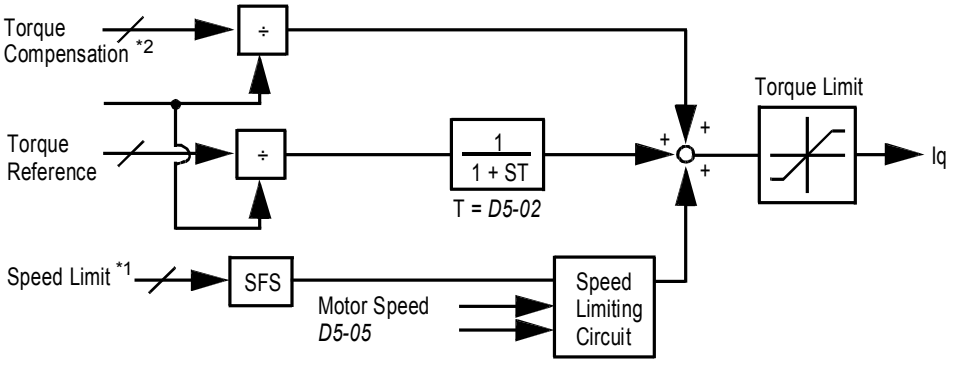


Figure 27 Torque Control Block Diagram

*1: When speed limit selection *(D5-03)* is set to "1", the master frequency reference input from terminal 13 or 14 becomes the speed limit; when speed limit selection *(D5-03)* is set to "2", the set value of *D5-04* becomes the speed limit.

*2: When terminal 14 function selection is set to torque compensation (*H3-09* = "14"), terminal l4 set value can be used as the torque compensation value.

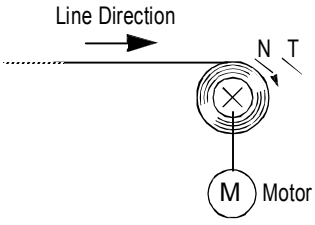
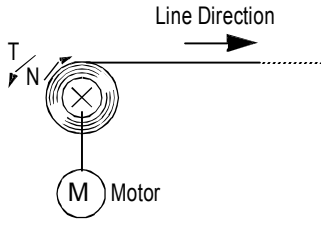
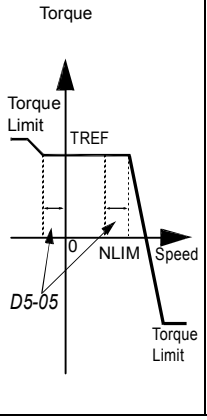
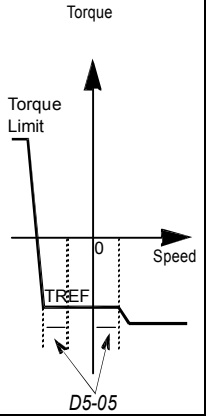
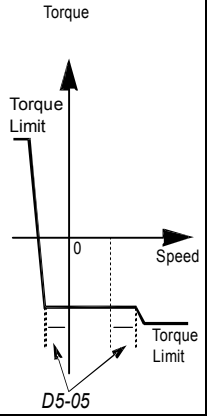
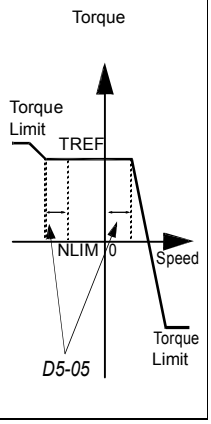
When torque reference > 0 and speed limit > 0 (winder application sequence), the following sequence is activated:

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

· When [-1 × speed limit bias *(D5-05)*] < motor speed < [speed limit + *D5-05*], torque control is activated using the set torque reference.
· When motor speed > [speed limit + *D5-05*], torque control is activated using the set torque reference.
· When motor speed < [-1 × *D5-05*], the speed limiting circuit outputs a positive torque reference to prevent the motor speed from increasing in the reverse direction.

Therefore, when torque reference > 0 and speed limit > 0, the torque control range is:
[-1 × *D5-05*] < motor speed < [speed limit + *D5-05*]

Refer to the following table for more details on the relationship between torque reference, speed limit and motor speed.

		Winder Control		Unwinder Control	
Configuration					
Direction of Motor Rotation		Forward	Reverse	Forward	Reverse
Reference Polarity	Torque Reference (TREF)	+	-	-	+
	Speed Limit (NLIM)	+	-	+	-
					

Speed/Torque Control Switching

When the KE200 is set up for close loop vector control (*A1-03* = "3"), speed control or torque control can be selected "on the fly" by using the multi-function input speed/torque control selection command (*H1-__* = "71").

Terminal No.	Parameter No.	Setting	Description
8	*H1-06*	71	Speed/torque control selection
13	*B1-01* *D5-03*	1 1	Frequency reference selection (terminals 13, 14) Speed limit selection (terminals 13, 14)
16	*H3-05*	13	Torque reference/speed limit

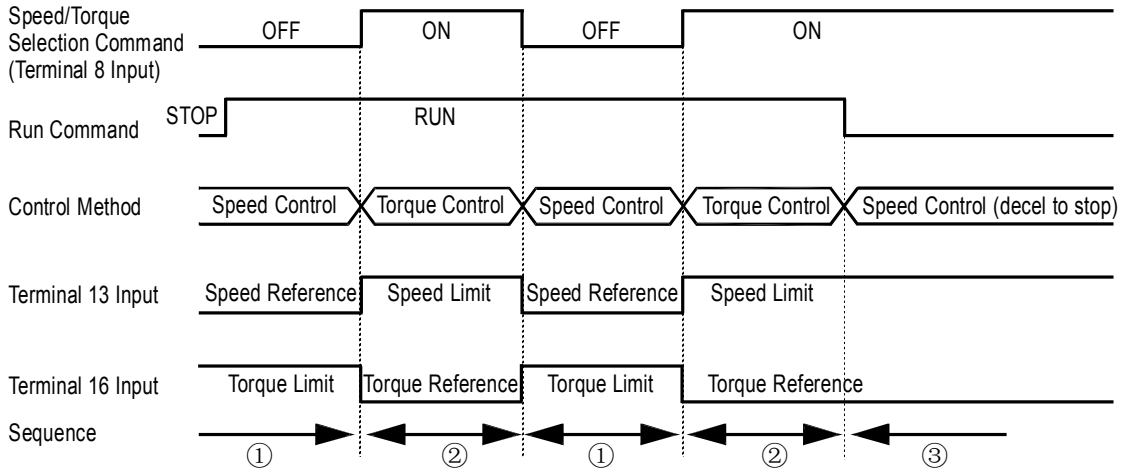


Figure 28 Speed/Torque Control Selection Timing Diagram

Sequence Description

When the speed/torque control selection contact is OFF, speed control is activated.

- Speed reference during speed control depends on the frequency reference selection *(B1-01)* setting. To use terminal 13 or 14 as the master frequency reference, set *Bl-0l* to "l".
- Torque limit during speed control is the smaller of the absolute value of terminal 16 torque limit, or the values set in the torque limit parameters (*L7-01* to *L7-04*).
- When a stop command is given during speed control, speed control is maintained and the smaller of the absolute value of terminal l6 torque limit, or the values set in the torque limit parameters (*L7-01* to *L7-04*), is used as the torque limit. Then the motor decelerates to stop.

When the speed/torque control selection contact is ON, torque control is activated.

- Speed limit during torque control is the master frequency reference at terminal 13 or 14 when speed limit selection *(D5-03)* is set to "1", and is the speed limit value *(D5-04)* when *D5-03* = "2", regardless of the frequency reference selection *(B1-01)* setting.
- During torque control, the terminal 16 analog input value becomes the torque reference.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

By giving a stop command during torque control, operation changes to speed control automatically, and the motor decelerates to stop. The torque limit during deceleration to stop becomes the values set in the torque limit parameters (*L7-01* to *L7-04*).

Note: The control mode actually changes after the speed/torque control selection command changes *and* after the reference delay timer *(D5-06)* elapses. The terminal 13 speed reference/speed limit and the terminal 16 torque limit/torque reference are stored in the inverter until the time set to *D5-06* elapses.

E Motor Parameters

E1 V/f Pattern

E1-01 Input Voltage *Input Voltage*

Q	Q	Q	Q

Setting Range: 155 to 255V (230V class), 310 to 510V (460V class) <1110>
Factory Default: 230V, 460V<1110>

Sets the inverter input voltage in units of 1V.

E1-02 Motor Selection *Motor Selection*

Q	Q	Q	Q

Select between fan-cooled, blower-cooled and vector/inverter duty motor types with this parameter.

Setting	Description
0	Fan-cooled motor characteristics *(factory default)*
1	Blower-cooled or TENV motor characteristics This setting allows 120% motor current at and above 5.6 Hz continuously, and allows 100% motor current at 0 Hz continuously (w/ linear in between).
2	Vector/inverter duty motor <1110> This setting allows 120% motor current at all frequencies.

E1-03 V/f Pattern Selection *V/f Selection*

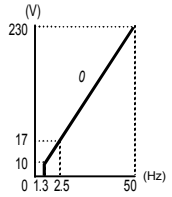
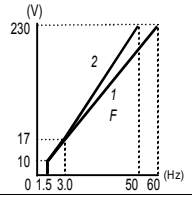
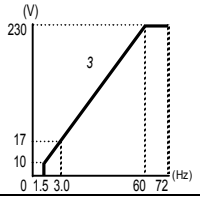
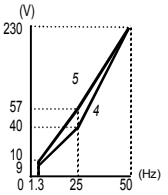
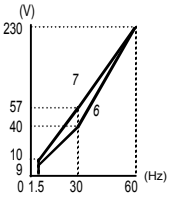
Q	Q	Q	Q

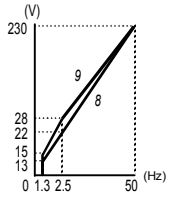
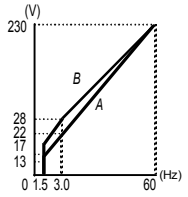
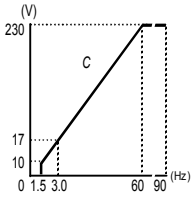
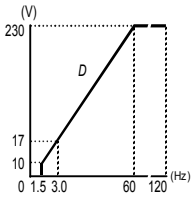
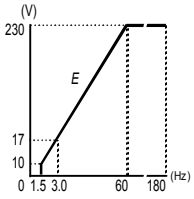
Choose a preset V/f pattern for operation in V/f modes only. It may be necessary to change the V/f pattern when using a high-speed motor, or when special torque adjustment is required in the application.

Set values 0 to E: preset V/f pattern can be selected
F: custom V/f pattern can be set *(factory default)*

Preset V/f patterns are automatically scaled by the input voltage value set in parameter *E1-01*. Set the V/f pattern according to the applications described in the table on the following page:

Preset V/f Patterns

	Specifications		E1-03	V/f Pattern *1
General-purpose	50Hz		0	
	60Hz Saturation		1 F	
	50Hz Saturation		2	
	72Hz		3	
Variable Torque	50Hz	Variable Torque 1	4	
		Variable Torque 2	5	
	60Hz	Variable Torque 1	6	
		Variable Torque 2	7	

	Specifications		E1-03	V/f Pattern *1
High Starting Torque *2	50Hz	High Starting Torque 1	8	
		High Starting Torque 2	9	
	60Hz	High Starting Torque 1	A	
		High Starting Torque 2	B	
High Speed Operation	90Hz		C	
	120Hz		D	
	180Hz		E	

Notes:

1 The following conditions must be considered when selecting a V/f pattern:
- The voltage and frequency characteristics of the motor.
- The maximum speed of the motor.

2 Select a high starting torque V/f pattern only under the following conditions:
- The wiring distance is long - 492 ft. (150m) and above.
- Large voltage drop at start-up.
- AC reactor is connected to the inverter's input or output.

3 Voltage in preset patterns is doubled for 460V class inverters.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

Custom V/f Pattern

Set up a custom V/f pattern by setting parameter *E1-03* to "F", and then setting the values in parameters *E1-04* to *E1-13*.

E1-04	*Maximum Frequency*	*Max Frequency*	Q	Q	Q	Q
E1-05	*Maximum Voltage*	*Max Voltage*	Q	Q	Q	Q
E1-06	*Motor Base Frequency*	*Base Frequency*	Q	Q	Q	Q
E1-07	*Middle Output Frequency A*	*Mid Frequency A*	Q	Q	A	-
E1-08	*Middle Output Voltage A*	*Mid Voltage A*	Q	Q	A	-
E1-09	*Minimum Output Frequency*	*Min Frequency*	Q	Q	Q	A
E1-10	*Minimum Output Voltage*	*Min Voltage*	Q	Q	A	-
E1-11	*Middle Output Frequency B*	*Mid Frequency B*	A	A	A	A
E1-12	*Middle Output Voltage B*	*Mid Voltage B*	A	A	A	A
E1-13	*Motor Base Voltage*	*Base Voltage*	A	A	Q	Q

Be sure to satisfy the following conditions for setting parameters *E1-04* to *E1-13*:
E1-09 E1-07 E1-06 E1-11 E1-04

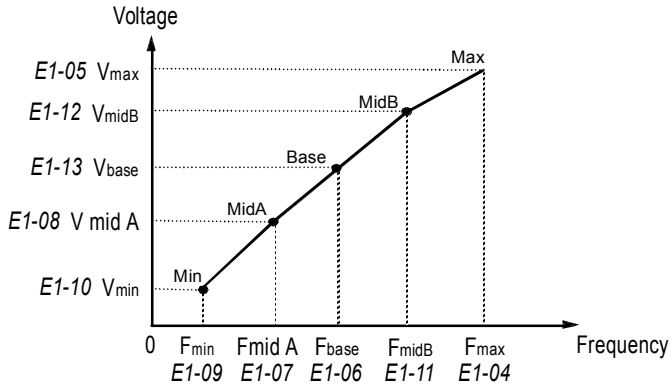


Figure 28 Custom V/f Pattern Setting

* For 460V class units, the value is twice that of 230V class units.

Increasing the voltage in the V/f pattern increases motor torque. However, when setting a custom V/f pattern, increase the voltage gradually while monitoring the motor current, to prevent:

- Inverter fault trips as a result of motor overexcitation
- Motor overheat or excessive vibration

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

V/F Pattern for Inverter Capacity 0.4 ~ 1.5kW for 200V Class

Parameter No.	Name	Unit	Factory Setting							
E1-03	V/f Pattern Selection	—	0	1	2	3	4	5	6	7
E1-04	Max. Output Frequency	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0
E1-05	Max. Voltage	V	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0
E1-06	Max. Voltage Frequency	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0
E1-07	Mid. Output Frequency	V	2.5	3.0	3.0	3.0	25.0	25.0	30.0	30.0
E1-08	Mid. Output Frequency Voltage	V	17.2	17.2	17.2	17.2	40.2	57.5	40.2	57.5
E1-09	Min. Output Frequency	Hz	1.3	1.5	1.5	1.5	1.3	1.3	1.5	1.5
E1-10	Min. Output Frequency Voltage	V	10.3	10.3	10.3	10.3	9.2	10.3	9.2	10.3

For 460V class units, the value is twice that of 230V class units.

Inverter Capacity 0.4 ~ 1.5kW for 200V Class (Continued)

Parameter No.	Name	Unit	Factory Setting							
E1-03	V/f Pattern Selection	—	8	9	A	B	C	D	E	F
E1-04	Max. Output Frequency	Hz	50.0	50.0	60.0	60.0	90.0	120.0	180.0	60.0
E1-05	Max. Voltage	V	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0
E1-06	Max. Voltage Frequency	Hz	50.0	50.0	60.0	60.0	60.0	60.0	60.0	60.0
E1-07	Mid. Output Frequency	V	2.5	2.5	3.0	3.0	3.0	3.0	3.0	3.0
E1-08	Mid. Output Frequency Voltage	V	21.8	27.6	21.8	27.6	17.2	17.2	17.2	17.2
E1-09	Min. Output Frequency	Hz	1.3	1.3	1.5	1.5	1.5	1.5	1.5	1.5
E1-10	Min. Output Frequency Voltage	V	12.6	14.9	12.6	17.2	10.3	10.3	10.3	10.3

For 460V class units, the value is twice that of 230V class units.

V/F Patterns for Inverter Capacity 2.2 ~ 45kW for 200V Class

Parameter No.	Name	Unit	Factory Setting							
E1-03	V/f Pattern Selection	—	0	1	2	3	4	5	6	7
E1-04	Max. Output Frequency	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0
E1-05	Max. Voltage	V	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0
E1-06	Max. Voltage Frequency	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0
E1-07	Mid. Output Frequency	V	2.5	3.0	3.0	3.0	25.0	25.0	30.0	30.0
E1-08	Mid. Output Frequency Voltage	V	16.1	16.1	16.1	16.1	40.2	57.5	40.2	57.5
E1-09	Min. Output Frequency	Hz	1.3	1.5	1.5	1.5	1.3	1.3	1.5	1.5
E1-10	Min. Output Frequency Voltage	V	8.0	8.0	8.0	8.0	6.9	8.0	6.9	8.0

For 460V class units, the value is twice that of 230V class units.

V/F Patterns for Inverter Capacity 2.2 ~ 45kW for 200V Class (Continued)

Parameter No.	Name	Unit	Factory Setting							
E1-03	V/f Pattern Selection	—	8	9	A	B	C	D	E	F
E1-04	Max. Output Frequency	Hz	50.0	50.0	60.0	60.0	90.0	120.0	180.0	60.0
E1-05	Max. Voltage	V	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0
E1-06	Max. Voltage Frequency	Hz	50.0	50.0	60.0	60.0	60.0	60.0	60.0	60.0
E1-07	Mid. Output Frequency	V	2.5	2.5	3.0	3.0	3.0	3.0	3.0	3.0
E1-08	Mid. Output Frequency Voltage	V	20.7	26.4	20.7	26.4	16.1	16.1	16.1	16.1
E1-09	Min. Output Frequency	Hz	1.3	1.3	1.5	1.5	1.5	1.5	1.5	1.5
E1-10	Min. Output Frequency Voltage	V	10.3	12.6	10.3	14.9	8.0	8.0	8.0	8.0

For 460V class units, the value is twice that of 230V class units.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

V/F Patterns for Inverter Capacity 55 ~ 300kW for 200V Class

Parameter	Name	Unit	Factory Setting							
E1-03	V/f Pattern Selection	–	0	1	2	3	4	5	6	7
E1-04	Max. Output Frequency	Hz	50.0<21>	60.0	60.0	72.0<21>	50.0<21>	50.0<21>	60.0	60.0
E1-05	Max. Voltage	V	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0
E1-06	Max. Voltage Frequency	Hz	50.0<21>	60.0	50.0<21>	60.0	50.0<21>	50.0<21>	60.0	60.0
E1-07	Mid. Output Frequency	V	2.5 <21>	3.0	3.0	3.0	25.0<21>	25.0 <21>	30.0	30.0
E1-08	Mid. Output Frequency Voltage	V	13.8<21>	13.8<21>	13.8<21>	13.8<21>	40.2<21>	57.5<21>	40.2<21>	57.5<21>
E1-09	Min. Output Frequency	Hz	1.3 <21>	1.5	1.5	1.5	1.3<21>	1.3 <21>	1.5	1.5
E1-10	Min. Output Frequency Voltage	V	6.9	6.9	6.9	6.9	5.7<21>	6.9	5.7 <21>	6.9

For 460V class units, the value is twice that of 230V class units.

V/F Patterns for Inverter Capacity 55 ~ 300kW for 200V Class (Continued)

Parameter	Name	Unit	Factory Setting							
E1-03	V/f Pattern Selection	–	8	9	A	B	C	D	E	F
E1-04	Max. Output Frequency	Hz	50.0<21>	50.0<21>	60.0	60.0	90.0<21>	120.0<21>	180.0<21>	60.0
E1-05	Max. Voltage	V	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0
E1-06	Max. Voltage Frequency	Hz	50.0<21>	50.0<21>	60.0	60.0	60.0	60.0	60.0	60.0
E1-07	Mid. Output Frequency	V	2.5<21>	2.5<21>	3.0	3.0	3.0	3.0	3.0	3.0
E1-08	Mid. Output Frequency Voltage	V	17.2<21>	23.0<21>	17.2<21>	23.0<21>	13.8<21>	13.8<21>	13.8<21>	13.8<21>
E1-09	Min. Output Frequency	Hz	1.3<21>	1.3<21>	1.5	1.5	1.5	1.5	1.5	1.5
E1-10	Min. Output Frequency Voltage	V	8.0<21>	10.3<21>	8.0<21>	12.6<21>	6.9	6.9	6.9	6.9

For 460V class units, the value is twice that of 230V class units.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

E2 Motor Set-up

E2-01 Motor Rated Current *Motor Rated FLA*

Q	Q	Q	Q

Sets the motor rated current in units of 0.01A for inverter models 27P5, 47P5 and smaller; 0.1A for models G5U2011, G5U4011 and larger. The default setting varies depending on the inverter model setting *(O2-04)*.

E2-02 Motor Rated Slip Frequency *Motor Rated Slip*

A	A	Q	Q

Setting range: 0.00 to 20.00Hz

Sets the motor rated slip frequency in units of 0.01Hz. The default setting varies depending on the inverter model setting *(O2-04)*. Use the following equation to calculate the motor rated slip frequency:

$$f_s = f - \frac{(N * P)}{120}$$

where:

f_s : slip frequency (Hz)
f : rated frequency (Hz)
N : rated motor speed (rpm)
P : number of motor poles

E2-03 Motor No-Load Current *No-Load Current*

A	A	Q	Q

Sets the motor no-load current in units of 0.01A for inverter models 27P5, 47P5 and smaller; 0.1A for models G5U2011, G5U4011 and larger. The default setting varies depending on the inverter model setting *(O2-04)*.

E2-04 Number of Motor Poles *Number of Poles*

	Q		Q

Setting Range: 2 to 48 poles
Factory Default: 4 poles

Sets the number of motor poles.

E2-05 Motor Terminal Resistance *Term Resistance*

A	A	A	A

Sets the motor phase-to-phase resistance value in units of 0.01W.

$$\text{Motor Terminal Resistance} = \text{Phase-to-Phase Resistance at Insulation Class Temperature} \times \frac{273 + (25^{\circ}C + \text{insulation class temperature}) / 2}{273 + \text{insulation class temperature}}$$

The default setting varies depending on the inverter model setting *(O2-04)*.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

E2-06 Leakage Inductance *Leak Inductance*

-	-	A	A

Sets the motor leakage inductance in units of 0.1%. The default setting varies depending on the inverter model setting *(O2-04)*.

E2-07 Core-Saturation Compensation Coefficient 1 *Saturation Comp1*

-	-	A	A

Setting Range: 0.00 to 1.00
Factory Default: 0.5

Sets the motor iron core saturation coefficient at 50% of the magnetic flux. This parameter is set automatically during auto-tuning, so it does not need to be changed.

E2-08 Core-Saturation Compensation Coefficient 2 *Saturation Comp2*

-	-	A	A

Setting Range: 0.00 to 1.00
Factory Default: 0.75

Sets the motor iron core saturation coefficient at 75% of the magnetic flux. This parameter is set automatically during auto-tuning, so it does not need to be changed.

E2-09 Motor Mechanical Loss *Mechanical Loss*

-	-	-	A

Setting Range: 0.0 to 10.0%
Factory Default: 0.0%

Sets the motor mechanical loss as a percentage of motor rated output power, in units of 0.1%.

E2-10 Motor Iron Loss Torque Compensation <1110> *Tcomp Iron Loss*

A	A	-	-

Setting Range: 0 to 65535
Factory Default: 14 (Factory default depends on inverter capacity.)

This parameter sets the motor iron loss of the torque compensation.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

E3 Motor 2 Set-up

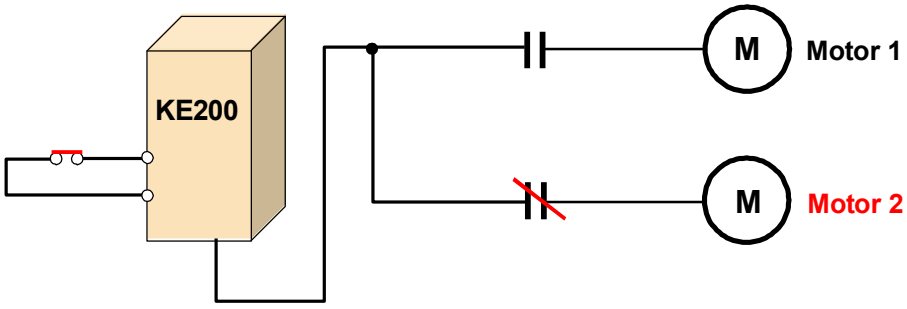
E3-01 Motor 2 Control Method Selection *Control Method*

A	A	A	A

The KE200 inverter has the capability to control 2 motors independently. A second motor may be selected using a multi-function contact input.

Select the control method best suited for your application for Motor 2.

Setting	Description
0	V/f Control - For general-purpose and multiple motor applications.
1	V/f with PG Feedback - For general-purpose applications requiring closed loop speed control.
2	Open Loop Vector *(factory default)* - For applications requiring precise speed control, quick response and higher torque at low speeds (150% torque below 1Hz).
3	Close loop vector - For applications requiring very precise speed and torque con- trol at a wide speed range including 0 speed. Uses encoder



The following is a list of parameters that become effective when motor 2 is selected.

Function E3 Control Method 2		Function E4 V/F Pattern 2		Function E5 Motor Setup 2	
E3-01	Control Method 2	E4-01	Max Frequency	E5-01	Motor Rated FLA
		E4-02	Max Voltage	E5-02	Motor Rated Slip
		E4-03	Base Frequency	E5-03	No-Load Current
		E4-04	Mid Frequency	E5-05	Term Resistance
		E4-05	Mid Voltage	E5-06	Leak Inductance
		E4-06	Min Frequency		
		E4-07	Min Voltage		

The inverter must be stopped to switch motors.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

The motor 2 parameters are identical to the motor 1 parameters. Refer to E1-03 through E1-10.

E4-01	*Motor 2 Maximum Frequency*	*Max Frequency*	A	A	A	A
E4-02	*Motor 2 Maximum Voltage*	*Max Voltage*	A	A	A	A
E4-03	*Motor 2 Base Frequency*	*Base Frequency*	A	A	A	A
E4-04	*Motor 2 Middle Output Frequency A*	*Mid Frequency A*	A	A	A	-
E4-05	*Motor 2 Middle Output Voltage A*	*Mid Voltage A*	A	A	A	-
E4-06	*Motor 2 Minimum Output Frequency*	*Min Frequency*	A	A	A	A
E4-07	*Motor 2 Minimum Output Voltage*	*Min Voltage*	A	A	AA	-

E5 Motor 2 Set-up

E5-01	*Motor 2 Rated Current*	*Motor Rated FLA*	A	A	A	A

Sets the motor rated current in units of 0.01A for inverter models 27P5, 47P5 and smaller; 0.1A for models G5U2011, G5U4011 and larger. The default setting varies depending on the inverter model setting *(O2-04)*.

E5-02	*Motor 2 Rated Slip Frequency*	*Motor Rated Slip*	A	A	A	A

Setting range: 0.00 to 20.00Hz

Sets the motor rated slip frequency in units of 0.01Hz. The default setting varies depending on the inverter model setting *(O2-04)*. Use the following equation to calculate the motor rated slip frequency:

$$f_S = f - \frac{(N * P)}{120}$$

where:

f_s: slip frequency (Hz)
f : rated frequency (Hz)
N : rated motor speed (rpm)
P : number of motor poles

E5-03	*Motor 2 No-Load Current*	*No-Load Current*	A	A	A	A

Sets the motor no-load current in units of 0.01A for inverter models 27P5, 47P5 and smaller; 0.1A for models G5U2011, G5U4011 and larger. The default setting varies depending on the inverter model setting *(O2-04)*.

E5-04	*Motor 2 Number of Motor Poles*	*Number of Poles*	-	A	-	A

Setting Range: 2 to 48 poles
Factory Default: 4 poles

Sets the number of motor poles for motor 2.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

E5-05 Motor 2 Terminal Resistance *Term Resistance*

A	A	A	A

Sets the motor phase-to-phase resistance value in units of 0.01W.

$$\text{Motor Terminal Resistance} = \text{Phase-to-Phase Resistance at Insulation Class Temperature} \times \frac{273 + (25^{\circ}C + \text{insulation class temperature}) / 2}{273 + \text{insulation class temperature}}$$

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

The default setting varies depending on the inverter model setting *(O2-04)*.

E5-06 Motor 2 Leakage Inductance *Leak Inductance*

A	-	A	A

Sets the motor leakage inductance in units of 0.1%. The default setting varies depending on the inverter model setting *(O2-04)*.

F Option Parameters

F1 PG Option Set-up

These parameters can be accessed during operation using a pulse generator (PG) for speed feedback.

When access level is BASIC (A1-03), the parameter is not displayed unless the option card is connected.

F1-01 PG Pulses per Revolution *PG Pulses/Rev*

-	Q	-	Q

Setting Range: 0 to 60000
Factory Default: 1024

Sets the number of PG pulses per motor revolution (pulses/rev).

F1-02 PG Disconnection Detection Stopping Method *PG Fdbk Loss Sel*

-	B	-	B

Selects the stopping method when a disconnected PG is detected.

Setting	Description
0	Ramp to stop - according to *C1-02*
1	Coast to stop *(factory default)*
2	Fast-stop according to *C1-09*
3	Alarm flashes, operation continues (this setting is disabled during close loop vector control)

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

F1-03 Overspeed Detection Stopping Method *PG Overspeed Sel*

-	B	-	B

Selects the stopping method when an overspeed condition is detected.

Setting	Description
0	Ramp to stop - according to *C1-02*
1	Coast to stop *(factory default)*
2	Fast-stop according to *C1-09*
3	Alarm flashes, operation continues (this setting is disabled during close loop vector control)

F1-04 PG Deviation Detection Stopping Method *PG Deviation Sel*

-	B	-	B

Selects the stopping method when excessive speed deviation is detected.

Setting	Description
0	Ramp to stop - according to *C1-02*
1	Coast to stop
2	Fast-stop according to *C1-09*
3	Alarm flashes, operation continues *(factory default)*

F1-05 PG Rotation Selection *PG Rotation Sel*

-	B	-	B

Sets the relationship between the motor rotation direction and PG polarity.

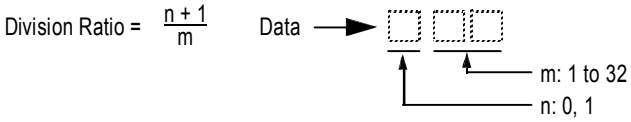
Setting	Description
0	Motor FWD direction is counterclockwise *(factory default).*
1	Motor FWD direction is clockwise.

The motor rotation direction applies when viewing the motor shaft from the load side.

F1-06 PG Division Rate (pulse output) *PG Output Ratio*

-	B	-	B

Setting Range: 1 to 132
Factory Default: 1
Sets the division ratio for monitoring the PG pulse signals.



Setting Example:
When *F1-06* is set to "132", then the division ratio = $\frac{1+1}{32} = \frac{2}{16}$

This parameter is effective only when the printed circuit board PG-B2 is used

F1-07 Integral Value During Accel/Decel *PG Ramp PI/I Sel*

-	B	-	-

Selects whether speed control (ASR) integral operation is activated during acceleration/deceleration.

Setting	Description
0	Integral operation disabled *(factory default)*
1	Integral operation enabled

F1-08 Overspeed Detection Level *PG Overspd Level*

-	A	-	A

Setting Range: 0 to 120%
Factory Default: 115%

Sets the motor overspeed detection level as a percentage of maximum output frequency *(E1-04)*.

F1-09 Overspeed Detection Time *PG Overspd Time*

-	A	-	A

Setting Range: 0.0 to 2.0s
Factory Default: 0.0s

Sets the elapsed time from when an overspeed condition is detected to when a fault occurs.

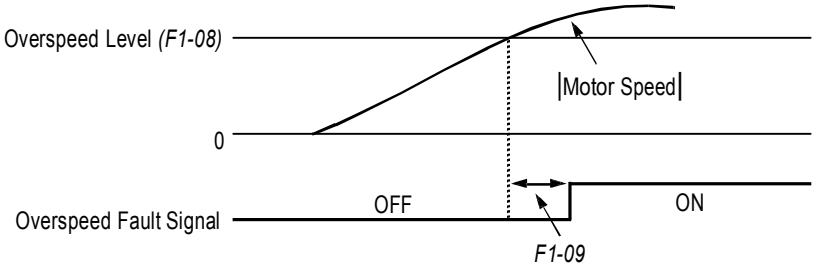


Figure 29 Overspeed Detection Timing Diagram

A fault signal is output to stop operation after the absolute value of the motor speed exceeds the set value of *F1-08* and after the time set to *F1-09* elapses. The stopping method is set by *F1-03*.
When parameter A1-02=1 [V/f w/PG] the factory setting will be 1.0. When parameter A1-02=3 [Close Loop Vector] the factory setting will be 0.0.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

F1-10 PG Deviation Detection Level *PG Deviate Level*

-	A	-	A

Setting Range: 0 to 50%
Factory Default: 115%

Sets the excessive speed deviation detection level as a percentage of maximum output frequency *(E1-04)*.

F1-11 PG Deviation Detection Time *PG Deviate Time*

-	A	-	A

Setting Range: 0.0 to 2.0s
Factory Default: 0.0s

Sets the elapsed time from when excessive speed deviation is detected to when a fault occurs.

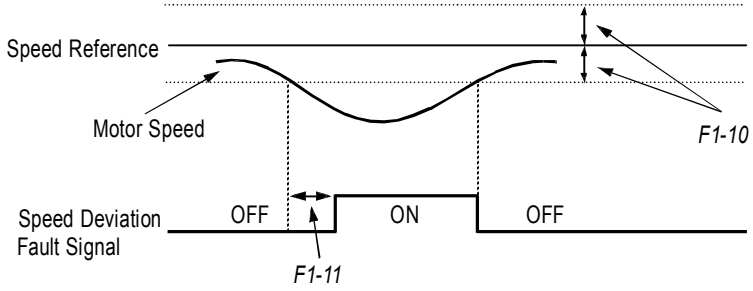


Figure 30 Overspeed Detection Timing Diagram

A fault signal is output to stop operation after the deviation between speed reference and the motor speed exceeds the set value of *F1-10* and after the time set to *F1-11* elapses. The stopping method is set by *F1-04*. Also, detection is not activated while accelerating/decelerating or during torque control.

F1-12 Number of Teeth Gear 1 *PG # Gear Teeth1*

-	A	-	-

F1-13 Number of Teeth Gear 2 *PG # Gear Teeth2*

-	A	-	-

Setting Range: 0 to 1000
Factory Default: 0

Sets the number of teeth for each gear when gears are installed between the motor and the PG. When the number of gear teeth is set, the motor revolutions per minute (rpm) are calculated as shown below.

$$\text{No. of Motor RPM's} = \frac{\text{No. of PG Output Pulses} \times 60}{\text{PG Pulses/Revolution } (F1\text{-}01)} \times \frac{\text{No. of Teeth Gear 2 } (F1\text{-}13)}{\text{No. of Teeth Gear 1 } (F1\text{-}12)}$$

This function is disabled when either *F1-12* or *F1-13* = "0".

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

F1-14 PGO Detection Time *PGO Detect Time*

-	A	-	A

Setting Range: 0.0 to 10 seconds
Factory Default: 2 seconds

Parameter F1-14 sets the time from when the pulse generator (PG) signal is missing to when the fault signal is displayed.
The stopping method when a "PGO" fault is detected is selected by parameter F1-02.
If a speed reference is commanded, but the motor is physically locked, a "PGO" fault will occur even though the PG is not disconnected from the inverter.

F2 AI-14B Set-up

F2-01 Bipolar or Unipolar Input Selection *AI-14 Input Sel*

A	A	A	A

Sets CH1 to CH3 input functions when AI-14B option is connected.

Setting	Function	CH1 (TC1 to TC4)	CH2 (TC2 to TC4)	CH3 (TC3 to TC4)
0	3-channel individual input *(factory default)*	Substitute for terminals 13 and 17	Substitute for terminals 14 and 17	Substitute for terminals 16 and 17
1	3-channel additional input	Sum of CH1 to CH3 input values is used as the frequency reference value.		

When the 3CH individual input is used, parameter *B1-01* is automatically set to "l" (frequency reference from control circuit terminal). The option/inverter reference selection, which is selected by a multi-function contact input (*H1-__* = "2"), is disabled when using the AI-14B option.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

F3 DI-08/DI-16H Set-up

F3-01 Digital Input Option *DI Input*

A	A	A	A

Selects the setting mode of the frequency reference input from the DI-08 and DI-16H options.

Setting	Frequency Reference Setting Mode
0	BCD 1% unit *(factory default)*
1	BCD 0.1% unit
2	BCD 0.01% unit
3	BCD 1Hz unit
4	BCD 0.1Hz unit
5	BCD 0.01Hz unit
6	Binary DI-08: 255/100% DI-16H, 12-bit selection: 4096/100% DI-16H, 16-bit selection: 30000/100%
7	Binary, set value is displayed in decimal notation.

F4 AO-08/AO-12 Set-up

F4-01 Analog Output Channel 1 Selection *AO CH1 Select*

A	A	A	A

Selects the analog output monitors for channel 1 of the AO-08 and AO-12 options.

Analog Output Channel 1 Selection

F4-01 Setting	Function	Description
1	Frequency reference	Monitors the frequency reference value. 10V= Max frequency (0-+/-10V possible)
2	Output frequency *(factory default)*	Monitors the output frequency. 10V= Max frequency (0-+/-10V possible)
3	Inverter output current	Monitors the output current. 10V=Rated current (0 to +10V output)
5	Motor speed	Monitors the motor speed. 10V= Max frequency (0 to +/- 10 V possible)
6	Output voltage	Monitors the inverters internal output voltage reference value. 10V=200 or 400 VAC
7	DC bus voltage	Monitors the DC voltage of the inverters internal main circuit. 10V=400 or 800 VDC (0 to +10V output)
8	Output power	Monitors the output power, this is an internally detected value. 10V=Max motor capacity. (0 to +/-10 V possible)
9	Torque reference (internal)	Monitors the internal torque reference value when vector control is used. 10 V=Rated torque. (0 to +/-10V possible)
10-14	Not Used	--
15	Terminal 13 input voltage level	Monitors the input voltage of the frequency reference (voltage). An input of 10 V corresponds to 100%. 10 V=100% (10 V) 0 to +/-10 V possible.
16	Terminal 14 input voltage or current level	Monitors the input current of the frequency reference. (current) An input of 20 mA corresponds to 100%. 20 mA=100% (20 mA) 0 to + 10 V output.
17	Terminal 16 input voltage level	Monitors the input voltage of the multi-function analog input. An input of 10 V corresponds to 100%. 10 V= 100% (10 V). (0 to +/-10 V possible)

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

Analog Output Channel 1 Selection (Continued)

F4-01 Setting	Function	Description
18	Motor secondary current (Iq)	Monitors the calculated value of the motors secondary current. (Iq) The motors rated secondary current corresponds to 100%. 10 V=Rated secondary current. (0 to + 10 V output)
19	Motor excitation current (Id)	Monitors the calculated value of the motors excitation current. (Id) The motors rated excitation current corresponds to 100%. 10 V=Rated excitation current. (0 to + 10 V output).
20	SFS output frequency	Monitors the output frequency after a soft start. This is the frequency without the correction from compensation functions such as slip compensation. 10 V=Max. frequency (0 to +/- 10 V possible)
21	ASR input	Monitors the input to the speed control loop. The max. frequency corresponds to 100%. 10 V=Max. frequency (0 to +/- 10 V possible)
22	ASR output	Monitors the output from the speed control loop. Analog monitor becomes 10 V/ max. output frequency with V/F control. In vector control the analog monitor becomes 10V= motor rated excitation current. (0 to +/-10V possible.)
23	Speed deviation	Monitors the speed deviation within the speed control loop. The max. frequency corresponds to 100%. 10 V=Max. frequency (0 to +/-10 V possible.)
24	PID feedback	Monitors the feedback value when the PID control is utilized. The input for the max. frequency corresponds to 100%. 10 V= Max frequency. (0 to +/-10 V possible.)
25	Not Used	--
26	Voltage reference (Vq output)	Monitors the inverters internal voltage reference value for the motors secondary current control. 10 V= 200 or 400 VAC (0 to =/- 10 V possible.)
27	Voltage reference (Vd output)	Monitors the inverters internal voltage reference value for the motors excitation current control. 10 V= 200 or 400 VAC (0 to =/- 10 V possible.)
28-30	Not Used	--
31	Not Used	--
32	ACR(q) Output	Monitors current control output value for the motors secondary current. 10 V= 100%.
33	ACR(d) Output	Monitors current control output value for the motors excitation current. 10 V= 100%.
34-35	Not Used	--
36	PID Input Monitor	Monitors the input to the PID circuit. This is the PID reference + the PID reference bias - the PID feedback. 10 V= Max frequency.
37	PID Output Monitor	Monitors the output of the PID circuit. 10 V= Max frequency.
38	PID Setpoint or Reference	Monitors the PID setpoint. This is the PID setpoint + the PID setpoint bias. 10 V= Max frequency.

F4-02 Analog Output Channel 1 Gain *AO CH1 Gain*

A	A	A	A

Setting Range: 0.00 to 2.50
Factory Default: 1.00

Sets the channel 1 output gain for the analog output monitors. To obtain the output level, multiply the monitor output level by the gain value set in *F4-02*.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

F4-03 Analog Output Channel 2 Selection *AO CH2 Select*

A	A	A	A

Setting Range: Same as *F4-01*
Factory Default: Inverter output current (setting = "3")

Selects the analog output monitors for channel 2 of the AO-08 and AO-12 options.

F4-04 Analog Output Channel 2 Gain *AO CH2 Gain*

A	A	A	A

Setting Range: 0.00 to 2.50
Factory Default: 0.50

Sets the channel 2 output gain for the analog output monitors. To obtain the output level, multiply the monitor output level by the gain value set in *F4-04*.

F4-05 Analog Output Channel 1 Bias *AO CH1 Bias*

A	A	A	A

Setting Range: -10.0 to + 10.0
Factory Default: 0.0
Sets the channel 1 output bias for the analog output monitors. This is for the AO-08 and AO-12 option cards.

F4-06 Analog Output Channel 2 Bias *AO CH2 Bias*

A	A	A	A

Setting Range: -10.0 to + 10.0
Factory Default: 0.0

Sets the channel 2 output bias for the analog output monitors. This is for the AO-08 and AO-12 option cards.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

F5 DO-02 Set-up

The DO-02C option card has 2 form C type dry contacts. Each of the dry contacts can be individually set by F5-01 and F5-02.
The DO-02C option card connects to the control board at 3CN.
The table is a list of items that can be selected.

F5-01 DO-02C Digital Output Channel 1 Selection *DO-02 CH1 Select*

A	A	A	A

Selects the multi-function output selections for channel 1 of the DO-02C option.
For detailed information on these settings, refer to section ***H2***, ***Digital Outputs***, on page 88.

Setting	Description	Setting	Description
0	During run 1 *(factory default)*	13	Fref/Fout agree 2
1	Zero speed	14	Fref/set agree 2
2	Fref/Fout agree 1	15	Frequency detection 3
3	Fref/set agree 1	16	Frequency detection 4
4	Frequency detection 1	17	Torque detection 1 (N.C.)
5	Frequency detection 2	18	Torque detection 2 (N.O.)
6	Inverter ready	19	Torque detection 2 (N.C.)
7	DC bus undervoltage	1A	Reverse direction
8	Baseblock 1	1B	Baseblock 2
9	Option frequency reference	1C	Motor 2 selected
A	Remote operation	1D	Regenerating
B	Torque detection 1 (N.O.)	1E	Restart enabled
C	Loss of reference	1F	Overload (OL1)
D	DB overheat	20	OH pre-alarm
E	Fault	30	Current/torque limit
F	Not used	31	Speed limit
10	Minor fault	33	Zero servo end
11	Reset command active	37	During run 2
12	Timer output	-	--

F5-02 DO-02C Digital Output Channel 2 Selection *DO-02 CH2 Select*

A	A	A	A

Setting Range: Same as *F5-01*
Factory Default: Zero speed (setting = “1”)

Selects the multi-function output selections for channel 2 of the DO-02C option.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

F6 DO-08 Set-up

F6-01 DO-08 Digital Output Selection *DO-08 Selection*

A	A	A	A

Selects the multi-function output selections for the DO-08 option.

Setting	Terminal No.	Description
0 8-channel individual *(factory default)*	TD5/TD11	Overcurrent (SC, OC, GF)
	TD6/TD11	Overvoltage (OV)
	TD7/TD11	Inverter overload (OL2)
	TD8/TD11	Fuse blown (FU)
	TD9/TD11	Not used
	TD10/TD11	Inverter overheat (OH)
	TD1/TD2	During zero-speed detection
	TD3/TD4	During speed agree
1 binary output	TD5/TD11	Binary output *
	TD6/TD11	
	TD7/TD11	
	TD8/TD11	
	TD9/TD11	During zero-speed detection
	TD10/TD11	During speed agree
	TD1/TD2	During run
	TD3/TD4	Minor fault

* When F6-01 is set to binary output (setting = "1"), use the table below to read the DO-08 output.

TD8/TD11 (bit 3)	TD7/TD11 (bit 2)	TD6/TD11 (bit 1)	TD5/TD11 (bit 0)	Description
0	0	0	0	No fault
0	0	0	1	Overcurrent (SC, OC, GF)
0	0	1	0	Overvoltage (OV)
0	0	1	1	Inverter overload (OL2)
0	1	0	0	Inverter overheat (OH)
0	1	0	1	Overspeed (OS)
0	1	1	0	Fuse blown (FU)
0	1	1	1	Not used
1	0	0	0	External fault (EF3 ~ EF8)
1	0	0	1	Controller fault
1	0	1	0	Motor overload (OL1)
1	0	1	1	Not used
1	1	0	0	Power loss (UV1, UV2, UV3)
1	1	0	1	Excessive speed deviation (DEV)
1	1	1	0	PG disconnection (PGO)
1	1	1	1	Not used

Note: When the terminal is open, the bit setting is "0"; when the terminal is closed, the bit setting is "1".

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

F7 PO-36F Set-up

The PO-36F option card outputs pulse signals that correspond to the inverter output frequency. These signals are used in master/slave configurations where speed matching is needed.

.

F7-01 PO-36F Pulse Monitor Output Selection PO-36F Selection

A	A	A	A

Sets the number of pulse signals to be output from the PO-36F option.

Setting	Number of Output Pulses
0	Inverter output frequency × 1
1	Inverter output frequency × 6 *(factory default)*
2	Inverter output frequency × 10
3	Inverter output frequency × 12
4	Inverter output frequency × 36

F8 Function F8 SI-F/G Set-up

The setting of parameter F8-01 selects the stopping method when an E-15 fault is detected.

F8-01 *(E-15) Detection Stopping Method* *E-15 Det Sel*

A	A	A	A

An E-15 fault may occur when using the SI-F or SI-G communication options. The fault will occur after initial communication has been established then the connection is lost. The following fault code will be displayed:

Setting	Description
0	Ramp to stop according to C1-02 set value
1	*Coast to stop.*
2	Ramp to stop according to C1-09 set value.
3	Alarm flashes, operation continues.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

F9 CP-916 Setup

The CP-916 option card provides PLC and motion type functions. This allows the KE200 inverter to be a stand-alone control system.
The CP-916 option card connects to the control board at 3CN.
When the CP-916 option is installed, the 4CN speed feedback option port is the only option port that is supported.

Specifications
- RS 232C communication port - Used for programming the CP-916G and for communication to other devices such as PLC's or printers.
- High speed (4 Mb/s) peer to peer communication port.
- Available protocol;
  MEMOBUS (MODBUS) 19.2 kbps maximum.
  Application Download Tool 19.2 kbps maximum.
  CP 717 Programming Tool 9.6 kbps.

F9-01 *Option External Fault Selection* *EFO Selection*

A	A	A	A

Parameter F9-01 selects the initial state for an external fault condition when the inverter is configured for serial communication using the CP-916.

Setting	Description
0	*When closed, the inverter will trip. (factory default)*
1	When open, the inverter will trip.

The "EFO" fault code will be displayed.

F9-02 *Option External Fault Detection* *EFO Detection*

A	A	A	A

Parameter F9-02 selects the condition of detection for an external fault when using the CP-916 option.

Setting	Description
0	*The fault will always be detected, even when the drive is stopped. (factory default)*
1	The fault will be detected only when the drive is running.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

F9-03 *Option External Fault Action* *EFO Fault Action*

A	A	A	A

The setting of parameter F9-03 selects the stopping method when an EF0 fault is detected.

Setting	Description
0	Ramp to stop according to C1-02 set value.
1	*Coast to stop. (factory setting)*
2	Ramp to stop according to C1-09 set value.
3	Alarm flashes, operation continues.

F9-04 Trace Sample Time *Trace Sample Tim*

A	A	A	A

Setting Range: 0-60000
Factory Default: 0

Parameter F9-04 sets the trace sample time when using the CP-916B option card.

F9-05 *Torque Reference/Torque Limit Select (CP-916)* *Torq Ref/Lmt Sel*

-	-	-	A

Parameter F9-05 allows the CP-916 option card to set the torque limits when the inverter is in the speed control mode and the torque reference when operating in the torque control mode

Setting	Description
0	Disabled -Torque reference/torque limits set by G5 program parameters or by analog input.
1	*Enabled - Torque reference/torque limits set by G5 program parameters, analog input, or by the CP-916. (factory default)*

Operation Truth Table for Parameter F9-05

Set Value	Speed Control (Torque Limit)	Torque Control (Torque Reference)
F9-05 = 0	Set by parameter or analog input.	Set by analog input terminal 14 or 16.
F9-05 = 1	Set by CP-916 option card, parameter, or analog input.	Set by CP-916 option card.

Note: The inverter will use the lowest value from the CP-916, L7-01 to L7-04, or the multi-function analog input terminals 14 or 16.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

F9-06 *Bus Fault Select* *Bus Fault Sel*

A	A	A	A

The setting of parameter F9-06 selects the stopping method when an BUS fault is detected.
A BUS fault may occur when using the SI-B or the CP-916 communication options. The fault will occur after initial communication has been established then the connection is lost. The following fault code will be displayed: "BUS SI-B Com Err".

Setting	Description
0	Ramp to Stop - Ramp to stop according to C1-02 set value.
1	*Coast to stop.*
2	Fast-Stop - Ramp to stop according to C1-09 set value.
3	Alarm Only - Alarm flashes, operation continues.

H Control Circuit Terminal Parameters

H1 Digital Inputs

The KE200 series has six multi-function contact inputs for the set-up of numerous functions, including multi-step speed operation, PID, speed search, speed/torque control selection, and many other. This section includes descriptions of these functions.

H1-01	*Multi-function Input Terminal 3 Selection*	*Terminal 3 Sel*	B	B	B	B
H1-02	*Multi-function Input Terminal 4 Selection*	*Terminal 4 Sel*	B	B	B	B
H1-03	*Multi-function Input Terminal 5 Selection*	*Terminal 5 Sel*	B	B	B	B
H1-04	*Multi-function Input Terminal 6 Selection*	*Terminal 6 Sel*	B	B	B	B
H1-05	*Multi-function Input Terminal 7 Selection*	*Terminal 7 Sel*	B	B	B	B
H1-06	*Multi-function Input Terminal 8 Selection*	*Terminal 8 Sel*	B	B	B	B

The following table lists the function selections for the multi-function contact inputs (terminals 4 to 8), and indicates the control modes during which each function can be enabled.

H1-01 to 6 Setting	Function	Control Method *(A1-02)*				Reference Page
		V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
0	3-Wire Control	√	√	√	√	
1	Local/Remote Selection	√	√	√	√	
2	Option/Inverter Selection	√	√	√	√	
3	Multi-Step Ref. 1 *(factory default, H1-03)*	√	√	√	√	
4	Multi-Step Ref. 2 *(factory default, H1-04)*	√	√	√	√	
5	Multi-Step Reference 3	√	√	√	√	
6	Jog Frequency Ref. *(factory default, H1-05)*	√	√	√	√	
7	Multi-Accel/Decel 1	√	√	√	√	
8	Ext. Baseblock N.O. *(factory default, H1-06)*	√	√	√	√	
9	External Baseblock N.C.	√	√	√	√	
A	Accel/Decel Ramp Hold	√	√	√	√	
B	OH2 Alarm Signal	√	√	√	√	
C	Terminal 16 Enable	√	√	√	√	
D	V/f Mode Selection	-	√	-	-	
E	ASR Integral Reset	-	√	-	√	
10	MOP Increase	√	√	√	√	
11	MOP Decrease	√	√	√	√	

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

H1-01 to 6 Setting	Function	Control Method *(A1-02)*				Reference Page
		V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
12	Forward Jog	√	√	√	√	
13	Reverse Jog	√	√	√	√	
14	Fault Reset *(factory default, H1-02)*	√	√	√	√	
15	Fast-Stop	√	√	√	√	
16	Motor 2 Select	√	√	√	√	
17	Fast-Stop (Closed, motor decels by C1-09) <1110>	√	√	√	√	
18	Timer Function	√	√	√	√	
19	PID Disable	√	√	√	√	
1A	Multi-Accel/Decel 2	√	√	√	√	
1B	Program Lockout	√	√	√	√	
1C	Trim Control Increase	√	√	√	√	
1D	Trim Control Decrease	√	√	√	√	
1E	Reference Sample Hold	√	√	√	√	
1F	Terminal 13/14 Switch	√	√	√	√	
20-2F	External Fault *(factory default, H1-01)*	√	√	√	√	
30	Closed: PID Integral is Reset	√	√	√	√	
31	Closed: PID Integral Value is Held <1110>	√	√	√	√	
60	DC Injection Activate	√	√	√	√	
61	Speed Search 1	√	-	√	-	
62	Speed Search 2	√	-	√	-	
63	Energy Saving Command	√	√	-	-	
64	Speed Search 3	√	√	√	√	
65	KEB Ridethrough N.C.	√	√	√	√	
66	KEB Ridethrough N.O	√	√	√	√	
71	Speed/Torque Control Change	-	-	-	√	
72	Zero Servo Command	-	-	-	√	
77	ASR Gain Switch	-	-	-	√	

· 3-Wire Control (setting: "0")
When *H1-__*is set to "0", 3-wire control is enabled. The terminal set to "0" becomes the FWD/REV run command.

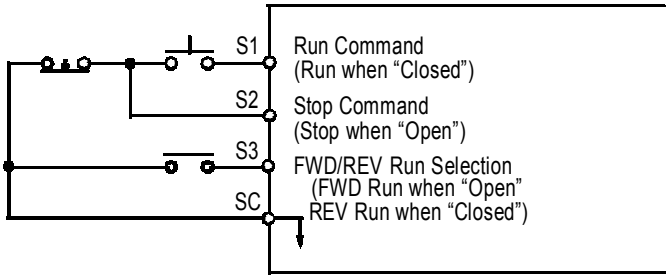


Figure 31 Terminal Function at 3-Wire Sequence Selection (H1-__= "0")

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

· Local/Remote Selection (setting: "1")

Selects the operation mode, only when the inverter is stopped.

Local: Operation according to frequency reference and run command from digital operator.
Remote: Operation according to frequency reference and run command set by *B1-01* and *B1-02*, respectively.

Note: When local/remote selection is set by a multi-function contact input terminal, local/remote selection from the digital operator key is disabled.

· Option/Inverter Selection (setting: "2")

Selects whether operation is performed using a reference command from an option card or from the inverter. Selection is effective only when the inverter is stopped.

Open: Runs by frequency reference and run command from inverter control circuit terminal or digital operator.
Closed: Runs by frequency reference and run command from an option card.

Multi-Step Ref 1 through 3 and Jog Freq Ref (Set value = 3, 4, 5, and 6)

Terminal 8 (H1-06 = 6) Jog Freq Ref	Terminal 7 (H1-05 = 5) Multi-Step Ref 3	Terminal 6 (H1-04 = 4) Multi-Step Ref 2	Terminal 5 (H1-03 = 3) Multi-Step Ref 1	Preset Reference
O	O	O	O	Reference 1 (d1-01)
O	O	O	X	Reference 2 (d1-02)
O	O	X	O	Reference 3 (d1-03)
O	O	X	X	Reference 4 (d1-04)
O	X	O	O	Reference 5 (d1-05)
O	X	O	X	Reference 6 (d1-06)
O	X	X	O	Reference 7 (d1-07)
O	X	X	X	Reference 8 (d1-08)
X	—	—	—	Jog Reference (d1-09)

O - Open
X - Closed
-- Has no effect

d1-01 is effective when b1-01 is set to 0 (reference from the digital operator)
d1-02 is effective when the terminal 16 setting (H3-05) is set to anything other than zero.

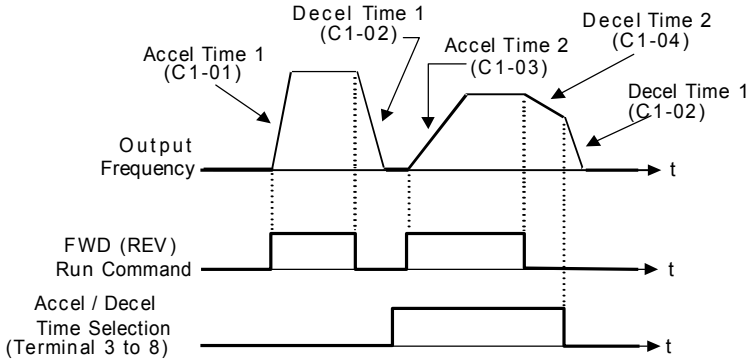
It is possible to mix analog and digital references in the multi-speed input function. The parameters must be set as shown below

.

Parameter	Reference	Digital	Analog
(d1-01)	Reference 1	b1-01 = 0	b1-01 = 1 (terminal 13 or 14)
(d1-02)	Reference 2	H3-05 0	H3-05 = 0 (terminal 16)
(d1-03)	Reference 3	d1-03	not available
(d1-04)	Reference 4	d1-04	
(d1-05)	Reference 5	d1-05	
(d1-06)	Reference 6	d1-06	
(d1-07)	Reference 7	d1-07	
(d1-08)	Reference 8	d1-08	
(d1-09)	Jog Reference	d1-09	

· Multi Accel/Dec1 (Set value = 7)

Open: Acceleration 1 / Deceleration 1 is set by parameters C1-01and C1-02 respectively.
Closed: Acceleration 2 / Deceleration 2 is set by parameters C1-03 and C1-04 respectively.



· External Baseblock N.O. (setting: "8")
Baseblock operation is performed when the contact output is closed. External baseblock operation differs as described below, depending on the run command input status.

When an external baseblock signal is input while the inverter is running, BB blinks on the digital operator display, and the inverter output is shut OFF. When the external baseblock signal is removed, operation restarts at the previous frequency reference before baseblock. Output voltage is then increased up to its previous level before baseblock, in the voltage recovery time *(L2-04)*.
When a stop signal is input and an external baseblock signal is input while the inverter is decelerating, BB blinks on the digital operator, the inverter output shuts OFF and the frequency reference is set to 0.

· External Baseblock N.C. (setting: “9”)
Baseblock operation is performed similar to setting “8”, except that operation is performed when the contact output is closed.

· Accel/Decel Hold Command (setting: “A”)
The accel/decel hold command is used to temporarily hold the output frequency at the current frequency reference, when the hold command is input. When a stop command is input, the accel/decel hold condition is released and operation stops.

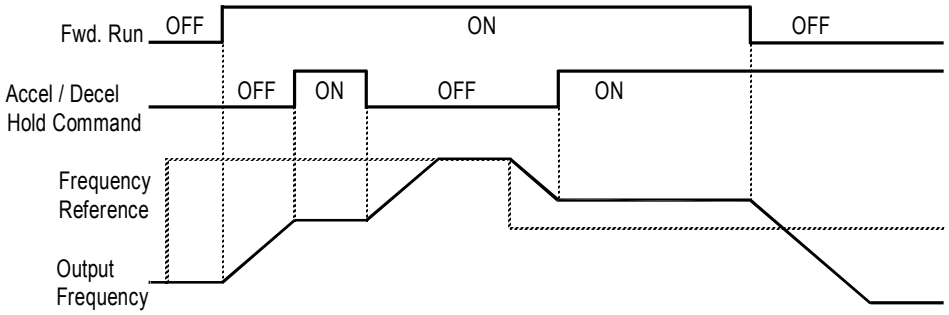


Figure 32 Accel / Decel Hold Command Timing Diagram

Notes:

1. When hold reference memory selection is enabled (*D4-01* = “1”) and an accel/decel hold command is input, by inputting a run command again after a stop command is input, the held output frequency is stored unless the accel/decel stop command is released. Operation resumes at the stored frequency.
2. When the power supply is turned OFF after the accel/decel hold command is input, the held output frequency is also stored.
3. When *D4-01* is set to “0”. the held output frequency is not stored,

· Inverter Overheat OH2 Alarm (setting: “B”)
When the inverter overheat alarm signal is input, OH2 blinks on the digital operator display. This contact can be connected to an external temperature switch for monitoring the inverter ambient temperature. A multi-function contact output *(H2-__)* can be set to “20” to close a contact at this condition.

· Multi-function Analog Input Selection (setting: “C”)
This setting disables the terminal 16 multi-function analog input.

Open: Terminal 16 command is not accepted.
Closed: Terminal 16 command is accepted.

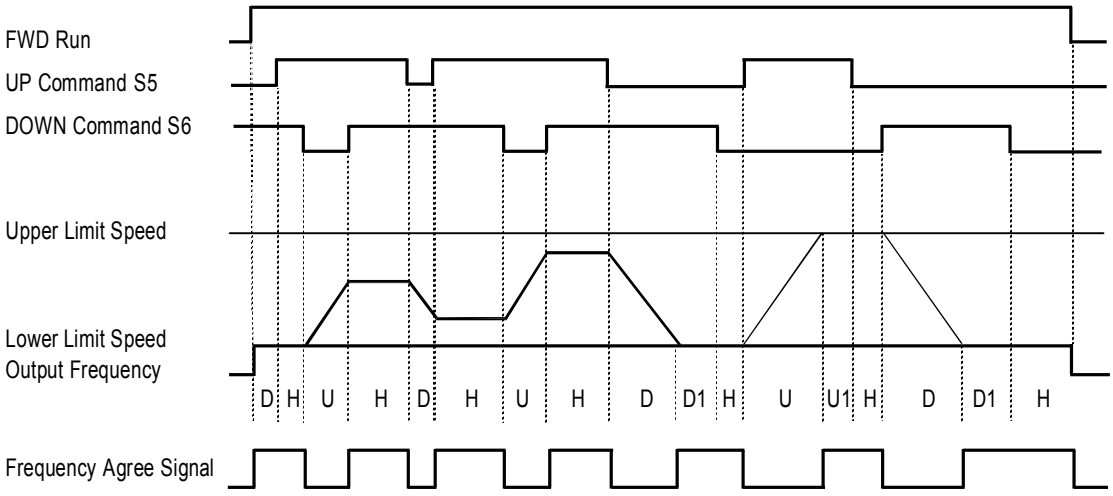
· Feedback Mode During V/f Selection (setting: “D”)
Feedback input can be disabled while the inverter is running when this function is selected. However, the speed control integral value *(C5-05)* is held until stop.

Open: Feedback control enabled (closed loop)
Closed: Feedback control disabled (open loop)
This function is available only during V/f control with PG feedback.

· Speed Control Integral Value Reset (setting: "E")
The speed control integral value can be reset while the inverter is running when this function is selected. Reset is effective only when integral control selection during accel/decel *(F1-07)* = "0".
Open: PI-control (speed control integral values are added.)
Closed: P-control (speed control integral values are reset by the integral time constant.)

· Up/Down Command (settings: Up = "10". Down = "11")
With the FWD (REV) run command entered, a change in frequency is performed by inputting the Up or Down signals to any two contact inputs, so that operation can be performed at the desired speed.

UP command	Closed	Open	Open	Closed
DOWN command	Open	Closed	Open	Closed
Operation Status	Accel	Decel	Hold	Hold



U: Up (accelerating) status
D: Down (decelerating) status
H: Hold (constant speed) status
U1: Up status, with clamping at upper limit speed
D1: Down status, with clamping at lower limit speed

Figure 33 UP/DOWN Command Timing Diagram

Notes:

1. Be sure to set frequency reference selection *(B1-01)* = "1". When *B1-01* = "0", Up/Down operation is disabled.
2. Upper limit speed
   = Max. output frequency *(E1-04)* × Frequency reference upper limit *(D2-01)*, if used
3. The lower limit value is either the master frequency reference from control circuit terminals 13 or 14, or the frequency reference lower limit *(D2-01)*, whichever is larger.
4. When hold reference memory selection is enabled (*D4-01* = "1") and a hold command is input, the held output frequency is stored even after the power supply is turned OFF. When *D4-01* = "0", the held output frequency is *not* stored.
5. If the jog frequency reference is input during Up/Down operation, the jog frequency reference has priority.

· Forward and Reverse JOG commands (settings: Fwd. Jog = “12”, Rev Jog = “13”)
Forward and reverse run jog frequency commands are enabled.

Setting	Description
12	Forward jog command is closed, run at jog frequency reference *(D1-09)*.
13	Reverse jog command is closed, run at jog frequency reference *(D1-09)*.

Notes:

1. When either the forward or reverse jog command is input during run, this command has priority.
2. When both the forward and reverse jog commands are closed for more than 500ms, the inverter stops according to the stopping method selection *(Bl-03)*.
3. The forward and reverse jog commands can be set independently.

· Fault Reset (setting: “14”)
Closing this contact resets a fault after the condition is removed.

· Fast-Stop (Set value = 15)
Open: The inverter operates normally.
Closed: The inverter decelerates to stop using deceleration time C1-09 (factory set to 10 sec.). The run command can remain closed during this period of time. The inverter will not run, from the external terminals or the digital operator as long as this input is closed.
To restart the inverter, the run command must be cycled.

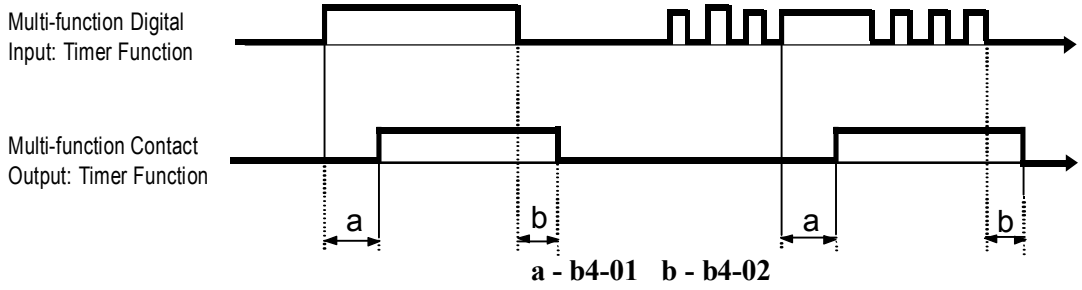
· Motor 2 Select (Set value = 16)
Open: Motor 1 is selected.
Closed: Motor 2 is selected.
When Motor 2 is selected, the following parameters are effective;

The inverter must be stopped to switch motors.
A multi-function digital output may be programmed when motor 2 is selected. Refer to page 88 for more information.

· Fast-Stop (setting: “17”) <1110>
When this input is closed the motor decelerates to a stop using the rate defined by parameter C1-09.

· Timer Function (Set value = 18)
The timer function works independently from the inverter.
The timer input must be on longer than the time in b4-01for the output to close.
The timer input must be off longer than the time in b4-02 for the output to open.

b4-01 is the on-delay time setting (0.0 - 300.0 second)
b4-02 is the off-delay time setting (0.0 - 300.0 second)



a - b4-01 b - b4-02

· PID Disable (Set value = 19)
Open: PID control is enabled.
Closed: PID control is disabled

· Program Lockout (setting: "1B")
Opening this contact prohibits the changing of VS-616G5 parameters.

· TrimCtl Increase (Set value = 1C)
· TrimCtl Decrease (Set value 1D)
Closed: Increases or decreases the output frequency based on the setting of d4-02 (trim control level). This function is not available when the reference is set from the digital operator.

· Analog Reference Sample/Hold Selection (setting: "1E")
If the contact input closes for 100ms or longer, the analog frequency reference is sampled once, after which the analog frequency reference is held.

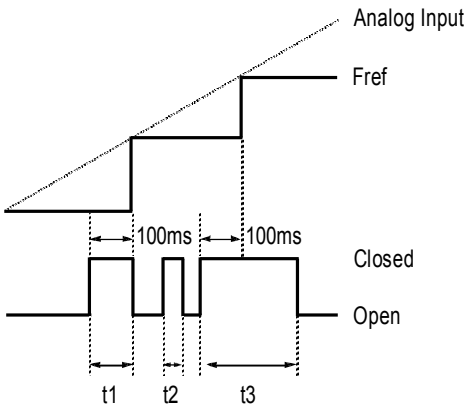


Figure 34 Sample/Hold Selection - Analog Reference

Note: t1, t3 - Reference is held at 100ms or longer.
t2 - Reference is *not* held at less than 100ms.

· Terminal 13/14 Selection (setting: "1F")

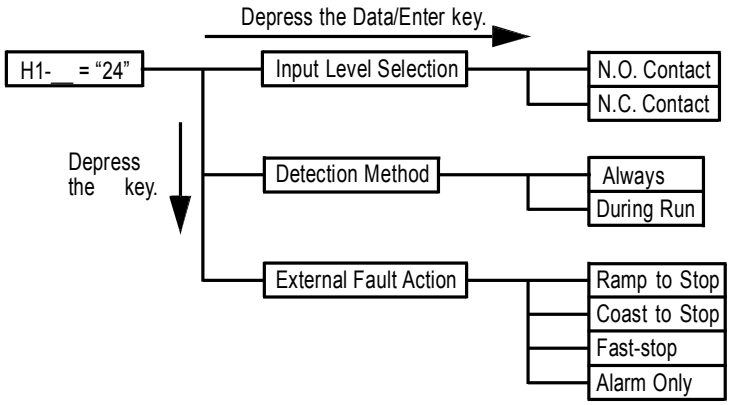
Open: Terminal 13 is used for the master frequency reference.
Closed: Terminal 14 is used for the master frequency reference.

Note: When the set value of Terminal 14 Selection *(H3-09)* is other than "1F" and the contact input is set for terminal 13/14 selection (*H1-__* = "1F"), a setting error (OPE3) occurs.

· External Fault (setting: "20-2F")
Use this contact input to select how the inverter responds to an external fault.

External Fault Selection								Setting Result
Input Level Selection		Detection Method		External Fault Action				
N.O.	N.C.	Always	During Run	Ramp to Stop	Coast to Stop	Fast-stop	Alarm Only	
√		√		√				20
√		√			√			**24**
√		√				√		28
√		√					√	2C
√			√	√				22
√			√		√			26
√			√			√		2A
√			√				√	2E
	√	√		√				21
	√	√			√			25
	√	√				√		29
	√	√					√	2D
	√		√	√				23
	√		√		√			27
	√		√			√		2B
	√		√				√	2F

Notes:
1. N.O. = normally open contact; N.C. = normally closed contact
2. Setting "24" is the factory default.
3. Set up the external fault function according to the following tree:



· PID Integral reset (Set value = 30)
Open: PID Integral values are added.
Closed: PID Integral value is set to zero.

· PID Control Integral Hold (Set value = 31) <1110>
Closed: Integral value of the PID control is held.

· DC Injection Braking Command (setting: "60")
When a DC injection braking command is input while the inverter is stopped, DC injection braking operation is activated. When a run command or a jog command is input, DC injection braking is released to start operation (operation has priority).

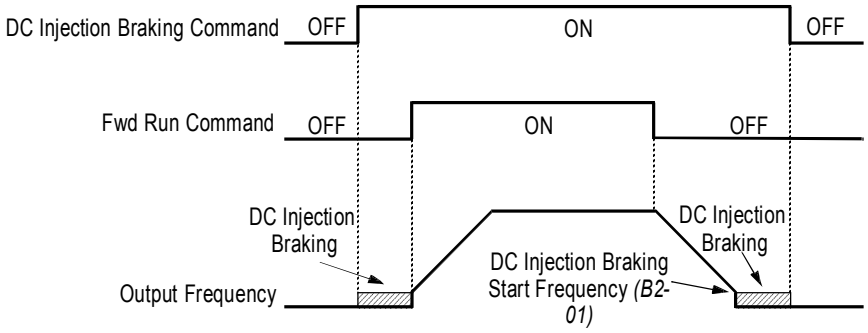
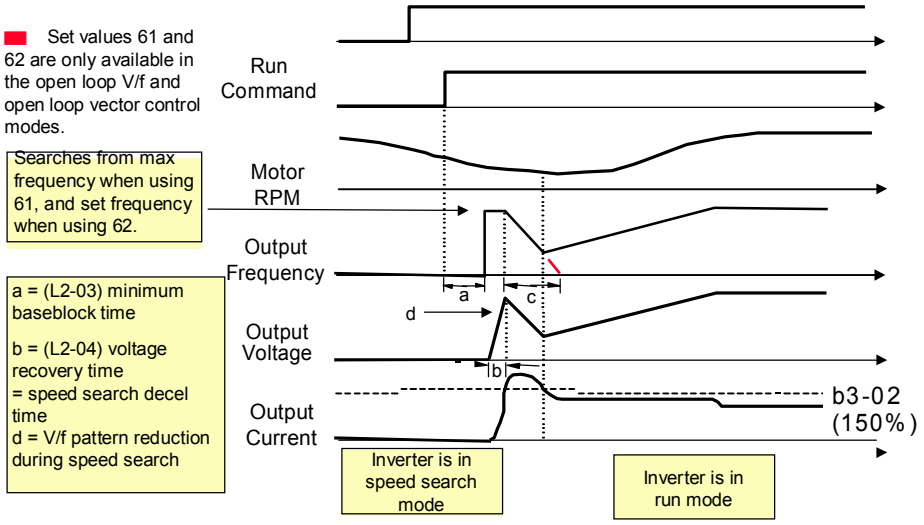


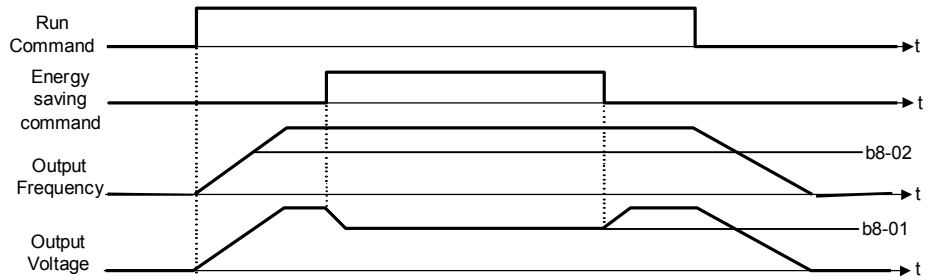
Figure 35 DC Injection Braking Contact Input Timing Diagram

·Speed Search 1 and Speed Search 2 (Set value = 61 and 62)

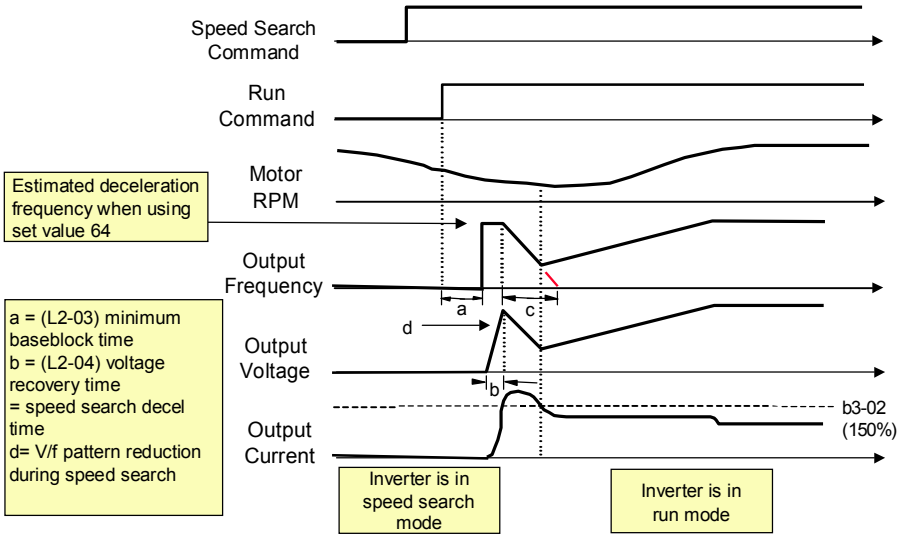


· Energy Save Mode (Set value = 63)

After the energy savings input is closed and the output frequency is equal to or greater than (b8-02) energy savings start frequency, the output voltage drops to the value in (b8-01) energy savings gain. The output voltage increases and decreases based on L2-04 (voltage recovery time).



· Speed Search 3 (Set value = 64)



V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

· KEB Ridethrough (settings: N.C. = “65”, N.O. = “66”)
In general applications, the Kinetic Energy Braking (KEB) control circuit attempts to maintain the DC bus voltage at an optimum level [1.35 × input voltage *(E1-01)*] during momentary power loss, by using load inertia to regenerate voltage back to the DC bus. The inverter decelerates at the fast-stop rate *(C1-09)*, until power is restored, or until the time runs out and an undervoltage fault (UV) occurs. The larger the inertia, the longer the deceleration rate can be extended. If the inertia is small, then the inverter must decelerate quickly to regenerate voltage back to the DC bus, and thus the ride- through time is shorter. For most applications, set KEB Frequency Constant *(L2-06)* to “0” (factory default).

·

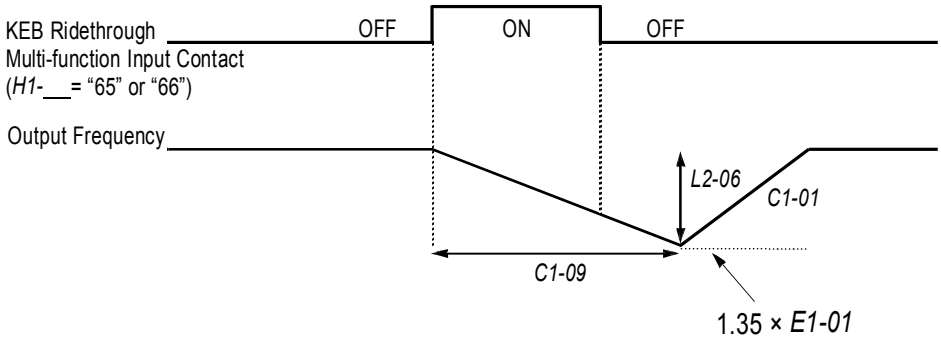


Figure 36 KEB Ridethrough Timing Diagram

Note: Larger model inverters (2022 and above, 4018 and above) require a separate uninterruptible power supply (UPS) for control power, in order for load inertia ridethrough to be effective.

H2 Digital Outputs

The KE200 Series has three multi-function contact outputs for the indication of various conditions, including frequency detection, speed agree, zero speed, overtorque detection, and many others. This section includes descriptions of these functions.

H2-01 Multi-function Output 1 Selection (terminal 9, 10) Terminal 9 Sel
H2-02 Multi-function Output 2 Selection (terminal 25, 27) Terminal 25 Sel
H2-03 Multi-function Output 3 Selection (terminal 26, 27) Terminal 26 Sel

B	B	B	B
B	B	B	B
B	B	B	B

The following table lists the function selections for the multi-function contact outputs (terminals 9, 25 and 26), and indicates the control modes during which each function can be enabled.

H2-01 to 3 Setting	Function	Control Method *(A1-02)*				Reference Page
		V/f	V/f w/ PG	Open Loop Vector	Closer Loop Vector	
0	During run 1 *(factory default, H2-01)*	√	√	√	√	
1	Zero-speed *(factory default, H2-02)*	√	√	√	√	
2	Frequency agree 1 *(factory default, H2-03)*	√	√	√	√	
3	Desired frequency agree 1	√	√	√	√	
4	Frequency detection 1	√	√	√	√	

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

H2-01 to 3 Setting	Function	Control Method *(A1-02)*				Reference Page
		V/f	V/f w/ PG	Open Loop Vector	Closer Loop Vector	
5	Frequency detection 2	√	√	√	√	
6	Inverter ready	√	√	√	√	
7	DC bus undervoltage	√	√	√	√	
8	Baseblock 1	√	√	√	√	
9	Option reference	√	√	√	√	
A	Remote operation	√	√	√	√	
B	Torque detection 1 (N.O.)	√	√	√	√	
C	Loss of reference	√	√	√	√	
D	DB overheat	√	√	√	√	
E	Fault	√	√	√	√	
F	Not used	-	-	-	-	
10	Minor fault	√	√	√	√	
11	Reset command active	√	√	√	√	
12	Timer output	√	√	√	√	
13	Frequency agree 2	√	√	√	√	
14	Desired frequency agree 2	√	√	√	√	
15	Frequency detection 3	√	√	√	√	
16	Frequency detection 4	√	√	√	√	
17	Torque detection 1 (N.C.)	√	√	√	√	
18	Torque detection 2 (N.O.)	√	√	√	√	
19	Torque detection 2 (N.C.)	√	√	√	√	
1A	Reverse direction	√	√	√	√	
1B	Baseblock 2	√	√	√	√	
1C	Motor 2 Selection	√	√	√	√	
1D	Regenerating	-	-	-	√	
1E	Restart enabled	√	√	√	√	
1F	Overload (OL1)	√	√	√	√	
20	OH pre-alarm	√	√	√	√	
30	Current/torque limit	-	-	√	√	
31	Speed limit	-	-	-	√	
33	Zero servo completion	-	-	-	√	
37	During run 2	√	√	√	√	

· During Run (setting: “0”)
Closes when a run command is input, or when the inverter outputs voltage.

· Zero-speed (setting: “1”)
Closes when the inverter output frequency is less than the minimum output frequency *(El-09)* during V/f control with PG feedback. Closes when the motor speed is less than the zero-speed level (B2-01) during close loop vector control

· Frequency Agree 1 (setting: "2")
Closes whenever the output frequency "agrees" with the frequency reference, plus or minus the speed agree detection width *(L4-02)*. This is effective during both forward *and* reverse operation.

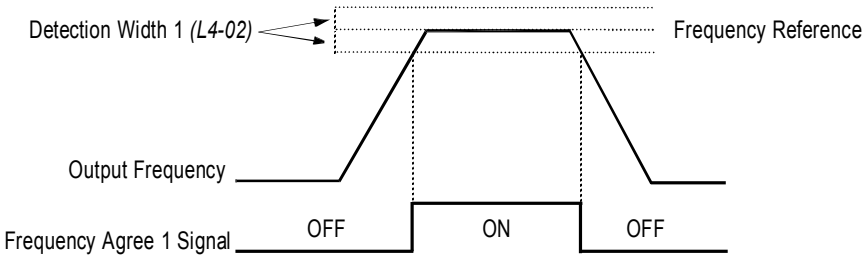


Figure 37 Frequency Agree Signal 1 Timing Diagram

· Desired Frequency Agree 1 (setting: "3")
Closes whenever the output frequency "agrees" with the speed agree detection level *(L4-01)*, plus or minus the speed agree detection width *(L4-02)*. This is effective during both forward *and* reverse operation.

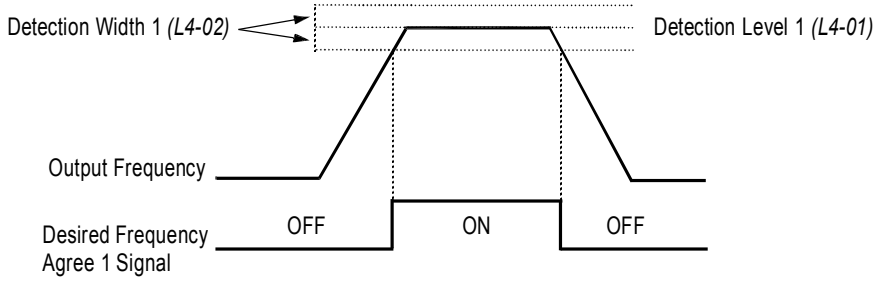


Figure 38 Desired Frequency Agree 1 Signal Timing Diagram

· Frequency Detection 1 (setting: "4")
Closes whenever the output frequency is at or below the speed agree detection level (L4-01). During acceleration from below the detection level, the output frequency increases through the detection bandwidth (L4-02) before the contact opens again. This is effective during both forward and reverse operation.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

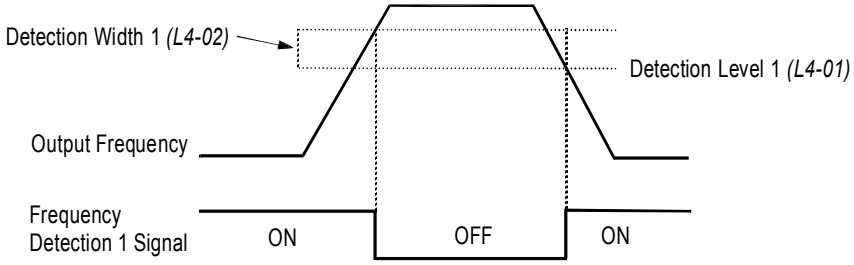


Figure 39 Frequency Detection 1 Signal Timing Diagram

· Frequency Detection 2 (setting: "5")
Closes whenever the output frequency is at or above the speed agree detection level *(L4-01)*. During deceleration from above the detection level, the output frequency decreases through the detection bandwidth *(L4-02)* before the contact opens again. This is effective during both forward *and* reverse operation.

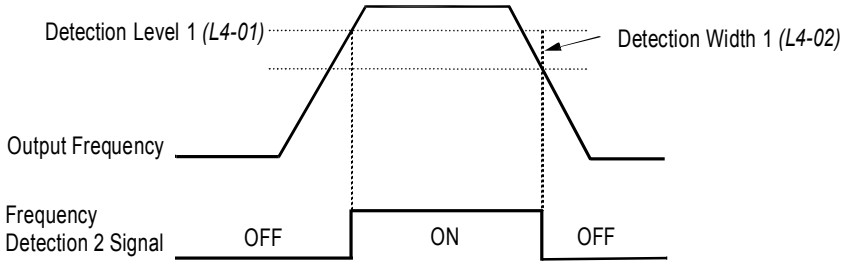


Figure 40 Frequency Detection 2 Signal Timing Diagram

· Inverter Ready (setting: "6")
Closes when the inverter is ready for operation (no faults or alarms).

· DC Bus Undervoltage (setting: "7")
Closes when the main circuit DC bus voltage or control circuit power supply is drops below the trip level, or when the main circuit magnetic contactor (MC) turns OFF.

· Baseblock 1 - N.O. (setting: "8")
Closes when the inverter output shuts OFF.

· Frequency Reference Selection (setting: "9")
Opens when the frequency reference is input from the control circuit terminals or an option.
Closes when the frequency reference is input from the digital operator.

· Run Command Selection (setting: "A")
Opens when run command is input from the control circuit terminals or an option.
Closes when run command is input from the digital operator.

· Overtorque Detection 1 - N.O. (setting: "B")
Closes during overtorque detection 1 (see section ***L6***, ***Overtorque Detection***, on page 113).

· Loss of Frequency Reference (setting: "C")
Closes when frequency reference is reduced by 90% within 400ms. The inverter will respond according to the setting of reference loss selection *(L4-05)*. After reference loss, if *L4-05* = "1", then operation continues at 80% of the previous frequency reference, and the contact closes.

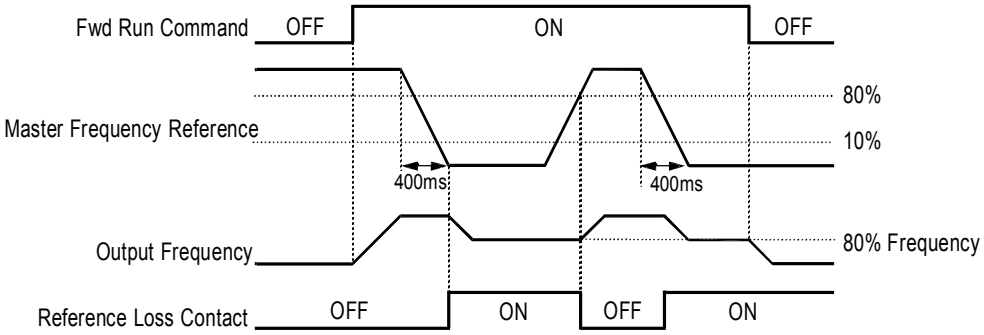


Figure 41 Reference Loss Timing Diagram

· Dynamic Braking Resistor Overheat (setting: "D")
Closes during braking resistor overheating or a braking transistor fault.

· Fault (setting: "E")
Closes when a fault occurs (except CPF00 and CPF01).

· Alarm (setting: "10")
Closes while an alarm is displayed.

· Fault Reset (setting: "11")
Closed while fault is being reset.

· Timer Output (setting: "12")
Closes when timer contact input closes (after On-delay time elapses).
Opens when timer contact input opens (after Off-delay time elapses).

· Frequency Agree 2 (setting: "13")
Closes whenever the output frequency "agrees" with the frequency reference, plus or minus the speed agree detection width *(L4-04)*. This is used for setting up an alternate detection width.

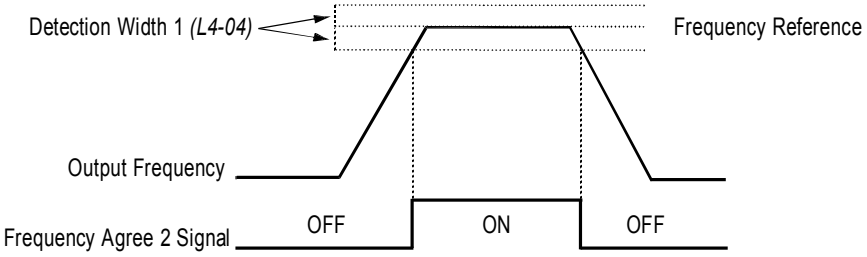


Figure 42 Frequency Agree Signal 2 Timing Diagram

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

· Desired Frequency Agree 2 (setting: “14”)
Closes whenever the output frequency “agrees” with the speed agree detection level *(L4-03)*, plus or minus the speed agree detection width *(L4-04)*. Choose forward or reverse operation in *L4-03*.

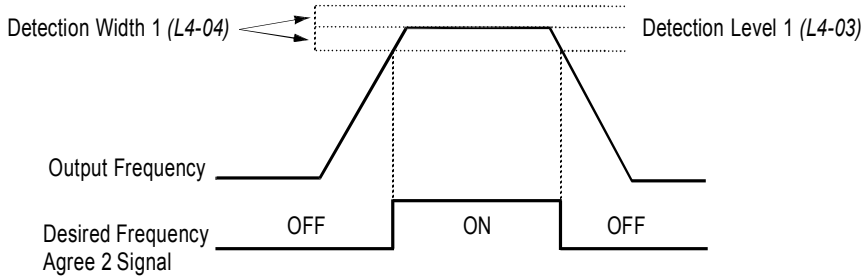


Figure 43 Desired Frequency Agree 2 Signal Timing Diagram

· Frequency Detection 3 (setting: “15”)
Closes whenever the output frequency is at or below the speed agree detection level *(L4-03)*. During acceleration from below the detection level, the output frequency increases through the detection bandwidth *(L4-04)* before the contact opens again. Choose forward or reverse operation in *L4-03*.

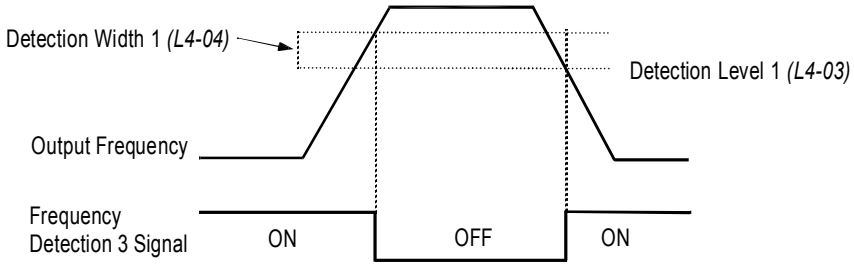


Figure 44 Frequency Detection 3 Signal Timing Diagram

· Frequency Detection 4 (setting: “16”)
Closes whenever the output frequency is at or above the speed agree detection level *(L4-03)*. During deceleration from above the detection level, the output frequency decreases through the detection bandwidth *(L4-04)* before the contact opens again. Choose forward or reverse operation in *L4-03*.

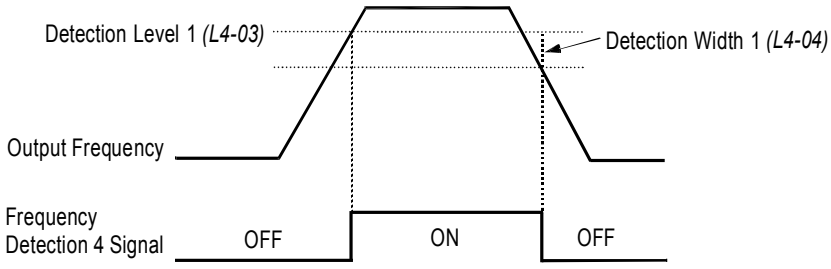


Figure 45 Frequency Detection 2 Signal Timing Diagram

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

· Overtorque Detection 1 - N.C. (setting: “17”)
Closes during overtorque detection 1 (see section ***L6***, ***Overtorque Detection***, on page 113).

· Overtorque Detection 2 - N.O. (setting: “18”)
Closes during overtorque detection 2 (see section ***L6***, ***Overtorque Detection***, on page 113).

· Overtorque Detection 2 - N.C. (setting: “19”)
Opens during overtorque detection 2 (see section ***L6***, ***Overtorque Detection***, on page 113).

· During Reverse Run (setting: “1A”)
Closes during a reverse run command.

· Baseblock 2 - N.C. (setting: “1B”)
Opens when the inverter output shuts OFF.

· Motor 2 Selection (setting: “1C”)
Closed when motor 2 is selected.
Motor 2 may be selected by using a multi-function digital input.

· Motoring/Regenerating Mode (setting: “1D”)
Closes during regenerative operation (close loop vector control only).

· Automatic Restart (setting: “1E”)
Closes during automatic restart operation.

· OL1 Pre-alarm (setting: “1F”)
Closes when the motor-calculated electronic thermal overload value increases to 90% of the internal fault detection level.

· OH Pre-alarm (setting: “20”)
Closes when the heatsink temperature exceeds the overheat temperature level *(L8-02)*, or when a multi-function contact input (*H1-__* = “B”) closes.

· Current/Torque Limit (setting: “30”)
Closes during torque limit.

· Speed Limit (setting: “31”)
Closes when the speed limit level *(D5-03)* is reached during torque control (close loop vector control).

· Zero-Servo Completion (setting: “33”)
Closes when zero-servo operation is completed.

· During Run 2 (setting: “37”)
Closes when a run command is input (does *not* close during baseblock, injection braking or initial excitation).

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

H3 Analog Inputs

The KE200 series has three analog inputs (two multi-function and one reference), for the external input of numerous references and limits, including frequency, torque, PID, and others. This section includes descriptions of these functions.

H3-01 Terminal 13 Signal Selection *Term 13 Signal*

B	B	B	B

Selects the type of voltage signal input at terminal 13.

Setting	Description
0	0 to 10V input *(factory default)*
1	-10 to +10V input

The resolution of terminal 13 is 11 bit.

H3-02 Terminal 13 Reference % Gain *Terminal 13 Gain*

B	B	B	B

Setting Range: 0.0 to 1000.0%
Factory Default: 100.0%

Sets the terminal 13 input gain level when the reference voltage is 10V.

H3-03 Terminal 13 Reference ±% Bias *Terminal 13 Bias*

B	B	B	B

Setting Range: -100.0 to 100.0%
Factory Default: 0.0%

Sets the terminal 13 input bias level when the reference voltage is 0V.

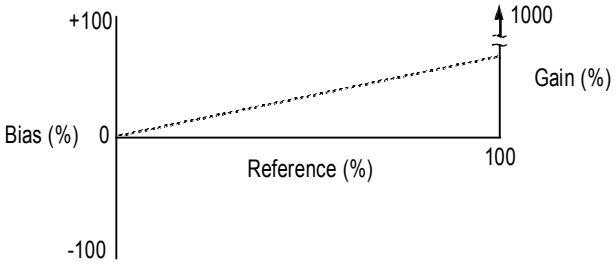


Figure 46 Analog Input Gain and Bias Adjustment

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

H3-04 Terminal 16 Signal Selection *Terminal 16 Sel*

B	B	B	B

Selects the type of voltage signal input at terminal 16.

Setting	Description
0	0 to 10V input *(factory default)*
1	-10 to +10V input

The resolution of terminal 16 is 11 bit.

H3-05 Terminal 16 Multi-function Selection *Terminal 16 Sel*

B	B	B	B

The following table lists the function selections for the multi-function analog inputs (terminals 14 and 16), and indicates the control modes during which each function can be enabled.

Setting	Function	Control Method *(A1-02)*				Setting Level
		V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
0	Aux. Frequency Ref. *(factory default)*	√	√	√	√	±100% / ±10V
1	Frequency Gain	√	√	√	√	100% / 10V
2	Frequency Bias	√	√	√	√	±100% / ±10V
4	Voltage Bias	√	√	-	-	100% / 10V
5	Accel/Decel Change	√	√	√	√	100% / 1V
6	DC Injection Braking Current	√	√	√	-	100% / 10V
7	Overtorque Level	√	√	√	√	100% / 10V
8	Stall Prevention Level	√	√	-	-	100% / 10V
9	Reference Lower Limit	√	√	√	√	100% / 10V
A	Jump Frequency	√	√	√	√	100% / 10V
B	PID Feedback	√	√	√	√	±100% / ±10V
C	PID Reference Bias <1110>	√	√	√	√	10V/Fmax
D	Frequency Reference Bias 2 <1110>	√	√	√	√	10V/Fmax
10	Forward Torque Limit	-	-	√	√	100% / ±10V
11	Reverse Torque Limit	-	-	√	√	100% / ±10V
12	Regenerative Torque Limit	-	-	√	√	100% / ±10V
13	Torque Reference	-	-	-	√	±100% / ±10V
14	Torque Compensation	-	-	-	√	±100% / ±10V
15	Forward/Reverse Torque Limit	-	-	√	√	±100% / 10V
1F	Not Used	-	-	-	-	-

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

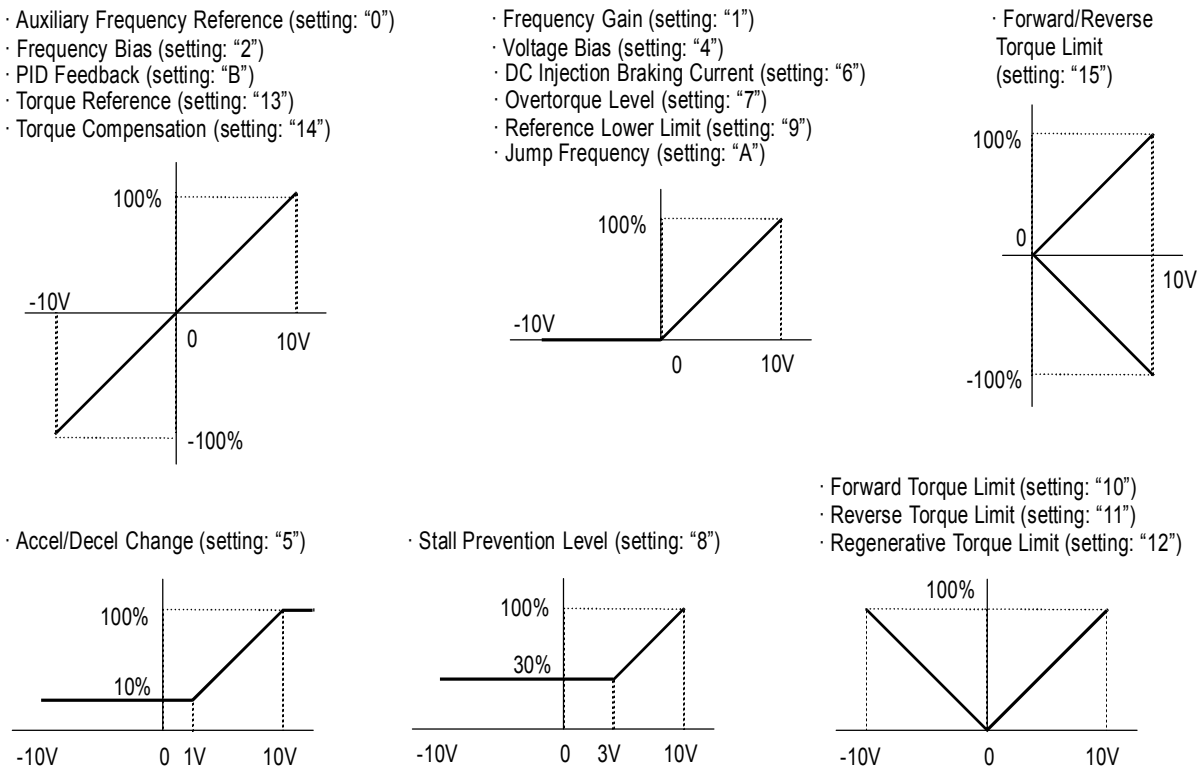


Figure 47 Multi-function Analog Input Selection

H3-06 Terminal 16 Reference % Gain *Terminal 16 Gain*

B	B	B	B

Setting Range: 0.0 to 1000.0%
Factory Default: 100.0%

Sets the terminal 16 input gain level when the reference voltage is 10V. See Figure 46, on page 95.

H3-07 Terminal 16 Reference ±% Bias *Terminal 16 Bias*

B	B	B	B

Setting Range: -100.0 to 100.0%
Factory Default: 0.0%

Sets the terminal 16 input bias level when the reference voltage is 0V. See Figure 46, on page 95.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

H3-08 Terminal 14 Signal Selection *Term 14 Signal*

A	A	A	A

Selects the type of signal input at terminal 14.

Setting	Description
0	0 to 10V input
1	-10 to +10V input
2	4 to 20mA *(factory default)*

The resolution of terminal 14 is 10 bit.

Note: To enable terminal 14 for a voltage signal (settings: "0" or "1"), cut jumper wire J1 on the control printed circuit board. J1 is located on the bottom left-hand corner of the control board directly behind terminal 13.

H3-09 Terminal 14 Multi-function Selection *Terminal 14 Sel*

A	A	A	A

Selects the multi-function analog input function for terminal 14 (see Terminal 16 Multi-function Selection for details).

H3-10 Terminal 14 Reference % Gain *Terminal 14 Gain*

A	A	A	A

Setting Range: 0.0 to 1000.0%
Factory Default: 100.0%

Sets the terminal 14 input gain level when the reference current is 20mA. See Figure 46, on page 95.

H3-11 Terminal 14 Reference ±% Bias *Terminal 14 Bias*

A	A	A	A

Setting Range: -100.0 to 100.0%
Factory Default: 0.0%

Sets the terminal 14 input bias level when the reference current is 4mA. See Figure 46, on page 95.

H3-12 Analog Input Filter Time Constant *Filter Avg Time*

A	A	A	A

Setting Range: 0.00 to 2.00s
Factory Default: 0.00s

Sets up a delay filter time constant at terminals 13, 14 and 16. This filter inserts a delay between the time the command is input to the time it is received by the inverter.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

H4 Analog Outputs

The KE200 Series has two analog outputs, for the external monitoring of drive conditions such as output frequency, output current, PID feedback and others.

H4-01 Terminal 21 Analog Output Selection *Terminal 21 Sel*

B	B	B	B

Selects the analog output monitors for terminal 21.

Setting	Description
1	Frequency reference
2	Output frequency *(factory default)*
3	Inverter output current
5	Motor speed
6	Output voltage
7	DC bus voltage
8	Output power
9	Torque reference (internal)
15	Terminal 13 input voltage level
16	Terminal 14 input voltage or current level
17	Terminal 16 input voltage level
18	Motor secondary current (Iq)
19	Motor excitation current (Id)
20	SFS output frequency
21	ASR input
22	ASR output
23	Speed deviation
24	PID feedback
26	Voltage reference (Vq output)
27	Voltage reference (Vd output)
32	ACR (q) Output
33	ACR (d) Output
36	PID Input Monitor <1110>
37	PID Output Monitor<1110>
38	PID Setpoint Monitor <1110>

The resolution of terminal 21 is 9 bit plus sign.

H4-02 Terminal 21 Analog Output Gain *Terminal 21 Gain*

B	B	B	B

Setting Range: 0.00 to 2.50
Factory Default: 1.00

Sets the terminal 21 output gain for the analog output monitors. To obtain the output level, multiply the monitor output level by the gain value set in *H4-02*.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

H4-03 Terminal 21 Analog Output Bias *Terminal 21 Bias*

B	B	B	B

Setting Range: -10.0 to 10.0%
Factory Default: 0.0%

Sets the terminal 21 output bias for the analog output monitors. To obtain the output level, multiply the monitor output level by the gain value set in *H4-02*, then add the bias value set in *H4-03*.

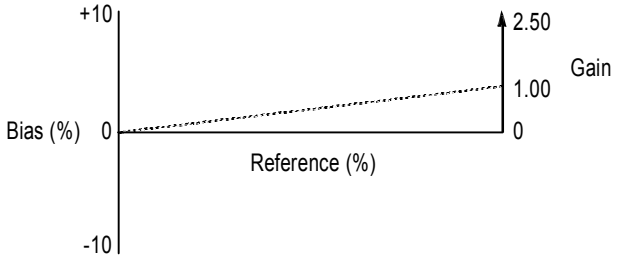


Figure 48 Analog Output Gain and Bias Adjustment

H4-04 Terminal 23 Analog Output Selection *Terminal 23 Sel*

B	B	B	B

Selects the analog output monitors for terminal 23 (see Terminal 21 Analog Output Selection). The resolution of terminal 23 is 9 bit plus sign.

H4-05 Terminal 23 Analog Output Gain *Terminal 23 Gain*

B	B	B	B

Setting Range: 0.00 to 2.50
Factory Default: 1.00

Sets the terminal 23 output gain for the analog output monitors. To obtain the output level, multiply the monitor output level by the gain value set in *H4-05*. See Figure 48.

H4-06 Terminal 23 Analog Output Bias *Terminal 23 Bias*

B	B	B	B

Setting Range: -10.0 to 10.0%
Factory Default: 0.0%

Sets the terminal 23 output bias for the analog output monitors. To obtain the output level, multiply the monitor output level by the gain value set in *H4-05*, then add the bias value set in *H4-06*. See Figure 48.

H4-07 Analog Output Signal Selection *AO Level Select*

B	B	B	B

Selects the type of voltage signal output at terminals 21 and 23.

Setting	Description
0	0 to 10V input *(factory default)*
1	-10 to +10V input

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

H5 Serial Communication Set-up

The inverter uses communication port 6CN to communicate via MODBUS protocol.

H5-01 Serial Communication Station Address *Serial Comm Adr*

A	A	A	A

Setting Range: 0 to 1F
Factory Default: 1F

Selects a station address for identification of the inverter during serial communication.

H5-02 Serial Communication Baud Rate *Serial Baud Rate*

A	A	A	A

Selects the baud rate at which the inverter serially communicates with external devices.

Setting	Description
0	1200 Baud per Second
1	2400 Baud per Second
2	4800 Baud per Second
3	9600 Baud per Second *(factory default)*
4	19200 Baud <1110>

H5-03 Serial Communication Parity Selection *Serial Com Sel*

A	A	A	A

Selects the transmission parity for the 6CN MODBUS port.

Setting	Description
0	No parity *(factory default)*
1	Even parity
2	Odd parity

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

H5-04 Stopping Method After Communication Error *Serial Fault Sel*

A	A	A	A

Selects the stopping method after a transmission error is detected.

Setting	Description
0	Ramp to stop according to the time set in *C1-02*.
1	Fast-stop according to the time set in *C1-09*.
2	Coast to stop
3	Alarm only, continuous operation *(factory default)*

H5-05 MODBUS Time Out Detection *Serial Fault Dtct*

A	A	A	A

H5-05 enables or disables the MODBUS time out detection function. After initial communication begins, if communication is interrupted for longer than 2 seconds, then a communication fault will occur.
During a communication fault, the following fault code will be displayed: “CE Memobus Com Err”.

Setting	Description
0	Disabled - Time out detection is disabled.
1	*Enabled - Time out detection is enabled.*

L Protection Parameters

L1 Motor Overload

The KE200 Series protects against motor overload with a UL-recognized, built-in electronic thermal overload function.

L1-01 Motor Protection Fault Selection (OL1) *MOL Fault Select*

B	B	B	B

Selects whether motor overload protection is provided.

Setting	Description
0	Motor overload detection is disabled.
1	Motor overload detection is enabled, motor coasts to stop *(factory default)*.

The electronic thermal overload function estimates motor temperature, based on inverter output current and time, to protect the motor from overheating. When the electronic thermal overload relay is activated, an “OL1” error occurs, shutting OFF the inverter output and preventing excessive overheating in the motor. As long as the inverter is powered up, it continues to calculate the motor temperature.

When operating with one inverter connected to one motor, an external thermal relay is not needed.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

When operating several motors with one inverter, install a thermal relay on each motor. In this case, set parameter *L1-01* to "0".

L1-02 Motor Protection Time Constant *MOL Time Const*

B	B	B	B

Setting Range: 0.1 to 20.0 minutes <1110>
Factory Default: 8.0 minutes

Sets the amount of time that the motor withstands 150% overload, when the motor is operated continuously at rated current. This value should be set according to the overload resistance of motors used.

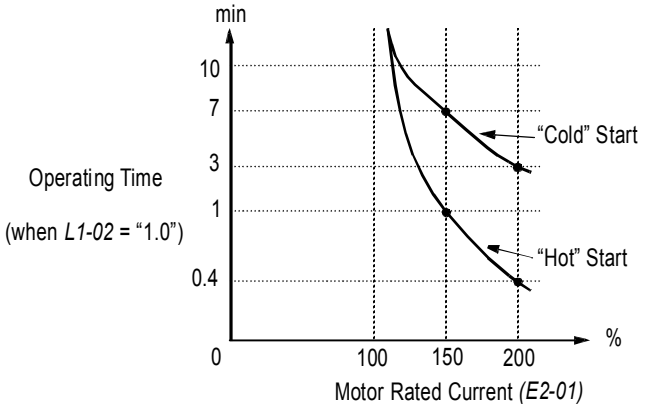


Figure 49 Electronic Thermal Overload Curve

Notes:
1. If the motor is running at 100% output current or less, the electronic thermal overload relay will *not* trip. (continued next page)
2. If the motor is run continuously at 150% output current, the electronic thermal overload relay will trip after one minute if the motor is started "hot", and after eight minutes if the motor is started "cold".

L2 Power Loss Ridethrough

When momentary power loss occurs, operation can restart automatically, according to the setting of the following parameters.

L2-01 Momentary Power Loss Ridethrough Selection *PwrL Selection*

B	B	B	B

Selects whether the inverter stops when power loss is detected or "rides through" a momentary power loss. When ridethrough operation is selected, speed search starts from the current output frequency.

Setting	Description
0	Momentary power loss ridethrough is disabled *(factory default)*. When momentary power loss is detected, a fault contact trips, stopping the inverter.
1	Momentary power loss ridethrough is enabled, for the time set in *L2-02*. When momentary power loss is detected, a fault contact does *not* trip. If power is not restored within the time set in L2-02, a fault contact trips, stopping the inverter.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

Setting	Description
2	Momentary power loss ridethrough is enabled, within the control logic time, regardless of the time set in *L2-02*. The control logic time differs depending on inverter capacity.

L2-02 Momentary Power Loss Ridethrough Time *PwrL RideThru t*

B	B	B	B

Setting Range: 0.0 to 2.0s
Factory Default: Inverter model dependent

Sets the ridethrough time allowed before the inverter trips, after momentary power loss. This setting is activated when *L2-01* is set to "1". If power is restored within this time, operation restarts automatically. If power is not restored within this time, a fault contact trips, stopping the inverter.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

L2-03 Minimum Baseblock Time *PwrL Baseblock t*

B	B	B	B

Setting Range: 0.1 to 5.0s
Factory Default: Inverter model dependent

After momentary power loss has occurred, the motor may have residual voltage. This can cause excess current to be drawn by the motor when operation restarts, and can trip the inverter. The minimum baseblock time allows the inverter to wait for this residual voltage to dissipate before restarting. This is only effective when *L2-02* is set to "1"or "2".

After momentary power loss:
· If the minimum baseblock time *(L2-03)* is greater than the power loss ridethrough time (*L2-02* or control logic time), then operation restarts after the minimum baseblock time elapses.
· If the minimum baseblock time is less than the power loss ridethrough time, then operation restarts after the power loss ridethrough time elapses.

L2-04 Voltage Recovery Time *PwrL V/f Ramp t*

A	A	A	A

Setting Range: 0.0 to 5.0s
Factory Default: Inverter model dependent

When operation restarts after momentary power loss, speed search is activated in order to detect the motor speed. After speed search is complete, the time for the output voltage to increase to its previous level (before power loss) is defined by the voltage recovery time.

L2-05 Undervoltage Detection Level *PUV Det Level*

A	A	A	A

Setting Range: 150 to 210V (230V class), 300 to 420V (460V class)
Factory Default: 190V (230V class), 380V (460V class)

Sets the inverter main circuit DC bus undervoltage level.
When setting this value less than the factory default, it is necessary to install an AC reactor on the input side. The AC reactor reduces peak current input to the inverter and smooths out the DC bus current ripple when operating at low voltages.

L2-06 Kinetic Energy Braking Frequency Constant *KEB Frequency*

A	A	A	A

Setting Range: 0 to 100%
Factory Default: 0%
This parameter allows for setting the load inertia ridethrough level, as a percentage of output frequency. This setting is used in conjunction with multi-function contact inputs set for KEB ridethrough (H1-__= "65" or "66"), after momentary power loss. When the KEB frequency constant is set to "0", KEB ridethrough functions as normal, to maintain a controlled deceleration rate for the longest time possible, during a momentary power loss (see section H1, Digital Inputs, on page 76 for more details). When the KEB frequency constant is set to any value other than "0", KEB ridethrough for systems use is enabled.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

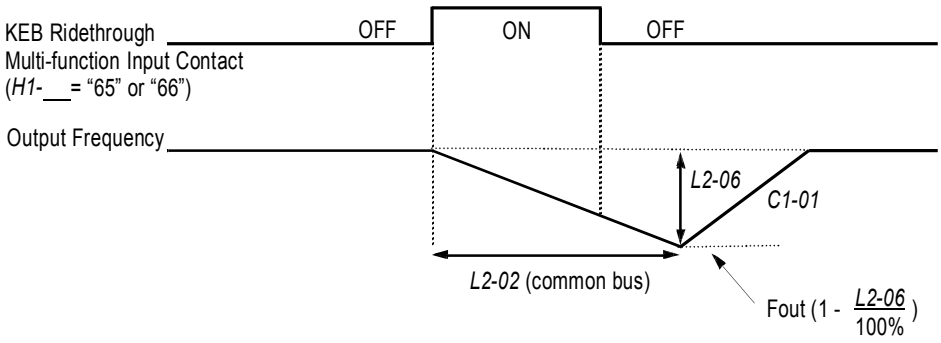


Figure 50 KEB Ridethrough Timing Diagram

In system applications requiring multiple drives with a common DC bus, KEB ride-through functions differently. The inverter decelerates from the output frequency to the KEB frequency level, according to the momentary power loss ridethough time *(L2-02)*. The KEB frequency constant *(L2-06)* is set according to the following equation:

$$\text{KEB Frequency Level} = \text{Output Frequency}\left(1 - \frac{L2\text{-}06}{100\%}\right)$$

This method is ideal when helper drives are being used on a film line, and a loss of power might cause a line break. This method will allow synchronized deceleration for all of the common-bus drives, to prevent speed deviation and thus a possible line break. If power is restored within the recovery time (L2-02), then the inverter accelerates to the previous frequency reference according to acceleration time 1 (C1-01).

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

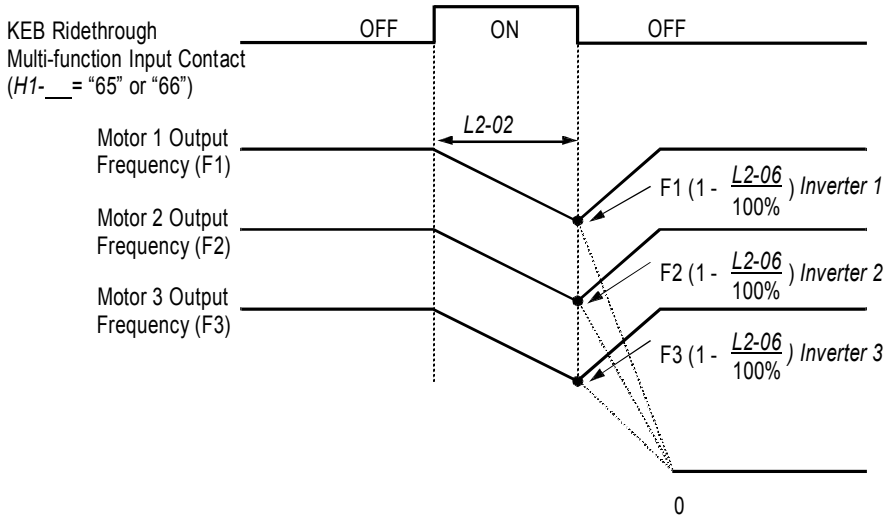


Figure 51 KEB Ridethrough - Common DC Bus Applications

Note: Enabling KEB ridethrough overrides the momentary power loss ride-through selection *(L2-01)*.

L3 Stall Prevention/Current Limit

This function automatically adjusts the output frequency, acceleration and/or deceleration rates in order to continue operation without tripping or "stalling" the inverter.

L3-01 Stall Prevention Selection During Acceleration StallP Accel Sel

B	B	B	-

Enables/disables stall prevention/current limit during acceleration.

Setting	Description
0	Stall prevention/current limit during acceleration is disabled. The inverter increases the output frequency at the set acceleration rate. If the acceleration rate is too fast for the load condition, the inverter may trip on overcurrent (OC) or overload (OL).
1	Stall prevention/current limit during acceleration is enabled *(factory default)*. The acceleration rate is automatically reduced according to motor current to prevent stalling during acceleration. The acceleration time may be longer than the set value *(C1-01)*.
2	Stall prevention/current limit during acceleration is enabled, with an *intelligent* acceleration mode. By monitoring motor current, the acceleration rate is automatically adjusted so that acceleration can be completed in the shortest amount of time, regardless of the set acceleration time.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

L3-02 Stall Prevention Level During Acceleration *StallP Accel Lvl*

B	B	B	-

Setting Range: 0 to 200%
Factory Default: 150%

The stall prevention/current limit level during acceleration is set as a percentage of inverter rated current. A setting of 200% disables current limit during acceleration. During acceleration, if the output current exceeds this current limit level *(L3-02)*, acceleration stops and frequency is maintained. When the output current decreases below this current limit level *(L3-02)*, acceleration restarts.

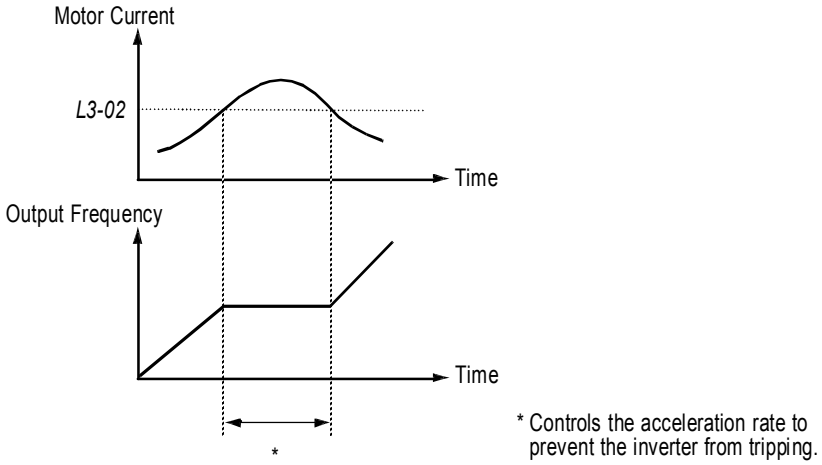


Figure 52 Stall Prevention/Current Limit During Acceleration

L3-03 Stall Prevention Limit (constant output area) *StallP CHP Level*

A	A	A	-

When a motor is used in the constant output area (constant HP), output frequency max. voltage output frequency *(E1-06)*. In this area, the stall prevention/current limit level during acceleration is automatically reduced for smoother acceleration. This parameter limits the stall prevention/current limit level during acceleration in the constant output area so that it does not decrease unnecessarily. The current limit level during acceleration is changed according to the following equation:

$$\text{Current Limit Level During Accel in Constant Output Area} = \text{Current Limit Level During Acceleration } \textit{(L3-02)} \times \frac{\text{Max. Voltage Output Frequency } \textit{(E1-06)}}{\text{Output Frequency}}$$

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

L3-04 Stall Prevention Selection During Deceleration StallP Decel Sel

B	B	B	B

If deceleration times are set too short for load conditions, the inverter automatically extends the deceleration time according to the main circuit DC bus voltage level. When using an optional braking resistor for the KE200 series, set parameter L3-04 to ”0”.

Setting	Description
0	Stall prevention during deceleration is disabled. An excessively short deceleration time will generate an overvoltage fault (OV), and the inverter will stop.
1	Stall prevention during deceleration is enabled *(factory default)*. The DC bus voltage level is monitored, and the deceleration rate is automatically extended to prevent an overvoltage condition. This deceleration rate may be longer than the set value *(C1-02)*.
2	Stall prevention during deceleration is enabled, with an *intelligent* deceleration mode. By monitoring DC bus voltage, the deceleration rate is automatically adjusted so that deceleration can be completed in the shortest amount of time, regardless of the set deceleration time.
3	Overvoltage (OV) countermeasure during deceleration (with braking resistor installed). Improves stall prevention during deceleration. Overvoltage (OV) sometimes occurs even under settings 1 or 2 above. The rising of the DC bus voltage is limited during fast deceleration of the motor. This feature allows a faster than normal decel time. *Note: When in vector mode setting 3 cannot be used with braking resistor and with stall prevention.*

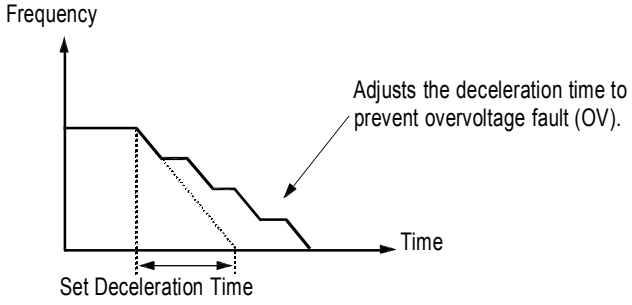


Figure 53 Stall Prevention During Deceleration

Note: Intelligent stall prevention during deceleration (*L3-04* = “2”) cannot be set in the vector control modes (when *A1-02* = “2” or “3”).

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

L3-05 Stall Prevention Selection During Running *StallP Run Sel*

B	B	-	-

Sets a function to prevent stalling during an overload condition while running at constant speed.

Setting	Description
0	Stall prevention/current limit during running is disabled. An excessively short deceleration time will generate an overvoltage fault (OV), and the inverter will stop.
1	Stall prevention/current limit during running is enabled *(factory default)*. When the inverter output current exceeds the current limit level *(L3-06)* for more than 100ms during speed agree, the output frequency is decreased according to deceleration time 1 *(C1-02)*, and this can prevent stalling. When the load condition is stabilized, the inverter accelerates to the previous frequency.
2	Stall prevention/current limit during running is enabled as in setting "1", however the output frequency is decreased according to deceleration time 2 *(C1-04)*.

L3-06 Stall Prevention Level During Running *StallP Run Lvl*

B	B	-	-

Setting Range: 30 to 200%
Factory Default: 160%

The stall prevention/current limit level during running is set as a percentage of inverter rated current. A setting of 200% disables current limit during running. During speed agree, if the output current exceeds this current limit level during running, then deceleration starts.
When the output current exceeds this current limit level (L3-06), deceleration continues. When the output current decreases below this current limit level (L3-06), acceleration starts, up to the set frequency.

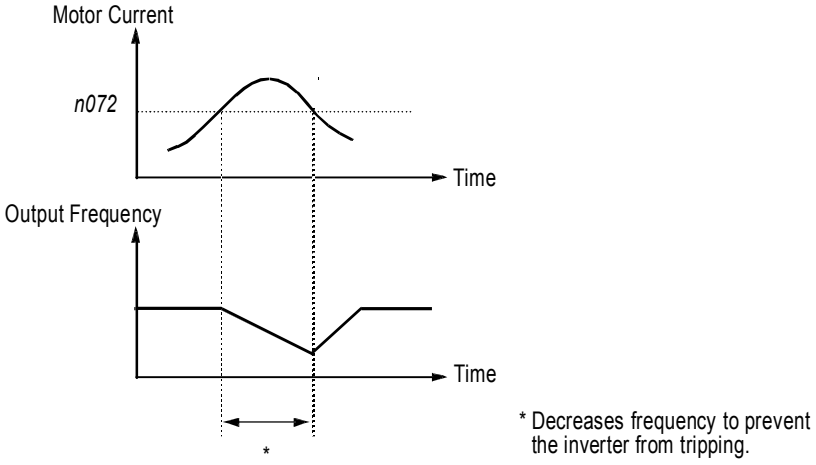


Figure 54 Stall Prevention/Current Limit During Running

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

L4 Reference Detection

The KE200 series utilizes three different functions for detecting output frequency:

- When frequency agree is enabled at the multi-function contact outputs (*H2-__* = "2" or "13"), the contact closes whenever the output frequency "agrees" with the frequency reference, plus or minus the speed agree detection width.
- When desired frequency agree is enabled at the multi-function contact outputs (*H2-__* = "3" or "14"), the contact closes whenever the output frequency "agrees" with the speed agree detection level, plus or minus the speed agree detection width.
- When frequency detection is enabled at the multi-function contact outputs (*H2-__* = "4", "5", "15" or "16"), the contact closes whenever the output frequency is less than or more than the speed agree detection level, depending on which detection is selected.

Refer to section ***H2***, ***Digital Outputs*** on page 88, for more detailed information on setting these functions.

L4-01 Speed Agree Detection Level (without sign) *Spd Agree Level*

B	B	B	B

Setting Range: 0.0 to 400.0Hz
Factory Default: 0.0Hz

Sets the detection level for the desired frequency agree 1 and frequency detection 1 and 2 functions. The set detection level is effective during both FWD and REV operation.

L4-02 Speed Agree Detection Width *Spd Agree Width*

B	B	B	B

Setting Range: 0.0 to 20.0Hz
Factory Default: 2.0Hz

Sets the detection width for frequency and desired frequency agree 1 and frequency detection 1 and 2 functions.

L4-03 Speed Agree Detection Level (with sign) *Spd Agree Lvl+-*

A	A	A	A

Setting Range: 0.0 to ±400.0Hz
Factory Default: 0.0Hz

Sets the detection level for the desired frequency agree 2 and frequency detection 3 and 4 functions. The set detection level is effective during either FWD or REV operation, depending on the set detection level (positive value for FWD operation, negative value for REV operation).

L4-04 Speed Agree Detection Width *Spd Agree Width+-*

A	A	A	A

Setting Range: 0.0 to 20.0Hz
Factory Default: 2.0Hz

Sets the detection width for frequency and desired frequency agree 2 and frequency detection 3 and 4 functions.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

L4-05 Operation When Frequency Reference Loss *Ref Loss Sel*

A	A	A	A

Selects operation when the frequency reference from the control circuit terminal is reduced by 90% within 400ms.

Setting	Description
0	Stop *(factory default)*.
1	Run at 80% of the previous frequency reference.

L5 Automatic Restart

After a fault occurs, the inverter and its fault detection circuit can be reset. The automatic restart function allows the inverter to continue operation after certain faults.

L5-01 Number of Automatic Restart Attempts *Num of Restarts*

B	B	B	B

Setting Range: 0 to 10
Factory Default: 0

Sets the number of automatic restart attempts. Setting to "0" disables this function.

Automatic Restart Operation

- When a fault is detected, the inverter output shuts OFF for the minimum baseblock time *(L2-03)*. The digital operator displays the fault while the inverter output is shut OFF.
- While the minimum baseblock time elapses, the fault is reset automatically and speed search starts from the previous output frequency before the fault occurred.
- When the total number of faults exceeds the number of automatic restart attempts, the faults are *not* reset automatically and the inverter output remains OFF. At this time, a fault contact output is activated.

The inverter can be set to automatically restart after the following faults occur:

- Overcurrent (OC)
- Overvoltage (OV)
- Undervoltage PUV (UV1)
- Ground fault (GF)
- Regenerative transistor fault (rr)

However, automatic restart is not available for the following faults:

- Control circuit undervoltage (UV2)
- MC answer-back fault (UV3)
- Load short-circuit (SC)
- Heatsink overheat (OH)
- Run command fault (EF)
- Overspeed (OS)
- Excessive speed deviation (DEV)
- PG disconnection (PGO)
- Parameter setting error (OPR)
- Communication error (CE)
- External fault (EF3 to EF8)

The number of restart attempts is reset to 0 when:

- A fault does not occur for more than 10 minutes after restart.
- A fault reset command is input from the control circuit terminal or the digital operator.
- Power is cycled.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

L5-02 Automatic Restart Operation Selection *Restart Sel*

B	B	B	B

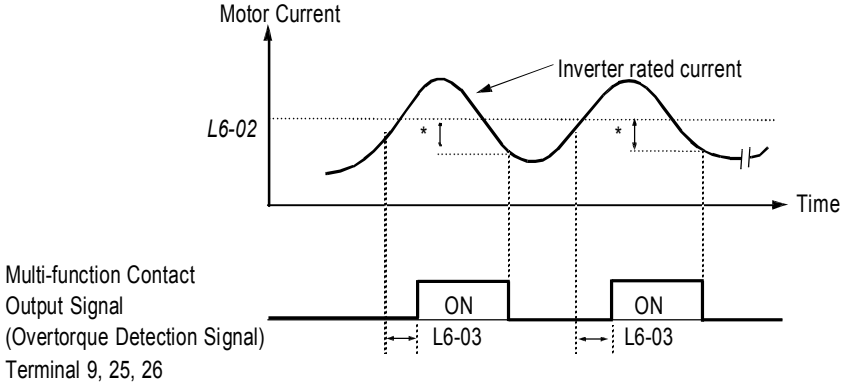
Selects whether a fault contact output is activated during automatic restart.

Setting	Description
0	No fault relay *(factory default)*
1	Fault relay active

L6 Torque Detection

The overtorque detection circuit activates when the motor load causes the motor current (or torque during vector control) to exceed the overtorque detection level *(L6-02)*. When an overtorque condition is detected, alarm signals are sent to multi-function output terminals 9, 25 and 26.

To output an overtorque detection signal, select torque detection 1 at either of the multi-function contact outputs (*H2-__* = "B" or "17"). Refer to section ***H2***, ***Digital Outputs*** on page 88, for more details.



Release width (hysteresis) during overtorque detection is 5% of the inverter rated current level.

Figure 55 Overtorque Characteristics Timing Diagram

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

L6-01 Overtorque Detection 1 Selection *Torq Det 1 Sel*

B	B	B	B

Activates overtorque detection, and selects whether detection generates an alarm or a fault.

Setting	Description
0	Overtorque detection is disabled *(factory default)*.
1	Overtorque detection is enabled whenever at the speed agree level (when inverter is not accelerating or decelerating). Continue running after detection (OL3 alarm).
2	Overtorque detection is enabled always. Continue running after detection (OL3 alarm).
3	Overtorque detection is enabled whenever at the speed agree level. Coast to a stop after detection (OL3 fault).
4	Overtorque detection is enabled always. Coast to a stop after detection (OL3 fault).

L6-01 Notes:

1. To detect torque during acceleration or deceleration, set to “2” or “4”.
2. To continue operation after overtorque detection, set to “1” or “2”. During detection, the digital operator displays an “OL3” alarm (blinking).
3. To stop the inverter after an overtorque detection fault, set to “3” or “4”. During detection, the digital operator displays an “OL3” fault.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

L6-02 Overtorque Detection 1 Level *Torq Det 1 Lvl*

B	B	B	B

Setting Range: 0 to 300%
Factory Default: 150%

Sets the overtorque detection level as a percentage of inverter rated current, during V/f control, and motor rated torque, during vector control.

L6-03 Overtorque Detection 1 Time *Torq Det 1 Time*

B	B	B	B

Setting Range: 0.0 to 10.0s
Factory Default: 0.1s

The overtorque detection delay time inserts a delay, between the time motor current (or torque) exceeds the overtorque detection level *(L6-02)* and when the overtorque detection function is enabled. The digital operator then displays "OL3".

L6-04 Overtorque Detection 2 Selection *Torq Det 2 Sel*

A	A	A	A

Activates overtorque detection 2, and selects whether detection generates an alarm or a fault.

Setting	Description
0	Overtorque detection is disabled *(factory default)*.
1	Overtorque detection is enabled whenever at the speed agree level (when inverter is not accelerating or decelerating). Continue running after detection (OL4 alarm).
2	Overtorque detection is enabled always. Continue running after detection (OL4 alarm).
3	Overtorque detection is enabled whenever at the speed agree level. Coast to a stop after detection (OL4 fault).
4	Overtorque detection is enabled always. Coast to a stop after detection (OL4 fault).

Overtorque detection 2 functions the same as overtorque detection 1 *(L6-01)*, except that "OL4" is displayed on the digital operator instead. This function is used when two types of detection are output to the multi-function output terminals.

L6-05 Overtorque Detection 2 Level *Torq Det 2 Lvl*

A	A	A	A

Setting Range: 0 to 300%
Factory Default: 150%

Sets the second overtorque detection level as a percentage of inverter rated current, during V/f control, and motor rated torque, during vector control.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

L6-06 Overtorque Detection 2 Time *Torq Det 2 Time*

A	A	A	A

Setting Range: 0.0 to 10.0s
Factory Default: 0.1s

The overtorque detection 2 delay time inserts a delay, between the time motor current (or torque) exceeds the overtorque detection level *(L6-05)* and when the second overtorque detection function is enabled. The digital operator then displays "OL3".

L7 Torque Limit

The torque limit function limits the amount of motor torque in all four quadrants of vector control operation:

- Forward Motoring
- Reverse Motoring
- Forward Regenerating
- Reverse Regenerating

Torque limit is activated in both the speed and torque control modes.

L7-01 Forward Torque Limit *Torq Limit Fwd*

-	-	B	B

Setting Range: 0 to 300%
Factory Default: 200%

Sets the motoring side torque limit value during FWD run.

L7-02 Reverse Torque Limit *Torq Limit Rev*

-	-	B	B

Setting Range: 0 to 300%
Factory Default: 200%

Sets the motoring side torque limit value during REV run.

L7-03 Regenerative Forward Torque Limit *Torq Lmt Fwd Rgn*

-	-	B	B

Setting Range: 0 to 300%
Factory Default: 200%

Sets the regenerating side torque limit value during FWD run.

L7-04 Regenerative Reverse Torque Limit *Torq Lmt Rev Rgn*

-	-	B	B

Setting Range: 0 to 300%
Factory Default: 200%
Sets the regenerating side torque limit value during REV run.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

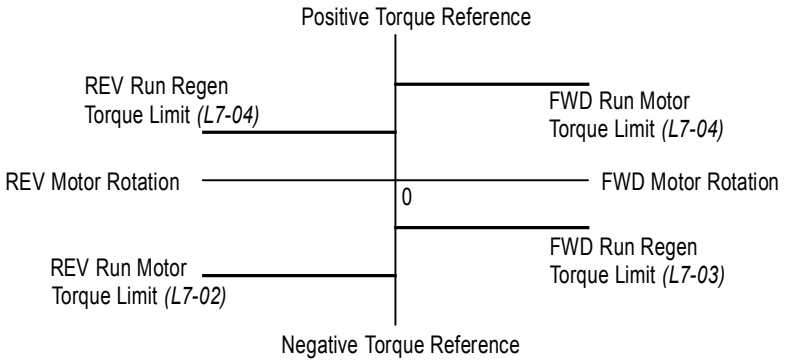


Figure 56 Torque Limit - 4 Quadrant Operation

L8 Hardware Protection

The KE200 series comes equipped with a number of built-in functions designed to protect the inverter and its components from damage. This section describes the set-up of these functions.

L8-01 Protection Selection for Internal DB Resistor *DB Resistor Prot*

B	B	B	B

When a Anyhertz dynamic braking resistor is used, protection against overheat is enabled with this function. The duty cycle of the braking resistor is monitored in software so that it does not exceed 3%.

Setting	Description
0	DB resistor overheat protection is not provided *(factory default)*.
1	DB resistor overheat protection is provided.

If the duty cycle exceeds 3%, a DB overheat fault (RH) occurs, and the inverter coasts to stop.

L8-02 OH Pre-Alarm Level *OH Pre-Alarm Lvl*

A	A	A	A

Setting Range: 0 to 100 C
Factory Default: 100 C

Sets the heatsink temperature level for protection against overheat (OH).

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

L8-03 Stopping Method Selection After OH Pre-Alarm OH Pre-Alarm Sel

A	A	A	A

Selects the stopping method when heatsink overheat is detected.

Setting	Description
0	Ramp to stop according to *C1-02* setting.
1	Coast to stop
2	Ramp to stop according to *C1-09* setting (fast-stop).
3	Operation continues, alarm only *(factory default).*

L8-05 Input Phase Loss Protection Ph Loss In Sel

A	A	A	A

The input phase loss detection circuit monitors the DC bus current ripple and activates when the one of the input phases are lost. The detection circuit calculates the maximum and minimum values of the DC bus voltage in one second intervals, and compares the difference (V) between these values with an internal detection level. If V reaches or exceeds the detection level, then after 0.5 second, input phase loss is detected; a PF fault occurs, and the motor coasts to stop.

Setting	Description
0	Input phase loss protection is disabled *(factory default).*
1	Input phase loss protection is enabled.

Input phase loss detection is disabled in the following cases:

- A Stop command is input.
- Magnetic Contactor (MC) shuts OFF.
- CPU A/D converter fault (CPF5).
- During deceleration.
- Output current 30% of Inverter rated current.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

L8-07 Output Phase Loss Protection *Ph Loss Out Sel*

A	A	A	A

The output phase loss detection circuit monitors the DCCT and activates when one of the output phases are lost. The detection circuit calculates the RMS current value (I_{RMS}) for each of the phases and compares it with an internal output detection level. If I_{RMS} decreases to or below the detection level for 10 seconds, an output phase loss (LF) fault occurs, and the motor coasts to stop.

Setting	Description
0	Output phase loss protection is disabled *(factory default).*
1	Output phase loss protection is enabled.

L8-10 Ground Fault Protection *Ground Fault Sel*

A	A	A	A

The ground fault detection circuit monitors the output current and activates when one of the output phases is connected to ground.
A ground fault will occur when the inverter output grounding current has exceeded 50% of the inverter rated current.
When a ground fault condition occurs, the following fault code will be displayed: “GF Ground Fault”.

Setting	Description
0	Disabled - Ground fault protection is disabled
1	Enabled - Ground fault protection is enabled. *(factory default).*

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

L8-17 IGBT Protection at Low Speed *Prtct@L-Spd*

A	A	A	-

This parameter assists in protecting the IGBT from overheating of the transistor junction when the output current is high and the output frequency is low. The settings are as follows:

Setting	Description
0	Conventional Method (No change in carrier), inverter relies on L8-19 protection (same as 1042 software).
1	*Lower fc - When output current is greater than 100%, and output frequency is less than or equal to 10Hz, the carrier frequency is automatically decreased to the L8-18 setting (between 8 and 2 kHz depending on model). The carrier will automatically return to the normal value after the load is reduced.* (factory default)
2	Short term OL2 - OL occurs in 2 seconds when at low output frequencies (6Hz or less) and in hard current limit.
3	I-Limit=150% - Current limit is 150% of inverter rated current. The IGBT junction temperature should be below any critical level provided the output current is less than 150%. <1110>

L8-19 OL2 Characteristics at Low speed <1110> *OL2 Chara@L-Spd*

A	A	A	A

This parameter allows the selection of normal or fast OL2 protection below 6 or 10 Hz. It is recommended that this parameter be enabled at all times. In some instances fast OL2 protection (L8-19=1) may not be desired, such as when operating in close loop vector at zero speed. If L8-19 is set to 0 (disabled) L8-17 must be set to 1,2, or 3.

Setting	Description
0	Disabled -OL2 protection is disabled at low speed. This OL2 protection is the same at high speed and low speed. *(factory default).*
1	Enabled - A current limiting function is performed at low speed, the inverter OL2 protection responds quickly at 6 Hz or less.

***Caution*:** When disabling OL2 protection, (L8-19=0) verify that the motor current will not go beyond the current limit level when operating below 10 Hz. Or set the carrier frequency equal to or less than 2 kHz.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

O Operator Parameters

O1 Monitor Selection

O1-01 Monitor Selection *User Monitor Sel*

B	B	B	B

The top level in the operation menu allows the viewing of four monitor variables. These are F_{ref}, F_{out}, I_{out}, and a user-selected monitor. This function can replace the output voltage monitor with another monitor in the operation mode. Choose one of the monitors *U1-04* to *U1-39* in this parameter.

Setting	Description
4	Control method
5	Motor speed
6	Output voltage *(factory default)*
7	DC bus voltage
8	Output power
9	Torque reference (internal)
10	Input terminal status
11	Output terminal status
12	Internal control status 1
13	Elapsed time
14	FLASH ID number
15	Terminal 13 input voltage level
16	Terminal 14 input voltage or current level
17	Terminal 16 input voltage level
18	Motor secondary current (Iq)
19	Motor excitation current (Id)
20	SFS output frequency
21	ASR input
22	ASR output
23	Speed deviation
24	PID feedback
25	DI-16H reference
26	Voltage reference (Vq output)
27	Voltage reference (Vd output)
28	CPU ID number
32	ACR (q) Output
33	ACR (d) Output
34	OPE Detected
35	Zero Servo Pulse
36	PID Deviation
37	PID Output Monitor
38	PID Setpoint

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

O1-02 Monitor Selection After Power-up *Power-On Monitor*

B	B	B	B

Selects the monitor to be displayed on the digital operator immediately after the power supply is turned ON.

Setting	Description
1	Displays frequency reference *(factory default)*.
2	Displays output frequency.
3	Displays output current.
4	Displays the monitor set in *O1-01*.

O1-03 Scale for Setting and Monitoring Frequency *Display Scaling*

B	B	B	B

Units for parameters and monitors related to frequency can be scaled as shown below.

Setting	Description
00000	Unit: 0.01Hz *(factory default)*
00001	Unit: 0.01%
00002 to 00039	Unit: rpm (0 to 3999)
00040 to 03999 (user-selected units)	Digits: 5th 4th 3rd 2nd 1st 0 0 0 0 0 The 1st thru 4th digits determine the set value at 100% output frequency. Decimal point position is set by the 5th digit as follows: 5th digit = 0: displayed as 0000 5th digit = 1: displayed as 000.0 5th digit = 2: displayed as 00.00 5th digit = 3: displayed as 0.000 *Example 1* If 100% output frequency is equal to 200.0 units: Set *O1-03* = "12000"; 100% of this reference is displayed as 200.0 and 60% of this reference is displayed as 120.0. *Example 2* If 100% output frequency is equal to 65.00: Set *O1-03* = "26500"; 60% of this reference is displayed as 39.00.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

O1-04 Display Units for Speed-Related Parameters *Display Units*

-	-	-	B

Sets the display units for parameters and monitors related to frequency, in the close loop vector control mode.

Setting	Description
0	Displays frequency in Hz *(factory default)*.
1	Displays frequency in rpm.

O1-05 Parameter Selection *Address Display*

A	A	A	A

Selects how the parameter addresses are displayed on the digital operator.

Setting	Description
0	Displays parameter number *(factory default)*.
1	Displays MODBUS address.

O2 Key Selections

O2-01 Local/Remote Key *Local/Remote Key*

B	B	B	B

Enables/disables the digital operator LOCAL/REMOTE key.

Setting	Description
0	Local/Remote key is disabled.
1	Local/Remote key is enabled *(factory default)*. Depressing the Local/Remote key switches operation commands between the digital operator and the settings of *B1-01* and *B1-02*.

O2-02 STOP Key During External Terminal Operation *Oper STOP Key*

B	B	B	B

Enables/disables the digital operator STOP key, during operation from the external terminals and during serial communication.

Setting	Description
0	The digital operator STOP key is disabled when Run command does *not* come from the digital operator.
1	The digital operator STOP key is always enabled *(factory default)*. The STOP key is enabled even during external terminal operation and serial communication.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

O2-03 User-Defined Default Value Setting *User Defaults*

B	B	B	B

Parameters set by user can be stored in the inverter as user default values.

Setting	Description
0	No change *(factory default)*
1	Sets user-specified values as defaults. Each parameter's set values are stored as user defaults. Even if the values are changed after this parameter is set, user defaults can be restored by setting *A1-03* = "1110" (user initialization). Up to 50 changed values can be stored.
2	Clears user defaults.

O2-04 Inverter Model Selection *Inverter Model #*

A	A	A	A

Setting Range: 23P7 to 2075, 43P7 to 4300
Factory Default: Inverter model dependent

Sets the inverter capacity, according to model number. Control parameters with defaults specific to the inverter capacity are set automatically (i.e. carrier frequency, motor data, etc.). This parameter does *not* need changing, unless the control board is replaced.

O2-05 Digital Operator M.O.P. Mode Selection *Operator M.O.P.*

A	A	A	A

Selects whether the ENTER key is used when the frequency reference is set by the digital operator. The digital operator can simulate a motor operated potentiometer (M.O.P.) by setting this parameter.

Setting	Description
0	The digital operator M.O.P. mode is disabled *(factory default)*. The inverter accepts the frequency reference command when the ENTER key is depressed.
1	The digital operator M.O.P. mode is enabled. The inverter accepts the frequency reference command as soon as changes are made with the arrow keys, *without* the ENTER key being depressed.

V/f	V/f w/PG	Open Loop Vector	Close Loop Vector

O2-06 Digital Operator Disconnection Detection *Oper Detection*

A	A	A	A

If the digital operator is disconnected from the inverter, this parameter selects whether the inverter detects this condition.

Setting	Description
0	Detection is disabled. Operation continues *(factory default)*.
1	Detection is enabled. When the inverter detects that the digital operator has been disconnected while running, the inverter coasts to stop and the error message "OPR Operator Disconnected" is displayed on the digital operator, after it is connected again.

This function can only be activated when the run command comes from the digital operator.

O2-07 Operation Time Setting *Elapsed Time Set*

A	A	A	A

Setting Range: 0 to 65535 Hours
Factory Default: 0 Hours

Sets the initial value for the cumulative operation time. Operation time starts accumulating from the set value. This is very useful for preventive maintenance purposes.

O2-08 Cumulative Operation Time Selection *Elapsed Time Run*

A	A	A	A

Defines the operation time that accumulates in the timer.

Setting	Description
0	Power-On time is the accumulated time *(factory default)*. The timer counts the time while the inverter power supply is turned ON as operation time.
1	Running time is the accumulated time. The timer counts the time while the inverter is running as operation time.

O2-09 Initialization Mode Selection *Init Mode Sel*

A	A	A	A

Sets factory defaults to worldwide specifications.

Setting	Description
0	Japanese specifications
1	American specifications *(factory default)*
2	European specifications

After changing this setting, reinitialize the inverter in parameter *A1-03*. This initialization affects market-driven parameter settings (motor-related parameters, carrier frequency, inverter rated current, etc.)

Chapter 7 Parameter List

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Initialize	Initialization	**A1-00**	Language Selection (Select Language)	0.1	0	0	0: English	o	Q	Q	Q	Q	
		A1-01	Access Level (Access Level)	0~4	1	2	0: Operation Only 1: User Level (Note 5) 2: Quick-Start [Q] 3: Basic Level [B] 4: Advanced Level [A]	o	Q	Q	Q	Q	
		A1-02	Control Method Selection (Control method)	0~3	1	0 (Note1)	0: V/F Control 1: V/F w/PG Fdbk 2: Open Loop Vector 3: Close Loop Vector	x	Q	Q	Q	Q	
		A1-03	Initialize (Init Parameters)	0 1110 2220 3330	N/A	0	0 : No Initialize 1110: User Initialize (Note 7) 2220: 2-Wire Initialize 3330: 3-Wire Initialize	x	Q	Q	Q	Q	
		A1-04	Password 1 * (Enter Password)	0000~ 9999	1	0000	Password protection for: A1-01 Access Level A1-02 Control Method A1-03 Initialization A2-01 to A2-32 User Parameters (If selected)	x	Q	Q	Q	Q	
	User Parameters	**A2-01 ~ A2-32**	User Setting Parameters (Function A2)	—	—	—	User Parameter 1 to User Parameter 32	x	A	A	A	A	

Note 1 Not initialized. (Domestic standard specifications: A1-01 = 1, A1-02 = 2)
Note 2 Setting range is only 0 and 1 when the control method is set to close loop vector control (A1-02 = 3)
Note 5 Selection "1: User Level" is only available after selecting setting 4: Advanced Level and then entering a user parameter in A2-01.
Note 7 Setting 1110: User Initialize is only available after setting Parameter No. O2-03 to 1.

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group B Application	Function b1 Sequence	**B1-01**	Reference Selection (Reference Source)	0 ~ 4	1	1	0: (Operator) 1: (Terminals) 2: Communication (Serial Com) 3: (Option PCB) 4: (EWS) Reference from CP-717 <1110>(Note 8)	x	Q	Q	Q	Q	
		B1-02	Operation Method Selection (Run Source)	0 ~ 4	1	1	0: (Operator) 1: (Terminals) 2: Communication(Serial Com) 3: (Option PCB) 4: (EWS) Run from CP-717 <1110> (Note 8)	x	Q	Q	Q	Q	
		B1-03	Stopping Method Selection (Stopping Method)	0 ~ 3 (Note 2)	1	0	0: (Ramp to Stop) 1: (Coast to Stop) 2: DC injection to stop (DCInj to Stop) 3: Coast to stop with timer (Coast w/Timer)	x	Q	Q	Q	Q	
		B1-04	Reverse Operation Prohibit (Reverse Oper)	0, 1	1	0	0: (Reverse Enabled) 1: (Reverse Disabled)	x	B	B	B	B	
		B1-05	Operation Selection for Setting of E1-09 or less (Zero-Speed Oper)	0 ~ 3	1	0	0: Run at frequency reference (Run at Freq Ref) 1: (STOP) 2: Run at minimum frequency (RUN at Min Freq) 3: (RUN at Zero RPM)	x	-	-	-	A	
		B1-06	Digital Input Scan Time (Cntl Input Scans)	0, 1	1	1	0: (2 mS - 2 Scans) 1: (5 mS - 2 Scans)	x	A	A	A	A	
		B1-07	Operation selection after switching to remote mode (LOC/REM RUN Sel)	0, 1	1	0	0: Cycle external run (Cycle Extern RUN) 1: Accept external run (Accept Extern RUN)	x	A	A	A	A	
		B1-08 <1110>	Run command acceptance while being programmed (RUN CMD at PRG)	0, 1	1	0	0: Disabled 1: Enabled	x	A	A	A	A	

Note 2 Setting range is only 0 and 1 when the control method is set to close loop vector control (A1-02 = 3)

Note 8 (Tentative) Setting parameter B1-01 or B1-02 to 4 allows reference and/or run source from CP-717 when either CP-916 or CP-216 option cards are installed.

Note 9 Drive can be switched between local and remote mode while continuing to run. When switching from remote to local the last remote speed command will be set as the local speed for a bumpless transition.

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group b Application	Function b2 DC Injection Brake	**B2-01**	DC Injection Braking Starting Frequency (DCInj Start Freq)	0.0~ 10.0	0.1Hz	0.5	—	x	B	B	B	B	
		B2-02	DC Injection Current (DCInj Current)	0~100	1%	50	—	x	B	B	B	-	
		B2-03	DC Injection Time at Start (DCInj Time @Start)	0.00~ 10.00	0.01s	0.00	—	x	B	B	B	B	
		B2-04	DC Injection Braking Time at Stop (DCInj Time @Stop)	0.00~ 10.00	0.01s	0.50 *	* When 02-09 = 1 (American), the setting is 0.00s. <24>	x	B	B	B	B	
		B2-08 <1110>	Magnetic Flux Com-pensation Capacity (FieldComp)	0~500	1%	0	100% is no-load current value at Min. frequency (E1-09)	x	-	-	A	A	
	Speed Search	**B3-01**	Speed Search Selection at Start (SpdSrch at Start)	0,1	1	0*	0: Disabled 1: Enabled * Factory setting defaults to 0: Disabled except when (A1-02=1) (V/F w/PG Fdbk) or 3 (Close loop vector).	x	A	A	A	A	
		B3-02	Speed Search Operation Current (SpdSrch Current)	0~200	1%	150*	* Factory setting defaults to 150 when A1-02=0 (V/F Control). When A1-02=2 (Open Loop Vector), the default is 100.	x	A	-	A	-	
		B3-03	Speed Search Deceleration Time (SpdSrch Dec Time)	0.1~ 10.0	0.1s	2.0	—	x	A	-	A	-	
	Delay Timers Brake Sequence	**B4-01**	Timer Function On-delay Time (Delay-ON Timer)	0.0~ 300.0	0.1s	0.0	—	x	A	A	A	A	
		B4-02	Timer Function Off-delay Time (Delay-OFF Timer)	0.0~ 300.0	0.1s	0.0	—	x	A	A	A	A	

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group b Application	Function b5 PID Control	**B5-01**	PID Control Mode Selection (PID Mode)	0 ~ 4	1	0	0: (Disabled) 1: (Enabled D=Fdbk) 2: Enabled D = Feed–Forward (Enabled D=Fdfwd) 3: Reference = Frequency Reference + PID Output (Fref+PID D=Fdbk) 4: Reference = Frequency Reference + PID Output D is feed-forward (Fref+PID D=Fdfwd)	x	A	A	A	A	
		B5-02	Proportional Gain (P) (PID Gain)	0.00~ 25.00	0.01	1.00	—	o	A	A	A	A	
		B5-03	Integral (I) Time (PID I Time)	0.0~ 360.0	0.1s	1.0	—	o	A	A	A	A	
		B5-04	Integral (I) Limit (PID I Limit)	0.0~ 100.0	0.1%	100	—	o	A	A	A	A	
		B5-05	Derivative (D) Time (PID D Time)	0.00~ 10.00	0.01s	0.00	—	o	A	A	A	A	
		B5-06	PID Limit (PID Limit)	0.00~ 100.0	0.1%	100.0	—	o	A	A	A	A	
		B5-07	PID Offset Adjustment (PID Offset)	–100.0 ~ +100.0	0.1%	0.0	—	o	A	A	A	A	
		B5-08	PID Primary Delay Time (PID Delay Time)	0.00~ 10.00	0.01s	0.00	—	o	A	A	A	A	
		B5-09 <1110>	PID Output Selection (Output Level Sel)	0, 1	1	0	0: PID Forward Output [X 1] (Normal Character) 1: PID Reverse Output [X–1] (Rev Character)	x	A	A	A	A	
		B5-10 <1110>	PID Output Gain (Output Gain)	0.0 ~ 25.0	.1	1.0	–	x	A	A	A	A	
		B5-11 <1110>	PID Output Reverse Selection (Output Rev Sel)	0, 1	1	0	0: When PID output is negative, motor direction is not changed, PID output is limited to 0. (0 limit) 1: When PID output is negative, motor reverses direction. (Reverse)	x	A	A	A	A	

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group b Application	PID Control	**B5-12** <1110>	PID Feedback Reference Missing Detection Selection (Fb Los Det Sel)	0~2	1	0	0: PID feedback missing detection disabled. (Disabled) 1: PID feedback missing detection enabled. (Alarm) Operation continues after detection, "Fbl" alarm is displayed. 2: PID feedback missing detection enabled. (Fault) Inverter output is shut off after detection, "Fbl" is displayed.	x	A	A	A	A	
		B5-13 <1110>	PID Feedback Reference Missing Detection Level (Fb los Det Lvl)	0~100	1%	0	—	x	A	A	A	A	
		B5-14 <1110>	PID Feedback Reference Missing Detection Time (Fb los Det Time)	0.0~ 25.5	0.1s	1.0	—	x	A	A	A	A	
	Function b6 Reference Hold	**B6-01**	Dwell Frequency at Start (Dwell Ref @Start)	0.0~ 400.0	0.1Hz	0.0	—	x	A	A	A	A	
		B6-02	Dwell Time at Start (Dwell Time @ Start)	0.0~ 10.0	0.1s	0.0	—	x	A	A	A	A	
		B6-03	Dwell Frequency at Stop (Dwell Ref @ Stop)	0.0~ 400.0	0.1Hz	0.0	—	x	A	A	A	A	
		B6-04	Dwell Time at Stop (Dwell Time @ Stop)	0.0~ 10.0	0.1s	0.0	—	x	A	A	A	A	
	Function b7 Droop Control Droop Control	**B7-01**	Droop Control Gain (Droop Quantity)	0.0~ 100.0	0.1%	0.0	—	o	-	-	-	A	
		B7-02	Droop Control Delay Time (Droop Delay Time)	0.03~ 2.00	0.01s	0.05	—	o	-	-	-	A	

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group b Application	Function b8 Energy Saving	**B8-01**	Energy-saving Gain (Energy Save Gain)	0~100	1%	80	—	x	A	A	-	-	
		B8-02	Energy-saving Frequency (Energy Save Freq)	0.0~ 400.0	0.1Hz	0.0	—	x	A	A	-	-	
		B8-03 <1110>	Energy -saving Mode Selection	0, 1	1	0	0: (Disabled) 1: (Enabled)	x	-	-	F (A) Note	F (A) Note	
		B8-04 <1110>	Energy-saving Control Gain (Energy Save Gain)	0.0~ 10.0	0.1	0.7*	*When control mode A1-02 = 3, default factory setting becomes1.0	o	-	-	F (A) Note	F (A) Note	
		B8-05 <1110>	Energy-saving Control Time Constant (Energy Save F .T)	0.00~ 10.00	0.01s	0.50*	*When control mode A1-02 = 3, default factory setting becomes.01	o	-	-	F (A) Note	F (A) Note	
	Zero Servo	**B9-01**	Zero-servo gain (Zero Servo Gain)	0~100	1	5	—	x	-	-	-	A	
		B9-02	Zero-servo Completion Width (Zero Servo Count)	0~ 16383	1	10	—	x	-	-	-	A	
								Note: USA (02x09=1) and EUR. (02x09=2) are Advanced, others are Factory setting.					
Group C Tuning	Function C1 Accel / Decel	**C1-01**	Acceleration Time 1 (Accel Time 1)	Depends on C1-10 0.00~ 600.00 or 0.0 ~ 6000.0	Depends on C1-10 0.01s or 0.1s	10.0	—	o	Q	Q	Q	Q	
		C1-02	Deceleration Time 1 (Decel Time 1)			10.0	—	o	Q	Q	Q	Q	
		C1-03	Acceleration Time 2 (Accel Time 2)			10.0	—	o	B	B	B	B	
		C1-04	Deceleration Time 2 (Decel Time 2)			10.0	—	o	B	B	B	B	
		C1-05	Acceleration Time 3 (Accel Time 3)			10.0	—	x	A	A	A	A	
		C1-06	Deceleration Time 3 (Decel Time 3)			10.0	—	x	A	A	A	A	
		C1-07	Acceleration Time 4 (Accel Time 4)			10.0	—	x	A	A	A	A	
		C1-08	Deceleration Time 4 (Decel Time 4)			10.0	—	x	A	A	A	A	
		C1-09	Emergency Stop Time (Fast Stop Time)			10.0	—	x	B	B	B	B	
		C1-10	Accel/Decel Time Set Unit (Acc/Dec Units)	0.1	1	1	0: Set unit of accel/decel time is 0.01s. (0.01 Seconds) 1: Set unit of accel/decel time is 0.1s. (0.1 Seconds)	x	A	A	A	A	
		C1-11	Accel/Decel Time Switching Frequency (Acc/Dec SW Freq)	0.0~ 400.0	0.1Hz	0.0	—	x	A	A	A	A	

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group C Tuning	Function C2 S-Curve Acc/Dec	**C2-01**	S-Curve Characteristic Time at Acceleration Start (SCrv Acc@ Start)	0.00~ 2.50	0.01s	0.20	—	x	A	A	A	A	
		C2-02	S-Curve Characteristic Time at Acceleration End (SCrv Acc@ End)	0.00~ 2.50	0.01s	0.20	—	x	A	A	A	A	
		C2-03	S-Curve Characteristic Time at Deceleration Start (SCrv Dec @ Start)	0.00~ 2.50	0.01s	0.20	—	x	A	A	A	A	
	Function C3 Motor Slip Compensation	**C3-01**	Slip Compensation Gain (Slip Comp Gain)	0.0~2.5	0.1	1.0*	* Default factory setting is 0.0 when A1-02=0 [V/F mode]. When A1-02=2 [Open Loop Vector] or 3 [Close loop vector] default factory	o	B	-	B	B	
		C3-02	Slip Compensation Primary Delay Time (Slip Comp Time)	0~10000	1 ms	200*	* Default factory setting is 2000ms when A1-02=0 [V/F mode]. When A1-02=2 [Open Loop Vector] default factory setting is 200ms.	x	A	-	A	-	
		C3-03	Slip Compensation Limit (Slip Comp Limt)	0~250	1%	200	—	x	A	-	A	-	
		C3-04	Slip Compensation Selection during Regeneration (Slip Comp Regen)	0, 1	1	0	0 : Disabled 1 : Enabled	x	A	-	A	-	
		C3-05 <1110>	Flux Calculation Method (Flux Select)	0, 1	1	0	0 : Magnetic flux is calculated by output frequency after compensation. (Slip Included) 1 : Magnetic flux is calculated by output frequency before compensation. (Slip Excluded)	x	-	-	A	-	
		C3-06 <1110>	Output Voltage Limit Operation Selection (Output V limit)	0, 1	1	0	0 : Disabled (Note 10) 1 : Enabled (Note 11)	x	-	-	A	A	

Note 10 When this parameter is "0" slip compensation will be disabled when the motor is operating above its base speed. The motor voltage will not be reduced above base speed.

Note 11 Open Loop Vector: When this parameter is set to "1" the motor voltage will be reduced slightly when the motor is operating above 90% base speed. Slip Compensation is enabled. Speed control accuracy is improved. This may prevent speed instabilities due to motor voltage saturation. This setting may improve speed regulation however motor torque/amp will be reduced by up to 10% due to motor voltage reduction above base speed. Close loop vector: Torque linearity is improved.

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group C Tuning	Function C4 Torque Compensation	**C4-01**	Torque Compensation Gain (Torq Comp Gain)	0.00~ 2.50	0.01	1.00	—	o	B	B	B	-	
		C4-02	Torque Compensation Time (Torq Comp Time)	0~10000	1 ms	20*	* When A1-02=2 [Open Loop Vector] factory default setting is 20 ms. When A1-02=1or 3 [V/F or V/F w/PG] factory default setting is 200 ms.	x	A	A	A	-	
		C4-03 <1110>	Forward Torque Compensation Value @ Start (F TorqCmp @start)	0.0~ 200.0	0.1%	0.0	Functions only when starting a motor. Torque reference and motor flux can be ramped up quickly to improve speed response during start. A setting of 0.0 disables this feature.	x	-	-	A	-	
		C4-04 <1110>	Reverse Torque Compensation Value @ Start. (R TorqCmp @ start)	200.0~ 0.0	0.1%	0.0	Functions only when starting a motor. Torque reference and motor flux can be ramped up quickly to improve speed response during start. A setting of 0.0 disables this feature.	x	-	-	A	-	
		C4-05 <1110>	Torque Compensation Time Constant (TorqCmp Delay T)	0~200	1ms	10	When 0~4ms is set, it is operated without filter. Functions with C4-03 and C4-04.	x	-	-	A	-	
	Function C5 ASR Tuning	**C5-01**	ASR Proportional (P) Gain 1 (ASR P Gain 1)	0.00~ 300.00	0.01	20.00*	When A1-02=1 [V/f w/PG] factory default setting is .20. When A1-02=3 factory default setting is 20.00.	o	-	B	-	B	
		C5-02	ASR Integral (I) Time 1 (ASR 1 Time 1)	0.000~ 10.000	0.001s	0.500*	When A1-02=1 [V/f w/PG] factory default setting is .200. When A1-02=3 factory default setting is .500	o	-	B	-	B	
		C5-03	ASR Proportional (P) Gain 2 (ASR P Gain 2)	0.00~ 300.00	0.01	20.00*	When A1-02=1 [V/f w/PG] factory default setting is .02 When A1-02=3 factory default setting is 20.00.	o	-	B	-	B	
		C5-04	ASR Integral (I) Time 2 (ASR 1 Time 2)	0.000~ 10.000	0.001s	0.500*	When A1-02=1 [V/f w/PG] factory default setting is .050. When A1-02=3 factory default setting is .500.	o	-	B	-	B	
		C5-05	ASR Limit (ASR Limt)	0.0~ 20.0	0.1%	5.0	—	x	-	A	-	-	
		C5-06	ASR Primary Delay Time (ASR Delay Time)	0.000~ 0.500	0.001s	0.004	—	x	-	-	-	A	
		C5-07	ASR Switching Frequency (ASR Gain SW Freq)	0.0~ 400.0	0.1Hz	0.0	—	x	-	-	-	A	
		C5-08	ASR Integral Limit (ASR I Limit)	0~400	1	400%	—	x	-	-	-	A	

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group C Tuning	Function C6 Carrier Frequency	**C6-01**	Carrier Frequency Upper Limit (Carrier Freq Max)	0.4~ 15.0**	0.1 kHz	15.0**	When control mode is vector control (A1-02=2, 3), the setting range of C6-01 and C6-02 is 2.0 ~15.0. ** Setting range and factory setting differ depending on inverter capacity.	x	B	B	B	B	
		C6-02	Carrier Frequency Lower Limit (Carrier Freq Min)	0.4~ 15.0	0.1 kHz	15.0**		x	A	A	-	-	
		C6-03	Carrier Frequency Proportional Gain (Carrier Freq Gain)	00~99**	1	00**		x	A	A	-	-	
	Function C7 Hunting Prevention	**C7-01**	Hunting Prevention Selection (Hunt Prev Select)	0, 1	1	1	0: Disabled 1: Enabled	x	A	A	-	-	
		C7-02	Hunting Prevention Gain (Hunt Prev Gain)	0.00~ 2.50	0.01	1.00	—	x	A	A	-	-	
Group C Tuning	Function C8 Factory Tuning	**C8-08**	AFR Gain (AFR Gain)	0.00~ 10.00	0.01	1.00	—	x	-	-	A	-	
		C8-09	AFR Time Constant (AFR Time)	0~2000	1 ms	50	—	x	-	-	A	-	
		C8-30 <1110>	Carrier Frequency Selection during Auto-tuning (Carrier in tune)	0~2	1	0	0: Carrier frequency is 2 kHz. 1: Carrier frequency depends on C6-01. 2: Carrier frequency is 5 kHz. (185~300 kW: 2.5 kHz)	x	-	-	A	A	

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group d Reference	Function d1Preset Reference	D1-01	Frequency Reference 1 (Reference 1)	0.00~ 400.00	0.01Hz	0.00	—	o	Q	Q	Q	Q	
		D1-02	Frequency Reference 2 (Reference 2)	0.00~ 400.00	0.01Hz	0.00	—	o	Q	Q	Q	Q	
		D1-03	Frequency Reference 3 (Reference 3)	0.00~ 400.00	0.01Hz	0.00	—	o	Q	Q	Q	Q	
		D1-04	Frequency Reference 4 (Reference 4)	0.00~ 400.00	0.01Hz	0.00	—	o	Q	Q	Q	Q	
		D1-05	Frequency Reference 5 (Reference 5)	000~ 400.00	0.01Hz	0.00	—	o	B	B	B	B	
		D1-06	Frequency Reference 6 (Reference 6)	0.00~ 400.00	0.01Hz	0.00	—	o	B	B	B	B	
		D1-07	Frequency Reference 7 (Reference 7)	0.00~ 400.00	0.01Hz	0.00	—	o	B	B	B	B	
		D1-08	Frequency Reference 8 (Reference 8)	0.00~ 400.00	0.01Hz	0.00	—	o	B	B	B	B	
		D1-09	Jog Frequency Reference (Jog Reference)	0.00~ 400.00	0.01Hz	6.00	—	o	Q	Q	Q	Q	
	Function d2 Reference Limits	D2-01	Frequency Reference Upper Limit (Ref Upper Limit)	0.0~110.0	0.1%	100.0	—	x	B	B	B	B	
		D2-02	Frequency Reference Lower Limit (Ref Lower Limit)	0.0~109.0	0.1%	0.0	—	x	B	B	B	B	
	Function d3 Jump Frequencies	D3-01	Jump Frequency 1 (Jump Freq 1)	0.0~400.0	0.1Hz	0.0	—	x	B	B	B	B	
		D3-02	Jump Frequency 2 (Jump Freq 2)	0.0~400.0	0.1Hz	0.0	—	x	B	B	B	B	
		D3-03	Jump Frequency 3 (Jump Freq 3)	0.0~400.0	0.1Hz	0.0	—	x	B	B	B	B	
		D3-04	Jump Frequency Width (Jump Bandwidth)	0.0~20.0	0.1Hz	1.0	—	x	B	B	B	B	

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group d Reference	Function d4 Sequence	**D4-01**	Frequency Reference Hold Function Selection (MOP Ref Memory)	0, 1	1	0	0: (Disabled) No hold frequency is memorized. 1: (Enabled) Hold frequency is memorized.	x	A	A	A	A	
		D4-02	±Speed Limits (Trim Control Lvl)	0~100	1%	25*	*When 02-09=1 [USA], the unit is 10%. <24>	x	A	A	A	A	
	Function d5 Torque Control	**D5-01**	Torque Control Selection (Torq Control Sel)	0, 1	1	0	0: (Speed Control) 1: (Torque Control)	x	-	-	-	A	
		D5-02	Torque Reference Delay Time (Torque Ref Filter)	0~1000	1 ms	0	—	x	-	-	-	A	
		D5-03	Speed Limit Selection (Speed Limit Sel)	1, 2	1	1	1: (Analog Input) terminal 13, 14 2: (Program Setting)	x	-	-	-	A	
		D5-04	Speed Limit (Speed Lmt Value)	–120 ~ +120	1%	0	—	x	-	-	-	A	
		D5-05	Speed Limit Bias (Speed Lmt Bias)	0~120	1%	10	—	x	-	-	-	A	
		D5-06	Speed/torque Control Switching Timer (Ref Hold Time)	0~1000	1 ms	0	—	x	-	-	-	A	

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group E Motor	Function E1 V/F Pattern	**E1-01**	Input Voltage Setting (Input Voltage)	155~255 (Note 13)	1 V	200 (Note 13)	[1]When 02-09=1 [USA], the value is 1.15 times of Japanese spec., which is 230/200	x	Q	Q	Q	Q	
		E1-02	Motor Selection (Motor Selection)	0, 1, 2	1	0	0: (Std Fan-Cooled) 1: (Std Blower-Cooled) 2: (Vector Motor) <1110>	x	Q	Q	Q	Q	
		E1-03	V/f Pattern Selection (V/F Selection)	00~0F	1	0F	V/f pattern selection 0: 50Hz 1: 60Hz Saturation 2: 50Hz Saturation 3: 72Hz 4: 50Hz Variable Torque 1 5: 50Hz Variable Torque 1 6: 60Hz Variable Torque 1 7: 60Hz Variable Torque 2 8: 50Hz High Starting Torque 1 9: 50Hz High Starting Torque 2 A: 60Hz High Starting Torque 1 B: 60Hz High Starting Torque 2 C: 90Hz D: 120Hz E: 180Hz F: User-defined V/f pattern	x	Q	Q	Q	Q	
		E1-04	Max. Output Frequency (Max Frequency)	40.0~400.0	0.1Hz	60.0* (Note 13)	*Factory setting differs depending on the inverter capacity 02-04. When 02-09=2 [EUR.], the value is 50.0Hz.	x	Q	Q	Q	Q	
		E1-05	Max. Voltage (Max Voltage)	0.0~255.0 (Note 13)	0.1 V	200.0 (Note 13)*	*Factory setting differs depending on the inverter capacity (02-04). When 02-09=1 (USA), the value is 1.15 times of Japanese spec., which is 230/200	x	Q	Q	Q	Q	
Note 13: This value is for the 200V class. For 400V class, the value is twice that of 200V class.													

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group E Motor	Torque Control	**E1-06**	Max. Voltage Frequency (Base Frequency)	0.0~ 400.0	0.1Hz	60.0* (Note 13)	*Factory setting differs depending on the inverter capacity (02-04). When 02-09=2 (EUR.), the value is 50.0Hz.	x	Q	Q	Q	Q	
		E1-07	Mid. Output Frequency (Mid Frequency A)	0.0~ 400.0	0.1Hz	3.0* (Note 13)	*Factory setting differs depending on the inverter capacity (02-04). When 02-09=2 (EUR.), A1-02=0, and E1-03=OF, the value is 5/6 times that of Japan spec.[for a V/F pattern with a 50Hz base frequency]	x	Q	Q	A	F	
		E1-08	Mid. Output Frequency Voltage (Mid Voltage A)	0.00~ 255. 0 (Note 13)	0.1 V	11.0 (Note 13)*	*Factory setting differs depending on the inverter capacity (02-04). When 02-09=1 (USA), the value is 1.15 times of Japanese spec., which is 230/200 .	x	Q	Q	A	F	
		E1-09	Min. Output Frequency (Min Frequency)	0.0~ 400.0	0.1Hz	0.5* (Note 13)	*Factory setting differs depending on the inverter capacity (02-04). When 02-09=2 (EUR.), A1-02=0, and E1-03=OF, the value is 5~6 times of Japan.	x	Q	Q	Q	A	
		E1-10	Min. Output Frequency Voltage (Min Voltage)	0.0~ 255.0 (Note 13)	0.1V	2.0 (Note 13)*	*Factory setting differs depending on the inverter capacity (02-04). When 02-09=1 (USA), the value is 1.15 times of Japanese spec., which is 230/200.	x	Q	Q	A	F	
		E1-11	Mid. Output Frequency 2 (Mid Frequency B)	0.0~ 400.0	0.1Hz	0.0	—	x	A	A	A	A	
		E1-12	Mid. Output Frequency Voltage 2 (Mid Voltage B)	0.0~ 255.0 (Note 13) *	0.1V	0.0	*When 02-09=1 (USA), the value is 1.15 times of Japanese spec., which is 230/200.	x	A	A	A	A	
		E1-13	Base Voltage (Base Voltage)	0.0~ 255.0 (Note 13)	0.1V	200.0 (Note 13) *	*When 02-09=1 (USA), the value is 1.15 times of Japanese spec., which is 230/200.	x	A	A	Q	Q	
Note 13: This value is for the 200V class. For 400V class, the value is twice that of 200V class.													

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group E Motor	Function E2 Motor Setup	**E2-00**	Motor Rated (Motor Rated)	—	—	—	* When inverter capacity is 7.5 kW or less, min. setting unit becomes 0.01 A. ** Factory setting differs depending on inverter capacity (02-04).	x	-	-	-	-	
		E2-01	Motor Rated Current (Motor Rated FLA)	0.1~ 1500.0	0.1A*	1.9**		x	Q	Q	Q	Q	
		E2-02	Motor Rated Slip (Motor Rated Slip)	0.00~ 20.00	0.01Hz	2.90**		x	A	A	Q	Q	
		E2-03	Motor No-load Current (No-Load Current)	0.00~ 1500.0	0.01A*	1.20**		x	A	A	Q	Q	
		E2-04	Number of Motor Poles (Number of Poles)	2~48	1 pole	4		x	-	Q	-	Q	
		E2-05	Motor Line-to-line Resistance (Term Resistance)	0.000~ 65.000	0.001 W	9.842**		x	A	A	A	A	
		E2-06	Motor Leak Inductance (Leak Inductance)	0.0~ 30.0	0.1%	18.2**		x	-	-	A	A	
		E2-07	Motor Iron-core Saturation Coeffi-cient 1 (Saturation Comp 1)	0.00~ 0.50	0.01	0.50	—	x	-	-	A	A	
		E2-08	Motor Iron-core Saturation Coeffi-cient 2 (Saturation Comp 2)	0.00~ 0.75	0.01	0.75	—	x	-	-	A	A	
		E2-09	Motor Mechanical Loss (Mechanical Loss)	0.0~ 10.0	0.1%	0.0	—	x	-	-	-	A	
		E2-10	Motor Iron Loss of Torque Compensa-tion (Tcomp Iron Loss)	0~ 65535	1W	14	Access level is changed from F to A. <1110>	x	A	A	-	-	

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group E Motor	Function E3 Control Method	**E3-01**	Motor 2 Control Method Selection (Control Method)	0~3	1	2	0: (V/F Control) 1: (V/F w/PG Fdbk) 2: (Open Loop Vector) 3: (Close loop vector)	x	A	A	A	A	
	Function E4 V/F Pattern 2	**E4-01**	Motor 2 Max. Out-put Frequency (Max Frequency)	40.0~ 400.0	0.1Hz	60.0	—	x	A (Note 14)	A (Note 14)	A (Note 14)	A (Note 14)	
		E4-02	Motor 2 Max. Voltage (Max Voltage)	0.0~ 255.0 (Note 13)	0.1V	200.0 (Note 13)	—	x	A (Note 14)	A (Note 14)	A (Note 14)	A (Note 14)	
		E4-03	Motor 2 Max. Voltage Frequency (Base Frequency)	0.0~ 400.0	0.1Hz	60.0	—	x	A (Note 14)	A (Note 14)	A (Note 14)	A (Note 14)	
		E4-04	Motor 2 Mid. Output Frequency 1 (Mid Frequency)	0.00~ 400.0	0.1Hz	3.0*	* Factory setting differs depending on the control method [E3-01]	x	A (Note 14)	A (Note 14)	A (Note 14)	F (Note 14)	
		E4-05	Motor 2 Mid. Output Frequency Voltage 1 (Mid Voltage)	0.0~ 255.0 (Note 13)	0.1V	11.0 (Note 13)*	* Factory setting differs depending on the control method [E3-01]	x	A (Note 14)	A (Note 14)	A (Note 14)	F (Note 14)	
		E4-06	Motor 2 Min. Output Frequency (Min Frequency)	0.0~ 400.0	0.1Hz	0.5*	* Factory setting differs depending on the control method [E3-01]	x	A (Note 14)	A (Note 14)	A (Note 14)	A (Note 14)	
		E4-07	Motor 2 Min. Output Frequency Voltage (Min Voltage)	0.0~ 255.0 (Note 13)	0.1V	2.0* (Note13)	* Factory setting differs depending on the control method [E3-01]	x	A (Note 14)	A (Note 14)	A (Note 14)	F (Note 14)	
Note 13: This value is for the 200V class. For 400V class, the value is twice that of 200V class. Note 14: Control mode is determined by E3-01.													

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group E Motor	Function E5 Motor Setup 2	**E5-01**	Motor 2 Rated Current (Motor Rated FLA)	0.00~ 1500.0	0.1A*	1.9**	* Setting unit is 0.01A for models of 7.5 kW or less. ** Factory setting differs depending on inverter capacity (02-04).	x	A (Note 14)	A (Note 14)	A (Note 14)	A (Note 14)	
		E5-02	Motor 2 Rated Slip (Motor Rated Slip)	0.00~ 20.00	0.01Hz	2.90**		x	A (Note 14)	A (Note 14)	A (Note 14)	A (Note 14)	
		E5-03	Motor 2 No-load Current (No-Load Current)	0.00~ 1500.0	0.01A*	1.20**		x	A (Note 14)	A (Note 14)	A (Note 14)	A (Note 14)	
		E5-04	Motor 2 Number of poles (Motor 2 # Poles)	2~48	1 pole	4		x	- (Note 14)	A (Note 14)	- (Note 14)	A (Note 14)	
		E5-05	Motor 2 Line-to-line Resistor (Motor 2 term Ohms)	0.000~ 65.000	0.001 W	9.842**		x	A (Note 14)	A (Note 14)	A (Note 14)	A (Note 14)	
		E5-06	Motor 2 Leak Inductance (Motor 2 Leak)	0.0~ 30.0	0.1%	18.2**		x	A (Note 14)	- (Note 41)	A (Note 14)	A (Note 14)	
Note 13: This value is for the 200V class. For 400V class, the value is twice that of 200V class. Note 14: Control mode is determined by E3-01.													
Group F Options *	Function F1 PG Option Setup	**F1-01**	PG Constant (PG Pulses/Rev)	0~ 60000	1	600*	*When 02-09=1 (USA), 2 (EUR.), factory setting is 1024	x	-	Q	-	Q	
		F1-02	Operation Selection at PG Open Circuit (PG Fdbk Loss Sel)	0~3	1	1	0: (Ramp to Stop) 1: (Coast to Stop) 2: (Fast-Stop) 3: (Alarm Only)	x	-	B	-	B	
		F1-03	Operation Selection at Overspeed (PG Overspeed Sel)	0~3	1	1	0: (Ramp to Stop) 1: (Coast to Stop) 2: (Fast-Stop) 3: (Alarm Only)	x	-	B	-	B	
		F1-04	Operation Selection at Deviation (PG Deviation Sel)	0~3	1	3	0: (Ramp to Stop) 1: (Coast to Stop) 2: (Fast-Stop) 3: (Alarm Only)	x	-	B	-	B	
		F1-05	PG Rotation (PG Rotation Sel)	0, 1	1	0	0: Counter-clockwise (Fwd = C.C.W.) 1: Clockwise (Fwd = C.W.)	x	-	B	-	B	
		F1-06	PG Division Rate PG --Pulse monitor (PG Output Ratio)	1~132	1	1	Effective only when control circuit board PG-B2 is used.	x	-	B	-	B	
		F1-07	Integral Value during Accel/decel Enable/disable (PG Ramp PI/I Sel)	0, 1	1	0	0: (Disabled) 1: (Enabled)	x	-	B	-	-	
		F1-08	Overspeed Detection Level (PG Overspd Level)	0~120	1%	115	—	x	-	A	-	A	
* When access level is BASIC (A1-03), constant is not displayed unless the option is connected.													

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group F Options *	Function F1 PG Option Setup	**F1-09**	Overspeed Detection Delay Time (PG Overspd Time)	0.0~2.0	0.1s	0.0*	* When A1-02=1 [V/f w/PG] factory setting is 1.0. When A1-02=3 [Close loop vector] factory set- ting is 0.0.	x	-	A	-	A	
		F1-10	Excessive Speed Deviation Detection Level (PG Deviate Level)	0~50	1%	10	—	x	-	A	-	A	
		F1-11	Excessive Speed Deviation detection Delay Time (PG Deviate Time)	0.0~ 10.0	0.1s	0.5	—	x	-	A	-	A	
		F1-12	Number of PG Gear Teeth 1 (PG # Gear Teeth 1)	0~1000	1	0	—	x	-	A	-	-	
		F1-13	Number of PG Gear Teeth 2 (PG # Gear Teeth 2)	0~1000	1	0	—	x	-	A	-	-	
		F1-14	PGO Detection Time (PGO Detect Time)	0~10.0	0.1s	2.0	—	x	-	A	-	A	
	Function F2 AI-14 Setup	**F2-01**	AI-14B Card Input Selection (AI-14 Input Sel)	0, 1	1	0	0: (3-ch Individual) 1: (3ch Addition)	x	A	A	A	A	
* When access level is BASIC (A1-03), constant is not displayed unless the option is connected.													

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group F Options *	Function F3 DI-08, 16 Setup	**F3-01**	Digital Input Selection (DI Input)	0~7	1	0	0: (BCD 1%) 1: (BCD 0.1%) 2: (BCD 0.01%) 3: (BCD 1Hz) 4: (BCD 0.1Hz) 5: (BCD 0.01Hz) 6: BCD Special setting 5 digit input, Binary 255/100% (BCD (5DG) 0.01Hz) 7: (Binary)* *Set value is displayed as decimal.	x	A	A	A	A	
	Function F4 AO-08. 12	**F4-01**	Channel 1 Monitor Selection (AO Ch1 Select)	1~38	1	2	Analog Output option Channel 1 1: Frequency reference 2: Output frequency 3: Inverter output current 5: Motor speed 6: Output voltage 7: DC bus voltage 8: Output power 9: Torque reference (internal) 15: External terminal 13 input voltage 16: External terminal 14 input voltage 17: External terminal 16 input voltage 18: Motor secondary current (Iq) 19: Motor excitation current (Id) 20: Primary frequency after SFS 21: Speed controller ASR input 22: Speed controller ASR output 23: Speed deviation 24: PID feedback 26: Voltage reference (Vq out-put) 27: Voltage reference (Vd out put) 32: ACR (q) Output 33: ACR (d) Output 36: PID Input <1110> 37: PID Output <1110> 38: PID Reference <1110>	x	A	A	A	A	
		F4-02	Channel 1 Gain (AO Ch1 Gain)	0.00~ 2.50	0.01	1.00	—	o	A	A	A	A	
		F4-03	Channel 2 Monitor Selection (AO Ch2 Select)	1~38	1	3	Analog Output option Channel 2 selection *(same as F4-01)*	x	A	A	A	A	
		F4-04	Channel 2 Gain (AO Ch2 Gain)	0.00~ 2.50	0.01	0.50	—	o	A	A	A	A	
		F4-05 <1110>	CH1 Output Bias (AO Ch1 Bias)	–10.0 ~10.0	0, 1	0.0	–	o	A	A	A	A	
		F4-06 <1110>	CH2 Output Bias	–10.0 ~10.0	0, 1	0.0	–	o	A	A	A	A	
* When access level is BASIC (A1-03), constant is not displayed unless the option is connected.													

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group F Options	Function F5 DO - 02 Setup	**F5-01**	Channel 1 Output Selection (DO-02 Ch1 Select)	00~37	1	0	—	x	A	A	A	A	
		F5-02	Channel 2 Output Selection (DO-02 Ch2 Select)	00~37 <26>	1	1	—	x	A	A	A	A	
	Function F6 DO - 08 Setup	**F6-01**	Output Mode Selection (DO-08 Selection)	0, 1	1	0	0: (8ch Individual) 1: (Binary Output)	x	A	A	A	A	
	Function F7 PO - 36F Setup	**F7-01**	Frequency Multiple Selection (PO-36F Selection)	0~4	1	1	0: (1 X Output Freq) 1: (6 X Output Freq) 2: (10 X Output Freq) 3: (12 X Output Freq) 4: (36 X Output Freq)	x	A	A	A	A	
	Function F8 SI - F/G Setup	**F8-01**	SI-F/G Communication Error Detection Operation Selection (E-15 Det Sel)	0~3	1	1	0: (Ramp to Stop) 1: (Coast to Stop) 2: (Fast - Stop) 3: (Alarm Only)	x	A	A	A	A	
	Function F9 CP-916 Setup / DDS • SI-B	**F9-01**	Option External Fault Selection (EFO Selection)	0, 1	1	0	0: When 1 is shown, EFO occurs (Normally Open) 1: When 0 is shown, EFO occurs. (Normally Closed)	x	A	A	A	A	
		F9-02	Option External Fault Detection Selection (EFO Detection)	0, 1	1	0	0: (Always Detected) 1: (Only During Run)	x	A	A	A	A	
		F9-03	Option External Fault Detection Operation Selection (EFO Fault Action)	0~3	1	1	0: (Ramp to Stop) 1: (Coast to Stop) 2: (Fast - Stop) 3: (Alarm Only)	x	A	A	A	A	
		F9-04	Trace Sampling Time (Trace Sample Tim)	0~ 60000	1	0	—	x	A	A	A	A	
		F9-05	Torque Reference/ Torque Limit Selec-tion through DP-RAM communica-tion (Torq Ref / Lmt Sel)	0, 1	1	1	0: (Disabled) 1: (Enabled)	x	-	-	-	A	
		F9-06	DP-RAM Communi-cation Error Detec-tion Operation Selection (BUS Fault Sel)	0~3	1	1	0: (Ramp to Stop) 1: (Coast to Stop) 2: (Fast - Stop) 3: (Alarm Only)	x	A	A	A	A	

Function	Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
								V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Terminal Function Function H1 Digital Inputs	**H1-01**	Terminal 3 Selection (Terminal 3 Sel)	00~77	1	24	Multi-function input (terminal 3) 0: 3-Wire Control 1: Local/Remote Selection 2: Option/Inverter Selection 3: Multi-Step Reference 1 4: Multi-Step Reference 2 5: Multi-Step Reference 3 6: Jog Frequency Reference 7: Multi-Accel/Decel 1 8: External Baseblock N.O. 9: External Baseblock N.C. A: Accel/Decel Ramp Hold B: OH2 Alarm Signal C: Terminal 16 Enable D: V/F Mode Select E: ASR Integral Reset F: Terminal Not Used 10: MOP Increase 11: MOP Decrease 12: Forward Jog 13: Reverse Jog 14: Fault Reset 15: Fast-Stop N.O. 16: Motor 2 Select 17: Fast Stop N.C. input <1110> 18: Timer Function 19: PID Disable 1A: Multi-Accel/Decel 2 1B: Program Lockout 1C: Trim Control Increase 1D: Trim Control Decrease 1E: Ref Sample Hold 1F: Terminal 13/14 Switch 24: External Fault 30: PID Integral Reset 31: PID Control Integral Hold <1110> 60: DC Injection Activate 61: Speed Search 1 62: Speed Search 2 63: Energy Save Mode 64: Speed Search 3 65: KEB Ridethrough N.C. 66: KEB Ridethrough N.O 71: Speed/Torque Control Change 72: Zero Servo Command 77: ASR Gain Switch	x	B	B	B	B	
	H1-02	Terminal 4 Selection (Terminal 4 Sel)	00~77	1	14	Multi-function input (terminal 4) *(same as H1-01)*	x	B	B	B	B	
	H1-03	Terminal 5 Selection (Terminal 5 Sel)	00~77	1	3 (0) (Note 15)	Multi-function input (terminal 5) *(same as H1-01)*	x	B	B	B	B	

Function	Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
								V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
	H1-04	Terminal 6 Selection (Terminal 6 Sel)	00~77	1	4 (3) (Note 15)	—	x	B	B	B	B	
	H1-05	Terminal 7 Selection (Terminal 7 Sel)	00~77	1	6 (4) (Note 15)	—	x	B	B	B	B	
	H1-06	Terminal 8 Selection (Terminal 8 Sel)	00~77	1	8 (6) (Note 15)	—	x	B	B	B	B	
Note 15: Factory settings in the parentheses are values obtained at 3-wire initialization.												

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Terminal	Function H2 Digital Outputs	**H2-01**	Multi-function Input Terminal 9-10 (Terminal 9 Sel)	00~37	1	0	Multi-function output 1 (terminal 9, terminal 10) *(same as F5-01)*	x	B	B	B	B	
		H2-02	Multi-function Input Terminal 25 (Terminal 25 Sel)	00~37	1	1	Multi-function output 2 (terminal 25, terminal 27) *(same as F5-01)*	x	B	B	B	B	
		H2-03	Multi-function Input Terminal 26 (Terminal 26 Sel)	00~37	1	2	Multi-function output 3 (terminal 26, terminal 27) *(same as F5-01)*	x	B	B	B	B	
	Function H3 Analog Inputs	**H3-01**	Signal Level Selection Terminal 13 (Term 13 Signal)	0, 1	1	0	0: (0 - 10 VDC) 1: (–10 +10 VDC)	x	B	B	B	B	
		H3-02	(Terminal 13 Gain)	0.0~ 1000.0	0.1%	100.0	Frequency reference gain of AI-14U, AI-14B (3ch addition input), DI-08, and DI-16 is common.	o	B	B	B	B	
		H3-03	(Terminal 13 Bias)	–100.0 ~ +100.0	0.1%	0.0	Frequency reference gain of AI-14U, AI-14B (3ch addition input), DI-08, and DI-16 is common.	o	B	B	B	B	
		H3-04	Terminal 16 Signal Level Selection (Term 16 Signal)	0, 1	1	0	0: (0 - 10 VDC) 1: (–10 +10 VDC)	x	B	B	B	B	
		H3-05	Terminal 16 Multi-function Analog Input (Terminal 16 Sel)	0~1F	1	0	Multi-function analog input selection (terminal 16) 0: Auxiliary Reference 1: Frequency Gain 2: Frequency Bias 4: Voltage Bias 5: Accel/Decel Change 6: DC Brake Current 7: Overtorque Level 8: Stall Prevention Level 9: Reference Lower Limit A: Jump Frequency B: PID Feedback C: PID Setpoint D: Frequency Bias 2 10: Forward Torque Limit 11: Reverse Torque Limit 12: Regenerative Torque Limit 13: Torque reference 14: Torque Compensation 15: Forward/Reverse Torque Limit 1F: Not Used	x	B	B	B	B	

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Terminal	Analog Inputs	**H3-06**	(Terminal 16 Gain)	0.0~ 1000.0	0.1%	100.0	—	o	B	B	B	B	
		H3-07	(Terminal 16 Bias)	–100.0 ~ +100.0	0.1%	0.0	—	o	B	B	B	B	
		H3-08	Signal Level Selection Terminal 14 (Term 14 Signal)	0, 1, 2	1	2	0: (0 - 10 VDC) 1: (–10 +10 VDC) 2: (4 - 20 mA)	x	A	A	A	A	
		H3-09	Multi-function Analog Input Terminal 14 (Terminal 14 Sel)	1~1F	1	1F	The function choices for terminal 14 are the same as the choices for terminal 16 [see H3-05}, except that [setting 0] “Auxiliary Reference” is not available.	x	A	A	A	A	
		H3-10	Terminal 14 Gain (Terminal 14 Gain)	0.0~ 1000.0	0.1%	100.0	—	o	A	A	A	A	
		H3-11	Terminal 14 Bias (Terminal 14 Bias)	–100.0 ~ +100.0	0.1%	0.0	—	o	A	A	A	A	
		H3-12	Analog Input Filter Time Constant (Filter Avg Time)	0.00~ 2.00	0.01s	0.00	—	x	A	A	A	A	

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group H Terminal Function	Function H4 Analog Outputs	**H4-01**	Monitor Selection Terminal 21 (Terminal 21 Sel)	1~38	1	2	Analog output selection (terminal 21 (same as F4-01) 1: Frequency reference 2: Output frequency 3: Inverter output current 5: Motor speed 6: Output voltage 7: DC bus voltage 8: Output power 9: Torque reference (internal) 15: External terminal 13 input voltage 16: External terminal 14 input voltage 17: External terminal 16 input voltage 18: Motor secondary current (Iq) 19: Motor excitation current (Id) 20: Primary frequency after SFS 21: Speed controller ASR input 22: Speed controller ASR output 23: Speed deviation 24: PID feedback 26: Voltage reference (Vq output) 27: Voltage reference (Vd output) 31: Not Used 32: ACR (q) Output 33: ACR (d) Output 36: PID Input <1110> 37: PID Output <1110> 38: PID Reference <1110>	x	B	B	B	B	
		H4-02	Terminal 21 Output Gain (Terminal 21 Gain)	0.00~ 2.50	0.01	1.00	—	o	B	B	B	B	
		H4-03	Terminal 21Output Bias (Terminal 21 Bias)	–10.0~ +10.0	0.0%	0.0	—	o	B	B	B	B	
		H4-04	Terminal 23 Monitor (Terminal 23 Sel)	1~38	1	3	Analog output selection (terminal 23) (same as H4-01)	x	B	B	B	B	
		H4-05	Terminal 23 Output Gain (Terminal 23 Gain)	0.00~ 2.50	0.01	0.50	—	o	B	B	B	B	
		H4-06	Terminal 23 Output Bias (Terminal 23 Bias)	–10.0~ +10.0	0.1%	0.0	—	o	B	B	B	B	
		H4-07	Analog Output Signal Selection (AO Level Select)	0, 1	1	0	0: (0 - +10 VDC) 1: (–10V +10 VDC)	x	B	B	B	B	

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Group H Terminal Function	Function H5 Serial Com Setup MODBUS Communication	**H5-01**	Station Address (Serial Comm Adr)	0~20	1	1F	—	x	A	A	A	A	
		H5-02	Communication Speed Selection (Serial Baud Rate)	0~4	0	3	0 : (1200 Baud) 1 : (2400 Baud) 2 : (4800 Baud) 3 : (9600 Baud) 4 : (19200 Baud) <1110>	x	A	A	A	A	
		H5-03	Communication Parity Selection (Serial Com Sel)	0, 1, 2	1	0	0 : (No Parity) 1 : (Even Parity) 2 : (Odd Parity)	x	A	A	A	A	
		H5-04	Stopping Method After Communica-tion Error (Serial Fault Sel)	0~3	1	3	0: (Ramp to Stop) 1: (Coast to Stop) 2: (Fast - Stop) 3: (Alarm Only)	x	A	A	A	A	
		H5-05	Timeover Detection (Serial Flt Dtct)	0, 1	1	1	0 : (Disabled) 1 : (Enabled)	x	A	A	A	A	
Protection	Function L1 Motor Overload	**L1-01**	Motor Protection Selection (MOL Fault Select)	0, 1	1	1	0: (Disabled) 1: (Coast to Stop)	x	B	B	B	B	
		L1-02	Motor Protection Time Constant (MOL Time Const)	0.1~5.0 min.	0.1 min.	1.0	When O2-09=1 [American Spec] the setting range is 0.1~20min. The factory default setting then becomes 8 min. 8 min. is the operation time from a cold start.	x	B	B	B	B	
Protection	Function L2 Power Loss Ride Through	**L2-01**	Momentary Power Loss Detection (PwrL Selection)	0, 1, 2	1	0	0 : (Disabled) 1 : Power loss ride through (PwrL RideThru t) 2 : (CPU Power Active)	x	B	B	B	B	
		L2--02	Momentary Power Loss Ride Through (PwrL Ridethru t)	0.0~2.0	0.1s	0.7**	** Factory setting differs depending on inverter capacity (02-04).	x	B	B	B	B	
		L2-03	Min. Baseblock Time (PwrL Baseblock t)	0.1~5.0	0.1s	0.5*	* Factory setting differs depending on inverter capacity. Lower limit of setting range is changed from 0 to 0.1. <1110>	x	B	B	B	B	
		L2-04	Voltage Recovery Time (PwrL V/F Ramp t)	0.0~5.0	0.1s	0.3*	* Factory setting differs depending on inverter capacity (02-04).	x	A	A	A	A	
		L2-05	Undervoltage Detection Level (PUV Det Level)	150~ 210	1V	190*	*Voltage Class 200V class=190V Det level 400V class=190V x 2= 380V level	x	A	A	A	A	
		L2-06	KEB Deceleration Rate (KEB Frequency)	0.0~ 100.0	0.1%	0.0	—	x	A	A	A	A	

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Protection	Function L3 Stall Prevention Function	**L3-01**	Stall Prevention During Acceleration (StallP Accel Sel)	0, 1, 2	1	1	0: (Disabled) 1: (General Purpose) 2: (Intelligent)	x	B	B	B	-	
		L3-02	Stall Prevention Level During Accel-eration (StallP Accel Lvl)	0~200	1%	150	—	x	B	B	B	-	
		L3-03	Stall Prevention Limit During Accel-eration (StallP CHP Lvl)	0~100	1%	50	—	x	A	A	A	-	
		L3-04	Stall Prevention During Deceleration (StallP Decel Sel)	0, 1, 2, 3	1	1	0: (Disabled) 1: (General Purpose) 2: (Intelligent) <1110> can use setting 2 for all control modes A102=0,1,2,3 3: With braking resistor (Stall prev w/R) When in Vector w/PG A1-02=3 setting 3 cannot be set with braking resistor and with stall prevention.	x	B	B	B	B	
		L3-05	Stall Prevention Selection during Running (StallP Run Sel)	0, 1, 2	1	1	0: (Disabled) 1: (Decel Time 1) C1-02 2: (Decel Time 2) C1-04	x	B	B	-	-	
		L3-06	Stall Prevention Level during Running (StallP Run Level)	30~200	1%	160	—	x	B	B	-	-	
		L3-07	Stall Prevention Function P Gain (StallP Gain)	0.10~ 2.00	0.01	1.00	—	x	F	F	-	-	
		L3-08	Stall Prevention Function Integral Time (StallP Intg Time)	10~250	1 ms	100	—	x	F	F	-	-	

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Protection	Function L4 Reference Detection	**L4-01**	Frequency Detection Level (Spd Agree Level)	0.0~ 400.0	0.1Hz	0.0	—	x	B	B	B	B	
		L4-02	Frequency Detection Width (Spd Agree Width)	0.0~ 20.0	0.1Hz	2.0	—	x	B	B	B	B	
		L4-03	Frequency Detection Level ± (Spd Agree Lvl ±)	–400.0 ~ +400.0	0.1Hz	0.0	—	x	A	A	A	A	
		L4-04	Frequency Detection Width ± (Spd Agree Wdth ±)	0.0~ 20.0	0.1Hz	2.0	—	x	A	A	A	A	
		L4-05	Frequency Loss Detection Selection (Ref Loss Sel)	0, 1	1	0	0: (Stop) 1: (Run@ 80% PrevRef)	x	A	A	A	A	
	Function L5 Fault Restart	**L5-01**	Number of Auto Restart Attempts (Num of Restarts)	0~10	1	0	—	x	B	B	B	B	
		L5-02	Auto Restart Operation Selection (Restart Sel)	0, 1	1	0	0: (No Flt Relay) 1: (Flt Relay Active)	x	B	B	B	B	
	Function L6 Torque Detection	**L6-01**	Overtorque Detection Selection 1 (Torq Det 1 Sel)	0~4	1	0	0: (Disabled) 1: (@SpdAgree - Alm) Detected during speed agree only. Operation continues after detection and OL3 flashes on display. 2: (At RUN - Alarm) Overtorque detection during running. Operation continues after detection and OL3 flashes on the display. 3: (@SpdAgree - Flt) Detected during the speed agree only. Inverter trips on OL3, output is shut OFF. 4: (At RUN - Fault) Detected during running, and the inverter trips on OL3. Output is shut OFF.	x	B	B	B	B	

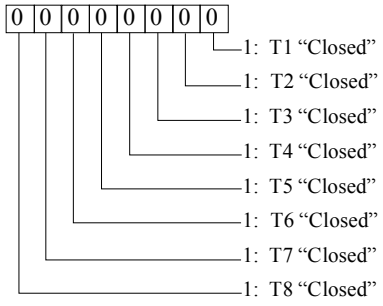
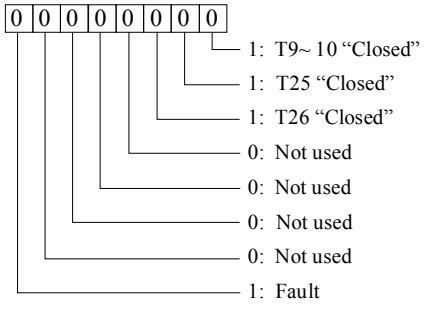
Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Protection	Function L6 Torque Detection	**L6-02**	Overtorque Detection Level 1 (Torq Det 1 Lvl)	0~300	1%	150	—	x	B	B	B	B	
		L6-03	Overtorque Detection Time 1 (Torq Det 1 Time)	0.0~ 10.0	0.1s	0.1	—	x	B	B	B	B	
		L6-04	Overtorque Detection Selection 2 (Torq Det 2 Sel)	0~4	1	0	0: (Disabled) 1: (@SpdAgree - Alm) Detected during speed agree only. Operation continues after detection and OL4 flashes on display. 2: (At RUN - Alarm) Overtorque detection during running. Operation continues after detection and OL4 flashes on the display. 3: (@SpdAgree - Flt) Detected during the speed agree only. Inverter trips on OL4, output is shut OFF. 4: (At RUN - Fault) Detected during running, and the inverter trips on OL4. Output is shut OFF.	x	A	A	A	A	
		L6-05	Overtorque Detection Level 2 (Torq Det 2 Lvl)	0~300	1%	150	—	x	A	A	A	A	
		L6-06	Overtorque Detection Time 2 (Torq Det 2 Time)	0.0~ 10.0	0.1s	0.1	—	x	A	A	A	A	
	Function L7 Torque Limit	**L7-01**	Forward Torque Limit (Torq Limit Fwd)	0~300	1%	200	—	x	-	-	B	B	
		L7-02	Reverse Torque Limit (Torq Limit Rev)	0~300	1%	200	—	x	-	-	B	B	
		L7-03	Forward Regenerative Torque Limit (Torq Lmt Fwd Rgn)	0~300	1%	200	—	x	-	-	B	B	
		L7-04	Reverse Regenerative Torque Limit (Torq Lmt Rev Rgn)	0~300	1%	200	—	x	-	-	B	B	

Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Protection	Function L8 Hardware Protection	**L8-01**	Internal DB Resistor Protection Selection (DB Resistor Prot)	0, 1	1	0	0: (Not Provided) 1: (Provided)	x	B	B	B	B	
		L8-02	Overheat Pre-alarm Level (OH Pre-Alarm Lvl)	50~130	1 deg C	95 C*	*Factory setting depends on inverter model [02-04].	x	A	A	A	A	
		L8-03	Operation Selection after OH Pre-alarm (OH Pre-Alarm Sel)	0~3	1	3	0: (Ramp to Stop) using C1-02 1: (Coast to Stop) 2: (Fast-Stop) using C1-09 3: (Alarm Only) display flashes OH Heatsink Ovrtemp	x	A	A	A	A	
		L8-05	Input Phase Loss Protection (PH Loss In Sel)	0, 1	1	0	0: (Disabled) 1: (Enabled)	x	A	A	A	A	
		L8-07	Output Phase Loss Protection (PH Loss Out Sel)	0, 1	1	0*	0: (Disabled) 1: (Enabled) *When 02-09=1, the factory default setting is 1.	x	A	A	A	A	
Protection	Function L8 Hardware Protection	**L8-10**	Short-circuit Protection Selection (Ground Fault Sel)	0, 1	1	1	0: (Disabled) 1: (Enabled)	x	A	A	A	A	
		L8-17	IGBT Protection Selection at Low Frequency (Prtct@L - Spd)	0, 1	1	1*	0: Conventional 1: (Lower fc) Carrier frequency is decreased when fout 10Hz and the load is > 100% iac. 2: (Short term OL2) OL occurs after 2 seconds during low speed [fout £ 6Hz] current limit. 3: (I-Limit=150%) Current limit is set to 150% of the inverter rated current. < G5 plus > Addition * When 02-09=1 factory setting is 1. * When 02-09=2 factory setting is 2.	x	A	A	A	-	
		L8-19 <1110>	OL2 Characteristics Selection at Low Speed (OL2 Chara@L-Spd)	0, 1	1	0	0: (Disabled) Low frequency OL disabled 1: (Enabled) Low frequency OL enabled	x	A	A	A	A	

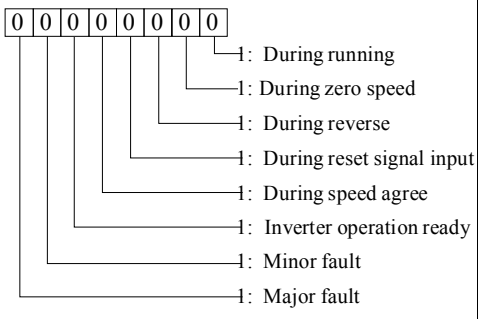
Function		Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
									V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Operator	Function o1 Monitor Selection	**O1-01**	Monitor Selection (User Monitor Sel)	4~39	1	6	Monitor selection 4: Control method 5: Motor speed 6: Output voltage 7: DC bus voltage 8: Output power 9: Torque reference (internal) 10: Input terminal status 11: Output terminal status 12: Internal Control Status 1 13: Elapsed time 14: Flash software ID number 15: External terminal 13 input voltage 16: External terminal 14 input voltage 17: External terminal 16 input voltage 18: Motor secondary current (Iq) 19: Motor excitation current (Id) 20: Primary frequency after SFS 21: Speed controller ASR input 22: Speed controller ASR output 23: Speed deviation 24: PID feedback 25: DI-16 reference 26: Voltage reference (Vq output) 27: Voltage reference (Vd output) 28: CPU ID number	o	B	B	B	B	
	Function o2 Key Selections	**O1-02**	Monitor Selection after Power Up (Power- On Monitor)	1~4	1	1	1: (Frequency Ref) 2: (Output Freq) 3: (Output Current) 4: (User Monitor)	o	B	B	B	B	
		O1-03	Frequency Units of Reference Setting and Monitor (Display Scaling)	0~ 39999	1	0	—	x	B	B	B	B	
		O1-04	(Display Units)	0, 1	1	0	0: (Hertz) 1: (RPM)	x	-	-	-	B	
		O1-05	Parameter No. Display Selection (Address Display)	0, 1	1	0	0: (Parameter Number) 1: (Memobus Address)	x	A	A	A	A	
		O2-01	LOCAL/REMOTE Key Enable/Disable (Local/Remote Key)	0, 1	1	1	0: (Disabled) 1: (Enabled)	x	B	B	B	B	
		O2-02	STOP Key Function Selection (Oper STOP Key)	0, 1	1	1	0: (Disabled) When the inverter is operated from the digital operator. 1: (Enabled) Always enabled.	x	B	B	B	B	

Function	Parameter No.	Name (Digital Operator Display)	Setting Range	Setting Unit	Factory Setting	Remarks (Digital Operator Display)	Change during Operation o: Enabled x: Disabled	Parameter Access Level				User Setting
								V/f	V/f w/ PG	Open Loop Vector	Close Loop Vector	
Operator Function o2 Key Selection	**O2-03**	User Parameter Initialization Selection (User Defaults)	0, 1, 2	1	0	0: (No Change) Micno default values used 1: (Set Defaults) Sets user specified value as default. 2: (Clear All) Clears user defaults	x	B	B	B	B	
	O2-04	kVA Selection (Inverter Model #)	0~FF	1	–*	* Not initialized. Sets the inverter capacity according to the model number.	x	B	B	B	B	
	O2-05	Frequency Reference Setting Method Selection (Operator M.O.P.)	0, 1	1	0	0: (Disabled) 1: (Enabled)	x	A	A	A	A	
	O2-06	Operation Selection When Digital Operator is Disconnected (Oper Detection)	0, 1	1	0*	0: (Disabled) Operation continues even if the digital operator is disconnected. 1: (Enabled) Inverter fault when the digital operator is disconnected. * When 02-09=1, the value is 1.	x	A	A	A	A	
	O2-07	Elapsed Timer Setting (Elapsed Time Set)	0~ 65535	1 hour	—	—	x	A	A	A	A	
	O2-08	Elapsed Timer Selection (Elapsed Time Run)	0, 1	1	0	0: (Power - On Time) 1: (Running Time)	x	A	A	A	A	
	O2-09	Initialization Mode Selection (Init Mode Sel)	0~3	1	0	0: (Japanese spec) 1: (American spec) 2: (European spec) 3: (OMRON spec) When 02-09 = 1 or 2, it is added by <1032>. When 02-09 = 0 or 3, it is added by <1040>.	x	A	A	A	A	

Monitor Display (Un-XX)

Function	Parameter No.	Name (Digital Operator Display)	Min. Unit	Description	Analog Monitor Output Level	Parameter Access Level			
						V/f	V/f w/ PG	Vector w/o PG	Vector w/ PG
Monitor	**U1-01**	Frequency Reference (Frequency Ref)	0.01Hz	The unit differs depending on O1-03 setting.	10V/Max. output frequency	Q	Q	Q	Q
	U1-02	Output Frequency (Output Freq)	0.01Hz	The unit differs depending on O1-03 setting.	10V/Max. output frequency	Q	Q	Q	Q
	U1-03	Output Current (Output Current)	0.1A	Minimum unit is 0.01 A for 7.5 kW or less.	10V/Inverter rated current	Q	Q	Q	Q
	U1-04	Control Method* (Control Method)	—	0: V/f control 1: V/f control with PG 2: Vector control without PG 3: Vector control with PG	—	Q	Q	Q	Q
	U1-05	Motor Speed (Motor Speed)	0.01Hz	The unit differs depending on O1-03 setting.	10V/Max. Output frequency	x	Q	Q	Q
	U1-06	Output Voltage (Output Voltage)	0.1V	—	10V/200V or 400V	Q	Q	Q	Q
	U1-07	DC Bus Voltage V (DC Bus Voltage)	1V	—	10V/400V or 800V	Q	Q	Q	Q
Monitor	**U1-08**	Output Power (Output kWatts)	0.1kW	—	10V/Inverter capacity (kW)	Q	Q	Q	Q
	U1-09	Torque Reference (Torque Reference)	0.1%	—	10V/Motor rated torque	x	x	Q	Q
	U1-10	Input Terminal Status* (Input Term Sts)	—		—	Q	Q	Q	Q
	U1-11	Output Terminal Status* (Output Term Sts)	—		—	Q	Q	Q	Q

* Cannot be changed by U1-04

Function	Parameter No.	Name (Digital Operator Display)	Min. Unit	Description	Analog Monitor Output Level	Parameter Access Level			
						V/f	V/f w/ PG	Vector w/o PG	Vector w/ PG
Monitor	**U1-12**	Operation Status* (Int Ctl Sts 1)	—		—	Q	Q	Q	Q
	U1-13	Elapsed Time* (Elapsed Time)	1 hour	—	—	Q	Q	Q	Q
	U1-14	Software No. at FLASH Side* (FLASH ID)	—	—	—	Q	Q	Q	Q
	U1-15	Control Circuit Terminal 13 (Term 13 Level)	0.1%	—	10V/10V	B	B	B	B
	U1-16	Control Circuit Terminal 14 Input Voltage (Term 14 Level)	0.1%	—	10V/10V or 20 mA	B	B	B	B
	U1-17	Control Circuit Terminal 16 Input (Terminal 16 Level)	0.1%	—	10V/10V	B	B	B	B
	U1-18	Motor Secondary Current (Iq) (Mot SEC Current)	0.1%	—	10V/Motor rated primary current	B	B	B	B
	U1-19	Motor Excitation Current (Mot EXC Current)	0.1%	—	10V/Motor rated primary current	x	x	B	B
	U1-20	Output Frequency after Soft-start (SFS Output)	0.01Hz	—	10V/Max. output frequency	A	A	A	A
	U1-21	ASR Input (ASR Input)	0.01%	—	10V/Max. output frequency	x	A	x	A
	U1-22	ASR Output (ASR Output)	0.01%	Analog monitor output level becomes 10V/Max. output frequency for V/f control mode with PG.	10V/Motor rated primary current	x	A	x	A
	U1-23	Speed Deviation (Speed Deviation)	0.01%	—	10V/Max. output Frequency	x	A	x	A
	U1-24	PID Feedback Capacity (PID Feedback)	0.01%	–	10V/Max. output Frequency	A	A	A	A

* Cannot be changed by U1-04

Function	Parameter No.	Name (Digital Operator Display)	Min. Unit	Description	Analog Monitor Output Level	Parameter Access Level			
						V/f	V/f w/ PG	Vector w/o PG	Vector w/ PG
Monitor	**U1-25**	D1-16H Input Status* (DI-16 Reference)	—	Displays input value according to F3-01 setting. For example: When lower 8 bit is ON, Binary selection: 256, BCD selection: 99	—	A	A	A	A
	U1-26	Output Voltage Reference Vq (Voltage Ref (Vq))	0.1V	—	10V/200V or 400V	x	x	A	A
	U1-27	Output Voltage Reference Vd (Voltage Ref (Vd))	0.1V	—	10V/200V or 400V	x	x	A	A
	U1-28	Software No. at CPU Side* (CPU ID)	—	—	—	A	A	A	A
	U1-32	ACR (q) Output (ACR (q) Output)	0.1%	—	—	x	x	A	A
	U1-33	ACR (d) Output (ACR (d) Output)	0.1%	—	—	x	x	A	A
	U1-34	OPE Detection Parameter* (OPE Detected)	—	—	—	A	A	A	A
	U1-35	No. of O Servo Moving Pulses (Zero Servo Pulse)	1	—	—	x	x	x	A
	U1-36 <1110>	PID Deviation (PID Input)	0.01%	PID reference + PID reference bias – PID feedback capacity	10V/Max. Output Frequency	A	A	A	A
	U1-37 <1110>	PID Output Capacity (PID Output)	0.01%	PID output capacity	10V/Max. Output Frequency	A	A	A	A
	U1-38 <1110>	PID Reference (PID Setpoint)	0.01%	PID reference + PID reference bias	10V/Max. Output Frequency	A	A	A	A
	U1-39 <1110>	Temperature for Cooling Fin (Heatsink Temp)	1 C	—	—	F	F	F	F

* Cannot be changed by U1-04

Function	Parameter No.	Name (Digital Operator Display)	Min. Unit	Description	Analog Monitor Output Level	Parameter Access Level			
						V/f	V/f w/ PG	Vector w/o PG	Vector w/ PG
Function U2 Fault Trace	**U2-01**	Current Fault (Current Fault)	—	—	—	Q	Q	Q	Q
	U2-02	Last Fault (Last Fault)	—	—	—	Q	Q	Q	Q
	U2-03	Frequency Reference at Fault (Frequency Ref)	0.01Hz	—	—	Q	Q	Q	Q
	U2-04	Output Frequency at Fault (Output Freq)	0.01Hz	—	—	Q	Q	Q	Q
	U2-05	Output Current at Fault (Output Current)	0.1A	—	—	Q	Q	Q	Q
	U2-06	Motor Speed at Fault (Motor Speed)	0.01Hz	—	—	x	Q	Q	Q
	U2-07	Output Voltage Refer-ence at Fault (Output Voltages)	0.1V	—	—	Q	Q	Q	Q
	U2-08	DC Bus Voltage at Fault (DC Bus Voltage)	1V	—	—	Q	Q	Q	Q
	U2-09	Output Power at Fault (Output kWatts)	0.1kW	—	—	Q	Q	Q	Q
	U2-10	Torque Reference at Fault (Torque Reference)	0.1%	—	—	x	x	Q	Q
	U2-11	Input Terminal Status at Fault (Input Term Sts)	—	Displays the same status as the U1-10.	—	Q	Q	Q	Q
	U2-12	Output Terminal Status at Fault (Output Term Sts)	—	Displays the same status as the U1-11.	—	Q	Q	Q	Q
	U2-13	Operation Status at Fault (Inverter Status)	—	Displays the same status as the U1-12.	—	Q	Q	Q	Q
	U2-14	Elapsed Operation Time at Fault (Elapsed Time)	1 hour	—	—	Q	Q	Q	Q

Function	Parameter No.	Name (Digital Operator Display)	Min. Unit	Description	Analog Monitor Output Level	Parameter Access Level			
						V/f	V/f w/ PG	Vector w/o PG	Vector w/ PG
Function U3 Fault History	**U3-01**	Most Recent Fault (Last Fault)	—	—	—	Q	Q	Q	Q
	U3-02	Second Most Recent Fault (Fault Message 2)	—	—	—	Q	Q	Q	Q
	U3-03	Third Most Recent Fault (Fault Message 3)	—	—	—	Q	Q	Q	Q
	U3-04	Fourth/oldest Fault (Fault Message 4)	—	—	—	Q	Q	Q	Q
	U3-05	Elapsed Operation Time at Fault (Elapsed Time 1)	1 hour	—	—	Q	Q	Q	Q
	U3-06	Elapsed Time of Second Fault (Elapsed Time 2)	1 hour	—	—	Q	Q	Q	Q
	U3-07	Elapsed Time of Third Fault (Elapsed Time 3)	1 hour	—	—	Q	Q	Q	Q
	U3-08	Elapsed Time of Fourth/ oldest Fault (Elapsed Time 4)	1 hour	—	—	Q	Q	Q	Q

Chapter 8 Maintenance & Trouble Shooting

8.1 Maintenance & Inspection

This section describes basic maintenance and inspection procedures for the KE200 inverter.

Periodic Inspection

The KE200 inverter will function longer if it is kept clean, cool and dry, and if all precautions highlighted in this manual are observed. Periodically inspect the inverter as described in the table below to prevent accidents and to ensure high performance with high reliability.
To prevent electrical shock, disconnect all power before servicing the inverter. Then wait at least five minutes after the power supply is disconnected and all LEDs are extinguished.

Component	Check	Corrective Action
External Terminals, Connectors, Mounting Screws, etc.	Loose screws or connectors	Securely tighten.
Heatsink	Build-up of dust and dirt	Blow with dry, compressed air [39.2 10^4 to 58.8 10^4 Pa (4 to 6kg·cm^2) pressure].
Printed Circuit Board (PCB)	Accumulation of conductive dust or oil	Blow with dry, compressed air [39.2 10^4 to 58.8 10^4 Pa (4 to 6kg·cm^2) pressure]. If dust and oil cannot be removed, replace the board.
Cooling Fan	For abnormal noise and vibration	Replace the cooling fan.
Power Components	Accumulation of dust and dirt	Blow with dry, compressed air [39.2 10^4 to 58.8 10^4 Pa (4 to 6kg·cm2) pressure].
Smoothing Capacitor	Discoloration or odor	Replace the capacitor or the inverter.

8.2 Alarm & Fault Displays

This section describes the alarm and fault displays, explanations for fault conditions, and corrective actions to be taken if the KE200 inverter malfunctions.

Inverter Alarms & Faults

When the KE200 inverter detects a fault, the fault is displayed on the digital operator and activates a fault contact output, after which the motor coasts to a stop. Check the causes listed in the table below and take the corresponding corrective actions. To restart the inverter, remove any run command and turn ON the reset input signal or depress the RESET key on the digital operator, or cycle power to reset the stop status. If taking the corrective actions described does not solve the problem, contact your Micno representative immediately.

Unlike faults, alarms do not activate fault contact outputs. After the cause of the alarm is corrected, the inverter returns to its former operation status automatically.

Fault Diagnosis and Corrective Actions

Fault Display	Name	Description	Corrective Action	Class
UV1 DC Bus Undervolt	Main circuit undervoltage (PUV)	Undervoltage in the DC main circuit during running. Detection level 230 V class: Approx. 190 V or less 460 V class: Approx. 380 V or less	· Check the power supply wiring. · Correct the line voltage	A
UV2 CTL PS Undervolt	Control circuit undervoltage (CUV)	Undervoltage in the control circuit during running.		A
UV3 MC Answerback	MC fault	The pre-charge contactor opened during running.		A
UV Under Voltage	Momentary power loss	· The main circuit DC voltage fell below the PUV level. · The control power source fell below the CUV level. · The pre-charge contactor opened.	--	B
OC Overcurrent	Overcurrent (OC)	The inverter output current exceeded the OC level.	· Check the motor coil resistance. · Extend the accel/decel time. · Check the motor insulation. · Multi-meter check.	A
GF Ground Fault	Ground fault (GF)	Inverter output grounding current exceeded 50% of inverter rated current.	· Check that motor insulation has not deteriorated. · Check that connection between inverter and motor is not damaged.	A

Fault Display	Name	Description	Corrective Action	Class
OV Overvoltage	Overvoltage (OV)	The main circuit direct current voltage exceeded the OV level. Detection level 230 V class: Approx. 410 V 460 V class: Approx. 820 V	Extend the deceleration time, add braking circuit.	A
SC Short Circuit	Load short-circuit (SC)	Inverter output (load) is short-circuited.	· Check the motor coil resistance. · Check the motor installation.	A
PUF DC Bus Fuse Open	Fuse blown (FU)	· The DC bus fuse is blown. · The output transistors were damaged.	Check for damaged transistor, load side short circuit, grounding, etc.	A
OH Heatsink Over tmp	Heatsink overheat (OH1)	The transistor heatsink temperature exceeded the allowable value.	Check the fan and ambient temperature.	A
OL1 Motor Overloaded	Motor overload (OL1)	Inverter output exceeded the motor overload level.	Reduce the load.	A
OL2 Inv Overloaded	Inverter overload (OL2)	Inverter output exceeded the inverter overload level.	Reduce the load, extend the acceleration time.	A
PF Input Pha Loss	Input open-phase	Inverter input power supply has open phase. Large unbalance in input voltage.	· Check the line voltage. · Re-tighten the input terminal screws.	A
LF Output Pha Loss	Output open-phase	Inverter output has open-phase.	· Check the output wiring. · Check the motor impedance. · Re-tighten the output terminal screws.	A
RR Dyn Brk Transistr	Braking transistor failure	The braking transistor has failed.	The inverter requires repair.	A
RH Dyn Brk Resistor	Braking resistor unit overheat	The braking resistor unit temperature has exceeded the allowable value. (Protects only inverter built-in type)	Reduce the regenerative load.	A
OS Over speed	Overspeed (OS)	The motor speed exceeded the overspeed level.	--	A
PGO PG open	PG open circuit (PGO)	The PG line is broken.	· Check the PG line. · Check the condition of the motor lock or the load.	A
DEV Speed Deviation	Speed deviation (DEV)	The deviation of the speed reference and speed feedback exceeded the regulation level.	Check the load.	B
EF External Fault	Simultaneous forward/ reverse run commands	Both FWD and REV run commands are simultaneously input for 500ms or longer.	Check sequence circuit.	B
BB Base Block	External baseblock	External baseblock command is input from control circuit terminal.	Check sequence circuit.	B

Fault Display	Name	Description	Corrective Action	Class
EF3 External Fault 3	External fault at terminal 3	Fault occurred in the external control circuit.	Check the condition of the input terminal. If the LED lights when terminal is not connected, then the inverter requires repair.	A
EF4 External Fault 4	External fault at terminal 4	Fault occurred in the external control circuit.	Check the condition of the input terminal. If the LED lights when terminal is not connected, then the inverter requires repair.	B
EF5 External Fault 5	External fault at terminal 5			
EF6 External Fault 6	External fault at terminal 6			
EF7 External Fault 7	External fault at terminal 7			
EF8 External Fault 8	External fault at terminal 8			
OPE01 kVA Selection	kVA setting error (OPE01)	Inverter kVA setting error.	Check and set the parameter data *(O2-04)*.	C
OPE02 Limit	Parameter setting range error (OPE02)	Parameter data is out of range.	Check the parameter data settings.	C
OPE03 Terminal	Multi-function input setting error (OPE03)	· Multi-function input settings in *H1-01* to *H1-06* are not in ascending order. · Or, set values other than "F" are over-lapping.	Check the function selection.	C
OPE10 V/f	V/f data setting error (*E1-04* to *E1-10*)	V/f data is set such that the following equation is *not* satisfied: *E1-04 E1-06 > E1-07 E1-09*	Check the parameter data settings.	C
OPE11 FC/ On-Dly	Parameter setting error	When one of the following setting errors occurs: · Carrier frequency upper limit *(C6-01)* > 5kHz, and Carrier frequency lower limit *(C6-02)* 5kHz · Carrier frequency proportional gain *(C6-03)* > 6 and *(C6-01)* < *(C6-02)*	Check the parameter data settings.	C
ERR EEPROM R/W Err	EEPROM writing fault (ERR)	EEPROM internal data did not match when initializing the parameter.	Replace the control board.	B
CALL Serial Com Call	SI-B transmission error	Control data was not received correctly when power supply was turned ON.	Check transmission devices and transmission signals.	C
CE Memobus Com Err	Transmission error	Control data was not received correctly when power supply was turned ON.	Check transmission devices and transmission signals.	A

Fault Display	Name	Description	Corrective Action	Class
CPF00 COM-ERR(OP&INV)	Control circuit fault 1 (CPF00) Digital perator transmission fault	· Transmission between the inverter and digital operator cannot be established 5 seconds after supplying power. · MPU peripheral element check fault (on-line)	· Insert the operator connector again. · Check the wiring of control circuit. · Replace the control board.	A
CPF01 COM-ERR(OP&INV)	Control circuit fault 2 (CPF01) Digital perator transmission fault	· Transmission between the inverter and digital operator is established once after supplying power, but later transmission fault continues for more than 2 seconds. · MPU peripheral element check fault (on-line).	· Insert the digital operator connector again. · Check the digital control circuit wiring. · Replace the control board.	A
CPF02 BB Circuit Err	Baseblock circuit fault (CPF02)	Inverter PCB control board fault.	Replace the control board.	A
CPF03 EEPROM Error	EEPROM fault (CPF03)			A
CPF04 Internal A/D Err	CPU internal A/D converter fault (CPF04)			A
CPF05 External A/D Err	CPU external A/D converter fault (CPF05)			A
CPF06 Option Error	Option connection fault (CPF06)	The option card is not installed correctly.	Install the option card again.	A
CPF20 Option A/D Error	A/D converter fault in analog speed reference card (CPF20)	Option card (AI-14B) A/D converter fault	Replace the option card.	A

Classes are described as follows:

A: Major fault. Motor coasts to stop, operation indicator illuminates, and fault contact output (terminals 18 & 19) is activated.

B: Fault. Operation continues, operation indicator illuminates, and multi-function fault signal is output (when multi-function output is selected). Fault contact output is *not* activated.

C: Alarm (warning). Operation cannot be performed, and operation indicator illuminates, but *no* fault signal is output.

Motor Faults

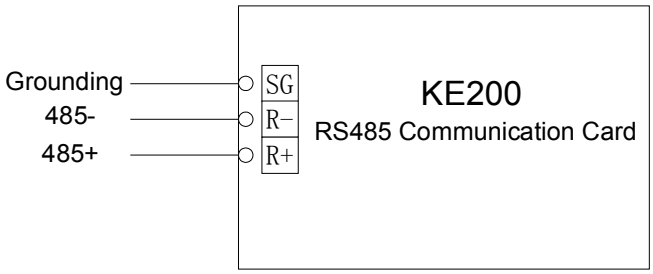
If a motor fault occurs, follow the checkpoints listed in the table below and take the corresponding cor- rective actions. If taking the corrective actions described does not solve the problem, contact your Micno representative immediately.

Motor Faults and Corrective Actions

Fault	Check Point	Corrective Action
Motor does not rotate	Power supply voltage applied to power supply terminals L1, L2, L3? Charge LED is ON?	· Turn ON power supply. · Turn OFF power supply, and then ON again. · Check power supply voltage. · Make sure terminal screws are tight.
	Use rectifier type voltmeter to test. Voltage output to output terminals T1, T2, T3 correct?	Turn OFF power supply, then turn ON again.
	Motor locks due to excessive load?	Reduce the load and release the lock.
	Fault displayed in operator display?	Check troubleshooting table on page 64.
	FWD or REV run command entered?	Check the wiring.
	Frequency setting voltage entered (when using terminals 13 or 14)?	· Check the wiring. · Check frequency setting voltage.
	Are reference and run source settings correct?	Check reference and run source selections *(B1-01, B1-02)*.
Motor rotation reverses	Wiring of terminals T1, T2, T3 correct?	Match wiring to the phase order of the motor leads T1, T2, T3.
	FWD and REV wiring run signals entered?	Correct the wiring.
Motor rotates, but variable speed not available.	Wiring of frequency setting circuit correct?	Correct the wiring.
	Are reference and run source settings correct?	Check reference and run source selections *(B1-01, B1-02)*.
	Load excessively large?	Reduce the load.
Motor rpm too high or too low	Motor ratings (number of poles, voltage) correct?	Check motor nameplate specifications.
	Accel/decel speed change ratio for gears, etc. correct?	Check speed changer (gears, etc.)
	Maximum frequency set value correct?	Check the maximum frequency set value.
	Use rectifier voltmeter. Voltage between motor terminals not excessively reduced?	Check V/f characteristics values.
Motor rpm not stable during operation	Load excessively large?	Reduce the load.
	Load variation excessively large?	· Reduce the load variation. · Increase inverter motor capacity.
	3-phase or single-phase power supply used? For 3-phase power supply, open phase?	· For 3-phase power supply, check the wiring if power supply is open phase. · For single-phase power supply, connect AC reactor to the power supply.

Chapter 9 MODBUS Communication Protocol

KE200 series inverter provides RS485 communication interface, and adopts MODBUS communication protocol. User can realize centralized monitoring through PC/PLC, host computer, and also can set inverter's operating commands, modify or read function parameters, read operating status and fault information, etc.

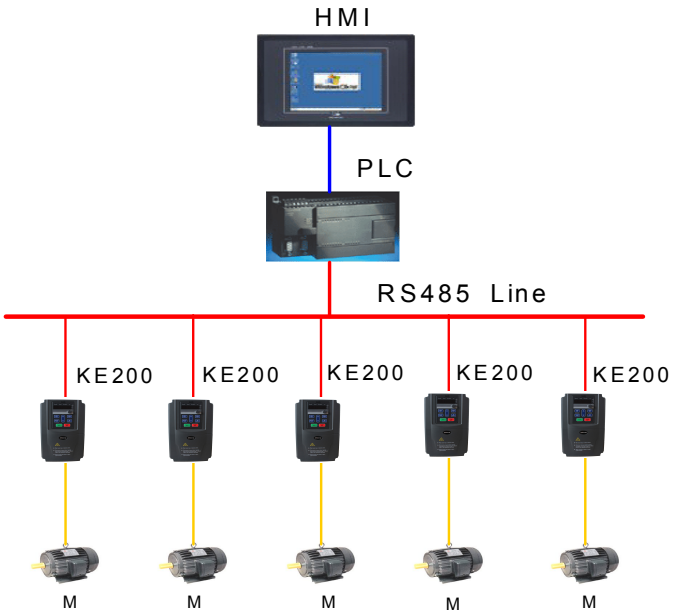


9.1 About Protocol

This serial communication protocol defines the transmission information and use format in the series communication. It includes the formats of master-polling, broadcast and slave response frame, and master coding method with the content including slave address (or broadcast address), command, transmitting data and error checking. The response of slave adopts the same structure, including action confirmation, returning the data and error checking etc. If slave takes place the error while it is receiving the information or cannot finish the action demanded by master, it will send one fault signal to master as a response.

9.2 Application Method

The inverter could be connected into a "Single-master Multi-slave" PC/PLC control network with RS485 bus.



9.3 Bus Structure

(1) Interface mode

RS485

(2) Transmission mode

There provide asynchronous series and half-duplex transmission mode. At the same time, just one can send the data and the other only receives the data between master and slave. In the series asynchronous

communication, the data is sent out frame by frame in the form of message.

(3) Topological structure

In Single-master Multi-slave system, the setup range of slave address is 0 to 247. 0 refers to broadcast communication address. The address of slave must be exclusive in the network. That is basic condition of MODBUS communication.

9.4 Protocol Description

KE200 series inverter communication protocol is a kind of asynchronous serial master-slave communication protocol. In the network, only one equipment (master) can build a protocol (Named as “Inquiry/Command”). Other equipment (slave) response “Inquiry/Command” of master only by providing the data, or doing the action according to the master’s “Inquiry/Command”. Here, master is Personnel Computer, Industrial control equipment or Programmable logical controller, and the slave is inverter or other communication equipment with the same communication protocol. Master not only can visit some slave separately for communication, but also sends the broadcast information to all the slaves. For the single “Inquiry/Command” of master, all of slaves will return a signal that is a response; for the broadcast information provided by master, slave needs not feedback a response to master.

The parameter of H5-01~H5-05 should be set correct before build the communication with the host machine. H5-01~H5-03 should be reset after switching on the power of KE200.

It should be pay more attention that when you set the communication parameters by the operator, after setting, the power supply of KE200 should be switched off and then switched on, and then the setting will be effective. The communication parameters are listed as below:

Parameters code	Name	Setting range	Minimum setting	Default	Remark
B1-01	Reference Selection (Reference Source)	0~4	0	1	0: Operator 1: Terminals 2: Communication (Serial Com) 3: Communication (Serial Com)
B1-02	Operation Command Selection (Run Source)	0~4	0	1	0: Operator 1: Terminals 2: Communication (Serial Com) 3: Communication (Serial Com)
H5-01	Station Address (Serial Comm Adr)	0~20	0	1F	KE200 Adr
H5-02	Communication Speed Selection (Serial Baud Rate)	0~4	0	3	0: 1200BPS 1: 2400BPS 2: 4800BPS 3: 9600BPS
H5-03	Communication Parity Selection (Serial Com Sel)	0,1,2	0	1	0: No Parity 1: Even Parity 2: Odd Parity
H5-04	Stopping Method After Communication Error (Serial Fault Sel)	0~3	0	1	0: Ramp To Stop 1: Coast to Stop 2: Fast – Stop 3: Alarm Only
H5-05	Timeover Detection (Serial Flt Dtct)	0.1	0	1	0: Disabled 1: Enabled

9.5 Communication Data Structure

MODBUS protocol communication data format of MICNO series inverter is shown as following:

In RTU mode, the Modbus minimum idle time between frames should be no less than 3.5 bytes. The checksum adopts CRC-16 method. All data except checksum itself sent will be counted into the calculation. Please refer to section: CRC Check for more information. Note that at least 3.5 bytes of Modbus idle time should be kept and the start and end idle time need not be summed up to it.

The entire message frame must be transmitted as a continuous data stream. If a idle time is more than 1.5 bytes before completion of the frame, the receiving device flushes the incomplete message and assumes that the next byte will be the address field of a new message. Similarly, if a new message begins earlier than 3.5 bytes interval following a previous message, the receiving device will consider it as a continuation of the previous message. Because of the frame's confusion, at last the CRC value is incorrect and communication fault will occur.

RTU frame format:

<table>
<tr><td>START</td><td>Transmission time of 3.5 bytes</td></tr>
<tr><td>Slave Address</td><td>Communication addr. : 0 to 247</td></tr>
<tr><td>Command Code</td><td>03H:Read slave parameters
06H: Write slave parameters</td></tr>
<tr><td>DATA (N-1)</td><td rowspan="4">Data:
Function code parameter address, the number of function code parameter, Function code parameter, etc.</td></tr>
<tr><td>DATA (N-2)</td></tr>
<tr><td>……</td></tr>
<tr><td>DATA0</td></tr>
<tr><td>CRC Low byte</td><td rowspan="2">Detection Value: CRC value</td></tr>
<tr><td>CRC High byte</td></tr>
<tr><td>END</td><td>Transmission time of 3.5 bytes</td></tr>
</table>

9.6 Command Code and Communication Data Description

9.6.1 Command code: 03H（0000 0011）, reads N words. (There are 16 characters can be read at the most.)

For example: The inverter start address 0026H (DC Bus Voltage) of the slave 01（H5-01=1） continuously reads two consecutive values.

Master command information

START	T1-T2-T3-T4 (Transmission time of 3.5 words)
Address	01H
Command Code	03H
Start Address High byte	00H
Start Address Low byte	26H
Data Number High byte	00H
Data Number Low byte	02H
CRC CHK Low byte	25H
CRC CHK High byte	C0H
END	T1-T2-T3-T4 (Transmission time of 3.5 words)

Slave responding information

START	T1-T2-T3-T4 (Transmission time of 3.5 words)
Address	01H
Command Code	03H
Byte Number	04H
Data Address 0004H High byte	02H
Data Address 0004H Low byte	4DH
Data Address 0005H High byte	00H
Data Address 0005H Low byte	00H
CRC CHK Low byte	6BH
CRC CHK High byte	9CH
END	T1-T2-T3-T4 (Transmission time of 3.5 words)

9.6.2 Command code: 10H（0001 0000）, write a word

For example: Write 0001H into address 0000H (communication start-up address of KE200), slave address 01H (H5-01=1).

Master command information

START	T1-T2-T3-T4 (Transmission time of 3.5 words)
Address	01H
Command Code	10H
Write Data Start Address High byte	00H
Write Data Start Address Low byte	00H
Write Data Number High byte	00H
Write Data Number Low byte	01H
Write Data Number	02H
Write Data Content High byte	00H
Write Data Content Low byte	01H
CRC CHK Low byte	67H
CRC CHK High byte	90H
END	T1-T2-T3-T4 (Transmission time of 3.5 words)

Slave responding information

START	T1-T2-T3-T4 (Transmission time of 3.5 words)
Address	01H
Command Code	10H
Write Data Start Address High byte	00H
Write Data Start Address Low byte	00H
Write Data Number High byte	00H
Write Data Number Low byte	01H
CRC CHK Low byte	01H
CRC CHK High byte	C9H
END	T1-T2-T3-T4 (Transmission time of 3.5 words)

Command code: 08H（0000 1000）, diagnostic function

Meaning of subsidiary function code:

Subsidiary Function Code	Remark
0000	Feedback inquiry data

Example: if we do loop detection for the driver address 01H, we will get the same inquiry string content and response string content, the format is as below:

RTU Master Command Information

START	T1-T2-T3-T4 (Transmission time of 3.5 words)
ADDR	01H
CMD	08H
Subsidiary Function Code High byte	00H
Subsidiary Function Code Low byte	00H
Data Content High Byte	12H
Data Content Low Byte	ABH
CRC CHK Low Byte	ADH
CRC CHK High Byte	14H
END	T1-T2-T3-T4 (Transmission time of 3.5 words)

RTU Slave responding information

START	T1-T2-T3-T4 (Transmission time of 3.5 words)
ADDR	01H
CMD	08H
Subsidiary Function Code High byte	00H
Subsidiary Function Code Low byte	00H
Data Content High Byte	12H
Data Content Low Byte	ABH
CRC CHK Low Byte	ADH
CRC CHK High Byte	14H
END	T1-T2-T3-T4 (Transmission time of 3.5 words)

Communication Frame Error Checking

It includes two parts for the frame error checking, bit checking of byte (Odd / Even Parity Checking) and complete data checking (CNC checking and LRC checking)

Bit checking of byte

Customers can choose different bit checking type based on different request, No parity checking also can selected, it will affect the bit checking setting for each byte.

Meaning of Even Parity Checking, add additional Even Parity Checking bit before transmission, it's used to check whether the number of "1" in the transited data is Odd or Even, if it is Even, the checking bit will be changed as "0", otherwise it will be changed as "1", to keep the parity of data to be unchanged.

Meaning of Odd Parity Checking, add additional Odd Parity Checking bit before transmission, it's used to check whether the number of "1" in the transited data is Odd or Even, if it is Odd, the checking bit will be changed as "0", otherwise it will be changed as "1", to keep the parity of data to be unchanged.

For example, if the data of "11001110" will be transited, it includes 5 Nos of "1", if we adopt Even Parity Checking, the Even Parity Checking bit is "1", if we adopt Odd Parity Checking, the Odd Parity Checking bit is "0", during the data transiting, parity check bit will be put to the checking bit of frame after calculating, the receive equipment will also do the parity checking, if the parity of the received data is different with the preset value, that means the communication error has happened.

9.6.3 CRC checking

In RTU mode, messages include an error-checking field that is based on a CRC method. The CRC field checks the contents of the entire message. The CRC field is two bytes, containing a 16-bit binary value. The CRC value is calculated by the transmitting device, which appends the CRC to the message. The receiving device recalculates a CRC during receipt of the message, and compares the calculated value to the actual value received in the CRC field. If the two values are not equal, an error results.

The CRC is started by 0xFFFF. Then a process begins of applying successive eight-bit bytes of the message

to the current contents of the register. Only the eight bits of data in each character are used for generating the CRC. Start and stop bits, and the parity bit, do not apply to the CRC.

During generation of the CRC, each eight-bit character is exclusive ORed with the register contents. Then the result is shifted in the direction of the least significant bit (LSB), with a zero filled into the most significant bit (MSB) position. The LSB is extracted and examined. If the LSB was a 1, the register is then exclusive ORed with a preset, fixed value. If the LSB was a 0, no exclusive OR takes place. This process is repeated until eight shifts have been performed. After the last (eighth) shift, the next eight-bit byte is exclusive ORed with the register's current value, and the process repeats for eight more shifts as described above. The final contents of the register, after all the bytes of the message have been applied, is the CRC value.

When the CRC is appended to the message, the low byte is appended first, followed by the high byte. The following are C language source code for CRC-16.

```
unsigned int crc_cal_value(unsigned char *data_value,unsigned char data_length)
{
        int i;
    unsigned int crc_value = 0xffff;
    while(data_length--)
    {
        crc_value ^= *data_value++;
        for(i=0;i<8;i++)
                {
                    if(crc_value&0x0001)
                        crc_value = (crc_value>>1)^0xa001;
                    else
                        crc_value = crc_value>>1;
                }
        }
        return(crc_value);
}
```

9.6.4 Address definition of communication parameter

Here is about address definition of communication parameter. It's used to control the inverter operation, status and related parameter setting.

(Ⅰ) holding register address list: Command data (both write and read are available)

Register Address	BIT display	content
0000H	Address of Running Command	
	0	1: Forward running
	1	1: Reverse Running
	2	1: Make 3# external terminal close
	3	1: Make 4# external terminal close
	4	1: Make 5# external terminal close
	5	1: Make 6# external terminal close
	6	1: Make 7# external terminal close
	7	1: Make 8# external terminal close
	8-F	Not used
0001H	Address of frequency reference	
0002H-0005H	Not used	
0006H	Address of PID target value	

0007H	Setting address of Analog output 1（-11V/-726 valid when the setting of H4-01 is 1F）	
0008H	Setting address of Analog output 2（-11V/-726 valid when the setting of H4-01 is 1F）	
0009H	Terminals output setting address	
	0	1: Terminal output (terminal 9，10) close
	1	1: PHC1 (terminal 25, 27) close
	2	1: PHC2 (terminal 26, 27) close
	3-5	Not used
	6	1: Fault terminal (terminal 18, 20) Determined by 7^{th} Bit
	7	1: Fault terminal close
	8-F	Not used
000EH	Not used	000EH
000FH	Command selection setting address	
	0	0: frequency / detection unit is 0.01HZ 1: frequency / detection unit is Determined by 01-03
	1	0: the PID target value which is sent from the dataway is invalid 1: the PID target value which is sent from the dataway is valid
	2-B	Not used
	C	1: the terminal 5 which is transmitting the data at the same time is valid
	D	1: the terminal 6 which is transmitting the data at the same time is valid
	E	1: the terminal 7 which is transmitting the data at the same time is valid
	F	1: the terminal 8 which is transmitting the data at the same time is valid

0010H	Address of KE200 status	
	0	1: running
	1	1: 0 speed running
	2	1: reverse running
	3	1: the reset signal is inputting
	4	1: speed matching
	5	1: KE200 is ready
	6	1: Minor fault
	7	1: major fault
	8-F	Not used
0011H	Address of operator status	
	0	1: OPE happening
	1	1: ERR happening
	2	1: PRG state
	3	1CN state
	4	00: JVOP-130
		01: JVOP-132
		10: JVOP-100
		11: computer
	5-F	Not used
0012H	Address of OPE serial number	
0013H	Not used address	
0014H	Address of fault 1	
	0	FU fuse burn-out
	1	UV1 under voltage of main power
	2	UV2 under voltage of control power
	3	UV3 MC fault
	4	SC load short-circuit
	5	GF short-circuit to ground
	6	OC over current
	7	OV over voltage
	8	OH KE200 over heat
	9	OH1 KE200 over heat
	A	OL1 motor over load
	B	OL2 KE200 over load
	C	OL3 over torque 1
	D	OL4 over torque 2
	E	RR braking transistor fault
	F	RH braking resistor over heat

0015H	Address of fault 2	
	0	EF3 external fault 3
	1	EF4 external fault 4
	2	EF5 external fault 5
	3	EF6 external fault 6
	4	EF7 external fault 7
	5	EF8 external fault 8
	6	FAN cooling fan fault
	7	OS over speed
	8	DEV speed deviation is too large
	9	PGO PG disconnection
	A	PF input phase failure
	B	LF output phase failure
	C	Not used
	D	OPR operator is pulled out
	E	ERR EEPROM write fault
	F	Not used
0016H	Address of fault 3	
	0	CE MEMOBUS communication fault
	1-3	Not used
	4	CF control fault
	5	SVE zero servo fault
	6-F	F not used
0017H	Address of CPF 1	
	0	Not used
	1	Not used
	2	CPF02 happening
	3	CPF03 happening
	4	CPF04 happening
	5	CPF05 happening
	6	CPF06 happening
	7	F not used
0018H	Address of CPF 2	
	0	CPF20 happening
	1	CPF21 happening
	2	CPF22 happening
	3	CPF23 happening
	4	F not used

0019H	Address of minor fault 1	
	0	UV under voltage detecting
	1	OV over voltage detecting
	2	OH KE200 over heat
	3	OH2 warning of INV over heat
	4	OL3 over torque 1 detecting
	5	OL4 over torque 2 detecting
	6	EF 2 line input fault
	7	BB external BB block
	8	EF3 external fault 3
	9	EF4 external fault 4
	A	EF5 external fault 5
	B	EF6 external fault 6
	C	EF7 external fault 7
	D	EF8 external fault 8
	E	FAN cooling fan fault
	F	OS over speed
001AH	Address of minor fault 2	
	0	EV speed deviation is too large
	1	PGO PG disconnection
	2	OPR operator is pulled out
	3	CE MODBUS communication fault
	4	Not used
	5	Not used
	6	OL1 motor overload
	7	OL2 KE200 over load
	8	F not used

（Ⅱ）U1-XX Monitor Display

Register address	Parameters	Content
0020H	U1-01	Frequency reference
0021H	U1-02	Output frequency
0022H	U1-03	Output current
0023H	U1-04	Control method
0024H	U1-05	Motor speed
0025H	U1-06	Output voltage
0026H	U1-07	DC bus voltage
0027H	U1-08	Output power
0028H	U1-09	Torque reference
0029H	U1-10	Input terminal status: bit0 set as 1 T1 “Closed” bit1 set as 1 T2 “Closed” bit2 set as 1 T3 “Closed” bit3 set as 1 T4 “Closed” bit4 set as 1 T5 “Closed” bit5 set as 1 T6 “Closed” bit6 set as 1 T7 “Closed” bit7 set as 1 T8 “Closed”
002AH	U1-11	Output terminals status bit0 set as 1 T9~T10 “Closed” bit1 set as 1 T25 “Closed” bit2 set as 1 T26 “Closed” bit3-6 Not used bit7 Fault output terminal T18 “Closed”
002BH	U1-12	Running status 0 1: During running 1 1: During zero speed 2 1: During reverse 3 1: During reset signal input 4 1: During speed agree 5 1: Inverter operation ready 6 1: Minor fault 7 1: Major fault
002CH	U1-13	Elapsed time
002DH	U1-14	Software No.（BLINK）
002EH	U1-15	Input current of control circuit terminal 13

Register address	Parameters	Content
002FH	U1-16	Input current of control circuit terminal 14
0030H	U1-17	Input current of control circuit terminal 16
0031H	U1-18	Motor secondary current
0032H	U1-19	Motor excitation current
0033H	U1-20	Output frequency after soft-start
0034H	U1-21	ASR input
0035H	U1-22	ASR output
0036H	U1-23	Speed deviation
0039H	U1-26	Output voltage reference Vg
003AH	U1-27	Output voltage reference Vd
003BH	U1-28	Software No.（CPU）

0080H	U2-01	Current fault
0081H	U2-02	Last fault
0082H	U2-03	Frequency reference at fault
0083H	U2-04	Output frequency at fault
0084H	U2-05	Output current at fault
0085H	U2-06	Motor speed at fault
0086H	U2-07	Output voltage at fault
0087H	U2-08	DC bus voltage at fault
0088H	U2-09	Output power at fault
0089H	U2-10	Torque reference at fault
008AH	U2-11	Input terminal status at fault 0 1: TI “Closed” 1 1: T2 “Closed” 2 1: T3 “Closed” 3 1: T4 “Closed” 4 1: T5 “Closed” 5 1: T6 “Closed” 6 1: T7 “Closed” 7 1: T8 “Closed”
008BH	U2-12	Output terminal status at fault 0 1: T9~T10 “Closed” 1 1: T25 “Closed” 2 1: T26 “Closed” 3-6 Not used 7 1: Fault output terminal T18 “Closed”
008CH	U2-13	Running status at fault 0 1: During running 1 1: During zero speed 2 1: During reverse 3 1: During reset signal input 4 1: During speed agree 5 1: Inverter operation ready 6 1: Minor fault 7 1: Major
008DH	U2-14	Elapsed operation time at fault

（Ⅳ）U3-XX Monitoring Display

Register address	Parameters	Content
0090H	U3-01	Most recent fault
0091H	U3-02	Second most recent fault
0092H	U3-03	Third most recent fault
0093H	U3-04	Forth / Oldest fault
0094H	U3-05	Elapsed operation time at fault
0095H	U3-06	Elapsed time of second fault
0096H	U3-07	Elapsed time of third fault
0097H	U3-08	Elapsed time of forth / oldest fault

Fault No. of 0080，0081，0090~93

Display	Meaning	Fault No.
FU	Fuse burn-out	01H01H
UV1	Main circuit under voltage	02H
UV2	Control circuit under voltage	03H
UV3	MC fault	04H
SC	load short-circuit	05H
GF	Short-circuit to ground	06H
OC	Over current	07H
OV	Over voltage	08H
OH	Inverter over heat	09H
OH1	Inverter over heat	OAH
OL1	Motor over heat	OBH
OL2	Inverter over load	OCH
OL3	Over torque 1	ODH
OL4	Over torque 2	OEF
RR	Braking transistor failure	OFH
RH	Braking resistor over heat	10H
EF3	External fault 3	11H
EF4	External fault 4	12H
EF5	External fault 5	13H
EF6	External fault 6	14H
EF7	External fault 7	15H

EF8	External fault 8	16H
FAN	Cooling fan fault	17H
OS	Over speed	18H
DEV	Speed deviation is too large	19H
PGO	PG open circuit	1AH
PF	Input open-phase	1BH
LF	Output open-phase	1CH
OPR	Operator is pulled out	1EH
ERR	EEPROM writing fault	1FH
CE	MODBUS communication fault	21H
CF	Control fault	25H
SVE	Zero servo fault	26H

（Ⅴ）parameters data (both write and read are available), please refer to the manual for the setting range details.

Register address	**Function codes**	**Name**
0100H	A1-00	Language selection
0101H	A1-01	Access level
0102H	A1-02	Control method selection
0103H	A1-03	Initialize
0104H	A1-04	Password 1
0105H	A1-05	Password 2
0106H 0125H	A2-01-A2-32	User setting parameters
0180H	B1-01	Reference selection
0181H	B1-02	Operation method selection
0182H	B1-03	Stop method selection
0183H	B1-04	Reverse operation prohibit
0184H	B1-05	operation selection for setting or E1-09 or less
0185H	B1-06	Digital input scan time

Register address	Function codes	Name
0196H	B5-03	integration time（I）
0197H	B5-04	Integral （I） limit
0198H	B5-05	Derivative time（D）
0199H	B5-06	PID limit
019AH	B5-07	PID offset adjustment
019BH	B5-08	PID primary delay time
019CH	B6-01	DOWEL frequency at start
019DH	B6-02	DOWEL time at start
019EH	B6-03	DOWEL frequency at stop
019FH	B6-04	DOWEL time at stop
01A0H	B7-01	Droop control gain
01A1H	B7-02	Droop control delay time
01A2H	B8-01	Energy-saving gain
01A3H	B8-02	Energy-saving frequency
0186H	B1-07	Operation selection after switching to remote mode
0187H	B2-01	DC injection braking start frequency
0188H	B2-02	DC injection current
0189H	B2-03	DC injection time at start
018AH	B2-04	DC injection braking time at stop
018BH	B2-05	DC braking proportion multiples
018CH	B2-06	DC braking integration time
018DH	B2-07	DC braking limit
018EH	B3-01	Speed search selection at start
018FH	B3-02	Speed search operation current
0190H	B3-03	Speed search deceleration time
0191H	B3-04	V/F value during speed searching
0192H	B4-01	Timer function On-delay time
0193H	B4-02	Timer function Off-delay time
0194H	B5-01	PID control mode selection
0195H	B5-02	Proportional gain

01A4H	B9-01	Zero-servo gain
01A5H	B9-01	Zero-servo completion width
0200H	C1-01	Acceleration time 1
0201H	C1-02	Deceleration time 1
0202H	C1-03	Acceleration time 2
0203H	C1-04	Deceleration time 2
0204H	C1-05	Acceleration time 3
0205H	C1-06	Deceleration time 3
0206H	C1-07	Acceleration time 4
0207H	C1-08	Deceleration time 4
0208H	C1-09	Emergency stop time
0209H	C1-10	ACC / DEC time set unit
020AH	C1-11	ACC / DEC time switching frequency
020BH	C2-01	S-curve characteristic time at acceleration start
020CH	C2-02	S-curve characteristic time at acceleration end
020DH	C2-03	S-curve characteristic time at deceleration start
020EH	C2-04	S-curve characteristic time at deceleration end
020FH	C3-01	Slip compensation gain
0210H	C3-02	Slip compensation primary delay time
0211H	C3-03	Slip compensation limit
0212H	C3-04	Slip compensation selection during regeneration
0242H	C3-05	Slip compensation of V/F characteristic
0213H	C4-01	Torque compensation gain
0214H	C4-02	Torque compensation time
0215H	C5-01	ASR proportional gain 1
0216H	C5-02	ASR integral gain 1
0217H	C5-03	ASR proportional gain 2
0218H	C5-04	ASR integral gain 2
0219H	C5-05	ASR limit
021AH	C5-06	ASR primary delay
021BH	C5-07	ASR switching frequency
0241H	C5-08	ASR integral limit
021CH	C6-01	Carrier frequency upper limit
021DH	C6-02	Carrier frequency lower limit

021EH	C6-03	Carrier frequency proportional gain
021FH	C7-01	Hunting prevention selection
0210H	C7-02	Hunting prevention gain
0221H	C7-03	Hunting prevention parameter
0222H	C7-04	Hunting prevention limit

Register address	**Function codes**	**Name**
0229H	C8-07	ACRd limit
022AH	C8-08	AFR gain
022BH	C8-09	AFR parameter
022CH	C8-10	AFR limit
022DH	C8-11	Voltage DROP compensation parameter
022EH	C8-12	Parameter during AVR
022FH	C8-13	PWM adjustment method selection
0230H	C8-14	
0231H	C8-15	QN delay time
0232H	C8-16	QN delay time adjusted value
0233H	C8-17	Delay time of current detection
0234H	C8-18	COS detection filter 1
0235H	C8-19	COS detection filter 2
0236H	C8-20	Testing (simulating) mode
0237H	C8-21	OBSERVER selection
0238H	C8-22	Observer output phase compensation gain
0239H	C8-23	Observer output phase compensation filter
023AH	C8-24	Observer output voltage compensation gain
023BH	C8-25	Observer proportional value during speed detection
023CH	C8-26	Observer gain
023DH	C8-27	Inverter rated current
023EH	C8-28	DCCT gain
023FH	C8-29	PWM2 phase / 3 phase switching level
0223H	C8-01	Current feedback gain
0224H	C8-02	ACRq multiples
0225H	C8-03	ACRq integral time
0226H	C8-04	ACRq limit

0227H	C8-05	ACRd multiples
0228H	C8-06	ACRd integral time
0240H	C8-30	Carrier frequency selection during Auto-Tuning
0280H	D1-01	Frequency reference 1
0281H	D1-02	Frequency reference 2
0282H	D1-03	Frequency reference 3
0283H	D1-04	Frequency reference 4
0284H	D1-05	Frequency reference 5
0285H	D1-06	Frequency reference 6
0286H	D1-07	Frequency reference 7
0287H	D1-08	Frequency reference 8
0288H	D1-09	Jog frequency reference
0289H	D2-01	Frequency reference upper limit
028AH	D2-02	Frequency reference lower limit
028BH	D3-01	Jump frequency 1
028CH	D3-02	Jump frequency 2
028DH	D3-03	Jump frequency 3
028EH	D3-04	Jump frequency width
028FH	D4-01	Frequency reference hold function selection
0290H	D4-02	±speed limit
0291H	D5-01	Torque control selection
0292H	D5-02	Torque reference delay time
0293H	D5-03	Speed limit selection
0294H	D5-04	Speed limit
0295H	D5-05	Speed limit bias
0296H	D5-06	Speed / torque control switching timer
0300H	E1-01	Input voltage setting
0301H	E1-02	Motor selection
0302H	E1-03	V/F curve selection
0303H	E1-04	Max. output frequency
0304H	E1-05	Max. voltage
0305H	E1-06	Max. voltage frequency
0306H	E1-07	Mid. output frequency
0307H	E1-08	Mid. output frequency voltage
0308H	E1-09	Min. output frequency

0309H	E1-10	Min. output frequency voltage
030AH	E1-11	Mid. output frequency 2
030BH	E1-12	Min. output frequency voltage 2
030CH	E1-13	Base voltage
030EH	E2-01	Motor rated current
030FH	E2-02	Motor rated slip
0310H	E2-03	Motor no-load current
0311H	E2-04	Number of motor poles
0312H	E2-05	Motor line-to-line resistance
0313H	E2-06	Motor leak inductance
0314H	E2-07	Motor iron-core saturation coefficient 1
0315H	E2-08	Motor iron-core saturation coefficient 2
0316H	E2-09	Motor mechanical loss
0317H	E3-01	Motor 2 control method selection
0318H	E4-01	Motor 2 Max. output frequency
0319H	E4-02	Motor 2 Max. voltage
031AH	E4-03	Motor 2 Max. voltage frequency
031BH	E4-04	Motor 2 Mid. output frequency
031CH	E4-05	Motor 2 Mid. output frequency voltage
031DH	E4-06	Motor 2 Min. output frequency
031EH	E4-07	Motor 2 Min. output frequency voltage
031FH	E5-01	Motor 2 rated current
0320H	E5-02	Motor 2 rated slip
0321H	E5-03	Motor 2 no-load current
0322H	E5-04	Motor 2 number of poles
0323H	E5-05	Motor 2 line-to-line resistance
0324H	E5-06	Motor 2 leak inductance
0380H	F1-01	PG constant
0381H	F1-02	PG operation selection at PG open circuit
0382H	F1-03	PG operation selection at over speed
0383H	F1-04	PG operation selection at speed deviation is too large
0384H	F1-05	PG rotation
0385H	F1-06	PG division rate
0386H	F1-07	Integral value during ACC / DEC

0387H	F1-08	Over speed detection level
0388H	F1-09	Over speed detection delay time
0389H	F1-10	Excessive speed deviation detection level
038AH	F1-11	Excessive speed deviation detection delay time
038BH	F1-12	Number of PG gear teeth 1
038CH	F1-13	Number of PG gear teeth 2
0397H	F1-14	PGO detection time
038DH	F2-01	AI-14B card input selection
038EH	F3-01	Digital input selection
038FH	F4-01	Channel 1 monitor selection
0390H	F4-02	Channel 1 gain
0391H	F4-03	Channel 2 monitor selection
0392H	F4-04	Channel 2 gain
0393H	F5-01	Channel 1 output selection
0394H	F5-02	Channel 2 output selection
0395H	F6-01	Output mode selection
0396H	F7-01	Frequency multiple selection
0400H	H1-01	Terminal 3 selection
0401H	H1-02	Terminal 4 selection
0402H	H1-03	Terminal 5 selection
0403H	H1-04	Terminal 6 selection
0404H	H1-05	Terminal 7 selection
0405H	H1-06	Terminal 8 selection
0406H	H2-01	Terminal 9-10 selection
0407H	H2-02	Terminal 25 selection
0408H	H2-03	Terminal 26 selection
0409H	H3-01	Terminal 13 signal level selection
040AH	H3-02	Terminal 13 gain
040BH	H3-03	Terminal 13 bias
040CH	H3-04	Terminal 16 signal level selection
040DH	H3-05	Terminal 16 function selection
040EH	H3-06	Terminal 16 gain
040FH	H3-07	Terminal 16 bias
0410H	H3-08	Terminal 14 signal level selection
0411H	H3-09	Terminal 14 function selection

0412H	H3-10	Terminal 14 gain
0413H	H3-11	Terminal 14 bias
0414H	H3-12	Analog input filter time constant
0415H	H4-01	Terminal 21 monitor selection
0416H	H4-02	Terminal 21 output gain
0417H	H4-03	Terminal 21 output bias
0418H	H4-04	Terminal 23 monitor selection
0419H	H4-05	Terminal 23 output gain
041AH	H4-06	Terminal 23 output bias
041BH	H4-07	Analog output signal selection
041CH	H5-01	Station address
041DH	H5-02	Communication speed selection
041EH	H5-03	Communication parity selection
041FH	H5-04	Stopping method after communication error
0420H	H5-05	Timeover detection
0480H	L1-01	Motor protection selection
0481H	L1-02	Motor protection time constant
0482H	L2-01	Momentary power loss detection
0483H	L2-02	Momentary power loss ride through
0484H	L2-03	Min. base-block time
0485H	L2-04	Voltage recovery time
0486H	L2-05	Under voltage detection level
0487H	L2-06	KEB deceleration rate
0488H	L3-01	Stall prevention during acceleration
0489H	L3-02	Stall prevention level during acceleration
048AH	L3-03	Stall prevention limit during acceleration
048BH	L3-04	Stall prevention during deceleration
048CH	L3-05	Stall prevention during running
048DH	L3-06	Stall prevention level during running
048EH	L3-07	Stall prevention function P gain
048FH	L3-08	Stall prevention function integral time
04A4H	L8-01	Internal dynamic braking resistor protection selection
04A5H	L8-02	Over hear pre-alarm level
04A6H	L8-03	Operation selection after over heat pre-alarm

04A7H	L8-04	Over hear detection level
04A8H	L8-05	Input phase loss protection
04A9H	L8-06	Input phase loss detection level
04AAH	L8-07	Output phase loss protection
04ABH	L8-08	Output phase loss detection level
04ACH	L8-09	Short-circuit protection selection at load side
04ADH	L8-10	Short-circuit protection selection for grounding
04AEH	L8-11	Inverter overload protection selection

0490H	L4-01	Frequency detection level
0491H	L4-02	Frequency detection width
0492H	L4-03	Frequency detection level（+/-）
0493H	L4-04	Frequency detection width（+/-）
0494H	L4-05	Frequency reference loss detection selection
0495H	L5-01	Number of auto restart attempts
0496H	L5-02	Auto restart operation selection
0497H	L5-03	Retry interval time after fault
0498H	L6-01	Over torque detection selection 1
0499H	L6-02	Over torque detection level 1
049AH	L6-03	Over torque detection time 1
049BH	L6-04	Over torque detection selection 2
049CH	L6-05	Over torque detection level 2
049DH	L6-06	Over torque detection time 2
049EH	L7-01	Forward torque limit
049FH	L7-02	Reverse torque limit
04A0H	L7-03	Forward regenerative torque limit
04A1H	L7-04	Reverse regenerative torque limit
04A2H	L7-05	Torque limit proportion
04A3H	L7-06	Torque limit integral time

04AFH	L8-12	AVR function selection
04B0H	L8-13	Testing method while leaving factory
04B1H	L8-14	UV3 detection
0500H	01-01	Display selection at detection mode
0501H	01-02	Detection selection while switch on the power

0502H	01-03	Frequency reference / detection setting / display unit
0503H	01-04	Setting unit of parameters which are related to frequency
0504H	01-05	Meaning selection of function codes
0505H	02-01	Function selection of LOCAL/REMOTE button
0506H	02-02	Function selection of STOP button
0507H	02-03	Customer defined initial value selection
0508H	02-04	Inverter capacity selection
0509H	02-05	Frequency reference setting method selection
050AH	02-06	Operation selection after operator disconnection
050BH	02-07	Accumulated operation time setting
050CH	02-08	Accumulated operation time selection
050DH	02-09	Initial method

（Ⅵ）ENTER command

Register address	Function codes	Name
FFFDH	ENTER	Write the data to EEPROM

ENTER command the master to use communication mode, write the parameters into the internal RAM data area of KE200, ENTER command is to write the data in the RAM into the internal nonvolatile memory of KE200. Write “0” to the register of FFFDH, that command will be activated. Cause the internal nonvolatile memory of KE200 can be written not more than 100,000 times, so that don’t use the ENTER command frequently. It is not to use ENTER command to write the data into internal nonvolatile memory while setting parameters by the operator.

ENTER command

Slave inverter address		01H
The function No.		10H
initial address	superior	FFH
	inferior	FDH
Numbers	inferior	00H
	inferior	01H
Data numbers		02H
ENTER correspond data	inferior	00H
	inferior	00H
CRC-16	inferior	BCH
	inferior	B2H

Response for error messages

While the slave equipment gives response, it uses a function code or fault address to indicate whether it is a correct response or not. For correct response, the slave inverter gives the related function codes and data address or subsidiary function codes. For incorrect response, the slave equipment feeds back a code which is the same as normal code, but the logic of the first place is 1.

For example, the signal which is sent from master equipment to slave equipment is requested to read the address data of inverter function codes, the function code is as below:

0 0 0 0 0 0 1 1 （hexadecimal 03H）

For correct response, the slave equipment feeds back the same function code, for incorrect response, it will feed back the function code as below:

1 0 0 0 0 0 1 1 （hexadecimal 83H）

Except for the function code is modified due to the mistake, the slave equipment will feed back a 1 bit abnormal code, it defines the reason of abnormal. After the master equipment gets the abnormal response, it needs to resent the massage in normal condition, or to make command modification for the correspond fault.

Meaning of incorrect codes

Code	Name	Meaning
01H	Illegal command	Error of function codes * The function codes from PLC are not 01H,08H,10H
02H	Illegal data address	Error of register address * The register addresses which will be stored are not registered * The start address which are transmitting at the same time are not 0000H, 0001H, 0002H
03H	Operation failure	Numbers are error * Read or write data numbers are not in the range of 1-16
21H	Illegal data or over limitation data	Data setting error * Control data or parameters only have the upper and lower limitation while writing. * Related parameters setting is not correct while writing the parameters.
22H	Data frame error	Write method error * PLC is trying to write parameters while running. * PLC output ENINT write command while running * PLC is trying to write parameters besides A1-00-05,E1-03,02-04 after " CPF03" appearing * Try to write private data for reading
23H	Parameters are read only	Write into UV * while "UV" fault happening, PLC is trying to write data * while "UV" fault happening, PLC is trying to output ENINT command
24H	EEPROM busy	Writing while the parameters are in the deal processing * during the data processing, PLC is trying to write data.

About the reset of communication error "CE"

To reset "CE" fault, before 2 second to get the reset signal, the inverter should receive a normal data at least one time. The "CE fault cannot be reset if the inverter is not in the communication status.

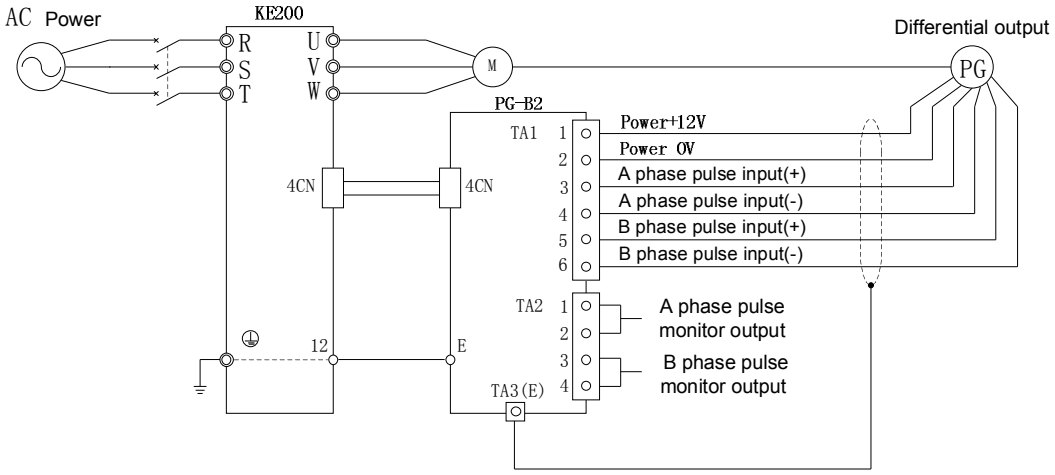
Appendix 1 Wiring of KE200 PG Card

PG card is required for KE200 close loop vector control mode, KE200 PG card model: PG-B2

（1）The specifications of PG-B2 (special for close-loop vector control) terminals

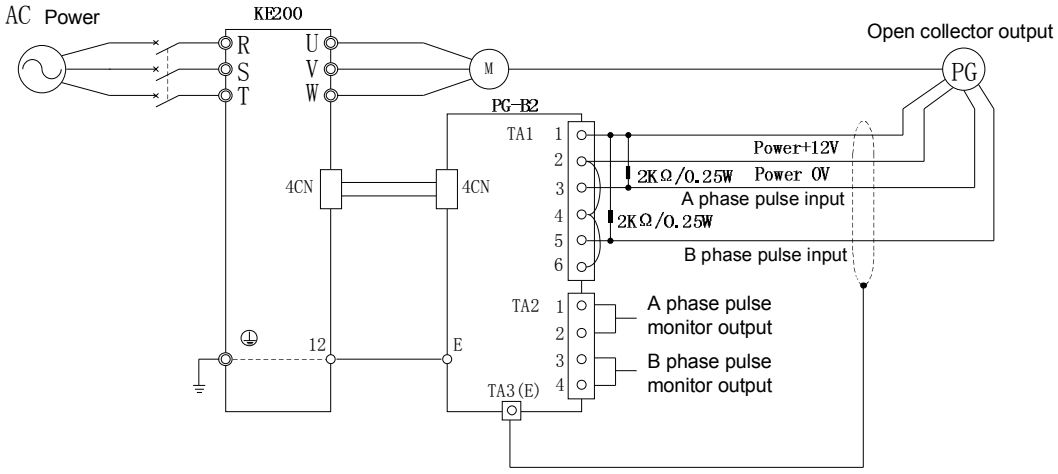
PG-B2 terminals and specifications			
Terminal	**NO.**	**Content**	**Specification**
TA1	1	Power for pulse generator	DC+12V(±5%)Max.200mA
	2		DC0V (Ground grounding connection terminals for power)
	3	A phase pulse input terminal	H:+8～12V L: Below +1V (The maximum response frequency is 30KHz)
	4		Pulse input COM
	5	B phase pulse input terminal	H:+8～12V L: Below +1V (The maximum response frequency is 30KHz)
	6		Pulse input COM
TA2	1	A phase pulse monitor output terminal	Open collector output DC24V Max.30mA
	2		A phase pulse monitor output COM
	3	B phase pulse monitor output terminal	Open collector output DC24V Max.30mA
	4		B phase pulse monitor output COM
TA3	(E)	Shielded wire connection terminal	—

（2）The two connection modes between PG-B2 and encoder.



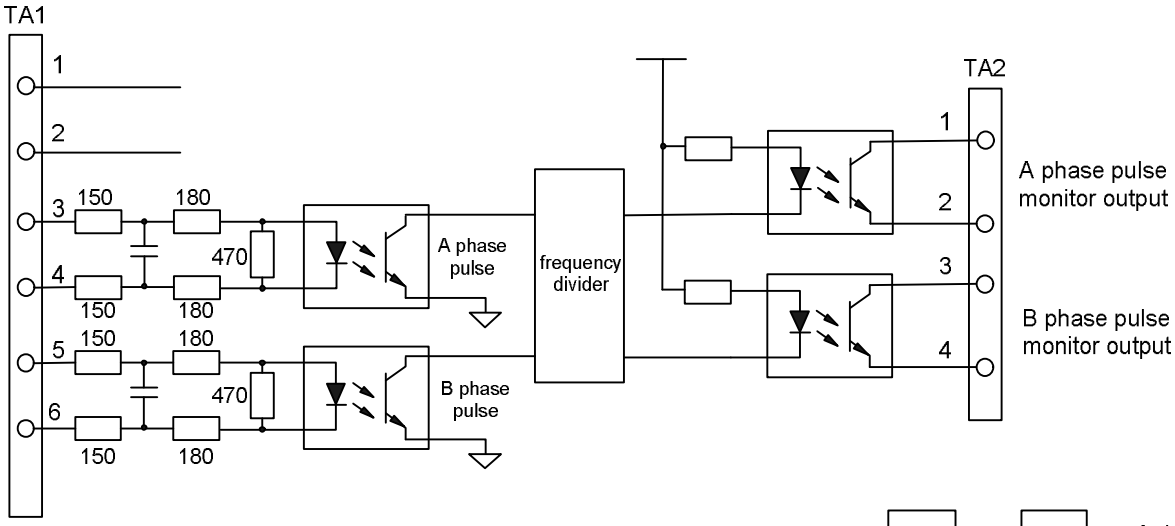
※Signal cable, must use twisted shielded cable.
※PG power, can only be used for PG (encoder). Being used as other power will cause fault because of interference.
※PG wiring length＜100m.
※The direction of rotation of PG is set by F1-05, the factory default is A phase advance when the motor forwards.

The wiring diagram of differential encoder and PG-B2

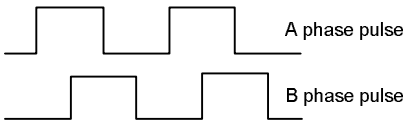


※ Signal cable, must use twisted shielded cable.
※ PG power, can only be used for PG (encoder). Being used as other power will cause fault because of interference.
※ PG wiring length＜100m.
※ The direction of rotation of PG is set by F1-05, the factory default is A phase advance when the motor forwards.

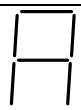
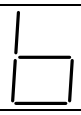
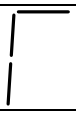
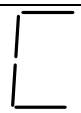
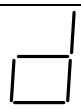
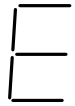
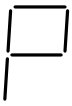
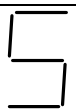
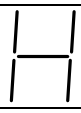
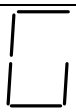
The wiring diagram of collector encoder and PG-B2



- To connect with voltage output type PG (encoder), please select the PG card which has bigger than 12mA current output interface at the optical coupling (diode).
- The frequency dividing ratio of pulse monitoring is adjustable by F1-06



Appendix 2 Comparison Table of LED Display & English Letter

LED Display	English Letter	LED Display	English Letter
	A		o
	b		T
	C		U
	d		r
	E		P
	F		S
	H		v
	L		G

Scan QR code for
more information .....

micno SHENZHEN MICNO ELECTRIC CO., LTD.

ADD:6th Floor, Building 8, Shiling Industrial Park,Xinwei, Xili, Nanshan District, Shenzhen, China

TEL: +86-755-2167 5210 WEB: www.micno.com.cn

FAX: +86-755-2167 5200 E-mail: overseas@micno.com.cn