AC MOTOR SPEED CONTROLLER

B900 Series

Current Vector Frequency Drive

Installation & Quick-Start Manual

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⚠WARNING

PRECAUTIONS

1) Read this manual in its entirety before installing or operating the B900 inverter.
2) Do not connect or disconnect wiring, or perform signal checks while the power supply is turned ON.
3) The B900 Drive internal capacitor is still charged even after the power supply is turned OFF. To prevent electrical shock, disconnect all power before servicing the inverter. Then wait at least one minute after the power supply is disconnected and all LED's are extinguished.
4) Do not perform a withstand voltage test or a megger test on any part of the B900 Drive. This electronic equipment uses semiconductors and is vulnerable to high voltage.
5) Do not remove the operator unless the power supply is turned OFF. Never touch the printed control board while the power supply is turned ON.
6) The B900 Drive is suitable for use on a circuit capable of delivering not more than 65,000 RMS symmetrical amperes, 600 Volts maximum (575V class units), 480 Volts maximum (460V class units), and 240 Volts maximum (230V class units).

Failure to observe these and other precautions highlighted in this manual will expose the user to high voltages, resulting in equipment damage, serious injury or death.

NOTICE

No patent liability is assumed with respect to the use of the information contained herein. Moreover, because Bedford is constantly improving its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, Bedford assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.

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RECEIVING & INSTALLATION

1.1 INTRODUCTION

The B900 Drive, a series of high quality, general-purpose inverters with flux vector control, directly controls the current (or torque) in an AC induction motor. With an initial power range of 0.5 to 500 HP, it is suited for any application, and provides smooth start-up at low speeds, and extremely precise operation. It's proprietary auto-tuning function enables high-performance tuning of motors manufactured worldwide.

The B900 Drive combines four control methods into one compact drive, including flux vector and conventional V/f control. From precision machinery to multiple motor drives, the B900 Drive proves to be the ***Ultimate*** drive for any application. This functionality includes Bedford proprietary features like Adaptive Vector Control (AVC™), full-range automatic torque boost, auto-tuning, UL-recognized electronic thermal motor overload, energy savings operation, PID control, low-noise operation and various other features. It also features a 2-line × 16-character, alphanumeric digital operator for simple programming in seven different languages. Utilizing the latest microprocessor technology, members of Yaskawa design team have collaborated to make the B900 Drive the ***Ultimate*** drive for *any* application.

This manual details installation, quick-start and diagnostic procedures for the B900 Drive series adjustable frequency drive controller. For more detailed descriptions of programming procedures, contact your Bedford representative.

1.2 SOFTWARE VERSION EXPLANATION

Bedford recognizes the need to continuously improve product quality. This product may receive feature enhancements in the form of software or hardware changes. New programming parameters will be added to the latest programming manual. When a new parameter is added a software version note will be placed next to the parameter.

Software Version Example:

For Parameter A1-00, select the language displayed on the digital operator according to the following table:

Setting	Description
0	English *(factory default)*
1	Japanese
2	Deutsche <1110>*
3	Francais <1110>*
4	Italiano <1110>*
5	Espanol <1110>*
6	Portugues <1110>*

*This version note <1110> indicates that five additional languages have been added with software version 1110.

The part number of the main control printed circuit board on the drive reflects the software version. The software version normally increases to a higher number with newer versions. Please consult the factory for details.

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The B900 Drive ships preset to open loop vector control, quick-start access level.

1.3 B900 Series SPECIFICATIONS

230V

Inverter Model B900		B900															
		20P4	20P7	21P5	22P2	23P7	25P5	27P5	2011	2015	2018	2022	2030	2037	2045	2055	2075
Output Characteristics	Nominal Motor Output (HP) *	0.5	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100
	Capacity (kVA)**	1.2	2.3	3.0	4.2	6.7	9.5	13	19	24	30	37	50	61	70	85	110
	Rated Output Current (A) #	3.2	6	8	11	17.5	25	33	49	64	80	96	130	160	183	224	300
	Max. Voltage	3-Phase, 200/208/220/230V (Proportional to input voltage)															
	Rated Output Frequency	Up to 400 Hz available															
	Overload Capacity	150% Rated Current / 1 minute															
Power Supply	Input Current (A)	3.9	7.2	9.6	13.2	21	30	40	59	77	88	106	143	176	202	247	330
	Rated Voltage & Frequency	3-Phase 200 to 230V, 50/60Hz															
	Voltage Fluctuation	+10%, -15%															
	Frequency Fluctuation	±5%															

460V

B900		40P4	40P7	41P5	42P2	43P7	44P0	45P5	47P5	4011	4015	4018	4022	4030	4037	4045	4055	4075	4110	4160	4185	4220	4300
Output Characteristics	Nominal Motor Output (HP) *	0.5	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150	200	250	350	500
	Capacity (kVA)**	1.4	2.6	3.7	4.7	6.1	8.4	11	16	21	26	31	40	50	61	73	98	130	170	230	260	340	460
	Rated Output Current (A) #	1.9	3.6	5.1	6.6	8.5	11.7	14.8	21	28.6	34	41	52	65	80	96	128	165	224	302	340	450	605
	Max. Voltage	3-Phase, 380/400/415/440 (Proportional to input voltage)																					
	Rated Output Frequency	Up to 400 Hz available																					
	Overload Capacity	150% Rated Current / 1 minute																					
Power Supply	Input Current (A)	2.3	4.3	6.1	8	10.2	14	17.8	26	35	40	46	58	72	88	106	141	182	247	330	408	540	726
	Rated Voltage & Frequency #	3-Phase 380 to 460V, 50/60Hz																					
	Voltage Fluctuation	+10%, -15%																					
	Frequency Fluctuation	±5%																					

* HP ratings based on NEMA 4-pole motor data. However, when sizing a drive to match a motor, use output current ratings.

\# For proper operation, the motor rated current must be less than or equal to the inverter rated current.

** kVA ratings are based on 200V, 400V, and 600V inputs respectively.

B900 Series SPECIFICATIONS *(continued)*

575V

Inverter Model B900			B900																
			51P5	52P2	53P7	55P5	57P5	5011	5015	5018	5022	5030	5037	5045	5055	5075	5090	5110	5160
Output Characteristics	Nominal Motor Output (HP) *	Constant Torque	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150	200
		Variable Torque	3	3	5	10	10	15	20	25	30	40	50	60	75	100	150	200	200
	Capacity (kVA) **		2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150	200
	Rated Output Current (A) #	Constant Torque (A)	3.5	4.1	6.3	9.8	12.5	17	22	27	32	41	52	62	77	99	130	172	200
		Variable Torque (A)	3.9	4.6	7	11	14	19	25	30	36	46	58	69	86	111	145	192	224
	Maximum Voltage		3-Phase, 500/575/600V(Proportional to input voltage)																
	Rated Output Frequency		Up to 400 Hz available																
	Overload Capacity		150% Rated Current / 1 minute (CT rating) 120% Rated Current / 1 minute (VT rating)																
Power Supply	Input Current (A)		4.3	5.1	7.7	12.1	15.4	21	28	33	40	51	64	76	95	122	160	211	246
	Rated Voltage & Frequency		3-Phase, 500 to 600V, 50/60Hz																
	Voltage Fluctuation		+10%, -15%																
	Frequency Fluctuation		±5%																

* HP ratings based on NEMA 4-pole motor data. However, when sizing a drive to match a motor, use output current ratings.

\# For proper operation, the motor rated current must be less than or equal to the inverter rated current.

** kVA ratings are based on 200V, 400V, and 600V inputs respectively.

B900 Drive SPECIFICATIONS *(continued)*

Control Characteristics	Control Method	Sine wave PWM
	Starting Torque	150% below 1Hz (150% at 0 rpm with PG)
	Speed Control Range	100:1 (1000:1 with PG)
	Speed Control Accuracy	±0.2% (±0.02% with PG)
	Speed Response	5Hz (30Hz with PG)
	Torque Limit	Can be set by parameter: 4 quadrant control
	Torque Accuracy	±5%
	Torque Response	20Hz (40Hz with PG)
	Frequency Control Range	0.1 to 400 Hz
	Frequency Accuracy	Digital command: 0.01%, Analog command: 0.1%
	Frequency Setting Resolution	Digital Operator Reference: 0.01Hz Analog Reference: 0.03Hz (@60Hz)
	Output Frequency Resolution	0.01 Hz
	Frequency Setting Signal	-10 to +10V, 0 to +10V, 4 to 20mA
	Accel/Decel Time	0.0 to 6000.0 sec. (Accel/Decel time setting independently, 4 steps available)
	Braking Torque	Approx. 20%
Protective Functions	Motor Overload Protection	UL-recognized electronic thermal overload relay (I^2T)
	Instantaneous Overcurrent	Motor coasts to stop at approximately 200% rated output current. (CT Rating)
	Fuse Protection	Motor coasts to stop at blown fuse.
	Overload	Motor coasts to stop after 1 min. at 150% rated output current. (CT Rating)
	Overvoltage	Motor coasts to stop if converter output voltage exceeds 410VDC (820VDC at 460V input, 1040VDC at 575V input)
	Undervoltage	Motor coasts to stop if converter output voltage drops below user adjustable value
	Momentary Power Loss	Immediately stop after 15 ms or longer power loss. (Continuous system operation during power loss less than 2s is equipped as standard.)
	Heatsink Overheat	Thermistor - OH1, OH2
	Stall Prevention	Stall prevention during acceleration, deceleration and constant speed operation
	Ground Fault	Provided by electronic circuit (overcurrent level)
	Power Charge Indication	Charge LED stays on until bus voltage drops below 50VDC
	Input Phase Loss	Single-phase protection
Environmental Conditions	Location	Indoor (protected from corrosive gases and dust)
	Ambient Temperature	+14 to 104°F (-10 to 40°C) for NEMA 1 type +14 to 113°F (-10 to 45°C) for Open Chassis type
	Storage Temperature	-4 to 140°F (-20 to 60°C)
	Humidity	95% RH (non-condensing)
	Vibration	9.8m/s^2 (1G) less than 20Hz, up to 1.96m/s^2 (0.2G) at 20 to 50Hz

1.4 MOUNTING

⚠CAUTION

PRECAUTIONS

1) When preparing to mount the B900 Drive, lift it by its base. Never lift it by the front cover.
2) Mount the inverter onto nonflammable material.
3) The B900 drive generates heat. For the most effective cooling possible, mount it vertically. For more details, refer to “Dimensions/Heat Loss” and “Clearances” .
   For mounting configurations other than normal vertical mounting, please consult the factory.
4) When mounting units in an enclosure, install a fan or other cooling device to keep the intake air temperature below 113°F (45°C).

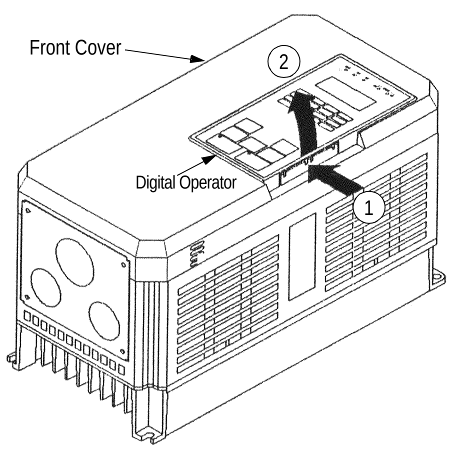
Failure to observe these precautions may result in equipment damage.

Choosing a Location

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

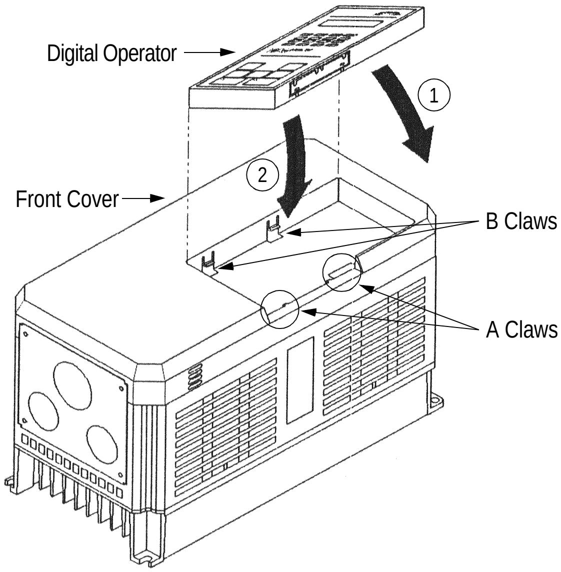
· Extreme cold and heat. Use only within the ambient temperature range:
  NEMA 1: 14 to 104°F (-10 to 40°C).
  Open Chassis: 14 to 113°F (-10 to 45°C)
· Direct sunlight (not for use outdoors)
· Rain, moisture
· High humidity
· Oil sprays, splashes
· Salt spray
· Dust or metallic particles in the air
· 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.)

Removing and Replacing the Digital Operator (Pls. refer to the actual inverters due to updated designs)



To remove the digital operator from the front cover, push the operator retaining tab in the direction shown by arrow 1 and lift the digital operator in the direction shown by arrow 2.

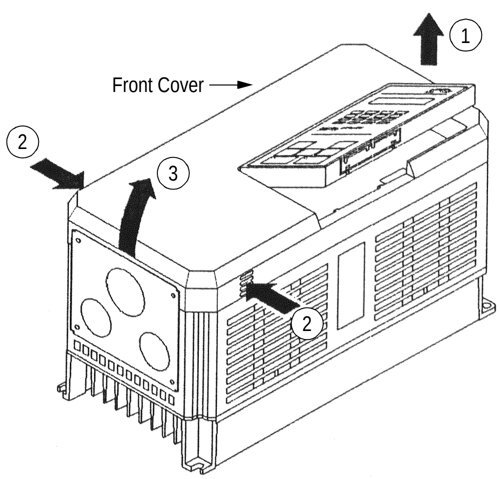
Figure 4 Removing the Digital Operator



To replace the digital operator, engage the operator onto the A tabs in the direction shown by arrow 1 and then press the operator onto the B tabs in the direction shown by arrow 2, locking the digital operator into place.

Figure 5 Replacing the Digital Operator

Removing and Replacing the Front Cover (Pls. refer to the actual inverter due to updated designs)



To remove the front cover, first remove the digital operator (see previous section). Then squeeze the cover on both sides in the direction shown by arrows 2 and lift the cover in the direction shown by arrow 3.

Figure 6 Removing and Replacing the Front Cover

Clearances

When mounting the B900 Drive, allow sufficient clearances for effective cooling as shown below:

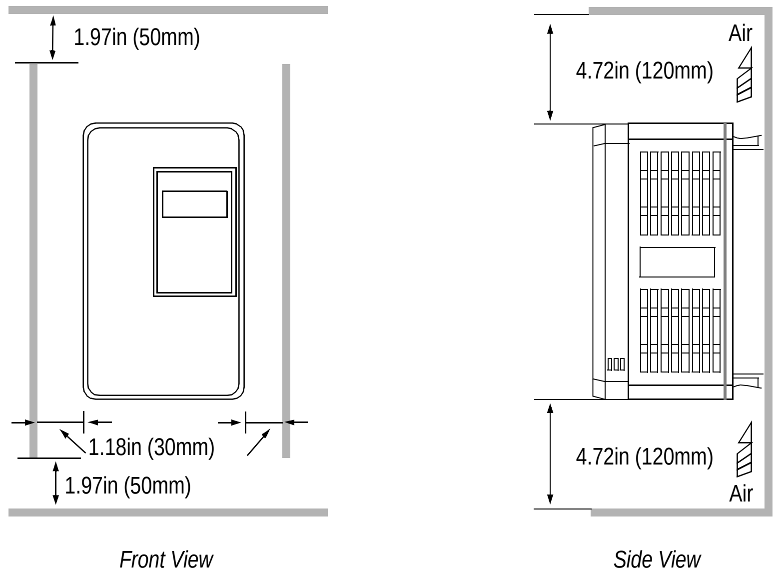


Figure 8 *B900 Series* ***Clearances***

Notes:

1) The required clearances at the top, bottom, and both sides of the inverter are the same for both open chassis and NEMA 1 enclosures.
2) For inverter models 25HP and less (230V & 460V), and models 20HP and less (575V), remove the top and bottom covers to convert NEMA 1 units to open chassis.
3) Allowable intake air temperature:
   Open chassis: 14°F to 113°F (-10°C to +45°C)
   NEMA 1: 14°F to 104°F (-10°C to 40°C)
4) When mounting units in an enclosure, install a fan or other cooling device to limit the air temperature within the inverter to below 113°F (45°C).

1.5 WIRING

CAUTION

PRECAUTIONS

1) Do not connect or disconnect wiring, or perform signal checks while the power supply is turned ON.
2) Connect the power supply wiring to terminals L1, L2 and L3 on the main circuit input section. DO NOT connect the power supply wiring to output terminals T1, T2 and T3.
3) Connect the motor wiring to terminals T1, T2 and T3 on the main circuit output section.
4) *Never* touch the output circuit directly or place the output line in contact with the inverter enclosure.
5) Do not connect a phase-advancing capacitor or an LC/RC noise filter to the output circuit.
6) The motor wiring must be less than 328ft (100m) in length, and it is strongly recommended that it be in a separate conduit from all other wiring.
7) Control wiring must be less than 164ft (50m) in length and in a separate conduit from the power wiring.
8) Tighten the screws on the main circuit and control circuit terminals.
9) Low voltage wires shall be wired with Class 1 wiring.
10) Please observe national electrical code (NEC) when wiring electrical devices.

Failure to observe these precautions may result in equipment damage.

Inspection

After wiring is complete, verify that:

All wiring is correctly installed.
Excess screws and wire clippings are removed from inside of the unit.
Screws are securely tightened.
Exposed wire has no contact with other wiring or terminals.

B900 Drive Standard Connection Diagram

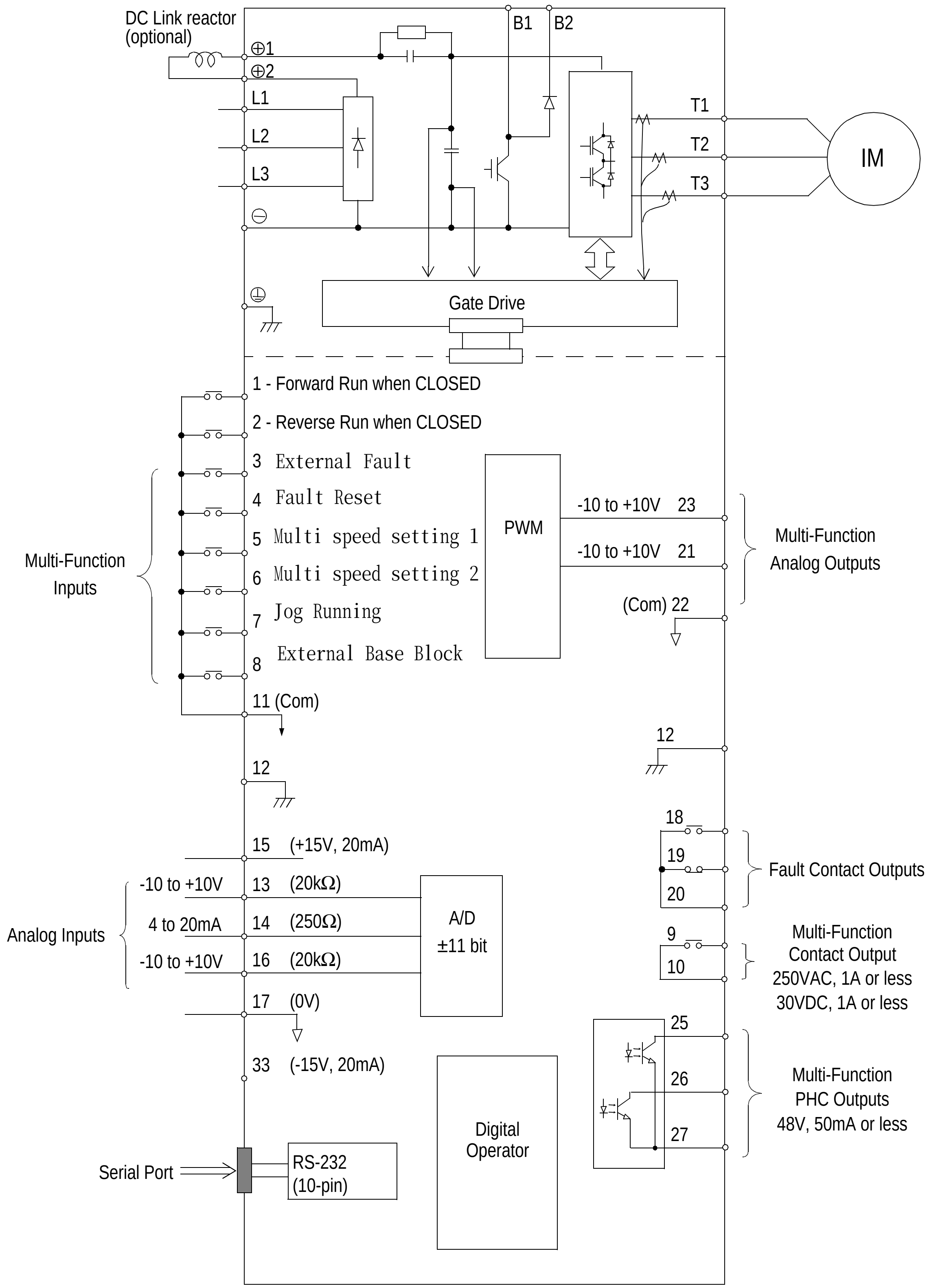


Figure 9 *B900 drive* ***Terminal Diagram***

B900 Drive Standard Connection Diagram

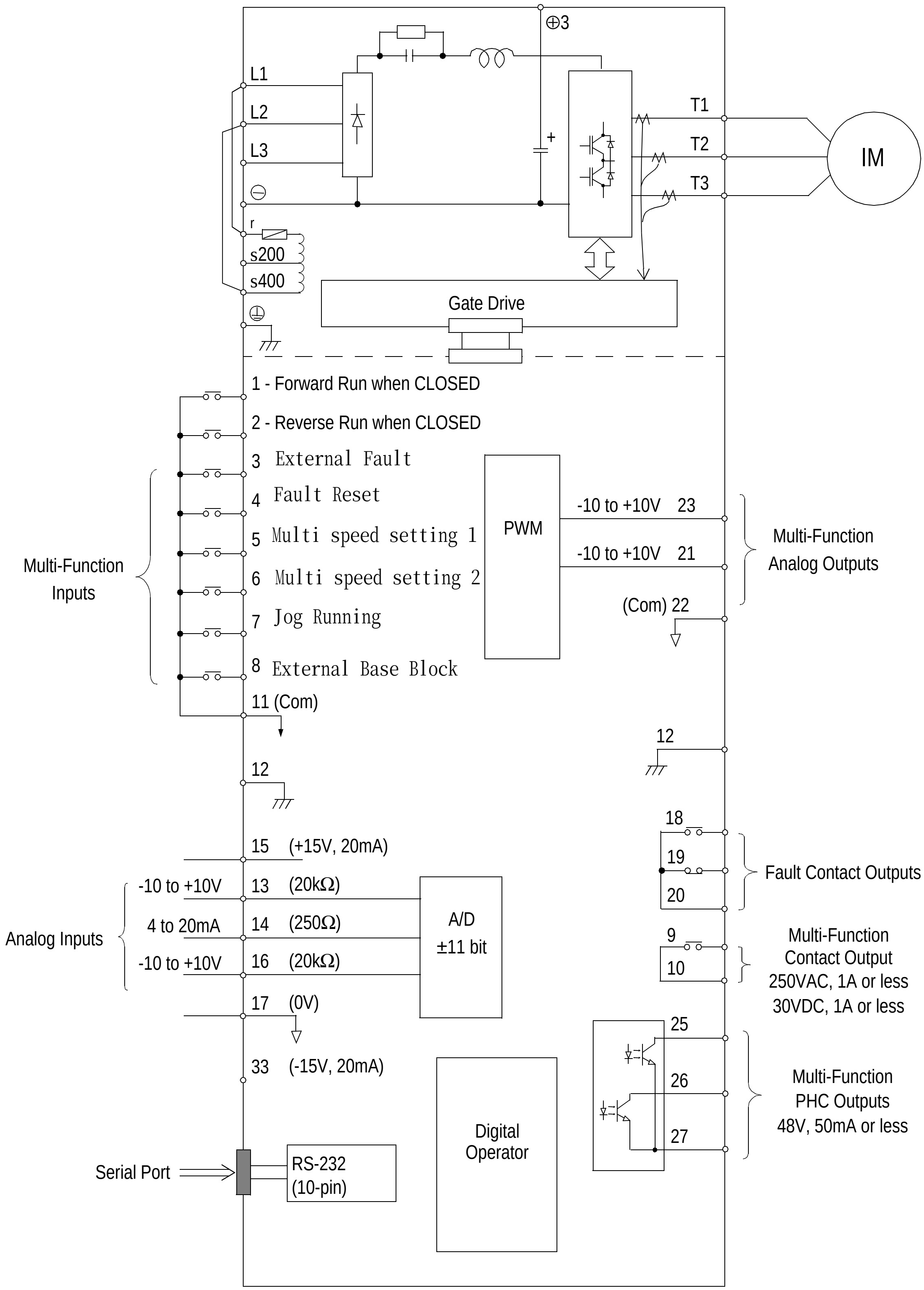


Figure 10 *B900 Drive* ***Terminal Diagram***

Main Circuit Wiring

Input Wiring

· Molded-Case Circuit Breaker (MCCB)

Be sure to connect MCCBs or fuses between the AC main circuit power supply and B900 Drive input terminals L1, L2 and L3, to protect the input wiring.

· Ground Fault Interrupter

When connecting a ground fault interrupter to input terminals L1, L2 and L3, select one that is not affected by high frequency.

· Magnetic Contactor (MC)

Inverters can be used without an MC installed on the power supply side. When the main circuit power supply is shut OFF in the sequence, an MC can be used instead of an MCCB. However, when an MC is switched OFF on the primary side, dynamic braking does not function and the motor coasts to stop.

The load can be operated/stopped by opening/closing the MC on the primary side. However, frequent switching may cause the inverter to malfunction.

When using a braking resistor unit, use a sequencer to break the power supply side of the inverter in the event of an overload relay trip contact. If the inverter malfunctions, the braking resistor unit may be burned out.

· Terminal Block Connection Sequence

Input power supply phases can be connected to any terminal regardless of the order of L1, L2 and L3 on the terminal block.

· AC Reactor

When connecting an inverter (230V/460V/575V, 15kW or less) to a large capacity power supply transformer (600kVA or more), or when switching a phase-advancing capacitor, excessive peak current may flow through the input power supply circuit, which may damage the converter section. In such cases, install a DC reactor (optional) between inverter ⊕1 and ⊕2 terminals, or an AC reactor (optional) on the input side. Installation of a reactor is effective for improvement of power factor on the power supply side.

· Surge Suppressor

For inductive loads (i.e. magnetic contactors, magnetic relays, magnetic valves, solenoids, magnetic brakes, etc.) connected near the inverter, use a surge suppressor across the coil to minimize the inductive “kick” when energizing and de-energizing these devices.

Output Wiring

· Motor Connection

Connect motor lead wires to output terminals T1, T2 and T3. Verify that the motor rotates in the forward direction (CCW: counterclockwise when viewed from the motor load side) with the forward run command. If the motor rotation is incorrect, exchange any two of the motor leads.

· Magnetic Starter

Do not connect a magnetic starter or a magnetic contactor to the output circuit. If the motor load is connected or disconnected while the inverter is running, the inverter overcurrent protective circuitry may trip.

- Thermal Overload Relay

  An Underwriter's Laboratory (UL) recognized electronic overload protective function is incorporated into the inverter. However, when driving several motors with one inverter, or when switching between multiple windings of a multiple winding motor, connect an external thermal overload relay. In this case, disable the inverter motor overload feature by setting parameter *L1-01* to "0".

- Wiring Distance Between Inverter and Motor

  If the total wiring distance between inverter and motor is excessively long and the inverter carrier frequency (IGBT switching frequency) is high, harmonic leakage current from the wiring may adversely affect the inverter and peripheral devices. If the wiring distance is long, reduce the inverter carrier frequency as described below. Carrier frequency can be set by parameter *C6-01*. Please note that motor audible noise may increase when lowering the carrier frequency.

Wiring Distance Between Inverter and Motor

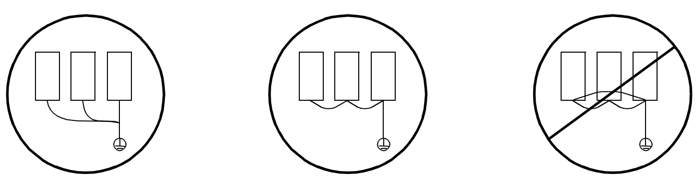
Wiring Distance between Inverter and Motor	Up to 164 ft. (50m)	Up to 328 ft. (100m)	More than 328 ft. (100m)
Carrier Frequency (Set value of parameter *C6-01*)	15kHz or less	10kHz or less	5kHz or less

Grounding

- Ground Resistance

  230V class: 100Ω or less, 460V class: 10Ω or less, 575V class: 10Ω or less.

- Never ground the B900 Drive in common with welding machines, motors, or other high-current electrical equipment. Run all ground wiring in a separate conduit.
- Use ground wiring as specified in "Wire and Terminal Screw Sizes" on page 31, and keep the length as short as possible.
- When using several B900 Drive units side by side, ground the units as shown in Figure 12, (a) or (b). Do not loop the wires as shown in (c).



(a) Acceptable   *(b) Acceptable*   *(c) Not Acceptable*

Figure 12 Grounding Example of 3 *B900* ***Inverters***

Terminal Functions

230V Class Terminal Functions

<table>
<tr><td>Model B900</td><td>20P4 to 27P5</td><td>2011 to 2015</td><td>2018 to 2022</td><td>2030 to 2075</td></tr>
<tr><td>Nominal Motor Output</td><td>0.5 to 10HP</td><td>15 to 20HP</td><td>25 to 30HP</td><td>40 to 100HP</td></tr>
<tr><td>L1</td><td colspan="4" rowspan="3">Main circuit input power supply</td></tr>
<tr><td>L2</td></tr>
<tr><td>L3</td></tr>
<tr><td>T1</td><td colspan="4" rowspan="3">Inverter output</td></tr>
<tr><td>T2</td></tr>
<tr><td>T3</td></tr>
<tr><td>B1</td><td rowspan="2">Braking resistor unit</td><td colspan="3" rowspan="2">---</td></tr>
<tr><td>B2</td></tr>
<tr><td>⊖</td><td rowspan="3">DC reactor (⊕1 - ⊕2)
DC power supply (⊕1 -⊖)</td><td rowspan="4">DC reactor (⊕1 - ⊕2)
DC power supply (⊕1 - ⊖)
Braking unit (⊕3 - ⊖)</td><td rowspan="4">DC power supply (⊕1 - ⊖)
Braking unit (⊕3 - ⊖)</td><td rowspan="4">Braking unit (⊕3 - ⊖)
(⊕1 and ⊕2 terminals not provided)</td></tr>
<tr><td>⊕1</td></tr>
<tr><td>⊕2</td></tr>
<tr><td>⊕3</td><td>---</td></tr>
<tr><td>r</td><td colspan="2" rowspan="2">---</td><td colspan="2" rowspan="2">Cooling fan power supply</td></tr>
<tr><td>s</td></tr>
<tr><td>⏚</td><td colspan="4">Ground terminal (Ground resistance: 100Ω or less)</td></tr>
</table>

460V Class Terminal Functions

<table>
<tr><td>Model B900</td><td>40P4 to 4015</td><td>4018 to 4045</td><td>4055 to 4160</td><td>4185 to 4300</td></tr>
<tr><td>Nominal Motor Output</td><td>0.5 to 25HP</td><td>30 to 75HP</td><td>100 to 200HP</td><td>250 to 500HP</td></tr>
<tr><td>L1</td><td colspan="4" rowspan="3">Main circuit input power supply</td></tr>
<tr><td>L2</td></tr>
<tr><td>L3</td></tr>
<tr><td>T1</td><td colspan="4" rowspan="3">Inverter output</td></tr>
<tr><td>T2</td></tr>
<tr><td>T3</td></tr>
<tr><td>B1</td><td rowspan="2">Braking resistor unit</td><td colspan="3" rowspan="2">---</td></tr>
<tr><td>B2</td></tr>
<tr><td>⊖</td><td rowspan="3">DC reactor (⊕1 - ⊕2)
DC power supply (⊕1 - ⊖)</td><td rowspan="4">DC power supply (⊕1 - ⊖)
Braking unit (⊕3 - ⊖)</td><td rowspan="4">Braking unit (⊕3 - ⊖)
(⊕1 and ⊕2 terminals not provided)</td><td rowspan="4">Braking unit (⊕3 - ⊖)</td></tr>
<tr><td>⊕1</td></tr>
<tr><td>⊕2</td></tr>
<tr><td>⊕3</td><td>---</td></tr>
<tr><td>s</td><td rowspan="4">---</td><td rowspan="2">Cooling fan
power supply</td><td colspan="2">---</td></tr>
<tr><td>r</td><td colspan="2" rowspan="3">Cooling fan power supply
(Control power supply)
r - s 200: 200 to 230 VAC input
r - s 400: 380 to 460 VAC input</td></tr>
<tr><td>s 200</td><td rowspan="2">---</td></tr>
<tr><td>s 400</td></tr>
<tr><td>⏚</td><td colspan="4">Ground terminal (Ground resistance: 10Ω or less)</td></tr>
</table>

Terminal Functions (continued)

575V Class Terminal Functions

<table>
<tr><td>Model B900</td><td>51P5 to 5015</td><td>5018 to 5022</td><td>5030 to 5160</td></tr>
<tr><td>Nominal Motor Output</td><td>2.0 to 20HP</td><td>25 to 30HP</td><td>40 to 200HP</td></tr>
<tr><td>L1</td><td colspan="3" rowspan="3">Main circuit input power supply</td></tr>
<tr><td>L2</td></tr>
<tr><td>L3</td></tr>
<tr><td>T1</td><td colspan="3" rowspan="3">Inverter output</td></tr>
<tr><td>T2</td></tr>
<tr><td>T3</td></tr>
<tr><td>B1</td><td colspan="2" rowspan="2">Braking resistor unit</td><td rowspan="2">—</td></tr>
<tr><td>B2</td></tr>
<tr><td>⊖</td><td rowspan="3">DC reactor (⊕1 - ⊕2)
DC power supply (⊕1 - ⊖)</td><td rowspan="2">DC power supply (⊕1 - ⊖)</td><td rowspan="2">Braking unit (⊕1 - ⊖)
DC power supply (⊕1 - ⊖)</td></tr>
<tr><td>⊕1</td></tr>
<tr><td>⊕2</td><td>—</td><td>—</td></tr>
<tr><td>l_1</td><td rowspan="2">—</td><td colspan="2" rowspan="2">Cooling fan and control power supply</td></tr>
<tr><td>l_2</td></tr>
<tr><td>⏚</td><td colspan="3">Ground terminal (Ground resistance: 10Ω or less)</td></tr>
</table>

Wire and Terminal Screw Sizes

230V Class Wire Size

Circuit	Model B900-	Terminal Symbol	Terminal Screw	Wire Size *		Max. Torque lb-in (N·m)	Wire Type
				AWG	mm^2		
Main	20P4	L1, L2, L3, ⊖, ⊕1, ⊕2, B1, B2, T1, T2, T3	M4	14 - 10	2 - 5.5	12.4 (1.4)	Power cable: 600V vinyl sheathed wire or equivalent
		⏚					
	20P7	L1, L2, L3, ⊖, ⊕1, ⊕2, B1, B2, T1, T2, T3	M4	14 - 10	2 - 5.5	12.4 (1.4)	
		⏚					
	21P5	L1, L2, L3, ⊖, ⊕1, ⊕2, B1, B2, T1, T2, T3	M4	14 - 10	2 - 5.5	12.4 (1.4)	
		⏚		12 - 10	3.5 - 5.5		
	22P2	L1, L2, L3, ⊖, ⊕1, ⊕2, B1, B2, T1, T2, T3	M4	12 - 10	3.5 - 5.5	12.4 (1.4)	
		⏚					
	23P7	L1, L2, L3, ⊖, ⊕1, ⊕2, B1, B2, T1, T2, T3	M4	10	5.5	12.4 (1.4)	
		⏚					
	25P5	L1, L2, L3, ⊖, ⊕1, ⊕2, B1, B2, T1, T2, T3	M5	8	8	22.1 (2.5)	
		⏚		10 - 8	5.5 - 8		
	27P5	L1, L2, L3, ⊖, ⊕1, ⊕2, B1, B2, T1, T2, T3	M5	8	8	22.1 (2.5)	
		⏚		10 - 8	5.5 - 8		
	2011	L1, L2, L3, ⊖, ⊕1, ⊕2, ⊕3, T1, T2, T3	M6	4	22	45.1 (5.1)	
		⏚		8	8		
	2015	L1, L2, L3, ⊖, ⊕1, ⊕2, ⊕3, T1, T2, T3	M8	3	30	90.3 (10.2)	
		⏚	M6	8	8	45.1 (5.1)	
	2018	L1, L2, L3, ⊖, ⊕1, ⊕2, ⊕3, T1, T2, T3	M8	3	30	90.3 (10.2)	
		⏚		6	14		
		r, s	M4	20 - 10	0.5 - 5.5	12.4 (1.4)	
	2022	L1, L2, L3, ⊖, ⊕1, ⊕2, ⊕3, T1, T2, T3	M8	2	38	90.3 (10.2)	
		⏚		6	14		
		r, s	M4	20 - 10	0.5 - 5.5	12.4 (1.4)	
	2030	L1, L2, L3, T1, T2, T3	M10	4/0	100	203.6 (23.0)	
		⏚, ⊖, ⊕3	M8	4	22	90.3 (10.2)	
		r, s	M4	20 - 10	0.5 - 5.5	12.4 (1.4)	
	2037	L1, L2, L3, T1, T2, T3	M10	1/0 x 2P	60 x 2P	203.6 (23.0)	
		⏚, ⊖, ⊕3	M8	4	22	90.3 (10.2)	
		r, s	M4	20 - 10	0.5 - 5.5	12.4 (1.4)	
	2045	L1, L2, L3, T1, T2, T3	M10	1/0 x 2P	60 x 2P	203.6 (23.0)	
		⏚, ⊖, ⊕3	M8	4	22	90.3 (10.2)	
		r, s	M4	20 - 10	0.5 - 5.5	12.4 (1.4)	
	2055	L1, L2, L3, T1, T2, T3	M10	1/0 x 2P	60 x 2P	203.6 (23.0)	
		⏚, ⊖, ⊕3	M8	3	30	90.3 (10.2)	
		r, s	M4	20 - 10	0.5 - 5.5	12.4 (1.4)	
	2075	L1, L2, L3, T1, T2, T3	M12	4/0 x 2P	100 x 2P	349.6 (39.5)	
		⏚, ⊖, ⊕3	M8	1	50	90.3 (10.2)	
		r, s	M4	20 - 10	0.5 - 5.5	12.4 (1.4)	
Control	Common to all models	1-33	M3.5	20 - 16	Stranded 0.5 - 1.25 Solid 0.5 - 1.25	-	Twisted shielded wire with Class 1 wiring
		G	M3.5	20 - 14	0.5 - 2	8.9 (1.0)	

* Wire sizes are based on 75°C copper wire.

Wire and Terminal Screw Sizes

460V Class Wire Size

Circuit	Model B900	Terminal Symbol	Terminal Screw	Wire Size *		Max. Torque lb-in (N·m)	Wire Type
				AWG	mm^2		
Main	40P4	L1, L2, L3,⊖, ⊕1, ⊕2, B1, B2, T1, T2, T3	M4	14 - 10	2 - 5.5	12.4 (1.4)	Power cable: 600V vinyl sheathed wire or equivalent
		⏚					
	40P7	L1, L2, L3,⊖, ⊕1, ⊕2, B1, B2, T1, T2, T3	M4	14 - 10	2 - 5.5	12.4 (1.4)	
		⏚		12 - 10	3.5 - 5.5		
	41P5	L1, L2, L3,⊖, ⊕1, ⊕2, B1, B2, T1, T2, T3	M4	14 - 10	2 - 5.5	12.4 (1.4)	
		⏚		12 - 10	3.5 - 5.5		
	42P2	L1, L2, L3,⊖, ⊕1, ⊕2, B1, B2, T1, T2, T3	M4	14 - 10	2 - 5.5	12.4 (1.4)	
		⏚		12 - 10	3.5 - 5.5		
	43P7	L1, L2, L3,⊖, ⊕1, ⊕2, B1, B2, T1, T2, T3	M4	14 - 10	2 - 5.5	12.4 (1.4)	
		⏚		12 - 10	3.5 - 5.5		
	44P0	L1, L2, L3,⊖, ⊕1, ⊕2, B1, B2, T1, T2, T3	M4	12 - 10	3.5 - 5.5	12.4 (1.4)	
		⏚					
	45P5	L1, L2, L3,⊖, ⊕1, ⊕2, B1, B2, T1, T2, T3	M4	12 - 10	3.5 - 5.5	12.4 (1.4)	
		⏚					
	47P5	L1, L2, L3,⊖, ⊕1, ⊕2, B1, B2, T1, T2, T3	M5	8 - 6	8 - 14	22.1 (2.5)	
		⏚					
	4011	L1, L2, L3,⊖, ⊕1, ⊕2, B1, B2, T1, T2, T3	M5	8 - 6	8 - 14	22.1 (2.5)	
		⏚	M6	8	8	45.1 (5.1)	
	4015	L1, L2, L3,⊖, ⊕1, ⊕2, B1, B2, T1, T2, T3	M5	8 - 6	8 - 14	22.1 (2.5)	
		⏚	M6	8	8	45.1 (5.1)	
	4018	L1, L2, L3,⊖, ⊕1, ⊕2, ⊕3, T1, T2, T3	M6	6	14	45.1 (5.1)	
		⏚	M8	8	8	90.3 (10.2)	
		r, s	M4	20 - 10	0.5 - 5	12.4 (1.4)	
	4022	L1, L2, L3,⊖, ⊕1, ⊕2, ⊕3, T1, T2, T3	M6	4	22	45.1 (5.1)	
		⏚	M8	8	8	90.3 (10.2)	
		r, s	M4	20 - 10	0.5 - 5	12.4 (1.4)	
	4030	L1, L2, L3,⊖, ⊕1, ⊕2, ⊕3, T1, T2, T3	M8	4	22	90.3 (10.2)	
		⏚		8	8		
		r, s	M4	20 - 10	0.5 - 5	12.4 (1.4)	
	4037	L1, L2, L3,⊖, ⊕1, ⊕2, ⊕3, T1, T2, T3	M8	3	30	90.3 (10.2)	
		⏚		6	14		
		r, s	M4	20 - 10	0.5 - 5	12.4 (1.4)	
	4045	L1, L2, L3,⊖, ⊕1, ⊕2, ⊕3, T1, T2, T3	M8	1	50	90.3 (10.2)	
		⏚		6	14		
		r, s	M4	20 - 10	0.5 - 5	12.4 (1.4)	
	4055	L1, L2, L3, T1, T2, T3	M10	4/0	100	203.6 (23.0)	
		⏚, ⊖, ⊕3	M8	4	22	90.3 (10.2)	
		r, s200, s400	M4	20 - 10	0.5 - 5	12.4 (1.4)	
	4075	L1, L2, L3, T1, T2, T3	M10	1/0 x 2P	60 x 2P	203.6 (23.0)	
		⏚, ⊖, ⊕3	M8	4	22	90.3 (10.2)	
		r, s200, s400	M4	20 - 10	0.5 - 5	12.4 (1.4)	
	4110	L1, L2, L3, T1, T2, T3	M10	1/0 x 2P	60 x 2P	203.6 (23.0)	
		⏚, ⊖, ⊕3	M8	3	30	90.3 (10.2)	
		r, s200, s400	M4	20 - 10	0.5 - 5	12.4 (1.4)	
	4160	L1, L2, L3, T1, T2, T3	M12	4/0 x 2P	100 x 2P	349.6 (39.5)	
		⏚, ⊖, ⊕3	M8	1	50	90.3 (10.2)	
		r, s200, s400	M4	20 - 10	0.5 - 5	12.4 (1.4)	
	4185	L1, L2, L3,⊖, ⊕1, ⊕3, T1, T2, T3	M16	650MCM x 2P	325 x 2P	867.4 (98.0)	
		⏚	M8	1	50	90.3 (10.2)	
		r, s200, s400	M4	20 - 10	0.5 - 5.5	12.4 (1.4)	
	4220	L1, L2, L3,⊖, ⊕1, ⊕3, T1, T2, T3	M16	650MCM x 2P	325 x 2P	867.4 (98.0)	
		⏚	M8	1/0	60	90.3 (10.2)	
		r, s200, s400	M4	20 - 10	0.5 - 5.5	12.4 (1.4)	
	4300	L1, L2, L3,⊖, ⊕1, ⊕3, T1, T2, T3	M16	650MCM x 2P	325 x 2P	867.4 (98.0)	
		⏚	M8	1/0	60	90.3 (10.2)	
		r, s200, s400	M4	20 - 10	0.5 - 5.5	12.4 (1.4)	
Control	Common to all models	1-33	M3.5	20 - 16	Stranded 0.5 - 1.25 Solid 0.5 - 1.25	-	Twisted shielded wire with Class 1 wiring
		G	M3.5	20 - 14	0.5 - 2	8.9 (1.0)	

* Wire sizes are based on 75°C copper wire.

Wire and Terminal Screw Sizes (continued)

575V Class Wire Size

Circuit	Model B900	Terminal Symbol	Terminal Screw	Wire Size *		Max. Torque lb-in (N·m)	Wire Type
				AWG	mm^2		
Main	51P5 52P2	L1, L2, L3, ⊖ , ⊕1, ⊕2, B1, B2, T1, T2, T3	M4	14 - 10	2 - 5.5	12.4 (1.4)	Power cable: 600V vinyl sheathed wire or equivalent
		⏚					
	53P7	L1, L2, L3, ⊖ , ⊕1, ⊕2, B1, B2, T1, T2, T3	M4	14 - 10	2 - 5.5	12.4 (1.4)	
		⏚		12 - 10	3.5 - 5.5		
	55P5	L1, L2, L3, ⊖ , ⊕1, ⊕2, B1, B2, T1, T2, T3	M4	12 - 10	3.5 - 5.5	12.4 (1.4)	
		⏚					
	57P5	L1, L2, L3, ⊖ , ⊕1, ⊕2, B1, B2, T1, T2, T3	M4	10	5.5	12.4 (1.4)	
		⏚		12 - 10	3.5 - 5.5		
	5011	L1, L2, L3, ⊖ , ⊕1, ⊕2, B1, B2, T1, T2, T3	M5	10 - 6	5.5 - 14	12.4 (1.4)	
		⏚	M6			45.1 (5.1)	
	5015	L1, L2, L3, ⊖ , ⊕1, ⊕2, B1, B2, T1, T2, T3	M5	8 - 6	8 - 14	22.1 (2.5)	
		⏚	M6	10 - 6	5.5 - 14	45.1 (5.1)	
	5018 5022	L1, L2, L3, ⊖ , ⊕1, B1, B2, T1, T2, T3	M6	8 - 6	8 - 14	45.1 (5.1)	
		⏚	†	10 - 6	5.5 - 14	20 (2.3)	
		l_1 , l_2	M4	14 - 10	2 - 5.5	12.4 (1.4)	
	5030	L1, L2, L3, ⊖ , ⊕1, T1, T2, T3	M8	6 - 1/0	14 - 50	90.3 (10.3)	
		⏚	†	8 - 2	8 - 30	20 (2.3)	
		l_1 , l_2	M4	14 - 10	2 - 5.5	12.4 (1.4)	
	5037	L1, L2, L3, ⊖ , ⊕1, T1, T2, T3	M8	4 - 1/0	22 - 50	90.3 (10.3)	
		⏚	†	8 - 2	8 - 30	20 (2.3)	
		l_1 , l_2	M4	14 - 10	2 - 5.5	12.4 (1.4)	
	5045	L1, L2, L3, ⊖ , ⊕1, T1, T2, T3	M8	3 - 1/0	30 - 50	90.3 (10.3)	
		⏚	†	8 - 2	8 - 30	20 (2.3)	
		l_1 , l_2	M4	14 - 10	2 - 5.5	12.4 (1.4)	
	5055	L1, L2, L3, ⊖ , ⊕1, T1, T2, T3	M8	2 - 1/0	30 - 50	90.3 (10.3)	
		⏚	†	6 - 2	22 - 30	20 (2.3)	
		l_1 , l_2	M4	14 - 10	2 - 5.5	12.4 (1.4)	
	5075	L1, L2, L3, ⊖ , ⊕ 1, T1, T2, T3	M8	2/0 - 1/0	50 - 60	90.3 (10.3)	
		⏚	†	4 - 2	22 - 30	20 (2.3)	
		l_1 , l_2	M4	14 - 10	2 - 5.5	12.4 (1.4)	
	5090	L1, L2, L3, ⊖ , ⊕1, T1, T2, T3	M10	3/0 - 300	80 - 150	203.6 (23)	
		⏚	†	4 - 2/0	22 - 60	20 (2.3)	
		l_1 , l_2	M4	14 - 10	2 - 5.5	12.4 (1.4)	
	5110	L1, L2, L3, ⊖ , ⊕1, T1, T2, T3	M12	300-400	150 - 200	349.6 (39.5)	
		⏚	†	4 - 2/0	22 - 60	20 (2.3)	
		l_1 , l_2	M4	14 - 10	2 - 5.5	12.4 (1.4)	
	5160	L1, L2, L3, ⊖ , ⊕1, T1, T2, T3	M12	350-400	180 - 200	349.6 (39.5)	
		⏚	†	3 - 2/0	30 - 60	20 (2.3)	
		l_1 , l_2	M4	14 - 10	2 - 5.5	12.4 (1.4)	
Control	Common to all models	1-33	M3.5	20 - 16	Stranded 0.5 - 1.25 Solid 0.5 - 1.25	-	Twisted shielded wire with Class 1 wiring
		G		20 - 14	0.5 - 2	8.9 (1.0)	

* Wire sizes are based on 75°C copper wire.† Indicates terminal uses a pressure lug.

Wire and Terminal Screw Sizes (continued)

JST Closed Loop Connectors

Wire Size *		Terminal Screw	JST Closed-Loop Connectors (Lugs)	Max. Torque lb-in (N·m)
AWG	mm^2			
20	0.5	M3.5	1.25 - 3.5	8.9 (1.0)
		M4	1.25 - 4	12.4 (1.4)
18	0.75	M3.5	1.25 - 3.5	8.9 (1.0)
		M4	1.25 - 4	12.4 (1.4)
16	1.25	M3.5	1.25 - 3.5	8.9 (1.0)
		M4	1.25 - 4	12.4 (1.4)
14	2	M3.5	2 - 3.5	8.9 (1.0)
		M4	2 - 4	12.4 (1.4)
		M5	2 - 5	22.1 (2.5)
		M6	2 - 6	45.1 (5.1)
		M8	2 - 8	90.3 (10.2)
12 - 10	3.5 - 5.5	M4	5.5 - 4	12.4 (1.4)
		M5	5.5 - 5	22.1 (2.5)
		M6	5.5 - 6	45.1 (5.1)
		M8	5.5 - 8	90.3 (10.2)
8	8	M5	8 - 5	22.1 (2.5)
		M6	8 - 6	45.1 (5.1)
		M8	8 - 8	90.3 (10.2)
6	14	M6	14 - 6	45.1 (5.1)
		M8	14 - 8	90.3 (10.2)
4	22	M6	22 - 6	45.1 (5.1)
		M8	22 - 8	90.3 (10.2)
3 - 2	30 - 38	M8	38 - 8	90.3 (10.2)
1 - 1/0	50 - 60	M8	60 - 8	90.3 (10.2)
		M10	60 - 10	203.6 (23.0)
3/0	80	M10	80 - 10	203.6 (23.0)
4/0	100		100 - 10	203.6 (23.0)
4/0	100	M12	100 - 12	349.6 (39.5)
300MCM	150		150 - 12	349.6 (39.5)
400MCM	200		200 - 12	349.6 (39.5)
650MCM	325	M12 x 2	325 - 12	349.6 (39.5)
		M16	325 - 16	867.4 (98.0)

Note 1:

The use of a JST closed-loop connector (lug) is recommended to maintain proper clearances. Please contact your Bedford representative for more information.

Note 2:

Voltage drop should be considered when determining wire size. Voltage drop can be calculated using the following equation:

$$\text{Phase-to phase voltage drop (V)} = \sqrt{3}\ \text{wire resistance } (\Omega/\text{km}) \times \text{wiring distance (m)} \times \text{current (A)} \times 10^{-3}$$

Select a wire size so that voltage drop will be less than 2% of the normal rated voltage.

Control Circuit Wiring

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

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	—		
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 (20kΩ), 0 to +10V/(20kΩ)
	14	Master frequency ref. (current)	4 to 20mA/100%.	Multi-function analog input (*H3-08, H3-09, H3-10, H3-11*)	4 to 20mA (250Ω)
	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 (20kΩ), 0 to +10V/(20kΩ)
	17	Common terminal for control circuit	0V		—
	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)*	—

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	

Figure 13 Control Circuit Terminal Arrangement

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- CHAPTER 2 -

OPERATION

⚠WARNING

PRECAUTIONS

1) Only turn ON the input power supply after replacing the front cover. Do not remove the cover while the inverter is powered up.
2) When the retry function (parameter *L5-02*) is selected, do not approach the inverter or the load, since it may restart suddenly after being stopped.
3) Since the Stop key can be disabled by a function setting, install a separate emergency stop switch to remove input power from the inverter.
4) Do not touch the heatsink or braking resistor, due to very high temperatures.
5) Since it is very easy to change operation speed from low to high speed, verify the safe working range of the motor and machine before operation. Also, verify the parameter settings prior to operation.
6) Install a separate holding brake, if necessary.
7) Do not check signals during operation.
8) All inverter parameters have been preset at the factory. Do not change the settings unless it is required.

Failure to observe these precautions may result in equipment damage, serious personal injury or death.

2.1 TRIAL OPERATION

To ensure safety, prior to initial operation, disconnect the machine coupling so that the motor is isolated from the machine. If initial operation must be performed while the motor is still coupled to the machine, use great care to avoid potentially hazardous conditions. Check the following items before a trial run:

· Wiring and terminal connections are proper.
· Wire clippings and other debris removed from the unit.
· Screws are securely tightened.
· Motor is securely mounted.
· All items are correctly grounded.

Digital Operator Display at Power-Up

When the system is ready for operation, turn ON the power supply. Verify that the inverter powers up properly. If any problems are detected, turn OFF the power supply immediately. The digital operator display illuminates as shown below when the power supply is turned ON.

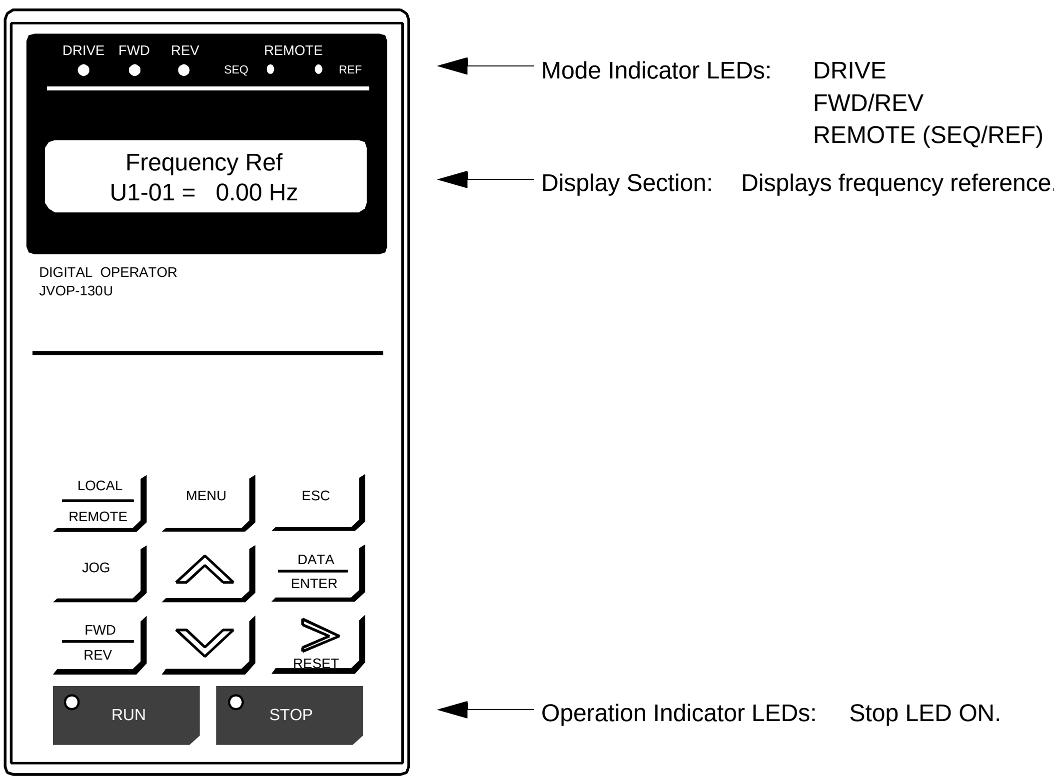


Figure 14 Digital Operator Display at Power-up

Operation Checkpoints:

- Motor rotates smoothly.
- Motor rotates in the correct direction.
- Motor has no abnormal vibration nor noise.
- Acceleration and deceleration are smooth.
- Unit is not overloaded.
- Status indicator LEDs and digital operator display are correct.

Operation by Digital Operator

The diagram below shows a typical operation profile using the digital operator.

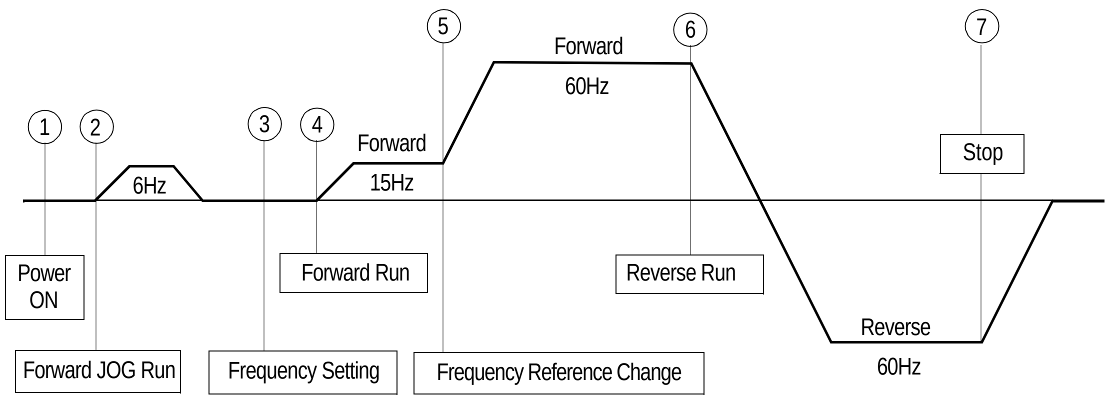


Figure 15 Operation Sequence by Digital Operator

Typical Operation Example by Digital Operator

Description	Key Sequence	Digital Operator Display
①Power ON · Displays frequency reference value.		Frequency Ref U1-01 = 0.00 Hz
Operation Condition Setting · Select LOCAL mode.	LOCAL / REMOTE	REMOTE LED (SEQ, REF) OFF
②Forward Jog Run (6Hz) · JOG run procedure (Runs while depressing JOG key.)	JOG	
③Frequency Setting · Change frequency reference value. Digit to be changed blinks.	DATA / ENTER	Frequency Ref 0 00.00 Hz
	Change the value by depressing ∧ ∨ > RESET	Frequency Ref 01 5 .00 Hz
· Write-in set value.	DATA / ENTER	Entry Accepted Frequency Ref 01 5 .00 Hz
· Select output frequency monitor display.	ESC ∧	Output Freq U1-02 = 0.00 Hz
④Forward Run · Forward run (15Hz) Run & FWD LEDs light.	RUN	Output Freq U1-02 = 15.00 Hz
⑤Frequency Reference Value Change (15~60Hz) · Select frequency reference value display	∧ DATA / ENTER Depress twice.	Frequency Ref 0 15.00 Hz
· Change set value.	Change the value by depressing ∧ ∨ > RESET	Frequency Ref 06 0 .00 Hz
· Write-in set value.	DATA / ENTER	Entry Accepted
· Select output frequency monitor display.	∧ DATA / ENTER	Output Freq U1-02 = 60.00 Hz
⑥Reverse Run · Select reverse run. REV LED lights.	FWD / REV	Output Freq U1-02 = -60.00 Hz
⑦Stop · Decelerates to stop. Stop LED lights.	STOP / RESET	Output Freq U1-02 = 0.00 Hz

Operation by Control Circuit Terminal Signal

The diagram below shows a typical operation profile using the control circuit terminal signals.

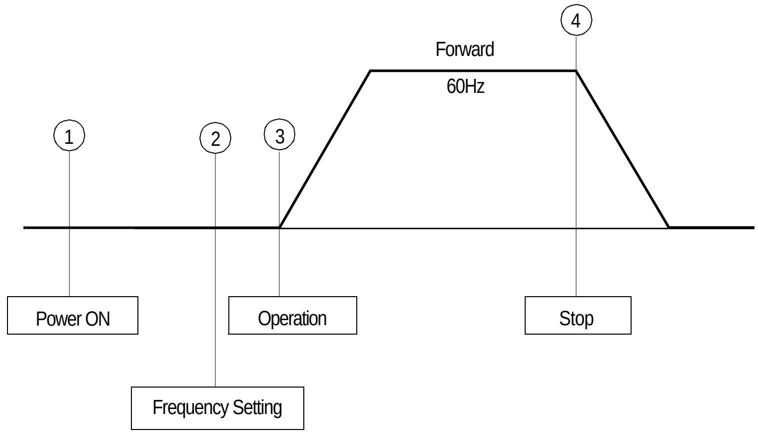


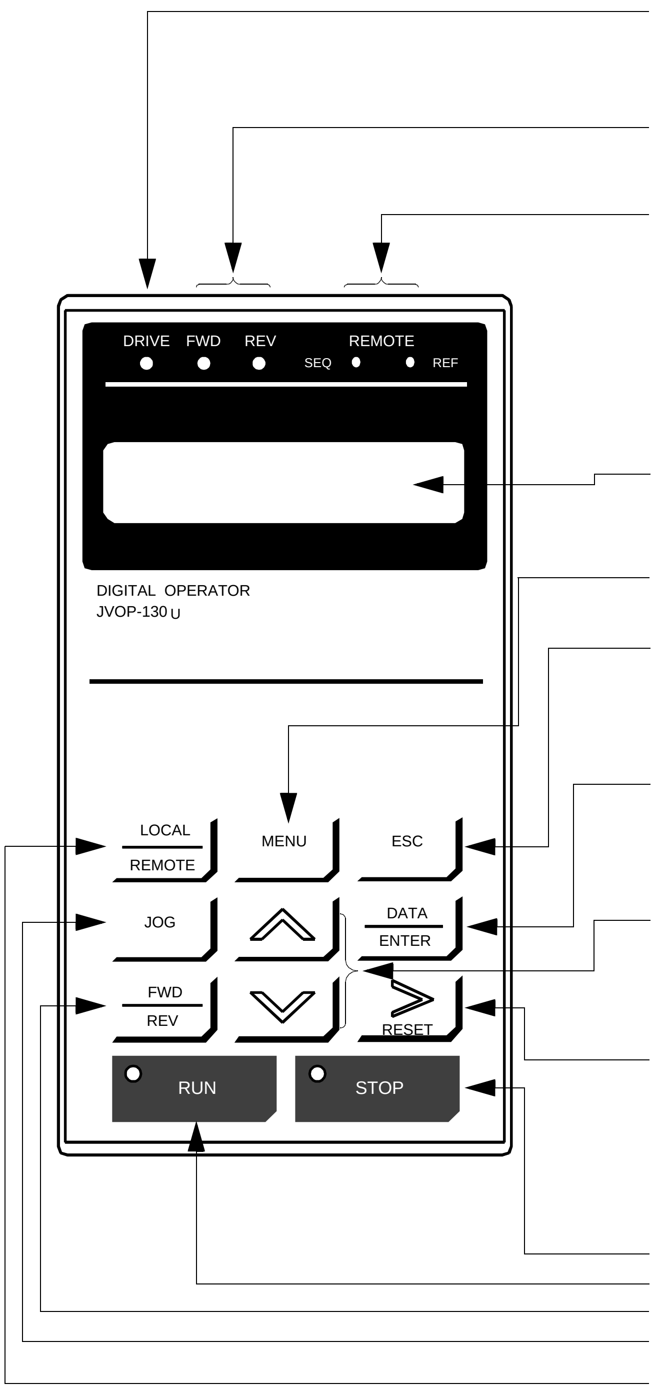
Figure 16   Operation Sequence by Control Circuit Terminal Signal

Typical Operation Example by Control Circuit Terminal Signal

Description	Key Sequence	Digital Operator Display
① Power ON · Displays frequency reference value. REMOTE mode is preset at the factory.		Frequency Ref U1-01 = 0.00 Hz REMOTE LED (SEQ, REF) ON
Output Frequency Display · Switch to output frequency display.		Output Freq U1-02 = 0.00 Hz
Forward Jog Run (6Hz) · Close between control circuit terminals 1 & 11, and 7 & 11 closed to perform JOG run. Run & FWD LEDs illuminate. · Open between terminals 1 & 11, and 7 & 11 after verifying JOG operation		Output Freq U1-02 = 6.00 Hz
② Frequency Setting · Input frequency reference via terminal 13 (voltage) or 14 (voltage/current) and verify the input value with the digital operator.		Frequency Ref U1-01 = 60.00 Hz
Output Frequency Display · Select output frequency monitor display.		Output Freq U1-02 = 0.00 Hz
③ Forward Run · Close between terminals 1 & 11 to perform forward run.		Output Freq U1-02 = 60.00 Hz
④ Stop · Open between terminals 1 & 11 to stop operation. Stop LED illuminates.		Output Freq U1-02 = 0.00 Hz

2.2 DIGITAL OPERATOR DISPLAY

All functions of the B900 Drive are accessed using the digital operator. Below are descriptions of the display and keypad sections.



Mode Indicator LEDs

Drive Mode LED

Illuminates when selecting drive mode (operation via external terminals is possible).
OFF when selecting any other mode.

Rotation Direction LEDs

FWD: Illuminates at forward command.
REV: Illuminates at reverse command.

Remote Mode LEDs

Illuminates when selecting input mode from the control circuit terminal or serial communication.

SEQ: Illuminates when selecting run command from the control circuit terminal or serial communication.
REF: Illuminates when selecting frequency reference from the control circuit terminals 13, 14, or 16, or serial communication.

Display

Displays set values of parameters or monitoring values such as output frequency and current (2 lines x 16 characters).

Menu Key

Displays the main menu for mode selection.

Escape Key

Returns display to the previous status, before[DATA/ENTER] key was depressed. Returns menu to previous layer (i.e. function, group, mode).

Data/Enter Key

Selects mode, group, function or parameter. Displays each parameter's set value. By depressing this key (after changing a parameter setting), the set value is entered.

Menu/Value Change Keys

Selects mode, group, function, parameter or set value.
∧: Increment key
∨: Decrement key

Digit Selection Key

Selects a digit of a set value to be changed. The selected digit blinks. Resets operation at faults.

Operation Command Keys

Operation command keys operate the inverter. These are enabled only in the drive mode.

STOP: Red LED illuminates after depressing STOP key.
RUN: Red LED illuminates after depressing RUN key.
FWD/REV: Selects forward or reverse run.
JOG: Jog run is enabled while depressing this key.

Operation Mode Selection Key

Alternate between REMOTE and LOCAL (digital operator) operation.

Figure 17 Digital Operator Display at Power-up

2.3 OPERATION MODE SELECTION

The B900 Drive has two operation modes: LOCAL and REMOTE (see table below for description). These two modes can be selected by the digital operator “LOCAL/REMOTE” key or a multi-function input terminal command only when operation is stopped. The operation mode selected can be verified by observing the SEQ and REF LEDs on the digital operator (as shown below). The operation mode is set to REMOTE (run by control circuit terminals 13 and/or 14 frequency reference and run command from control circuit terminals) prior to shipment. Multi-function contact inputs from control circuit terminals 3 to 8 are enabled in both operation modes.

- LOCAL: Both frequency reference and run command are set by the digital operator. SEQ and REF LEDs go OFF.
- REMOTE: Master frequency reference and run command can be selected as described in the table below.

Operation Mode Selection

Setting	Reference Selection *(B1-01)*	REF LED	Operation Method Selection *(B1-02)*	SEQ LED
0	Master frequency reference from digital operator	OFF	Operation by run command from digital operator	OFF
1	Master frequency reference from control circuit terminals 13 and 14	ON	Operation by run command from control circuit terminal	ON
2	Master frequency reference set by serial communication	blinking	Operation by run command from serial communication	blinking
3	Master frequency reference set by option card	blinking	Operation by run command from option card	blinking
4	Master frequency reference set by EWS (Engineering Work Station). This setting will be used with the CP-717 <1110>.	ON	Operation by run command from EWS (CP-717) <1110>.	ON

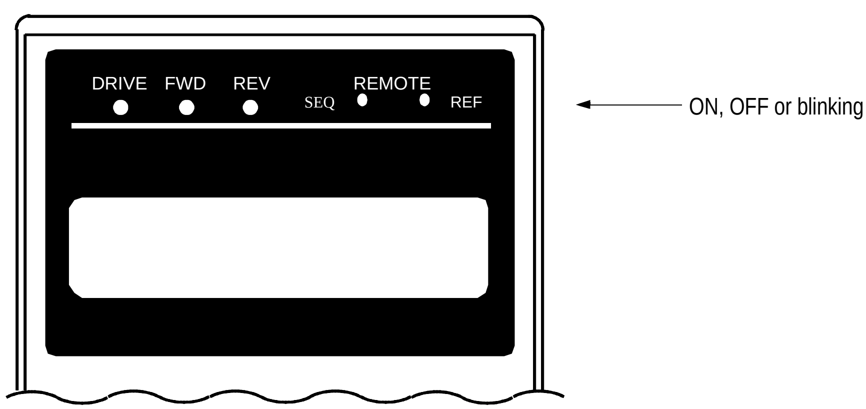


Figure 18 Operation Mode LEDs

- CHAPTER 3 -

QUICK-START PROGRAMMING

Quick-Start Parameter Sequence

Main Menu *	Key Press	Function	Parameter No.
Operation		Frequency Reference	U1-01
	^	Output Frequency	U1-02
	^	Output Current	U1-03
	^	Output Voltage	U1-06
	^ DATA/ENTER	U2 Fault Trace U2-01 to U2-14	U2
	^ DATA/ENTER	U3 Fault History U3-01 to U3-08	U3
	^ DATA/ENTER	U1 Monitor U1-01 to U1-14	U1
Initialize	ESC, ^, DATA/ENTER	Select Language	A1-00
	^	Access Level	A1-01
	^	Control Method	A1-02
	^	Initialize Parameters	A1-03
	^	Enter Password	A1-04
Programming	ESC, ^, ^, DATA/ENTER	Reference Source	B1-01
	^	Run Source	B1-02
	^	Stopping Method	B1-03
	^	Acceleration Time 1	C1-01
	^	Deceleration Time 1	C1-02
	^	Preset Frequency Reference 1	D1-01
	^	Preset Frequency Reference 2	D1-02
	^	Preset Frequency Reference 3	D1-03
	^	Preset Frequency Reference 4	D1-04
	^	Jog Frequency Reference	D1-09
	^	Input Voltage	E1-01
	^	Motor Selection	E1-02
	^	V/f Pattern Selection	E1-03
	^	Maximum Frequency	E1-04
	^	Maximum Voltage	E1-05
	^	Maximum Voltage Output Frequency	E1-06
	^	Middle Output Frequency	E1-07
	^	Middle Output Voltage	E1-08
	^	Minimum Output Frequency	E1-09
	^	Minimum Output Voltage	E1-10
	^	Base Voltage	E1-13
	^	Motor Rated Current	E2-01
	^	Motor Rated Slip Frequency	E2-02
	^	Motor No-Load Current	E2-03
	^	Number of Motor Poles	E2-04
Auto-Tuning	ESC, ^, ^, ^, DATA/ENTER	Rated Voltage	--
	^	Rated Current	--
	^	Rated Frequency	--
	^	Rated Speed	--
	^	Number of Poles	--
	^	Select Motor 1 or 2	--
Modified Constants	ESC, ^, ^, ^, ^, DATA/ENTER		

* Depress the Menu key on the digital operator to return to **Main Menu: Operation.**

The B900 Series ships preset to open loop vector control, quick-start access level. Included in this section are descriptions of the Quick-Start parameters, for simplified operation of this drive.

3.1 Main Menu: Initialize <ENTER>

V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
√	√	√	√

A1-00 Language Selection *Select Language*

The B900 series software incorporates seven display languages. Select the language displayed on the digital operator according to the following table:

Setting	Description
0	English *(factory default)*
1	Japanese
2	German <1110>
3	French <1110>
4	Italian <1110>
5	Spanish <1110>
6	Portuguese

V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
√	√	√	√

A1-01 Parameter Access Level *Access Level*

This parameter determines the group of parameters that can be accessed during set-up/programming. There are five access levels ranging from parameters for viewing only (0: Operation Only), to parameters required for advanced applications (4: Advanced Level). The inverter defaults to a setting of "2: Quick Start" to aid in simplifying set-up. See the following table:

Setting	Description
0	Operation Only
1	User Program - Accesses parameters selected by OEM.
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.

V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
√	√	√	√

A1-02 Control Method Selection *Control Method*

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 open loop speed control, higher torque at low speeds (150% torque below 1Hz).
3	Flux Vector - For applications requiring precise speed and torque control, including zero speed control. Uses encoder feedback.

	V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
A1-03 Operator Status *Init Parameters*	√	√	√	√

Use this parameter to re-initialize the inverter to its factory default settings. It is also possible to re-initialize the inverter to settings as determined by the user. See the B900 Programming Manual for further details on the user initialization.

Setting	Description
0	No Initialization *(factory default)*
1110	User Initialization
2220	2-Wire Initialization
3330	3-Wire Initialization

	V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
A1-04 Password Entry *Enter Password*	√	√	√	√

This parameter allows the password lock-out of users from prohibited parameters. This parameter is used in conjunction with Function A2, the user parameters group. When the "user program" access level is selected and the programming is locked via the A1-04 password, only those parameters in group A1 and A2 can be accessed. All other parameters cannot be viewed.

Main Menu: Programming <ENTER>

	V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
B1-01 Frequency Reference Selection *Reference Source*	√	√	√	√
B1-02 Operation Method Selection *Run Source*	√	√	√	√

B1-01 and B1-02 determine how the inverter is to receive a frequency reference and a start/stop command, respectively. 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	Engineering Workstation (EWS) - For use with CP-717 <1110>

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* & *B1-02*.

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

V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
√	√	√	√

B1-03 Stopping Method Selection *Stopping Method*

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

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

· Deceleration to Stop (*B1-03* = "0")

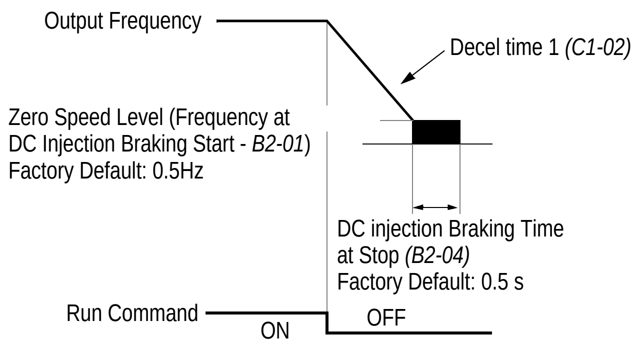


Figure 19 Stopping Method - Deceleration to Stop

Upon removal of the FWD (REV) run command, the motor decelerates at a deceleration rate determined by the time set in deceleration time 1 *(C1-02)* and DC injection braking is applied immediately before stop. If the deceleration time is 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 resistor/unit.

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

· Coast to Stop (*B1-03* = "1")

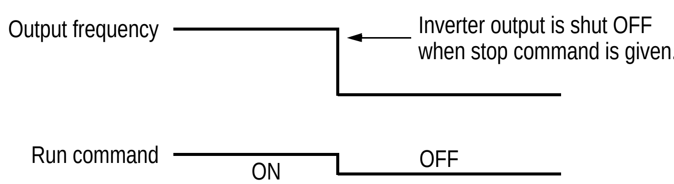


Figure 20 Stopping Method - Coast to Stop

Upon removal of the FWD (REV) run command, the motor coasts. After a stop command is given, a run command can be accepted, but operation does not start until after the minimum baseblock time *(L2-03)* elapses.

· DC Injection Braking Stop (*B1-03* = “2”)

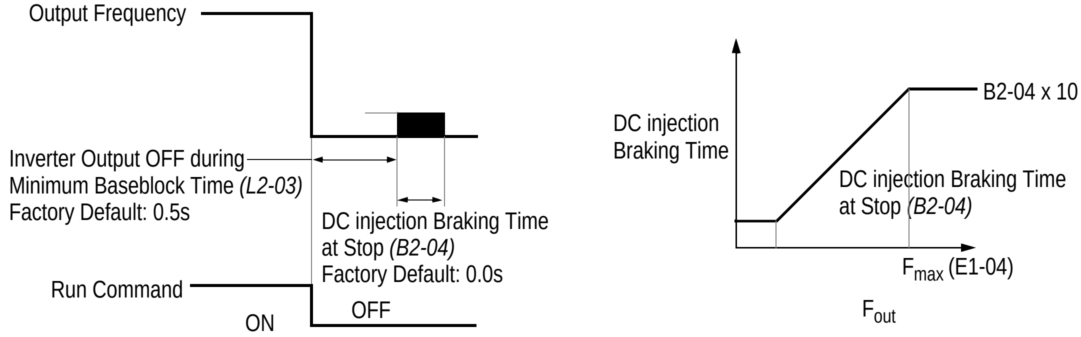


Figure 21 Stopping Method - DC Injection Braking Stop

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 from maximum frequency is the time set in *B2-04* multiplied by 10 (see the figure above). This stopping method is disabled during flux vector control.

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

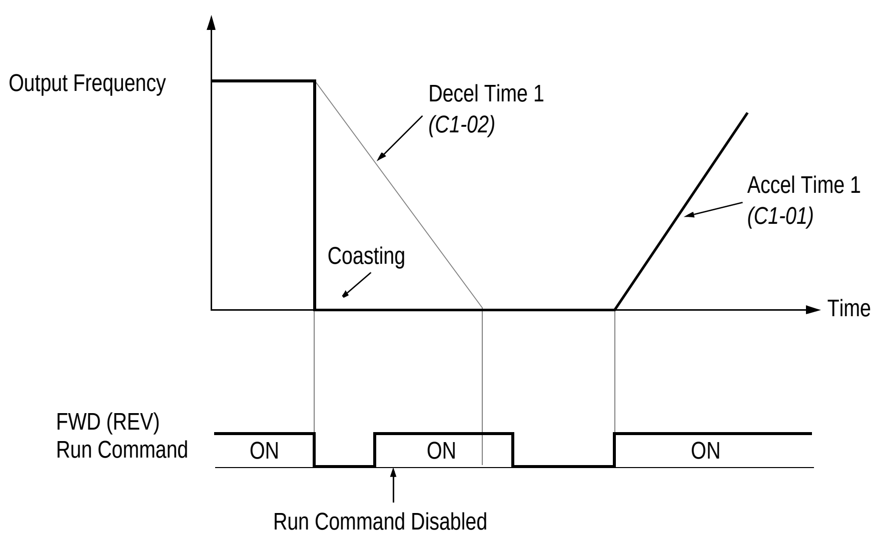


Figure 22 Stopping Method - Coast to Stop w/ Timer

After a stop command is given, a run command is not accepted while the coast to stop timer C1-02 elapses (same as Decel Time 1). After the timer runs out, another run command must be given for the inverter to begin acceleration. This stopping method is disabled during flux vector control.

				V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
C1-01	*Acceleration time 1*	*Accel Time 1*		√	√	√	√
C1-02	*Deceleration time 1*	*Decel Time 1*		√	√	√	√

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

Acceleration time 1 sets the time necessary for the output frequency to accelerate from 0Hz to maximum output frequency as set in parameter E1-04. Deceleration time 1 sets the time necessary for the output frequency to decelerate from the maximum output frequency to 0Hz.

			V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
D1-01	*Preset Frequency Reference 1*	*Reference 1*	√	√	√	√
D1-02	*Preset Frequency Reference 2*	*Reference 2*	√	√	√	√
D1-03	*Preset Frequency Reference 3*	*Reference 3*	√	√	√	√
D1-04	*Preset Frequency Reference 4*	*Reference 4*	√	√	√	√

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

Up to 4 preset speed references (including jog) can be set through multi-function contact input function selections in the Quick-Start mode. Terminals 6 and 7 are factory defaulted to multi-step speed inputs 1 and 2, respectively. See the following table for programming preset speed references in the Quick-Start mode.

Terminal 5	Terminal 6	Speed Reference
Open	Open	Speed Reference 1 - Set Reference Source *(B1-01)* to “0”.
Closed	Open	Speed Reference 2 (When H3-05 $\neq$ 0 and H3-09 $\neq$ 0)
Open	Closed	Speed Reference 3
Closed	Closed	Speed Reference 4

Note: 9 preset references can be set in the Advanced modes.

			V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
D1-09	*Jog Frequency Reference*	*JOG Reference*	√	√	√	√

The jog frequency reference can be set in this parameter. In the Quick-Start mode, depress the JOG key on the digital operator, or close terminal 7 when parameter H1-05 is set to “6”, to use this function. The jog command always has priority over other reference commands. When using terminal 7 to select the jog frequency, a separate run command must be applied to run the inverter.

V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
√	√	√	√

E1-01 Input Voltage *Input Voltage*

Setting Range: 155 to 255V (230V class), 310 to 510V (460V class), 445 to 733V (575V class)
Factory Default: 230V, 460V, 575V

Set this parameter to the inverter input supply voltage in units of 1V. This parameter does not have to be set to the exact incoming voltage level. The nominal voltage is normally sufficient (i.e. 230V, 380V, 460V, 575V).

V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
√	√	√	√

E1-02 Motor Selection *Motor Selection*

Select between fan-cooled, blower-cooled, and vector duty motor types with this parameter. This parameter sets the motor overload (OL1) protection to match typical motor characteristics. Set this parameter to “0” for standard TEFC motors, as these motors typically have a limited constant torque speed range. Set to “1” for standard blower-cooled motors with a constant torque speed range of 10:1. Set to “2” for vector duty motors which have a 100:1 or 1000:1 speed range or when full torque at zero speed is required.

Setting	Description
0	Fan-cooled motor characteristics *(factory default)*
1	Blower-cooled motor characteristics
2	Vector duty motor <1110>

V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
√	√	–	–

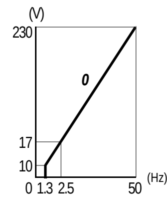
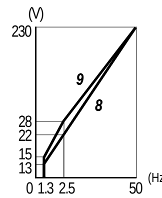
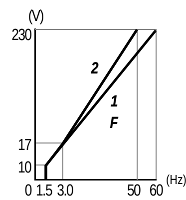
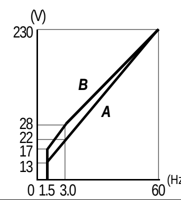
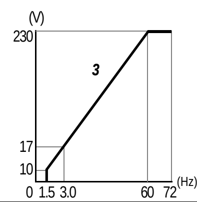
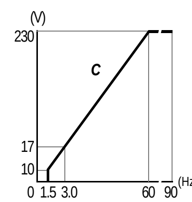
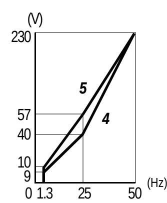
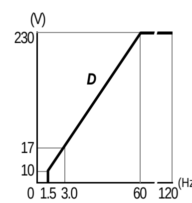
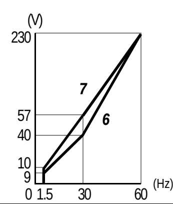
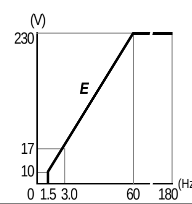
E1-03 V/f Pattern Selection *V/f Selection*

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 (E1-04 through E1-13 are fixed).
F: Custom V/f pattern can be set *(factory default)* (E1-04 through E1-13 can be set individually).

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		Specifications		E1-03	V/f Pattern *1
General-purpose	50Hz		0		High Starting Torque *2	50Hz	High Starting Torque 1	8	
							High Starting Torque 2	9	
	60Hz Saturation		1 **F**			60Hz	High Starting Torque 1	A	
	50Hz Saturation		2				High Starting Torque 2	B	
	72Hz		3		High Speed Operation	90Hz		C	
Variable Torque	50Hz	Variable Torque 1	4			120Hz		D	
		Variable Torque 2	5						
	60Hz	Variable Torque 1	6			180Hz		E	
		Variable Torque 2	7						

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 - 492ft (150m) and above.
- Large voltage drop at start-up.
- AC reactor is connected to the inverter's input or output.
- A motor rated below the nominal output of the inverter is used.

*3 Voltage in preset patterns is doubled for 460V class inverters. The 575V patterns are 2.5 times as large as the 230V patterns.

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 *E1-10*.

			V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
E1-04	*Maximum Frequency*	*Max Frequency*	√	√	√	√
E1-05	*Maximum Voltage*	*Max Voltage*	√	√	√	√
E1-06	*Maximum Voltage Output Frequency*	*Base Frequency*	√	√	√	√
E1-07	*Middle Output Frequency*	*Mid Frequency A*	√	√	–	–
E1-08	*Middle Output Voltage*	*Mid Voltage A*	√	√	–	–
E1-09	*Minimum Output Frequency*	*Min Frequency*	√	√	√	–
E1-10	*Minimum Output Voltage*	*Min Voltage*	√	√	–	–
E1-13	*Motor Base Voltage*	*Base Voltage*	–	–	√	√

Be sure to satisfy the following conditions for setting parameters *E1-04* to *E1-10*:
E1-09 ≤ *E1-07* < *E1-06* ≤ *E1-04*

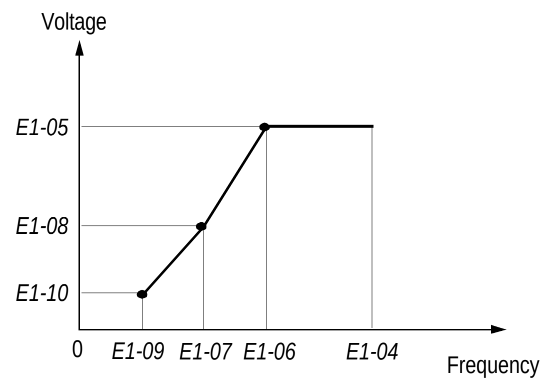


Figure 23 Custom V/f Pattern Setting

Parameter No.	Name	Unit	Setting Range	Factory Default
E1-04	Maximum output frequency	0.1 Hz	50.0 to 400 Hz	**60.0 Hz**
E1-05	Maximum voltage	0.1 V	0.1 to 255 V *	**230 V ***
E1-06	Maximum voltage output frequency (base frequency)	0.1 Hz	0.2 to 400 Hz	**60.0 Hz**
E1-07	Mid. output frequency	0.1 Hz	0.1 to 399 Hz	**3.0 Hz**
E1-08	Mid. output frequency voltage	0.1 V	0.1 to 255 V *	**17.2 V ***
E1-09	Minimum output frequency	0.1 Hz	0.1 to 10.0 Hz	**1.5 Hz**
E1-10	Minimum output frequency voltage	0.1 V	0.1 to 50.0 V *	**10.3 V ***

* For 460V class units, the value is twice that of 230V class units. For 575V class units the value is 2.5 times the 230V value.

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 Patterns for Inverter Capacity 0.4 ~ 1.5kW for 230V 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. For 575V class units the value is 2.5 times the 230V value.

V/F Patterns for Inverter Capacity 0.4 ~ 1.5kW for 230V 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. For 575V class units the value is 2.5 times the 230V value.

V/F Patterns for Inverter Capacity 2.2 ~ 45kW for 230V 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. For 575V class units the value is 2.5 times the 230V value.

V/F Patterns for Inverter Capacity 2.2 ~ 45kW for 230V 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. For 575V class units the value is 2.5 times the 230V value.

V/F Patterns for Inverter Capacity 55 ~ 300kW for 230V 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. For 575V class units the value is 2.5 times the 230V value.

V/F Patterns for Inverter Capacity 55 ~ 300kW for 230V 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. For 575V class units the value is 2.5 times the 230V value.

V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
√	√	√	√

E2-01 Motor Rated Current *Motor Rated FLA*

Sets the motor rated current in units of 0.01A for inverter sizes 7.5kW and smaller; 0.1A for sizes 11kW and larger. This setting varies depending on the inverter model setting (O2-04).

V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
–	–	√	√

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

Setting range: 0.00 to 20.00Hz

Sets the motor rated slip frequency in units of 0.01Hz. This setting varies depending on the motor. Use the following equation to calculate the motor rated slip frequency:

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

where:

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

V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
–	–	√	√

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

Sets the motor no-load current in units of 0.01A for inverter sizes 7.5kW and smaller; 0.1A for sizes 11kW and larger. This setting varies depending on the inverter model setting (O2-04).

V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
–	√	–	√

E2-04 Number of Motor Poles Number of Poles

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

Sets the number of motor poles.

V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
–	√	–	√

F1-04 PG Constant PG Pulses/Rev

Setting Range: 0 to 60000
Factory Default: 1024

Sets the encoder pulse count (per revolution) for the closed loop control modes (VF w/PG and Flux Vector).

Main Menu: Auto-Tuning <ENTER>

Adaptation to most motors manufactured worldwide is possible with the B900 Drive automatic tuning function. Available in both open loop vector and flux vector control modes, the inverter prompts the user for minimal motor information, then guides the user through a quick, simple tuning process. Below is the motor data required for automatic tuning in the quick-start mode:

Name	Description	V/f Control	V/f w/ PG	Open Loop Vector	Flux Vector
Motor Rated Voltage	Sets motor’s rated voltage in VAC.	–	–	√	√
Motor Rated Current	Sets motor’s rated current in A.	–	–	√	√
Motor Rated Frequency	Sets motor’s rated frequency in Hz.	–	–	√	√
Motor Rated Speed	Sets motor’s rated speed in rpm.	–	–	√	√
Number of Motor Poles	Sets the number of motor poles.	–	–	√	√
Motor Selection	Chooses connected motor as 1st or 2nd motor.	–	–	√	√

Be sure to uncouple the motor before beginning auto-tuning. After scrolling through tuning parameters using ∧ key, depress Run key to begin auto-tuning. During tuning, “Tune Proceeding” flashes on the digital operator display. After complete, “Tune Successful” is displayed.

Note: If the Stop key is depressed during tuning, auto-tuning is interrupted and the motor coasts to stop. The data changed during tuning returns to its original values.

After tuning is complete, depress the Menu key to exit the auto-tuning mode.

- CHAPTER 4 -

DIAGNOSTICS

⚠WARNING

PRECAUTIONS

1) Never touch high voltage terminals in the inverter.
2) Replace all protective covers before powering up the inverter. When removing the cover, be sure to shut OFF the power supply to the inverter.
3) Perform maintenance or inspection only after verifying that the charge LED has gone OFF, after the main circuit power supply is turned OFF.
4) Only authorized personnel should be permitted to perform maintenance, inspections or parts replacement.

Failure to observe these precautions highlighted in this manual will expose the user to high voltages, resulting in equipment damage, serious injury or death.

⚠CAUTION

PRECAUTIONS

1) The control PCB board employs CMOS ICs. Do not touch the CMOS elements.
2) Do not connect or disconnect wiring or connectors while power is applied to the circuit.

Failure to observe these precautions may result in equipment damage.

4.1 MAINTENANCE & INSPECTION

This section describes basic maintenance and inspection procedures for the B900 Drive.

Periodic Inspection

The B900 Drive 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 $\times 10^4$ to 58.8 $\times 10^4$ Pa (4 to 6kg·cm^2) pressure].
Printed Circuit Board (PCB)	Accumulation of conductive dust or oil	Blow with dry, compressed air [39.2 $\times 10^4$ to 58.8 $\times 10^4$ 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 $\times 10^4$ to 58.8 $\times 10^4$ Pa (4 to 6kg·cm2) pressure].
Smoothing Capacitor	Discoloration or odor	Replace the capacitor or the inverter.

Parts Replacement Schedule

Replace the following parts periodically, for long, safe, trouble-free operation of the B900 Drive:

Parts	Approximate Interval	Remarks
Cooling Fan	2 to 3 years	Replace with new one.
Smoothing Capacitor	5 years	Replace with new one (after inspection).
Breakers or Relays	--	Decide after inspection.
Fuses	10 years	Replace with new one.
Aluminum Electrolytic Capacitor on PCB Board	5 years	Replace with new one (after inspection).

Optimum operating conditions:

Ambient temperature:	86°F yearly average
Load factor:	80% or below
Operation rate:	12 hours or less per day

4.2 ALARM & FAULT DISPLAYS

This section describes the alarm and fault displays, explanations for fault conditions, and corrective actions to be taken if the B900 Drive malfunctions.

Inverter Alarms & Faults

When the B900 Drive 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 Yaskawa 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 575 V class: Approx. 546 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 575 V class: Approx. 1040 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: $E1\text{-}04 \geq E1\text{-}06 > E1\text{-}07 \geq E1\text{-}09$	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 corrective actions. If taking the corrective actions described does not solve the problem, contact your Yaskawa 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.

5. COPY MODE GUIDE

1. COPY MODE Specification:

(1) Use E^2PROM as save IC component, which don't need back up power.

(2) Only allow same capacity of Bedford B900 inverter to enter copy parameter function,

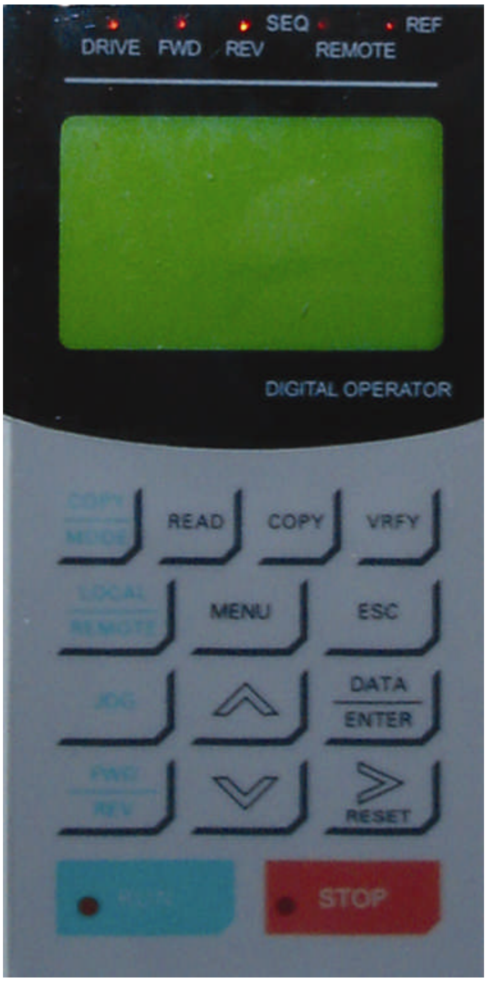
(3) During the copy mode, the below functions can be in proceed.

- READ: Read the parameter from frequency inverter and write into E^2PROM.
- COPY: Save the parameter from keypad to frequency inverter.
- VRFY: Automatically compare the parameter between keypad and frequency inverter

(4) Only memory one piece frequency inverter's parameters

2. COPY MODE Explanation

There are 4-function keys of COPY MODE, which are COPY/MODE,READ,COPY,VRFY.



1.Drive Light On/Off indicator:
Drive mode: Light On
PRGM mode: Light off
COPY mode: Light flushing

2. COPY/MODE
Switch key between COPY mode and Drive

3. READ
Parameter Read Key

4. COPY
Parameter input key

5. VRFY
Parameter comparison key

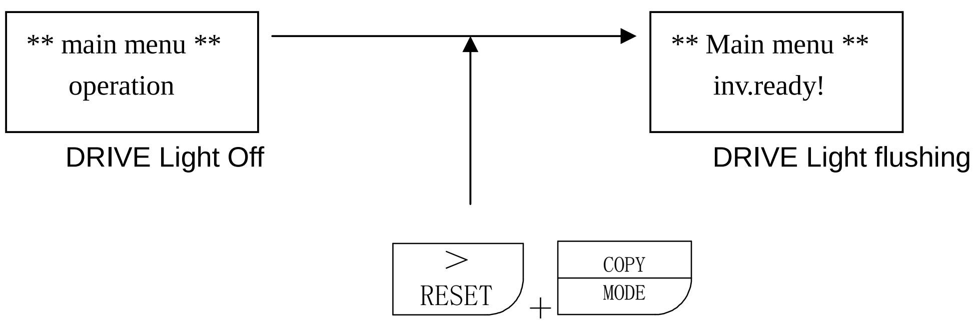
3. OPERATION

Once power ON, the above keypad display under Drive Mode, Drive light on.

3.1 COPY MODE USER GUIDE:

DANGER
While switch COPY/MODE, control circuit terminal must be turn off. It is danger to switch COPY/MODE when motor is running.

Only under main menu, COPY MODE can be switched from Drive Mode (Drive light on), when switching, Please press [> RESET] firstly, and then press to [COPY MODE] (Drive light flushing).



DESCRIPIION	KEY OPERATION	LED DISPLAY
● DRIVE MODE	MENU	** Main menu ** Operation
● COPY MODE switching	> RESET + COPY MODE	** Copy mode ** inv.ready!

From COPY MODE switch to DRIVE MODE, press [MENU] key only.

3.2 COPY MODE OPERATION GUIDE

(1)Read out (READ)

Read all the parameters from inverter, and then write into the keypad's E^2PROM function, which we called (READ). During read, we also delete all the parameter of E^2PROM and replace them with latest parameter

Example: read parameter from the inverter

DESCRIPIION	KEY OPERATION	LED DISPLAY
● COPY MODE condition		** Copy mode ** inv.ready!
● READ to execute	READ	** Copy mode ** READ：■■■■■
● READ to finish		** Copy mode ** read ok！

(2) Input (COPY)

Input the parameter from Keypad E^2PROM to frequency inverter, which we called (COPY). This function is available for same capacity of the inverter only.

Example: Input inverter parameter

DESCRIPIION	KEY OPERATION	LED DISPLAY
● COPY MODE condition		** Copy mode ** inv.ready!
● READ to execute.	COPY	** Copy mode ** COPY：■■■■■
● READ to finish.		** Copy mode ** write ok！

(3) Comparing (VRFY)

The function to compare the parameters from the Keypad E^2PROM with frequency inverter's parameters, which we call (VRFY), this function is available for same capacity of the inverter only.

Example:

DESCRIPIION	KEY OPERATION	LED DISPLAY
● COPY MODE condition		** Copy mode ** inv.ready!
● READ to execute.	VRFY	** Copy mode ** VRFY：■■■■■
● READ to finish.		** Copy mode ** VRFY ok！

4. ERROR MESSAGE

(1)	COPE 00 Inv Status fault	Inverter abnormality
(2)	COPE 02 EEPROM fault	Inside E^2PROM of the keypad trouble
(3)	COPE 03 empty data	Inside E^2PROM of the keypad no date.
(4)	COPE 04 capacity fault	Inverter capacity fault

⚠WARNING

PRECAUTIONS

1) Only turn ON the input power supply after replacing the front cover. Do not remove the cover while the inverter is powered up.
2) When the retry function (parameter *L5-02*) is selected, do not approach the inverter or the load, since it may restart suddenly after being stopped.
3) Since the Stop key can be disabled by a function setting, install a separate emergency stop switch.
4) Do not touch the heatsink or braking resistor, due to very high temperatures.
5) Since it is very easy to change operation speed from low to high speed, verify the safe working range of the motor and machine before operation.
6) Install a separate holding brake, if necessary.
7) Do not check signals during operation.
8) All inverter parameters have been preset at the factory. Do not change the settings unless required.

Failure to observe these precautions may result in equipment damage, serious personal injury or death.

NOTICE

No patent liability is assumed with respect to the use of the information contained herein. Moreover, because Bedford is constantly improving its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, Bedford assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.

Contents

Introduction

Thank you for purchasing Bedford B900 Series high performance vector inverter. The B900 employs the latest hardware and software technology to provide unmatched performance, reliability and application flexibility.

The B900 flexible control mode architecture allows four choices of motor control technology for your application:

- Open Loop Vector is best for most applications, as it offers Adaptive Vector Control technology (AVC) for precise speed regulation, quick response and high starting torque.
- Closed Loop Flux Vector is the choice for applications requiring torque control, very precise speed regulation and full torque control at zero speed.
- V/f (Volts per Hertz) mode with Bedford's proprietary full range auto-torque boost provides ideal control for multi-motor applications.
- Closed Loop V/f allows encoder feedback for use with the Volts/hertz mode.

Use the following key to determine which control mode and access level are available for each parameter.

No.	Parameter Name	LCD Display	V/f	V/f w/PG	Open Loop Vector	Flux Vector
A1-00	*Language Selection*	*Select Language*	Q	Q	Q	Q

Q: Quick-Start Level, selected parameters for maintenance-level programming
B: Basic Level, selected parameters for basic programming in most applications
A: Advanced Level, all parameters for advanced programming in special applications

The menu structure for all access levels are the same for the Operation, Initialize, Auto-tuning and Modified constants sections. The Programming section menu structure for each access level is as follows:

Quick-Start Access Level Structure

MENU — Programming — Data Name — Data Entry

Basic Access Level Structure

MENU — Programming — Function Level — Data Name — Data Entry

Advanced Access Level Structure

MENU — Programming — Group Level — Function Level — Data Name — Data Entry

Software Version Explanation

Bedford recognizes the need to continuously improve product quality. This product may receive feature enhancements in the form of software or hardware changes. New programming parameters will be added to the latest programming manual. When a new parameter is added a software version note will be placed next to the parameter.

Software Version Example:

Q	Q	Q	Q

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

Setting	Description
0	English *(factory default)*
1	Japanese
2	Deutsche <1110>
3	Francais <1110>
4	Italiano <1110>
5	Espanol <1110>
6	Portugues <1110>

This version note <1110> indicates that five additional languages have been added with software version 1110.

The part number of the main control printed circuit board on the drive reflects the software version. The software version normally increases to a higher number with newer versions. Please consult the factory for details.

The B900 ships preset to open loop vector control, quick-start access level. This publication describes all Quick-Start, Basic and Advanced parameters. For installation and simplified Quick-Start parameters.

B900 Series Parameter Tree

Menu

- Operation — Inverter operation is enabled. Inverter status is displayed.
  - U — Monitoring Items / Monitor
- A — Initialize — Language selection in LCD display. Constant access levels, control method selection and initializing passwords.
- Programming — Parameters are set/read. Items to be set/read vary depending on the access level setting.
  - B — Application / Application
  - C — Tuning / Tuning
  - D — Reference / Reference
  - E — Motor Parameters / Motor
  - F — Option / Option
  - H — Control Circuit Terminals / Terminal
  - L — Protection / Protection
  - O — Digital Operator / Operator
- Auto-tuning — Motor parameters are automatically set by inputting turning data (motor name-plate values) when performing vector.
- Modified Constants — Only parameters that have been changed from the factory setting are set/read.

Group	Function	Display	Access Level
U1	Status monitoring	Monitor	Q, B, A
U2	Fault trace	Fault Trace	Q
U3	Fault history	Fault History	Q
A1	Initialization	Initialize	Q
A2	User setting parameter	User Parameters	A
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
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
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
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
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
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
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
O1	Display selection	Monitor Select	B, A
O2	Key selection	Key Selections	B, A

V/f	V/f w/PG	Open Loop Vector	Flux 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)*
1	Japanese
2	Deutsch <1110>
3	Francais <1110>
4	Italiano <1110>
5	Espanol <1110>
6	Portugues <1110>

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	Flux Vector - For applications requiring very precise speed and torque control at a wide speed range including 0 speed. Uses encoder feedback.

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

			V/f	V/f w/PG	Open Loop Vector	Flux Vector
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	Flux 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”)

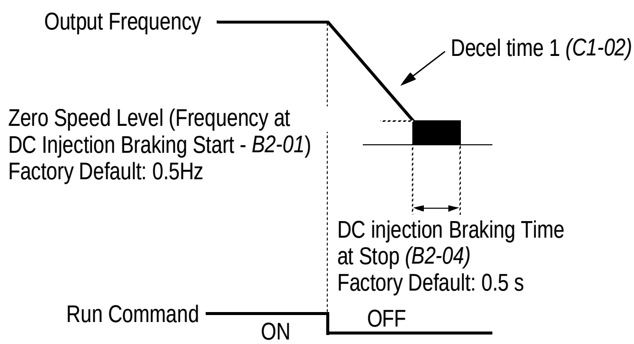


Figure 1 Stopping Method - Ramp to Stop

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”)

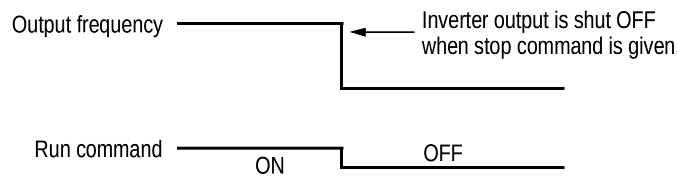


Figure 2 Stopping Method - Coast to Stop

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”)

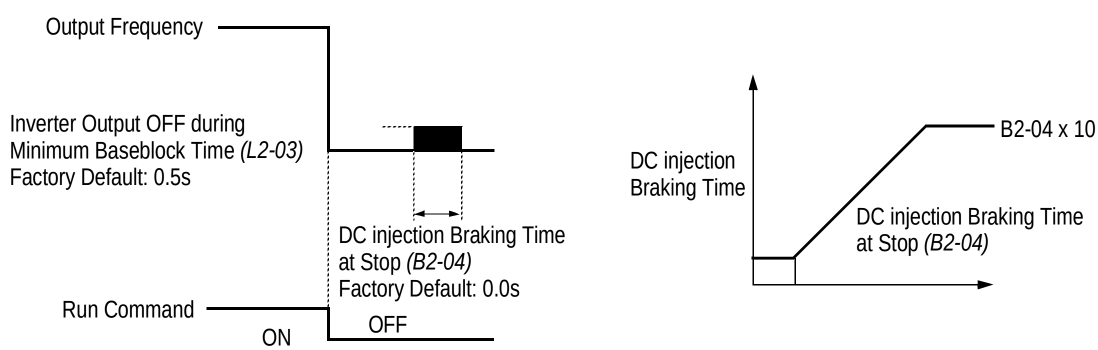


Figure 3 Stopping Method - DC Injection Braking to Stop

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 flux vector control. Braking duty cycle should allow excess motor heat to dissipate.

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

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

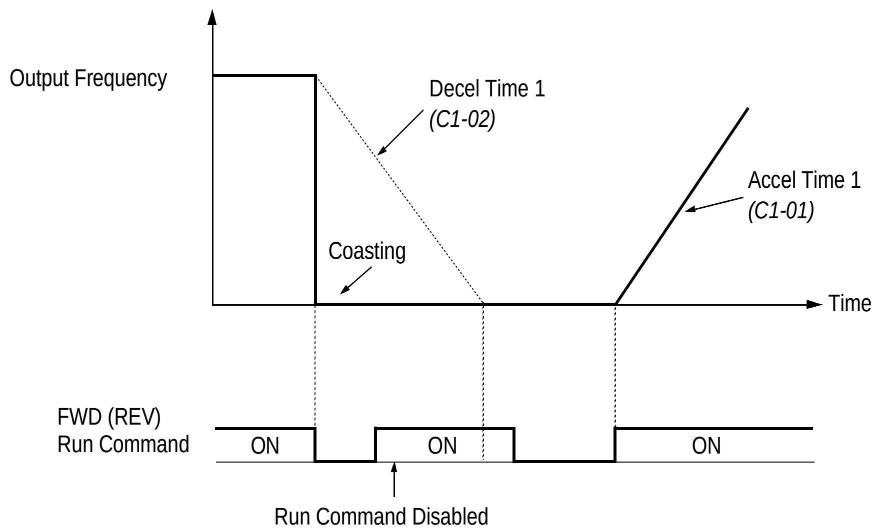


Figure 4 Stopping Method - Coast to Stop w/ Timer

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 flux vector control.

B1-04 Prohibition of Reverse Operation *Reverse Oper*

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

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

V/f	V/f w/PG	Open Loop Vector	Flux Vector
-	-	-	A

During flux vector control, select an operation mode to be employed when the frequency reference (analog 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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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 control, the inverter will run.

V/f	V/f w/PG	Open Loop Vector	Flux 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 flux vector control) starts, in units of 0.1 Hz. When *B2-01* < *E1-09*, DC injection braking starts from the minimum frequency reference *(E1-09)*.

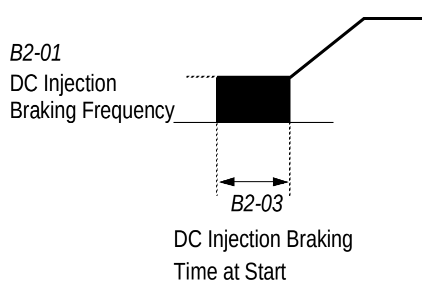


Figure 5 DC Injection Braking at Starting

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 flux vector control mode, initial excitation is performed according to the motor no-load current set in *E2-03*. This parameter should not be set unnecessarily high or motor overexcitation may occur.

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

Parameter	Name	Display	V/f	V/f w/PG	Open Loop Vector	Flux 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 flux vector control) is set in units of 0.1 second. When *B2-03* is set to "0", DC injection braking is disabled and acceleration starts from the minimum output frequency.

Parameter	Name	Display	V/f	V/f w/PG	Open Loop Vector	Flux Vector
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 flux vector control) is set in units of 0.1 second. When *B2-04* is set to "0", DC injection braking is disabled, and the inverter output shuts OFF.

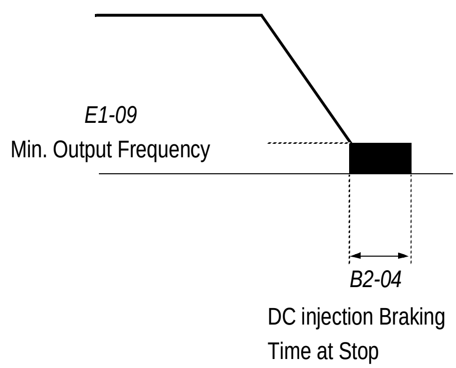


Figure 6 DC Injection Braking Time at Stop

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

Parameter	Name	Display	V/f	V/f w/PG	Open Loop Vector	Flux Vector
B2-08	*Magnetic Flux Compensation Level* <1110>	*FieldComp*	-	-	A	A

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

This parameter allows the magnetizing motor flux 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	Flux 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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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 (Flux Vector)

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

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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	Flux 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:

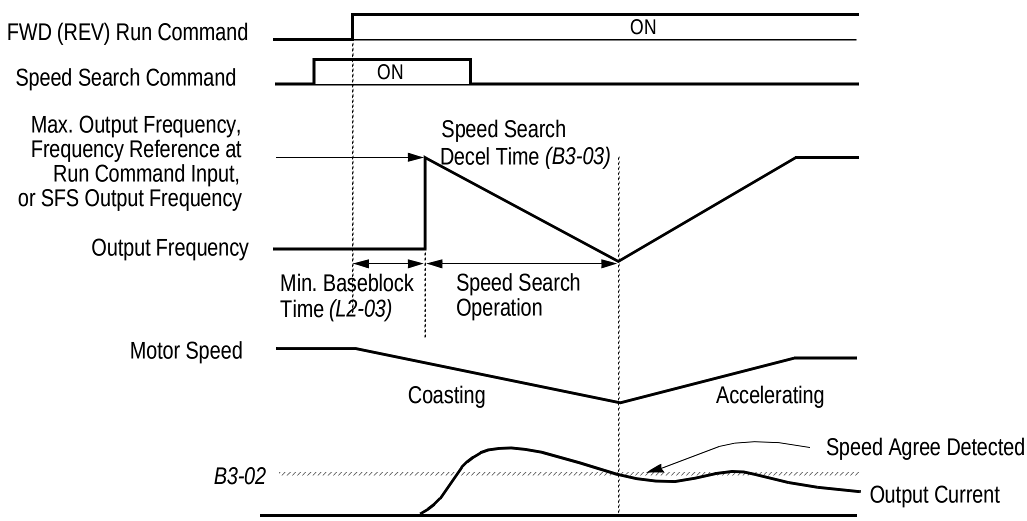


Figure 7 Search Command Input Timing Diagram

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	Flux 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.

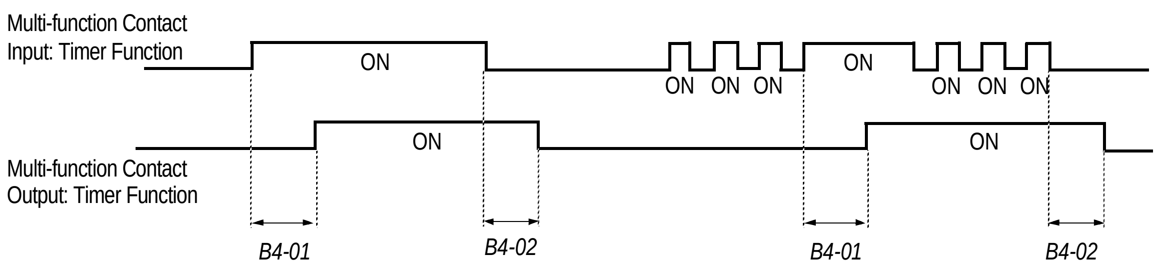


Figure 8 Timing Diagram of Timer Function

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.

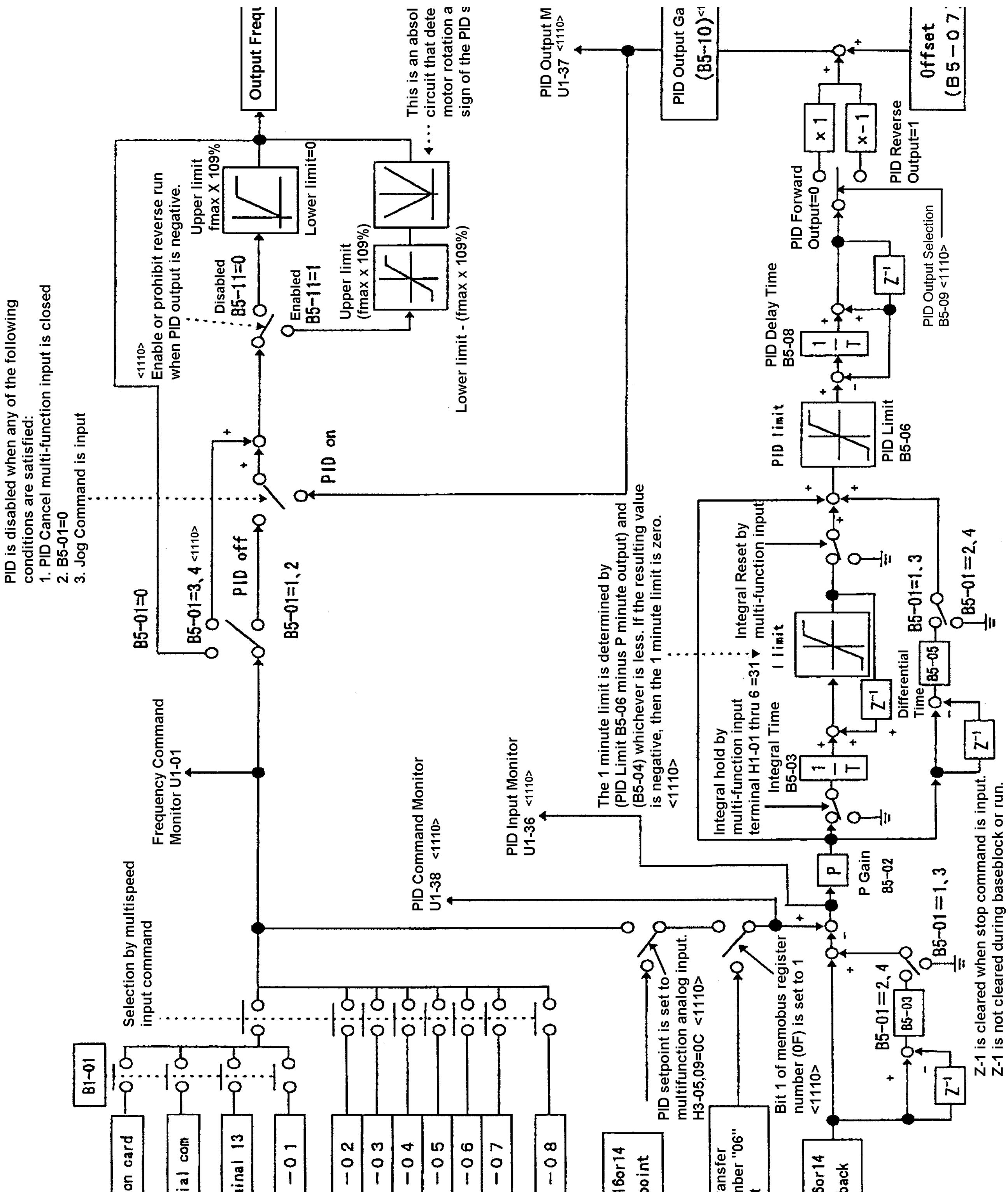


Figure 9 PID Block Diagram

V/f	V/f w/PG	Open Loop Vector	Flux 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 Fdbk
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 setpoint or detected feedback value setpoint 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	Flux 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	Flux 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 percentage 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 oscillations 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	Flux 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	Flux 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	Flux Vector

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

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
-	-	-	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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
-	-	-	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*

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

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

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
-	-	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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
-	-	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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
-	-	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	Flux Vector

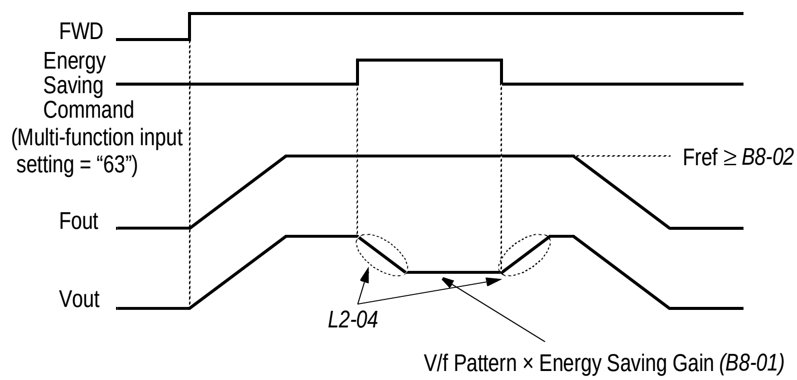


Figure 10 Timing Diagram of Energy Saving Function

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.

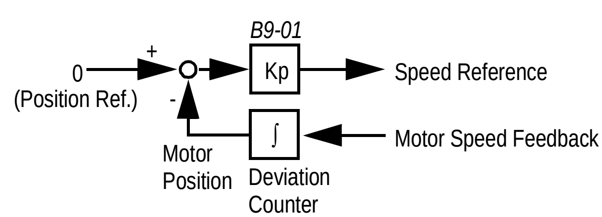


Figure 11 Zero Servo Position Loop

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.

.

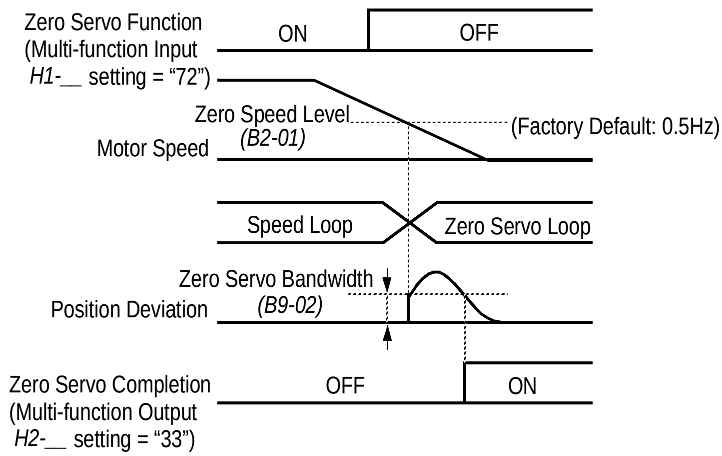


Figure 12 Timing Diagram of Zero Servo Function

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 flux vector control (*Al-02* = "3").

C Tuning Parameters

C1 Accel/Decel

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

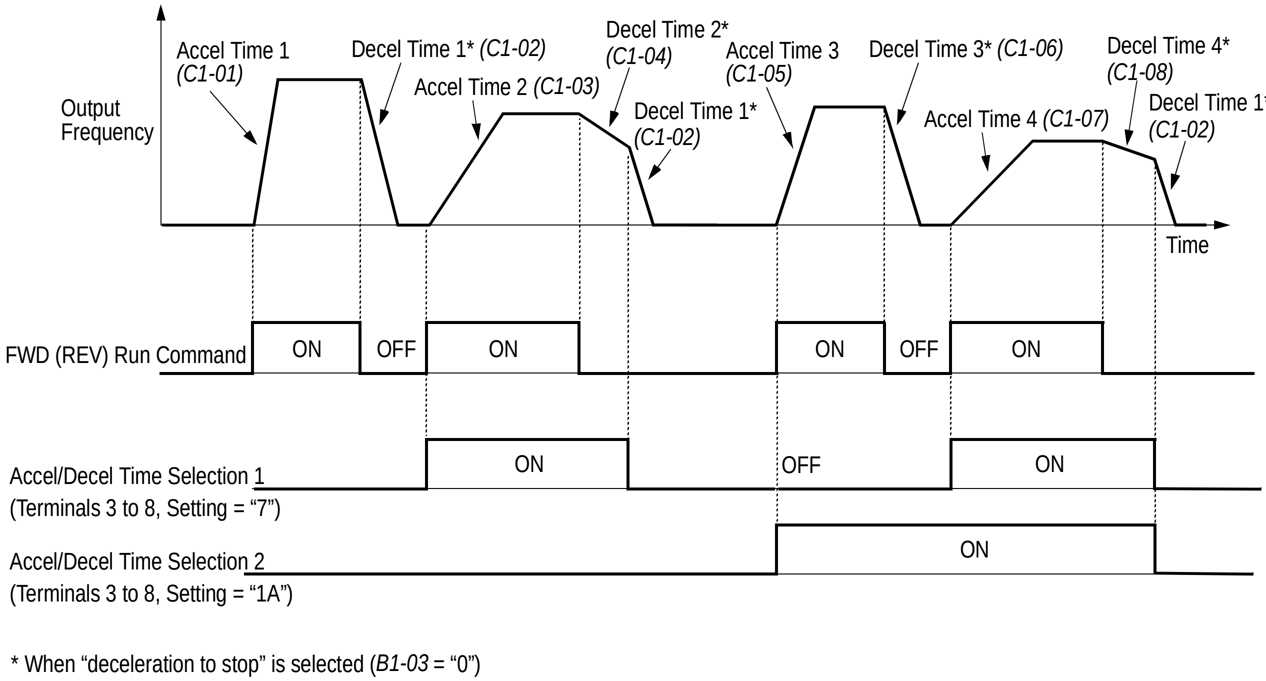


Figure 13 Timing Diagram of Accel/Decel Time Adjustment

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	Flux 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”.

	V/f	V/f w/PG	Open Loop Vector	Flux Vector
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.

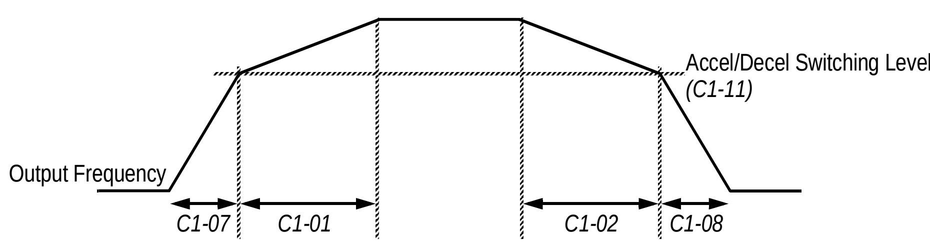


Figure 14 Accel/Decel Switching Level Adjustment

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.

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

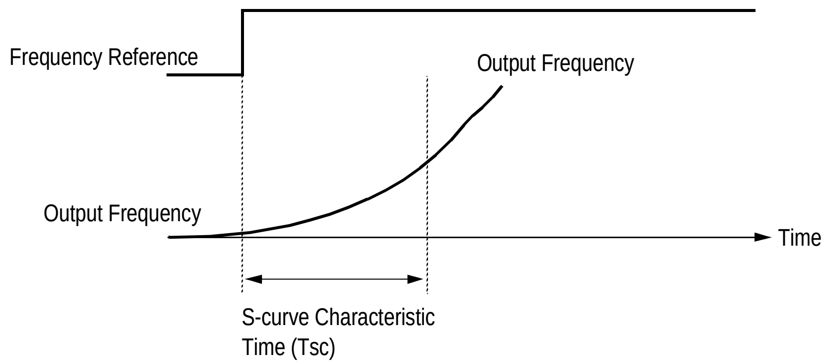


Figure 15 S-curve Characteristic Timing Diagram

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

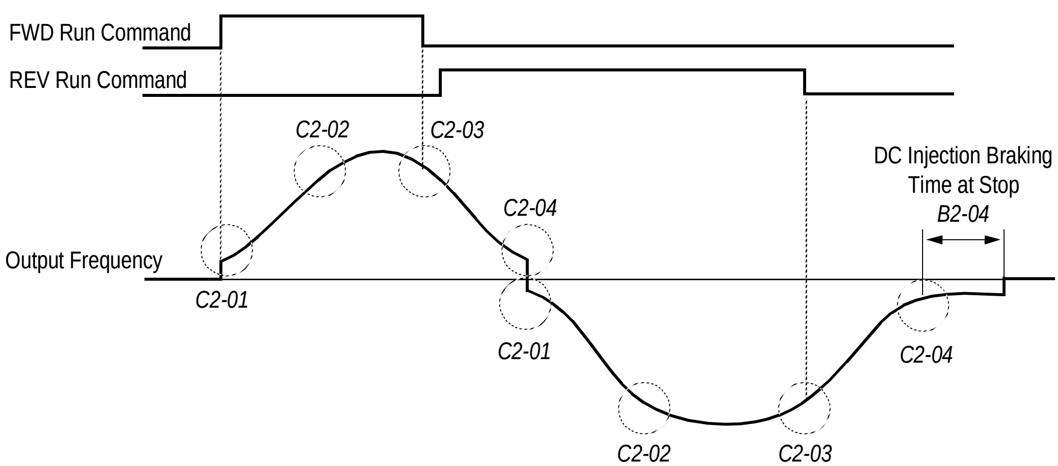


Figure 16 S-curve Characteristics - FWD/REV Operation

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	Flux 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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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 flux 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 [Flux Vector] the default factory setting will be 1.0.

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

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
A	-	A	-

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

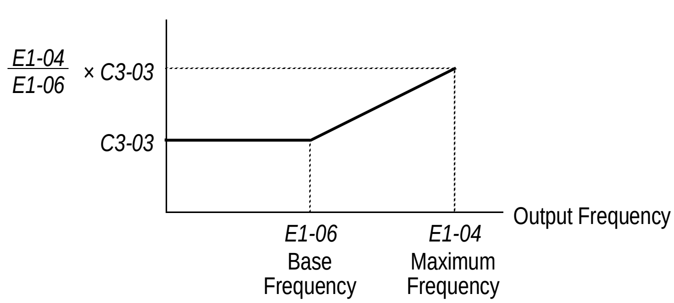


Figure 17 Slip Compensation Limit Adjustment

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

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

V/f	V/f w/PG	Open Loop Vector	Flux Vector
A	-	A	-

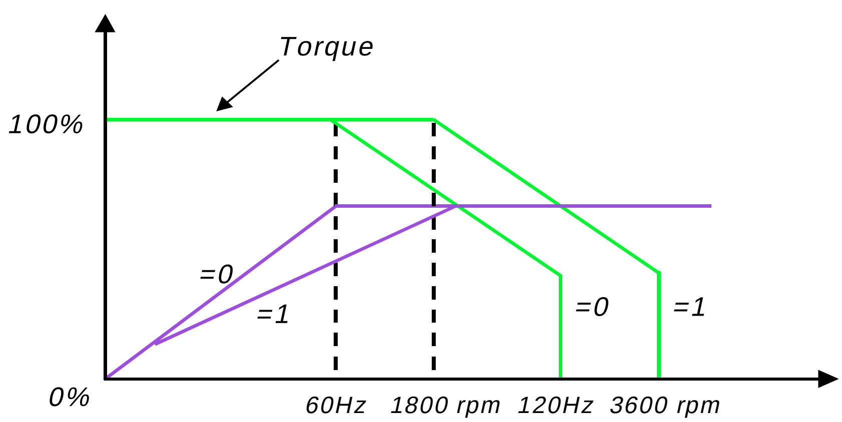
Setting	Description
0	Slip compensation disabled during regeneration *(factory default)*
1	Slip compensation enabled during regeneration

C3-05 Flux Calculation Method *Flux Select*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
-	-	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	Flux Vector

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

V/f	V/f w/PG	Open Loop Vector	Flux Vector
-	-	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. **Flux 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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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 B900 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	Flux Vector

Output voltage ∝ Torque compensation gain × Required torque

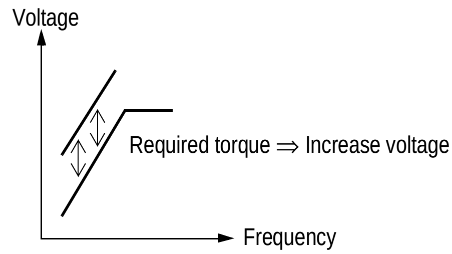


Figure 18 Torque Characteristics

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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
-	-	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	Flux Vector

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

V/f	V/f w/PG	Open Loop Vector	Flux Vector
-	-	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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
-	-	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.

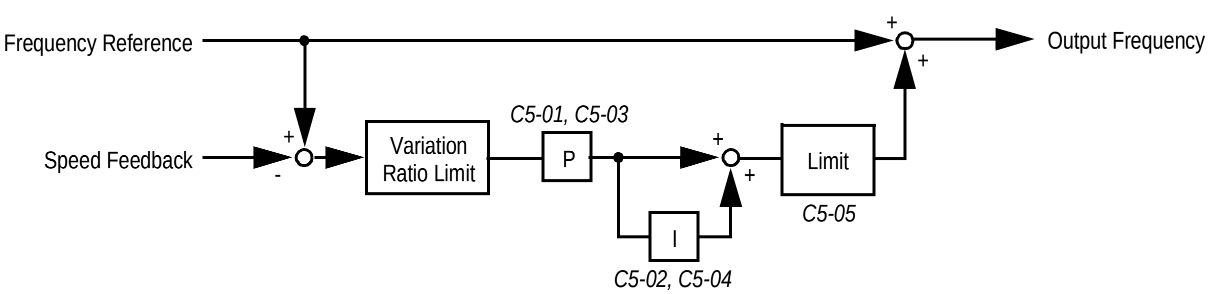


Figure 19 ASR Block Diagram (V/f Control with PG Feedback)

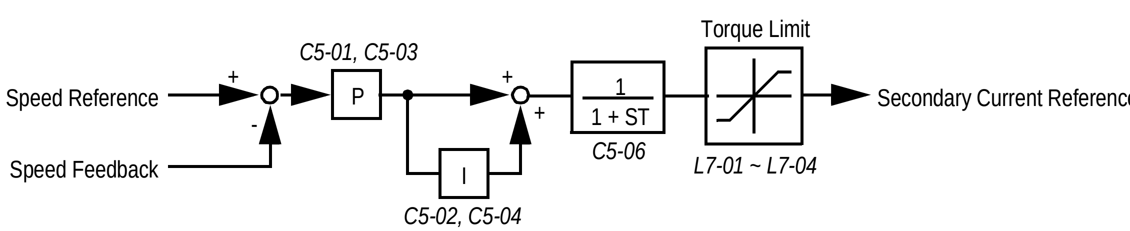


Figure 20 ASR Block Diagram (Flux Vector Control)

V/f	V/f w/PG	Open Loop Vector	Flux 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").

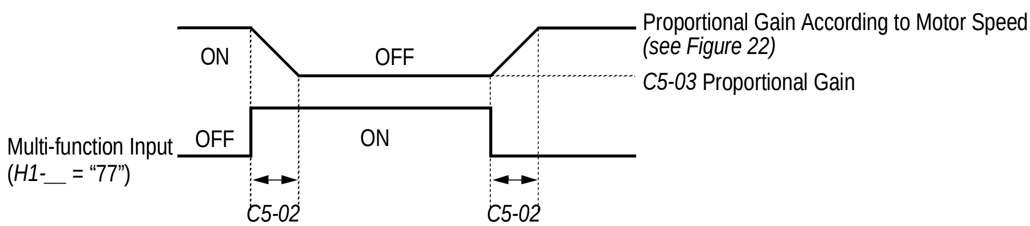


Figure 21 ASR Multi-function Input Timing Diagram

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	Flux Vector

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

V/f	V/f w/PG	Open Loop Vector	Flux Vector
-	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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
-	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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
-	-	-	A

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

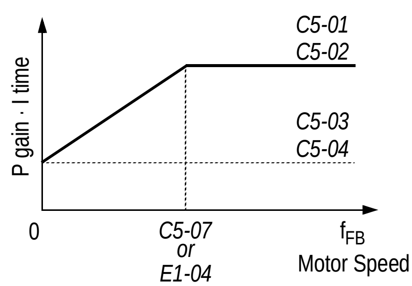
Mechanical backlash in an application causes secondary current (I_2) reference variations in the motor's rotor. This condition can prevent the adjustment of ASR parameters.The output delay time constant is used to control these secondary current (I_2) reference variations.

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

V/f	V/f w/PG	Open Loop Vector	Flux Vector
-	-	-	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 flux 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

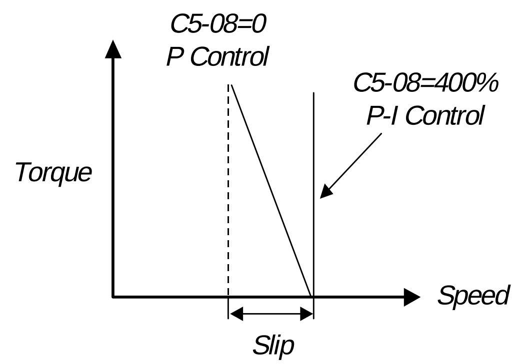
Notes:

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	Flux 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 Flux Vector control mode. Setting parameter C5-08 to zero will make the ASR control proportional. 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.

	V/f	V/f w/PG	Open Loop Vector	Flux Vector
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:

Carrier Frequency Factory Defaults

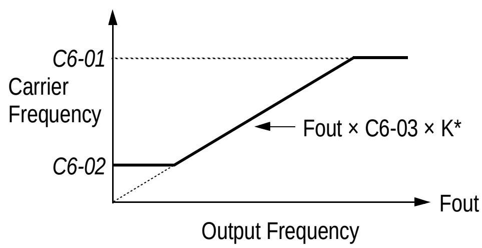
Model CIMR-G5U	Upper Limit *C6-01* Setting	Lower Limit *C6-02* Setting	Gain *C6-03* Setting	Model CIMR-G5U	Upper Limit *C6-01* Setting	Lower Limit *C6-02* Setting	Gain *C6-03* Setting
230							
20P4	15.0	15.0	0	2015	15.0	15.0	0
20P7	15.0	15.0	0	2018	15.0	15.0	0
21P5	15.0	15.0	0	2022	10.0	10.0	0
22P2	15.0	15.0	0	2030	10.0	10.0	0
23P7	15.0	15.0	0	2037	10.0	10.0	0
25P5	15.0	15.0	0	2045	10.0	10.0	0
27P5	15.0	15.0	0	2055	10.0	10.0	0
2011	15.0	15.0	0	2075	10.0	10.0	0
-	-	-	-	2090	2.0	2.0	0
-	-	-	-	2185	2.0	2.0	0
460							
40P4	15.0	15.0	0	4022	8.0	8.0	0
40P7	15.0	15.0	0	4030	8.0	8.0	0
41P5	15.0	15.0	0	4037	6.0	6.0	0
42P2	15.0	15.0	0	4045	6.0	6.0	0
43P7	15.0	15.0	0	4055	6.0	6.0	0
44P0	15.0	15.0	0	4075	6.0	6.0	0
45P5	15.0	15.0	0	4090	5.0	5.0	0
47P5	12.5	12.5	0	4110	5.0	5.0	0
4011	12.5	12.5	0	4132	5.0	5.0	0
4015	10.0	10.0	0	4160	5.0	5.0	0
4018	10.0	10.0	0	4185	2.0	2.0	0
-	-	-	-	4220	2.0	2.0	0
-	-	-	-	4300	2.0	2.0	0
575							
51P5	10.0	10.0	0	5030	10.0	10.0	0
52P2	10.0	10.0	0	5037	10.0	10.0	0
53P7	10.0	10.0	0	5045	10.0	10.0	0
55P5	10.0	10.0	0	5055	8.0	8.0	0
57P5	10.0	10.0	0	5075	2.0	1.0	36
5011	10.0	10.0	0	5090	2.0	1.0	36
5015	10.0	10.0	0	5110	2.0	1.0	36
5018	10.0	10.0	0	5160	2.0	1.0	36
5022	10.0	10.0	0				

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

C6-03 Carrier Proportional Gain *CarrierFreq Gain*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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	Flux 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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
–	–	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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
–	–	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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
–	–	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	Flux Vector

D Reference Parameters
D1 Preset References

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*	Q	Q	Q	Q
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*	B	B	B	B

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	Flux 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").

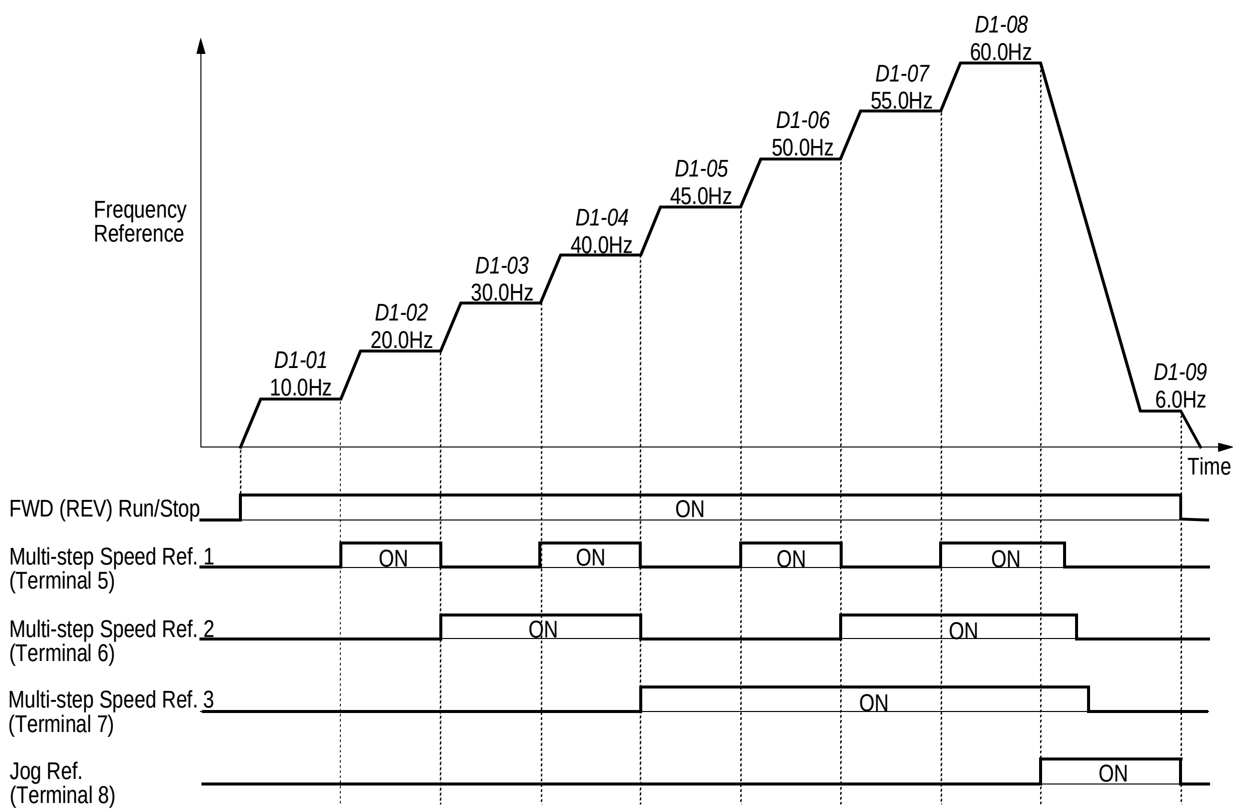


Figure 24 Multi-step Speed Operation - Timing Diagram

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	Flux Vector

D2 Reference Limits

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

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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.

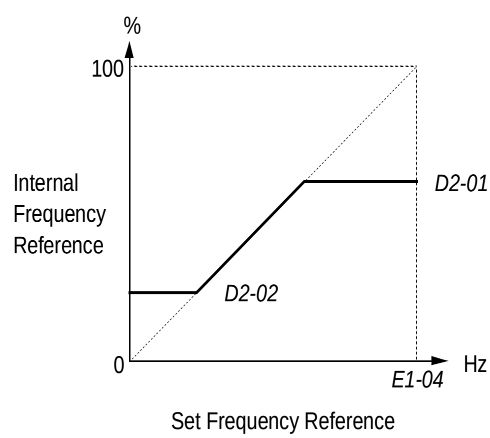


Figure 25 Setting Frequency Upper and Lower Limits

D3 Jump Frequencies

Parameter	Name	Display	V/f	V/f w/PG	Open Loop Vector	Flux Vector
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	Flux Vector

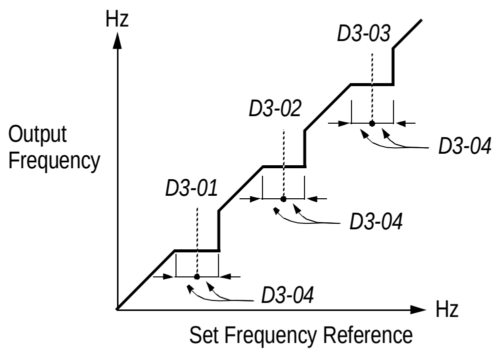


Figure 26 Jump Frequencies

D4 Sequence

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

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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*

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

D5 Torque Control

D5-01 Torque Control Selection *Torq Control Sel*

-	-	-	A

Selects between speed and torque control during flux 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	Flux Vector

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

V/f	V/f w/PG	Open Loop Vector	Flux Vector
-	-	-	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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
-	-	-	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”).

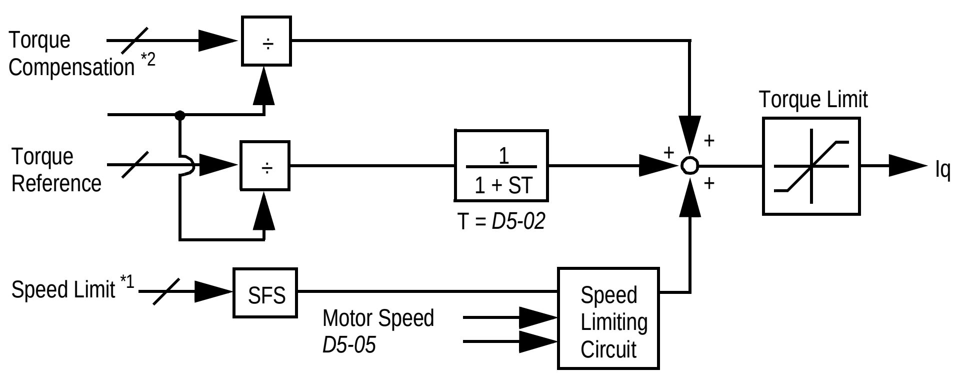


Figure 27 Torque Control Block Diagram

*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.

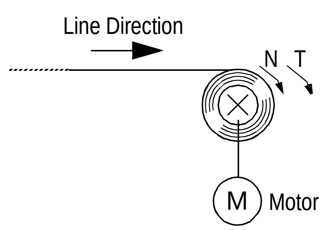
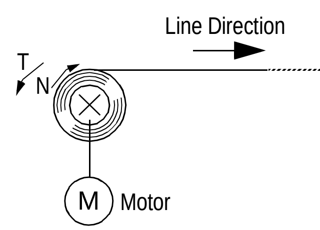
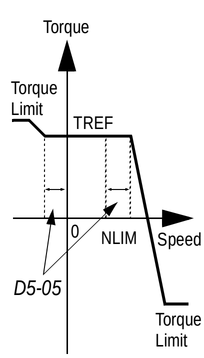
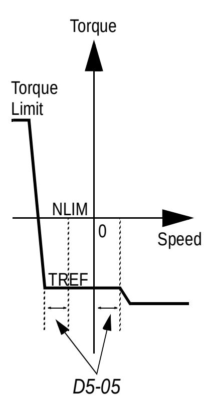
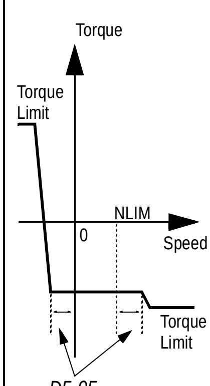
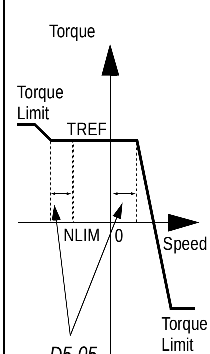
When torque reference > 0 and speed limit > 0 (winder application sequence), the following sequence is activated:

- 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 < [-l × *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:

[-l × *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.

<table>
<tr><th colspan="2"></th><th colspan="2">Winder Control</th><th colspan="2">Unwinder Control</th></tr>
<tr><td colspan="2">Configuration</td><td colspan="2">
</td><td colspan="2">
</td></tr>
<tr><td colspan="2">Direction of Motor Rotation</td><td>Forward</td><td>Reverse</td><td>Forward</td><td>Reverse</td></tr>
<tr><td rowspan="2">Reference Polarity</td><td>Torque Reference (TREF)</td><td>+</td><td>-</td><td>-</td><td>+</td></tr>
<tr><td>Speed Limit (NLIM)</td><td>+</td><td>-</td><td>+</td><td>-</td></tr>
<tr><td colspan="2">Torque Profile</td><td>
</td><td>
</td><td>
</td><td>
</td></tr>
</table>

Speed/Torque Control Switching

When the B900 is set up for flux 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

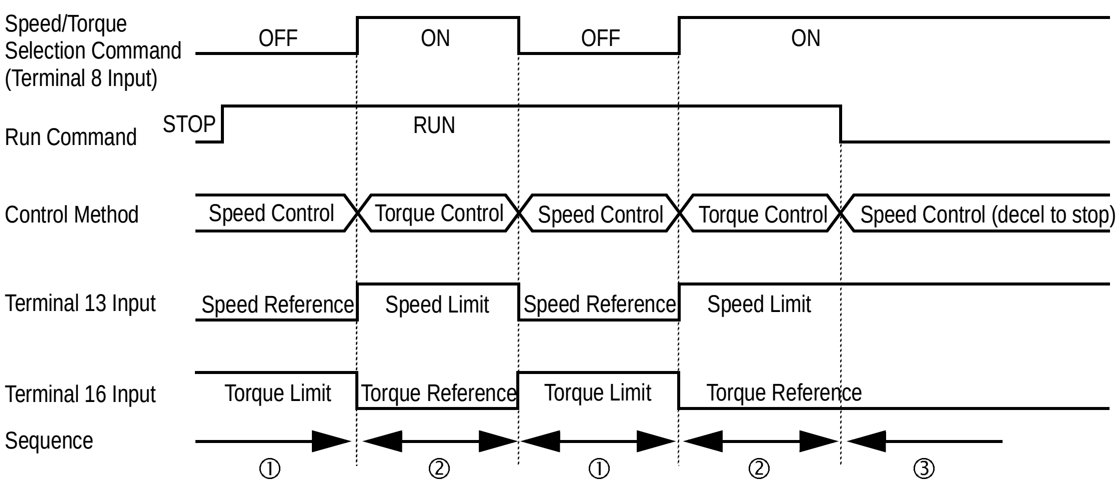


Figure 28 Speed/Torque Control Selection Timing Diagram

Sequence Description

① 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.

② 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	Flux Vector

③ 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) 445 to 733 (575V class)<1110>
Factory Default: 230V, 460V, 575V <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

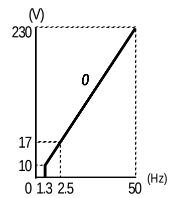
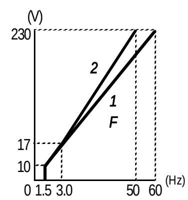
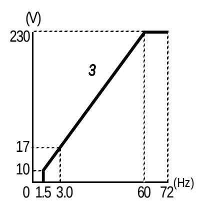
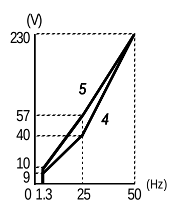
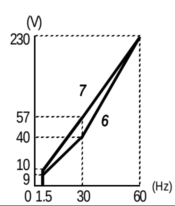
Choose a preset V/f pattern for operation in V/f modes only. It may be necessary to change the V/f pattern when using a high-speed motor, or when special torque adjustment is required in the application.

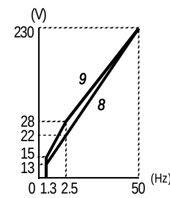
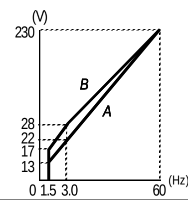
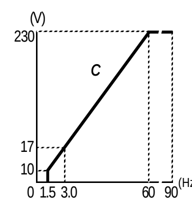
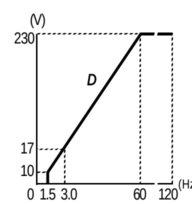
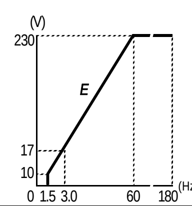
Set values 0 to E: preset V/f pattern can be selected
F: custom V/f pattern can be set *(factory default)*

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:

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

Preset V/f Patterns

	Specifications		E1-03	V/f Pattern *1
General-purpose	50Hz		0	
General-purpose	60Hz Saturation		1 **F**	
General-purpose	50Hz Saturation		2	
General-purpose	72Hz		3	
Variable Torque	50Hz	Variable Torque 1	4	
Variable Torque	50Hz	Variable Torque 2	5	
Variable Torque	60Hz	Variable Torque 1	6	
Variable Torque	60Hz	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	50Hz	High Starting Torque 2	9	
High Starting Torque *2	60Hz	High Starting Torque 1	A	
High Starting Torque *2	60Hz	High Starting Torque 2	B	
High Speed Operation	90Hz		C	
High Speed Operation	120Hz		D	
High Speed Operation	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. The 575V patterns ar 2.5 times the 230V patterns.

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*.

			V/f	V/f w/PG	Open Loop Vector	Flux Vector
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*

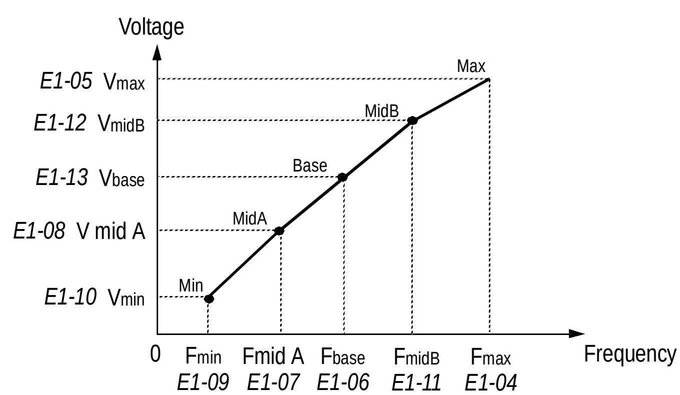


Figure 28 Custom V/f Pattern Setting

* For 460V class units, the value is twice that of 230V class units. For 575V class units the value is 2.5 times the 230V value.

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	Flux 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. For 575V class units the value is 2.5 times the 230V value.

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. For 575V class units the value is 2.5 times the 230V value.

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

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. For 575V class units the value is 2.5 times the 230V value.

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. For 575V class units the value is 2.5 times the 230V value.

V/f	V/f w/PG	Open Loop Vector	Flux 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. For 575V class units the value is 2.5 times the 230V value.

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. For 575V class units the value is 2.5 times the 230V value.

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

E2 Motor Set-up

E2-01 Motor Rated Current — *Motor Rated FLA*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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:

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

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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
–	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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
A	A	A	A

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

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

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

	V/f	V/f w/PG	Open Loop Vector	Flux 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)*.

	V/f	V/f w/PG	Open Loop Vector	Flux Vector
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.

	V/f	V/f w/PG	Open Loop Vector	Flux Vector
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.

	V/f	V/f w/PG	Open Loop Vector	Flux Vector
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%.

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

E3 Motor 2 Set-up

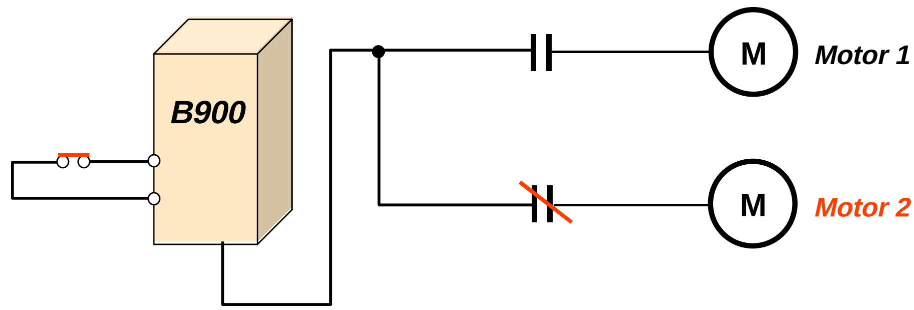
E3-01 Motor 2 Control Method Selection — *Control Method*

A	A	A	A

The B900 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	Flux Vector - For applications requiring very precise speed and torque control at a wide speed range including 0 speed. Uses encoder feedback.



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	Flux Vector

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

			V/f	V/f w/PG	Open Loop Vector	Flux Vector
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:

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

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	Flux 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.

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

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 flux vector control)

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

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

V/f	V/f w/PG	Open Loop Vector	Flux Vector
–	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 flux vector control)

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

V/f	V/f w/PG	Open Loop Vector	Flux Vector
–	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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
–	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.

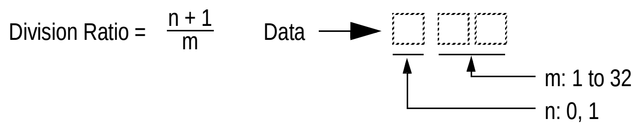
The motor rotation direction applies when viewing the motor shaft from the load side.

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

V/f	V/f w/PG	Open Loop Vector	Flux Vector
–	B	–	B

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

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



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

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.

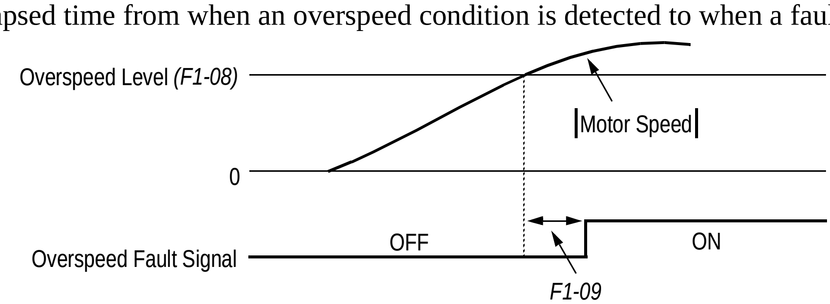


Figure 29 Overspeed Detection Timing Diagram

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 [Flux Vector] the factory setting will be 0.0.

V/f	V/f w/PG	Open Loop Vector	Flux 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.

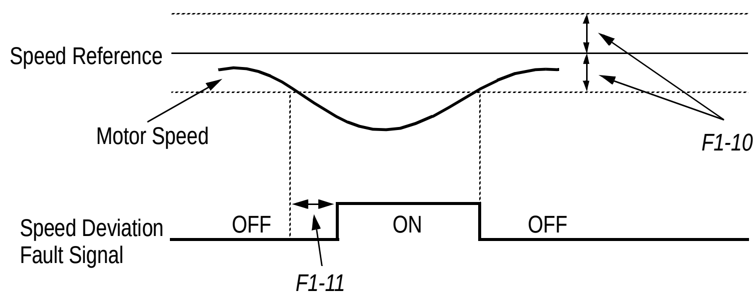


Figure 30 Overspeed Detection Timing Diagram

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	Flux 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	Flux Vector

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

F3-01 Digital Input Option — *DI Input*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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=200,400 or 575 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	Flux 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= 200,400 or 575 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= 200,400 or 575 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	Flux 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.

	V/f	V/f w/PG	Open Loop Vector	Flux Vector
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*.

	V/f	V/f w/PG	Open Loop Vector	Flux Vector
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.

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

F6 DO-08 Set-up

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

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

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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*

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

F9 CP-916 Setup

The CP-916 option card provides PLC and motion type functions. This allows the B900 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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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*

V/f	V/f w/PG	Open Loop Vector	Flux Vector
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	Flux 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	Flux 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 B900 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.

Parameter	Name	Display	V/f	V/f w/PG	Open Loop Vector	Flux Vector
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	Flux 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	√	√	√	√	

H1-01 to 6 Setting	Function	Control Method *(A1-02)*				Reference Page
		V/f	V/f w/ PG	Open Loop Vector	Flux 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.

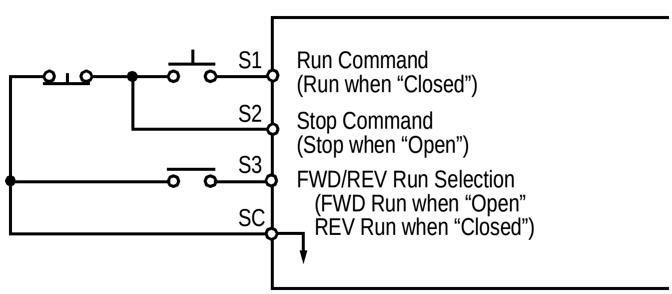


Figure 31 Terminal Function at 3-Wire Sequence Selection (H1-__ = “0”)

V/f	V/f w/PG	Open Loop Vector	Flux 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.

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

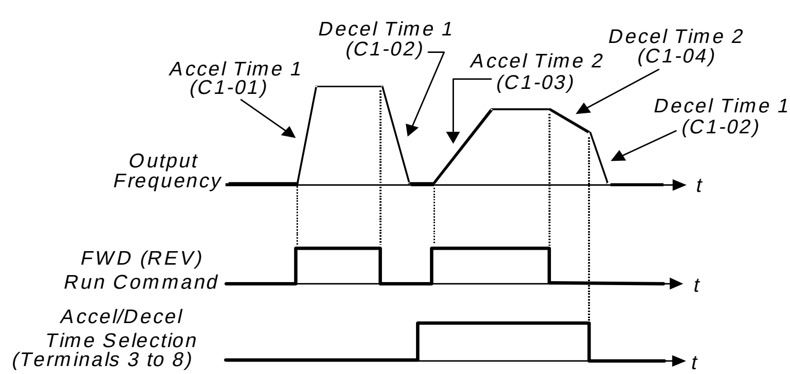
It is possible to mix analog and digital references in the multi-speed input function. The parameters must be set as shown below

.

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.

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

· 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.

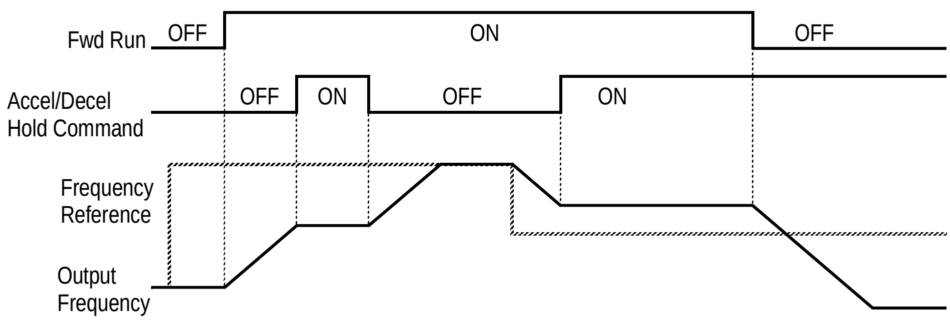


Figure 32   Accel/Decel Hold Command Timing Diagram

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.

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

· 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".

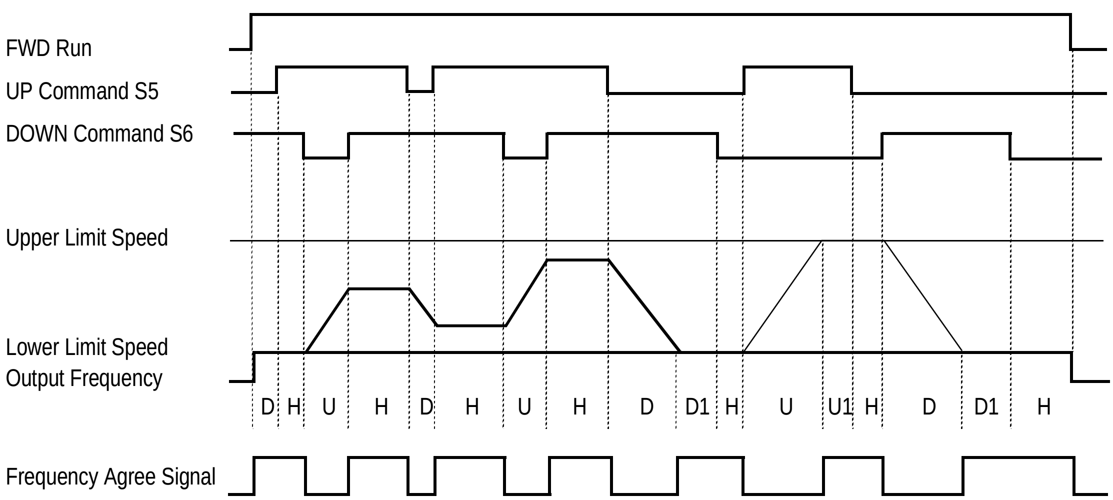
Open: PI-control (speed control integral values are added.)

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.

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

· 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;

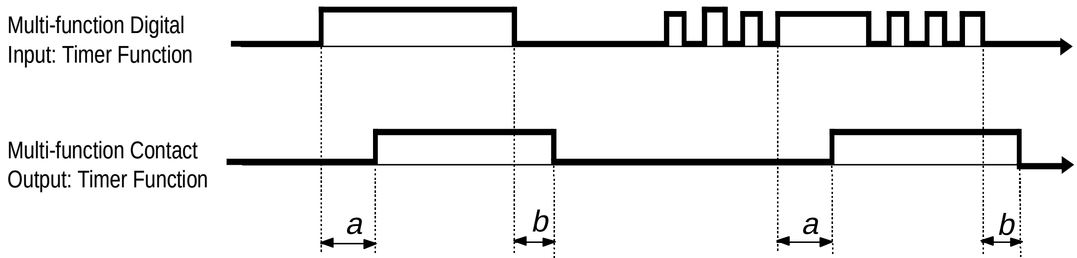
The inverter must be stopped to switch motors.
A multi-function digital output may be programmed when motor 2 is selected. Refer to page 88 for more information.

· 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)

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



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.

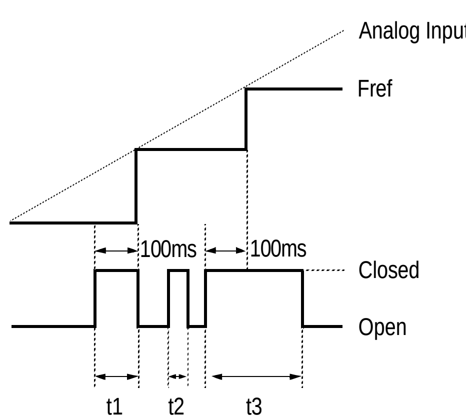


Figure 34 Sample/Hold Selection - Analog Reference

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

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

· 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.

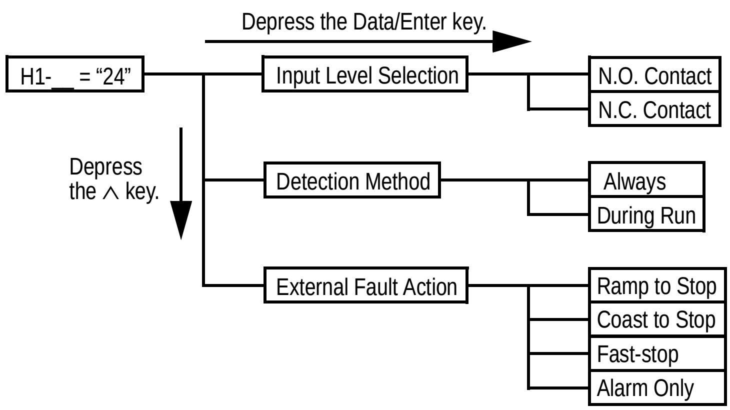
· External Fault (setting: “20-2F”)
Use this contact input to select how the inverter responds to an external fault.

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:

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



· 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).

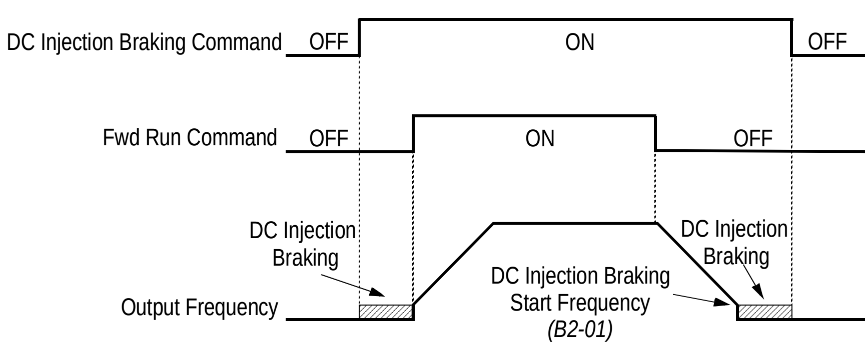
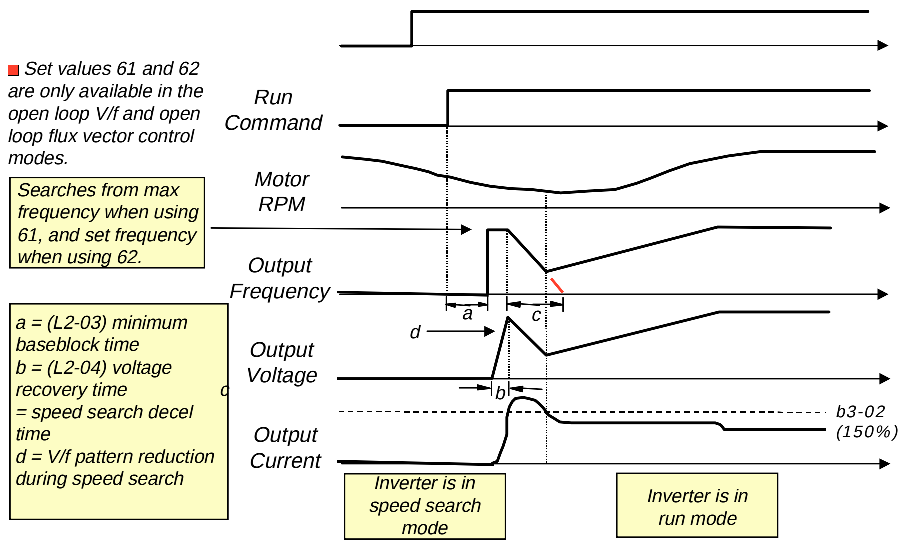


Figure 35 DC Injection Braking Contact Input Timing Diagram

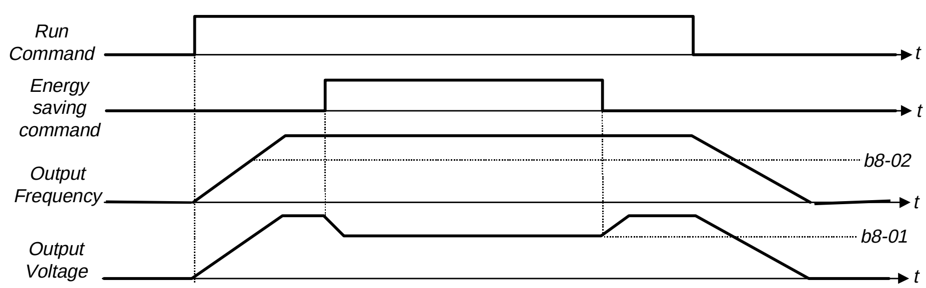
V/f	V/f w/PG	Open Loop Vector	Flux Vector

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



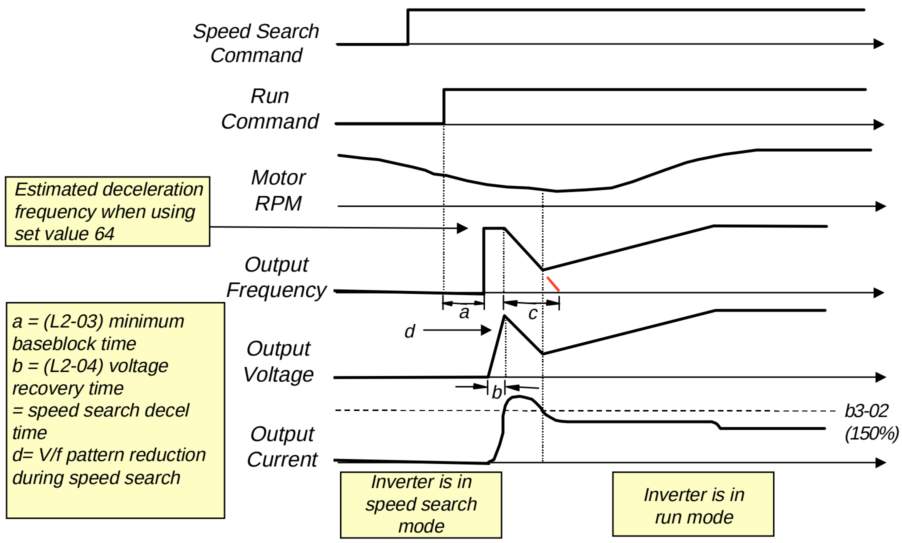
· Energy Save Mode (Set value = 63)

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).



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

· Speed Search 3 (Set value = 64)



V/f	V/f w/PG	Open Loop Vector	Flux 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).

·

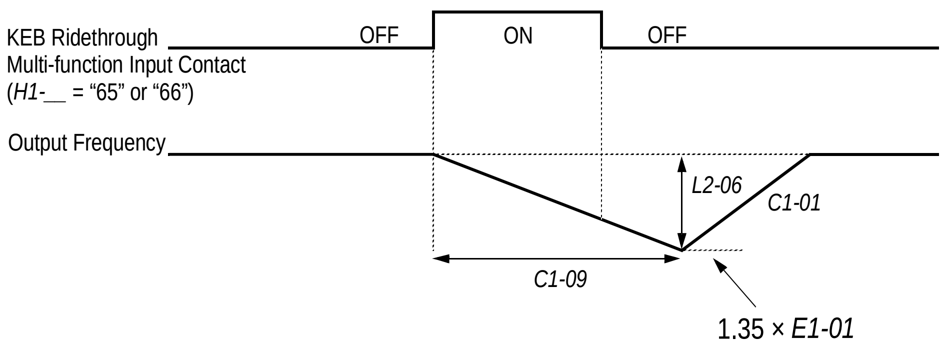


Figure 36 KEB Ridethrough Timing Diagram

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 B900 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	Flux 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	√	√	√	√	

H2-01 to 3 Setting	Function	Control Method *(A1-02)*				Reference Page
		V/f	V/f w/ PG	Open Loop Vector	Flux 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 flux 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.

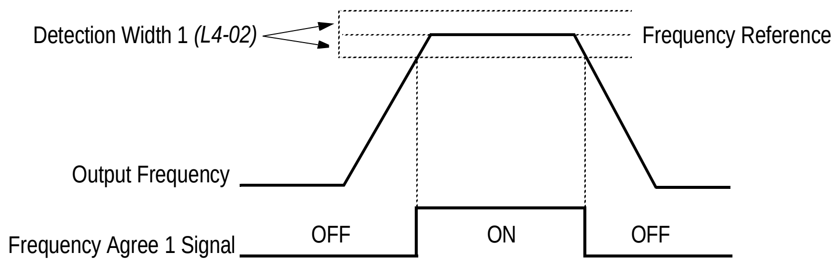


Figure 37 Frequency Agree Signal 1 Timing Diagram

· 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.

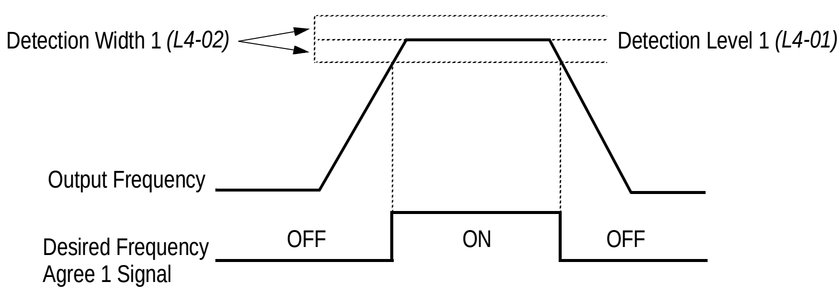


Figure 38 Desired Frequency Agree 1 Signal Timing Diagram

· 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.

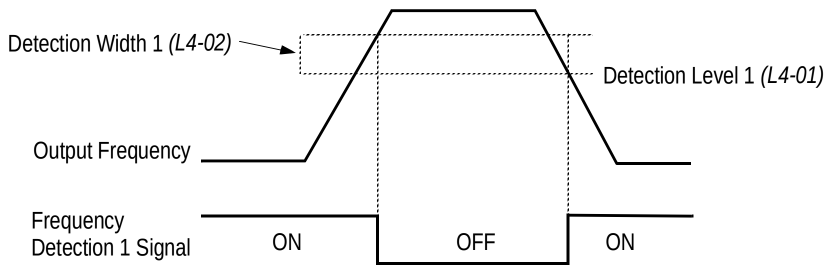


Figure 39 Frequency Detection 1 Signal Timing Diagram

- 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.

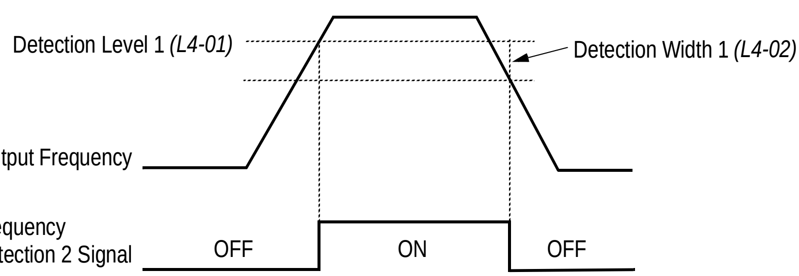


Figure 40 Frequency Detection 2 Signal Timing Diagram

- 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.

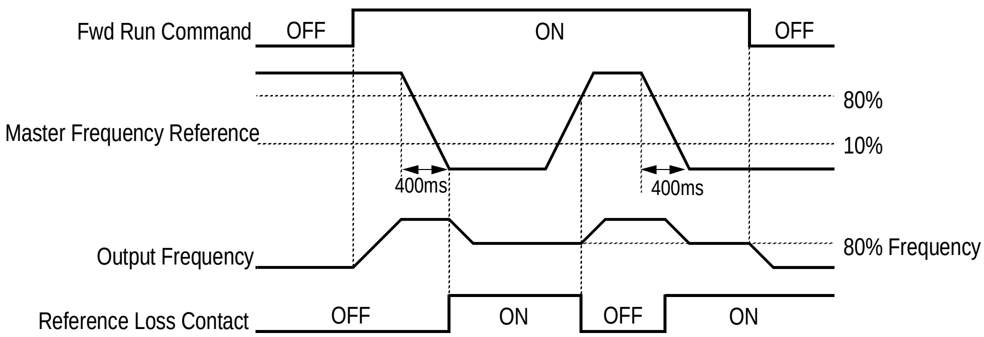


Figure 41 Reference Loss Timing Diagram

· 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.

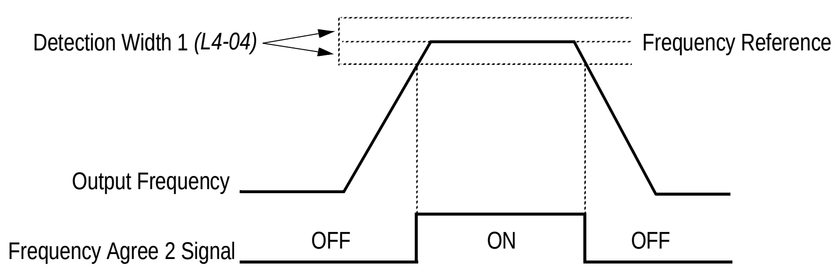


Figure 42 Frequency Agree Signal 2 Timing Diagram

· 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*.

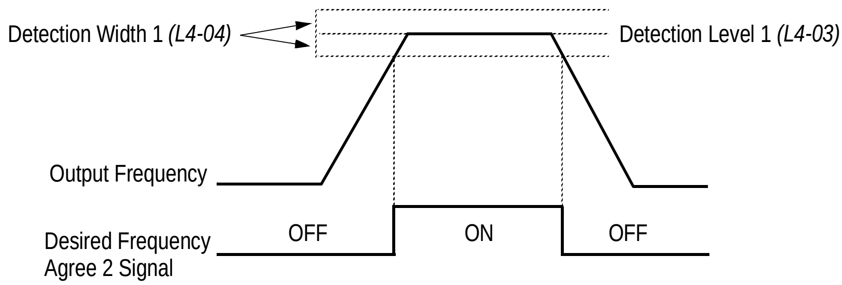


Figure 43 Desired Frequency Agree 2 Signal Timing Diagram

· 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*.

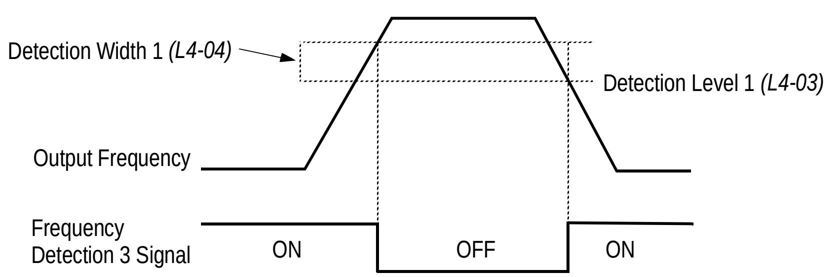


Figure 44 Frequency Detection 3 Signal Timing Diagram

· 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*.

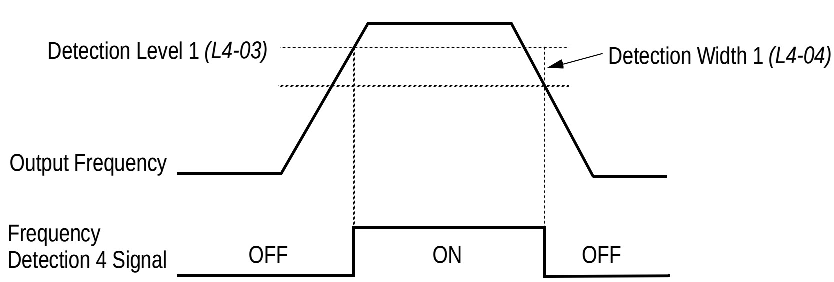


Figure 45 Frequency Detection 2 Signal Timing Diagram

· 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 (flux 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 (flux 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).

H3 Analog Inputs

The B900 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.

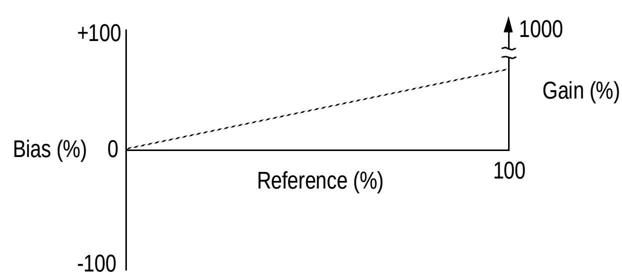


Figure 46 Analog Input Gain and Bias Adjustment

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	Flux 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	–	–	–	–	–

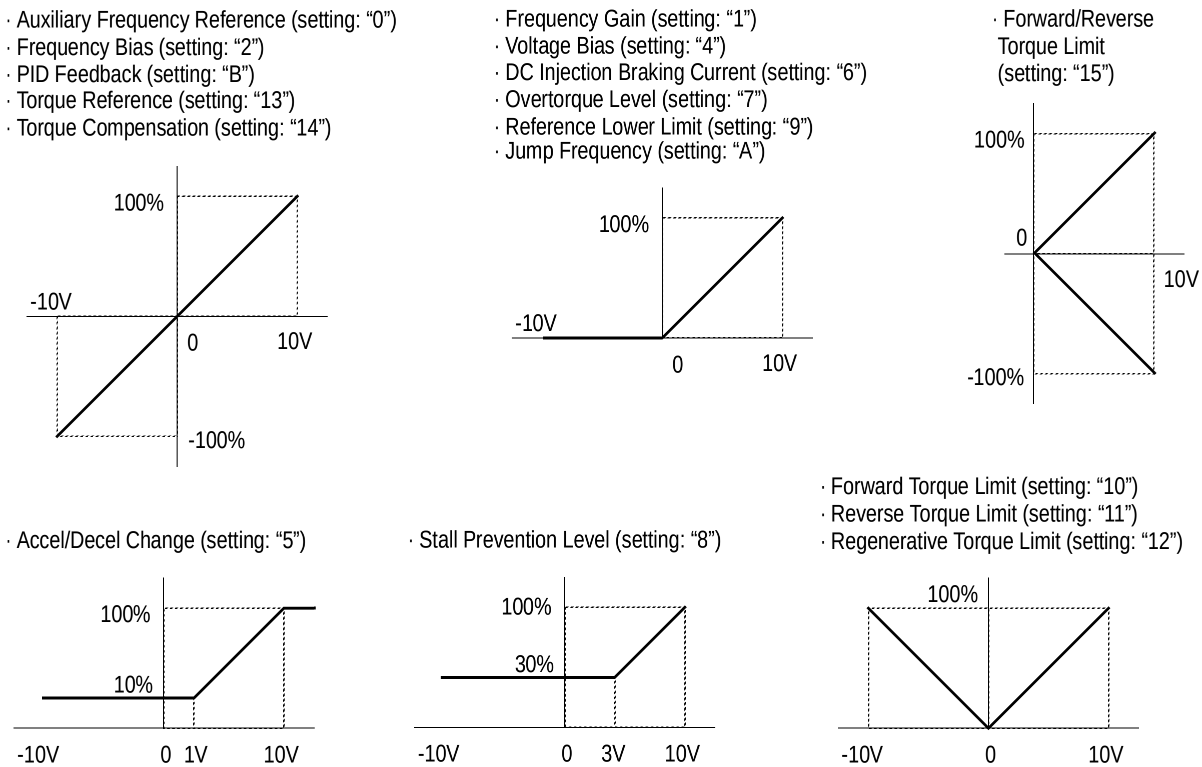


Figure 47 Multi-function Analog Input Selection

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.

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.

H4 Analog Outputs

The B900 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*.

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*.

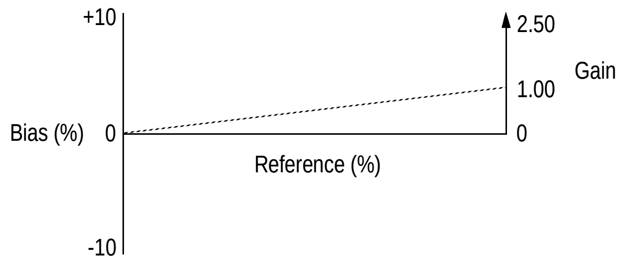


Figure 48 Analog Output Gain and Bias Adjustment

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

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

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 B900 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.

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.

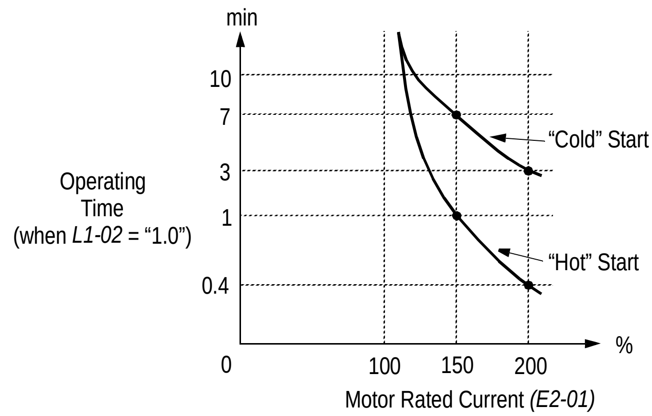


Figure 49 Electronic Thermal Overload Curve

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.

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.

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), 431 to 603V (575V class)
Factory Default: 190V (230V class), 380V (460V class), 546V (575V 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.

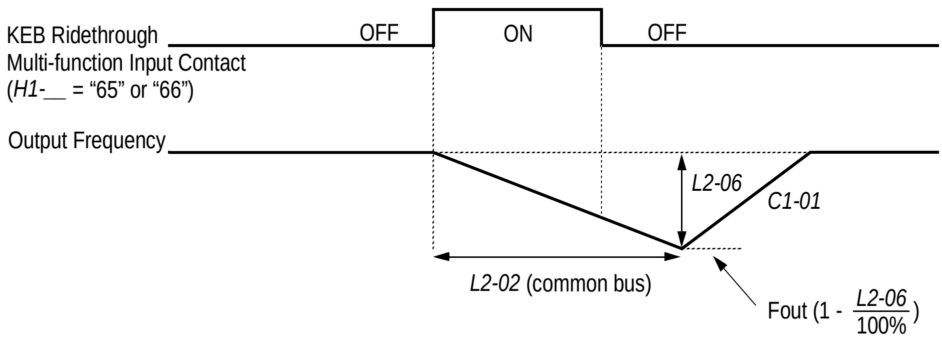


Figure 50 KEB Ridethrough Timing Diagram

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).

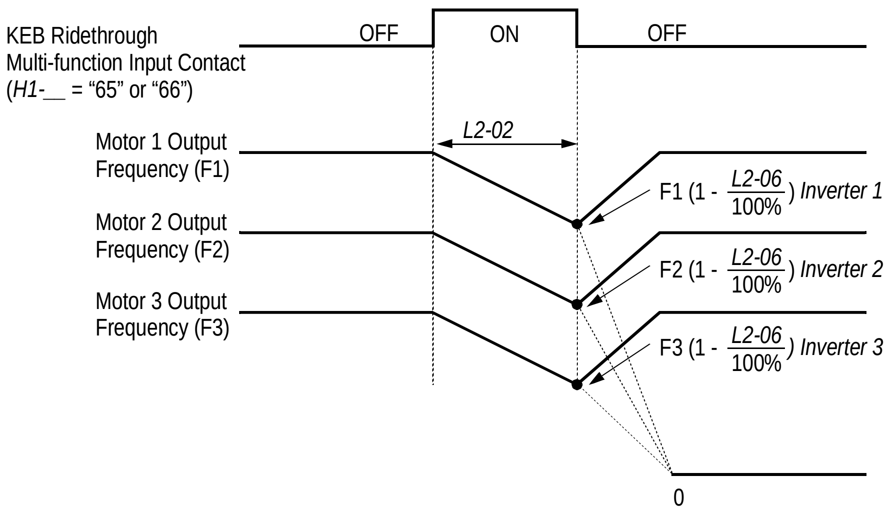


Figure 51 KEB Ridethrough - Common DC Bus Applications

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.

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.

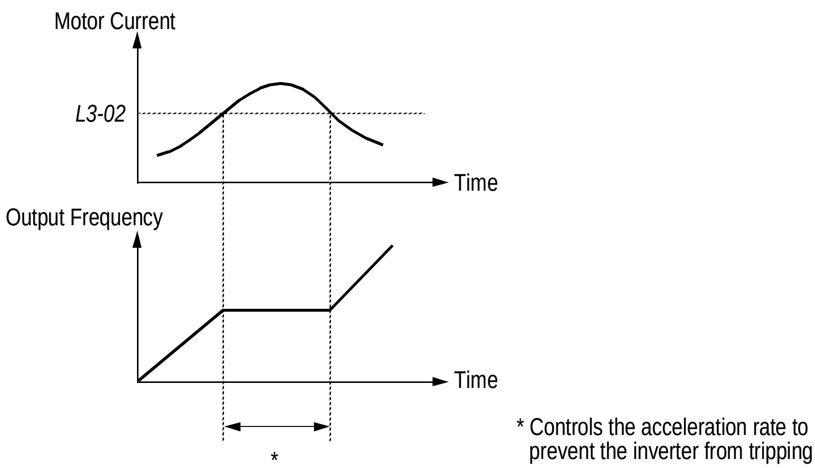


Figure 52 Stall Prevention/Current Limit During Acceleration

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:

$$\boxed{\text{Current Limit Level During Accel in Constant Output Area}} = \boxed{\text{Current Limit Level During Acceleration } (L3\text{-}02)} \times \frac{\text{Max. Voltage Output Frequency } (E1\text{-}06)}{\text{Output Frequency}}$$

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 B900 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.*

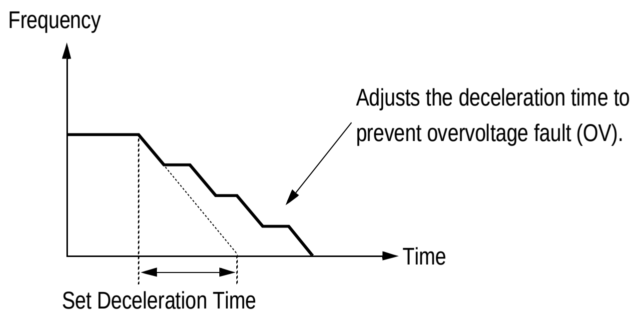


Figure 53 Stall Prevention During Deceleration

Note: Intelligent stall prevention during deceleration (*L3-04* = “2”) cannot be set in the vector control modes (when *A1-02* = “2” or “3”).

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.

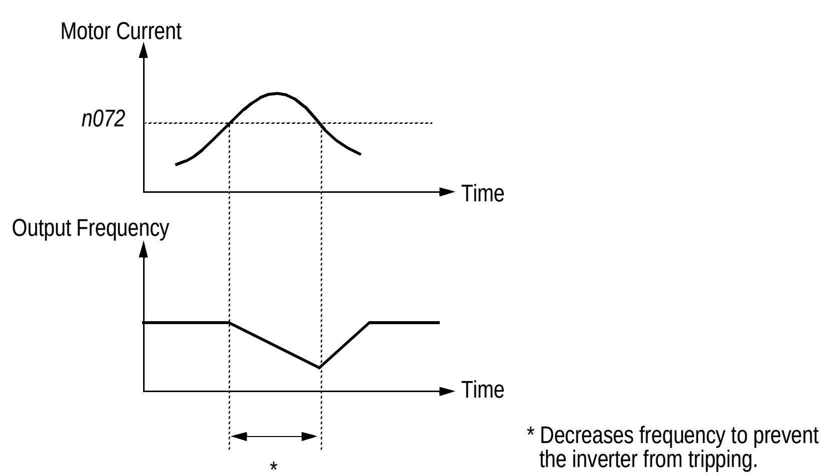


Figure 54 Stall Prevention/Current Limit During Running

L4 Reference Detection

The B900 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.

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.

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.

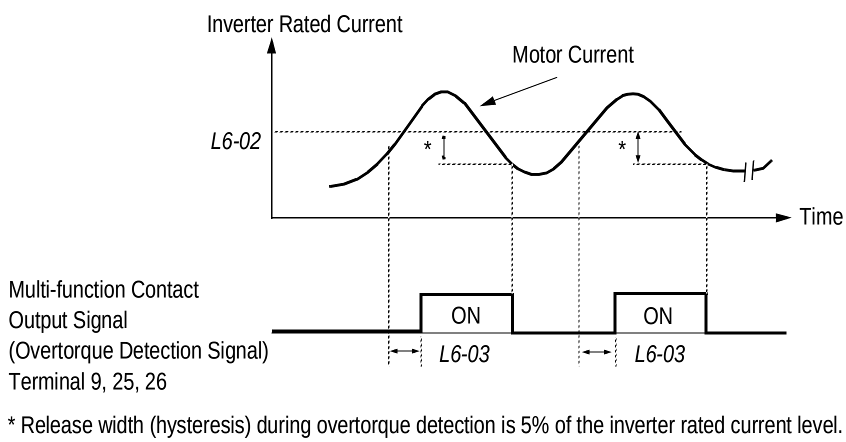


Figure 55 Overtorque Characteristics Timing Diagram

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.

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.

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.

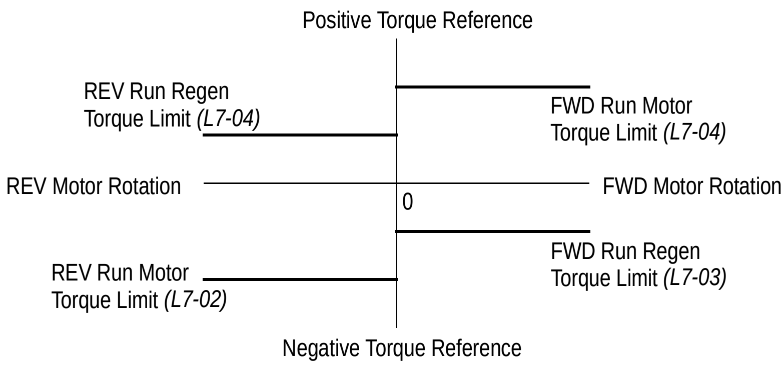


Figure 56 Torque Limit - 4 Quadrant Operation

L8 Hardware Protection

The B900 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 Bedford 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).

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 (ΔV) between these values with an internal detection level. If ΔV 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.

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).*

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 flux 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.

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

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.

O1-04 Display Units for Speed-Related Parameters *Display Units*

–	–	–	B

Sets the display units for parameters and monitors related to frequency, in the flux 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.

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.

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
3	OMRON 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.)

Main Menu: Auto-Tuning <ENTER>

Adaptation to most all 3 phase induction motors manufactured worldwide is possible with the Bedford automatic tuning function. Available in both open loop vector and flux vector control modes, the inverter asks the user for minimal motor information, then guides the user through a quick, simple tuning process. Below is the motor data required for automatic tuning in the quick-start mode:

Motor Rated Voltage	Sets motor rated voltage in VAC.	–	–	Q	Q
Motor Rated Current	Sets motor rated current in A.	–	–	Q	Q
Motor Rated Frequency	Sets motor rated frequency in Hz.	–	–	Q	Q
Motor Rated Speed	Sets motor rated speed in rpm.	–	–	Q	Q
Number of Motor Poles	Sets the number of motor poles.	–	–	Q	Q
Motor Selection	Chooses connected motor as 1st or 2nd motor.	–	–	Q	Q

After scrolling through tuning parameters using the ∧ key, depress the Run key to begin auto-tuning. During tuning, “Tune Proceeding” flashes on the digital operator display. After complete, “Tune Successful” is displayed.

Note: If the Stop key is depressed during tuning, auto-tuning is interrupted and the motor coasts to stop. The data changed during tuning returns to its original values.

After tuning is complete, depress the Menu key to exit the auto-tuning mode.

1. 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	Flux Vector	
Initialize	Initialization	**A1-00**	Language Selection (Select Language)	0.1	1	1 (Note1)	0: English 1: Japanese 2: Deutsch <1110> 3: Francais <1110> 4: Italiano <1110> 5: Espanol <1110> 6: Portugues <1110>	o	Q	Q	Q	Q	
Initialize	Initialization	**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	
Initialize	Initialization	**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: Flux Vector	x	Q	Q	Q	Q	
Initialize	Initialization	**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	
Initialize	Initialization	**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 Parame-ters (If selected)	x	Q	Q	Q	Q	
Initialize	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 flux 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	Flux 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 flux 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	Flux 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 Compensation 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 (Flux 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: V/f	V/f w/ PG	Open Loop Vector	Flux Vector	User Setting
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: V/f	Parameter Access Level: V/f w/ PG	Parameter Access Level: Open Loop Vector	Parameter Access Level: Flux Vector	User Setting
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	
Group b Application	PID Control	**B5-13** <1110>	PID Feedback Reference Missing Detection Level (Fb los Det Lvl)	0~100	1%	0	—	x	A	A	A	A	
Group b Application	PID Control	**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	
Group b Application	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	
Group b Application	Function b6 Reference Hold	**B6-02**	Dwell Time at Start (Dwell Time @ Start)	0.0~ 10.0	0.1s	0.0	—	x	A	A	A	A	
Group b Application	Function b6 Reference Hold	**B6-03**	Dwell Frequency at Stop (Dwell Ref @ Stop)	0.0~ 400.0	0.1Hz	0.0	—	x	A	A	A	A	
Group b Application	Function b6 Reference Hold	**B6-04**	Dwell Time at Stop (Dwell Time @ Stop)	0.0~ 10.0	0.1s	0.0	—	x	A	A	A	A	
Group b Application	Function b7 Droop Control Droop Control	**B7-01**	Droop Control Gain (Droop Quantity)	0.0~ 100.0	0.1%	0.0	—	o	-	-	-	A	
Group b Application	Function b7 Droop Control Droop Control	**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	Flux 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	Flux Vector	
Group C Tuning	Function C2 S-Curve Acc/Dec	**C2-01**	S-Curve Character-istic Time at Accel-eration Start (SCrv Acc@ Start)	0.00~ 2.50	0.01s	0.20	—	x	A	A	A	A	
		C2-02	S-Curve Character-istic Time at Accel-eration End (SCrv Acc@ End)	0.00~ 2.50	0.01s	0.20	—	x	A	A	A	A	
		C2-03	S-Curve Character-istic Time at Decel-eration 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 [Flux Vector] default factory setting is 1.0	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 calcu-lated 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. Flux 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	Flux Vector	
Group C Tuning	Function C4 Torque Compensation	**C4-01**	Torque Compensa-tion Gain (Torq Comp Gain)	0.00~ 2.50	0.01	1.00	—	o	B	B	B	-	
Group C Tuning	Function C4 Torque Compensation	**C4-02**	Torque Compensa-tion 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	-	
Group C Tuning	Function C4 Torque Compensation	**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 set-ting of 0.0 disables this feature.	x	-	-	A	-	
Group C Tuning	Function C4 Torque Compensation	**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 set-ting of 0.0 disables this feature.	x	-	-	A	-	
Group C Tuning	Function C4 Torque Compensation	**C4-05** <1110>	Torque Compensa-tion Time Constant (TorqCmp Delay T)	0~200	1ms	10	When 0~4ms is set, it is oper-ated without filter. Functions with C4-03 and C4-04.	x	-	-	A	-	
Group C Tuning	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] fac-tory default setting is .20. When A1-02=3 factory default setting is 20.00.	o	-	B	-	B	
Group C Tuning	Function C5 ASR Tuning	**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] fac-tory default setting is .200. When A1-02=3 factory default setting is .500	o	-	B	-	B	
Group C Tuning	Function C5 ASR Tuning	**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] fac-tory default setting is .02 When A1-02=3 factory default setting is 20.00.	o	-	B	-	B	
Group C Tuning	Function C5 ASR Tuning	**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] fac-tory default setting is .050. When A1-02=3 factory default setting is .500.	o	-	B	-	B	
Group C Tuning	Function C5 ASR Tuning	**C5-05**	ASR Limit (ASR Limt)	0.0~ 20.0	0.1%	5.0	—	x	-	A	-	-	
Group C Tuning	Function C5 ASR Tuning	**C5-06**	ASR Primary Delay Time (ASR Delay Time)	0.000~ 0.500	0.001s	0.004	—	x	-	-	-	A	
Group C Tuning	Function C5 ASR Tuning	**C5-07**	ASR Switching Frequency (ASR Gain SW Freq)	0.0~ 400.0	0.1Hz	0.0	—	x	-	-	-	A	
Group C Tuning	Function C5 ASR Tuning	**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	Flux 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	
Group C Tuning	Function C6 Carrier Frequency	**C6-02**	Carrier Frequency Lower Limit (Carrier Freq Min)	0.4~ 15.0	0.1 kHz	15.0**		x	A	A	-	-	
Group C Tuning	Function C6 Carrier Frequency	**C6-03**	Carrier Frequency Proportional Gain (Carrier Freq Gain)	00~99**	1	00**		x	A	A	-	-	
Group C Tuning	Function C7 Hunting Prevention	**C7-01**	Hunting Prevention Selection (Hunt Prev Select)	0, 1	1	1	0: Disabled 1: Enabled	x	A	A	-	-	
Group C Tuning	Function C7 Hunting Prevention	**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	-	
Group C Tuning	Function C8 Factory Tuning	**C8-09**	AFR Time Constant (AFR Time)	0~2000	1 ms	50	—	x	-	-	A	-	
Group C Tuning	Function C8 Factory Tuning	**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	Flux 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	Flux 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 V/f	V/f w/ PG	Open Loop Vector	Flux Vector	User Setting
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. For 575V class, then modify the values by 575/200

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	Flux 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. For 575V class, then modify the values by 575/200

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: V/f	V/f w/ PG	Open Loop Vector	Flux Vector	User Setting
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	Flux 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: (Flux Vector)	x	A	A	A	A	
	Function E4 V/F Pattern 2	**E4-01**	Motor 2 Max. Output 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. For 575V class, then modify the values by 575/200
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 V/f	V/f w/ PG	Open Loop Vector	Flux Vector	User Setting
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. For 575V class, modify the values by 575/200
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	V/f	V/f w/ PG	Open Loop Vector	Flux Vector	User Setting
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	Flux 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 [Flux Vector] factory setting 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	Flux 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	
Group F Options *	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 output) 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	Flux 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 Selection through DP-RAM communication (Torq Ref / Lmt Sel)	0, 1	1	1	0: (Disabled) 1: (Enabled)	x	-	-	-	A	
		F9-06	DP-RAM Communication Error Detection 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 V/f	V/f w/ PG	Open Loop Vector	Flux Vector	User Setting
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	Flux 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	Flux 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	
Terminal	Function H2 Digital Outputs	**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	
Terminal	Function H2 Digital Outputs	**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	
Terminal	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	
Terminal	Function H3 Analog Inputs	**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	
Terminal	Function H3 Analog Inputs	**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	
Terminal	Function H3 Analog Inputs	**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	
Terminal	Function H3 Analog Inputs	**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	Flux 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 V/f	V/f w/ PG	Open Loop Vector	Flux Vector	User Setting
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	Flux 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 575V class=190x575/200=546 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: V/f	Parameter Access Level: V/f w/ PG	Parameter Access Level: Open Loop Vector	Parameter Access Level: Flux Vector	User Setting
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 Acceleration (StallP Accel Lvl)	0~200	1%	150	—	x	B	B	B	-	
	L3-03	Stall Prevention Limit During Acceleration (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	Flux 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	Flux 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	Flux 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	
Protection	Function L8 Hardware Protection	**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	
Protection	Function L8 Hardware Protection	**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	
Protection	Function L8 Hardware Protection	**L8-05**	Input Phase Loss Protection (PH Loss In Sel)	0, 1	1	0	0: (Disabled) 1: (Enabled)	x	A	A	A	A	
Protection	Function L8 Hardware Protection	**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	
Protection	Function L8 Hardware Protection	**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	-	
Protection	Function L8 Hardware Protection	**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	Flux 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 out put) 28: CPU ID number	o	B	B	B	B	
Operator	Function o1 Monitor Selection	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	
Operator	Function o1 Monitor Selection	O1-03	Frequency Units of Reference Setting and Monitor (Display Scaling)	0~ 39999	1	0	—	x	B	B	B	B	
Operator	Function o1 Monitor Selection	O1-04	(Display Units)	0, 1	1	0	0: (Hertz) 1: (RPM)	x	-	-	-	B	
Operator	Function o1 Monitor Selection	O1-05	Parameter No. Display Selection (Address Display)	0, 1	1	0	0: (Parameter Number) 1: (Memobus Address)	x	A	A	A	A	
Operator	Function o2 Key Selections	O2-01	LOCAL/REMOTE Key Enable/Disable (Local/Remote Key)	0, 1	1	1	0: (Disabled) 1: (Enabled)	x	B	B	B	B	
Operator	Function o2 Key Selections	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	Flux Vector	
Operator Function o2 Key Selection	**O2-03**	User Parameter Initialization Selection (User Defaults)	0, 1, 2	1	0	0: (No Change) Yaskawa 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	

2. 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 fre-quency	x	Q	Q	Q
	U1-06	Output Voltage (Output Voltage)	0.1V	—	10V/200V or 400V ?575	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)	—	0 0 0 0 0 0 0 0 1: T1 “Closed” 1: T2 “Closed” 1: T3 “Closed” 1: T4 “Closed” 1: T5 “Closed” 1: T6 “Closed” 1: T7 “Closed” 1: T8 “Closed”	—	Q	Q	Q	Q
	U1-11	Output Terminal Status* (Output Term Sts)	—	0 0 0 0 0 0 0 0 1: T9~ 10 “Closed” 1: T25 “Closed” 1: T26 “Closed” 0: Not used 0: Not used 0: Not used 0: Not used 1: Fault	—	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)	—	0 0 0 0 0 0 0 0 1: During running 1: During zero speed 1: During reverse 1: During reset signal inpu 1: During speed agree 1: Inverter operation ready 1: Minor fault 1: Major fault	—	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 Reference 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